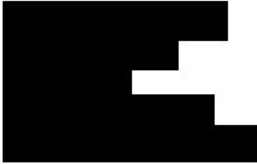


6911 Southpoint Drive  
Burnaby, BC  
V3N 4X8

December 16, 2025



**RE: [REDACTED] Project - Queue #12 - Interconnection System Impact Study Report**

Dear [REDACTED],

Enclosed is the Interconnection System Impact Study report for the proposed Interconnection Request (IR), Queue #12 - [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 IR 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 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 (IC) provides security for such costs.

#### **Interconnection Study Costs**

The Interconnection Customer is responsible for paying the full cost of all Interconnection Studies in cash. Interconnection Study costs vary depending on the scope, complexity, and other factors such as whether any scope is shared with another Interconnection Customer. The deposit amounts specified in the OATT are not proxy Interconnection Study costs. If actual Interconnection Study costs exceed the deposit amount, the Interconnection Customer must pay the remaining balance in cash.

#### **Cost Estimate**

Based on the Interconnection System Impact Study, the non-binding good faith estimated cost (typical accuracy range of +100%/-35%) for Network Upgrades required to interconnect your IR is **\$2.1M**.

#### **Major Scope of Work Identified:**

- Protection & Control:
  - Modify Remedial Action Scheme (RAS) and Direct Transfer Trip (DTT) schemes at BCH stations South Bank (SBK), GM Shrum (GMS), and Sukunka (SNK), including updates to GMS Area Gen Shed RAS, Peace Region Local Wind Farm Gen Shed RAS (LAPS RAS), and Peace Region Anti-islanding DTT scheme; also send Gen Shed DTT signals to SNK.

- Update protection systems at GMS for contingency inputs and reconfiguring relays at SNK for a 3-terminal scheme
- Telecom:
  - Add primary (PY) and secondary (SY) teleprotection devices and configure channel authorizations in teleprotection cabinets at SNK and SBK
  - Create PY and SY fibre authorizations via ██████████ (ZBW) station for direct fibre connections between SNK and the IC's step-up substation (SNWx) 411L relays.
  - Install RS232 channel authorization in the misc. digital rack at SNK for connectivity to Williston substation (WSN).
  - Terminate SNWx SCADA remote terminal unit (RTU) to the digital control panel (DCP) at WSN.

**Exclusions:**

- GST
- Book value of decommissioned equipment
- Permits
- Station works other than P&C/SCADA & Telecom scopes.
- Dismantling/ removal and disposal of any existing BC Hydro assets.

**Key Assumptions:**

- Construction may be completed by BCH or its contractor(s).
- Outages are available as required.
- Estimate is based on construction duration of 12 months.
- Local construction crew will be engaged for this project, thus no Living Out Allowances (LOA) are considered in the estimate.
- Communication, Protection and Control (CPC) will have the internal resources to complete the installation, testing and commissioning.
- No expansion of existing station or control building to accommodate new equipment.
- Impact Benefit Agreements with First Nations are not considered
- No construction during winter season

**Key Risks:**

- Availability of outage windows.
- Resource availability.
- Major equipment, materials, and general contractor pricing different than estimated.
- No defined supply chain strategy; construction costs may increase depending on delivery method
- Project schedule may be longer than expected, leading to increased loading costs.
- Costs may be affected by market conditions and escalation.

**Technical Interconnection Requirements**

As part of our commitment to maintaining a reliable and responsive grid, BC Hydro maintains its Technical Interconnection Requirements (TIR) documentation, including the 60 kV to 500 kV TIR for Power Generators. You will be required to meet the TIR as your project will be connecting to the BC Hydro Transmission system. 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/tqi/60kv-500kv-TIR-for-power-generators.pdf>

## Revenue Metering Requirements

The revenue metering requirements and associated costs to interconnect your Interconnection Request have been identified in the Interconnection System Impact Study. However, the revenue metering costs are not included in the above cost estimate as they are separate from 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 **September 2028** 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 or documentation, including providing your confirmation to proceed with the Facilities Study in writing.
- Execution of an SGIA
- Providing Financial commitments and securities, as required


Please note that changes to your Interconnection Request, delays in data submission, changes in earlier queued Interconnection Requests, or delays in receiving financial commitments may also impact the target in-service date.

If you have any questions, please contact the Transmission Generator Interconnections team at [transmission.generators@bchydro.com](mailto:transmission.generators@bchydro.com).

Sincerely,



Interconnections Manager, Transmission Generator Interconnections  
BC Hydro

Encl.: \_System Impact Study\_Report.pdf

[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]

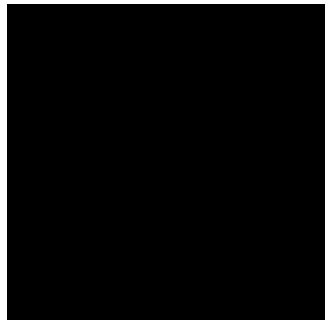
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Senior Engineer, Powertech Labs Inc.

Reviewed by: [Redacted]

[Redacted]  
Specialist Engineer, Powertech Labs Inc.

Accepted by: [Redacted]

[Redacted]  
Manager, Transmission Planning



## Report Metadata

Header: [REDACTED] Project  
Subheader: Interconnection System Impact Study  
Title: [REDACTED]  
Subtitle: [REDACTED]  
Report Number: 1016H-APR-00001  
Revision: 0  
Confidentiality: Public  
Date: 2025 Dec 16  
Volume: 1 of 1

Prepared for: [REDACTED]  
Prepared by: [REDACTED]  
Title: Senior Engineer, Powertech Labs Inc.  
Checked by: [REDACTED]  
Title: Specialist Engineer, Powertech Labs Inc.  
Reviewed by: [REDACTED]  
Title: Specialist Engineer, Powertech Labs Inc.

Related Facilities: Facility station code – SNWx  
Line designation – 2L393

Additional Metadata: Transmission Planning 2025-025  
Filling subcode 1350

## Revisions

Revision	Date	Description
0	2025 Dec	Initial release

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The entire report Interconnection Planning  
except those  
listed below

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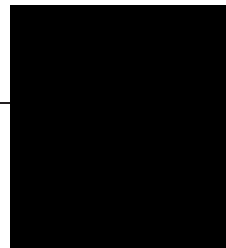
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Senior Engineer, Powertech Labs Inc.



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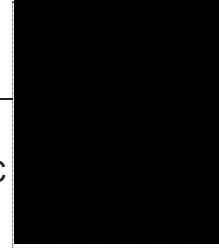
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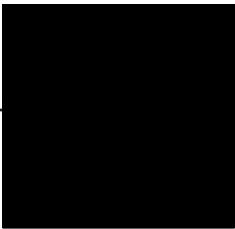
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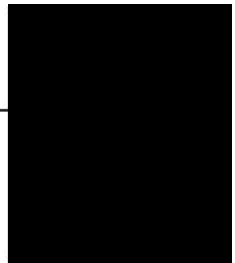
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Appendix E	Telecom requirements and Telecom Block Diagram
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## Acronyms

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
DKT	Dokie Terminal Station
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
ROW	Right of Way
SCADA	Supervisory Control and Data Acquisition
SBK	South Bank Substation
SGB	Shell Groundbirch Gas Processing Plant Switching Station
SIS	System Impact Study
SLS	Sundance Lakes Substation
SNK	Sukunka Switching Station
SRN	Saturn 1 Gas Plant Substation
TIR	BC Hydro 60 kV to 500 kV Technical Interconnection requirements for Power Generators
TOV	Temporary Overvoltage
VT	Voltage Transformer
VIC	Virtual Inertia Control
WECC	Western Electricity Coordinating Council
WTG	Wind Turbine Generator
ZBW	██████████ Substation



## Executive Summary

██████████, the Interconnection Customer (IC), requests to connect the ██████████ Project to the BCH system in the Peace Region.

The ██████████ Project comprises ██████████ for the plant total installed capacity of 56 MW. The project's maximum power injection at the proposed Point of Interconnection (POI) is approximately 54.6 MW.

The ██████████ Project will indirectly connect to the BC Hydro system via the existing third-party owned 230 kV transmission line 2L393 and will be connected on 2L393 via a line tap located just outside the perimeter fence of the existing ██████████ Substation (ZBW). 2L393 is a third-party owned line that interconnects ZBW to the BC Hydro's Sukunka substation (SNK). The proposed POI in the BC Hydro system is at the 2L393 line position within the SNK substation. The IC's proposed commercial operation date (COD) is December 31, 2028.

To interconnect the ██████████ Project at the proposed POI, the SIS was conducted and has identified the following requirements and conclusions:

1. A T-tap connection on the existing third-party owned circuit 2L393 is acceptable for interconnecting the IC's generating project to the BCH system.
2. The proposed ██████████ Project can meet the reactive power capability requirement specified in the BC Hydro's TIR Section 6.4.2. over the entire MW operating range (including at zero MW output) and no additional reactive resource is required at the IC's facility.
3. The WTGs at ██████████ Project can provide fast frequency response (FFR) when the turbine's Inertia Emulation is enabled. The turbine's Inertia Emulation is required at ██████████ Project to limit the system frequency drop during a major frequency event. The turbine's Inertia Emulation settings should be determined in coordination with BC Hydro in the later stage of interconnection studies.
4. BCH will upgrade the line protection relays at BC Hydro's SNK substation associated with 2L393 to convert from a two terminal line protection to a three terminal line protection for successful integration of ██████████ Project. As part of the line protection upgrade, telecommunication

facilities will be required for each substation. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the upgraded protection schemes.

5. Anti-islanding protection is required for the ██████████ Project and shall be configured in the manner that does not compromise the required ride-through performance.
6. ██████████ Project is required to participate in the existing Peace area anti-islanding direct transfer trip (DTT) scheme. Modifications to the existing DTT scheme are required to include the ██████████ Project for the applicable contingencies.
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.
8. The interconnection of the ██████████ Project does not cause any system performance violation (i.e. thermal overload, voltage violation, or voltage instability, etc.) under the system normal and contingency conditions. No transient instability or transient voltage violation was observed in the area under the applicable study contingencies.
9. Voltage disturbances resulting from the energization of the ██████████ Project's ██████████ transformer will need to be mitigated using an independent pole-operated (IPO) 230 kV circuit breaker equipped with a Point-On-Wave (POW) controller for controlled closing.

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

██████████, the Interconnection Customer (IC), requests to connect its ██████████ to the BC Hydro system. The project will have ██████████. The total installed capacity of the project is 56 MW, with a maximum power injection of 54.6 MW at the proposed Point of Interconnection (POI).

The ██████████ Project will indirectly connect to the BC Hydro system via the existing third-party owned 230 kV transmission line 2L393 and will be connected on 2L393 via a line tap located just outside the perimeter fence of the existing ██████████ Substation (ZBW). 2L393 is a third-party owned line that interconnects ZBW to the BC Hydro’s Sukunka substation (SNK). The proposed POI in the BC Hydro system is at the 2L393 line position within the SNK substation. The IC’s proposed commercial operation date (COD) is December 31, 2028.

The project overview is provided in Table 1-1 below.

Table 1-1: Summary of Project Information

Project Name	██████████ Project	
Interconnection Customer	██████████	
Point of Interconnection	Tap on the third-party owned 2L393 at close point to ZBW	
IC Proposed COD	December 31, 2028	
Type of Interconnection Service	NRIS <input checked="" type="checkbox"/>	ERIS <input type="checkbox"/>
Maximum Power Injection (MW)	54.6 (Summer)	54.6 (Winter)
Number of Generator Units	██████████	
Plant Fuel	Wind	

██████████ The ██████████ collector system further connects to the 230 kV transmission system via a main power transformer at the IC’s step-up substation, temporarily referred to as “SNWx”.

Figure 1-1 illustrates the interconnection of ██████████ Project to the Peace Region transmission system. SNK is a switching station that interconnects



## 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 (hereafter referred to as the "TIR") 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 May 30, 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) cases, which were selected based on the proposed COD submitted on May 27, 2025, were used as base scenarios for the SIS. In November 2025, the IC proposed a revised COD of December 31, 2028. Due to the timing of receiving this proposed change, the revised COD could not be fully assessed in detail prior to completion of the SIS. The potential impacts of the earlier COD will be studied in detail the next stage of the interconnection process. However, it is not expected to affect the study conclusions.
- 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.
- 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

### 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 the connection of ██████████ Project does not cause any overload or voltage violation in the studied regional system under system normal operating conditions and under the studied contingencies.

Note that BCH TIR Section 6.4.2 requires Inverter Base Resource (IBR) power plants to have the dynamic reactive power capability at a minimum of +/- 33% of its MPO at the high-voltage side of the switchyard over the full MW operating range. The results of the simulations for the ██████████ Project indicate that the project meets this requirement over the entire MW operating range (including at zero MW output). No additional reactive resource is required at the facility.

### 5.2 Transient Stability Study

Transient stability studies were performed using the 2031HW, 2032HS, and 2032LS base cases to assess the impact from the ██████████ Project interconnection 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 ██████████ Project. No transient instability or transient voltage recovery violation has been observed under the study conditions and contingencies. However, ██████████ Project was unexpectedly tripped under certain contingencies (e.g., line fault close at SNK on 2L313, and SNK\_2CB21 stuck breaker with line fault close at SNK on 2L312).

The ██████████ Project is required to have voltage ride-through (VRT) and frequency ride-through (FRT) capabilities per BCH's TIR. Using the default settings provided by the vendor, it was observed that the ██████████

Project was tripped under certain contingencies while other generators in the region have acceptable performance. As mentioned above, the user-defined model of the ██████████ used in the ██████████ ██████████ Project requires further investigation and adjustment to prevent unexpected tripping of this plant under certain contingencies. The IC will need to investigate the unexpected tripping and timely address the concern, which shall be done before start of the project commissioning.

In addition, upon the IC's submission, the WTGs at ██████████ Project can provide fast frequency response (FFR) when the turbine's Inertia Emulation is enabled. The turbine's Inertia Emulation is required at ██████████ Project to limit the system frequency drop during a major frequency event. The turbine's Inertia Emulation settings should be determined in coordination with BC Hydro in the later stage of interconnection studies.

### 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 were 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 ██████████ ██████████ 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.
- The current Direct Transfer Trip (DTT) scheme for ZBW will be modified to provide anti-islanding protection of the ██████████ Project. This will be implemented by adding the tripping of the SNK breakers 2CB1 and 2CB12 to isolate the 2L393 line in response to any protection tripping or unintentional opening of any two lines: 2L312 (SNK–SLS) and either 2L308 (GMS–DKT) or 2L309 (DKT–SNK).
- Voltage disturbance resulting from energization of the ██████████ Project's ██████████ main power transformer will be mitigated using an independent pole-operated (IPO) circuit breaker equipped with a Point-On-Wave (POW) controller for controlled closing of the entrance breaker 2CB2.

- The harmonic current injection from the ██████████ Project shall not exceed the limits specified in BC Hydro's Generation Technical Interconnection Requirements, which follow IEEE Std 519-2022. Harmonic studies will be conducted when the IC harmonic current spectrum becomes available at a later stage of the project.
- The ██████████ Plant demonstrated stable operation under these reduced SCR conditions, with SCR values determined based on credible operating scenarios 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 ██████████ Project is required to participate in the GMS Area Generation Shedding RAS for Peace region 500 kV transmission system contingencies.

The Peace area anti-islanding DTT scheme functional requirements will be modified to include ██████████ Project for loss of GMS T13 and T14, 2L308, or 2L309, when 2L312 is out of service.

## 5.7 Station Upgrade Requirements

No station work is required for this interconnection project.

## 5.8 Transmission Line Upgrade Requirements

There is no transmission line engineering scope of work for BC Hydro for this project.

## 5.9 Protection, Control and Telecommunications

### 5.9.1 Protection

The ██████████ Project will be required to participate in the GMS Area Generation Shedding RAS Scheme. The line protection relays at BC Hydro's SNK substations associated with 2L393 will be upgraded to convert from a two terminal line protection to a three terminal line protection. 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 ██████████ ██████████ Project.

- Entrance protection that complies with the latest version of the BCH TIR.
- Provide two SEL-411L-0 relays (same part number and identical firmware version with 2L393 SNK/ZBW existing relays) at the entrance of SNWx to provide protection coverage for 2L393. BC Hydro P&C Planning will provide core protection settings for these relays.
- The IC together with the third-party owner of ZBW are responsible for implementing RAS requirements at their facility with no single point of failure.
- 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 ██████████ Project from operating in islanded condition.
- The IC will be participating in Peace Region Local Wind Farm Gen Shed RAS (LAPS RAS) scheme, by the existing tripping scheme at SNK for ZBW.
- The IC will be participating in Peace Region Anti-islanding DTT Scheme, by the existing tripping scheme at SNK for ZBW.

The existing ZBW owner should retain the existing 2L393 SEL-411L-0 protection relays and make the required modifications to accommodate SNWx IC interconnection.

## 5.9.2 Control

The IC will provide SCADA data reporting to the control centers in accordance with the TIR, including required telemetry, metrological data 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 or broadband IP satellite 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's telemetry, status and metrological data will be routed to the appropriate Data Collection Platform (DCP). BC Hydro control centers are required to reconfigure the existing equipment to accommodate the new IC, include the generator into the network model, and add the new telemetry, status and alarm points.

The IC is responsible to provide a minimum 9600 bps continuous channel for the ██████████ Substation to connect to the appropriate DCP site via the closest BC Hydro station with appropriate telecom facilities (station to be determined by BC Hydro Telecom).

The IC is responsible for providing an appropriate Power Parameter Information System (PPIS) meter per the TIR requirements, 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. As a minimum it can be a dial-up telephone line. Alternative communications include IP cellular modem, IP satellite, BCH WAN (where appropriate) and is subject to BCH review and approval.

At the request of BC Hydro, IC will be required to provide protection event records from the interconnecting line protection relays to BC Hydro under the following circumstances:

- Fault on interconnecting line
- Relay miss-operation for fault outside of interconnecting line
- Relay operation due to Power Quality Protection elements

The proponent may elect to provide facilities for BC Hydro to remotely access the interconnecting relays (IP or dial-up depending on relay manufacturer and telecommunications facilities). Alternately the proponent may elect to provide a key contact person's information on their station Operating Order that will retrieve event records when requested by BC Hydro.

The exchange of event reports will assist BC Hydro in analyzing system disturbances. This should improve the protection performance of both BC Hydro and the IC(s) for faults near points of interconnection.

The relay interrogation functionality should be provided by an SEL-3622 or equivalent. Communications and equipment selection is subject to BC Hydro review and approval.

Minor work will be required by BC Hydro to commission telemetry, alarms, and remote access at SNWx. The IC is responsible for providing an appropriate PPIS meter per the TIR, connected to a suitable high voltage source for harmonics and power quality metering.

### **5.9.3 Telecommunications**

A telecom solution has been identified to meet the telecom requirements for telecommunication and telecontrol, RAS and other network additions (see these requirements in Appendix E). The detailed telecom work scope and specs will be provided in detail at a later stage of Interconnection Studies.

#### **Telecom System Upgrade/Extension**

##### **IC's Work Required at SNWx**

- The IC will design for the installation of 48 strands single-mode fiber optic cable along the new 230kV transmission line structures and terminates at ZBW.
- Create and assign PY and SY Fibre Authorizations for a direct fiber connection between ZBW and SNWx, and SNWx and SNK.
- Create and assign Fiber Authorization for SNWx SCADA connection to WSN via SNK

##### **Third-Party Owner's Work at ZBW**

- Terminate the 48 strands single-mode fiber optic cable coming from SNWx to ZBW.
- Cross-connect the fiber authorizations between SNK and SNWx.

- Create and assign PY and SY Fibre Authorizations for a direct fiber connection between ZBW and SNWx.

### **BCH's Work Required at SNK**

- Add PY and SY teleprotection devices and create channel authorization between SNK and SBK, and fiber authorization between SNK and SNWx. Install single mode RS232-fiber modem for SNWx SCADA, create fiber Auth between SNK and SNWx and create RS232 channel auth to WSN.

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

- a) The IC will install and extend the fiber cable from ZBW to SNWx along the new transmission line structures.
- b) SNWx will use some spare fiber pairs on the existing SNK-ZBW fiber backhaul.
- c) Existing equipment facility at SNK will be used to transport RAS and SCADA signals to SBK and WSN respectively.
- d) 2L393 will become a line with three terminals (SNK/ZBW/SNWx) in this project.
- e) Both SNWx and ZBW will participate in the GMS Area Gen Shed RAS scheme, as one of the gen shed candidates for all the 500 kV transmission system contingencies.
- f) SNWx will be participating in Peace Region Local Wind Farm Gen Shed RAS (LAPS RS) scheme, by the existing tripping at SNK for ZBW.

## 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 Transformers	3 x VTs 230,000 GRDY/138,000-115-115V- TBD and Supplied by IC (VT must be CSA certified, and customer to submit certificate document)
Current Transformers	3 x CTs, Transformer, Metering-Current, 253 kV Max, Outdoor, Dry, 200x400x800-5-5 A, TBD and Supplied by IC (CT must be CSA certified, and customer to submit certificate document)

## 8 Conclusions

This System Impact Study has concluded the following requirements:

1. A T-tap connection on the existing third-party owned circuit 2L393 is acceptable for interconnecting the IC's generating project to the BCH system.
2. The proposed ██████████ Project can meet the reactive power capability requirement specified in the BC Hydro's TIR Section 6.4.2. over the entire MW operating range (including at zero MW output) and no additional reactive resource is required at the IC's facility.
3. The WTGs at ██████████ Project can provide fast frequency response (FFR) when the turbine's Inertia Emulation is enabled. The turbine's Inertia Emulation is required at ██████████ Project to limit the system frequency drop during a major frequency event. The turbine's Inertia Emulation settings should be determined in coordination with BC Hydro in the later stage of interconnection studies.
4. BCH will upgrade the line protection relays at BC Hydro's SNK substation associated with 2L393 to convert from a two terminal line protection to a three terminal line protection for successful integration of ██████████ ██████████ Project. As part of the line protection upgrade, telecommunication facilities will be required for each substation. The IC shall provide required relays, telecom facility and associated equipment at its facilities to accommodate the upgraded protection schemes.
5. Anti-islanding protection is required for the ██████████ Project and shall be configured in the manner that does not compromise the required ride-through performance.
6. ██████████ Project is required to participate in the existing Peace area anti-islanding direct transfer trip (DTT) scheme. Modifications to the existing DTT scheme are required to include the ██████████ Project for the applicable contingencies.
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.

8. The interconnection of the ██████████ Project does not cause any system performance violation (i.e. thermal overload, voltage violation, or voltage instability, etc.) under the system normal and contingency conditions. No transient instability or transient voltage violation was observed in the area under the applicable study contingencies.
  
9. Voltage disturbances resulting from the energization of the ██████████ Project's ██████████ transformer will need to be mitigated using an independent pole-operated (IPO) 230 kV circuit breaker equipped with a Point-On-Wave (POW) controller for controlled closing.

## Appendix A

### Schematic Diagram of the IC's Project

The following shows the plant schematic diagram for the IC's project (as submitted).

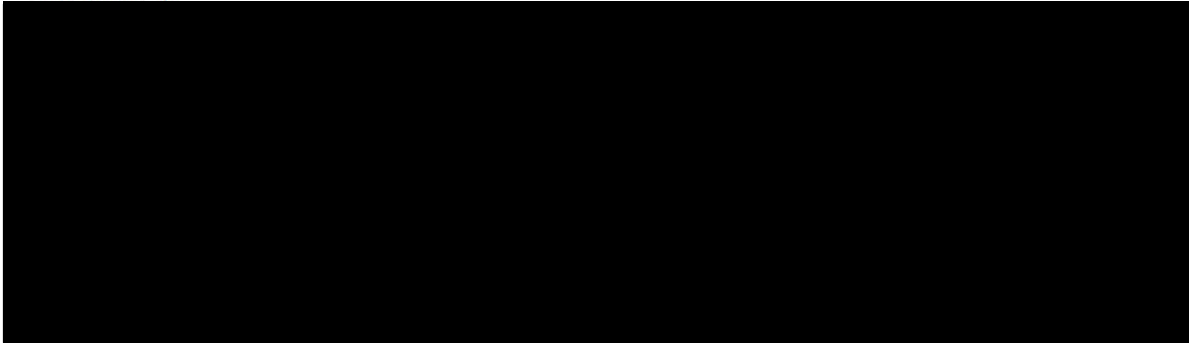


Figure A-1: Schematic Diagram of ██████████ Project.

## Appendix B

### Steady-state Power Flow Study Results

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	2L309	2L312	2L313	2L393	2L340	2L308
31HW	Winter Rating (MVA)			539.4	538.2	538.6	358.5	796.7	541.4
	Max	P0	System Normal	25.31	45.55	54.94	23.96	12.68	50.86
	Max	P1.2	2L309	---	70.85	54.94	23.96	20.09	27.12
	Max	P1.2	2L312	70.58	---	54.74	26.38	0.831	93.18
	Max	P1.2	2L313	1.357	15.10	---	24.08	3.78	27.68
	Max	P1.2	2L393	18.287	36.67	54.94	---	10.07	44.25
	Max	P2.3	2L340	26.339	44.50	54.93	23.96	---	51.81
	Max	P2.2	1L349	25.992	43.32	54.92	23.98	14.49	52.86
	Max	P2.2	SNK_2CB12	54.562	---	54.64	---	0.85	78.31
32HS	Summer Rating (MVA)			427.5	424.7	431	358.5	796.7	427.5
	Max	P0	System Normal	35.97	58.07	72.44	24.18	12.76	68.17
	Max	P1.2	2L309	---	93.84	72.42	24.11	21.11	34.36
	Max	P1.2	2L312	92.47	---	71.85	26.38	0.85	121.38 [2]
	Max	P1.2	2L313	4.53	18.42	---	25.02	3.35	36.91
	Max	P1.2	2L393	27.05	46.84	72.56	---	10.12	59.62
	Max	P2.3	2L340	37.24	56.65	72.42	24.09	---	69.37
	Max	P2.2	1L349	38.69	55.17	72.41	24.07	14.61	70.72
	Max	P2.2	SNK_2CB12	72.30	---	71.71	---	0.88	102.54 [2]
32LS	Summer Rating (MVA)			427.5	424.7	431	358.5	796.7	427.5
	Max	P0	System Normal	38.71	54.37	72.13	23.97	11.76	70.71
	Max	P1.2	2L309	---	93.14	71.93	23.96	20.73	34.37
	Max	P1.2	2L312	92.26	---	71.60	26.38	1.14	121.13 [2]
	Max	P1.2	2L313	6.67	14.09	---	24.29	2.45	39.95
	Max	P1.2	2L393	29.86	43.08	71.99	---	9.14	62.33
	Max	P2.1	2L340	39.91	53.13	71.94	23.96	---	71.84
	Max	P2.2	1L349	41.42	51.48	71.91	23.96	13.59	73.25
	Max	P2.2	SNK_2CB12	72.05	---	71.46	---	1.17	102.26 [2]

Notes:  
 [1] P1.2, P2.1 and etc. are the contingency categories defined in NERC TPL-001-4.  
 [2] These are existing overloads and are currently addressed by Peace Region generation shedding RAS.

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

Case	IC's Plant Output	Contingency		Bus Voltage (pu)			
		Cat.	Description	SNK 230	SLS 230	SGB 230	MKT 230
31HW	Max	P0	System Normal	1.0341	1.0330	1.0327	1.0407
	Max	P1.2	2L309	1.0341	1.0312	1.0314	1.0407
	Max	P1.2	2L312	1.0303	1.0335	1.0329	1.0411
	Max	P1.2	2L313	1.0347	1.0346	1.0338	----
	Max	P1.2	2L393	1.0341	1.0335	1.0331	1.0407
	Max	P2.3	2L340	1.0340	1.0327	1.0323	1.0407
	Max	P2.3	1L349	1.0339	1.0319	1.0320	1.0407
	Max	P2.3	SNK_2CB12	1.0259	1.0337	1.0331	1.0417
32HS	Max	P0	System Normal	1.0369	1.0426	1.0435	1.0404
	Max	P1.2	2L309	1.0368	1.0405	1.0420	1.0404
	Max	P1.2	2L312	1.0300	1.0469	1.0463	1.0412
	Max	P1.2	2L313	1.0379	1.0445	1.0449	----
	Max	P1.2	2L393	1.0380	1.0435	1.0442	1.0403
	Max	P2.3	2L340	1.0368	1.0416	1.0434	1.0404
	Max	P2.3	1L349	1.0367	1.0414	1.0427	1.0404
	Max	P2.3	SNK_2CB12	1.0258	1.0471	1.0465	1.0417
32LS	Max	P0	System Normal	1.0344	1.0351	1.0349	1.0407
	Max	P1.2	2L309	1.0342	1.0328	1.0332	1.0407
	Max	P1.2	2L312	1.0296	1.0368	1.0360	1.0413
	Max	P1.2	2L313	1.0351	1.0368	1.0361	----
	Max	P1.2	2L393	1.0349	1.0359	1.0354	1.0406
	Max	P2.3	2L340	1.0343	1.0349	1.0345	1.0407
	Max	P2.3	1L349	1.0341	1.0335	1.0338	1.0407
	Max	P2.3	SNK_2CB12	1.0253	1.0370	1.0361	1.0418

## Appendix C

### Transient Stability Study Results

There is no transient instability or transient voltage recovery violation identified in the SIS. However, ██████████ Project was unexpectedly tripped under certain contingencies (e.g., line fault close at SNK on 2L313, and SNK\_2CB21 stuck breaker with line fault close at SNK on 2L312). A summary of the transient stability study results for 2031HW, 2032HW, and 2032LS load conditions with ██████████ 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)		██████████ 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	Close to SBK	6	7	Acceptable	Acceptable
P1.2	2L392	Close to SBG	6	7	Acceptable	Acceptable
P1.2	2L308	Close to DKT	6	7	Acceptable	Acceptable
P1.2	2L309	Close to DKT	6	7	Acceptable	Acceptable
P1.2	2L312	Close to SNK	6	7	Acceptable	Acceptable
P1.2	2L313	Close to SNK	6	7	Tripped	Acceptable
P1.2	2L393	Close to SNK	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_SLS_2CB11 fault @SLS_2L312	Close to SLS	14	6	Acceptable	Acceptable
P4	Stuck Breaker_SNK_2CB12 fault@SLS_2L312	Close to SLS	6	15	Acceptable	Acceptable
P4	Stuck Breaker_SNK_2CB12 fault@SNK_2L312	Close to SNK	14	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 fault @SBK_2L391	Close to SBK	14	7	Acceptable	Acceptable
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	6	15	Acceptable	Acceptable
P4	Stuck Breaker_SNK_2CB21 fault@SNK_2L312	Close to SNK	20	6	Tripped	Acceptable
P4	Stuck Breaker_SNK_2CB21 fault@SLS_2L312	Close to SLS	6	20	Acceptable	Acceptable

## Appendix D

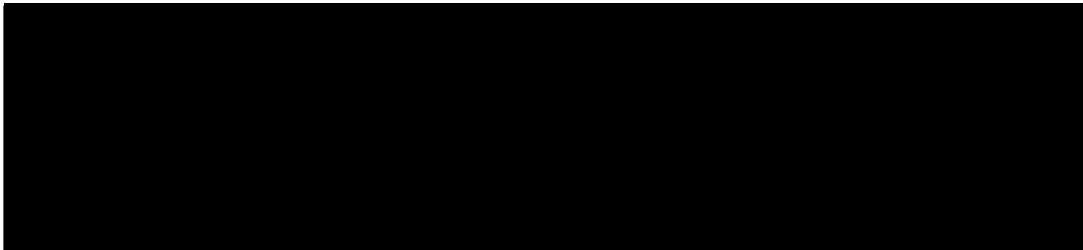
### Power Flow and Dynamic Models and Data

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

- G1: MBASE: ██████████
- G2: MBASE: ██████████
- G3: MBASE: ██████████

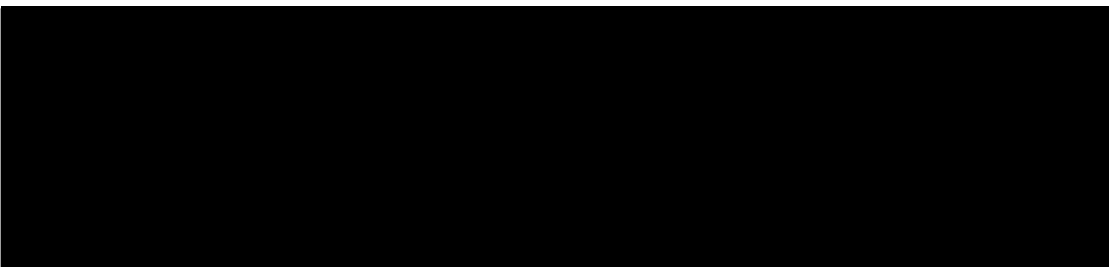
In dynamic simulation, each equivalent generator is represented by a user-defined ██████████ which is proprietary and parameterized with vendor support. Table D-1 shows a selection of model parameters used in this SIS.

Table D-1: Selected Model Parameters in ██████████

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In addition, the wind farm model package includes a user-defined reactive power control model ██████████, 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 Reactive Power Control Model ██████████

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## Appendix E

### 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.

#### Telecommunication Required for SNWx IC and ZBW Owner

- Provide WECC Level 3 64 kbps synchronous circuits between SNWx and SNK for “SNWx – SNK 2L393 PY/SY DIGITAL TELEPROT”. Physical interface shall be C37.94 optical over single mode fibre using ST connectors.
- Provide WECC Level 3 64 kbps synchronous circuits between SNWx and ZBW for “SNWx – ZBW 2L393 PY/SY DIGITAL TELEPROT”. Physical interface shall be C37.94 optical over single mode fibre using ST connectors.
- Retain existing WECC Level 3 64 kbps synchronous circuits between SNK and ZBW for “SNK – ZBW 2L393 PY/SY DIGITAL TELEPROT”.
- Provide WECC Level 1 transfer trip facilities from SBK to SNK for “GMS Area Gen Shed RAS PY/SY TT to SNK”.

#### Telecontrol Requirements for Telecom

- Provide a SNWx SCADA channel.
- Provide REMACC and PML channels from commercial providers.

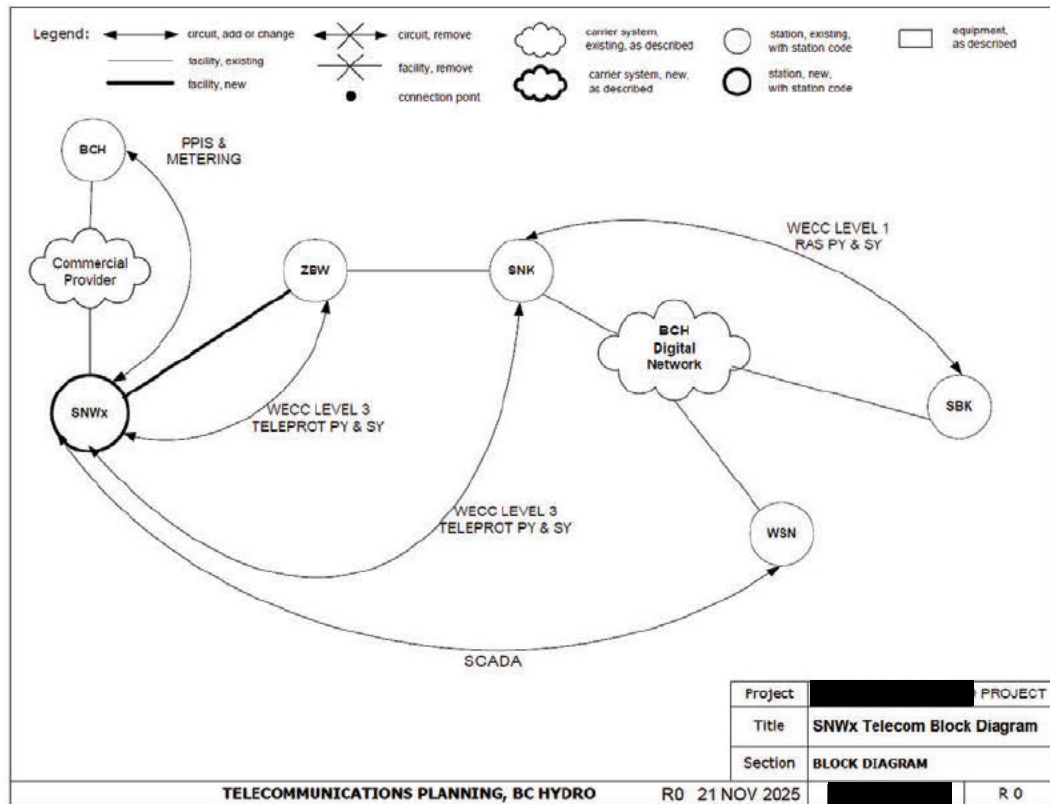


Figure E-1: The telecom block diagram identified in SIS of Project.

## Appendix F

### 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 ██████████ ██████████ and the Telecommunications Service Provider. The ██████████ ██████████ Project 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.