Information Document
Northeast Area Transmission Constraint Management
ID #2011-008R

Information Documents are not authoritative. Information Documents are 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)[1] in effect, the Authoritative Document(s) governs.

1 Purpose

This Information Document relates to the following Authoritative Document:

- Section 302.1 of the ISO rules, *Real Time Transmission Constraint Management*

The purpose of this Information Document is to provide information regarding the unique operating characteristics and resulting constraint conditions and limits in the northeast area of the Alberta interconnected electric system. In this Information Document the AESO has defined the northeast 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 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 northeast area.

2 General

The northeast area is connected to the interconnected electric system by three (3) long 240 kV bulk transmission line paths ([9L07/9L89/9L55/9L47/9L22 or 9L81], [9L74,9L57/9L10] and [9L23/9L85/9L45 /9L990/9L81/9L930]) and a number of 144 kV transmission lines as shown in Appendix 2. The transfer-in and transfer-out limits for the northeast area are mainly established to avoid overload and voltage instability/deviation in the event of next single contingency, and are dependent on the status of each of the three (3) 240 kV paths connecting the northeast area to the interconnected electric system.

Loss of two (2) of these 240 kV bulk transmission paths can cause generation instability, voltage instability or unacceptable low voltage excursions under high transfer-out conditions.

Loss of all three (3) 240 kV bulk transmission lines can result in extreme voltage and frequency excursions in the northeast area causing generating unit tripping, load loss and the separation of the northeast area into electrical islands, and may also cause power outage to the City of Fort McMurray and the community of Fort MacKay.

Two (2) maps of the northeast area are provided in this Information Document. Appendix 2 provides a detailed geographical map of the northeast area indicating bulk transmission lines and substations. Appendix 3 provides a detailed schematic of the northeast area cutplanes transfer-out and transfer-in conditions respectively, including the generating units (listed in Appendix 1) that are considered effective in managing a regional transmission constraint.

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 electric system.

The AESO respects the Fort McMurray Import limits when managing the inflow to the northeast area and the AESO respects the Fort McMurray Export cutplane limits when managing the outflow from the northeast area. The map attached as Appendix 3 illustrates these cutplanes.

3 Constraint Conditions and Limits

To manage transmission constraints in the northeast area of Alberta, the AESO has established regional

[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 associated 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.

cutplane flow limits for each of the Fort McMurray Import and Fort McMurray Export cutplanes. A further description of those cutplane limits under different operating conditions is set out in Tables 2 to 5 of Appendix 4.

3.1 *Non-Studied Constraints and Limits*

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

3.2 Studied Constraints and Limits

Transfer-In Limits at the Fort McMurray Import Cutplane

The Fort McMurray Import cutplane power flow is defined in relation to four (4) specific substations in the northeast area and is calculated as the total of inflow on:

9L10 @ 939S Livock; plus

1117L @ 167S Ipiatik Lake;plus

9L47 @ 852S Round Hill; plus

9L930 @ 72S Leismer.

The AESO establishes transfer-in limits at the Fort McMurray Import cutplane to avoid voltage instability in the event of certain contingency conditions. Those specific conditions along with the corresponding inflow limit are set out in Appendix 4, Tables 2 and 3. The transfer-in limits on the Fort McMurray Import cutplane are determined by voltages at 888S Dover and 825S Whitefish Lake substations. As identified in Appendix 4, Table 2, maintaining voltages at a higher acceptable range at these substations enables more power transfer into the northeast area.

Transfer-Out Limits at the Fort McMurray Export Cutplane

Fort McMurray Export cutplane power flow is calculated as the total of outflow on:

9L57 @ 888S Dover; plus

9L07 @ 888S Dover; plus

9L23 @ 848s Ruth Lake; plus

9L84 @ 934S Black Fly; plus

848S Ruth Lake transformers 901T and 902T.

The AESO establishes transfer-out limits at the Fort McMurray Export cutplane to avoid bulk transmission line overloads or unacceptable low voltage excursions in the event of certain contingency conditions. The specific contingency conditions and the corresponding outflow limit are set out in Appendix 4, Tables 4 and 5.

4 Transmission Constraint Management

While the AESO manages transmission constraints in all areas of Alberta in accordance with the provisions of section 302.1 of the ISO rules, not all of those provisions are effective in the northeast area due to certain unique operating conditions that exist in the area. Because of those unique operating conditions, this Information Document represents the application of the general provisions of section 302.1 of the ISO rules to the northeast area, and provides additional clarifying steps as required to effectively manage transmission constraints in that area. The application and exception to certain provisions of section 302.1 of the ISO rules are allowed under the rule to account for the effectiveness of each rule provision.

The protocol steps which are effective in managing transmission constraints in the northeast area are outlined in Table 1 below, followed by additional steps which may be required.

Table 1 – Transmission Constraint Management – Sequential Procedures for Northeast Area

Section 302.1 of the ISO rules, subsection 2(1) protocol steps	Applicable to the Fort McMurray Import cutplane inflow?	Applicable to the Fort McMurray Export cutplane outflow?
(a) Determine effective pool assets	Yes	Yes
(b) Ensure maximum capability not exceeded	No	Yes
(c) Curtail effective downstream constraint side export service and upstream constraint side import service	No	No
(d) Curtail effective demand opportunity service on the downstream constraint side	Yes	No
(e)(i) Issue a dispatch for effective contracted transmission must-run	No	No
(e)(ii) Issue a directive for effective non-contracted transmission must-run	No[2]	No
(f) Curtail effective pool assets in reverse energy market merit order followed by pro-rata curtailment	No	Yes
(g) Curtail effective loads with bids in reverse energy market merit order followed by pro-rata load curtailment	Yes	No

Applicable Protocol Steps

The first step in managing a transmission constraint is to identify those generating units and loads effective in managing the transmission constraint, otherwise known as the effective pool assets. While all of the generating units and loads operating in the northeast area are indicated on the single line diagram in Appendix 3, for various reasons not all of them are effective in managing a transmission constraint in all conditions. A list of the generation pool assets that are effective in managing a transmission constraint are set out in Appendix 1.

Step (a)

The Fort McMurray Import cutplane is managed by curtailing effective downstream load for inflow constraints. The Fort McMurray Export cutplane has effective generation pool assets which are identified in Appendix 1.

Step (b)

Curtailing generation pool assets to their maximum capability is not effective for the Fort McMurray Import constraints, but it is effective for Fort McMurray Export outflow constraints and is used when a Fort McMurray Export constraint occurs.

[2] An exception would be if the inflow limit does not allow for non-industrial system designation firm load to be served.

Step (c)

There are no interties within the northeast area and southern Alberta import and export flows on the system are not effective in managing a transmission constraint.

Step (d)

Curtailing effective demand opportunity service on the downstream constraint side is only effective when inflow limits are exceeded for the Fort McMurray Import cutplane inflow and is used if demand opportunity service is available to be curtailed when a Fort McMurray Import constraint occurs.

Steps (e)(i) and (ii)

There are no transmission must-run contracts in the northeast area and transmission must-run is not effective in managing a transmission constraint in the northeast area.[3]

Step (f)

In order to address a long-term constraint, curtailing effective generating units using the reverse merit order followed by pro-rata curtailment is only effective when outflow limits are exceeded for Fort McMurray Export cutplane. A short term constraint is considered to include the hour the constraint occurred, plus the following two (2) hours, when the reverse merit order is utilized. For long-term constraints, the pro rata curtailment of identified effective generation pool assets occurs.

Step (g)

Curtailing load pool assets in reverse energy market merit order followed by pro-rata load curtailment of identified generation pool assets is the last step of the protocol and is used when inflow limits are exceeded for the Fort McMurray Import or Fort McMurray Export cutplanes. When pro-rata load curtailment is required, the AESO issues directives to effective direct connect industrial loads and to the northeast area legal owner of transmission facilities specifying the required pro-rata curtailment levels.

5 Project Updates

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

6 Appendices

Appendix 1 – *Effective Pool Assets*

Appendix 2 – *Geographical Map of the Northeast Area*

Appendix 3 – *Northeast Area Cutplanes: Transfer-in and Transfer-out Single Line Diagram*

Appendix 4 – *Cutplane Transfer Limits for the Northeast Area*

Revision History

Posting Date	Description of Changes
2018-02-13	Amended Appendix 4, Table 4 - N-0 Fort McMurray Export Cutplane Transfer-out Limits.

[3] In the unusual circumstance that the northeast area is being supported by a single path and the inflow is limited to an amount less than the non-industrial system designation firm load, the AESO may issue directives to effective generation pool assets to provide sufficient energy to meet such firm load.

2015-08-25	With energization of Christina Lake 240 kV transmission development, maps amended to include the new Ipiatik Lake 167S substation and new line numbers 1116L and 1117L. Transfer-in (import) cutplane limits in Appendix 4 have been revised. Table 5 revised to reflect that the Livock phase shifting transformer is not applicable to table limits.
2015-08-13	Maps amended to include the new Dawes 2011S substation and new line number 9L89. Also, transfer-out (export) cutplane limits have been revised.
2014-05-29	Updated to remove Kinosis-Leismer Cutplane.
2014-05-08	Appendix 4 amended to reflect changes to the Kinosis-Leismer Cutplane Transfer-in Limits. Section 2, Section 3.2, Appendix 2 and Table 4 amended to reflect a portion of 9L990 renamed to 9L45.
2014-05-01	Maps amended to include Kettle River 2049S substation, Bohn 931S substation and the 7L05 line.
2014-02-14	Map amendments to include Engstrom 2060S substation and the 7L167 Line
2013-12-11	Updated to include map amendments, cutplane table amendments, and minor drafting edits.
2012-12-04	Updated to include cutplane name changes, updated maps and minor drafting edits.
2012-09-13	Updated to include minor drafting edits
2012-06-14	Updated to include material content from existing Section 302.5 of the ISO rules, Northeast Area Transmission Constraint Management
2011-06-30	Initial Release

Appendix 1 – Effective Pool Assets

1. The effective pool assets for the Fort McMurray Export cutplane, listed alphabetically by their pool IDs, are:

   CNR5

   MKR1

   MKRC

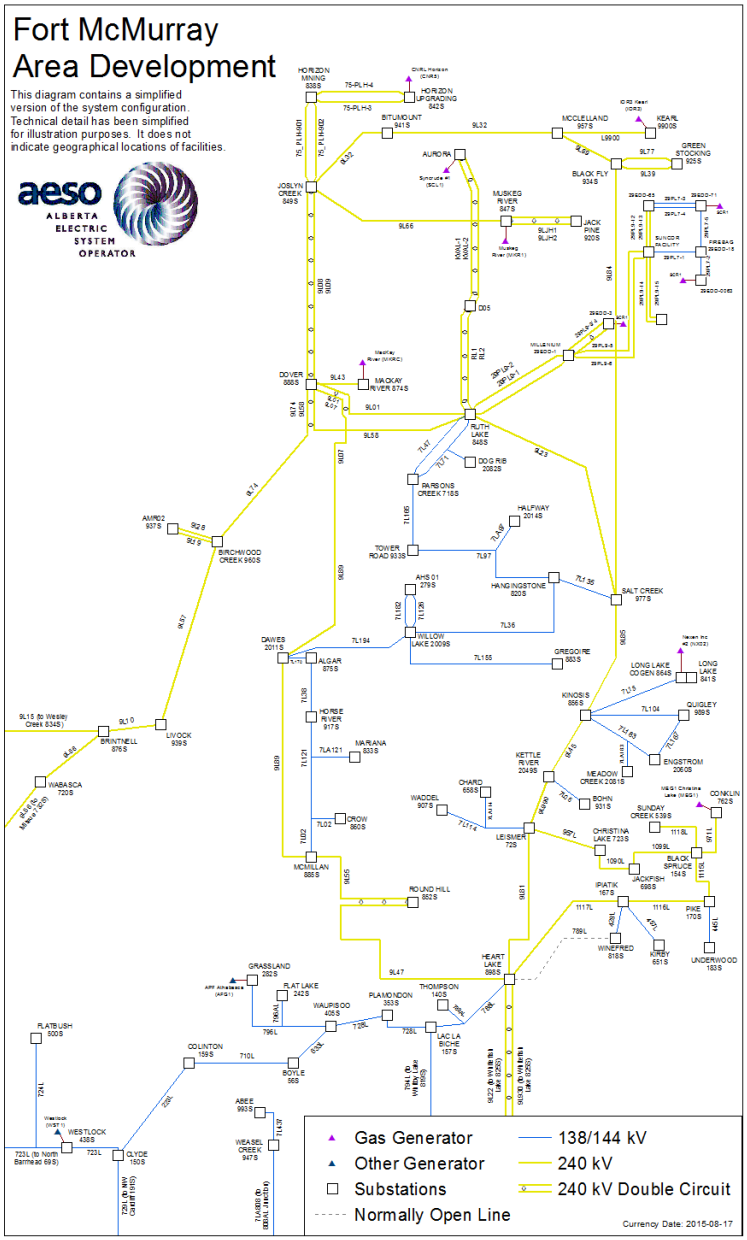
   SCL1

   SCR1

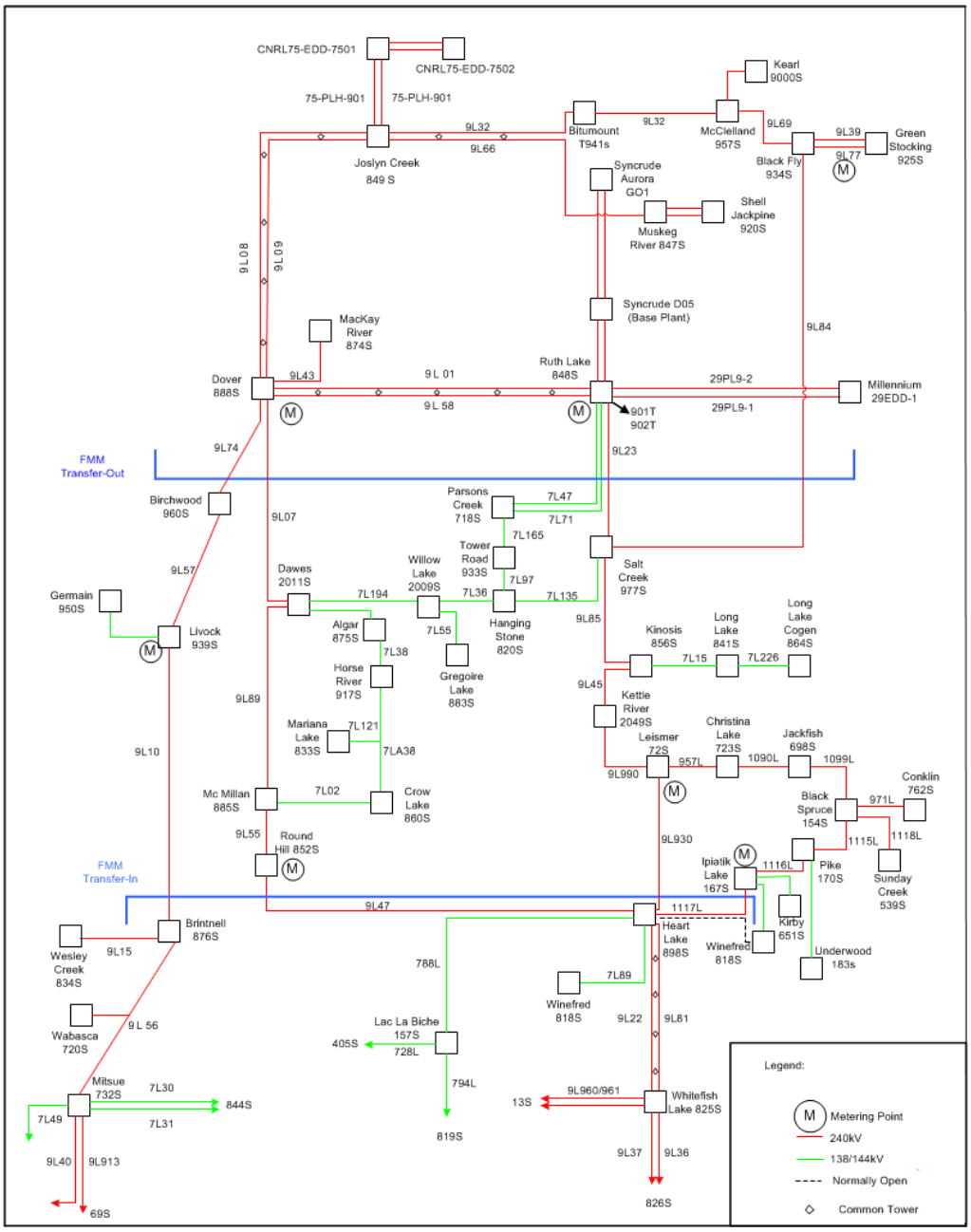
2. The effective pool assets for the Fort McMurray Import cutplane are:

   Load – curtailed in accordance with the transmission facility owner load curtailment plan, if applicable.

Appendix 2 – Geographical Map of the Northeast Area



Appendix 3 – Northeast Area Cutplanes: Transfer-in and Transfer-out Single Line Diagram



Appendix 4 – Cutplane Transfer-Limits for the Northeast Area

The Import Cutplane limits are dependent on the availability and status (in service) of the area capacitor banks

Table 2 – N-0 Fort McMurray Import Cutplane Transfer-in Limits[1]

Contingency	Limit (MW)	Limiting Contingency	Limiting Element
N-0	593 Voltage	9L85	area voltage
	512 Thermal	9L85	898S Heart Lake voltage

Note:

[1] The above limits assume the Conklin and three Long Lake units are in service.

Table 3 – N-1 Fort McMurray Import Cutplane Transfer-in Limits

Contingency	Limit (MW)	Limiting Contingency	Limiting Element
9L01	623 Voltage	9L85	area voltage
	549 Thermal	9L85	898S Heart Lake voltage
9L58	623 Voltage	9L85	area voltage
	549 Thermal	9L85	898S Heart Lake voltage
9L07	522 Voltage	9L85	area voltage
	442 Thermal	MacKay Generator	888s Dover voltage
9L08	589 Voltage	9L85	area voltage
	505 Thermal	9L85	898S Heart Lake voltage
9L09	589 Voltage	9L85	area voltage
	505 Thermal	9L85	898S Heart Lake voltage

Contingency	Limit (MW)	Limiting Contingency	Limiting Element
9L10	523 Voltage	9L85	area voltage
	433 Thermal	MacKay Generator	898S Heart Lake voltage
9L15	618 Voltage	9L85	area voltage
	516 Thermal	MacKay Generator	888s Dover voltage
9L22	395 Voltage	9L85	Heart Lake 240 kV voltage
	300 Thermal	9L81	Heart Lake 240 kV voltage
9L23	592 Voltage	9L85	area voltage
	510 Thermal	Long Lake G2	898S Heart Lake voltage
9L32	570 Voltage	9L85	area voltage
	480 Thermal	9L23	898S Heart Lake voltage
9L101	593 Voltage	9L85	area voltage
	511 Thermal	9L85	898S Heart Lake voltage
9L45	564 Voltage	9L10	area voltage
	455 Thermal	9L07	7L194 Willow Lake to Dawes
9L47	525 Voltage	9L85	area voltage
	447 Thermal	9L10	898S Heart Lake voltage
9L55	515 Voltage	9L85	area voltage
	414 Thermal	9L10	898S Heart Lake voltage
9L56	574 Voltage	9L85	area voltage

Contingency	Limit (MW)	Limiting Contingency	Limiting Element
	572 Thermal	MacKay Generator	898S Heart Lake voltage
9L57	514 Voltage	9L85	area voltage
	460 Thermal	MacKay Generator	898S Heart Lake voltage
9L69	553 Voltage	9L85	area voltage
	505 Thermal	9L85	898S Heart Lake voltage
9L74	525 Voltage	9L85	area voltage
	483 Thermal	MacKay Generator	898S Heart Lake voltage
9L81	390 Voltage	9L85	Heart Lake 240 kV Voltage
	300 Thermal	9L22	Heart Lake 240 kV Voltage
9L84	550 Voltage	9L85	area voltage
	496 Thermal	9L85	898S Heart Lake voltage
9L85	570 Voltage	1099L	area voltage
	415 Thermal	1099L	72s Leismer voltage
9L89	529 Voltage	9L85	Area voltage
	446 Thermal	Mackay Generator	888S Dover Voltage
9L930	523 Voltage	9L85	area voltage
	400 Thermal	1099L	Dover and Leismer 240kV bus voltage violations
9L990	575 Voltage	9L10	area voltage
	425 Thermal	9L10	898S Heart Lake voltage

Contingency	Limit (MW)	Limiting Contingency	Limiting Element
957L	565 Voltage	9L85	area voltage
	492 Thermal	9L85	898S Heart Lake voltage
1090L	519 Voltage	9L85	area voltage
	479 Thermal	9L85	898S Heart Lake voltage
1099L	579 Voltage	9L85	area voltage
	466 Thermal	9L930	888s Dover and 72s Leismer voltage
1116L	555 Voltage	9L85	area voltage
	442 Thermal	9L930	888s Dover and 72s Leismer voltage
1115L	530 Voltage	9L85	area voltage
	458 Thermal	9L930	888s Dover and 72s Leismer voltage
1117L	561 Voltage	9L85	area voltage
	400 Thermal	9L930	888s Dover and 72s Leismer voltage
848S Ruth Lake 901T	555 Voltage	9L85	area voltage
	510 Thermal	9L85	898S Heart Lake voltage
848S Ruth Lake 902T	555 Voltage	9L85	area voltage
	510 Thermal	9L85	898S Heart Lake voltage
2011S Dawes T1	560 Voltage	9L85	area voltage

Contingency	Limit (MW)	Limiting Contingency	Limiting Element
	512 Thermal	9L85	898S Heart Lake voltage
885S McMillan T2	555 Voltage	9L85	area voltage
	512 Thermal	9L85	898S Heart Lake voltage
977S Salt Creek 901T	550 Voltage	9L85	area voltage
	501 Thermal	9L85	898S Heart Lake voltage

Table 4 – N-0 Fort McMurray Export Cutplane Transfer-out Limits

Transient Stability Limit (MW)	850

Table 5 – N-1 Fort McMurray Export Cutplane Transfer-out Limits

Contingency	Transient Stability Limit (MW)	Limiting Contingency
9L15	685	29PL9-1/2
9L56	650	29PL9-1/2
9L10	570	29PL9-1/2
9L57	570	29PL9-1/2
9L74	570	29PL9-1/2
9L08 / 9L09	710	9L09/9L08
9L32-1	710	29PL9-1/2
9L32-2 / 9L101	710	29PL9-1/2
9L69	710	29PL9-1/2
9L84	710	9L08/9L09
9L23	680	29PL9-1/2
9L01/9L58	710	29PL9-1/2
9L07	680	29PL9-1/2
9L89	680	29PL9-1/2
9L55	650	29PL9-1/2
9L47	640	29PL9-1/2
9L930	690	29PL9-1/2
1117L	710	29PL9-1/2
1116L	710	29PL9-1/2
1115L	710	29PL9-1/2
1099L	680	29PL9-1/2
1090L	680	29PL9-1/2
957L	690	29PL9-1/2
9L62	595	29PL9-1/2
9L45	595	29PL9-1/2

Contingency	Transient Stability Limit (MW)	Limiting Contingency
9L85	570	29PL9-1/2
848S Ruth Lake transformer 901T	700	29PL9-1/2
848S Ruth Lake transformer 902T	700	29PL9-1/2
2011S Dawes transformer T1	700	29PL9-1/2
885S McMillan transformer T2	700	29PL9-1/2
977S Salt Creek transformer 901T	700	29PL9-1/2