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October 14, 2022

Sara Hardgrave
Acting Commission Secretary and Manager
Regulatory Services
British Columbia Utilities Commission
Suite 410, 900 Howe Street
Vancouver, BC V6Z 2N3

Dear Sara Hardgrave:

**RE: Project No. 1599273
British Columbia Utilities Commission (BCUC or Commission)
British Columbia Hydro and Power Authority (BC Hydro)
Mainwaring Substation Upgrade Project
Compliance with BCUC Order Nos. C-4-22 and G-243-22
CONFIDENTIAL Semi-Annual Progress Report No. 1
January 1, 2022 to June 30, 2022 (Semi-Annual Report)**

BC Hydro writes in compliance with BCUC Order Nos. C-4-22 and G-243-22 to provide its confidential Semi-Annual Report. BC Hydro also reports material changes to the Project schedule pursuant to Order C-4-22.

BC Hydro is providing the confidential Semi-Annual Report to the BCUC only. A public version of the Semi-Annual Report is being filed under separate cover redacting commercially sensitive and contractor-specific information. BC Hydro seeks this confidential treatment pursuant to section 42 of the *Administrative Tribunals Act* and Part 4 of the Commission's Rules of Practice and Procedure.

For further information, please contact Joe Maloney at 604-623-4348 or by email at bchydroregulatorygroup@bchydro.com.

Yours sincerely,



Chris Sandve
Chief Regulatory Officer

jm/tl
Enclosure

BC Hydro Mainwaring Substation Upgrade Project

Semi-Annual Progress Report No. 1

Six Month Period

January 1, 2022 to June 30, 2022

PUBLIC

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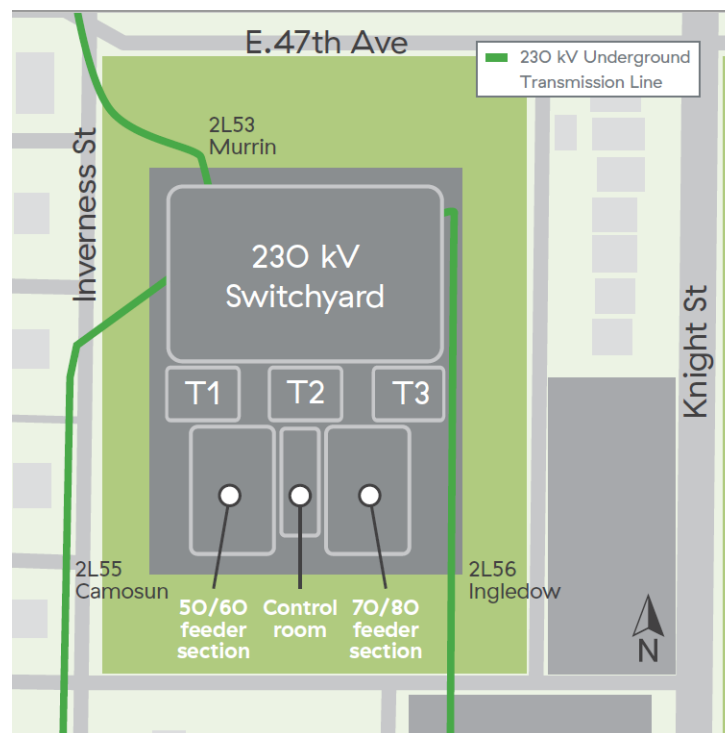
Appendix A	Design Images
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1 Background

1.1 Project Overview

The Mainwaring substation is centrally located within the Metro Vancouver Burnaby sub-region, which comprises 16 substations. The Metro Vancouver Burnaby sub-region has the largest load in the BC Hydro system. Based on peak demand, the Mainwaring substation is the seventh largest distribution substation in the BC Hydro system. The Mainwaring substation is a high criticality substation with a normalized criticality score of 83/100 (with zero being the least critical and 100 being the most critical substation). The Mainwaring substation layout is shown in [Figure 1](#) below.

Figure 1 Mainwaring Substation Layout



The Mainwaring Substation Upgrade Project (**the Project**) addresses significant reliability, safety, environmental and reputational risks due to the deteriorated condition of the T1 and T3 power transformers and the 50/60 feeder section in the

substation. Both the T1 and T3 power transformers have a “Poor” Asset Health Rating (**AHR**) and are reaching their end-of-life. Most of the equipment in the 50/60 series feeder section also has a “Poor” or “Very Poor” AHR. The deterioration of these key assets increases the likelihood of equipment failure, which can cause unplanned outages and impacts to customers, and poses safety risks to the works and the public. Additionally, the presence of Polychlorinated Biphenyls (**PCBs**) in equipment needs to be addressed to comply with the federal PCB Regulations.¹

The Project will replace the T1 and T3 power transformers with two new 150 MVA transformers and replace the existing 50/60 feeder section with three new indoor gas insulated feeder sections with a total of 21 feeder positions and all associated equipment. The existing substation fence will be expanded within BC Hydro’s property to accommodate a new gas insulated switchgear building.

1.2 BCUC Application and Decision

In November 2021, British Columbia Hydro and Power Authority (**BC Hydro**) filed an application with the British Columbia Utilities Commission (**BCUC**) seeking a Certificate of Public Convenience and Necessity (**CPCN**) for the Project (**Application**). At the time of the Application, the Project had a total cost estimate range of \$91.5 million to \$143.3 million, with an expected in-service date of October 2026. The Project schedule allowed all required PCB-containing equipment to be removed from the site before the federal PCB Regulations compliance deadline of December 31, 2025.

On August 16, 2022, the BCUC issued Order No. C-4-22 granting a CPCN to BC Hydro for the Project. In the Order, the BCUC directed BC Hydro to file semi-annual progress reports and also a Material Change report in the event of a change to BC Hydro’s plan as set out in the Application that would reasonably be

¹ The PCB Regulations are issued under the *Canadian Environmental Protection Act, 1999* and are intended to protect the health of Canadians and the environment by preventing the release of PCBs to the environment, and by accelerating the phasing out of these substances.

expected to have a significant impact on the Project (i.e., a schedule delay of greater than six months, the total Project cost exceeding 10% of the estimated Project cost, or a change to the Project scope).

BC Hydro files the Progress Report No. 1 (**Report**), which provides an update on the Project covering the period ending June 30, 2022 (**Reporting Period**). The Report complies with project reporting requirements for semi-annual progress reports as set out in Appendix A to Order C-4-22. In section [7](#) of the Report, BC Hydro also reports “material changes” to the Project schedule pursuant to Order C-4-22.

Commercially sensitive numbers and content has been redacted. Public disclosure of the redacted information would harm our negotiating position and ultimately harm our customers.

2 Project Status

2.1 General Project Status

The table below provides a high-level status update for the Project.

Table 1 Project Status Dashboard²

● Green: No Concerns; ● Amber: Some Concerns but in Control; ● Red: Serious Concerns

Status as of:		June 30, 2022
Project Status	●	All key performance indicators are green. The Project is currently in Definition phase and is on track to meet the end-of-Definition phase milestone date.
Safety	●	No construction work will occur prior to approval of Implementation phase. Constructability and design measures are being considered during Preliminary Design to address potential safety issues during construction, operation and maintenance.
Scope	●	All scope items of the Project are well defined. No material scope risk has been identified.
Schedule	●	The Project is not forecasting to miss any key milestones in the Definition phase against the planned approved date. The Project has progressed on schedule for key milestones to date. The Project will seek approval of Implementation funding by December 2022.
Cost	●	The estimate at completion for the Definition phase is within the BC Hydro-approved Expected Cost to the end of Definition phase.
First Nations	●	The Project has minimal or no incremental adverse impacts on Aboriginal rights or Aboriginal title. Potentially Impacted First Nations were updated on the Application filing.
Stakeholder Engagement	●	No new issues. Contact is maintained with the City of Vancouver and other external stakeholders including nearby residents. A virtual Open House is planned for September 2022. ³

2.2 Major Accomplishments and Work Completed

2.2.1 Procurement Activities

BC Hydro initiated procurement for long lead time equipment (new power transformers, resin impregnated paper bus, and gas insulated switchgear) in the Definition phase to avoid delayed equipment delivery and schedule impacts. Specifically, BC Hydro committed to Original Equipment Manufacturer Design (Stage 1) work of \$ [REDACTED] million in the Definition phase for the aforementioned long lead time equipment. Supply and/or installation work (Stage 2) will be awarded in the Implementation phase. These contracts are summarized in section [5.2](#).

² The presented key performance indicators are BC Hydro's internal indicators of project health that reflect performance against BC Hydro-approved scope, schedule and cost.

³ As of June 30, 2022, the virtual Open House had not yet occurred.

2.2.2 Contract Management Activities

There have been no contract issues. All contracts are progressing well. Stage 1 work for the transformer contract is complete. Stage 1 work for the resin impregnated paper bus and gas insulated switchgear is on schedule and will be complete by the end of the Definition phase.

2.2.3 Engineering and Design

During the Reporting Period, the following engineering and design works were advanced:

- The civil, electrical, and mechanical designs of the new gas insulated switchgear feeder building and the site preparation (e.g., expansion of the substation ground) were advanced to 65% completion;
- Design of the distribution scope is in progress to reach 65% completion. The design will avoid future feeder egress constraints when the 70/80 feeder section is replaced with gas insulated switchgear;
- The design of the protection and control and supervisory control and data acquisition was advanced to 35% completion. The design of the protection and control system was approved, and an initial design of the telecommunication system was completed; and
- An early draft of the scope and specification of the civil contract for the gas insulated switchgear feeder building was prepared.

2.2.4 Construction Activities

There have been no site construction activities undertaken to date. The construction schedule and outage staging plan were further refined.

2.2.5 Environment and Archaeology

There are no reportable environmental incidents and no archaeological finds or issues.

- A tree inventory report was completed, and a tree planting plan was developed to mitigate the loss of buffer area on the southern portion of the Project area;
- Soils contaminated with PCB and metals were identified within the fenced substation. Contaminated soils will be disposed of offsite at a permitted facility during construction;
- No *Water Sustainability Act* permits are required for groundwater management during construction;
- Station equipment has insulating oil containing PCBs.⁴ Oil management will be required during the Implementation phase. Disposal of hazardous waste (e.g., asbestos, concrete wash water) is anticipated during construction;
- An archaeology and heritage assessment has been completed. Results of these assessments indicate low archaeological potential. BC Hydro's Chance Find procedure⁵ will be implemented during construction; and
- An environmental management plan has been developed for the Project. All environmental risks will be managed through the implementation of the environmental management plan.

2.2.6 First Nations

No concerns or questions have been raised by potentially affected First Nations during the Reporting Period. Engagement with First Nations continues on the Project, including discussions on potential procurement opportunities.

⁴ PCB concentrations in oil are below the *PCB Regulations* limit of 50 ppm, as noted in Table 2-7 of the Application.

⁵ BC Hydro's Chance Find procedure requires that work stop immediately if a potential artifact or heritage object is discovered at a work site.

2.2.7 Public Engagement

No new issues were identified during the Reporting Period. Work is ongoing to address issues raised to date as summarized in Table 5-2 of the Application. Regular contact is maintained with the City of Vancouver and other external stakeholders, including nearby residents. Local residents were notified of the filing of the Application and were provided instructions on how to access the public version of the Application. Planning started for a virtual open house in September 2022.

2.2.8 Regulatory, Permits, and Authorizations

There were no permitting requirements during the Reporting Period.

2.3 Project Challenges

There have been no material project challenges during the Reporting Period.

2.4 Plans for Next Six Months

The Project plans to undertake the following activities from July 2022 to December 2022:

- Progress design of all disciplines to 95% completion;
- Complete updated Preliminary Design Estimate (+15%/ -10%);
- Complete all Definition Phase deliverables and obtain endorsement from the BC Hydro Gate Board and approval from the BC Hydro Board of Directors to proceed to Implementation phase;
- Issue Request for Proposal for the gas insulated switchgear feeder building contract;
- Progress vendor design for gas insulated switchgear and resin impregnated paper bus;
- Release Stage 2 Contract change orders for supply and installation of major equipment after approval of Implementation phase funding;

- Further soil testing in the substation expansion area;
- Issue construction requirements document to BC Hydro Construction Services for site preparation work;
- Engage a First Nations designated business that is also a BC Hydro-approved vegetation management contractor for tree removal to facilitate site preparation work; and
- Hold a virtual open house in September 2022, before any construction activity begins on site.

3 Scope Change Summary

There have been no material changes in project scope.

4 Project Schedule

As of the end of the Reporting Period (June 30, 2022), the Project in-service date is forecast to be December 2026. This is a two-month delay from the in-service date of October 2026 stated in the Application. The delay is due to needing more time to complete the Preliminary Design estimate. The table below provides the forecast dates for the Project major milestones as of June 30, 2022 and a comparison to the estimated dates provided in Table 4-4 of the Application. Variances are explained in section [4.1.1](#).

Table 2 Project Major Milestones as of June 30, 2022

Row No.	Description of Major Milestone	Estimated Date in Application dated Nov 5, 2021	Actual / Current Forecast as of June 30, 2022	Status and Comments
1	Stage 1 Contract Award - Transformers	July 2021	July 2021	Complete
2	Application Filed with BCUC	November 2021	November 2021	Complete
3	Requested BCUC Decision Date	August 2022	August 2022	Complete
4	Stage 2 Contract Award - Transformers	October 2022	December 2022	Forecasting delay

Row No.	Description of Major Milestone	Estimated Date in Application dated Nov 5, 2021	Actual / Current Forecast as of June 30, 2022	Status and Comments
5	Gas Insulated Switchgear Feeder Building Contract Award	October 2022	March 2023	Forecasting delay
6	Construction Services Mobilization	November 2022	January 2023	Forecasting delay
7	Contractor Mobilization	January 2023	March 2023	Forecasting delay
8	Asset In-Service Date - T4 Transformer	September 2024	October 2024	Forecasting delay
9	PCB Equipment Removal Complete	January 2025	July 2025	Forecasting delay
10	Asset In-Service Date - T5 Transformer	March 2025	October 2025	Forecasting delay
11	Project In-Service Date	October 2026	December 2026	Forecasting delay
12	Project Complete	October 2027	June 2028	Forecasting delay

4.1.1 Schedule Variance Explanation for Forecast as of June 30, 2022

The table below provides the reasons for the variances between the Application dated November 5, 2021 and the actual/current forecast as of June 30, 2022.

Table 3 Schedule Variance Explanation for Forecast as of June 30, 2022

Row in Table 2	Explanation	Variance
4, 6, 7, 11	Forecasting delay due to needing more time to complete the Preliminary Design estimate.	2 months, each row
5	Forecasting delay due to needing more time to prepare the specifications for the site preparation and gas insulated switchgear building request for proposal.	5 months
8	Forecasting a one-month delay due to the timing of available outage window for replacing the transformer.	1 month
9	Forecasting a six-month delay due to the timing of available outage window for replacing the transformer and due to leaving the T1 power transformer in place longer to eliminate the temporary installation of the T5 power transformer. ⁶ While the July 2025 PCB removal completion date still meets the December 31, 2025 deadline as required by federal regulation, BC Hydro is implementing the risk treatments listed in section 6 to ensure compliance.	6 months

⁶ As noted in BC Hydro's response to BCUC IR 2.27.1, during review of the construction outage staging plan with Transmission & Distribution System Operations, BC Hydro identified that the temporary installation of the T5 power transformer could be eliminated if the sequence was modified. By leaving the T1 power transformer in place longer and removing the T3 power transformer first, the remaining transformer capacity is higher and BC Hydro is able to rely on Distribution circuit ties for the remaining supply redundancy.

Row in Table 2	Explanation	Variance
10	Forecasting a seven-month delay due to the timing of available outage window for replacing the transformer and due to leaving the T1 power transformer in place longer to eliminate the temporary installation of the T5 power transformer. ⁶	7 months
12	Forecasting a two-month delay due to needing more time to complete the Preliminary Design estimate, plus a six-month delay to allow more time after the in-service date to prepare and review the Project Completion and Evaluation Report, including providing a briefing to BC Hydro’s Board of Directors, before filing the Project Completion and Evaluation Report with the BCUC.	8 months

5 Project Costs

5.1 Project Cost Summary as of June 30, 2022

The table below provides the actual costs incurred to the end of the Reporting Period (June 30, 2022). The table also provides the forecast to Project completion as of June 30, 2022 and a comparison to the estimated Project cost range breakdown provided in Table 4-2 of the Application.

Table 4 Project Expenditure Summary - Application, Forecast and Actual Cost as of June 30, 2022 (\$ millions)

Row No.	Description	Forecast Analysis				Actuals Analysis		
		A	B	C	D	E	F	G
		Project Cost Range in Application dated Nov 5, 2021	Forecast as of June 30, 2022	\$ million [E-A]	% [F/A]	Actuals to June 30, 2022	\$ million [H-A]	% [J/A]
1	Pre-Implementation Phase Costs Excluding Interest During Construction and Capital Overhead							
	Implementation Phase Costs							
	Direct Construction Costs							
2	Site Work, Temporary Work, Foundation & Steel Structure							
3	Bus Work & Grounding							

Row No.	Description	Project Cost Range in Application dated Nov 5, 2021	Forecast Analysis			Actuals Analysis		
			A	B	C	D	E	F
			Forecast as of June 30, 2022	\$ million [E-A]	% [F/A]	Actuals to June 30, 2022	\$ million [H-A]	% [J/A]
4	Major Equipment ⁷							
5	Gas Insulated Switchgear Feeder Building							
6	Gas Insulated Switchgear							
7	Protection & Control, Automation, SCADA & Telecommunication							
8	Distribution							
9	Asset Dismantle and Removal							
10	General Construction Requirements							
11	Total Direct Construction Costs							
	Indirect Construction Costs							
12	General Management							
13	Engineering & Design							
14	Total Indirect Construction Costs							
15	Implementation Costs							
	Before Contingency & Loadings							
16	Contingency							
17	Escalation							
18	Capital Overhead							
19	Interest During Construction							
20	BC Hydro Expected Amount	114.4	112.0	-2.4	-2	7.6	-106.8	-93
21	Project Reserve (Loaded)	28.9	28.9	0.0	0	0.0	-28.9	-100
22	BC Hydro Authorized Amount	143.3	140.9	-2.4	-2	7.6	-135.7	-95
23	Project Cost Range	143.3 - 91.58						

The table below provides the reason for the variance between the Application dated November 5, 2021 and the forecast as of June 30, 2022.

⁷ Includes power transformers, instrument transformers, station service transformers, current limiting reactors, neutral reactors, surge capacitors, disconnect switches, and surge arresters.
⁸ Estimating accuracy range of +25%/-20% of the Expected Cost of the Implementation phase.

Table 5 Cost Variance Explanation for Forecast as of June 30, 2022

Row in Table 4	Explanation	Variance \$ million
1	Decrease due to Definition phase contingency not being spent/utilized and engineering design underspend.	

5.2 Summary of Individual Contracts Exceeding \$3.0 million

Table 6 Summary of Contracts Exceeding \$3.0 million

Description Supplier and Scope of Supply	Initial Contract Value ⁹ (\$ million)			Expected Equitable Adjustment (\$ million)	Expected Forecast Contract Cost (\$ million)	Actuals to end of Reporting Period (\$ million)
	Stage 1 (design)	Stage 2 (supply and/or installation)	Total			
Hyundai Electric Energy System Co c/o Hyundai Electric America Corp. Power Transformer						
ABB Inc. Medium Voltage Gas-Insulated Switchgear						
MindCore Technologies Inc. 25kV Resin Impregnated Paper Bus						
Total						

5.3 Forecast Project Cost of September 16, 2022

An updated preliminary estimate was completed on August 31, 2022 and endorsed by BC Hydro’s Gate Board on September 16, 2022. Approval for full Implementation Phase Funding based on the updated Expected and Authorized Costs will be sought from the BC Hydro Board of Directors in December 2022.

⁹ Estimated value at the time the contract was awarded.

The updated preliminary estimate has an estimating accuracy range of +15% / -10% of the Expected Cost. The updated Authorized Cost is \$156.3 million, an increase of 9% of the Authorized Cost of \$143.3 million presented in Table 4-2 in the Application. The updated Expected Cost is \$129.5 million, an increase of 13% of the Expected Cost of \$114.4 million presented in the Application. The updated Expected Cost remains within the Project cost range presented in the Application.

BC Hydro provides the updated preliminary estimate for the BCUC's information, in [Table 7](#) below. Order C-4-22 requires Material Change reports when the total Project cost exceeds 10% of the estimated Project cost provided in Table 4-2 of the Application. BC Hydro does not consider a Material Change report to be required for the updated preliminary estimate. BC Hydro defines the total Project cost as the Authorized Cost and the increase in the Authorized Cost is less than 10% of the Application amount. The use of the Authorized Cost as the Project cost is consistent with BC Hydro's Fiscal 2023 to Fiscal 2025 Revenue Requirements Application where BC Hydro provided the Authorized Costs for projects in Appendices I and J, and consistent with its use for determining whether the "Major Project" expenditure threshold has been exceeded as noted in section 2.3 of Order G-313-19.

Cost increases are due primarily to design progression, atypical current market conditions such as material and labour cost escalations being experienced by vendors and suppliers, and increases in BC Hydro's escalation and interest during construction rates. Since there is still significant market uncertainty and prices are expected to continue to be volatile, the updated estimate now includes a Special Reserve of \$7.1 million for price escalation risk.

Variances greater than \$1 million, between the estimated Project cost range breakdown provided in Table 4-2 of the Application and the updated preliminary estimate, are explained in section [5.3.1](#).

Table 7 Project Estimate as of September 16, 2022 (\$ millions)

Row No.	Description	A Project Cost Range in Application dated Nov 5, 2021	B Updated Preliminary Estimate as of Sep 16, 2022	C \$ million [B-A]	D % [C/A]
1	Pre-Implementation Phase Costs Excluding Interest During Construction and Capital Overhead				
	Implementation Phase Costs				
	Direct Construction Costs				
2	Site Work, Temporary Work, Foundation & Steel Structure				
3	Bus Work & Grounding				
4	Major Equipment ¹⁰				
5	Gas Insulated Switchgear Feeder Building				
6	Gas Insulated Switchgear				
7	Protection & Control, Automation, SCADA & Telecommunication				
8	Distribution				
9	Asset Dismantle and Removal				
10	General Construction Requirements				
11	Total Direct Construction Costs				
	Indirect Construction Costs				
12	General Management				
13	Engineering & Design				
14	Total Indirect Construction Costs				
15	Implementation Costs Before Contingency & Loadings				
16	Contingency				
17	Escalation				
18	Capital Overhead				
19	Interest During Construction				
20	BC Hydro Expected Amount	114.4	129.5	15.1	13

10 Includes power transformers, instrument transformers, station service transformers, current limiting reactors, neutral reactors, surge capacitors, disconnect switches, and surge arresters.

Row No.	Description	A Project Cost Range in Application dated Nov 5, 2021	B Updated Preliminary Estimate as of Sep 16, 2022	C \$ million [B-A]	D % [C/A]
21	Project Reserve (Loaded)	28.9	26.8	-2.1	-7
22	BC Hydro Authorized Amount	143.3	156.3	13.0	9
23	Project Cost Range	143.3 - 91.5 ¹¹	148.9-116.6 ¹²		

5.3.1 Project Cost Variance Explanation for Estimate of September 16, 2022

The table below provides the reasons for the variances between the Application dated November 5, 2021 and the updated preliminary cost estimate of September 16, 2022.

Table 8 Cost Variance Explanation for Project Estimate of September 16, 2022

Row in Table 7	Explanation	Variance \$ million
1	Decrease due to Definition phase contingency not being spent/utilized and engineering design underspend.	
2	\$ [redacted] million increase due to (1) more refined design resulting in increased quantities for various equipment and (2) update to BC Hydro escalation rates to account for future market condition changes. Partially offset by \$ [redacted] million decrease due to removal of temporary work.	
5	Increase to material and labour costs due to higher than expected escalation. Specifically, the updated preliminary estimate takes into consideration the contract price of the completed Barnard substation project escalated to reflect expected market conditions for the 2023 proposal price. ¹³	
3,7,8	Increase due to (1) more refined design resulting in increased quantities for various equipment and (2) update to BC Hydro escalation rates to account for future market condition changes.	

¹¹ Estimating accuracy range of +25%/-20% of the Expected Cost of the Implementation phase.

¹² Estimating accuracy range of +15%/-10% of the Expected Cost of the Implementation phase.

¹³ BC Hydro recently completed the installation of new gas insulated switchgear feeders at Barnard substation in Burnaby. The gas insulated switchgear building types for the Barnard project and the Mainwaring project are similar.

Row in Table 7	Explanation	Variance \$ million
6	Increase to material and labour costs due to escalation. Specifically, (1) the gas insulated switchgear was revised to use the contract amount, and (2) the gas insulated switchgear cable termination and gas insulated switchgear panel cost was revised to use the actual cost from the Barnard substation project escalated to reflect expected market conditions for the 2023 proposal price. ¹³	
9	Decrease due to more refined design resulting in reduced quantities for various equipment.	
10,12	Increase to work packages requiring more effort due to more refined budgets attributable to Project progression, primarily for construction and contract management and procurement management.	
17	Decrease due to Project progression, primarily: refined cash flow for Implementation phase, elimination of escalation for Definition phase as it is now complete, and reduction in contingency.	
19	Increase due to increased implementation costs before contingency and loadings (line 15), extended in-service date, and increased interest during construction rates.	
21	\$█ million decrease due to Project progression resulting in a decreased in the P90-P50 estimate. Partially offset by a \$█ million increase due to the addition of a special reserve for price escalation risk.	

6 Project Risks

This section describes the material¹⁴ Project risks that have potential to impact the Project. Over the life of the Project, risks and associated risk treatments are and will be identified, analyzed, monitored, and reviewed, in accordance with BC Hydro’s project management practices and procedures.

¹⁴ BC Hydro defines ‘material’ in this case to be any risk with a pre-treatment risk level in the Executive Risk zone, as identified in the Project Delivery Risk Matrix, which was provided in Appendix O of the Application.

Table 9 Summary of Material Project Risks and Treatments

From Application dated Nov 5, 2021						Updated for Reporting Period ending June 30, 2022			
1	2	3	4	5	6	7	8	9	10
Section in Application	Risk Status ¹⁵	Description of Risk Event and Consequence	Consequence Type	Risk Level	Residual Risk Level	Risk Status	Risk Treatments (Identified in the Application or New)	Treatment Status	Residual Risk Level
6.3.1	Identified	Risk of this Regulatory Proceeding Impacting the Project Schedule BC Hydro expects to proceed to the Implementation phase of the Project by October 2022 in order to meet the PCB removal timeline. BC Hydro is requesting a decision from the BCUC on whether to grant a CPCN for the Project no later than August 2022.	Financial Loss	10 Probability: Possible (L6) Severity: \$10M to \$100M (S4)	8 Probability: Very Unlikely (L4) Severity: \$10M to \$100M (S4)	Identified	<ul style="list-style-type: none"> Comprehensive Application Regulatory schedule allows for a decision by August 2022 Include a three-month contingency to mitigate impact from the regulatory proceeding Prepare contingency plan to remove PCB-containing equipment to meet the regulatory timeline 	Complete Complete Complete In progress	8 Probability: Very Unlikely (L4) Severity: \$10M to \$100M (S4)
6.3.2	Identified	Risk of Transformer Failure Due to the age and condition of the T1 and T3 power transformers, there is a risk of failure and loss of equipment redundancy, resulting in an increased risk of service loss.	Reliability	10 Probability: Possible (L6) Severity: Localized load shedding (S4)	8 Probability: Very Unlikely (L4) Severity: Localized load shedding (S4)	Identified	<ul style="list-style-type: none"> Install the new T5 transformer on a temporary pad prior to putting T4 in service Advance design of the transformers from the Implementation phase to the Definition phase New: Implement preventive maintenance and enhanced surveillance for early warning signals of any incipient fault until the transformers are replaced 	Removed ¹⁶ Complete In progress	8 Probability: Very Unlikely (L4) Severity: Localized load shedding (S4)
6.3.3	Identified	Risk of Sunk Costs Associated with Early Equipment Procurement In order to meet the PCB removal deadline, BC Hydro will place orders for long lead time equipment prior to BCUC's decision on whether to grant a CPCN for the Project and prior to approval from BC Hydro's Board of Directors of Full Implementation Funding. This could result in sunk costs for this equipment.	Financial Loss	10 Probability: Possible (L6) Severity: \$10M to \$100M (S4)	8 Probability: Remote (L5) Severity: \$1M to \$10M (S3)	Treated	<ul style="list-style-type: none"> Stage the award of the long lead time equipment contracts Include an exit clause in the Stage 1 contract 	Complete Complete	8 Probability: Remote (L5) Severity: \$1M to \$10M (S3)

¹⁵ Instances of "Active" risk status in the Application were errors because "Active" means that the risk event had occurred, and the consequence may or may not have occurred. The correct risk status is "Identified" because the risk event had been identified, and had not occurred and treatment plans may still have been in development.

¹⁶ As noted in BC Hydro's response to BCUC IR 1.19.1, the updated construction staging plan no longer requires the temporary installation of T5 to maintain redundancy of supply during construction. Instead, BC Hydro will maintain redundancy of supply to all customers throughout the Project construction period by planning transformer outages during off peak seasons and using the transfer capacity available on the distribution system during those seasons.

From Application dated Nov 5, 2021						Updated for Reporting Period ending June 30, 2022			
1	2	3	4	5	6	7	• 8	9	10
Section in Application	Risk Status	Description of Risk Event and Consequence	Consequence Type	Risk Level	Residual Risk Level	Risk Status	Risk Treatments • (Identified in the Application or New)	Treatment Status	Residual Risk Level
6.4.1	Identified	Risk of Missing PCB Deadline due to Schedule Delays There is a risk that equipment containing PCBs will not be removed by the deadline of December 31, 2025, resulting in non-compliance with <i>PCB Regulations</i> and fines.	Reputational	11 Probability: Possible (L6) Severity: Loss of trust (S5)	10 Probability: Remote (L5) Severity: Loss of trust (S5)	Identified	<ul style="list-style-type: none"> Complete critical Implementation phase work in the Definition phase Procure long lead time equipment early Prioritize construction work for PCB removal Prepare a contingency plan for removal of PCB-containing equipment to meet the regulatory timeline 	In progress In progress In progress In progress	10 Probability: Remote (L5) Severity: Loss of trust (S5)
6.4.2	Identified	Risk of Worker Injury in an Energized Substation There is a risk of a worker or equipment violating the Limits of Approach requirements while working in the energized substation, resulting in worker injury or fatality.	Safety - Worker	10 Probability: Remote (L5) Severity: Fatality (S5)	9 Probability: Very Unlikely (L4) Severity: Fatality (S5)	Identified	<ul style="list-style-type: none"> BC Hydro maintains role of Prime Contractor Require mandatory Power System Safety Protection and local component training for workers working within the substation Provide workers with the proper training and work methods Use mostly BC Hydro internal resources for high-risk work within the energized substation Review contractor's safety management plan to ensure robust safe work procedures Coordinate the sequencing of construction tasks to reduce the overlap of activities that may be hazardous Use physical barriers, warning tapes and signage to isolate live equipment and only allow work in designated areas Use a safety watcher to oversee work where unqualified workers distance cannot be maintained 	Planned Planned Planned Planned Planned In progress Planned Planned	9 Probability: Very Unlikely (L4) Severity: Fatality (S5)

From Application dated Nov 5, 2021						Updated for Reporting Period ending June 30, 2022			
1	2	3	4	5	6	7	• 8	9	10
Section in Application	Risk Status	Description of Risk Event and Consequence	Consequence Type	Risk Level	Residual Risk Level	Risk Status	Risk Treatments • (Identified in the Application or New)	Treatment Status	Residual Risk Level
6.4.3	Identified	<p>Risk of Noise Level Exceeding City Bylaw Limits</p> <p>There is a risk that the noise level will be above 45 dBA after installation of the new transformers resulting in complaints from the community.</p>	Reputational	<p>11</p> <p>Probability: Possible (L6)</p> <p>Severity: Loss of trust (S5)</p>	<p>7</p> <p>Probability: Possible (L6)</p> <p>Severity: Limited Complaints to Company or Shareholder (S1)</p>	Identified	<ul style="list-style-type: none"> Specify and order low noise level (70/72 dBA) transformers Make provision for total tank sound enclosure If after installation, noise levels exceed the bylaw noise threshold, BC Hydro will install the total tank sound enclosure to further reduce the noise level at the substation property line 	<p>Complete</p> <p>Complete</p> <p>Planned</p>	<p>7</p> <p>Probability: Possible (L6)</p> <p>Severity: Limited Complaints to Company or Shareholder (S1)</p>

7 Material Change Report

Pursuant to Order C-4-22, BC Hydro reports the following applicable Material Change, as of September 16, 2022:

- Schedule delays of greater than six months compared to the schedule provided in Table 4-4 of the Application.

The total Project cost does not exceed 10% of the estimated Project cost provided in Table 4-2 of the Application and there is no change to the Project scope provided in Chapter 4 of the Application.

7.1 Forecast Project Schedule as of September 16, 2022

An updated project schedule was developed concurrently with the updated preliminary estimate of August 31, 2022. The updated project schedule was endorsed by BC Hydro's Gate Board on September 16, 2022. The updated in-service date will be provided to the BC Hydro Board of Directors with the request for Implementation phase funding approval in December 2022.

The Project in-service date is forecast to be December 2026; this is unchanged from the forecast as of June 30, 2022 that is reported in section [4](#). This is a two-month delay from the in-service date of October 2026 stated in the Application.

BC Hydro provides the updated Project major milestones to inform the BCUC of an expected six-month delay in the PCB equipment removal complete milestone.

Although this Material Change is provided before of approval from BC Hydro Board of Directors, future Material Changes for schedule delays will be reported subsequent to the changes receiving approval from the appropriate authority within BC Hydro.

The table below provides the forecast dates for the Project major milestones as of September 16, 2022 and a comparison to the estimated dates provided in Table 4-4

of the Application. There are three schedule delays of greater than six months compared to the schedule provided in Table 4-4 of the Application:

1. The date for the PCB equipment removal complete milestone is now forecast to be July 2025. This is a six-month delay from the date of January 2025 in the Application;
2. The date of the T5 transformer asset in-service date is now forecast to be October 2025. This is a seven-month delay from the date of March 2025 in the Application; and
3. The date for the Project Complete milestone is now forecast to be June 2028. This is an eight-month delay from the date of October 2027 in the Application.

There is no change to the material risks or the treatment plans as a result of these changes. Variances are explained in section [7.1.1](#).

Table 10 Project Major Milestones as of September 16, 2022

Row No.	Description of Major Milestone	Estimated Date in Application dated Nov 5, 2021	Actual / Current Forecast as of Sep 16, 2022	Status and Comments
1	Stage 1 Contract Award - Transformers	July 2021	July 2021	Complete
2	Application Filed with BCUC	November 2021	November 2021	Complete
3	Requested BCUC Decision Date	August 2022	August 2022	Complete
4	Stage 2 Contract Award - Transformers	October 2022	December 2022	Forecasting delay
5	Gas Insulated Switchgear Feeder Building Contract Award	October 2022	March 2023	Forecasting delay
6	Construction Services Mobilization	November 2022	January 2023	Forecasting delay
7	Contractor Mobilization	January 2023	June 2023	Forecasting delay
8	Asset In-Service Date - T4 Transformer	September 2024	October 2024	Forecasting delay
9	PCB Equipment Removal Complete	January 2025	July 2025	Forecasting delay
10	Asset In-Service Date - T5 Transformer	March 2025	October 2025	Forecasting delay
11	Project In-Service Date	October 2026	December 2026	Forecasting delay
12	Project Complete	October 2027	June 2028	Forecasting delay

7.1.1 Schedule Variance Explanation for Forecast as of September 16, 2022

The table below provides the reasons for the variances between the Application dated November 5, 2021 and the actual/current forecast as of September 16, 2022. These explanations are consistent with section [4.1.1](#).

Table 11 Schedule Variance Explanation for Forecast as of September 16, 2022

Row in Table 10	Explanation	Variance
9	Forecasting a six-month delay due to the timing of available outage window for replacing the transformer and due to leaving the T1 power transformer in place longer to eliminate the temporary installation of the T5 power transformer. ⁶ While the July 2025 PCB removal completion date still meets the December 31, 2025 deadline as required by federal regulation, BC Hydro is implementing the risk treatments listed in section 6 to ensure compliance.	6 months
10	Forecasting a seven-month delay due to the timing of available outage window for replacing the transformer and due to leaving the T1 power transformer in place longer to eliminate the temporary installation of the T5 power transformer. ⁶	7 months
12	Forecasting a two-month delay due to needing more time to complete the Preliminary Design estimate, plus a six-month delay to allow more time after the in-service date to prepare and review the Project Completion and Evaluation Report, including providing a briefing to BC Hydro's Board of Directors, before filing the Project Completion and Evaluation Report with the BCUC.	8 months

BC Hydro Mainwaring Substation Upgrade Project

Semi-Annual Progress Report No. 1

Appendix A

Design Images

Figure A-1 Rendering of gas insulated switchgear feeder building design showing cable room with resin impregnated paper bus configuration

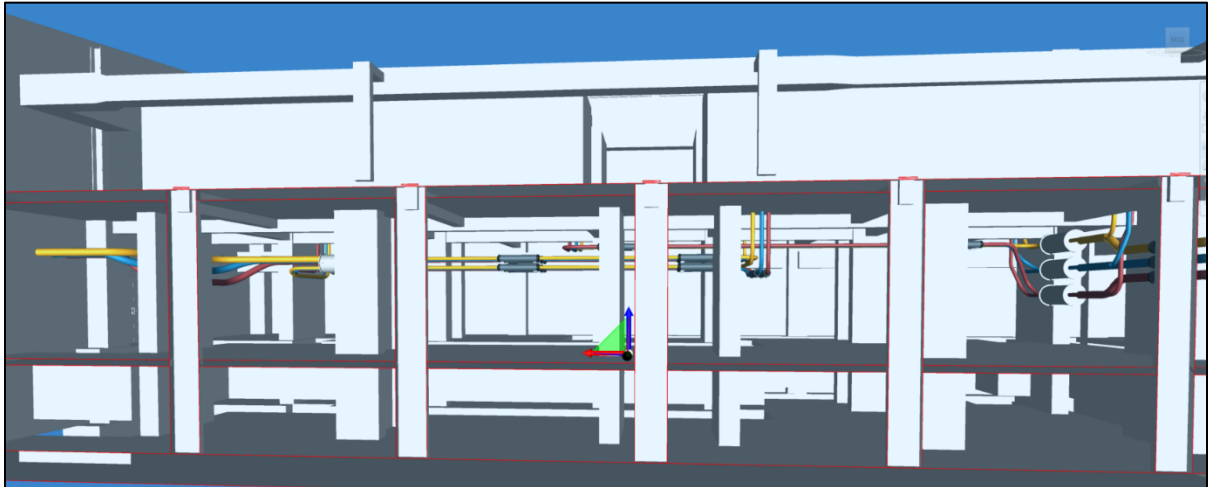


Figure A-2 Rendering of gas insulated switchgear feeder building design showing building exterior

