BC HYDRO

T&D SYSTEM OPERATIONS

SYSTEM OPERATING ORDER 7T-14

BRIDGE RIVER – LOWER MAINLAND INTERCONNECTION
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1.0 GENERAL

This System Operating Order covers operation of:

- The 345 kV transmission system from Bridge River Terminal to Rosedale and to Wahleach
- The 230 kV transmission system from Bridge River Terminal to Kelly Lake
- The 230 kV transmission system from Bridge River Terminal to Cheekye and to Horne Payne and Burrard
- Associated remedial action schemes (RAS).

In this System Operating Order, Generation Shedding refers to removal of generation outputs either by tripping units or unit run back. Projects have been undertaken that necessitated the upgrade and expansion of the generator shedding / run back remedial action scheme (RAS) for the Bridge River Area. The RAS includes:

- generation shedding at Bridge River 1, and Bridge River 2 generating stations,
- generation shedding at Upper Harrison (UH), Kwalsa (KWL) IPP Clusters and Upper Lillooet (UL) IPP Clusters
- generation run back at Cheakamus Generating Station.

The Bridge River Area generation shedding recommendations are provided by the Transient Stability Analysis (TSA-PM) program in the EMS. For each contingency, there are a number of circuit elements being monitored for thermal overload. All Generation Shedding arming, Runback scheme arming requirements, pre-outage restrictions and post contingency actions, are documented in SOO 7T-14 Attachment 1.

The operating limits and RAS Arming requirements for the Bridge River – Lower Mainland Interconnection can be found in Sections 5 and 7 and Attachment 1. These requirements cover the worst case operating conditions. Variations from the limits and arming conditions will be provided through additional Operating Plans for specific operating conditions on a case basis. Operating Plans are engineered to support outages and short term operating requirements, superseding as necessary **any** requirements in this order.

References:
The following Operating Orders should be reviewed together with this order and Attachment 1 for and local area operating and switching requirements.

- SOO 5T-10 “Ratings for All Transmission Circuits 60 kV or Higher”
- SOO 7T-25 “Bridge River 1 - Seton – Carquille – 100 Mile House 60 kV Operation”
- SOO 7T-22 “System Voltage Control”
- OO 3T-BRT-01 “Bridge River Terminal Operation “
- OO 3T-WAH-01 “Wahleach Generating Station”
- OO 3T-SAC-01 “Sachteen Substation Operation”

Definitions:

BDW refers to Brandywine Falls IPP
BR1 refers to all Bridge River plant 1 station and units
BR2 refers to all Bridge River plant 2 station and units
BRR refers to all Bridge River units
BRT refers to Bridge River Terminal Substation
BSY refers to Burrard Synchronous Condenser Station
CBN refers to Clayburn Substation
CKY refers to Cheekye Substation
CYP refers to Cypress Substation
FTZ refers to Fitzsimmons IPP Generating Station
FCN refers to Function Junction Substation
HOP refers to Hope Substation
HPN refers to Horne Payne Substation
ING refers to Ingledow Substation
KWL refers to Kwalsa IPP Clusters

MCP refers to Miller Creek IPP
PEM refers to Pemberton Substation
RBW refers to Rainbow Substation
ROS refers to Rosedale Substation
ROS-CBN refers to the transmission lines between Rosedale and Clayburn plus at least one of the CBN 500 / 230 kV transformer connections in-service or the 230 kV transmission lines between Clayburn and Ingledow in-service
RUT refers to Rutherford Creek IPP
SAC refers to Sachteen Substation, a distribution tap off 3L2
SOR refers to Soo River IPP Substation
SZM refers to Spuzzum Substation
TIS refers to Tisdall Switching Station
UHT refers to the Upper Harrison Terminal Substation
UH refers to the Upper Harrison IPP (plants and units)
UL refers to the Upper Lillooet IPP (plants and units)
WAH refers to Wahleach Substation and generating unit
WLT refers to Walters Substation

Harrison Hydro LP Kwalsa (KWL) IPP consists of 9 generating plants and 23 generating units:

Station	Abbreviation	Unit	MW	MVA
Upper Stave	USR	G1	4	4.78
		G2	10	11.38
		G3	10	11.38
		G4	10	11.38
Lamont	LMN	G1	15	16.75
		G2	15	16.75
Fire	FRE	G1	13	14.79
		G2	13	14.79
Douglas	DGL	G1	13	14.79
		G2	13	14.79
Stokke	SKK	G1	13	14.79
		G2	13	14.79
Tipella	TPA	G1	13	14.79
		G2	13	14.79
North West Stave	NWS	G1	3	3.65
		G2	8	8.62
		G3	8	8.62
Tretheway	TWY	G1	11	11.77
		G2	11	11.77
Big Silver	BSV	G1	11	12.23
		G2	11	12.23
		G3	11	12.23
		G4	11	12.23

Upper Lillooet IPP (UL) consists of 2 generating plants and 6 generating units:

Station	Abbreviation	Unit	MW	MVA
Upper Lillooet	ULR	G1	9.45	10.5
		G2	25.74	28.6
		G3	25.74	28.6
		G4	25.74	28.6
Boulder Creek	BDH	G1	14.04	15.6
		G2	14.04	15.6

The Clayburn 500 / 230 kV transformers maintain a parallel path to the Bridge River Terminal - Rosedale, - Ingledow transmission lines as long as all equipment is in service.

2.0 RESPONSIBILITIES

Refer to BC Hydro operating responsibilities as defined in System Operating Order 1J-11 “Power System Operation – Authority and Responsibility”. Operator Desk assignments are defined in SOO 1T-11A "Operating Responsibility and Operating Authority Assignment to Desks."

3.0 VOLTAGE CONTROL

All BRR units are capable of synchronous condenser operation and should be utilized as required for VAR support, especially during system light load conditions. A minimum of two BRR units are required on-line at all times, either as a synchronous condenser or generator, to control voltage if a BRT T4 outage should occur. This requirement has been implemented in TSA-PM.

With WAH G1 shutdown and a loss of any 230 kV circuit between CBN and ROS, a 5 to 6 percent voltage rise may occur on the Upper Fraser Valley 60 kV system. Manual adjustment of the BRT voltage may be necessary to maintain acceptable voltage levels.

Extended operation of the 345 kV system at voltages above 367 kV should be avoided and immediate steps are required to reduce voltages that are above 380 kV (refer to SOO 7T-22).

Two 35 MVAr 345 kV switchable shunt reactors are installed at UHT. One is connected to the line feeding Kwalsa the other is connected to 3L2.

See Section 7.1 for BRR unit terminal voltage limitations above 250 MW output and during normal and abnormal system conditions.

See SOO 7T-22 for station voltage normal operating ranges.

4.0 PLANT / STATION INFORMATION

4.1 Atchelitz

No synchronizing is available.

4.2 Bridge River 2

4.2.1 BR2 3D5, 3D6, 3D7, 3D8

BR2 3D6 and 3D8 can be used for energizing or de-energizing off-loaded unit transformers.

BR2 3D5 and 3D7 can be used for energizing or de-energizing off-loaded unit transformers. However, prior to operating these disconnects, the associated station service should be off-loaded to minimize and prevent transients on the 13.8 kV side. It is also recommended that operations of these disconnects to energize or de-energize be infrequent. (No more than 12 times per year).

4.3 Bridge River Terminal

Synchronizing capabilities have been removed. There is no manual synchronizing, automatic synchronizing or synchro-check available at the station. Synchronizing of the BRR generation must be done through unit breakers at each generating station.

3L2 remote supervisory reclose blocking from FVO and SIO has been provided. When the reclosing is "ON" or "OFF" it will be displayed at FVO and SIO. 3L2 reclosing can also be blocked locally by the 79CS push button on panel R6.

BRT 3L2 three pole auto-reclosing is automatically blocked if 2CB3 and 2CB4 or 2D4 or 3D4 or 3CB5 (and/or its isolating disconnects) and 3CB6 (and/or its isolating disconnects) are open. Single pole auto reclosing is not blocked.

BRT 3CB2 three pole is blocked from reclosing if 3CB5 and/or its isolating disconnects are open. Single pole auto reclosing is not blocked.

BRT 3CB1 three pole is blocked from reclosing if 3CB6 and/or its isolating disconnects are open. Single pole auto reclosing is not blocked.

4.3.1 BRT 2CB3 OOS

The isolating disconnects for BRT 2CB3 (2D1CB3 & 2D2CB3) are manually operated disconnects and so do not have auxiliary contacts available. 29S3 switch is installed on panel F1 at BRT to provide isolating disconnect switch status for the generation shedding scheme. Placing the switches to the on position will allow generation shedding of units selected for the BRT T4 contingency when either CB is isolated. The 29S3 switch should set as follows:

29S3 in ON position if: 2D1CB3 and/or 2D2CB3 are OPEN
29S3 in OFF position if: 2D1CB3 and 2D2CB3 are CLOSED

An alarm is initiated when 29S3 is turned on. See OO 3T-BRT-01 for further details.

4.3.2 BRT 2CB4 OOS

The isolating disconnects for BRT 2CB4 (2D1CB4 & 2D2CB4) are manually operated disconnects and so do not have auxiliary contacts available. 29S4 switch is installed on panel F1 at BRT to provide isolating disconnect switch status for the generation shedding scheme. Placing the switches to the on position will allow generation shedding of units selected for the BRT T4 contingency when BRT 2CB4 is isolated. The 29S4 switches should set as follows:
29S4 in ON position if: 2D1CB4 and/or 2D2CB4 are OPEN
29S4 in OFF position if: 2D1CB4 and 2D2CB4 are CLOSED

An alarm is initiated when 29S3 or 29S4 is turned on. See OO 3T-BRT-01 for further details.

4.3.3 BRT 3CB1 OOS

- For loss of BRT T4 (fault on 2L19, BR1 T3, BR1 T30 or BRT T4) choose BR1 G1 and G4 and BR2 G5 and G6 for shedding first, because they will be effectively shed anyway.
- If additional generation needs to be shed, choose any combination of the other four BR1/BR2 units that provides the remaining shedding requirement.
- It is preferable to have BR1 G2 and G3 and BR2 G7 and G8 on-line. This will prevent self-excitation if the ROS-CBN connection is subsequently lost and a 2L19, BR1 T3, BR1 T30 or BRT T4 fault occurs before adjustments can be made to the BR1/BR2 generation or if BRT T4 is subsequently lost and, a fault occurs on ROS T1, 2L78 or 2L77.

4.3.4 BRT 3CB2 OOS

- For loss of BRT T4 (fault on 2L19, BR1 T3, BR1 T30 or BRT T4) choose BR1 G2, and G3 and BR2 G7 and G8 for shedding first, because they will be effectively shed anyway.
- If additional generation needs to be shed, choose any combination of the other four BR1/BR2 units that provides the remaining shedding requirement.
- It is preferable to have BR1 G1 and G4 and BR2 G5 and G6 on-line. This will prevent self-excitation if the ROS-CBN connection is subsequently lost and a 2L19, BR1 T3, BR1 T30 or BRT T4 fault occurs before adjustments can be made to the BR1/BR2 generation or if BRT T4 is subsequently lost and, a fault occurs on ROS T1, 2L78 or 2L77.

4.3.5 BRT 3CB5 OOS

- For loss of 3L2 (fault on 3L2), choose BR1 G2, and G3 and BR2 G7 and G8 for shedding first to avoid these units being out of synch with the rest of bulk system after 3L2 auto reclose.
- If additional generation needs to be shed, choose any combination of the other four BR1/BR2 units that provides the remaining shedding requirement.

4.3.6 BRT 3CB6 OOS

- For loss of 3L2 (fault on 3L2), choose BR1 G1 and G4 and BR2 G5 and G6 for shedding first to avoid these units being out of synch with the rest of bulk system after 3L2 auto reclose.
- If additional generation needs to be shed, choose any combination of the other four BR1/BR2 units that provides the remaining shedding requirement.

4.3.7 BRT T4 / (2L19, BR1 T3 and T30) Switching

Before switching BRT T4 out of service ensure the BRR generation limits can be met before switching BRT T4 OOS.

Suggested switching:

1. SON Gen shed off
2. BR1 60 kV Gen shed off
3. BRR units Gen shed off for loss of BRT T4 / (BR1 T3 and T30)
4. Reduce the SON, LAJ, JME, WDN (total generation) to 18 MW for switching. SON 66 kV voltage should be kept below 68,kV as generation is reduced. This may mean that you might have to reduce the SON generator and/or LAJ generator voltage to 12.5 – 13 kV.
5. SON/LAJ/JME/WDN below 35MW if both BR1 T3 and T30 remain OOS (SOO 7T-25). Adjust unit voltages to zero VAR transfer through the BR1 transformers.
6. BRR generation below 200MW for switching.
7. Place all units on shed for loss of 3L2 except one unit. It is desirable that the unit left on-line after shedding be loaded at its minimum load (10MW) to carry area load and the plant station service. Having this unit left at minimum load should prevent excessive frequency should 3L2 trip (only when generating MW). If the unit cannot be left at minimum load, there is a risk of losing the unit(s) and loss of station service. Loss of station service will require a crew to restore the plant, or alternatively, connect BR1 12F51 and SS1 to BR1 T3, and arm all the online units at BR1 and BR2 on 3L2 contingency.
8. Block auto reclosing on 3L2 at BRT.

When BR1 T3 and BR1 T30 is being re-energized, reduce the SON, LAJ, JME, WDN (total generation) to approximately 18 MW for switching. Ensure the SON generating shedding is armed after switching and before going above 35 MW (as per SOO 7T-25).

Before returning BRT T4 to service, reduce BRR output to 200 MW or less, to reduce loop closure accelerating torque on the BRR machines to acceptable levels.

After switching out 2L19 at BR1 end (with both of BR1 T3 and T30 out of service after switching) or BR1 T30 or BR1 T3 at BR1 end (with BRT T4 in service in each switching cases):

- DO NOT BLOCK RAS ARMING for T3 OR T4 OR T30 OR 2L19 contingency.
- TSAPM will auto arm gen shed for BRT T4 contingency under this system configuration correctly.

4.3.8 Energizing 3L2 with BRT T4 OOS

It is not possible to energize BR1, BR2 and BRT using 3L5 and 3L2 circuit from ROS, as the BRT open-end voltage is too high for the generator transformers. Energize 3L2 from BRT only. WAH G1 should be off the bus if possible, before the ROS end is closed. See Section 6.5.1 for the number of units required to prevent self-excitation of BR1 and BR2 generators prior to energizing. 3L2 requires 125 MVAR for charging and double that amount should be connected for energizing from generation sources only (without BRT T4 connection).

4.4 Rosedale

Synchronizing is available, through SCADA and local control to 3CB1, 3CB2 and 3CB3. Bandwidth is 59.8 – 60.2 Hz advance angle 40 degrees.

3L5 and 2L78 remote supervisory reclose blocking has been provided. When the reclosing is "ON" or "OFF" it will be displayed. Reclosing of either line can also be blocked locally by the 79CS push button.

The synchroverifier relays at ROS on 2L78 and 3L5 have been set to prevent auto-reclosing when either line is de-energized (i.e. the synchroverifier relay would not allow any 'dead line' closure).

For ROS breaker outages it is suggested to block associated line reclosing or circuit breaker reclosing to ensure out of synch reclosing of in-service CB's cannot occur. Individual circuit breaker reclosing can be accomplished by turning off that CB's "29CS" switch. The ROS CB isolating switches are manually operated. Should an isolated CB be closed during maintenance the open isolating switches cannot be used to set-up logic to ensure relays know the CB is isolated. The "29CS" switches can be used for this purpose.

Whenever ROS 3CB1 is OOS, three-pole auto-reclosing of 3CB3 is automatically blocked. This can also be accomplished prior to isolation by;

- 3L5 reclosing at ROS can be turned off remotely.

Whenever ROS 3CB3 is OOS, auto-reclosing of the 3CB1 should be blocked. This can be accomplished locally prior to isolation or by;

- 2L78 reclosing at ROS can be turned off remotely.
- ROS 3CB2 becomes the lead CB for 3L5 reclosing and will reclose for multi-phase trip and reclose operations.

A distribution tie between WAH and ALZ is possible through 25 kV switches. 2L78 and 3L3 must be in service before any parallel switching between WAH and ALZ can occur. WAH G1 output adjustments may be requested to assist the distribution switching.

4.4.1 ROS T1 OOS

With ROS T1 OOS prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.

Outages scheduled on 2L77, 2L78 or ROS T1, with one of BRT 3CB1 or 3CB2 OOS, require assessment of the minimum units on line required at BRR and KWL IPPs: the loss of BRT T4 while either BRT 3CB1 or 3CB2 is OOS with 2L77, 2L78 or ROS T1 OOS could cause self-excitation to the remaining BRR or KWL IPPs left connected to 3L2.

4.4.2 Switching ROS T1

Shut down WAH G1 prior to switching 2L77 or 2L78 / ROS T1. To reduce the closing angle across the 345/60 kV connection at WAH, 2L78 is the preferred circuit for supplying ALZ during outages to ALZ 2CB4.

WAH G1 should not be connected to 3L3 while 2L77 or 2L78 / ROS T1 is OOS as self-excitation of the WAH unit is possible should 3L2 become open ended at BRT.

A distribution tie between WAH and ALZ is possible through 25 kV field switches. Prior to switching 2L78 ensure that 60L93 connection is open (N.O. at WAH) and no distribution ties between WAH and ALZ are in place or scheduled by FVO. Or, WAH G1 should be connected to the 60 kV with the 345 kV connection open.

4.5 Wahleach

Overvoltage on 3L3 at WAH in excess of 16.56 kV timed and 19.2 kV instantaneous on the low voltage side will result in overvoltage protection tripping 3L3, separating WAH G1 from the system.

5.0 TRANSMISSION LINE INFORMATION

5.1 2L1

5.1.1 Normal Operation

2L1 connects BRT to PEM, RBW and FCN.

Line disconnect 2D1L1 between BRT and PEM is normally closed.

Line disconnect 2D2L1 between PEM and RBW is normally closed.

2L1 protection operations will:

- trip the associated 230 kV circuit breakers at BRT and FCN
- trip PEM feeder breaker 25CB61 connecting MCP
- trip FCN feeder breaker 25CB51 connecting BDW if 2L5 is OOS
- If RBW 25CB3 is closed, trip RBW feeder breaker 25CB64 and 25CB65 connecting FTZ and SOR.

Planned switching of 2L1 that opens both the FCN and BRT terminals will trip the PEM and FCN feeders that connect the IPPs.

5.1.2 Special Operating Conditions

If 2L1 is sectionalized with 2D1L1 open or with 2D2L1 open then protection modifications are required to ensure that a direct transfer trip is sent to IPPs that are connected to a radial 230 kV line.

5.1.3 Switching

Normally, 2L1 is energized from BRT and then closed in at FCN.

2D1L1

- To open, 2L1 must be de-energized.
- Can be closed to energize from 2D1L1 to BRT.
- Cannot be closed to make a parallel.

2D2L1

- to open, 2L1 must be de-energized.
- to close:
  - 2L2 must be on load and <350 Amps flowing, AND
  - BRR total generation must be less than 300 MW, AND
  - Reactive power through 2L2 minimized using BRR generation.

5.1.4 <u>Technical Information</u>

2L1 protection at BRT and FCN differentiates between single phase faults and multi-phase faults.

For single phase faults: direct transfer trips are sent to PEM and RBW with intentional delay tripping of the BRT and FCN terminals to allow the IPPs to be disconnected from the system before the line end terminals are opened. This is done to prevent self-excitation if 2L1 remains energized from any of the IPPs.

For multi-phase faults there is no intentional delay of the tripping.

The Transfer Trip facilities are an integral part of the power system protection tripping pattern for clearing all infeeds to a fault. In the event that transfer trip facilities are not working IPPs should be advised of any planned (or forced) Transfer Trip outages. This lead time (4 hours) is required to do investigation or make repairs and to let the IPP decide if they want to remain on line. The IPP's can remain on-line for up to 4 hours subject to system conditions. T&D Operations Planning will analyze all the issues for each scenario (supported where necessary by internal management and technical staff). If the transfer trip channel cannot be restored within four hours the IPP's affected should be taken off-line as soon as possible and remain off-line until the transfer trip channels are:

Circuit	Lead End	Follow End	Synchroverifier Angle
2L1	BRT	FCN	None

2L1 reclosing is supervised by loss of potential at the master end and restoration of potential at the follow end.

FCN 2L1 line protection and transformer protection trip common devices, such that the line and transformer will trip together to clear a fault. The transformer high side disconnect will open in either case, to prevent a Ferro resonant condition on the re-energization of the line, and switching surges that may impact the transformer. If the fault is a line fault only that line auto reclosing will close FCN 2CB3 and the associated transformer high side disconnect and low side breaker must be closed manually. If the fault is on the transformer the Control Centre will receive a SCADA alarm if the transformer protection has initiated the trip. If the line protection initiates the trip, there will be no alarm.

5.2 2L2

5.2.1 Normal Operation

2L2 is normally in service between CKY and TIS with automatic reclosing enabled. RBW T2 (with connected Distribution IPPs - Soo River (SOR) and Fitzsimmons Creek (FTZ)), and Rutherford (RUT) IPP are connected to 2L2.

5.2.2 Special Operating Conditions

RBW 25CB65 connects SOR to the system through 2L2 at RBW. RBW 25CB64 connects FTZ to the system through 2L2 at RBW. SOR and FTZ must be switched over to 2L1 (RBW 25CB3 closed and 25CB2 / 2D2 open) prior to any switching on 2L2 that requires the line to be de-energized.

RBW 25CB3, 25CB1, 25CB22, 2D1 and 2D2 status provides supervision to permit SOR and FTZ to remain on line during 2L2 / 2L1 switching.

For any 2L2 faults and an unsuccessful reclose attempt, the RUT private line can be sectionalized at 2D3L2 to allow test energizing 2L2.

Avoid configuring 2L2 with 2D2L2 open and RUT generation on line. OTL logic will not be functional to trip RUT or RBW, and over tripping RUT will occur for TIS 2L2 or CKY 2L2 protection operations where not required.

5.2.3 Switching

Refer to SOO 5T-03 for 2L2 disconnect switch capabilities.

Normally, 2L2 is energized from CKY and then placed on load at TIS. Afterwards, RBW T2 and RUT may be returned to normal configuration.

Removing 2L2 from service must consider the IPP status. 2L2 is normally de-energized by:

- Transferring RBW distribution supply (and SOR and FTZ IPPs) to 2L1 and RBW T1.
- shutting down and off-loading RUT
- offloading 2L2 at TIS
- de-energizing from CKY

5.2.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle (Reclosing)
2L2	CKY	TIS	to be determined

At CKY, 2L2 automatic reclosing is supervised by loss of voltage. At TIS, automatic reclosing is supervised by loss and restoration of voltage and synch-check (single phase).

A transfer trip signal is sent from 2L2 protection relays for all protection operations. To avoid temporary overvoltage conditions on the transmission system during SLG faults, the tripping signal is delayed by 6 cycles at TIS and CKY prior to a transfer trip signal being sent to RBW 25CB65 (for tripping SOR), to RBW 25CB64 (for tripping FTZ) and to RUT 2CB1 circuit breakers (for tripping RUT). To avoid generator instability, there is no time delayed tripping for multiphase faults.

2L2 open terminal logic (OTL) initiates IPP transfer tripping when both ends of 2L2 are opened. OTL is embedded in the 2L2 protection relays and determines that the line is open when all circuit breakers are open or the station line disconnect switch is open.

If 2L2 is being operated with 2D1L2 open, TIS 2D24 must remain open to enable OTL initiated transfer tripping to RBW and RUT and to disable protection initiated transfer tripping from the TIS 2L2 protections. Alternatively, TIS 2L2 protections can be modified to simulate TIS 2D24 being open (IN105 de-asserted).

RBW 25CB65 tripping is supervised by RBW 25CB3 being closed with RBW 25CB1 / 25CB2 and RBW 2D1 / 2D2 open. When RBW 25CB3 is closed the associated 2L2 / 2L1 transfer trip will trip into all IPPs connected to RBW station from the line they may be connected to. Tripping from RBW 2L1 (2L2) line protection voltage elements 27/59 and receipt of TT - 85TTX, is blocked when 25CB1 (25CB2) is open. When 25CB3 is closed, 2L1 line protection only is enabled to cross-trip 25F65 (SOR).

5.3 2L5

5.3.1 Normal Operation

2L5 is connected to IPPs through feeder breakers at FCN Substation. Switching 2L5 must consider the IPPs status prior to de-energizing. See Section 6.3 for scheduling considerations concerning IPPs and transfer trip reconfiguration if required.

There are no tapped stations off 2L5. Brandywine Falls is connected to FCN 25F51. If 2L5 is OOS then transfer tripping of BDW will occur for 2L1 tripping. When 2L1 is OOS at FCN then transfer tripping BDW will occur for 2L5 tripping.

5.3.2 Special Operating Conditions

(This section is intentionally blank).

5.3.3 Switching

(This section is intentionally blank).

5.3.4 Technical Information

2L5 is connected to Brandywine IPP through a feeder breaker FCN. To protect the IPPs from overvoltage conditions during SLG faults a transfer trip signal is sent to the CBs that connect the IPPs to the BC Hydro system should the IPP be left connected directly to a line. Transfer tripping is sent from PN relay operations at either CKY or FCN and supervisory opening of both ends of a line. The open terminal logic determines that the line is open when all CB's are open or the station line MODS is open with the CB's closed. If only one of the line terminals is seen to the logic as open then the TT is not sent to the IPPs. But when both terminals are open, then the TT is sent to the IPPs. There are no tapped stations off 2L5. Brandywine Falls is connected to FCN 25F51. FCN 25F51 will be tripped when 2L1 AND 2L5 are de-energized via protection or switching.

All 2L5 outages should be scheduled when it has the least impact on the IPPs. Scheduled outages allowing the IPPs off-line are the preference to making temporary protection transfer trip changes. Changes to the transfer tripping logic for 2L5 protections should be limited to situations where the required outages are <u>urgent</u> or scheduled but lengthy (i.e. several days or more).

Abnormal operating condition may also be 2L5 isolated at either end where the open terminal logic is fooled with CB or line DS closed. The purpose is to coordinate the clearing speeds required for system stability (fast clearing) and IPP transfer trips (slower clearing). The easiest solution is to do a simple wiring change at CKY or FCN to do the following:

2L5 System:	**CKY terminal open**	**FCN terminal open**
BDW connected to CKY	Send TT to FCN 25CB51	Send TT to FCN 25CB51

Circuit	Lead End	Follow End	Synchroverifier Angle
2L5	CKY	FCN	None

FCN 2L1 and 2L5 line protection and transformer protection trip common devices, such that the line and transformer will trip together to clear a fault. The transformer high side disconnect will open in either case, to prevent a Ferro resonant condition on the re-energization of the line, and switching surges that may impact the transformer. If the fault is a line fault only that line auto reclosing will close FCN 2CB3 and the associated transformer high side disconnect and low side breaker must be closed manually. If the fault is on the transformer the Control Centre will receive a SCADA alarm if the transformer protection has initiated the trip. If the line protection initiates the trip, there will be no alarm.

Whenever 2L5 trips from protection relays at either end a TT is sent to open FCN 25F51 BDW and blocks feeder reclosing to disconnect the IPP from the system. Whenever both CKY and FCN line end CBs are opened by supervisory a TT signal is sent to trip BDW. The signal is sent to the feeder CB's that are connected to these IPPs. BDW is connected to FCN 25F51. Detection of voltage on FCN 25F51 will block supervisory closing of 25CB51. Local closing control of FCN 25CB51 is not blocked by detection of voltage on FCN 25F51.

5.4 2L41

5.4.1 <u>Normal Operation</u>

2L41 is normally in service between BRT and TIS with automatic reclosing enabled.

5.4.2 <u>Special Operating Conditions</u>

(This section is intentionally blank).

5.4.3 <u>Switching</u>

When placing 2L41 in service, energize from BRT and place on load by closing TIS 2CB1 and 2CB2.

When removing 2L41 from service, off load at TIS and de-energize at BRT.

5.4.4 <u>Technical Information</u>

Circuit	Lead End	Follow End	Synchroverifier Angle (Reclosing)
2L41	BRT	TIS	To be determined

At BRT, 2L41 automatic reclosing is supervised by loss of voltage. At TIS, automatic reclosing is supervised by loss and restoration of voltage and synch-check (single phase).

5.5 2L74

5.5.1 Normal Operations

2L74 is normally operated with reclosing lead end at ING and the follow end at FLW.

5.5.2 Special Operating Considerations

(This section is intentionally blank).

5.5.3 Switching

The following applies for switching 2L74 when 5L40 or CBN T1 / T2 are OOS:

- Ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.

- If WAH G1 is required for voltage support with 2L75, 2L76 or 2L79 OOS, leave it on prior to switching out 2L75. Prior to switching in 2L75 adjust BRR plants to obtain a ratio of approximately 1:2 in the power flowing on 3L2 with respect to the power through BRT T4 before putting the line on load.

5.5.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle
2L74	ING	FLW	None

All lines have reclosing supervised by loss of potential at the master end and restoration of potential at the follow end.

5.6 2L75

5.6.1 Normal Operations

2L75 is normally operated with reclosing lead end at MLN and the follow end at FLW.

5.6.2 Special Operating Considerations

For (2L75 and 5L40) OOS OR (2L75 and CBN T1/T2) OOS:

- Block auto-reclosing at the follow end of 2L77 and 2L78 if WAH G1 or KWL IPPs unit(s) are available to be put on-line.

5.6.3 Switching

The following applies for switching 2L75 with 5L40 or CBN T1 / T2 OOS.

- Ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.
- If WAH G1 is required for voltage support with 2L75, 2L76 or 2L79 OOS, leave it on prior to switching out 2L75. Prior to switching in 2L75 adjust BRR plants to obtain a ratio of approximately 1:2 in the power flowing on 3L2 with respect to the power through BRT T4 before putting the line on load.

5.6.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle
2L75	MLN	FLW	None

All lines have reclosing supervised by loss of potential at the master end and restoration of potential at the follow end.

5.7 2L76

5.7.1 Normal Operations

2L76 is normally operated in service with lead end for reclosing at MLE and follow end at MLN.

5.7.2 Special Operating Considerations

When (2L76 and 5L40) OOS OR (2L76 and CBN T1/T2) are OOS:

- Block auto-reclosing at the follow end of 2L77 and 2L78 if WAH G1 or KWL IPPs unit(s) are available to be put on-line.

5.7.3 Switching

The following applies for switching 2L76 when 5L40 or CBN T1 / T2 are OOS:

- Ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.
- If WAH G1 is required for voltage support with 2L76, leave it on prior to switching out 2L76. Prior to switching in 2L76 adjust BRR plants to obtain a ratio of approximately 1:2 in the power flowing on 3L2 with respect to the power through BRT T4 before putting the line on load.

5.7.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle
2L76	MLE	MLN	None

Reclose blocked on receipt of a DTT

All lines have reclosing supervised by loss of potential at the master end and restoration of potential at the follow end.

5.8 2L77

5.8.1 Normal Operations

2L77 is normally in service with reclosing on - lead at the CBN end and follow end at ALZ.

5.8.2 Special Operating Conditions

To prevent excessive accelerating torque on the WAH G1 and to facilitate simpler operating instructions, manual switching of any lines between CBN and BRT should be done after WAH G1 is shut down; provided that WAH G1 is not required for voltage control of the Fraser Valley 60 kV system.

WAH G1 may be required for voltage control during light summer loading when all lines are in service or during heavy winter loading when 3L2 or 2L75 / 2L76 with CBN T1 / T2 are OOS.

With 2L77 OOS, ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.

For 2L77 out of service:

- See separate System Operating Order 7T-14 Attachment 1 for generation shedding considerations.
- See Section 6 of this order for BRR, KWL IPP and WAH self-excitation considerations.

Outages scheduled on 2L77, with one of BRT 3CB1 or 3CB2 OOS, require assessment of the minimum units on line required at BRR and KWL IPPs: the loss of BRT T4 while either BRT 3CB1 or 3CB2 is OOS with 2L77, 2L78 or ROS T1 OOS could cause self-excitation to the remaining BRR or KWL IPPs left connected to 3L2.

5.8.3 Switching

Initially, there is no requirement to block auto reclosing between BRT and CBN for 2L77 outages since WAH will not be connected to the 345 kV system during the outage and KWL IPPs do not have enough units to allow them to be connected to the 345 kV system.

Shut down WAH G1 prior to switching 2L77. To reduce the closing angle across the 345/60 kV connection at WAH, 2L78 is the preferred circuit for supplying ALZ during outages to ALZ 2CB4.

If WAH G1 is required on the bus after switching connect to the 60 kV system prior to any 230 / 345 kV switching which separates WAH from the 230 / 345 kV CBN / BRT loop. WAH G1 should not be connected to 3L3 while 2L77 is OOS as self-excitation of the WAH unit is possible should 3L2 open at BRT.

A distribution tie between WAH and ALZ is possible through 25 kV field switches. Prior to switching 2L78 ensure that 60L93 connection is open (N.O. at WAH) and no distribution ties between WAH and ALZ are in place or scheduled by FVO. Or, WAH G1 should be connected to the 60 kV with the 345 kV connection open.

5.8.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle
2L77	CBN	ALZ	40 degrees, 6.1 sec.

All lines have reclosing supervised by loss of potential at the master end and restoration of potential at the follow end. 2L77 (CBN) lead end reclosing relay can be blocked by supervisory control.

5.9 2L78

5.9.1 Normal Operations

2L78 is normally operated in service with lead end for reclosing at ALZ and follow end at ROS.

5.9.2 Special Operating Conditions

To prevent excessive accelerating torque on the WAH G1 and to facilitate simpler operating instructions, manual switching of any lines between CBN and BRT should be done after WAH G1 is shut down; provided that WAH G1 is not required for voltage control of the Fraser Valley 60 kV system.

WAH G1 may be required for voltage control during light summer loading when all lines are in service or during heavy winter loading when 3L2 or 2L75 / 2L76 with CBN T1 / T2 are OOS. Switching precautions for these two cases are detailed in Sections 7.3 and 7.6.

For 2L78 out of service:

- See SOO 7T-14 Attachment 1 for generation shedding considerations
- See Section 6 for BRR, KWL IPPs and WAH self-excitation considerations.

Outages scheduled on 2L78, with one of BRT 3CB1 or 3CB2 OOS, require assessment of the minimum units on line required at BRR and KWL IPPs: the loss of BRT T4 while either BRT 3CB1 or 3CB2 is OOS with 2L77, 2L78 or ROS T1 OOS could cause self-excitation to the remaining BRR or KWL IPPs units left connected to 3L2.

5.9.3 Switching

Initially, there is no requirement to block auto reclosing between BRT and CBN for 2L78 outages since WAH will not be connected to the 345 kV system during the outage and KWL IPPs do not have enough units to allow them to be connected to the 34 kV system.

Shut down WAH G1 prior to switching 2L78. To reduce the closing angle across the 345/60 kV connection at WAH, 2L78 is the preferred circuit for supplying ALZ during outages to ALZ 2CB4.

If WAH G1 is required on the bus after switching follow the procedures in Section 6.2 and Section 7.4 to connect to the 60 kV system prior to any 230 / 345 kV switching which separates WAH from the 230 / 345 kV CBN / BRT loop. WAH G1 should not be connected to 3L3 while 2L77 or 2L78 / ROS T1 is OOS as self-excitation of the WAH unit is possible should 3L2 become open ended at BRT.

A distribution tie between WAH and ALZ is possible through 25 kV field switches. Prior to switching 2L78 ensure that 60L93 connection is open (N.O. at WAH) and no distribution ties between WAH and ALZ are in place or scheduled by FVO. Or, WAH G1 should be connected to the 60 kV with the 345 kV connection open.

5.9.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle
2L78	ALZ	ROS	20 degrees, 10 sec.

All lines have reclosing supervised by loss of potential at the master end and restoration of potential at the follow end. 2L78 (ALZ) lead end reclosing relay can be blocked by supervisory control. 2L78 (ROS) follow end reclosing relay can be blocked by supervisory control.

5.10 2L79

5.10.1 Normal Operations

2L79 is normally in service with reclosing on-lead at the CBN end and follow end at MLE.

5.10.2 Special Operating Considerations

When (2L79 and 5L40) is OOS OR (2L79 and CBN T1/T2) is OOS:

- Block auto-reclosing at the follow end of 2L77 and 2L78 if WAH G1 or KWL IPPs unit(s) are available to be put on-line.

5.10.3 Switching

The following applies for switching 2L75, 2L76 or 2L79 when 5L40 or CBN T1 / T2 are OOS:

- Ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.
- If WAH G1 is required for voltage support with 2L75, 2L76 or 2L79 OOS, leave it on prior to switching out 2L75, 2L76 or 2L79. Prior to switching in 2L75, 2L76 or 2L79, adjust BRR plants to obtain a ratio of approximately 1:2 in the power flowing on 3L2 with respect to the power through BRT T4 before putting the line on load.

5.10.4 Technical Information

Circuit	Lead End	Follow End	Synchroverifier Angle	
2L79	CBN	MLE		Reclose blocked on receipt of a DTT

All lines have reclosing supervised by loss of potential at the master end and restoration of potential at the follow end.

5.11 2L90

5.11.1 Normal Operations

Forest fires near Bridge River in the summer of 2002 and again in 2004, burned circuits 2L90 and 2L91 (from BRT to KLY). As a result, 2L90 was rebuilt and 2L91 was decommissioned. Portions of the 2L91 conductor have remained in the transmission corridor and may be used in place of damaged sections of 2L90 during future events.

2L90 is normally operated in service with lead end for reclosing at BRT and the follow end at KLY.

5.11.2 Special Operating Considerations

During periods of high outputs for Peace Generation, there may be excessive power transfer from the Northern Interior showing up on the Bridge River to Lower Mainland interconnection.

During periods of very low output for Peace Generation, there may be high transfer from Bridge River to Kelly Lake area. This can cause overload of 2L90 in summer when the 2L90 rating drops as a function of high ambient temperatures.

To avoid limitations for movement of the Bridge River area energy, it may be necessary to open 2L90. However, caution should be taken to ensure no other area circuit is out of service (to ensure generation shedding patterns match) and a real time study should be undertaken to confirm the benefit of the planned topology.

- If the removal causes further operating overloads, then a resolution will involve reduction of IPP generation that is contributing to the further overload. This should be recorded as an RMR in CROW.
- A record of a forced derating to the IPP should be entered in CROW, to log that the instruction has been provided to the IPP and to record that the derating is due to a transmission overload constraint.

For example, if taking out 2L90 leads to thermal overload at ROS T1, then it may be necessary to curtail area generation. The preference is to curtail IPP generation (that is electrically close to and contributing to the overload) first.

5.11.3 Technical Information

2L90 Rating

The Seton Lake crossing clearance is the limiting section of the line.

Table 1 - 2L90 Continuous Rating with Both BRT 2CB1 and 2CB2 In Service, or BRT 2CB1 OOS (cont'd on next page)

AMBIENT TEMP DEG (C)	STANDARD SUMMER CONDITIONS		STANDARD WINTER CONDITIONS	
	AMPS	MVA At 230 kV	AMPS	MVA At 230 kV
-10 º	-	-	1195	476
-5 º	-	-	1151	459
0 °	1035	412	1105	440
5 º	976	389	1057	421
10 °	912	363	1003	400
15 º	844	336	941	375
20 º	768	306	874	348
25 º	683	272	-	-
30 °	585	233	-	-
35 º	464	185	-	-
40 º	297	118	-	-

Table 2 - 2L90 Continuous Rating with BRT 2CB2 Out of Service (See Note Below)

AMBIENT TEMP DEG (C)	STANDARD SUMMER CONDITIONS		STANDARD WINTER CONDITIONS	
	AMPS	MVA At 230 kV	AMPS	MVA At 230 kV
-10 º	-	-	800	319
-5 º	-	-	800	319
0 º	800	319	800	319
5 º	800	319	800	319
10 °	800	319	800	319
15 º	800	319	800	319
			800	319
17.9 º	800	319	800	319
20 º	768	306	800	319
25 º	683	272	-	-
30 °	585	233	-	-
35 º	464	185	-	-
40 º	297	118	-	-

Note: Single Breaker Closed DS Rating: 800A - BRT 2D2CB1, BRT 2D1CB1

Table 3 - 2L90 Emergency Rating (30 minutes) with Both BRT 2CB1 and 2CB2 In Service, or BRT 2CB1 OOS (See Note Below)

AMBIENT TEMP DEG (C)	STANDARD SUMMER CONDITIONS		STANDARD WINTER CONDITIONS	
	AMPS	MVA At 230 kV	AMPS	MVA At 230 kV
-10 º	-	-	1200	478
-5 º	-	-	1200	478
0 °	1184	472	1200	478
3.29°	1152	459	1200	478
5 º	1136	453	1186	472
10 °	1085	432	1143	455
15 º	1030	410	1097	437
20 º	972	387	1049	418
25 º	910	363	-	-
30 °	842	335	-	-
35 º	768	306	-	-
40 º	684	272	-	-

Note: Per Stations Planning, KLY 2D29, 2D1CB9, 2D2CB9 Rating: 1200A

Table 4 - 2L90 Emergency Rating (30 minutes) with BRT 2CB2 Out of Service (See Note Below)

AMBIENT TEMP DEG (C)	STANDARD SUMMER CONDITIONS		STANDARD WINTER CONDITIONS	
	AMPS	MVA At 230 kV	AMPS	MVA At 230 kV
-10 º	-	-	800	319
-5 º	-	-	800	319
0 º	800	319	800	319
5 º	800	319	800	319
10 °	800	319	800	319
15 º	800	319	800	319
20 º	800	319	800	319
25 º	800	319	-	-

30 °	800	319	-	-
32.84°	800	319	-	-
35 º	768	306	-	-
40 º	684	272	-	-

Note: Single Breaker Closed DS Rating: 800A - BRT 2D2CB1, BRT 2D1CB1

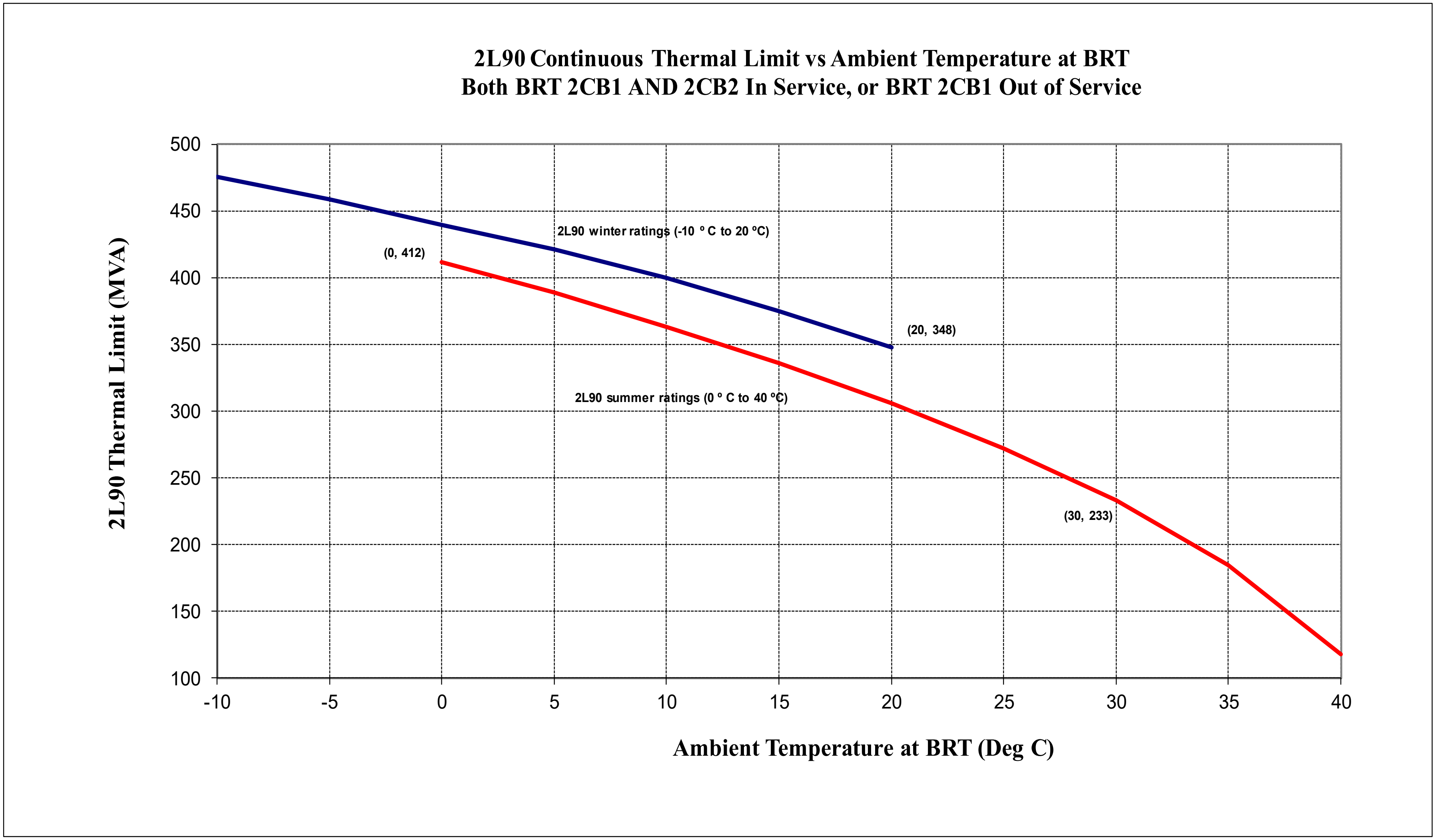
The standard summer and winter conditions are:

Wind: 2 ft/sec wind (.61 m/sec)
Sun: very clear and sunny (in winter, no sun)
Time: 18:00
Elevation: 2500 Ft, except as noted
Month: July (summer), December (winter)

Summer (May to October) and winter (November to April) periods in TSA-PM follow the definitions specified in SOO 5T-10 for the application of ratings that are in effect.

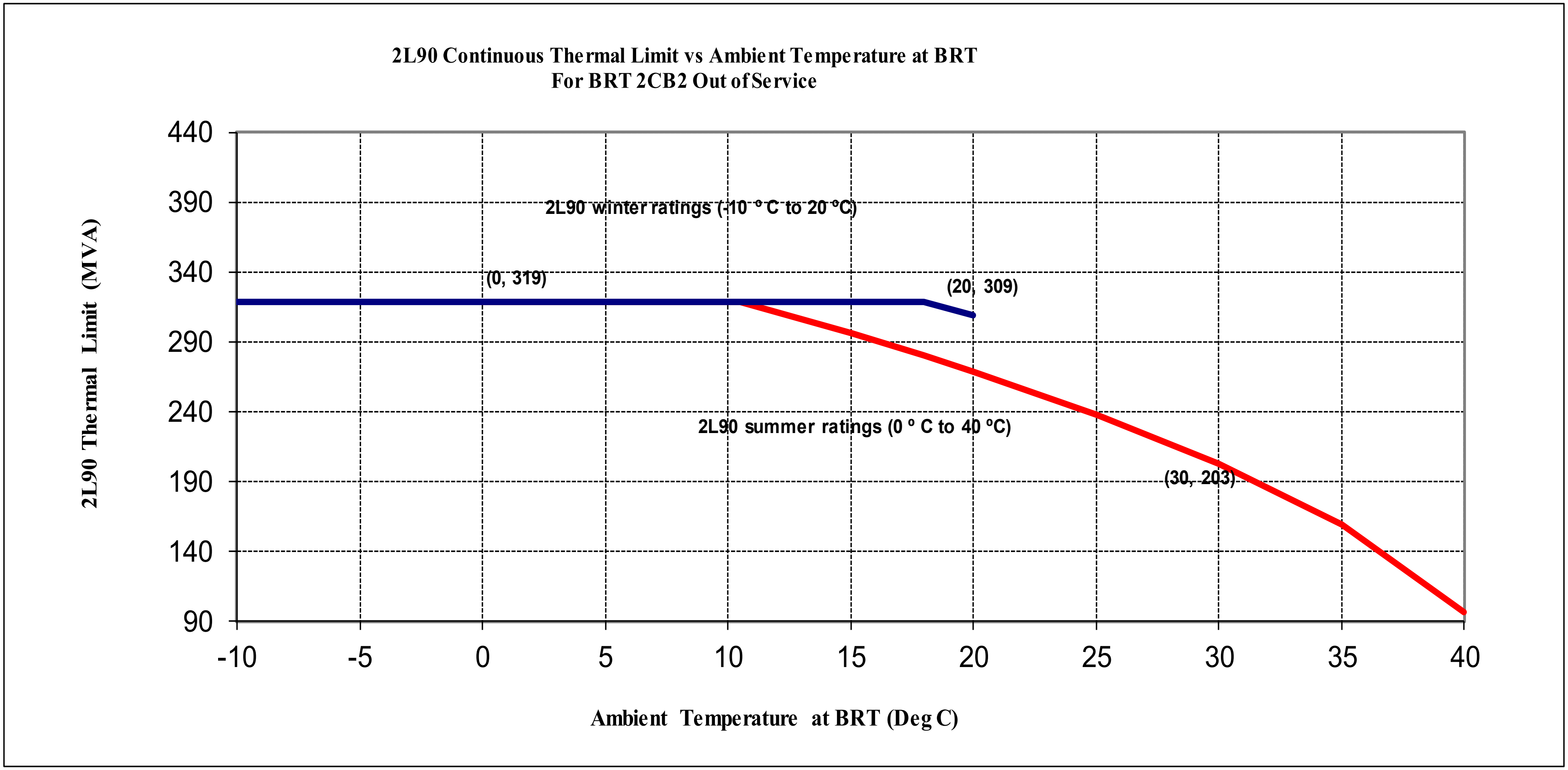
Graph 1 - 2L90 Continuous Thermal Limit versus Ambient Temperature at BRT – Both BRT 2CB1 AND 2CB2 In Service, OR BRT 2CB1 Out of Service

In the generation shedding recommendation tables of Attachment 1, the ambient temperature dependent continuous ratings for 2L90 are calculated based on the following Graph (source Table 1 above).



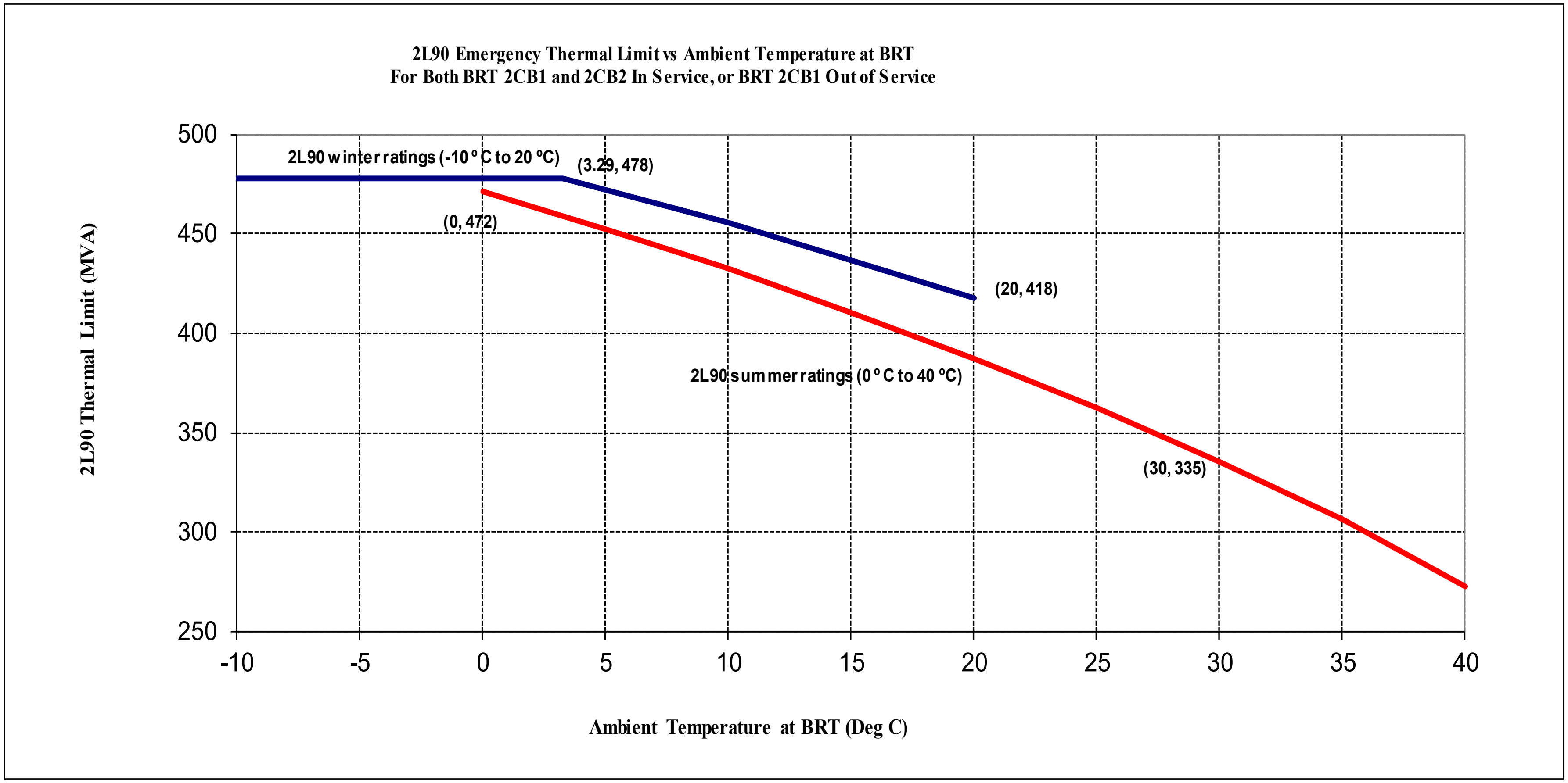
Graph 2 - 2L90 Continuous Thermal Limit versus Ambient Temperature at BRT – For BRT 2CB2 Out of Service

In the generation shedding recommendation tables of Attachment 1, the ambient temperature dependent continuous ratings for 2L90 are calculated based on the following Graph (source data is Table 2 above).



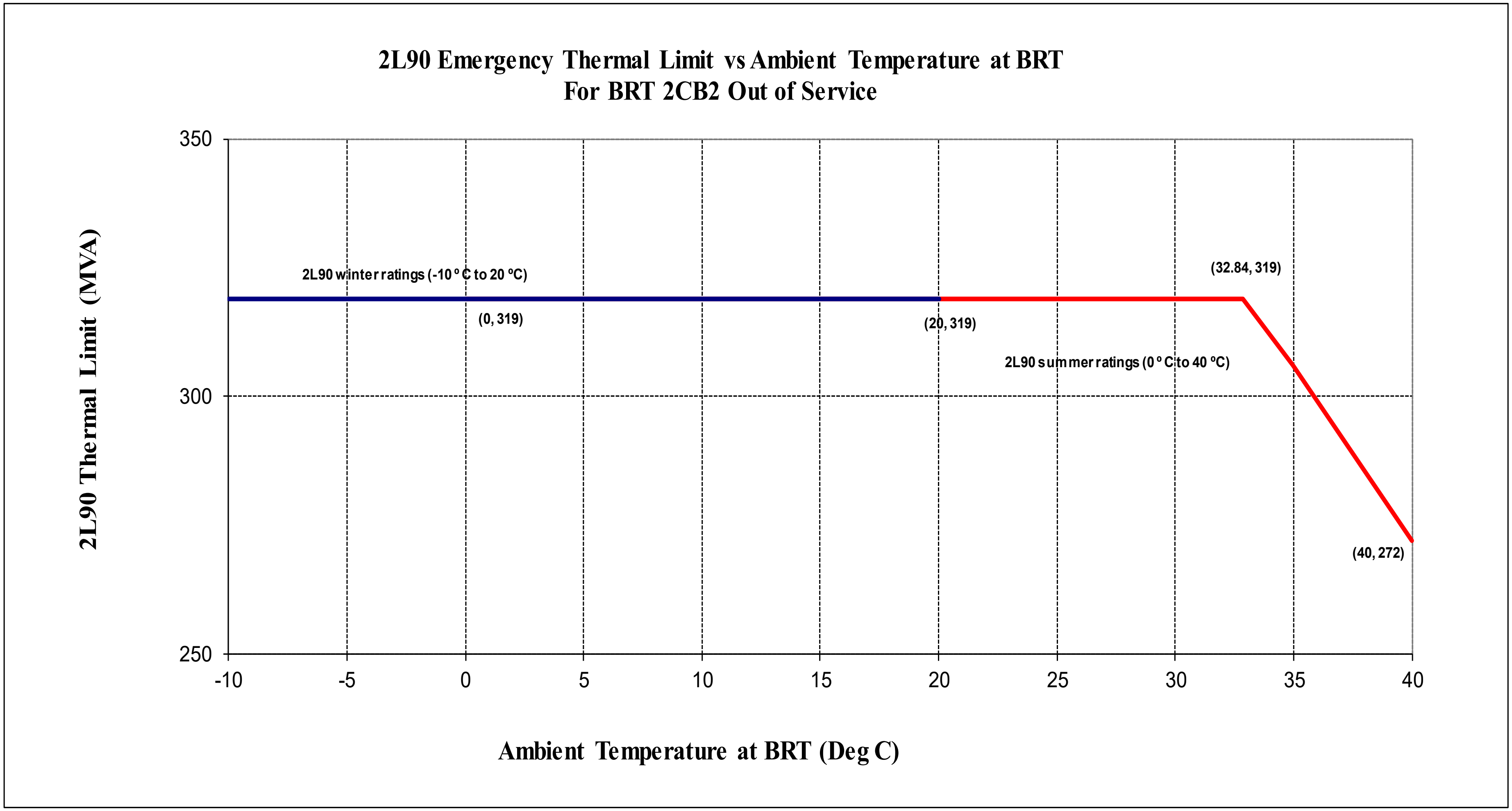
Graph 3 - 2L90 Emergency Thermal Limit versus Ambient Temperature at BRT – Both BRT 2CB1 AND 2CB2 In Service, OR BRT 2CB1 Out of Service

In the generation shedding recommendation tables of Attachment 1, the ambient temperature dependent emergency ratings for 2L90 are calculated based on the following Graph (source Table 3 above).



Graph 4 - 2L90 Emergency Thermal Limit versus Ambient Temperature at BRT – For BRT 2CB2 Out of Service

In the generation shedding recommendation tables of Attachment 1, the ambient temperature dependent emergency ratings for 2L90 are calculated based on the following Graph (source Table 4 above).



2L90 Overload Relay Information and Actions for Failures

The 2L90 thermal protection “module” contains an internal model of the conductor temperature. This module estimates solar influx using time of day and day of year and uses a fixed estimation for wind speed. Ambient temperature is measured at the substation (BRT) and power dissipation in the conductor is estimated using line current and conductor resistance which is calculated in the relay “module”.

Outputs and actions from the line thermal "module" are as follows:

1. If the estimated conductor temperature exceeds 45º C, the relay will send an alarm. The existing 2L90 Schweitzer "Stage 1 overload" alarm has been reused for this purpose.
    - If this alarm is received, the System Operator should consider removal of 2L90 from service (see Section 5.11.2 for recommended actions).

2. If the estimated conductor temperature exceeds 50º C and power flow is out of BRT, then the relay has capability to initiate generation shedding for the 2L90 overload, however this function is not implemented currently (cannot be armed locally or by TSA-PM).

3. If the estimated conductor temperature exceeds 50º C and power flow is into BRT, then the relay will trip the BRT end of 2L90 and the line will not auto-reclose.

4. If the relay is unable to communicate with the temperature sensor (there are independent sensors for each relay), or the sensor is damaged or mis-wired, the relay will bring up an alarm (used to be "Summer O/L status", now "Temperature Sensing failure").

If the ambient temperature sensing fails on one relay, then that relay will stop updating the conductor temperature, and the line thermal protection in the relay will be essentially disabled. Note there is both Primary and Secondary temperature sensing. As long as one of the temperature sensing relays is still working there is one set of line thermal protection. If both temperature sensors fail, the System Operator can choose to:

1. Have maintenance staff fix one or both of the failed relays.
2. Have maintenance staff set the Thermal Sensing Enable (TSE) in the relay to 0, which will then let the relay run on an assumed ambient temperature, which is another relay setting. This setting assumes the temperature is closer to winter settings, not summer settings.
3. Live with the risk; which during the winter is acceptable.

System Operators will have to assess the generation patterns expected from BRR generators and ambient temperatures expected in the area to determine the best alternative if one or all of the temperature sensing inputs to the relay “module” have failed.

5.12 3L2

5.12.1 Normal Operation

3L2 is normally operated in-service with lead end reclosing on at BRT and follow end at UHT.

5.12.2 Special Operating Conditions

When 3L2 and 5L40 are OOS:

- Block auto-reclosing at the follow ends of 2L75, 2L76, 2L77 and 2L78 if WAH G1 and KWL IPPs unit(s) are available to be put on line.

When Energizing 3L2 with BRT T4 OOS:

- It is not possible to energize BR1, BR2 and BRT using 3L5 and 3L2 circuit from ROS, as the BRT open-end voltage is too high for the generator transformers. Energize 3L2 from BRT only.

5.12.3 Switching

BRT is the lead end for energizing 3L2. 3L2 should be energized simultaneously with UHT 3RX1 (if it is available) to minimize the open terminal voltage.

Open terminal keying is utilized on 3L2. De-energize 3L2 by first opening one line breaker at UHT and BRT and then open the second breaker at UHT. The open terminal keying will open the second BRT breaker. WAH must be off line before switching 3L2 OOS.

No auto reclose blocking is required on 2L77 or 2L78 since WAH and KWL IPPs will be tripped on 2L77 or 2L78 contingency.

Sachteen (SAC) is a distribution substation supplied by a flying tap off 3L2 (C phase only). During a long term planned or unplanned outage on 3L2, local diesel powered generation can to be connected to SAC 25F51 to supply the area load (see Section 2.2 of OO 3T-SAC-01).

5.12.4 Technical Information

To maintain sufficient ground clearance, the 3L2 circuit conductor temperature should not be higher than 50° C. The 3L2 current rating, as a function of the ambient temperature reported at Pemberton, is as follows:

Circuit 3L2 Limits for 50° C Conductor Temperature:

Ambient Temperature at Pemberton (deg C)	Full Sun - Summer		No Sun – Winter	
	Current Limit (amps)	MVA Limit at 345 kV	Current Limit (amps)	MVA Limit at 345 kV
0 °	-	-	1970	1177
5 °	-	-	1870	1117
10 °	1590	950	1765	1055
15 °	1460	872	1650	986
20 °	1320	789	1525	911
25 °	1165	696	1390	831
30 °	960	574	-	-
35 °	745	445	-	-

With 3L2 OOS, ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.

5.13 3L3

5.13.1 Normal Operations

3L3 is normally operated with 3L3 in service, supplying WAH area loads including Hope Substation (HOP), Spuzzum Substation (SZM), BBR and bulk customer load. There is no reclosing on the line, to avoid out of sync closing for the WAH generator. WAH generation tripping exists only for a 3L3 contingency, to perform an anti-islanding protection function. This is a non-RAS function, but is enabled/ armed by TSA-PM to avoid post contingency impacts in an island is formed on a 3L3 contingency. The 60 kV network at WAH is normally not tied to ALZ unless 3L3 is out of service.

5.13.2 Special Operating Considerations

To operate with 3L3 out of service:
WAH can be tied to ALZ via 60L93 with certain restrictions:

- The WAH - ALZ 60 kV system can be momentarily paralleled with the 345 / 230 kV system for switching.
- 2L78 must be in service to allow the WAH 60 kV system to be paralleled with the WAH 345 kV system.
- WAH 13D1 is capable of de-energizing, but not re-energizing 3L3 / T1 from WAH with loop closure to be completed at ROS. (OO 3T-WAH-01)
- A distribution tie between WAH and ALZ is possible through 25 kV field switches. Prior to switching 3L3, ensure that no distribution ties between WAH and ALZ are in place or are scheduled by FVO.

During 3L3 outage, WAH G1 output should be adjusted so that the loading on WAH T2 / T5 / 60L93 / 60L95 does not exceed their ratings. (See OO 3T-WAH-01 for further details.) Further, the anti-islanding protection function for a 3L3 contingency should be blocked, to avoid unnecessary unit trips.

5.13.3 Switching

To remove 3L3 from service:

- Adjust the WAH G1 output so that the flow from WAH to ROS on 3L3 is between +5 MW and –5 MW (as close to zero as possible).
- Follow the steps for switching in 60L93 (WAH-ALZ) and switching out 3L3 (WAH-ROS) listed in OO 3T-WAH-01 but, before closing WAH 60CB1 (paralleling 60L93 with the path formed by 2L78 (ALZ-ROS) and 3L3 (WAH-ROS)), minimize the power flow (MW) on 3L3. This should minimize the angle across WAH 60CB1 and the shock torque on WAH G1.

To return 3L3 to service:

- Adjust the WAH G1 output so that the flow from WAH to ALZ on 60L93 is between +5 MW and –5 MW (as close to zero as possible).
- Follow the steps for switching in 3L3 (WAH-ROS) and switching out 60L93 (WAH-ALZ) listed in OO 3T-WAH-01 but, before closing ROS 3CB1 (paralleling 60L93 with the path formed by 2L78 (ALZ-ROS) and 3L3 (ROS-WAH), minimize the power flow (MW) on 60L93. This should minimize the angle across ROS 3CB1 and the shock torque on WAH G1.

5.14 3L5

5.14.1 Normal Operation

3L5 is normally operated in service with lead reclosing end at UHT and follow end at ROS.

5.14.2 Special Operating Conditions

To prevent excessive accelerating torque on the WAH G1 and to facilitate simpler operating instructions, manual switching of any lines between CBN and BRT should be done after WAH G1 is shut down; provided that WAH G1 is not required for voltage control of the Fraser Valley 60 kV system.

WAH G1 may be required for voltage control during light summer loading when all lines are in service or during heavy winter loading when 3L2 or 2L75 / 2L76 with CBN T1 / T2 are OOS. Switching precautions for these two cases are detailed in Sections 7.3 and 7.6.

5.14.3 Switching

(intentionally left blank)

5.14.4 Technical Information

With any of the above circuits OOS, ensure that the prolonged total transfer through BRT T4 does not exceed its rating of 450 MVA.

For a prolonged or planned outage to 2L77, 2L78 or ROS T1 with 3L2 in service, shed all the online units at BRR including Var units and Synchronous condensers and shed all online units at KWL for BRT T4 trip.

To prevent self-excitation of BRR generators, the following minimum units online requirement must be met:

- With none of UHT reactors in service, a minimum of (2 BR2 units and 1 BR1 unit) or 4 BR1 units must be online.
- With one of UHT reactors in service, a minimum of 2 BR2 units or 3 BR1 units must be online.

Note: One BR2 unit is a good substitution for one BR1 unit for the above minimum unit online requirement.

- WAH can be tied to ALZ via 60L93 with certain restrictions.

Outages scheduled on 2L77, 2L78 or ROS T1, with one of BRT 3CB1 or 3CB2 OOS, require assessment of the minimum units on line required at BRR and KWL IPPs: the loss of BRT T4 while either BRT 3CB1 or 3CB2 is OOS with 2L77, 2L78 or ROS T1 OOS could cause self-excitation to the remaining BRR or KWL IPPs left connected to 3L2.

6.0 SELF-EXCITATION PREVENTION

6.1 WAH Self-Excitation Risks:

6.1.1 **<u>If 2L78/ROS T1 is out of service</u>**,
WAH should not be connected to 3L3. This is to avoid subjecting WAH to self-excitation problems should 3L2 open-end at BRT. Also, there is no generation shedding facility to trip WAH for a BRT T4 contingency.

6.1.2 **<u>If 2L77 is out of service</u>**,
WAH should not be connected to 3L3. This is to avoid subjecting WAH to self-excitation problems should 3L2 open-end at BRT. Also, there is no generation shedding facility to trip WAH for a BRT T4 contingency.

Actually, if the two UHT 35 MVAr reactors are on-line, then WAH self-excitation may not be of concern if the ALZ reactive load is 10 MVAr (or higher) and the frequency is 63.5 Hz or lower. However, it is doubtful if the system can accommodate two UHT reactors on-line with 2L77 already opened.

6.2 BRR Self-Excitation Concerns:

Applicable for:

6.2.1 **<u>BRT T4 out-of-service</u>**
Concern: subjecting BRR generators to self-excitation should 3L2 open-end at UHT, or 3L5 open-end at ROS, or 2L78/ROS T1 trip, or 2L77 trip; or

6.2.2 **<u>3L5 out of service</u>**
Concern: subjecting BRR generators to self-excitation should BRT T4 trip; or

6.2.3 **<u>2L78/ROS T1 out of service</u>**
Concern: subjecting BRR generators to self-excitation should BRT T4 trip; or

6.2.4 **<u>2L77 out of service</u>**
Concern: subjecting BRR generators to self-excitation should BRT T4 trip.

Requirement for BRR post contingency minimum number of units on line:

6.2.5 **<u>Requirement if none of the two UHT 35 MVAr Reactors is on-line</u>**
A minimum of 2 BR2 and 1 BR1 units (198 MVA capacity) OR
A minimum of 4 BR1 units (208 MVA capacity) is required on-line

6.2.6 **<u>Requirement if one of the two UHT 35 MVAr Reactors is on-line</u>**
A minimum of 2 BR2 units (146 MVA capacity) OR
A minimum of 3 BR1 units (156 MVA capacity) is required on-line

6.3 KWL IPPs Self-Excitation Concerns:

6.3.1 Applicable for 3L2 outage

Concern: Subjecting KWL IPPs units to self-excitation should 3L5 open-end at ROS, or 2L78/ROS T1 trip, or 2L77 open-end at CBN.

(1) Requirement if none of the two UHT 35 MVAr reactors is on-line
A minimum of 8 bigger units must be on-line, e.g. 2 DGL, 2 FRE, 2 LMN & 2 USR for a total of 112 MVA or 100 MW capacity.

(2) Requirement if one of the two UHT 35 MVAr reactor is on-line
A minimum of 2 bigger units must be on-line, e.g. 2 LMN for a total of 35 MVA or 31 MW capacity.

Note: Units at KWL IPPs with more than 10 MVA capacity have been defined as bigger units in the above requirements. This definition applies to all the minimum units online requirements concerning KWL IPPs self-excitation issues.

6.3.2 Applicable for 3L5 outage

Concern: Subjecting KWL IPPs units to self-excitation should 3L2 open-end at BRT

(1) Requirement if none of the two UHT 35 MVAr reactors is on-line
A minimum of 14 bigger units must be on-line, e.g. 3 USR, 2 DGL, 2 FRE, 2 LMN, 2 SKK, 2 TPA, 1 TWY for a total of 180 MVA or 162 MW capacity.

(2) Requirement if one of the two UHT 35 MVAr reactors is on-line
A minimum of 8 bigger units must be on-line, e.g. 2 DGL, 2 FRE, 2 LMN & 2 USR for a total of 112 MVA or 100 MW capacity.

(3) Requirement if both UHT 35 MVAr reactors are on-line
A minimum of 2 bigger units must be on-line, e.g. 1 DGL & 1 FRE for a total of 27 MVA or 24 MW capacity.

These suggest that at least one UHT 35 MVAr RX should be on-line for 3L5 outage.

6.3.3 Applicable for 2L78/ROS T1 outage

Concern: Subjecting KWL IPPs units to self-excitation should 3L2 open-end at BRT.

(1) Requirement if none of the two UHT 35 MVAr reactors is on-line
All 23 KWL IPP units must be on-line.

(2) Requirement if one of the two UHT 35 MVAr reactors is on-line
A minimum of 14 bigger units must be on-line, e.g. 3 USR, 2 DGL, 2 FRE, 2 LMN, 2 SKK, 2 TPA, 1 TWY for a total of 180 MVA or 162 MW capacity.

(3) Requirement if both UHT 35 MVAr reactors are on-line
A minimum of 9 bigger units must be on-line, e.g. 2 DGL, 2 FRE, 2 LMN, 2 USR & 1 TPA for a total of 125 MVA or 112 MW capacity.

These suggest that at least one UHT 35 MVAr RX should be on-line for 2L78/ROS T1 outage.

As 3L3 is required to be open to prevent self-excitation to WAH for this outage, 3L5 will be effectively off loaded.

To alleviate this risk to KWL IPPs, 3L5 should be taken OOS, and the recommendations for a 3L5 outage should be followed.

6.3.4 Applicable for 2L77 outage

Concern: Subjecting KWL IPPs units to self-excitation should 3L2 open-end at BRT.

(1) Requirement if none of the two UHT 35 MVAr Reactors is on-line
A minimum of 18 bigger units must be on-line, e.g. 3 USR, 2 DGL, 2 FRE, 2 LMN, 2 SKK, 2 TPA, 2 TWY, and 3 BSV for a total of 235 MVA or 215 MW capacity.

(2) Requirement if one of the two UHT 35 MVAr Reactors is on-line
A minimum of 12 bigger units must be on-line, e.g. 2 DGL, 2 FRE, 2 LMN, 2 USR, 2 SKK & 2 TPA for a total of 165 MVA or 148 MW capacity.

(3) Requirement if both UHT 35 MVAr Reactors are on-line
A minimum of 7 bigger units must be on-line, e.g. 2 DGL, 2 FRE, 2 LMN & 1 USR for a total of 98 MVA or 88 MW capacity.

These suggest that at least one UHT 35 MVAr Reactors should be on-line for 2L77 outage.

All KWL IPPs units have to be off-line if the above minimum unit on-line requirements cannot be met.

If additional generation needs to be shed, choose any combination of the other four BR1/BR2 units that provides the remaining shedding requirement.

7.0 GENERATION SHEDDING / GENERATION RUN BACK

The Bridge River Area generation shedding recommendations are provided by the Transient Stability Analysis (TSA-PM) program in the EMS. For each contingency there are a number of circuit elements being monitored for thermal overload. In addition TSA-PM eliminates Transient instability using studied limits. The objective is to select a generation shedding pattern such that once the contingency has occurred and the recommended generation shed at one or more plants, there will not be any overload on the monitored circuit elements, nor exceedance of a transient stability limit. TSA-PM uses Linear Integer Programming method to select the generation shedding pattern. This methodology is computationally intensive, and is therefore very difficult to replicate for manual real-time application. A simpler methodology for manual generation shedding calculation is recommended in Section 7.3.

Details of the changes to the Generation Shedding requirements are described in Section 7.2.

Tables in SOO 7T-14 Attachment 1 - Bridge River - Lower Mainland Interconnection Generation Shedding Requirements, specified the generation shedding requirements for:

- System Normal condition with all of 2L1, 2L2, 2L3, 2L5, 2L9, 2L11, 2L13, 2L14, 2L17, 2L41, 2L77, 2L78, ROS T1, 2L90, 3L2, 3L3, 3L5, and BRT T4 in-service, and

- N-1 condition with one of 2L1, 2L2, 2L3, 2L5, 2L9, 2L11, 2L13, 2L14, 2L17, 2L41, 2L77, 2L78, ROS T1, 2L90, 3L2, 3L3, 3L5, and BRT T4 out-of-service.

Generation shedding of BR1 / BR2 units is initiated by protection operation for contingencies at BRT. Loss of T4 zone shedding initiation is from both T4 zone protection and from the status of 29S3 for 2D1CB3 and 2D2CB3 position, 29S4 for 2D1CB4 and 2D2CB4 position, 2CB3, 2CB4, 3CB5, 3CB6, 2D4 and 3D4. Refer to Section 4 for 29S3 & 29S4 position selection requirements.

7.1 Voltage Recommendations for Transient Stability

Whenever possible, the BRR/SON/LAJ generator terminal voltages should be at or above 13.8 kV to enhance stability.

However, if under NORMAL conditions defined as:

- all BRT lines and transformers in-service, and
- all BRT-ING lines in-service,

Then:

- a single BRT 2CB1 or 2CB2 outage is acceptable, and
- the BR1 and BR2 unit terminal voltages may be as low as 13.1 kV (0.95 per unit), and
- The total BR1 and BR2 output can be as high as 505 MW (4*52 + 2*72 + 2*76.5 = 505 MW).

Under ABNORMAL system conditions, defined as:

- any BRT line or transformer out-of-service or
- any BRT - ING lines out-of-service (with CBN 500 kV – 230 kV transformers OOS)

Then:

- BRR generator terminal voltages must be at or above 13.8 kV, whenever the total BRR output exceeds 250 MW.
- When an abnormal system condition also requires the BRR generator terminal voltages below 13.8 kV for reducing system voltage, BRR output must be reduced below 250 MW. System Performance Assessment (SPA) studies can be done to determine stable system conditions if BRR output is requested above 250 MW with lower than 13.8 kV terminal voltages.

7.2 Generation Shedding in Bridge River Area

TSA-PM implements generator shedding remedial action scheme (RAS) for the Bridge River Area. The RAS includes generation shedding to trip units at BR1, BR2, KWL IPP Clusters, UL IPP Clusters, and to run back units at CMS.

The KWL IPPs project consists of 9 plants and 23 units. The power project consists of three clusters of units/plants. Each cluster has a 138 kV circuit breaker at the Kwalsa Substation (KWL). The step up at KWL is to 345 kV, and power is passed on a single point of interconnection.

As units are commissioned they will automatically become part of the RAS scheme – because the cluster's 138 kV breaker is used to shed the cluster for armed contingencies.

Generation Shedding to KWL trips:

- KWL 1CB1: Lamont (LMN), North West Stave (NWS), and Upper Stave (USR) plants and is referred to as Upper Stave Cluster (up to 88 MW),
- KWL 1CB2: Douglas (DGL), Fire (FRE), and Stokke (SKK) plants and is referred to as Fire Cluster (up to 76 MW),
- KWL 1CB3: Tipella (TPA), Tretheway (TWY), and Big Silver (BSV) plants and is referred to as Tipella Cluster (up to 83 MW).

The Upper Lillooet IPP project consists of 2 plants/clusters and 6 units with a total capacity of 127.5 MVA.

Generation Shedding at Upper Lillooet IPP:

- Upper Lillooet Cluster (ULR): total 4 units, generation shedding application is to trip the four units as one cluster, through the four individual unit circuit breakers (up to 87 MW).
- Boulder Creek Cluster (BDH): total 2 units, generation shedding application is to trip the two units as one cluster, through the two individual unit circuit breakers (up to 28 MW).

Generation Run Back scheme has been implemented at CMS. Each CMS generating unit receives an independent signal from Bridge River Area RAS PLC at BRT to trigger the run back action if the unit is armed. Once the run back signal is received, the generating unit will ramp down to 40 MW at a rate of 1 MW/sec.

7.2.1 Generation Shedding/Run Back Functions in Bridge River Area

Bridge River Area Generation Shedding RAS Functions

No.	Contingency	Generation Shedding by Unit or Cluster tripping at:							Run Back to 40 MW each at:	
		BR1	BR2	Upper Stave Cluster (Note 2)	Fire Cluster (Note 3)	Tipella Cluster (Note 4)	Boulder Creek Cluster (BDH) (Note 5)	Upper Lillooet Cluster (ULR) (Note 6)	CMS G1	CMS G2
1	2L1 (OR FCN T2) OR 2L5 (OR FCN T1)	A	A	A	A	A	A	A		
2	2L2	A	A	A	A	A	A	A		
3	2L3	A	A	A	A	A	A	A	A	A
4	2L9 (OR LYN T1)	A	A	A	A	A	A	A	A	A
5	2L11	A	A	A	A	A	A	A	A	A
6	2L13 (OR CYP T2)	A	A	A	A	A	A	A	A	A
7	2L14 (OR CYP T3)	A	A	A	A	A	A	A	A	A
8	2L17 (OR LYN T2)	A	A	A	A	A	A	A	A	A
9	2L41	A	A	A	A	A	A	A		
10	2L77 (OR CBN T3/T6)	A	A	A	A	A	A	A		
11	2L78 (OR ROS T1)	A	A	A	A	A	A	A		
12	2L90	A	A	A	A	A	A	A		
13	3L2	A	A	A	A	A	A	A		
14	3L5	A	A	A	A	A	A	A		
15	3L3 (OR WAH T1 OR WAH T3 OR WAH T5)	A	A	A	A	A	A	A		
16	BRT T4 (OR 2L19 OR BR1 T3 OR BR1 T30)	A	A	A	A	A	A	A		
17	BRT T4 O/L (Note 7)	A	A							
18	2L90 O/L (Note 7)	A	A							

Note 1: “A” means Generation Shedding RAS function available for arming
Note 2: Upper Stave cluster includes: LMN, USR, and NWS. (up to 88 MW)
Note 3: Fire cluster includes: DGL, FRE, and SKK. (up to 76 MW)
Note 4: Tipella cluster includes: TPA, BSV, and TWY. (up to 83 MW)
Note 5: Boulder Creek cluster includes: BDH. (up to 28 MW)
Note 6: Upper Lillooet cluster includes: ULR. (up to 87 MW)
Note 7: This function has been retained, but is not used in the current generation shedding tables

7.2.2 Bridge River Area Generation Shedding Requirement Implementation

Tables in Attachment 1 specified the generation shedding requirements for:

- System Normal with all of 2L1, 2L2, 2L3, 2L5, 2L9, 2L11, 2L13, 2L14, 2L17, 2L41, 2L77, 2L78, ROS T1, 2L90, 3L2, 3L3, 3L5, and BRT T4 in-service, and
- N-1 conditions with one of 2L1, 2L2, 2L3, 2L5, 2L9, 2L11, 2L13, 2L14, 2L17, 2L41, 2L77, 2L78, ROS T1, 2L90, 3L2, 3L3, 3L5, and BRT T4 out-of-service.

The Bridge River Area generation shedding recommendations are provided by the TSA-PM program in the EMS advanced applications. For each contingency there are a number of circuit elements being monitored for thermal overload.

The objective is to select a generation shedding pattern such that once the contingency happened and the recommended generation is shed at one or more plants, there will not be any overload on the monitored circuit elements. TSA-PM used Linear Integer Programming method to select the generation shedding pattern.

Note: The terms UH IPP and KWL IPPs are interchangeable in the generation shedding functions and formulas.

For example: for 2L2 contingency under System Normal condition as shown on Table 1.1 of Attachment 1, loss of 2L2 may cause overload on one or more of 2L90, 2L1, ROS T1 circuit elements. The objective is to compile generation shedding amounts at Bridge River / KWL IPPs / UL IPPs generating plants such that the following Objective Function is minimized:

(BRR shed amount) * DF_BRR +
(UH shed amount) * DF_UH +
(UL shed amount) * DF_UL)
>=
(2L90 BRT + 0.33 * 2L2 TIS – 2L90_rating) OR
(2L1 PEM + 0.47 * 2L2 TIS – 2L1_rating) OR
(ROS T1 + 0.17 * 2L2 TIS – ROS T1_rating)

In computing the result, the program iterates the solution to address each of the overloads, and minimize the generation shedding amount.

Shedding generation at BRR has different effectiveness in removing overload on different circuit elements. The effectiveness is designated as DF_BRR, for distribution factor (reduction factor) at Bridge River.
Similarly, there is different effectiveness for the generation at other plants in reducing the overload for each of the monitored elements.

Circuit Elements	DF_BRR	DF_UH	DF_UL
2L90 BRT	0.42	0.27	0.47
2L1 PEM	0.21	0.14	0.22
ROS T1	0.42	0.55	0.25

For 2L90 overloading, (2L90 BRT + 0.33 * 2L2 TIS – 2L90_rating) is one of the constraints in the Objective Function presented above. It predicts the overload on 2L90 for 2L2 contingency. The formula says, for loss of 2L2, 33% of the pre-contingency 2L2 flow will be flow on 2L90 after the contingency. Adding the amount to the current 2L90 loading (pre-contingency 2L90 loading) will provide an estimate of the post-contingency 2L90 loading. In this way, 2L90 overload can be predicted by comparing it with 2L90 rating.

Generation is also shed to address transient stability concern if there is a requirement for the configuration.

7.3 Manual Generation Shedding / Generation Run Back Computations

BR2 units are preferred units for shedding because BR1 units have solid state exciters. BR1 units are more beneficial to be left connected to the system after a disturbance.

With the removal of synchronizing facilities at BRT it is suggested that when one of the four BRT 345 kV circuit breakers is OOS, shedding BR1/BR2 units for loss of 3L2 or BRT T4 may be beneficial for re-synchronizing generation to the system. When a group of BR1/BR2 units form an island that is separated from the rest of the system, they would all have to be shut down and re-synchronized one at a time. This would allow the units to be re-synchronized quicker.

The generation shedding amount will be calculated by TSA-PM by linear program using the distribution factors. Whenever there are restrictions from generation source (power supply and/or IPPs), such that TSA-PM results cannot be used, OPS or CR could manually calculate plant shedding amount following the rule as:

Shed the plant with biggest Distribution Factor first and shed as much as possible, then shed the plant with second biggest Distribution Factor, and so on (with consideration of post shedding minimum units online requirement, and BRT transient shedding requirement). This rule is described by the following example:

The case will be set up as:

	BRR	KWL IPP	UL
DF	0.6	0.4	0.5
MW online	400	90	40

- BRR transient stability requirement is to be shed down to 360MW,
- Post shedding minimum two units online, which is 100MW from the two units at minimum output.
- Total overload amount which is required to be shed = 180MW

Following the manual calculation method:

- We should pick BRR to be the first plant to be shed to release the overloading, since BRR has the biggest DF as 0.6. The required shed MW at BRR should be 360-100=260, which contribute to the overload relief as equivalent to 260*0.6=156MW.
- The second plant should be pick up to shed to release the left overload amount of 24MW (180MW-156MW) is UL, since it has the second biggest DF of 0.5. The required shed MW at UL should be 40MW, which contribute to the left overload relief as equivalent to 40*0.5=20MW.
- The last plant to shed to release all the left overload amount of 4 MW (24MW-20MW) is KWL IPPs, since it has the least DF of 0.4. The required shed MW at KWL IPPs should be 10MW, which contribute to the left overload relief as equivalent to 10*0.4=4MW.

8.0 ALARMS

The following alarms are implemented in TSA-PM.

ALARM MESSAGE	REFERENCES
<CTG NAME> - INSUFFICIENT SHEDDING	General Alarms in SOO 7T-14 Attachment 1
<CTG NAME> - MIN UNITS ONLINE VIOLATION	
AT LEAST 2 BRR UNITS REQUIRED ONLINE AT ALL TIMES	
MINIMUM BR UNITS ONLINE VIOLATION	
ALL UHT IPP UNITS MUST BE ONLINE	
2 BIG UHT IPP UNITS MUST BE ONLINE	
7 BIG UHT IPP UNITS MUST BE ONLINE	
8 BIG UHT IPP UNITS MUST BE ONLINE	
9 BIG UHT IPP UNITS MUST BE ONLINE	
12 BIG UHT IPP UNITS MUST BE ONLINE	
14 BIG UHT IPP UNITS MUST BE ONLINE	
18 BIG UHT IPP UNITS MUST BE ONLINE	
ALL UHT_IPP CLUSTERS MUST BE SHED	
ALL BR1 UNITS MUST BE SHED	
ALL BR2 UNITS MUST BE SHED	
VIOLATION OF 2L1 CONTINUOUS RATING	
VIOLATION OF 2L11 CONTINUOUS RATING	
VIOLATION OF 2L13 CONTINUOUS RATING	
VIOLATION OF 2L2 CONTINUOUS RATING	
VIOLATION OF 2L3 CONTINUOUS RATING	
VIOLATION OF 2L9 CONTINUOUS RATING	
VIOLATION OF 2L90 CONTINUOUS RATING	
VIOLATION OF 3L2 CONTINUOUS RATING	
VIOLATION OF BRT T4 CONTINUOUS RATING	
VIOLATION OF ROS T1 CONTINUOUS RATING	
TOTAL BR/UH_IPP/WAH GEN VIOLATION	
TOTAL BR/UL_IPP/CMS GEN VIOLATION	
TOTAL BR/UH_IPP/UL_IPP/CMS GEN VIOLATION	
TOTAL BR/UH_IPP/WAH/UL_IPP/CMS GEN VIOLATION	
LAJ GEN MUST BE LESS THAN: XX MW	
JME GEN MUST BE LESS THAN: XX MW	
SON GEN MUST BE LESS THAN: XX MW	
WDN GEN MUST BE LESS THAN: XX MW	
DISCONNECT 3L3 IF WAH G1 REQUIRE ONLINE	
INSUFFICIENT GEN-SHED FOR 60L65 OVERLOAD	
AVOID ONE 60KV CYP-WLT PATH OPEN WITH 2LXX OOS	

9.0 REVISION HISTORY

Revised by	Revision Date	Summary of Revision
Po Hu	20 August 2020	Updated 2L11 rating in SOO 7T-14 - Section 2 of Attachment 1

Po Hu	13 October 2020	• Section 5.11.3 Updated 2L90 rating.
		• Attachment 1:
		  • Updated ratings for 2L17, 3L3, BRT T4, WAH T1 have in Section 2
		  • Added pre-outage restrictions in Table 1.1-1.8, 1.11, 1.13, 1.18, 1.19 to protect BRT T4
		  • Added pre-outage restrictions in Table 1.5, 1.6, 1.9, 1.10, 1.11, 1.12, 1.14, 1.16, 1.17 to protect 2L17

Po Hu, Yan Ling Cong	06 November 2020	• Section 4.3.7 revised for BRT T4 recommended switching steps, and 2L19 switching RAS arming requirements.
		• Section 5.11.3 Reversed 2L90 rating because no de-rating.
		• Attachment 1:
		  • Reversed rating changes for 2L11, 2L17, BRT T4 in Section 2 because no de-rating.
		  • Added a clarification in note (2) in Section 2 for ROS T1 winter continuous rating
		  • Removed pre-outage restrictions in Table 1.1-1.8, 1.11, 1.13, 1.18, 1.19 to protect BRT T4
		  • Removed pre-outage restrictions in Table 1.5, 1.6, 1.9, 1.10, 1.11, 1.12, 1.14, 1.16, 1.17 to protect 2L17

Po Hu	23 April 2021	Main Body: 1. Section 5.11.3 - 2L90 ratings in SOO 7T-14 main body including Graph 1 and 2 have been updated because of 2L90 rating restoration, consistent in SOO 5T-10. Attachment 1: 1. A new table for emergency ratings is added in section 2. 2. Ratings for 2L9, 2L2, 2L5 are updated in Table 2.1 and 2.2. 3. Emergency ratings for BRT T4 are updated in Table 2.2. 4. Variable name for transmission elements, such as 2Lxx_rating, is changed to 2Lxx_Norm_Rating in **pre-outage restrictions** in all 19 Tables. 5. Variable name for transmission elements, such as 2Lxx_rating, is changed to 2Lxx_Over_Rating in **gen-shedding rules** in all 19 Tables.
Po Hu, Ming Bai	19 January 2022	Main Body: • Updated Section 5.11 to include 2L90 summer and winter emergency ratings (30 minutes). • Added Table 3 - 2L90 Emergency Rating (30 minutes) with Both BRT 2CB1 and 2CB2 In Service, or BRT 2CB1 OOS • Added Table 4 - 2L90 Emergency Rating (30 minutes) with BRT 2CB2 Out of Service • Added Graph 3 - 2L90 Emergency Thermal Limit versus Ambient Temperature at BRT – Both BRT 2CB1 AND 2CB2 In Service, OR BRT 2CB1 Out of Service • Added Graph 4 - 2L90 Emergency Thermal Limit versus Ambient Temperature at BRT – For BRT 2CB2 Out of Service Attachment 1: No changes.

Attachment 1 Bridge River – Lower Mainland Generation Shedding Requirements

See Attachment 1 of SOO 7T-14 posted separately from the main body.