BC Hydro
Power smart

6911 Southpoint Drive (B03)
Burnaby, BC
V3N 4X8

December 3rd, 2025

[redacted]

via electronic mail: [redacted]

Dear [redacted],

RE: [redacted] Project - Interconnection System Impact Study Report

Enclosed is the Interconnection System Impact Study report for the proposed [redacted] Project submitted under Attachment M-1: Standard Generator Interconnection Procedures (SGIP) including Standard Generator Interconnection Agreement (SGIA) of the Open Access Transmission Tariff (OATT).

This letter provides a non-binding good faith estimate of the cost and time to construct the facilities required to interconnect your project to BC Hydro's Transmission System, being the Network Upgrades, based on the findings of the Interconnection System Impact Study.

Open Access Transmission Tariff

The OATT defines Network Upgrades as additions, modifications, and upgrades to BC Hydro's Transmission System required at or beyond the Point of Interconnection (POI) to accommodate the interconnection of the Generating Facility to the BC Hydro's Transmission System. Pursuant to the OATT, BC Hydro will design, procure, construct, install, and own the Network Upgrades. While BC Hydro will pay the costs for the Network Upgrades, the Interconnection Customer provides security for such costs.

Cost Estimate

Based on the Interconnection System Impact Study (SIS), the non-binding good faith estimated cost (typical accuracy range of +100%/-35%) for Network Upgrades required to interconnect your project is **$83.5M**. Please note that the cost estimate may be amended in the near future to reflect the SIS results of other Interconnection Requests (with the same queue position) in the same region.

Major Scope of Work Identified:

Stations Scope – [redacted] Terminal Switching Station (TYTX)

- Acquire adequate property close to the existing transmission line 2L392 and construct a new 230kV switching station.

Transmission Line Scope

- Re-terminate line 2L392 near the POI to the new switching station and install up to three 230kV 3-pole dead-end structures for each side of the re-termination.
- A dead-end structure should be installed as a demarcation point between Customer owned 230kV line and BC hydro owned portion of the line.

Protection and Control Scope at Gordon M. Shrum (GMS), Southbank (SBK), Shell Groundbirch (SGB), and the new TYTX Switching Station, including:

- Modifications/additions to the local Load Shedding Remedial Action Scheme (RAS), updating/providing protection relays, connecting to Current Transformers (CTs) and Voltage Transformers (VTs) and installing the full scope of control systems at TYTX.

Telecom Scope at GMS, SBK, SGB, TYTX, and other microwave stations, repeater stations, and substations, including:

- Installing/adding routing nodes and equipment, towers, antennas, battery and charger requirements, microwave radio systems, routers and firewalls, and teleprotection terminals.

Exclusions:

- GST
- Outage costs
- Permits
- Cost change due to currency fluctuations.
- Book value of decommissioned equipment.
- Potential property impacts (see Key Assumptions below for more information).
- As the exact project location is unknown, site-specific requirements including but not limited to dewatering, ground improvements, slope stabilization, etc. are not included.

Key Assumptions:

- Project is considered greenfield outside of work around existing Transmission lines (taps, in-out reconfigurations, etc.).
- Construction may be completed by BCH or its contractor(s). It is assumed there is no major difference in construction costs between the two.
- BC Hydro's Contractor to assume Prime Contractor responsibility.
- Telecom estimates are included in this estimate as a lump sum and it is assumed that some costs will be shared with other Interconnection Requests.
- Environmental Assessment Certificate will not be required for this project.
- Temporary camp for construction will not be required.
- Existing Station and Control room expansions are not triggered by this Interconnection Request.
- The ultimate 7 circuit breaker switching station standard has been considered for properties, grounding, and civil (excluding foundations).
- Customer to design and build last span. BC Hydro to review and approve design.

Key Risks:

- Delays in receiving documentation or funding from the Interconnections Customer which may delay key milestones.
- Major Equipment delivery presents potential project cost and schedule risks, based on variance in equipment lead times.
- No defined supply chain strategy at this stage.
- Cost of construction may increase based on geotechnical conditions and environmental issues at the actual project site.
- Project schedule may be longer than expected, leading to increased costs.
- Cost of materials and major equipment may be affected by market conditions and escalation.
- Telecom scope presents high risk of change due to rapidly evolving technologies and standards.

- This project shares Telecom scope with other Interconnection Requests which adds additional complexity to these risks.
- Additional right of way or acquisition may be required to accommodate equipment.

Technical Interconnection Requirements and Revenue Metering Requirements

As part of our commitment to maintaining a reliable and responsive grid, BC Hydro maintains its Technical Interconnection Requirements (TIR) documentation (updated in February 2024). You will be required to meet the TIR as your project will be connecting to the BC Hydro Transmission system. Some of the revisions made in February 2024 include new provisions for Inverter-Based Resources (IBRs), which are required to participate in primary frequency regulation. BC Hydro looks forward to working closely with you so that you can meet the TIR and can assist with any technical questions you may have.

For more details on the TIR, please refer to:

https://app.bchydro.com/content/dam/BCHydro/customer-portal/documents/transmission/tgi/60kV-500kV-TIR-for-power-generators-2024-feb.pdf

The Revenue Metering requirements to interconnect your project have been identified in the System Impact Study report. However, the Revenue Metering costs are not included in the above estimate as they are separate from the cost of Network Upgrades. Revenue Metering costs that are attributable to the Interconnection Customer are to be paid in cash.

For more details on Revenue Metering requirements and responsibilities, please refer to:

https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/distribution/standards/ds-rmr-complex-revenue-metering.pdf.

Schedule

Based on the Interconnection System Impact Study, the non-binding good faith estimated in-service date for your project's Network Upgrades is **Quarter 3, 2031** to align with the requested in-service date from your Interconnection Request. To achieve this timeline, we may need to expedite certain activities, including engineering design and procurement of equipment; the expediting of activities may result in increased costs.

Timely actions required from you for the rest of the interconnection process to minimize risks to the schedule:

- Submission of any additional required technical data
- Submission of any required information or documents such as demonstration of Site Control
- Execution of a Standard Generator Interconnection Agreement
- Providing Financial commitments and securities, as required

Please note that changes to your interconnection request, delays in data submission or financial commitments may also impact the target in-service date.

Next Steps

In fall 2025, we are targeting to issue a final invoice for the System Impact Study costs. This invoice will reflect the total amount due or amount to be refunded, taking into account the System Impact Study deposits already paid.

Should you wish to discuss the contents of the SIS, BC Hydro can arrange for an optional SIS Review Meeting. After the SIS Review meeting, BC Hydro will provide you with a cost estimate for the Facilities

Study and any additional data requirements. After being provided with the cost estimate, we ask you to provide your confirmation to proceed with the Facilities Study in writing.

In addition to the confirmation, you will be required to provide the deposit for the Facilities Study, as well as any other additional data that may be necessary.

If you have any questions, please contact the Transmission Generator Interconnections team at transmission.generators@bchydro.com.

Sincerely,

[redacted]

[redacted]

Interconnections Manager, Transmission Generator Interconnections

BC Hydro

Encl.: [redacted]**_System Impact Study_Report.pdf**

BC Hydro
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[redacted] Project

Interconnection System Impact Study

BC Hydro EGBC Permit to Practice No: 1002449

Powertech Labs Inc. EGBC Permit to Practice No: 1002531

[redacted]

Prepared for: [redacted]

Prepared by: [redacted]

[redacted]
Senior Engineer, Powertech Labs Inc.

Reviewed by: [redacted]

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Principal Engineer, Powertech Labs Inc.

Accepted by: [redacted]

[redacted]
Manager, Transmission Planning

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Report Metadata

Header:	[redacted] Project
Subheader:	Interconnection System Impact Study
Title:	[redacted] Project
Subtitle:	[redacted]
Report Number:	1003Y-APR-00001
Revision:	0
Confidentiality:	Public
Date:	2025 Nov 27
Volume:	1 of 1
Prepared for:	[redacted]
Prepared by:	[redacted]
Title:	Senior Engineer, Powertech Labs Inc.
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Title:	Powertech Labs Inc
Reviewed by:	[redacted]
Title:	Principal Engineer, Powertech Labs Inc.
Related Facilities:	Facility station code – TAW Line designation – 2L392
Additional Metadata:	Transmission Planning 2025-024 Filling subcode 1350

Revisions

Revision	Date	Description
0	2025 Jul	Initial release
1	2025 November	IC name is corrected to [redacted]

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[redacted]

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Acronyms

The following are acronyms used in this report.

BCH	British Columbia Hydro and Power Authority
BMT	Bear Mountain Terminal substation
COD	Commercial Operation Date
CT	Current Transformer
DTT	Direct Transfer Trip
EMS	Energy Management System
ERIS	Energy Resource Interconnection Service
FJN	Fort St John Substation
FRT	Fault Ride-Through
FVO	Fraser Valley Office
GMS	Gordon M. Shrum Generating Station
HS	Heavy Summer Load Conditions
HW	Heavy Winter Load Conditions
IC	Interconnection Customer
IP	Internet Protocol
LS	Light Summer Load Conditions
MC	Measurement Canada or Canada Federal Regulations
MPO	Maximum Power Outputs
NERC	North American Electric Reliability Corporation
NRIS	Network Resource Interconnection Service
PODR	Point of Delivery Reference
POI	Point of Interconnection
POM	Point of Metering
PPIS	Power Parameter Information System
RAS	Remedial Action Scheme

SBK	South Bank Substation
SGB	Shell Groundbirch Gas Processing Plant Switching Station
SIS	System Impact Study
SKD	[redacted] Project
SLS	Sundance Lakes Substation
SRN	Saturn 1 Gas Plant Substation
TAW	[redacted] Project
TIR	BC Hydro 60 kV to 500 kV Technical Interconnection requirements for Power Generators
TOV	Temporary Overvoltage
TYTX	[redacted] 230 kV Switching Station
VT	Voltage Transformer
VIC	Virtual Inertia Control
WECC	Western Electricity Coordinating Council
WTG	Wind Turbine Generator

Executive Summary

[redacted], the Interconnection Customer (IC), requests to connect a wind farm referred as [redacted] Project into the BCH system in the Peace Region.

The [redacted] Project will comprise [redacted] The total installed capacity of the project is 200 MW, with a maximum power injection of 195.9 MW at the proposed Point of Interconnection (POI).

The proposed POI is located on BC Hydro's existing 230 kV transmission line 2L392, approximately 22.1 km from South Bank (SBK) substation in the Peace Region. The IC's proposed commercial operation date (COD) is September 30, 2031.

To interconnect the [redacted] Project at the proposed POI, the System Impact Study (SIS) was conducted and has identified the following requirements and conclusions:

1. A new 230 kV switching station (temporarily referred to as "TYTX") on the BCH's existing circuit 2L392 is required at or close to the proposed POI for interconnecting the IC's generating project. With the new switching station TYTX, 2L392 will be segregated into two new lines, temporarily referred to as: 2L392_A (SBK-TYTX) and 2L392_B (TYTX-SGB). The 230 kV transmission line which is to be built by the IC for connecting the project is temporarily designated as 2L392_C (i.e., from TYTX to TAW).

2. The proposed [redacted] project is required to install a total of [redacted] to meet the reactive power capability requirement specified in the BC Hydro's TIR Section 6.4.2. In addition, the turbine's "STATCOM" option is required so that each turbine can provide a partial reactive power capability at zero MW output.

3. Fast Frequency Response, also known as Virtual Inertia Control (VIC) in wind turbines, is required at the [redacted] Project. The proposed wind turbine generators, when equipped with the VIC option, are expected to temporarily boost the MW output to limit the system frequency drop during a major frequency event. The VIC settings should be determined in coordination with BC Hydro in the later stage of interconnection studies.

4. BCH will provide line protections for 2L392_A, 2L392_B and 2L392_C (BC Hydro end only). As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the new protection schemes.

5. Anti-islanding protection is required for the [redacted] Project and shall be configured in the manner that does not compromise the required ride-through performance.

6. A telecommunication-based anti-landing Direct Transfer Trip (DTT) scheme is required in accordance with IEEE Std 2800-2022. This DTT scheme will initiate a trip to the [redacted] Project for any projection tripping or manual opening of both lines 2L392_A and 2L392_B.

7. The project is required to participate in the GMS Area Generation Shedding Remedial Action Scheme (RAS) for contingencies on the Peace region 500 kV transmission system. Additionally, BCH will modify the existing Peace Region Load Shedding RAS to accommodate the 230 kV network configuration change.

8. The interconnection of the [redacted] Project together with the other 2024 Call for Power project in the Peace Region does not cause any system performance violation (i.e. thermal overload, voltage violation, or voltage instability, etc.) under the normal and contingency system operating conditions. No transient instability or transient voltage violation was observed in the area under the applicable study contingencies.

9. Voltage sags caused by energization of entrance transformers are not expected to exceed the limits specified in BC Hydro's Generation Technical Interconnection Requirements. Therefore, no additional mitigation measures are required for transformer energization.

Note that the above requirements and conclusions are made based on the IC's input data and study assumptions listed in Section 4, which represents the best available information for the study.

A non-binding good faith cost estimate and the estimated schedule of the Network Upgrades identified for the project interconnection are provided in a letter that accompanies this report. The identified Network Upgrades refer to the additions and modifications to the BC Hydro owned transmission facilities for interconnecting the proposed project.

1 Introduction

[redacted], the interconnection customer (IC), requests to connect its [redacted] Project to the BC Hydro system. The project will have [redacted] The total installed capacity of the project is 200 MW, with a maximum power injection of 195.9 MW at the proposed Point of Interconnection (POI).

The proposed POI is located on BC Hydro's existing 230 kV transmission line 2L392, approximately 22.1 km from South Bank (SBK) substation. The IC's proposed commercial operation date (COD) is September 30, 2031. The project overview is provided in Table 1-1 below.

Table 1-1: Summary of Project Information

Project Name	[redacted] Project	
Interconnection Customer	[redacted]	
Point of Interconnection	on 2L392 at 22.1 km from SBK	
IC Proposed COD	September 30, 2031	
Type of Interconnection Service	NRIS ☒	ERIS ☐
Maximum Power Injection (MW)	195.9 (Summer)	195.9 (Winter)
Number of Generator Units	[redacted]	
Plant Fuel	Wind	

There are [redacted] in the plant and each turbine generator is connected to one of the collector feeders through [redacted] These [redacted] feeders are further connected to the BCH's 230 kV transmission system via [redacted] and an IC-owned [redacted], 230 kV interconnection line. The IC's 230 kV main substation is referred to as "TAW" in this report.

Figure 1-1 illustrates the interconnection of [redacted] Project to the Peace Region transmission system where SBK is a major 500/230 kV substation which connects the Site C and Peace Canyon two generating stations. SGB is another major substation in the Southern Peace Region 230 kV transmission system, which are connected to Sundance Lakes Substation (SLS), Bear Mountain

Terminal substation (BMT), South Bank Substation (SBK), and Saturn 1 Gas Plant Substation (SRN).

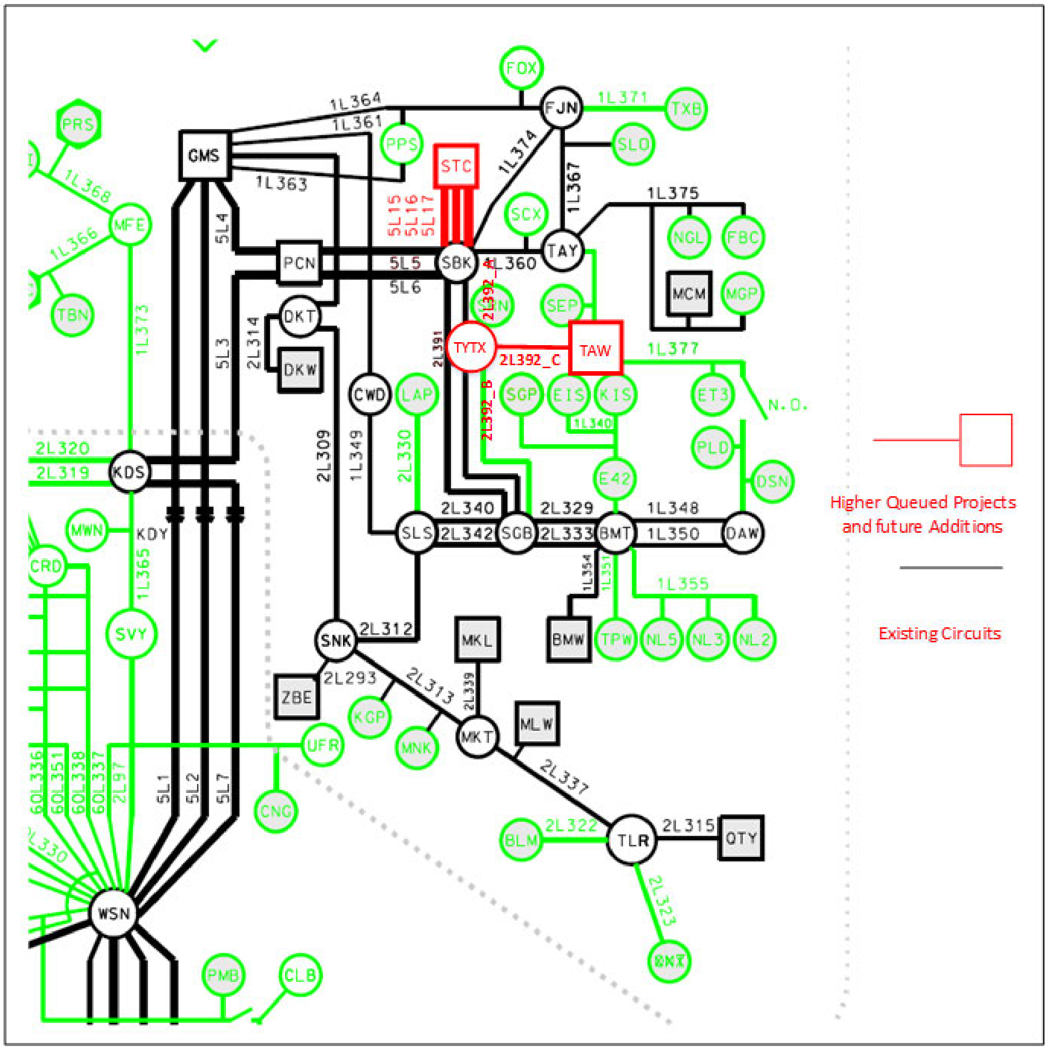

Figure 1-1: Peace Region Transmission System with [redacted] Project Addition

The other 2024 Power Call project named [redacted] Project (SKD) connected to the adjacent 230 kV transmission line 2L291 is also included and modelled in detail in this SIS.

Appendix A further shows the plant-level schematic diagram of the [redacted] Project.

2 Purpose of Study

The purpose of the System Impact Study (SIS) is to assess the impact to the BC Hydro transmission system of interconnecting the proposed Customer's facility, in accordance with the relevant BCH Open Access Transmission Tariff (OATT).

This study aims to identify transmission constraints and determine system reinforcement options, including the implementation of a Remedial Action Scheme (RAS) for generation shedding or generation runback, to ensure adequate performance and the reliable operation of the BC Hydro transmission system.

The SIS is performed in accordance with the North American Electric Reliability Corporation (NERC) reliability standards, Western Electricity Coordinating Council (WECC) performance criterion, and BC Hydro transmission planning requirements, specifically:

- NERC standards: FAC-002-3, TPL-001-4
- WECC Performance Criterion: TPL-001-WECC-CRT-4
- BC Hydro's 60 kV to 500 kV Technical Interconnection Requirements for Power Generators per NERC Standard FAC-001-3
- BC Hydro's Transmission Asset Planning FAC-002-3 Study Guide

3 Scopes of Study

This study investigates potential thermal overloading, voltage performance and stability constraints of the transmission system as a result of the proposed interconnection and identifies the requirements of the Network Upgrades in the BC Hydro transmission system to accommodate the IC's proposed interconnection.

This study is based on available information provided by the IC. Further studies or a study update may be required when additional data from the IC is available or key study assumptions are updated.

This study does not address the possible impact of the proposed interconnection on the adjacent systems that are neighboring with the BCH system. BC Hydro coordinates and cooperates with the neighboring systems per FAC-002-3 for them to assess the potential impact on the adjacent systems when needed.

4 Assumptions and Conditions

This SIS is performed based on the information in the IC's interconnection data form submitted on February 28, 2025.

The study assumptions and conditions used in the study cases include the forecasted load levels, generation resource plans, and facility ratings, etc. for the selected study years as appropriate. The key assumptions and study conditions used in this SIS are listed below:

- The 2031 Heavy Winter (HW) and 2032 Heavy/Light Summer (HS/LS) study cases are selected to study the proposed interconnection of the subject generating project.

- The generation dispatch in the study model represents both existing and future generators in BC Hydro's Base Resource Plan (BRP) that was available to start the SIS. Specifically, the other 2024 power call project in the study area ([redacted] Project) is included in the study model.

- Similarly, the forecasted loads in the study model represent the existing and future loads that were available at the time of preparing the SIS.

- The facility ratings used in this study are based on BC Hydro operating order 5T-10 dated May 12, 2025, and 5T-14 dated Dec 18, 2024.

- The regional generations are dispatched to the patterns that stress the transmission system in the study area. In these patterns, the regional generations are typically set to their Maximum Power Outputs (MPO) unless otherwise specified.

5 System Studies and Results

Based upon the IC's submitted information and the area system conditions, a new three-circuit-breaker-ring switching station (referred to as "TYTX") at the proposed POI on 2L392 is required to interconnect the IC's generating project to the BCH system. The addition of the new switching station would help to maintain reliability and adequate protection performance to serve the existing customers and the new addition.

With the new switching station TYTX, the existing line 2L392 will be segregated into three new lines, temporarily referred to as: 2L392_A (SBK-TYTX), 2L392_B (TYTX-SGB), and 2L392_C (TYTX-TAW). The temporary line designations will be replaced by permanent designations at a later stage of interconnection study.

5.1 Steady-State Power Flow Study

A series of pre- and post-contingency power flow analyses were performed to assess the impact of the subject project on the regional transmission system. The study was performed using the selected 2031HW, 2032HS, and 2032LS load conditions, based on the assumptions and considerations outlined in Section 4. Under all load conditions generation in Peace region is dispatched to high output with Columbia generation dispatched at lower output. Appendix B contains the key results of power flow studies for the base scenario studied in this SIS.

The study has indicated that there is no overload or voltage violation in the studied regional system under system normal operating conditions and under the studied contingencies due to the connection of [redacted] Project.

Note that BCH TIR Section 6.4.2 requires Inverter Base Resource (IBR) power plant to have the dynamic reactive power capability at a minimum of +/- 33% of its MPO from the farms at the high-voltage side of the switchyard over the full MW operating range. It means that the [redacted] plant shall be capable of injecting and absorbing reactive power of at least [redacted] Mvar and absorbing [redacted] Mvar. To fully meet this requirement, the IC is required to install at least [redacted] switchable capacitor bank at [redacted] side of the plant main transformer (i.e. [redacted] switchable capacitor bank on each collector bus).

5.2 Transient Stability Study

Transient stability studies were performed using the 2031HW, 2032HS, and 2032LS base cases to assess the impact from the [redacted] [redacted] Project interconnection and other successful ones on the transmission network in the vicinity area, in accordance with the TPL-001-WECC-CRT-4 Performance Criteria.

Appendix C shows a summary of the transient stability study results for 2031HW, 2032HS and 2032LS conditions with the addition of [redacted] Project. No transient instability or transient voltage recovery violation has been observed under the study conditions and contingencies.

5.3 Reliability Impact to Adjacent Utilities

The study did not find any reliability impact of the proposed interconnection to adjacent systems. Therefore, it is not necessary to coordinate the study results with adjacent utilities in accordance with FAC-002-3.

5.4 Analytical Studies

Analytical Studies was performed for the project, which has identified the following key findings and recommendations:

- The risk of temporary overvoltages (TOVs) was assessed under the unintentional islanding contingency. Islanding occurs when the [redacted] Project and possibly a portion of loads become isolated from the main grid but remain energized. Based on the analysis, no risk of TOVs was identified.
- Anti-islanding protection is required for the [redacted] Project. A telecommunication-based Direct Transfer Trip (DTT) scheme has been identified in accordance with IEEE Std 2800-2022. This DTT scheme will initiate a trip to the [redacted] Project for any projection tripping or manual opening of both lines 2L392_A and 2L392_B.
- Voltage disturbance resulting from energization of a [redacted] main power transformer was studied. Under system normal conditions, the voltage sags are not expected to exceed the limits specified in BC Hydro's 60-500 kV Generation Technical Interconnection Requirements for Power Generators (TIR). No additional mitigation measures are required for transformer energization.
- The harmonic current injection from the [redacted] Project shall not exceed the limits specified in TIR, which follow IEEE Std 519-2022. Harmonic studies will be conducted at a later stage when the detailed spectrum of harmonic current injection becomes available.
- The [redacted] Project's Electromagnetic Transient (EMT) model is parameterized with the voltage and frequency ride-through settings that

meets TIR requirements. BC Hydro will follow up on this topic during the pre-commissioning stage.

- The electromagnetic transient response of the [redacted] Project, including the wind turbine generators (WTGs) active and reactive power outputs are in accordance with the facility's electrical and control requirements.
- The [redacted] Project demonstrated stable operation under reduced Short Circuit Ratios (SCRs), which were determined based on the credible contingencies selected for the study.

5.5 Short Circuit Analysis

The short circuit analysis for the System Impact Study is based upon the latest BC Hydro system model, which includes project equipment and impedances provided by the IC. Thevenin impedances for the near-term system conditions and the ultimate fault levels at POI are not included in this report but can be provided upon IC's request.

5.6 Remedial Action Schemes

To maintain and meet the system reliability performance requirements under various operating conditions, the [redacted] Project is required to participate in the GMS Area Generation Shedding RAS for Peace region 500 kV transmission system contingencies. In addition, modifying the existing Peace Region Load Shed RAS is required to incorporate the changes of Peace Region 230 kV network configuration.

5.7 Station Upgrade Requirements

The station upgrade requirements for [redacted] Terminal switching station (TYTX) are as follows:

- Acquire adequate property for the new [redacted] Terminal switching station (TYTX) close to the existing transmission line 2L392. The property shall be chosen considering ultimate stage of the TYTX switching station.
- Construct a new outdoor 230kV, 3-circuit breaker ring bus switching station. Three circuit breakers (2CB1, 2CB2 and 2CB3) and associated disconnects shall be 3000A rated.
- Add three 230 kV line terminals associated motorized disconnects, Surge Arresters and Capacitor Voltage Transformers for the transmission lines 2L392_A, 2L392_B and 2L392_C.
- Add two single phase station service VTs, 2SSVT1 and 2SSVT2.

- Add one set of diesel generator for station service backup in case of station service VTs outage for breaker failure scenario.
- Construct a new control building and other required substation facilities and infrastructures such as P&C, telecom and SCADA equipment as required.
- Construct ground grid and other necessary equipment and facilities required for new TYTX switching station.
- Refer to draft one-line sketch (Appendix E) for details. The one-line sketch will be adjusted based on the size and orientation of the acquired property.

5.8 Transmission Line Upgrade Requirements

The transmission line engineering scope of work for this project is identified as below:

- Re-terminate line 2L392 at approximately structure 22-01 to connect SBK substation to the new TYTX switching station, forming section 2L392_A, and at approximately structure 22-02 (POI) to the new switching station TYTX, forming section 2L392_B. This may require up to three 230 kV dead-end structures depending on TYTX's location; the exact circuit number will be determined later (See Appendix F for details).
- Additional right of way may be required to accommodate the ingress and egress of the line.
- Some portion of the existing line may need to be decommissioned which will involve removing some conductor, hardware, and existing structure.
- Install a dead-end structure to demarcate the customer-owned 230 kV line from BC Hydro's portion; BC Hydro will design and build the last span into TYTX, or perform the BCH's review if the customer builds it. If customer would like to design and build the last span from 2L392_C to TYTX switching station, BC Hydro will be performing the BCH's review for this design.
- A single-mode fibre optic cable (minimum 72F, recommended 144F) may be installed on customer line 2L392_C, with BC Hydro designing its termination and transition to the control building; if the customer builds the last span to TYTX, BC Hydro will conduct the BCH's review.

5.9 Protection, Control and Telecommunications

5.9.1 Protection

The [redacted] Project will be required to participate in the GMS Area Gen Shed RAS Scheme (via tripping of 2L392_C at TYTX) and a Direct Transfer Trip (DTT) at the [redacted] Project is required for protection trips or manual opening of both 2L392_A and 2L392_B. BC Hydro will provide line protections for 2L392_A, 2L392_B and 2L392_C protections. As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes.

The IC is required to provide the following for the interconnection of its [redacted] Project.

- Entrance protection that complies with the latest version of the "60 kV to 500 kV BC Hydro Technical Interconnection Requirements for Power Generators."
- Provide two SEL-411L-1 relays (firmware and options specified by BC Hydro) at the entrance of TAW to provide protection coverage for 2L392_C. BC Hydro P&C Planning will provide core protection settings for these relays to protect transmission line 2L392_C during a transmission line fault. Non-core protection such as local breaker failure, auto-reclosing, backup protection for station elements will not be provided by BC Hydro P&C Planning.
- The IC is responsible for NERC PRC-related tasks, settings to compliance standards within their facilities.
- The IC is responsible for providing a communications link for remote interrogation of the Power Parameter Information System (PPIS) equipment by BCH servers.
- Provide anti-islanding protection to prevent [redacted] Project from operating in islanded condition.

5.9.2 Control

The IC will provide SCADA data reporting to the control centers in accordance with the TIR, including required telemetry and status information, which should be available to the Energy Management System (EMS) at the nearest suitable BC Hydro site with appropriate telecom facilities. This data is supplied to BC Hydro Control Centers in DNP 3.0 format. All data provided in response to poll messages transmitted by BC Hydro must be completed in less than or equal to 2 seconds. Continuous communications using commercial lease or privately constructed connection from the IC to BC Hydro control centers is acceptable provided the performance objective stated in the TIR is met.

The IC is responsible for providing an ION7650 for the PPIS meter, connected to a suitable high voltage source for harmonics and power quality metering.

The IC is responsible for providing a communications link for remote interrogation of the PPIS equipment by BCH servers. Alternative communications include IP cellular modem, IP satellite, BCH WAN (where appropriate). Communications and equipment selection is subject to BCH review and approval.

5.9.3 Telecommunications

The detailed telecom work scope and specs will be provided in detail at a later stage of Interconnection Studies.

Telecom System Upgrade/Extension

- Implement a TYTX-FJN microwave radio link. Perform a tower study at FJN and if required, reinforce or build a new tower. Build a new tower at TYTX.

IC's Work Required at TAW

- Install a single-mode fibre optic cable (minimum 48F) to TYTX, a 48V DC power supply with 8-hour reserve, redundant MPLS equipment connected to TYTX fibre, and integrate the C37.94 digital teleprotection circuits and the SCADA circuit into the MPLS system.

BCH's Work Required at TYTX

- Install a tower and antenna facing FJN. BC Hydro telecom designer to confirm tower height, azimuth and antenna sizes . Install an 11 GHZ (if possible, otherwise 7 GHz), dual shelf, microwave radio system facing FJN and other telecom equipment. Implement various telecom circuits.

The Telecom solution is developed based on the assumption as follows.

a) TYTX is assumed located at 56° 1' 19.00" N, 120° 58' 33.44" W.
b) TAW is assumed located at [redacted]
c) The microwave radio communications between TYTX-FJN are possible.
d) the Revenue Metering / PPIS circuit(s) required at TAW will be the responsibility of the IC and be carried by a commercial telecommunications provider using cellular wireless, Ku-band satellite, or some other service facility.

Appendix G summarizes the Telecom requirements for Teleprotection, RAS, Telecontrol, and other network additions along with the Telecom block diagram.

6 Cost Estimate and Schedule

A non-binding good faith cost estimate and the estimated schedule of the Network Upgrades identified for the project interconnection are provided in a letter that accompanies this report. The identified Network Upgrades refer to the additions and modifications to the BC Hydro owned transmission facilities for interconnecting the proposed project.

7 Revenue Metering

- The remote read load profile revenue metering installation should be in accordance with Canada federal regulations (MC) and BC Hydro Requirements for Complex Revenue Metering. The latest version of this document is published at BC Hydro's external website. The revenue metering responsibilities and charges shall be in accordance with Section 10 (10.1 and 10.2). For details about the specific responsibilities, see table on pages.23-25.
- Primary Metering is required; 3-element metering scheme with 3 CTs and 3 VTs connected L-N (Grd) should be used.
- Main and backup load profile interval meters are required to measure the power delivered. The meters will be programmed for 5 minutes interval and will be remotely read each day by BCH Billing Group using MV-90 System; the POM shall have a dedicated communications link (BC Hydro's approved wireless IP solutions, landline or other approved alternative). The communications link should be used for revenue metering only. If there is IP digital cell phone coverage for data in the site, BCH can supply an IP Wireless Communications Modem equipment. BCH Transmission P&C Telecom/P&C Engineering Department should inform the connectivity options for complex metering at this specific site.
- The revenue class meters (main and backup) are Measurement Canada (MC) approved and will be supplied and maintained by BC Hydro. The MC approved revenue class instrument transformers (CTs and VTs units) are supplied by BCH (Stock items w/CAT ID).
- When the impedance and losses between the POM and the PODR are significant, the meters should be programmed to account for the line and/or transformer losses between the POM and PODR (usually at the POI). In this case, the customer or the consultant shall provide a letter with the line parameters (and/or power transformer) data signed and stamped by a professional engineer.
- Before definition phase, BCH Revenue Metering department should be contacted to discuss the specifics of the project. A complex metering designer responsible for the metering tasks will be assigned at this point.

- During the feasibility/definition phase, the applicant is to send drawings to the assigned project manager, for distribution to the BCH Revenue Metering Department showing the 1-line diagram (SLD) and informing the planned metering scheme, meter cabinet location, as well as any other metering related document for review and approval.

In order to finalize the metering option, the IC will work with BCH to determine the required Revenue Metering configuration in accordance with the Electricity Purchase Agreement and associated agreements. Specific metering information is provided in the table below.

Point-of-Metering	230 kV (voltage level), at customer substation
Voltage and current Transformers	The CTs and VTs used on the metering scheme will be supplied by the Power Generator and should be of a model/type approved by Measurement Canada. The CTs and VTs must be pre-approved by BC Hydro's Revenue Metering Department.

8 Conclusions

This System Impact Study has concluded the following requirements:

1. A new 230 kV switching station (temporarily referred to as "TYTX") on the BCH's existing circuit 2L392 is required at or close to the proposed POI for interconnecting the IC's generating project. With the new switching station TYTX, 2L392 will be segregated into two new lines, temporarily referred to as: 2L392_A (SBK-TYTX) and 2L392_B (TYTX-SGB). The 230 kV transmission line which is to be built by the IC for connecting the project is temporarily designated as 2L392_C (i.e., from TYTX to TAW).

2. The proposed [redacted] project is required to install a total of [redacted] to meet the reactive power capability requirement specified in the BC Hydro's TIR Section 6.4.2. In addition, the turbine's "STATCOM" option is required so that each turbine can provide a partial reactive power capability at zero MW output.

3. Fast Frequency Response, also known as Virtual Inertia Control (VIC) in wind turbines, is required at the [redacted] Project. The proposed wind turbine generators, when equipped with the VIC option, are expected to temporarily boost the MW output to limit the system frequency drop during a major frequency event. The VIC settings should be determined in coordination with BC Hydro in the later stage of interconnection studies.

4. BCH will provide line protections for 2L392_A, 2L392_B and 2L392_C (BC Hydro end only). As part of the line protection replacements for each of the three lines, telecommunication facilities will be required to accommodate the new protection schemes. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the new protection schemes.

5. Anti-islanding protection is required for the [redacted] Project and shall be configured in the manner that does not compromise the required ride-through performance.

6. A telecommunication-based anti-islanding Direct Transfer Trip (DTT) scheme is required in accordance with IEEE Std 2800-2022. This DTT scheme will initiate a trip to the [redacted] Project for any projection tripping or manual opening of both lines 2L392_A and 2L392_B.

7. The project is required to participate in the GMS Area Generation Shedding Remedial Action Scheme (RAS) for contingencies on the Peace region 500 kV transmission system. Additionally, BCH will modify the existing Peace Region Load Shedding RAS to accommodate the 230 kV network configuration change.

8. The interconnection of the [redacted] Project together with the other 2024 Call for Power project in the Peace Region does not cause any system performance violation (i.e. thermal overload, voltage violation, or voltage instability, etc.) under the normal and contingency system operating conditions. No transient instability or transient voltage violation was observed in the area under the applicable study contingencies.

9. Voltage sags caused by energization of entrance transformers are not expected to exceed the limits specified in BC Hydro's Generation Technical Interconnection Requirements. Therefore, no additional mitigation measures are required for transformer energization.

Appendix A
Schematic Diagram of the IC's Project

The following shows the plant schematic diagram for the IC's project (as submitted). Note that the addition of switchable capacitor banks identified in this SIS [redacted] are not reflected on this diagram.

[redacted]

Figure A-1: Schematic Diagram of [redacted] Project.

Appendix B
Steady-state Power Flow Study Results

There is no thermal overload and voltage violation identified in the SIS. Table B-1 and Table B-2 show the key results of power flow studies for the base scenarios.

Table B-1: Summary of Branch Loading in Base Study Scenarios

Case	IC's Plant Output	Contingency [1]		Branch Loading (%)					
		Cat.	Description	2L392_A	2L392_B	2L391-A [2]	2L391-B [3]	2L312	2L308
31HW	Winter Rating (MVA)			664.1	664.1	664.1	664.1	538.2	541.4
	Max	P0	N/A	17.88	11.67	14.62	14.43	39.72	46.55
	Max	P1.2	2L392_A	---	29.58	26.61	2.81	34.46	51.43
	Max	P1.2	2L392_B	29.58	---	6.92	22.31	43.19	43.32
	Max	P1.2	2L391	17.88	11.68	---	---	39.72	46.55
	Max	P1.2	2L312	3.95	25.62	1.48	28.37	---	83.48
	Max	P2.3	SBK_1CB4	17.69	11.89	14.40	14.65	39.70	46.56
32HS	Summer Rating (MVA)			535	535	535	535	424.7	427.5
	Max	P0	N/A	26.55	11.47	22.46	14.92	50.70	62.50
	Max	P1.2	2L392_A	---	37.70	40.31	6.03	42.75	70.08
	Max	P1.2	2L392_B	36.91	---	15.58	22.17	54.02	59.54
	Max	P1.2	2L391	21.32	16.20	---	---	58.18	54.97
	Max	P1.2	2L312	9.44	27.97	5.47	31.42	---	109.08 [4]
	Max	P2.3	SBK_1CB4	26.32	11.70	22.23	15.14	50.66	62.55
32LS	Summer Rating (MVA)			535	535	535	535	424.7	427.5
	Max	P0	N/A	27.61	9.09	23.66	12.51	46.96	65.27
	Max	P1.2	2L392_A	---	36.78	42.12	6.65	38.72	72.99
	Max	P1.2	2L392_B	36.68	---	17.70	18.60	49.69	62.73
	Max	P1.2	2L391	23.04	13.67	---	---	54.28	58.18
	Max	P1.2	2L312	11.59	25.20	7.93	28.58	---	108.81 [4]
	Max	P2.1	SBK_1CB4	27.47	9.26	23.46	12.68	46.94	65.28

Notes:
[1] P1.2, P2.1 and etc. are the contingency categories defined in NERC TPL-001-4.
[2] 2L391-A is the line between SBK to SKD_Tap
[3] 2L391-B is the line between SGB to SKD_Tap
[4] These are existing overloads and are currently addressed by Peace Region generator shedding RAS.

Table B-2: Selected Bus Voltages in Base Study Scenarios

Case	IC's Plant Output	Contingency		Bus Voltage (pu)			
		Cat.	Description	TYTX 230	SGB 230	SLS 230	SNK 230
31HW	Max	P0	N/A	1.0328	1.0331	1.0334	1.0344
	Max	P1.2	2L392_A	1.0324	1.0328	1.0333	1.0340
	Max	P1.2	2L392_B	1.0321	1.0325	1.0325	1.0343
	Max	P1.2	2L391	1.0328	1.0331	1.0334	1.0344
	Max	P1.2	2L312	1.0330	1.0330	1.0336	1.0257
	Max	P2.3	SBK_1CB4	1.0330	1.0332	1.0336	1.0345
32HS	Max	P0	N/A	1.0361	1.0444	1.0437	1.0385
	Max	P1.2	2L392_A	1.0358	1.0442	1.0437	1.0384
	Max	P1.2	2L392_B	1.0332	1.0465	1.0455	1.0391
	Max	P1.2	2L391	1.0363	1.0426	1.0419	1.0377
	Max	P1.2	2L312	1.0358	1.0428	1.0434	1.0255
	Max	P2.3	SBK_1CB4	1.0360	1.0444	1.0438	1.0385
32LS	Max	P0	N/A	1.0338	1.0352	1.0356	1.0349
	Max	P1.2	2L392_A	1.0337	1.0350	1.0354	1.0342
	Max	P1.2	2L392_B	1.0328	1.0352	1.0356	1.0350
	Max	P1.2	2L391	1.0340	1.0341	1.0346	1.0350
	Max	P1.2	2L312	1.0342	1.0360	1.0368	1.0247
	Max	P2.3	SBK_1CB4	1.0340	1.0354	1.0358	1.0350

Appendix C
Transient Stability Study Results

There is no transient instability or transient voltage recovery violation identified in the SIS. A summary of the transient stability study results for 2031HW, 2032HW, and 2032LS load conditions with [redacted] project is provided in the table below.

Table C-1: Transient Stability Study Results (2031HW, 2032HW, 2032LS Scenarios)

Category	Contingency	Fault Location	Fault Clearing Time (Cycles)		[redacted] Project Performance	Other Generators in the study area
			Close End	Far End		
P1.2	5L1	Close to GMS	4	4	Acceptable	Acceptable
P1.2	5L3	Close to PCN	4	4	Acceptable	Acceptable
P1.2	5L4	Close to PCN	4	4	Acceptable	Acceptable
P1.2	5L15	Close to STC	4	4	Acceptable	Acceptable
P1.2	2L391	Close to SBK	6	7	Acceptable	Acceptable
P1.2	2L391	Close to SGB	6	7	Acceptable	Acceptable
P1.2	2L392_A	Close to SBK	6	7	Acceptable	Acceptable
P1.2	2L392_B	Close to SBG	6	7	Acceptable	Acceptable
P1.2	2L392_C	Close to TAW	6	7	Acceptable	Acceptable
P1.2	2L340	Close to SGB	6	7	Acceptable	Acceptable
P1.2	2L329	Close to BMT	6	7	Acceptable	Acceptable
P1.2	1L348	Close to DAW	9	10	Acceptable	Acceptable
P1.3	BMT_T1	BMT 230 kV	11	11	Acceptable	Acceptable
P1.3	SBK_T11	SBK 500 kV	6	6	Acceptable	Acceptable
P4	Stuck Breaker_SBK_1CB1 fault @SBK_1L374	Close to SBK	17	7	Acceptable	Acceptable
P4	Stuck Breaker_SBK_1CB2 fault @SBK_1L360	Close to SBK	18	5	Acceptable	Acceptable
P4	Stuck Breaker_SBK_2CB13	Close to SBK	14	7	Acceptable	Acceptable

	fault @SBK_2L391					
P4	Stuck Breaker_SBK_2CB22 fault @SBK_2L392	Close to SBK	14	7	Acceptable	Acceptable
P4	Stuck Breaker_SGB_2CB4 fault @SGB_2L391	Close to SGB	14	7	Acceptable	Acceptable
P4	Stuck Breaker_SGB_2CB5 fault @SGB_2L392	Close to SGB	14	7	Acceptable	Acceptable
P4	Stuck Breaker_SGB_2CB5 fault @BMT_2L329	Close to BMT	15	6	Acceptable	Acceptable
P4	Stuck Breaker_BMT_2CB11 fault @BMT_2L329	Close to BMT	14	7	Acceptable	Acceptable
P4	Stuck Breaker_SLS_2CB11 fault @SLS_2L312	Close to SLS	14	6	Acceptable	Acceptable
P4	Stuck Breaker_SNK_2CB12 fault @SNK_2L312	Close to SNK	14	6	Acceptable	Acceptable
P4	Stuck Breaker_TAW_2CB2 fault @TAW_2L392	Close to TAW	14	6	Acceptable	Acceptable
P4	Stuck Breaker_TAW_2CB3 fault @TAW_2L392	Close to TAW	14	6	Acceptable	Acceptable

Appendix D
Power Flow and Dynamic Models and Data

All WTGs connected to the same feeder are represented by one equivalent generator in power flow cases with the following data:

- G1: MBASE: [redacted]
- G2: MBASE:
- G3: MBASE:
- G4: MBASE:
- G5: MBASE:
- G6: MBASE:
- G7: MBASE:

In dynamic simulation, each equivalent generator is represented by a user-defined WTG model [redacted], which is proprietary and parameterized with vendor support. Table D-1 shows a selection of model parameters used in this SIS.

Table D-1: Selected Model Parameters in WTG User-Defined Model [redacted]

[redacted]

In addition, the wind farm model package includes a user-defined wind park controller model [redacted] which is proprietary and parameterized with vendor support. Table D-2 shows a selection of model parameters used in this SIS.

Table D-2: Selected Parameters in user-defined wind park controller model [redacted]

[redacted]

[redacted]

Appendix E

Preliminary One-Line Sketch for Future Proposed [redacted] Terminal Switching Station (TYTX)

The preliminary One-Line Sketch for the proposed switching station TYTX is provided below.

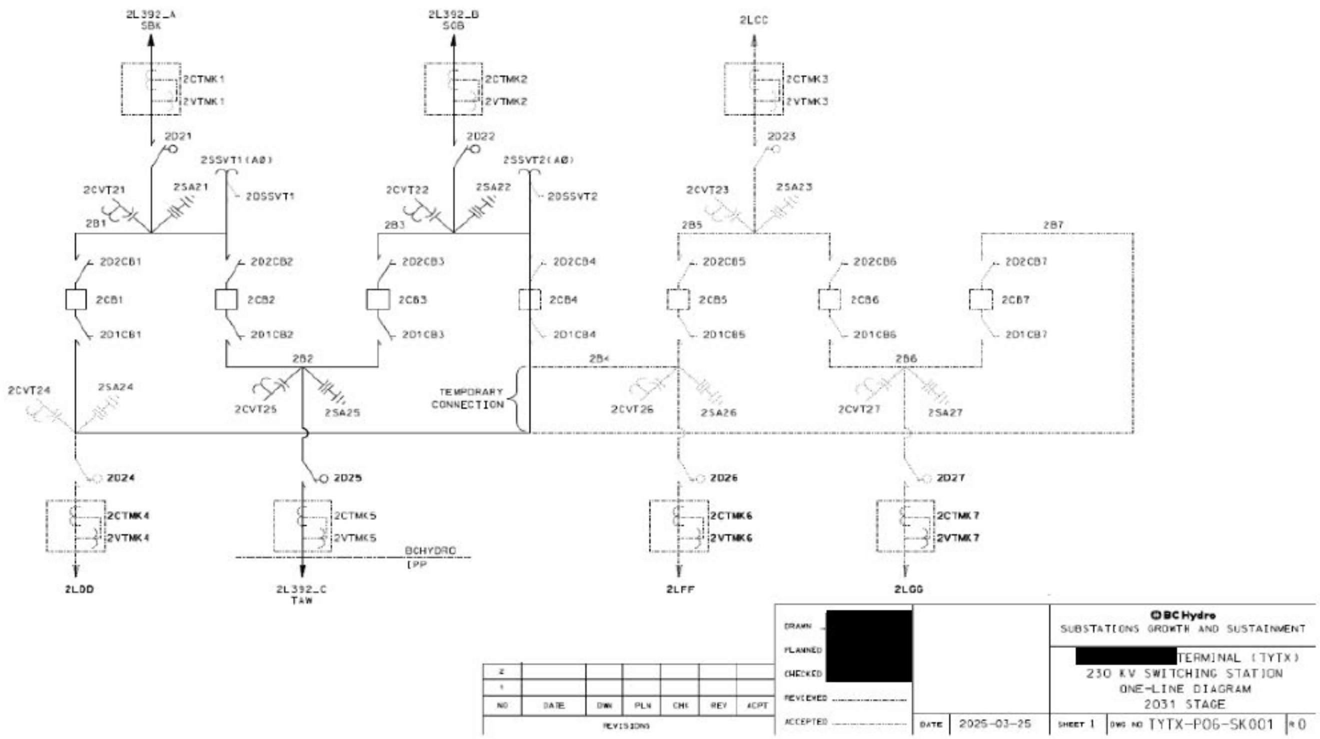

Figure E-1: Preliminary One-Line Sketch for The Proposed Switching Station TYTX.

Appendix F

Transmission Line Diagrams

The POI location, lines 2L391 and 2L392, and the conceptual Ingress and Egress of proposed switching station TYTX on 2L392 is provided in this appendix.

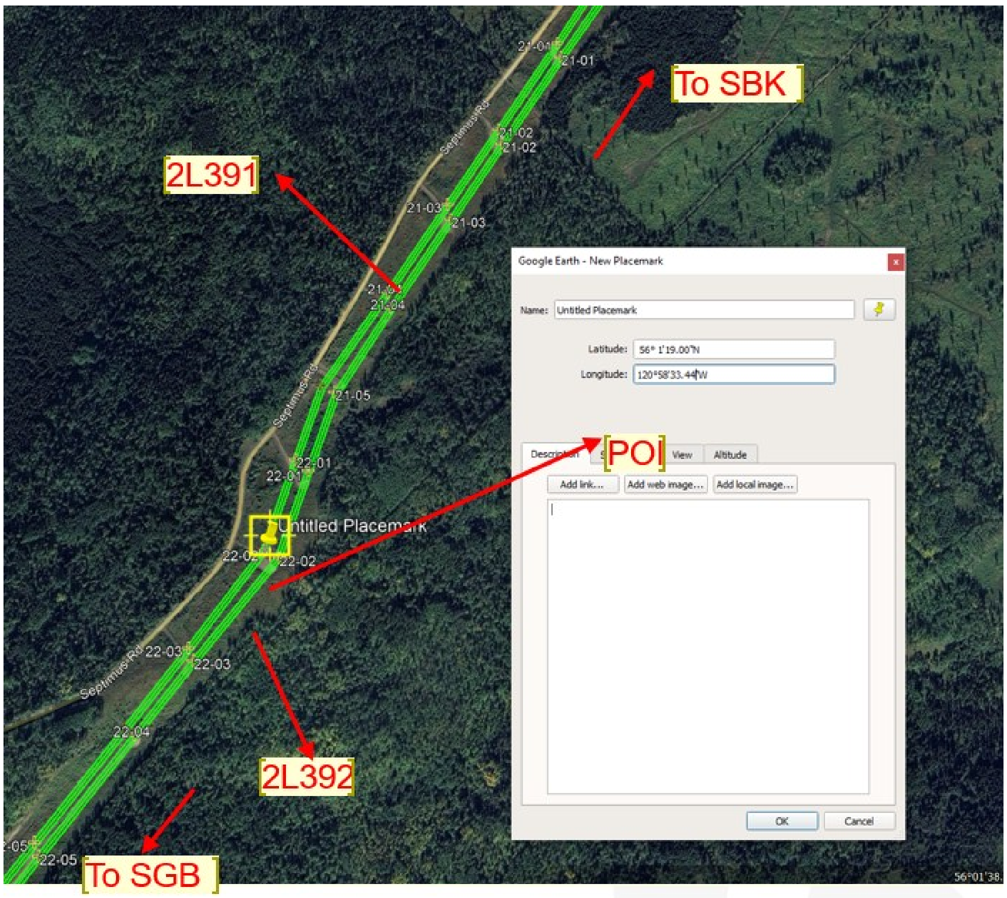

Figure F-1: POI (22.1 km from SBK), 2L391 and 2L392.

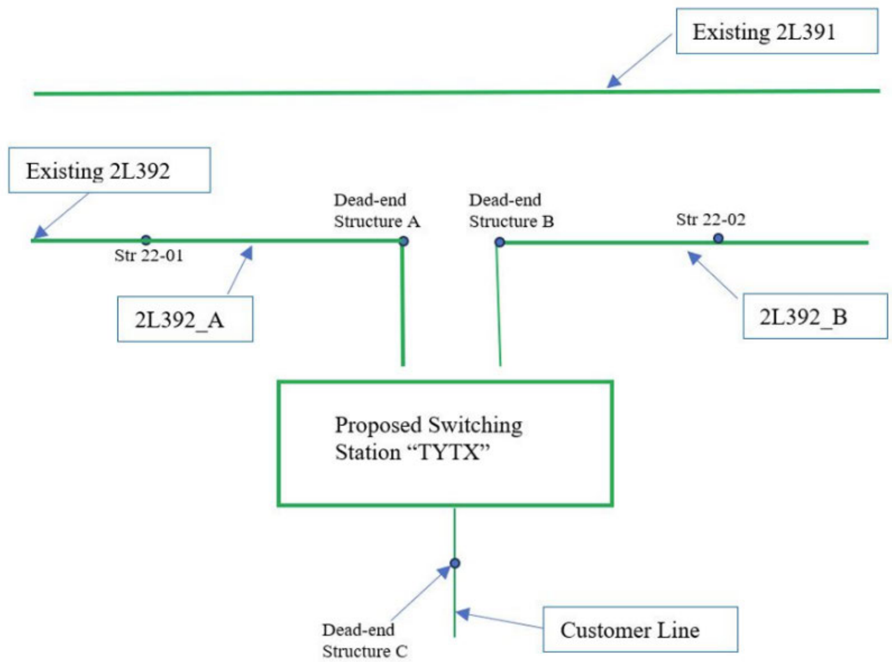

Figure F-2: Conceptual Ingress and Egress of Proposed Switching Station TYTX on 2L392.

Appendix G
Telecom requirements and Telecom Block Diagram

Below is a summary of Teleprotection, RAS and Telecontrol requirements for Telecom, along with the telecom block diagram that illustrates the telecom solution identified in this SIS.

Teleprotection and RAS Requirements for Telecom

- Provide WECC Level 3 64 kbps synchronous circuits between SBK and TYTX for “SBK-TYTX 2L392_A PY/SY Digital Teleprot”.
- Provide WECC Level 3 64 kbps synchronous circuits between TYTX and SGB for “TYTX-SGB 2L392_B PY/SY Digital Teleprot”.
- Provide WECC Level 3 64 kbps synchronous circuits between TYTX and TAW for “TYTX-TAW 2L392_C PY/SY Digital Teleprot”.
- Provide WECC Level 1 transfer trip facilities from SBK to GMS for “SBK 2L392_A PY/SY L/S TT to GMS”. The existing 2L392 transfer trip facilities between SBK and GMS may be reused if possible (but renamed to reflect the new 2L392_A line).
- Provide WECC Level 1 transfer trip facilities from SGB to GMS for “SGB 2L392_B PY/SY L/S TT to GMS”.
- Provide WECC Level 1 transfer trip facilities from SBK to TYTX for “SBK TAW PY/SY G/S TT to TYTX”.

Telecontrol Requirements for Telecom

- Provide a TAW SCADA channel.
- Provide TYTX SCADA, REMACC, and PML channels.

Other Requirements for Telecom

- Install multiple MPLS Links and other telecom circuits in BCH’s network.

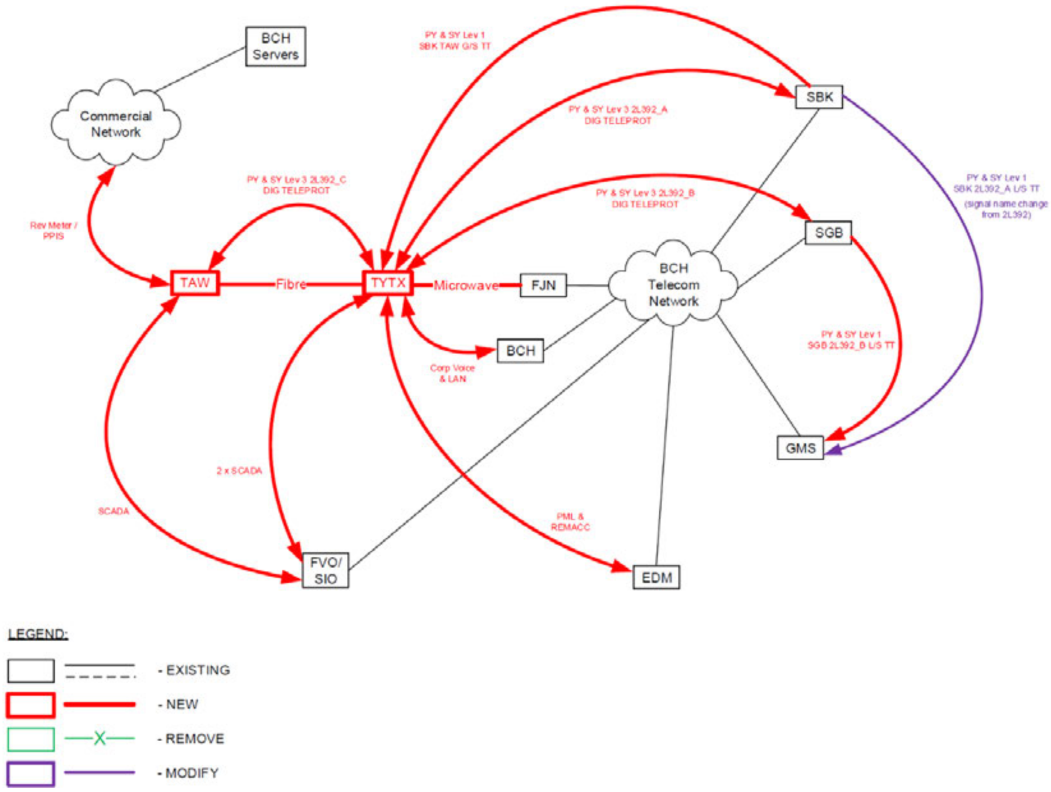

Figure G-1: The telecom block diagram identified in SIS of [redacted] Project.

Appendix H
Revenue Metering Related Telecommunications Requirements

A telecommunications channel is required for remote read/download data from the main and the backup meters. The design, supply and installation of the communications equipment shall be coordinated between BCH Revenue Metering, BCH Telecom, the [redacted] Plant and the Telecommunications Service Provider. The [redacted] Plant is required to provide terminals or connectors inside the BCH meter cabinet. Where the POI is on a 69 kV voltage class or higher BC Hydro transmission system and where a conventional wire-line telephone is installed, ground potential rise (GPR) protection shall be provided. Alternative technologies may be used, e.g., cellular, fiber optic, microwave, satellite, etc. However, these solutions must be discussed and approved by BCH before installation. BCH MV-90 Server must be able to access and download data from the meters remotely as they do when they dial in a site using a standard phone line (wireless or landline). For more details, refer to Section 8 of BCH Revenue Metering Requirements for Complex Metering published at the Revenue Metering webpage and at the BC Hydro external website.