REFERENCE: **YEC response to YUB-YEC-01-004 and YUB-YEC-01-080, PDF pages 225-229 and 552-556**

ISSUE: Disallowed portion of capital projects added to rate base resulting in 2023 and 2024 rate increases: WH2 Uprate Construction and Engineering (WH2) (rate base addition of $7.078 million to 2021 GRA approved); WH4 Servomotor Replacement (WH4) (rate base addition of $0.789 million to 2021 GRA approved) and Enterprise Asset Management System Purchase and Implementation Project (EAM) projects

QUOTE: YUB-YEC-01-004, PDF page 228:

"The mere fact the Board may have concluded in a previous GRA Application that there was insufficient evidence in that proceeding to support including the costs of certain assets in YEC's rate base for a previous test year does not displace the Board's statutory obligation to include costs in YEC's rate base for the current test years that are supported by sufficient evidence in the current proceeding.

In the specific instance of disallowed capital costs in Board Orders 2022-03 and 2022-10 for the WH2 and WH4 assets, the Board did not disagree with YEC's assertion that the assets were used and useful. The sole basis provided by the Board for disallowing some of the incurred or forecast costs was that the Board relied on the evidence and arguments then before it, and that generally the Board found that the business case then before it for each of these projects was deficient and that there was a lack of information in the other evidence then before it to justify the significant cost increases and a lack of an adequate justification of costs and benefits.

The WH2 and WH4 assets continue to be used and useful in the 2023 and 2024 test years for the current Application, and YEC has provided additional information and clarifications on the relevant costs for these assets in order to address the information deficiency issues raised by the Board in its earlier Orders related to the prior 2021 YEC GRA."

YUB-YEC-01-080, PDF pages 554-555:
"The fact the Board may have concluded in a previous GRA Application that there was insufficient evidence in that proceeding to support including the costs of certain assets in YEC's rate base for a previous test year does not displace the Board's statutory obligation to include costs in YEC's rate base for the current test years that are supported by sufficient evidence in the current proceeding.
…
As reviewed in the above quotes in this IR from Appendix A to Board Order 2022-03, the Board disallowed-denied inclusion of all EAM capital costs in rate base for the 2021 GRA based on concerns about the adequacy of the evidence presented by YEC in the 2021 GRA (i.e., based on a lack of project-specific evidence of the EAM's expected benefits, or the technical merits of the selected software solution). However, the Board specifically acknowledged in its decision that alignment of asset management practices with recognized standards (i.e., ISO 55000) is appropriate."

Preamble: Further to the above-noted responses on the three capital projects referenced, in which YEC has stated that in the current application it has now addressed the lack of information or deficiencies in the evidence presented by YEC in its 2021 GRA, the Board needs further clarification. This is because in its IR responses to YUB-YEC-01-004 and YUB-YEC-01-080, YEC purports that it has addressed all previous shortcomings of the evidence before the Board at that time which are summarized as follows:

Board Findings WH2 Uprate Project - Board Order 2022-03, paragraphs 277-278:

i) YEC's business plan for this project did not adequately justify the costs and benefits of this project,
ii) YEC did not discuss the WH2 alternative, its costs and the reasons for dismissing this alternative,
iii) YEC did not adequately explain the reasons the WH2 was the preferred alternative,
iv) Board concerns with the reasonableness of the WH2 costs,

v) Board concerns with the recommendations in the Hatch report, and,
vi) Board concerns with the deficiencies in the WH2 business case.

Board Findings WH4 Uprate Servomotor Replacement Project – Board Order 2022-03, paragraphs 281-282:

i) YEC did not explain why the costs for the WH4 project increased from the original Hatch cost estimate,
ii) YEC did not provide an adequate justification that supported the significant cost increase for the WH4 from the original Hatch estimate,
iii) Board concerns that the WH4 benefits espoused by YEC did not fully justify the costs that were incurred or forecast for this project,
iv) Board concerns with the reasonableness of the WH4 costs,
v) Board concerns with the lack of a business case for the WH4 project, and,
vi) Board concerns with the lack of support for the magnitude of costs of the project when compared to the expected benefits of the project

Board Findings Enterprise Asset Management System Purchase and Implementation Project (EAM) – Board Order 2022-03, paragraphs 332-333:

i) Board concerns with the lack of project-specific evidence pertaining to expected benefits from the EAM project,
ii) Board concerns that no details respecting other software alternatives were provided nor why the alternatives were ruled out in favour of the EAM project,
iii) Board concerns with the lack of details respecting the technical merits of the EAM project in comparison to other bidders,
iv) Board concerns with a lack of information to justify the significant cost increases in the EAM project

QUESTION:

a) In the tabular format provided below, for each project and issue identified in the Board Findings in Board Order 2022-03, please provide reference to and compare the information that was provided by YEC in its 2021 GRA with the information that YEC has provided in the current GRA. Please include an explanation of how YEC has addressed in the current Application the concerns expressed in Board Findings cited above. Do not combine any of the issues identified in the preamble above.

Issue identified in Board Findings in Board Order 2022-03	**Summary of information provided in 2021 GRA including Exhibit reference**	**Summary of information provided in 2023-2024 GRA Including Exhibit reference**	**Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03**
WH2 (i) YEC's business plan for this project did not adequately justify The costs and benefits of this project			
WH2 (ii) YEC did not discuss the WH2 alternative, its costs and the reasons For dismissing this alternative …			
WH2 (vi) Board concerns with the deficiencies in the WH2 business case			
…			
WH4 (i) YEC did not explain why the costs for the WH4 project increased from the original Hatch cost estimate			
…			
EAM (i) Board concerns with the lack of project-specific evidence pertaining to expected benefits from the EAM project			
…			

ANSWER:

As requested in YUB-YEC-2-1, YEC has prepared three tables below, which respond separately to each of the enumerated issues identified by the Board as arising from its findings in Board Order 2023-03 with respect to each of the three referenced projects (WH2 Uprate, WH4 Servomotor Replacement and EAM):

- Table 1: Board Findings Issue Information Comparison 2021 GRA and 2023/24 GRA – WH2 Uprate Project
- Table 2: Board Findings Issue Information Comparison 2021 GRA and 2023/24 GRA – WH4 Uprate Servomotor Replacement Project
- Table 3: Board Findings Issue Information Comparison 2021 GRA and 2023/24 GRA – Enterprise Asset Management System Purchase and Implementation Project (EAM)

For each issue, each table compares a summary of the information provided by YEC in its 2021 GRA with the information provided in the current GRA, and explains how the information provided in the current GRA addresses the concerns expressed in the corresponding Board finding.

YEC has noted that, in several instances, there are significant overlaps among the identified issues for each project. In light of these overlaps, YEC requests that the Board consider all of its responses together, holistically, when evaluating YEC's request that its previously disallowed capital costs for these three projects be included in its rate base, on a prospective basis, commencing with the 2023 and 2024 test years, based on all of the evidence before the Board in the current proceeding.

Regardless of the conclusions reached previously by the Board in the 2021 GRA on the basis of the evidentiary record that was before it in that proceeding, the evidence that YEC has placed before the Board in the current proceeding demonstrates the 2023 and 2024 test year benefits to ratepayers of each of these three projects, and provides clear justification for the capital costs that YEC incurred in respect of each of these three projects, having regard to those test year benefits.

To assist Board in its review, YEC provides a preface for each project table that contextualizes the information in the table by summarizing key points that are of

overarching relevance to the Board's evaluation of each project's current GRA business case.

Accordingly, YEC's response to YUB-YEC-2-1 is provided below in three parts, containing the preface and project table for each respective project.

Part 1: Board Findings Issue Information Comparison – WH2 Uprate Project

Preface

The work done by YEC on the WH2 Uprate project can essentially be divided into four distinct cost components:

1. The uprate component of this project, which was estimated at $2.739 million in the original $4.782 million cost estimate that Hatch provided in 2017;
2. The generator dismantling/reinstallation, generator rewind and rotor pole refurbishment non-uprate work component, which was estimated by Hatch at $2.043 million and comprised the balance of Hatch's original $4.782 million cost estimate;
3. The additional refurbishment work that was outside the scope of Hatch's original $4.782 million cost estimate, but which was determined to be necessary and prudent to carry out concurrently with the uprate work to address WH2 deficiencies, including deficiencies identified after the WH2 unit was disassembled, in order to extend the life of a facility commissioned in 1958; and
4. The Owner's Cost component (owner's engineer, AFUDC, internal cost and project management), which was not included in Hatch's original cost estimate (beyond 10% provided for administration and engineering) but was required for all of the above components.

The additional evidence that YEC has presented in the current 2023/24 GRA proceeding illustrates that, despite its description as the "WH2 Uprate project", most of the actual costs incurred on this project were not in fact in respect of the uprate component of the project (i.e. the first component, as described above). The evidence in this proceeding will enable the Board to properly evaluate the reasonableness of all of the costs incurred by YEC on this project, including costs incurred on the third component of the work on the project: i.e., for refurbishment work that was outside the scope of the work included in Hatch's original cost estimate, but which the Hatch report contemplated that it would be prudent for YEC to consider concurrently with the uprate component.

It is important for the Board to recognize that the Hatch report was a high-level initial study with respect to both the cost estimates and benefits of only the first and second components of the work described above. More particularly:

- Hatch's original $4.782 million cost estimate was a high-level estimate in 2017$, based on information gathered from different suppliers without any specifics related to the WH2 runners and assumptions in the study. This was in contrast to the detailed budget process that YEC subsequently undertook for this project in 2019. As noted below, YEC is providing the Board with additional information in Appendix A to this IR, which provides a summary of the steps taken in that budget process in which YEC hired an engineering company to develop turbine generator performance specifications outlining the desired performance and lifespan of the uprated WH2 unit that was included in the 2018 RFP process.
- The limitations of the high-level cost estimate in Hatch's report are illustrated, for example, by Table 3-2 of the report, regarding the $4.782 million capital cost estimate. That table shows the cost for the new turbine runner as $0.530 million, which was stated to be an "intermediate value" of wide ranging runner prices from suppliers. Appendix C of the Hatch report indicates further that this pricing was based on supplier prices ranging between $0.315 million and $1.7 million based on the (inapplicable) assumption that WH1 and WH2 runners would be purchased as a single contract (i.e., at a discounted price for two runner purchases). It is also not clear if delivery costs and/or taxes were included in the pricing from the supplier.
- As another example, Table 8-1 of the Hatch report estimates that the project (as originally scoped in the report) would yield avoided thermal generation of only 1.879 GWh annually, in contrast to YEC's current projection of approximately 5 GWh/year thermal displacement on a long-term average basis.
- Note also that Hatch's original estimate did not include YEC costs (owner's engineer, AFUDC, internal cost and project management) beyond the provision of 10% for "engineering and administration."

In light of the fact that Hatch's original high-level cost estimate was confined to the first and second components of the work described above, it is also important for the Board to recognize that the original cost estimate is not relevant to the Board's evaluation of the reasonableness of the costs incurred by YEC with respect to the third component of the work completed on this project. The additional work described in that third component was determined (after the Hatch report was completed) to be prudent and necessary independent of the uprate component of this project, and, on its own, will sustain long-term benefits to the system and ratepayers. Although the third component of this work was completed concurrently with the WH2 Uprate project and was accounted for as part of the total project costs (i.e. there is no separate accounting available for costs incurred on the

third component), for all intents and purposes, the third component could have properly been characterized as a separate and distinct capital project, and it must be assessed for prudence on its own merits. Further, the enhanced final uprate benefits will result in ratepayer savings even when considering the added costs for enhanced refurbishment of WH2.

To better assist the Board's understanding of the third component of the work described above, YEC has prepared additional information outlining the evolution of this project, which is set out in Appendix A to this IR response (WH2 Update – Additional Information on Budget Development). Appendix A highlights the extensive work that was done on project scoping from the time that the Hatch report was issued in 2017 up to the time of the Board's approval of a $12.3 million budget for this project in June 2019, which provided for asset refurbishment and life extension going beyond the scope of Hatch's original cost estimate, as well as uprating of the runners. Appendix A confirms that the June 2019 project budget, and not the Hatch report cost estimate, is the relevant basis for assessing final WH2 costs.

YEC's evidence in the current proceeding also clearly explains why the non-uprate alternative referenced in paragraph 277 of Board Order 2022-03, Appendix A, was dismissed by YEC, because Hatch had already effectively ruled out that option with the comments made about it in Hatch's 2017 report.

YEC's evidence before the Board in the current proceeding demonstrates that the overall benefits of this project, including both the uprate and refurbishment components of the work completed, are much higher than its costs to ratepayers, with incremental annual test year benefits of $1.105 million compared to the annual test year revenue requirement cost of no more than $0.885 million with total cost included in YEC's rate base. This indicates that the project reduces costs to ratepayers even before considering the additional life extension and environmental benefits of the project. Moreover, the annual benefits over the project life would be even higher as the annual cost of capital reduces over the years as the cost is depreciated.

Overall, it is apparent that there is no reasonable basis to cap YEC's cost recovery for the Project based on Hatch's original cost estimate plus 20%. It is more relevant for the Board to consider the final budgeted cost of the Project, which was the result of a much more comprehensive scoping and budget estimate process (including RFPs and fixing of prices

and guarantees). The actual final project cost of $12.814 million was only 4.5% higher than the 2019 budgeted estimate.

Table 1: Board Findings Issue Information Comparison 2021 GRA and 2023/24 GRA – WH2 Uprate Project

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
WH2 (i) YEC's business plan for this project did not adequately justify the costs and benefits of this project	The 2021 GRA Application [Exhibit B-1] provided a summary in section 5.2.1.9 of the WH2 Uprate project scope, uprate benefits, costs and status. This included the following information: • Project scope: In addition to runner replacement uprate, the project included unit rehabilitation, generator stator and rotor rewinding, governor replacement, exciter replacement, and upgrading of the control and condition monitoring systems. • Uprate benefits: The project would provide cost effective benefits for added dependable capacity (0.94 MW) and added renewable energy (6.4 GWh/yr). • Capital costs: Total projected capital costs of $12.297 million (after including $0.259 million in engineering related	Detailed information about YEC's business case for the WH2 uprate project and its costs and benefits is provided in the following filed documents: • 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-14, pages 5.1A-33 to 5.1A-39; and • 2023/24 GRA Consolidated Information Request responses, information requests YUB-YEC-1-4 and YUB-YEC-1-19. That information is supplemented by Appendix A to this IR response, which highlights the extensive further work that was done on project scoping after the Hatch report was issued in mid-2017, leading to the development of a project budget of $12.3 million that was approved in June 2019 and provided for asset refurbishment and life extension going beyond the scope of Hatch's	The new information in the 2023/24 GRA clearly justifies the cost of the WH2 Uprate project and demonstrates its benefit to ratepayers, including the revenue requirement and ratepayer savings included in the 2023 and 2024 test years. The project's benefits are much higher than its costs to ratepayers [incremental annual benefits of $1.105 million compared to the annual revenue requirement cost of no more than $0.885 million with total cost included in the rate base]. The project also included necessary rehabilitation work that was unrelated to the uprate component and therefore outside the scope of Hatch's original 2017 cost estimate, including necessary rehabilitation of deficiencies that were identified after the WH2 unit was disassembled. Overall, as indicated at page 5.1A-39 of the 2023/24 GRA Application, the project provides for better use of the

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	costs as shown in Appendix 5.4). Additional details regarding the WH2 Uprate project were also provided in the 2021 GRA Consolidated Information Request responses [Exhibit B-9 for round 1; Exhibit B-27 for round 2], including the responses summarized below: <u>YUB-YEC-1-57:</u> • The generator has never been rewound since it was put into service in 1958. All major components of WH2 are original. A major overhaul done in 2016 cost $686,764. • WH2 was selected for uprate instead of WH1 due to higher energy output and problems to be addressed with governor (see WH2(ii) issue below). • Table 8-1 of the 2017 Hatch report provided in YUB-YEC-1-57(d) Attachment 1 provided a summary of the economic benefits of various	original cost estimate, as well as uprating of the runners. As reviewed in more detail on pages 5.1A-33 to 5.1A-35, a material portion of the costs for the WH2 Uprate project were not related to the uprate element, and addressed refurbishments that were needed to extend the life of this hydro project. This included rehabilitation work determined to be necessary as a result of deficiencies that were identified after the WH2 unit was disassembled. The benefits of this extended renewable project life provide added cost savings for ratepayers compared to the option of developing new renewable resources or relying on existing thermal energy resources. As indicated on page 5.1A-38, the LTA thermal calculation tables in Appendix 2.1 of the 2023/24 GRA include benefits from the uprate component of the WH2 and WH4 projects. The table shows that, with WH2 and WH4 projects, the LTA	Whitehorse Hydro Generating Facility, ensuring renewable generation is retained and added to the Yukon Integrated System. This aligns with the direction provided in section 11 of OIC 1995/090 (as amended by OIC 2021/16), which requires the Board to include provision in rates to enable YEC to recover costs it reasonably incurs to plan or develop renewable generation projects. The WH2 assets were considered used and useful on November 23, 2021, and they continue to be used and useful in the 2023 and 2024 test years for the current Application, and for future years. The project ratepayer costs included in YEC's revenue requirements will reduce over time as the asset is depreciated.

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	turbine uprate options. Section 3 of the Hatch report further outlined the benefits of replacing the runner as well as some of the other improvements that were being made to the WH2 Unit. Section 3 also noted that Hatch's cost estimates for the uprate did not include the cost of refurbishment work that is typically done when equipment is dismantled. • The cost benefit analysis in Section 8 of the Hatch report indicated further that $2.04 million of Hatch's estimated costs of $4.78 million were for disassembly/install and rewind work that could be assigned to concurrent life extension activities rather than to the uprate. (Table 8-1 provided a $2.74 million cost estimate for the project excluding those life extension activities.)	thermal at the 2024 test year load is 68.0 GWh (see Table 2.1-2). Without these projects, the LTA thermal would be 73.5 GWh, i.e., the WH2 and WH4 projects displace 5.5 GWh thermal on an LTA basis. Based on 2023/24 GRA thermal generation cost of $0.20/kWh [90% LNG and 10% diesel], the annual LTA thermal displacement benefits from WH2 and WH4 projects included in the 2023/24 GRA are $1.120 million. It is estimated that approximately 90% of these LTA thermal displacement benefits relate to the WH2 Uprate project and the remaining 10% to the WH4 Servomotor project. The 2023/24 GRA also includes dependable capacity benefits from the WH2 Uprate project. As reviewed in Tab 2 of the 2023/24 GRA, for the test years, the dependable capacity from hydro units is increased from 70.5 MW in the 2021 GRA to 71.1 MW, an increase of 0.6 MW. This is about 1/3 of one diesel rental unit	

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	CW-YEC-1-33: Provides summary data showing that the WH2 Uprate project is an economic option to add firm energy and dependable capacity to YEC's portfolio in the near term, and that it is favourable when compared with options presented in the 2016 Resource Plan. YUB-YEC-1-49 Table 9, YUB-YEC-2-17 Table 4, UCG-YEC-1-34 REVISED Table 9 (Exhibit B-23): Capital cost details and updates for the project, including information that once the WH2 unit was disassembled, assessments that could only be done after disassembly revealed that the condition of components was worse than expected and that those components had to be replaced. YEC also found that certain components of the WH2 unit were misaligned and that additional machining was required to bring them back to proper alignment. UCG-YEC-1-52(e): The WH2 Uprate project cost includes $972,440 for the	[1.8 MW]. With the average annual cost of rental of $162,017/MW for 2024 for the Whitehorse location, the dependable capacity benefits from WH2 Uprate is $97,210/year. Based on the information provided above, the total incremental annual benefit included in the 2023/24 GRA that is attributable to the WH2 Uprate is $1.105 million, compared to the annual revenue requirement cost (including all refurbishment costs not related to the uprate component) of no more than $0.885 million included in the 2023/24 GRA for this project. This indicates that the project reduces costs to ratepayers even before considering the additional life extension and environmental benefits of the project [e.g., reduced GHG emissions and reliance on fossil fuel generation]. The benefits over the project life would be even higher as the annual cost of capital reduces over the years as the cost is depreciated.	

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	stator rewind and refurbishment of the rotor poles.		
WH2 (ii) YEC did not discuss the WH2 alternative, its costs and the reasons for dismissing this alternative	Information about YEC's selection of WH2 for the uprate project instead of other possible alternatives was included in the 2021 GRA Consolidated Information Request responses [Exhibit B-9], information request YUB-YEC-1-57(e) and in the copy of the Hatch report that was provided in YUB-YEC-1-57(d) Attachment 1: YUB-YEC-1-57(e): WH2 was selected over WH1 because the energy output of WH2 is higher based on the plant configuration. That is, WH2 produces more energy because it exhausts mid-stream; WH1 exhausts against the bank of the river which creates a loss of efficiency. Otherwise, the units are essentially identical units. Additionally, WH2 was having a problem with its governor, i.e., the WH2 governor was having issues with MW control and resolution was required.	Detailed information about YEC's consideration of alternatives to the WH2 Uprate project is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-14, pages 5.1A-35 to 5.1A-36. As indicated on page 5.1A-36, no other renewable option providing similar benefits (in terms of LTA thermal displacement and added dependable capacity) could be completed within the same two-year timeframe in which the WH Uprate project was completed and at the same cost. The Board's concern identified in paragraph 277 of Order 2022-03, Appendix A referenced "another alternative proposed by Hatch" described in paragraph 273 of Board Order 2022-03, Appendix A. As indicated at page 5.1A-35 of the 2023/24 GRA Application, YEC understands that the concern the	The information included in the 2023/24 GRA business case addresses the Board concern that was not examined during the 2021 GRA proceeding, and explains why there are no other alternatives for the project providing similar benefits that could be completed in the same timeframe, and why the alternative way of completing the project considered in the 2017 Hatch report was dismissed.

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	Hatch report: Economic assessments in the Hatch report showed that WH3 or WH4 uprates would not provide net economic benefits. Appendix A of Board Order 2022-03 (paragraph 273) referenced "another alternative proposed by Hatch" involving the "replacement of the cams that define the WH1 and WH2 wicket gate runner blade relationship…" This other alternative was not addressed specifically in the YEC GRA Application or in any information request related to this Application. On subsequent YEC review, this option was identified in the Hatch report (page 60 of report, page 67 of Attachment 1) for consideration only if YEC elects not to uprate any of the turbines of the WGS, i.e., the Hatch report had previously (page 8 of report, page 15 of Attachment 1) addressed and ruled out this option.	Board identified in paragraph 277 was referring to the non-uprate alternative described in the following statement in the 2017 Hatch report (page 8 of report): "It is possible to replace only the runner blades, keeping the same runner hub including the internal blade operating mechanism. Equipment cost would be reduced for this option. However, it is expected that the level of efficiency increase would not match that of a complete new runner, and would perhaps be 50% of the increase as compared to a completely new runner, there would also be increased uncertainty in the performance of the new runner. Furthermore, fitting the new runner blades to the existing runner hub would require an increased outage for the uprate project as this could not be done until the existing generating unit was dismantled." (underlining added) YEC did not need to give further consideration to this alternative	

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
		option because the quoted statement in the Hatch study had already ruled it out on the basis that it would have resulted in increased uncertainty in the performance of the new runner, and given that fitting the new runner blades to the existing runner hub would have require an increased outage for the uprate project that could not have been done until the existing generating unit was dismantled. Based on these considerations, the option of a complete new runner was adopted for the project. Please also see the response to the next question.	
WH2 (iii) YEC did not adequately explain the reasons the WH2 was the preferred alternative	Information about why WH2 was the preferred alternative for the uprate project was included in the 2021 GRA Consolidated Information Request responses [Exhibit B-9], information request YUB-YEC-1-57(e) and in the copy of the Hatch report that was provided in YUB-YEC-1-57(d) Attachment 1 (see below):	Detailed information about YEC's selection of the WH2 Uprate project as its preferred alternative is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-14, pages 5.1A-35 to 5.1A-36. Please see the response to WH2(ii) for explanation as to why the non-	The information included in the 2023/24 GRA business case addresses the Board concern that was not examined during the 2021 GRA proceeding, and explains why there are no other alternatives for the project providing similar benefits that could be completed in the same timeframe, and why the alternative way of completing the project

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	YUB-YEC-1-57(e): WH2 was selected over WH1 because the energy output of WH2 is higher based on the plant configuration. That is, WH2 produces more energy because it exhausts mid-stream; WH1 exhausts against the bank of the river which creates a loss of efficiency. Otherwise, the units are essentially Identical units. Additionally, WH2 was having a problem with its governor, i.e., the WH2 governor was having issues with MW control and resolution was required. Hatch report: Economic assessments in the Hatch report showed that WH3 or WH4 uprates would not provide net economic benefits. Appendix A of Board Order 2022-03 (paragraph 273) referenced "another alternative proposed by Hatch" involving the "replacement of the cams that define the WH1 and WH2 wicket gate runner blade relationship…" This other alternative was not addressed specifically in the YEC GRA Application or in any	uprate option noted in the Hatch report was not adopted. As indicated on page 5.1A-36, YEC explained previously in response to YUB-YEC-1- 57(e) in the 2021 GRA proceeding that WH2 was selected over WH1 because the energy output of WH2 was higher based on the plant configuration. That is, WH2 produces more energy because it exhausts midstream; WH1 exhausts against the bank of the river which creates a loss of efficiency. Otherwise, the units are essentially identical units. Additionally, WH2 was having a problem with its governor, i.e., the WH2 governor was having issues with MW control and a resolution was required. In addition to the above features favoring WH2 compared to WH1, YEC noted further on page 5.1A-36 of the 2023/24 GRA that WH2 is a Kaplan turbine with a broad range of high efficiency. It is advantageous to run the unit in the winter to follow the load when trying to conserve water.	discussed in the 2017 Hatch report was dismissed.

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	information request related to this Application. On subsequent YEC review, this option was identified in the Hatch report (page 60 of report, page 67 of Attachment 1) for consideration only if YEC elects not to uprate any of the turbines of the WGS, i.e., the Hatch report had previously (page 8 of report, page 15 of Attachment 1) addressed and ruled out this option.	In contrast, WH3 and WH4 are fixed blade propeller units with a narrow range of high efficiency. The efficiency gains from WH2 can be used to conserve water in the winter, adding to the benefits gained from uprating the unit. Apart from WH1, no other renewable option providing similar benefits could be completed within the same two-year timeframe in which the WH Uprate project was completed.	
WH2 (iv) Board concerns with the reasonableness of the WH2 costs	The Board raised concerns in Order 2022-03 after the evidence for the GRA was closed regarding the reasonableness of the updated project costs (excluding engineering) exceeding the original cost estimate of $4.78 million provided in the Hatch report. Updated information about project costs was provided to the Board in 2021 GRA Round 2 Consolidated Information Request responses [Exhibit B-27] information request YUB-YEC-2-17.	Detailed information about the reasonableness of WH2 Uprate project costs is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-14, pages 5.1A-33 to 5.1A-35. That information is also supplemented by Appendix A to this IR response, which highlights the extensive further work that was done on project scoping after the Hatch report was issued in mid-2017, leading to the development of a project budget of $12.3 million that was approved in June 2019 and provided for asset	The information included in the 2023/24 GRA business case (together with the additional information provided in Appendix A to this IR response) addresses Board concerns that were not directly examined during the 2021 GRA proceeding, and provides a further explanation as to why the project costs were higher than the initial estimates in the 2017 Hatch report, including scope changes and other issues identified during the project construction related to rehabilitation and life extension requirements.

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	In particular, YUB-YEC-2-17 (Table 4) indicated an updated forecast total project cost of $12.526, which included $12.267 million under capital projects plus $0.259 million in engineering related costs reported under deferred costs. This table also showed the equivalent initial GRA total cost forecast of $12.297 million. After the Board issued Order 2022-03, YEC also provided additional information about project costs in section III.2 of its Application for Review and Variance of YUB Order 2022-03, referring to the Hatch report provided in YUB-YEC-1-57(d) Attachment 1 [Exhibit B-9]. As indicated on page 10 of the Review and Variance application, Hatch's original cost estimates as provided in Table 3-2 (page 23) of its report are in 2017$ and do not include YEC costs (owner's engineer, AFUDC, internal cost and project management) beyond provision of 10% for "engineering and administration".	refurbishment and life extension going beyond the scope of Hatch's original cost estimate, as well as uprating of the runners. As indicated on page 5.1A-34 and in Appendix A to this IR response, the WH2 Uprate project scope as approved by YEC's board of directors addressed necessary WH2 refurbishment elements and was not restricted to turbine uprate requirements. The final scope of work for the WH2 uprate project included unit rehabilitation, runner replacement, generator stator and rotor rewinding, governor replacement, exciter replacement, upgrading the control and condition monitoring systems, and rehabilitation of the tailrace crane superstructure and concrete piers, i.e., the project actual scope went well beyond the scope for the Hatch cost estimates in the 2017 study. In addition to the above approved scope, once the WH2 unit was disassembled (i.e., after business	There are no other alternative options that provide similar benefits and that could be completed in the same time frame and with the same budget. The Information added in the 2023/24 GRA clearly justifies the cost of the WH2 Uprate project and demonstrates its benefit to ratepayers, including the revenue requirement and ratepayer savings included in the 2023 and 2024 test years. The project's benefits are much higher than its costs to ratepayers [incremental annual benefits of $1.105 million compared to the annual revenue requirement cost of no more than $0.885 million with total cost included in the rate base]. The project also included necessary rehabilitation work that was outside the scope of Hatch's original 2017 cost estimate, including work that was required to address the deficiencies identified after the WH2 unit was disassembled.

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	As indicated further on page 11 of the Review and Variance application, the Hatch report cost estimates were noted in that report to exclude any necessary rehabilitation work, including work to address deficiencies identified after the WH2 unit was disassembled. Actual project costs materially exceeded Hatch's original estimate (aside from escalations due to timing differences) because of the additional necessary work that was outside the scope of the original estimate. To elaborate, WH2 had been in service for approximately 60 years prior to the uprate project; however, most of the components were original. When developing the specifications for the project, YEC identified a number of systems associated with WH2 that were at end of life including the governor, excitation system, oil head, turbine shaft seal, greased bushing system, HPU and unit controls. It was most expeditious to undertake those required system	case assessments and when actual implementation was underway), assessments of both the embedded components as well as the removable components were also undertaken (this assessment can only be undertaken upon completion of disassembly). These assessments revealed in many cases that the condition of the components was worse than originally expected, and these components had to be refurbished as part of the project to ensure proper operation and acceptable service life of the unit. In addition, during the inspection and assessment process certain components of the WH2 unit were found to be misaligned – this discovery resulted in the need for additional machining of several components to bring the items back into proper alignment. WH2 had been in service for approximately 60 years prior to the uprate project with most of the components being original. When developing the specifications for the	The project ratepayer costs included in YEC's revenue requirements will reduce over time as the asset is depreciated.

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	replacements during the uprate project, even though there were not included in Hatch's initial cost estimate. Additionally, many unanticipated issues with the turbine and generator were discovered during site work once the unit was disassembled, which needed to be corrected to achieve the target life extension.	project, YEC identified a number of systems associated with WH2 that were at end of life including the governor, excitation system, oil head, turbine shaft seal, greased bushing system, HPU and unit controls. YEC followed recommendations from engineering and operations that it was essential to replace these aged assets, to ensure their continued reliability and to extend the life of the unit by approximately 40 years. No other renewable option providing similar benefits could be completed in the same time frame and budget.	
WH2 (v) Board concerns with the recommendations in the Hatch report	The Board raised these concerns in Order 2022-03 after the evidence for the GRA was closed. The Board does not specify in Order 2022-03 what recommendations in the Hatch report it its referencing in this issue. However, this issue appears to be concerned with the non-uprate alternative (not adopted) that allowed for efficiency gain of two percent and an offset in thermal generation half of that achieved with	Detailed information is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-14, pages 5.1A-33 to 5.1A-39. The Board does not specify in Order 2022-03 what recommendations in the Hatch report it is referencing in this issue. However, this issue appears to be concerned with the non-uprate alternative (not adopted) that allowed for efficiency gain of two percent and an offset in thermal	The information included in the 2023/24 GRA business case addresses the Board concern that was not examined during the 2021 GRA proceeding, and explains why the alternative way of completing the project considered in the 2017 Hatch report was dismissed. The new information included in the 2023/24 GRA business case clearly justifies the cost of the WH2 Uprate project and demonstrates its benefit

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	the WH2 uprate project. No information requests were provided on that issue in the 2021 GRA, and any evidence on that issue was limited to what was provided in the Hatch report itself (YUB-YEC-1-57(d) Attachment 1 [Exhibit B-9]).	generation half of that achieved with the WH2 uprate project. Please see issue WH2(ii) above for a summary of information provided in the 2023/24 GRA on this alternative. The new information included in the 2023/24 GRA clearly demonstrates that the benefits of the project exceed the cost included in the revenue requirements for the 2023 and 2024 test years [incremental annual benefits of $1.105 million compared to the annual revenue requirement cost of no more than $0.885 million with total cost included in the rate base].	to ratepayers, including the revenue requirement and ratepayer savings included in the 2023 and 2024 test years. As detailed in the response, the benefits from the project are much greater than those that were assumed in the 2017 Hatch report. Moreover, the costs of the project include extensive rehabilitation and YEC owner cost elements that were not included in the Hatch report scope or its original cost estimate.
WH2 (vi) Board concerns with the deficiencies in the WH2 business case	The Board's reference to this issue in Order 2022-03 appears to be as a summary reference to the issues already noted by the Board. Please see WH2(i) and other earlier issues reviewed above for summary of information provided in the 2021 GRA.	Detailed information is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-14. That information is also supplemented by Appendix A to this IR response, which highlights the extensive further work that was done on project scoping after the Hatch report was issued in mid-2017, leading to the development of a project budget of $12.3 million that was approved in	The business case provided in the 2023/24 GRA (together with the additional information provided in Appendix A to this IR response) addresses all the issues raised by the Board and clearly justifies the cost of the WH2 Uprate project and its benefits to ratepayers, including consideration of alternative options and reasons for the project being the preferred option, project cost, and

WH2 Issue identified in Board Findings in Board Order 2022-03, paragraphs 277-278	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
		June 2019 and provided for asset refurbishment and life extension going beyond the scope of Hatch's original cost estimate, as well as uprating of the runners. The business case provided in the 2023/24 GRA and reviewed in more detail in WH2 issues (i) and (iv) above now clearly demonstrates the cost and benefits of the project to the ratepayers, including alternative options and reasons for the project being the preferred option, project costs and other issues identified by the Board.	other issues identified by the Board. The project benefits are higher than the project costs thus reducing the required rate increase.

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Part 2: Board Findings Issue Information Comparison – WH4 Uprate Servomotor Replacement Project

Preface

It is important for the Board to recognize that Hatch's 2017 Capacity Increase Desktop Study provided only a high-level initial cost estimate for the WH4 Servomotor Replacement project; that the original estimate was in 2017$; and that it did not include YEC costs (owner's engineer, AFUDC, internal cost and project management) or any allowances for installation and commissioning or balance of plant.

YEC has provided detailed evidence in this proceeding comparing the actual costs incurred on this project against Hatch's original estimate, and explaining why the actual costs exceeded the original estimate. That evidence demonstrates that those costs were prudently incurred, and that the project's benefits are higher than its costs to ratepayers, with incremental annual benefits of $0.112 million compared to the annual revenue requirement cost of no more than $0.089 million. This indicates that the project reduces costs to ratepayers even before considering the additional environmental benefits of the project. Moreover, the benefits over the project life would be even higher as the annual cost of capital reduces over the years as the cost is depreciated.

Table 2: Board Findings Issue Information Comparison 2021 GRA and 2023/24 GRA – WH4 Uprate Servomotor Replacement Project

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
WH4 (i) YEC did not explain why the costs for the WH4 project increased from the original Hatch cost estimate.	The Board raised this concern in its Order 2022-03 after the evidence for the 2021 GRA was closed. YEC was not asked during the 2021 GRA proceeding to discuss or explain these costs differences. YEC's final argument noted that no material issues were raised in IRs or at the oral hearing regarding this project. YEC subsequently commented on this issue in its Application for Review and Variance of YUB Order 2022-03, section III.3. During the 2021 GRA proceeding, YEC did provide a copy of a Capacity Increase Desktop Study completed by Hatch for WH4 in 2017 (Exhibit B-27, YUB-YEC-2-23(a) Attachment 1). That study provided a high level initial cost estimate of $0.457 million to replace the servomotors and generator breaker; however, that estimate excluded the cost of	Detailed information about WH4 Servomotor Replacement project costs is provided in the following filed documents: • 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-15, pages 5.1A-40 to 5.1A-44; and • 2023/24 GRA Consolidated Information Request responses, information requests YUB-YEC-1-4 and YUB-YEC-1-19. In particular, the 2023/24 GRA Application specifically explains (at page 5.1A-42) that the 2017 Hatch study provided a high-level initial cost estimate, and that Hatch cost estimates for the WH4 servomotor were in 2017$ and did not include YEC costs (owner's engineer, AFUDC, internal cost and project management) or any allowances for	The information provided in the 2023/24 GRA addresses the Board concern that was not examined during the 2021 GRA proceeding, explains why the actual costs for the WH4 Servomotor Replacement project exceeded Hatch's original 2017 estimate, and shows that those costs were prudently incurred.

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	upgrades required due to existing equipment condition as well as owner's costs. YEC's evidence in the 2021 GRA proceeding regarding required upgrades to WH4 and actual costs is summarized as follows: • As indicated in response to YUB-YEC-58(d) (Exhibit B-9), the WH4 Servomotor Replacement project involved replacing the servomotors with spring assisted servomotors that would augment the force provided by the high pressure hydraulic unit (HPU) and overcome the gate stalling issue experienced beyond 92% stroke. The governor gate position limiter was also removed and the WH4 unit was recommissioned with the capability to operate at 100% gate opening. The ability to operate at 100%	installation and commissioning or balance of plant. The table included on page 5.1A-42 shows how the actual cost of $1.337 million compared to Hatch's initial 2017 cost estimate. • The first cost item is the servomotor supplier cost which increased from Hatch's initial estimate $0.457 million to $0.750 million. This $0.293 million increase reflected cost escalations after the 2017 cost estimates plus final design requirements and supplier costs for this work. Replacing the original servomotors with custom spring assisted servomotors was a significant change to the WH4 unit and required extensive analysis and testing to verify the unit was capable of handling the added flow and that	

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	gate opening would increase Energy and Capacity of the unit. • The $1.4 million updated actual cost for WH4, as reported in response to YUB-YEC-2-17(a) (Exhibit B-27), included $0.733 million for the servomotor supplier, $0.459 million for owner's engineer and internal costs and project management, and $0.208 million for balance of plant (which consists of a monorail lifting beam to remove/install the servomotors, the piping modifications and the new governor parts and tuning).	servomotors could be relied upon for safe unit operation. • The actual project costs also included $0.587 million for required and prudently incurred costs that were not included in the original Hatch estimate, i.e., $0.049 million for owner's engineer, $0.346 million for internal costs and project management, and $0.208 million for balance of plant (which consists of a monorail lifting beam to remove/install the servomotors, the piping modifications and the new governor parts and tuning).	
WH4 (ii) YEC did not provide an adequate justification that supported the significant cost increase for the WH4 from the original Hatch estimate	As noted above regarding the WH4(i) issue, the Board raised the concern about a cost increase from the original Hatch estimate in its Order 2022-03, after the evidence for the 2021 GRA was closed. YEC was not asked during the 2021 GRA proceeding to discuss or	As noted above regarding the WH4(i) issue, detailed information about WH4 Servomotor Replacement project costs is provided in the following filed documents: • 2023/24 GRA Application, Tab 5, Appendix 5.1A,	The new information provided in the 2023/24 GRA addresses the Board concern that was not examined during the 2021 GRA proceeding. This information explains and justifies the difference between the actual WH4 Servomotor Replacement

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	explain these costs differences. YEC's final argument noted that no material issues were raised in IRs or at the oral hearing regarding this project.	section 5.1A-15, pages 5.1A-40 to 5.1A-44; and • 2023/24 GRA Consolidated Information Request responses, information requests YUB-YEC-1-4 and YUB-YEC-1-19. Please see the above response to the WH4(i) issue for a summary of information provided in the current GRA explaining why WH4 costs exceeded the original Hatch cost estimate. Detailed information about the benefits of the WH4 Servomotor Replacement project is also provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-15, on pages 5.1A-43 and 5.1A-44. The information provided in the 2023/24 GRA clearly shows that the project benefits exceed project costs resulting in an overall rate reduction. In particular, based on the information provided on pages 5.1A-43 and 5.1A-44, the total incremental	project costs and Hatch's original 2017 estimate. It also explains and justifies how those costs were prudently incurred, and that the project benefits exceed project costs resulting in an overall rate reduction.

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
		benefits included in the 2023/24 GRA from WH4 Servomotor Replacements are $0.112 million, which is greater than the annual revenue requirement cost of no more than $0.089 million included in the 2023/24 GRA for this project. This indicates that the project reduces cost to ratepayers, which is in addition to the project's environmental benefits [e.g., reduced GHG emissions and reliance on fossil fuel generation]. The benefits over the project life would be even higher as the annual cost of capital reduces over the years as the cost is depreciated.	
WH4 (iii) Board concerns that the WH4 benefits espoused by YEC did not fully justify the costs that were incurred or forecast for this project.	The Board raised these concerns in its Order 2022-03 after the evidence for the 2021 GRA was closed. YEC was not asked during the 2021 GRA proceeding to discuss or justify, beyond what was provided in the Application, the costs incurred or forecast for this project. YEC's final argument noted that no material issues were raised	Detailed information about the benefits of the WH4 Servomotor Replacement project is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-15, on pages 5.1A-43 and 5.1A-44. The information provided in the 2023/24 GRA clearly shows that the project benefits exceed project costs resulting in an overall rate reduction.	The information added in the 2023/24 GRA now clearly justifies the cost of the WH4 Servomotor Replacement project and demonstrates its benefits to ratepayers, including the revenue requirement and ratepayer savings included in the 2023 and 2024 test years. The project's benefits are higher than its costs to ratepayers [incremental annual benefits of $0.112 million

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	in IRs or at the oral hearing regarding this project. The information provided by YEC during the 2021 GRA did include the following: 2021 GRA Application [Exhibit B-1], section 5.2.1.10: The project was described as increasing the output of WH4 by allowing full range operation of the wicket gates, adding 0.9 GWh/yr of additional hydraulic generation. 2021 Consolidated Information Request responses [Exhibit B-9 for round 1; Exhibit B-27 for round 2]: YUB-YEC-2-17 provided updated cost details, showing a slight cost reduction from the GRA Application. YUB-YEC-1-58 provided details on WH4's history , the project's inclusion in YEC's 10 Year Renewable Electricity Plan with its forecast benefits. YUB-YEC-2-23 provided further information on the project, including Attachment 1 with the Hatch's 2017	In particular, based on the information provided on pages 5.1A-43 and 5.1A-44, the total incremental benefits included in the 2023/24 GRA from WH4 Servomotor Replacements are $0.112 million, which is greater than the annual revenue requirement cost of no more than $0.089 million included in the 2023/24 GRA for this project. This indicates that the project reduces cost to ratepayers, which is in addition to the project's environmental benefits [e.g., reduced GHG emissions and reliance on fossil fuel generation]. The benefits over the project life would be even higher as the annual cost of capital reduces over the years as the cost is depreciated.	compared to the annual revenue requirement cost of no more than $0.089 million with total cost included in the rate base].

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	Capacity Increase Desktop Study for WH4.		
WH4 (iv) Board concerns with the reasonableness of the WH4 costs.	The Board raised these concerns in its Order 2022-03 after the evidence for the 2021 GRA was closed. YEC was not asked during the 2021 GRA proceeding to discuss issues regarding the reasonableness of the WH4 costs. YEC's final argument noted that no material issues were raised in IRs or at the oral hearing regarding this project.	Details of the actual project costs for the WH4 Servomotor Replacement are included in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-15, on pages 5.1A-41 and 5.1A-42. The total project cost includes the servomotor supplier cost of $0.750 million. Replacing the original servomotors with custom spring assisted servomotors was a significant change to the WH4 unit and required extensive analysis and testing to verify the unit was capable of handling the added flow and that servomotors could be relied upon for safe unit operation. The actual project cost also included $0.587 million for required and prudently incurred costs that were not included in the original Hatch estimate, i.e., $0.049 million for owner's engineer, $0.346 million for internal costs and project	The new information provided in the 2023/24 GRA addresses the Board concern that was not examined during the 2021 GRA proceeding, explains the increase in actual project costs for the WH4 Servomotor Replacement from Hatch's original 2017 estimate, and shows that those costs were prudently incurred, and that the project benefits exceed project costs resulting in an overall rate reduction.

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
		management, and $0.208 million for balance of plant (which consists of a monorail lifting beam to remove/install the servomotors, the piping modifications and the new governor parts and tuning). The information provided on pages 5.1A-43 and 5.1A-44 shows the project benefits exceed project costs resulting in an overall rate reduction.	
WH4 (v) Board concerns with the lack of a business case for the WH4 project	The Board raised this concern in its Order 2022-03 after the evidence for the 2021 GRA was closed. Please see above issue WH4(iii) for a summary of information provided in the 2021 GRA proceeding on project costs and benefits to justify a business case for this project.	Detailed information about YEC's business case for the WH4 Servomotor Replacement project is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-15, pages 5.1A-40 to 5.1A-44.	The detailed business case addresses the issues raised by the Board and shows the project's costs and benefits to the ratepayers.
WH4 (vi) Board concerns with the lack of support for the magnitude of costs of the project when compared to the expected benefits of the project	The Board raised this concern in its Order 2022-03 after the evidence for the GRA was closed. YEC was not asked during the 2021 GRA proceeding to discuss issues regarding the reasonableness of the WH4 costs. YEC's final argument noted that no material	Detailed information about the costs and benefits of the WH4 Servomotor Replacement project is provided in the 2023/24 GRA Application, Tab 5, Appendix 5.1A, section 5.1A-15, pages 5.1A-41 to 5.1A-44. In particular, based on the information provided on pages 5.1A-	The new information added in the 2023/24 GRA now clearly justifies the cost of the WH4 Servomotor Replacement project and demonstrates its benefits to ratepayers, including the revenue requirement and ratepayer savings

WH4 Servomotor Replacement Project Issue identified in Board Findings in Board Order 2022-03, paragraphs 281-282	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	issues were raised in IRs or at the oral hearing regarding this project.	43 and 5.1A-44, the total incremental benefits included in the 2023/24 GRA from WH4 Servomotor Replacements is $0.112 million, compared to the annual revenue requirement cost of no more than $0.089 million that is included in the 2023/24 GRA for this project. This indicates that the project reduces the cost to ratepayers before considering the environmental benefits of the project [e.g., reduced GHG emissions and reliance on fossil fuel generation]. The benefits over the project life would be even higher as the annual cost of capital reduces over the years as the cost is depreciated.	included in the 2023 and 2024 test years. The project's benefits are higher than its costs to ratepayers [incremental annual benefits of $0.112 million compared to the annual revenue requirement cost of no more than $0.089 million with total cost included in the rate base].

Part 3: Board Findings Issue Information Comparison – Enterprise Asset Management System Purchase and Implementation Project (EAM)

Preface

The EAM is an essential and fundamental part of YEC's multi-year Physical Asset Management Managed System (PAMMS) project. These projects are necessary to align YEC practices with the ISO 55000 standard for physical asset management and to address the insufficiency of YEC's pre-existing Computerized Maintenance Management System (CMMS).

In the current 2023/24 GRA proceeding, YEC has now provided the Board with the detailed business case analysis completed by METSCO in May 2023. METSCO's report provides detailed expert analysis of the available evidence relevant to assessing expected benefits specifically attributable to the EAM project, including project specific findings from METSCO's comparison with YEC's peer utilities. This analysis confirms the expected NPV benefit of the EAM project as a key component of PAMMS, with PAMMS having an estimated NPV of $7.4 million if it were to be implemented without EAM, and a significantly greater estimated NPV of $11.1 million if implemented with EAM.

In the current proceeding, YEC has also provided a detailed review of the selection process it followed to select the specific EAM supplier, to assist the Board in evaluating the prudency of the costs incurred.

1 **Table 3: Board Findings Issue Information Comparison 2021 GRA and 2023/24 GRA – EAM Project**

EAM Issue identified in Board Findings in Board Order 2022-03, paragraphs 332-333	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
EAM (i) Board concerns with the lack of project-specific evidence pertaining to expected benefits from the EAM project.	The 2021 GRA Application (Exhibit B-1) Tab 5, Section 5.4.1.1 described the EAM as key part of YEC's multi-year project to develop and implement a Physical Asset Management Managed System (PAMMS) to align YEC practices with the ISO 55000 standard for physical asset management and to address the insufficiency of YEC's existing Computerized Maintenance Management System (CMMS) to meet its current and future asset management needs. Further details on YEC's plans for developing an Asset Management Program (i.e. PAMMS) were also provided in Appendix 5.1, Section 5.1-1, item 5 (page 5.1-4). YUB-YEC 1-64(a) (Exhibit B-9) further summarized the EAM's tangible and intangible benefits, its estimated low and high annual dollar benefit, and its average estimated NPV of $2.87 million over 10 years. A detailed NPV analysis was	As outlined in Section 2.0 of Appendix 5.3A of the 2023/24 GRA Application, in response to the Board's concerns, YEC retained METSCO in 2023 to review the studies that YEC had previously conducted to assess the functionality of its existing asset management system, and to investigate and establish the value for cost of improving YEC's historical asset management function and making long-term changes based on YEC's analysis of its historical state and industry insights. • METSCO's work is summarized in Section 2.0 of Appendix 5.3A. The summary explains that PAMMS with EAM (Option 3) has positive NPV of $11.1 million, compared to NPV of $7.4 million for PAMMS without EAM (Option 2), and a negative	METSCO's report provides detailed expert analysis of the available evidence relevant to assessing expected benefits specifically attributable to the EAM project. This includes project specific findings from METSCO's comparison with YEC's peer utilities and its options analysis. The METSCO report provides independent expert evidence that confirms an expected NPV benefit from the EAM project as a key component of YEC's broader plan to implement PAMMS to align its practices with ISO 55000 standard for physical asset management.

EAM Issue identified in Board Findings in Board Order 2022-03, paragraphs 332-333	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	included in YUB-YEC-1-64(a) Attachment 1. YUB-YEC-2-24(a) to (d) (Exhibit B-27) clarified that YEC used external case studies to assess the EAM's tangible benefits for the NPV assessment, and provided further detail about specific studies.	NPV of -$19.0 million for the base case of retaining the status quo (Option 1). • METSCO's full report is also provided in Attachment 5.3A-1 of the 2023/24 GRA Application. The report details METSCO's comparison of YEC practices against industry standards and leading practices, including practices of YEC's peer utilities. It also includes METSCO's options analysis that concluded that Option 3 (implementing PAMMS with EAM) is the best business case approach.	
EAM (ii) Board concerns that no details respecting other software alternatives were provided nor why the alternatives were ruled out in favour of the EAM project.	YUB-YEC-1-64(b) (Exhibit B-9) reviewed YEC's evaluation of its existing CMMS (Key2Act), including a preliminary market study carried out by YEC and Hatch, which indicated that YEC's existing CMMS was incapable of supporting YEC's long term strategic objectives and	Appendix 5.3A of the 2023/24 GRA Application summarizes the business case for the EAM and the outcome of the expert analysis undertaken by METSCO (as provided in Attachment 5.3A-1). See the response to EAM(i) above for a summary of the scope and	The METSCO report provides independent expert evidence that confirms an expected NPV benefit from the EAM project as a key component of YEC's broader plan to implement PAMMS to align its

EAM Issue identified in Board Findings in Board Order 2022-03, paragraphs 332-333	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
	was not meeting YEC's current operational needs. YUB-YEC-1-64(d) (Exhibit B-9) further explained YEC's exploration of other software alternatives as part of the EAM-related tender process followed by YEC, starting with an RFI distributed to 27 vendors that was followed by a formal public tender. The basis for selection of the preferred alternative was also reviewed in YUB-YEC-2-24(e) to (g) (Exhibit B-27), including a review of the process, selection criteria, and respondents to the final invitational RFP. The successful bidder (Infor) was the second lowest bidder on the project, but they scored higher on technical merits and were the highest ranked bid overall. The evaluated price difference between Infor and the lowest price was $12,718.00 (0.5% difference)	assessment of three options considered in METSCO's options analysis, and its resulting confirmation of the NPV benefits of including EAM as a key component of PAMMS. Section 5.3A-2 of Appendix 5.3A (at pages 5.3A-12 to 5.3A-16) provides a more detailed review of the selection process for the specific EAM supplier. This includes details about: • the initial RFSQ for this project that was published through MERX as well as specific invites to 27 potential vendors; • the process used to identify the six bidders invited to participate in the RFP process; and • the subsequent RFP process (including compliance criteria, evaluation criteria and process, and final evaluation results to	practices with ISO 55000 standard for physical asset management. In particular, METSCO's report confirms that the status quo CMMS is not an acceptable software alternative. In summary, costs to replace the existing CMMS are prudent, and there is no reasonable basis to disallow all such costs for an EAM project. Section 5.3A-2 of Appendix 5.3A of the Application details the extensive process, with expert support, that YEC followed to select a final EAM software supplier to achieve an optimal combination of functionality/ performance and price, including the specific scoring and basis for the final Infor EAM selection.

EAM Issue identified in Board Findings in Board Order 2022-03, paragraphs 332-333	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
		achieve the optimal combination of performance and price) that YEC conducted in consultation with asset management experts including KPMG.	
EAM (iii) Board concerns with the lack of details respecting the technical merits of the EAM project in comparison to other bidders	As noted above, YUB-YEC-1-64(d) (Exhibit B-9) explained YEC's exploration of software alternatives as part of its EAM-related tender process, and YUB-YEC-2-24(e) to (g) (Exhibit B-27) further reviewed the process for selecting an alternative EAM supplier. In summary, YUB-YEC-2 24(f) explained that the successful bidder (Infor) was the second lowest bidder on the project, but they scored higher on "technical merits" and were the highest ranked bid overall.	As explained on page 5.3A-12 of Appendix 5.3A of the 2023/24 GRA Application, YEC interprets "technical merit" as referring to "the criteria used to assess the company, its experience, its software functionality, the implementation approach to install the software and the price." These criteria were incorporated into the procurement process described in Appendix 5.3A at pages 5.3A-12 to 5.3A-16. Pages 5.3A-12 to 5.3A-14 of Appendix 5.3A of the Application describe how technical merit was applied during the initial RFSQ process that included invitation of 27 potential suppliers, and resulted	The new information specifically addresses the Board's concerns about defining the reference to "technical merit" as referring to the criteria used in the selection of an EAM supplier, as well as describing in more detail the expert-supported selection process that was followed to apply the technical merit criteria to select Infor as the EAM supplier.

EAM Issue identified in Board Findings in Board Order 2022-03, paragraphs 332-333	Summary of information provided in 2021 GRA including Exhibit reference	Summary of information provided in 2023-2024 GRA including Exhibit reference	Explanation of how the new information addresses the concerns expressed in Board Findings in Board Order 2022-03
		in YEC inviting six bidders to participate in the RFP stage. Detailed scoring for each bid in the final RFP process for EAM supplier selection is provided on page 5.3A-16 of Appendix 5.3A, based on selection criteria (including functionality criteria) and process as described at pages 5.3A-14 and 5.3A-15. YEC carried out this process in consultation with asset management experts including KPMG. While the results indicate that the lowest price bid was not selected, the table at page 5.3A-16 shows how the Infor offering had the highest combined points for functionality/performance and cost.	
EAM (iv) Board concerns with a lack of information to justify the significant cost increases in the EAM project	There was no evidence before the Board in the 2021 GRA of any significant cost increases in the EAM project, nor was this a topic discussed or identified in the referenced Board findings in Board Order 2022-03, Appendix A, paragraphs 332-333.	There continues to be no evidence before the Board in the current GRA of any significant cost increases in the EAM project.	There is no apparent basis for the Board's identification in Appendix A of Order 2023-25 of this question as a concern previously expressed in Board Order 2022-03; nor is there any apparent basis for describing any difference in information provided on this matter in the 2023/24 GRA compared with the 2021 GRA.

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Appendix A: WH2 Uprate Project – Additional Information on Budget Development

Overview

The business case analysis that YEC has provided of the WH2 Uprate Project (the "Project") in its 2023/24 GRA Application reports on the initial 2017 Hatch cost estimate of $4.782 million for the Project (as originally scoped) and the final actual project cost of $12.814 million at completion in 2022 (which included significant additional refurbishment work going beyond the scope of the work contemplated by Hatch's original estimate).

To better assist the Board's understanding of the change in Project scope that resulted in this cost increase, Appendix A below provides additional information on Project budget development over the time period after the Hatch report was issued in mid-2017.

This added information shows that the increased final cost of the Project reflects extensive analysis done after Hatch provided its initial estimate in mid-2017, and before any construction commenced. This extensive new analysis involved an Owner's Engineer and a Turbine & Generator (T&G) contractor, with final T&G contracting scope and price being determined. Overall, this comprehensive project scoping work identified the opportunity and need for substantial further life extension work to refurbish or replace WH2 components, which went beyond the scope of the work contemplated by Hatch's original estimate, but which was entirely consistent with Hatch's expectations as to further work needed and with improved expected benefits from the uprate portion of the Project.

In summary, when YEC's Board of Directors approved a final Project Budget of $12.257 million in June 2019, as was required to proceed with the Project, the budget increase reflected the extensive work done after the Hatch report was completed, and was largely attributable to adding further life extension work and other refinements to the final scope of the Project. Accordingly, the June 2019 budget, and not the Hatch report, is the relevant base for assessing final Project costs. Economic analysis provided in June 2019 also confirmed that the improved uprate component could enable ratepayer savings to occur even with the greatly enhanced non-uprate components.

In that context, it is apparent that there is no reasonable basis to cap YEC's cost recovery for the Project based on Hatch's original cost estimate plus 20%. It is more relevant for the Board to consider the final budgeted cost of the Project, which was the result of a much more comprehensive scoping and budget estimate process (including RFPs and fixing of prices and

guarantees). The actual final project cost of $12.814 million was only 4.5% higher than the 2019 budgeted estimate.

Table A-1 below highlights the extent to which most of the Project's final actual cost was reflected in the $12.257 million Project Budget approved by YEC's Board of Director's in June 2019. The further information provided below reviews the additional steps and information development undertaken after the issuance of the Hatch report that led to this June 2019 budget, as well as factors contributing to the remaining cost increases incurred thereafter.

Table A-1: WH2 Project Budget Cost Development Before and After June 2019 ($000)

($Thousand)	Hatch Report Cost 2017	Total Actual Final Cost 2022*	Historic Costs incurred to June 2019	Project Budget June 2019	Total Approved Budget June 2019	Final Cost Variance from June 2019 Budget
	A	B	C	D	E=C+D	F=B-E
Owner's Engineer	435	1,154	183	541	724	430
Internal Costs & Project mgmt		1,361	203	717	920	441
Turbine & Generator	3,740	8,714	370	7,083	7,453	1,261
Balance of Plant	40	1,586		1,204	1,204	381
Contingency	567			1,711	1,711	-1,711
AFUDC			2	242	244	-244
Total	**4,782**	**12,814**	**758**	**11,499**	**12,257**	**557**

* For Column B, AFUDC included in cost categories.

Work Phase Leading to June 2019 Budget

After the Hatch report was issued in mid-2017, YEC selected WH2 for the WGS uprate, and initiated work on the Project with an RFP process in February 2018 to hire the Owner's Engineer (SNC Lavalin, contracted in March 2018).

The Owner's Engineer assisted YEC in developing turbine generator performance specifications outlining the desired performance and lifespan of the uprated WH2 unit. These specifications were included in a September 2018 RFP for the Turbine and Generator (T&G) portion of the uprate work. YEC received two bids, and Litostroj Power of Slovenia (Litostroj) was awarded the contract in late 2018.

In January 2019, YEC Management received approval to issue a Limited Notice to Proceed (LNTP) to the selected T&G contractor, Litostroj. The scope of work to be completed under the LNTP included unit dewatering and inspection, plus completion of value engineering to confirm the T&G scope of supply, including selection of component refurbishment vs. replacement. The resulting engineering assessment was completed prior to June 2019 and confirmed that major components of the WH2 unit that were anticipated to be reused could be cost effectively refurbished and reused with the uprated unit.

Litostroj provided an updated price proposal based on the value engineering assessment; it confirmed scope of work; and it provided final unit output guarantees as needed to finalize its contract. The business advantages of the refined Project that were identified as a result of this work are summarized as follows:

- Replacement of the existing turbine runner with a new runner of modern design that improves generating unit efficiency and power, while also increasing the annual flow through the hydro unit, will increase annual hydro energy generation from WH2 to offset thermal generation and provide increased dependable hydro capacity. The expected increase in firm energy as estimated in June 2019 was 6.2 GWh/yr (which is higher than Hatch's thermal displacement estimate of 1.9 GWh/yr), and the expected increase in dependable capacity was 0.94 MW (which is also higher than Hatch's estimate of 0.4 MW).
- The coordination of multiple maintenance activities and overhauls (expected in 2024 and 2034) into a single uprating project would minimize the unit downtime, and will maximize the unit's efficiency, availability and reliability over the next 40 years. The uprating of WH2 can be combined with a generator life extension program that includes generator rewind and turbine replacement.
- Levelized Cost of Capacity (LCOC) and Levelized Cost of Energy (LCOE) based on the above capacity and energy increases and the 2019 Project Budget including contingency were estimated at LCOC of $388/kW/yr and LCOE of $0.059/kWh, and were favourable when compared with other options presented in the 2016 Resource Plan.

Additional detail on updated scope for the Project as at June 2019 is provided below:

T&G Uprate – This includes work required directly on the turbine and generator to increase capacity and efficiency; the Project budget also included a contingency for potential refurbishment work on certain components that could only be fully inspected once the unit was disassembled:

1. Replacement and refurbishment of the identified T&G components based on the results of the detailed engineering analysis. Major parts to be replaced and refurbished on the turbine and generator are shown in Figures 1 and 2 below.

2. Refurbishment of WH2 draft tube. The draft tube is a conduit which connects the runner exit to the tail race where the water is being finally discharged from the turbine.
3. Reassembly, alignment and commissioning of the unit to manufacturer's specifications.
4. Detailed inspection and testing of the stay ring, head cover and generator spider, and repair as necessary.

Figure 1: Section drawing of the WH2 turbine showing major components that will be refurbished (green) and replaced (red).

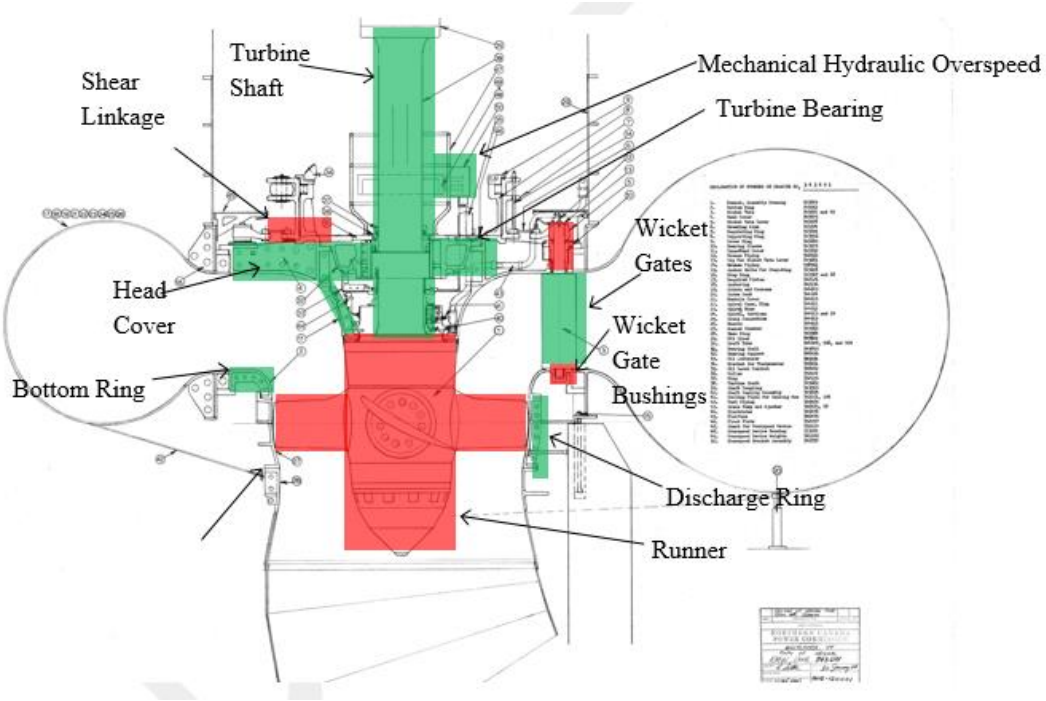
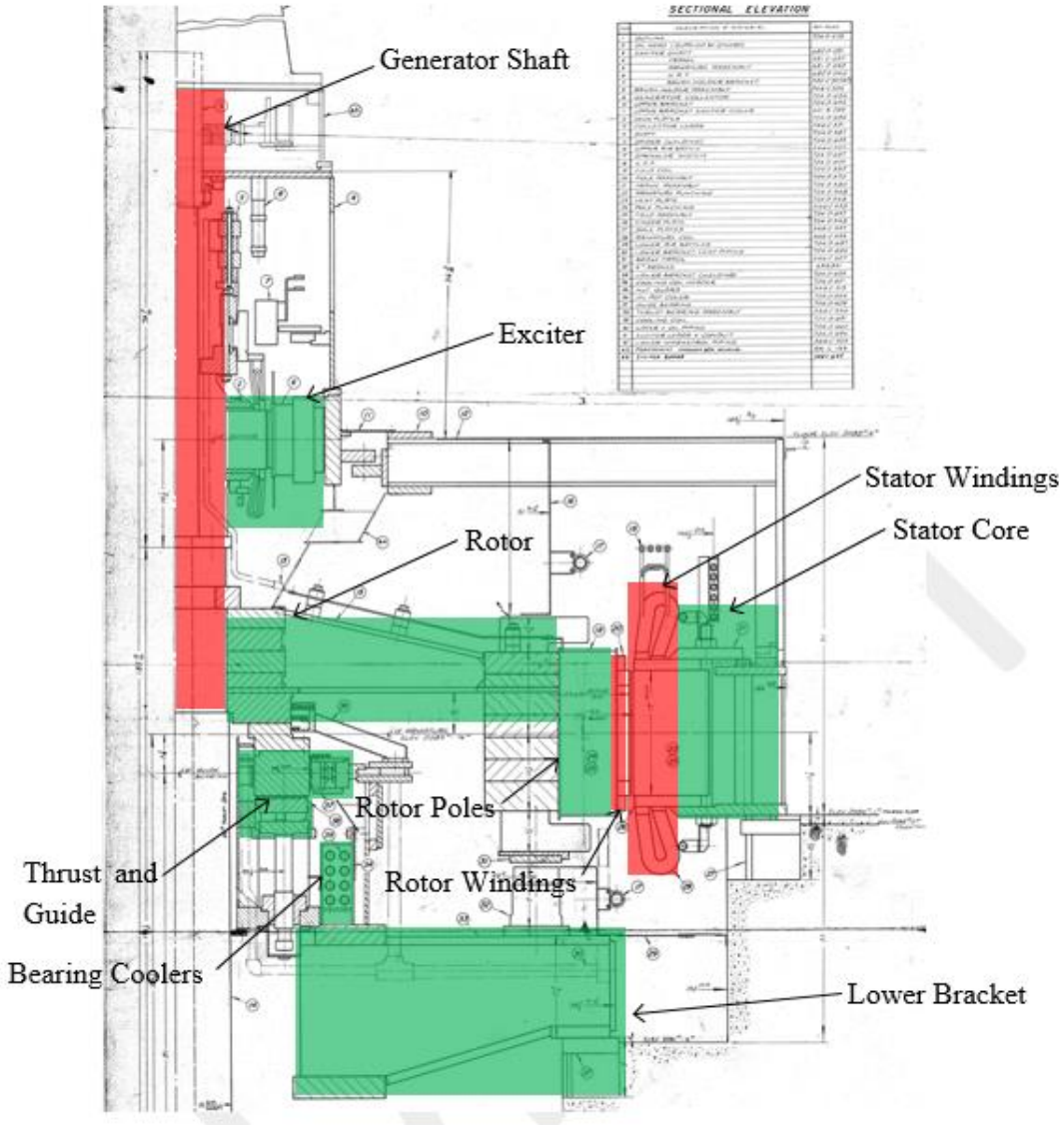


Figure 2: Section view of the WH2 generator showing major parts to be replaced (red) and refurbished (green) as part of the WH2 Uprate.



Balance of Plant Work (BoP) – This includes work required to support a new, modernized, higher capacity unit and to integrate it with YECs control and protection systems. A portion of this work scope was uncertain as at mid 2019 and could only be confirmed once the unit had been disassembled, and the uprate work was underway. Specifically, further assessment was noted to be required as follows:

1. The following WH2 hydro-mechanical components will be further assessed upon disassembly and refurbished as required (contingency provided in budget):
    a. Penstock [subsequent to the 2019 assessment and budget, this one item was postponed to a future project]
    b. Draft Tube
2. Replacement and additions to the station service power, unit control and protection systems, and integration of the uprated WH2 unit with YEC's control and protection systems, including:
    a. Protection and control integration engineering
    b. Condition monitoring and instrumentation integration
    c. Interposing relays and DC inverter
    d. SCADA/PLC updates
    e. Ventilation upgrades

The RFPs for BoP work were developed in 2019 after June, with work to be performed in 2020/2021.

Work Phase after June 2019 Budget

The Project work was mainly completed in 2021 as planned; only $0.457 of final costs were incurred in 2022. Final actual costs were $0.557 million more than the June 2019 Project budget, reflecting final cost requirements in excess of the $1.7 million contingency included in the budget. Increases in turbine and generator plus balance of plant costs at $1.6 million reflect additional refurbishment and plant modification requirements that were revealed during the construction process after the unit was disassembled. The remaining cost increases of $0.9 million over the 2019 budget were for Owner's Engineer, Internal Costs and Project Management.