Information Document
Cold Lake Area Transmission Constraint Management
ID# 2012-015R

Information Documents are not authoritative. Information Documents are provided for information purposes only and are intended to provide guidance. In the event of any discrepancy between an Information Document and any Authoritative Document(s) in effect, the Authoritative Document(s) governs.

1 Purpose

This Information Document relates to the following Authoritative Documents[1]: Section 302.1, *Real Time Transmission Constraint Management*. The AESO issues Information Documents to provide additional information and interpretations regarding certain subject matter set out in the AESO's Authoritative Documents. The purpose of this Information Document is to provide additional information regarding the unique operating characteristics and resulting constraint conditions and limits in the Cold Lake area of the Alberta interconnected electric system. In this Information Document the AESO has defined the Cold Lake area as the area illustrated by the maps in Appendix 2 and 3.

Section 302.1 of the ISO rules sets out the general transmission constraint management protocol steps the AESO uses to manage transmission constraints in real time on the interconnected electric system. These steps are referenced in Table 1 of this Information Document as they are applied to the Cold Lake area.

2 General

Given existing generation, bulk transmission lines in the Cold Lake area may be overloaded under certain contingencies. To guard against these possibilities, ATCO Electric has in place a two-stage remedial action scheme.

Protection against thermal overloading of transmission facilities is governed by TFO policies, which stipulate the thermal limits for transmission conductors under normal operating and system emergency conditions.

The remedial action scheme is based on SEL-49 thermal relays, which estimate conductor temperature based on a number of input variables.

The ATCO Electric operators and the AESO have remote visibility of the status of the thermal protection scheme (i.e., armed vs. disarmed, which generating unit is selected to trip and the status of the alarm and trip signals) and net output from the generating units.

A detailed geographical map of the Cold Lake area indicating bulk transmission lines, substations and cutplanes is provided in Appendix 2 to this information document. For a schematic of the Cold Lake area indicating generating asset locations relative to major power flow paths and cutplanes see Appendix 3 in this Information Document.

The AESO respects the Cold Lake inflow cutplane limits when managing the inflow to the Cold Lake area, and the AESO respects the Marguerite Lake-Bourque-Leming Lake outflow cutplane limits when managing the outflow from the Cold Lake area. The map attached as Appendix 3 illustrates these cutplanes.

A cutplane is a common term used in engineering studies and is a theoretical boundary or plane crossing two (2) or more bulk transmission lines or electrical paths. The cumulative power flow across the cutplane is measured and can be utilized to determine flow limits that approximate conditions that would allow safe, reliable operation of the interconnected system.

[1] "Authoritative Documents" is the general name given by the AESO to categories of documents made by the AESO under the authority of the *Electric Utilities Act* and regulations, and that contain binding legal requirements for either market participants or the AESO, or both. AESO Authoritative Documents include: the ISO rules, the Alberta reliability standards and the ISO tariff.

3 Constraint Conditions and Limits

When managing a transmission constraint in the Cold Lake area, the AESO ensures that bulk transmission line flows out of the area are managed in accordance with bulk transmission line ratings established by the legal owner of the transmission facility to protect transmission facilities and ensure the continued reliable operation of the interconnected electric system.

3.1 Non-Studied Constraints and Limits

For system conditions that have not been pre-studied, the AESO uses the energy management system tools and dynamic stability tools to assess system operating limits in real time.

3.2 Studied Constraints and Limits

The AESO also monitors the remedial action schemes that are in place in the area. A further description of these remedial action schemes is set out below.

In accordance with subsection 2(1) of section 302.1, the AESO follows the transmission constraint management procedures and applies the procedures to the Cold Lake area as outlined in section 4 of this Information Document. Transmission constraint management is employed as set out in section 4 of this Information Document in all of the following circumstances:

(a) when the remedial action scheme is unavailable;

(b) prior to remedial action scheme activation (if required); and

(c) for an appropriate period after the remedial action scheme has been activated once the system is operating in a safe and reliable mode.

The first remedial action scheme provides alarm signals in the event of bulk transmission line overload on either 7L89 or 7L66. These alarm signals initiate an automatic generation curtailment at both the Mahkeses and Foster Creek units to the levels specified in Appendix 4, Table 1. As this automated remedial action scheme is the primary method of generation curtailment, it is intended that the remedial action scheme be armed at all times.

The ATCO Electric transmission operator and the AESO have remote visibility of the status of the remedial action scheme (that is, armed vs. disarmed, which generating units are selected to trip, and the status of the run-back and trip signals) and the net-to-grid generation from the Mahkeses and Foster Creek generating units. For the Mahkeses plant, the operator selects one (1) generating unit to trip. For the 877S Foster Creek plant the operator selects both generating units to trip.

The remedial action scheme, based on thermal relays, has the following functionality:

(a) The thermal relay at 826S Marguerite Lake monitors the loading of 7L89.

(b) The thermal relay at 715S Leming Lake monitors the loading of 7L66.

(c) Each thermal relay will provide two (2) staged alarm outputs:

(i) Stage one alarm output, which is triggered for calculated conductor temperature of eighty five degrees Celsius (85°C), initiates automatic generation run-back to the level as outlined in Appendix 4.

(ii) Stage two alarm output, which is triggered for calculated conductor temperature of one hundred degrees Celsius (100°C), trips one (1) pre-selected generating unit at 889S Mahkeses and both generating units at 877S Foster Creek as noted in Appendix 4.

A second remedial action scheme that sheds load at CNRL Primrose 859S and Cenovus Foster Creek 1200S is also necessary in the Cold Lake area to prevent voltage collapse during critical contingencies, including the loss of 7L587 and 7L95 or the loss of both Mahkeses generators.

In addition, the 7L53 Thermal Protection Scheme is necessary in the Cold Lake area until the thermal rating of the 7L53 is restored as part of the Central East Transmission Development. The 7L53 Thermal Protection Scheme sheds load at Bonnyville 700S to support area voltage.

Cutplane Limits

With the increase of load in the Cold Lake area, there could be potential thermal overloads or low limit voltage violations under certain conditions. Table 2 and Table 3 within Appendix 5 contain the cutplane limits described below.

The Marguerite Lake-Bourque-Leming Lake Outflow Cutplane is defined as the algebraic sum of:

7L89 flow out of 826S Marguerite Lake to 700S Bonnyville

plus

7L146 flow out of 970S Bourque to 700S Bonnyville

plus

7L66 flow out of 715S Leming Lake to 717S Ethel Lake.

The Cold Lake Inflow Cutplane is defined as the algebraic sum of:

9L36 flow out of 825S Whitefish Lake to 826S Marguerite Lake

plus

9L37 flow out of 825S Whitefish Lake to 826S Marguerite Lake

plus

7L70 flow out of 819S Whitby Lake to 700S Bonnyville

plus

7L53 flow out of 706S Irish Creek to 700S Bonnyville.

4 Transmission Constraint Management

The AESO manages transmission constraints in all areas of Alberta in accordance with the provisions of section 302.1. However, not all of those provisions are effective in the Cold Lake area due to certain operating conditions that exist in that area. This Information Document describes the application of the general provisions of section 302.1 to the Cold Lake area, and the additional clarifying steps required to effectively manage transmission constraints in that area.

The section 302.1 subsection 2(1) protocol steps which are effective in managing transmission constraints in the Cold Lake area are outlined in Table 1 below.

Table 1

Transmission Constraint Management

Sequential Procedures for the Cold Lake Area

Section 302.1 of the ISO rules, subsection 2(1) protocol steps	Applicable to the Cold Lake area?
(a) Determine effective pool assets	Yes
(b) Ensure maximum capability not exceeded	Yes
(c) Curtail effective downstream constraint side export service and upstream constraint side import service	No

Section 302.1 of the ISO rules, subsection 2(1) protocol steps	Applicable to the Cold Lake area?
(d) Curtail effective demand opportunity service on the downstream constraint side	No
(e)(i) Issue a dispatch for effective contracted transmission must-run	No
(e)(ii) Issue a directive for effective non-contracted transmission must-run	No
(f) Curtail effective pool assets in reverse energy market merit order followed by pro-rata curtailment	Yes
(g) Curtail effective loads with bids in reverse energy market merit order followed by pro-rata load curtailment	No

Applicable Protocol Steps

The first step in managing constraints in any area is to identify those generating units effective in managing a constraint. All of the generating units and loads operating in the Cold Lake area are indicated in Appendix 3 (single line diagram) and the generating units effective in managing a transmission constraint are identified in Appendix 1. As per subsection 2(4) of section 302.1, when a transmission constraint has been or is expected by the AESO to activate a remedial action scheme, the AESO recommences the procedural sequence in Table 1 (above) once the AESO ensures that the system is operating in a safe and reliable mode.

Step (a) in Table 1

The effective pool assets are as shown in Appendix 1.

Step (b) in Table 1

Ensuring maximum capabilities are not exceeded is effective in managing Cold Lake area transmission constraints.

Step (c) in Table 1

There are no interties in the Cold Lake area and curtailing import and export flows elsewhere on the system is not effective in managing a transmission constraint.

Step (d) in Table 1

Curtailing effective demand opportunity service on the downstream constraint side is not effective in managing transmission constraints in the Cold Lake area because there is no demand opportunity service.

Steps (e)(i) and (ii) in Table 1

There are no transmission must-run contracts in the Cold Lake area and using transmission must-run is not effective in managing a transmission constraint.

Step (f) in Table 1

Curtailing effective pool assets using reverse energy market merit order followed by pro-rata curtailment is effective in managing Cold Lake area transmission constraints.

Step (g) in Table 1

Curtailing load is not effective in managing Cold Lake transmission constraints. Curtailing load would exacerbate a constraint where there is an abundance of generation in relation to load.

5 Project Updates

As necessary, the AESO intends to provide information in this section about projects underway in the Cold Lake area that are known to have an impact on the information contained in this Information Document.

6 Appendices to this Information Document

Appendix 1 – Effective Pool Assets

Appendix 2 – Geographical Map of the Cold Lake Area

Appendix 3 – Cold Lake Area Curtailment Monitoring Points Single Line Diagram

Appendix 4 – Remedial Action Scheme Conditions

Revision History

Posting Date	Description of Changes
2012-11-27	Initial Release
2013-11-12	Administrative Updates
2014-02-14	Maps amended to include 970S Bourque and minor drafting edits.
2014-05-22	Maps amended to include 940S Beartrap and section 3.2 amended to include a temporary remedial action scheme.
2014-12-18	Amended to include Marguerite Lake-Bourque-Leming Lake outflow cutplane limits and Cold Lake inflow cutplane limit. Maps amended to include Nabiye and 7L146. Amended the description of the RAS that sheds load at CNRL Primrose 859S and Cenovus Foster Creek 1200S. Amended to include a new temporary Thermal Protection Scheme for 7L53.

Appendix 1 – Effective Pool Assets

The effective pool assets for the Cold Lake area, listed alphabetically by their pool IDs, are:

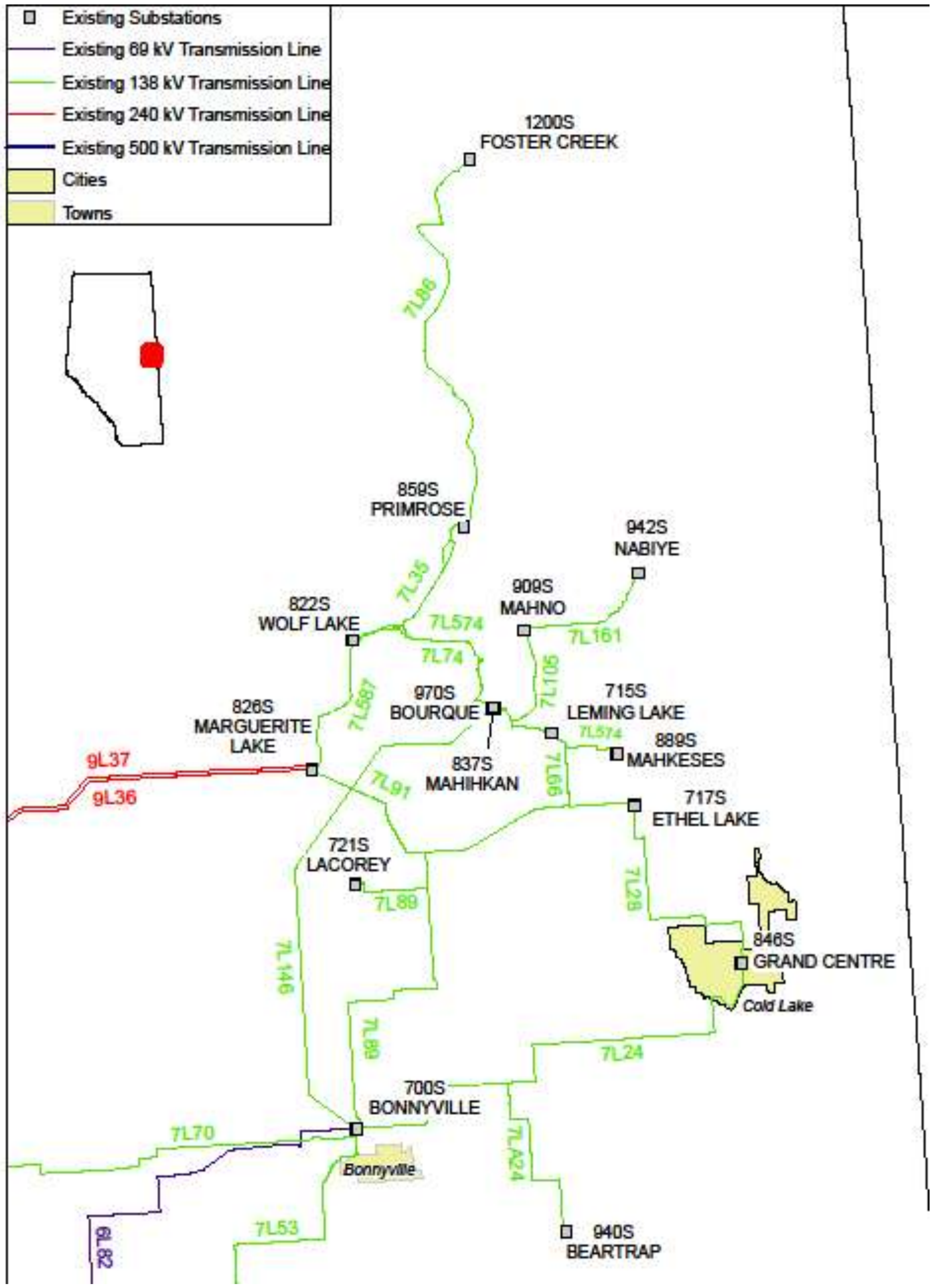
EC04

IOR1

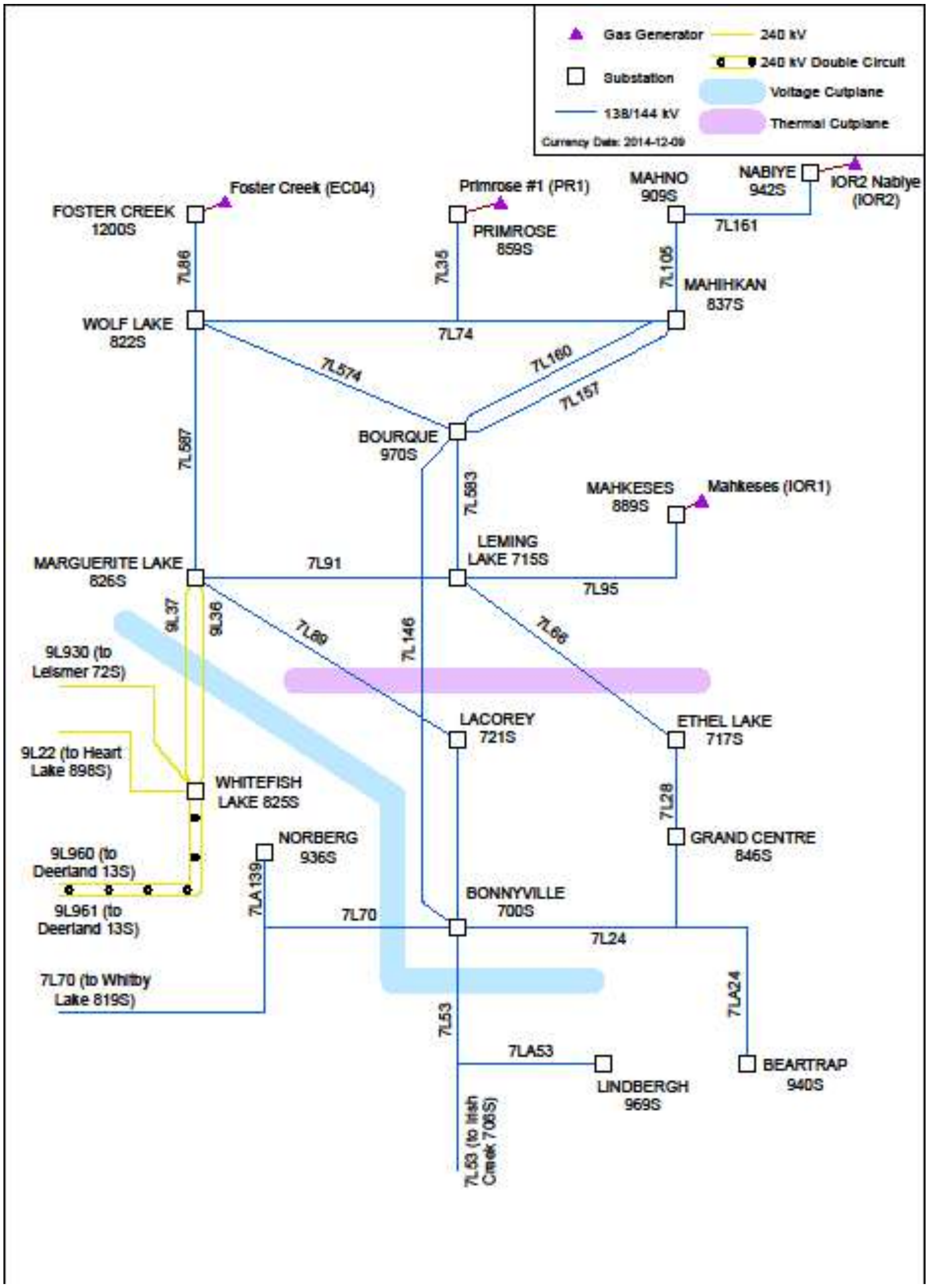
IOR2

PR1

Appendix 2 – Geographical Map of the Cold Lake Area



Appendix 3 – Cold Lake Area Cutplane Single Line Diagram



Appendix 4 – Remedial Action Scheme Conditions

Table 1 below sets out the conditions of the Cold Lake area remedial action scheme:

Table 1: Remedial Action Scheme Generation Levels

Remedial Action Scheme Output Status	Imperial Oil Mahkeses Plant net-to-grid generation level (MW)		EnCana Foster Creek Plant net-to-grid generation level (MW)
	Summer (May 1 to October 31)	Winter (November 1 to April 30)	All Year
Alarm (Triggered on calculated conductor temperature of 85°C)	Run-back to 115 MW at maximum unit ramp down rate within 7.5 minutes or less	Run-back to 130 MW at maximum unit ramp down rate within 7.5 minutes or less	Run-back to 0 MW at maximum unit ramp rate within 5.5 minutes or less
Trip (Triggered on calculated conductor temperature of 100°C)	Trips one pre-selected generating unit		Trips both generating units

Appendix 5 – Cutplane Transfer-Limits

Table 2: Marguerite Lake-Bourque-Leming Lake Outflow Cutplane Limit

MBL Outflow Cutplane "Thermal"			
Contingency	**Summer Limit** May 1 – Oct. 31	**Winter Limit** Nov. 1 – April 30	**Next Contingency**
None	210	250	7L146 or 7L587
826S Marguerite Lake 240/144 kV T1; or 240/144 kV T2	210	240	826S Marguerite Lake 240/144 kV T2; or 240/144 kV T1
9L36; or 9L37	210	240	9L37; or 9L36
7L91	200	230	7L146; or 7L587
7L583	200	230	7L146; or 7L587
7L587	180	220	7L146; or 7L587
7L89	130	170	7L146; or 7L587
7L66	120	160	7L146; or 7L587
7L146	120	160	7L66

Table 3: Cold Lake Inflow Cutplane Limit

Cold Lake Inflow Cutplane "Voltage"		
Contingency	**Limit (MW)**	**Next Contingency**
None	120	7L105; or 7L161
Nabiye Generators; or 7L105; or 7L161	90	7L95
7L587	70	Primrose G1
7L91	60	7L583
9L36; or 9L37	50	9L37; or 9L36
826S Marguerite Lake 240/144 kV T1; or 240/144 kV T2	50	826S Marguerite Lake 240/144 kV T2; or 240/144 kV T1
Foster Creek and Primrose Generators	40	7L587
7L89	30	7L146; or 7L66