Appendix D – Transmission System Details

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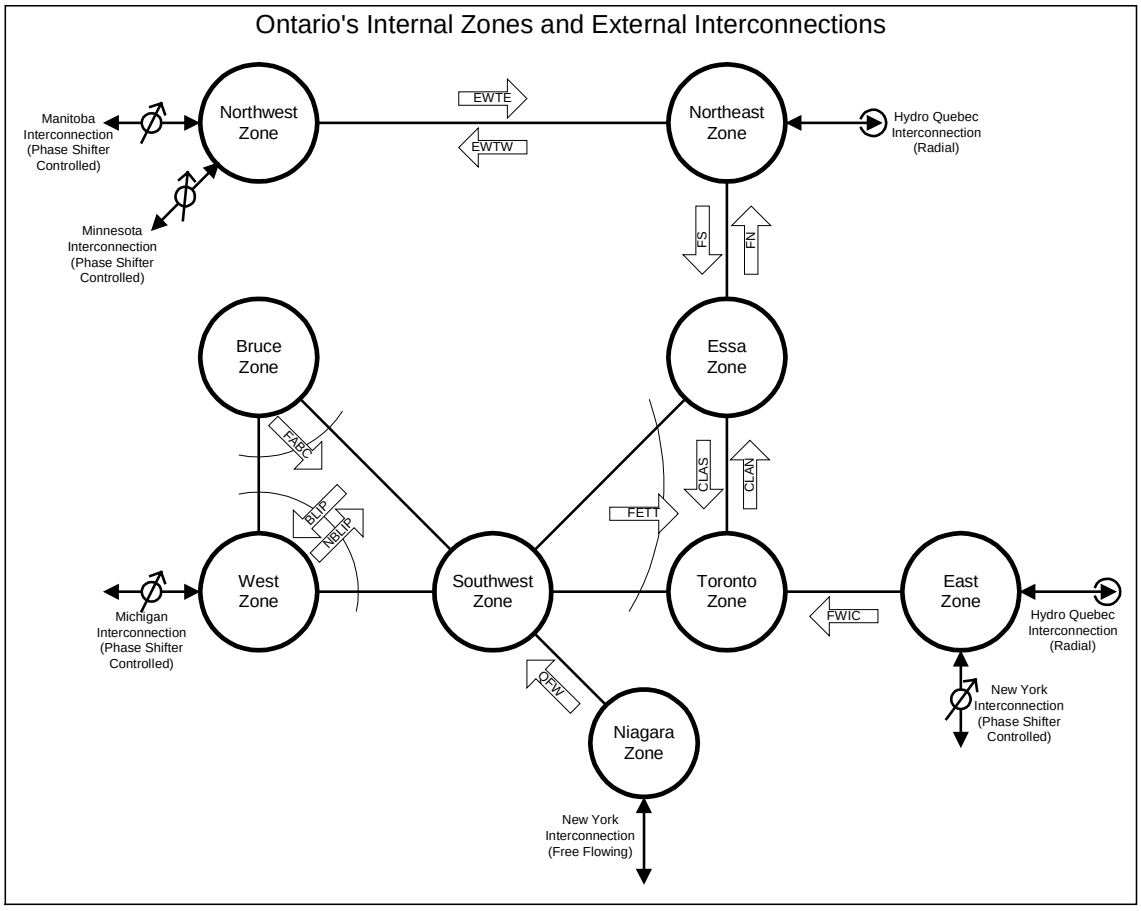
This appendix contains, in Section 1.0, a description of the Ontario Transmission System followed, in Sections 2.0 and 3.0, by Ontario's Interface and Interconnection Definitions and Limits. In Section 4.0 are shown Hydro One's committed transmission facilities addition plans and, in Section 5.0, the transmission outage plan for the studied period is presented along with comments regarding the impact of the outages, where necessary.

1.0 Transmission System Description

1.1 Transmission System Interfaces

There are eight major interfaces in the Ontario electricity system, which will be accounted for in this study, as illustrated in Figure D1.1.

Figure D1.1 Ontario's Internal Zones and External Interconnections



Interface Definitions

Interface definitions are formed by grouping one or more lines for the purpose of measuring their combined flow and enforcing a power flow limit or as it is more commonly called an interface limit. Interface limits are directional and interfaces may have limits imposed in one or both directions. Section 2.1 shows the major interface definitions used in Ontario. Notice that for each individual transmission element included in an interface definition both the positive direction of power flow and measurement point (e.g. which end of a transmission line the power flow is measured at) are specified.

Interface Capability Limits

Section 2.2 shows the base limits for the major interfaces that correspond to the definitions in Section 2.1; only normal system (all transmission elements in-service) limits are shown. Note that some limits are simply constants (e.g. BLIP) and others are more complicated and may depend on parameters such as specific generator unit statuses, other flows, primary demand, etc. (e.g. NBLIP, FETT, FABC). In cases where interface limits are based on thermal capability, separate ratings are shown for summer and winter conditions.

1.2 Interface Characteristics

The EWTE/EWTW Interface

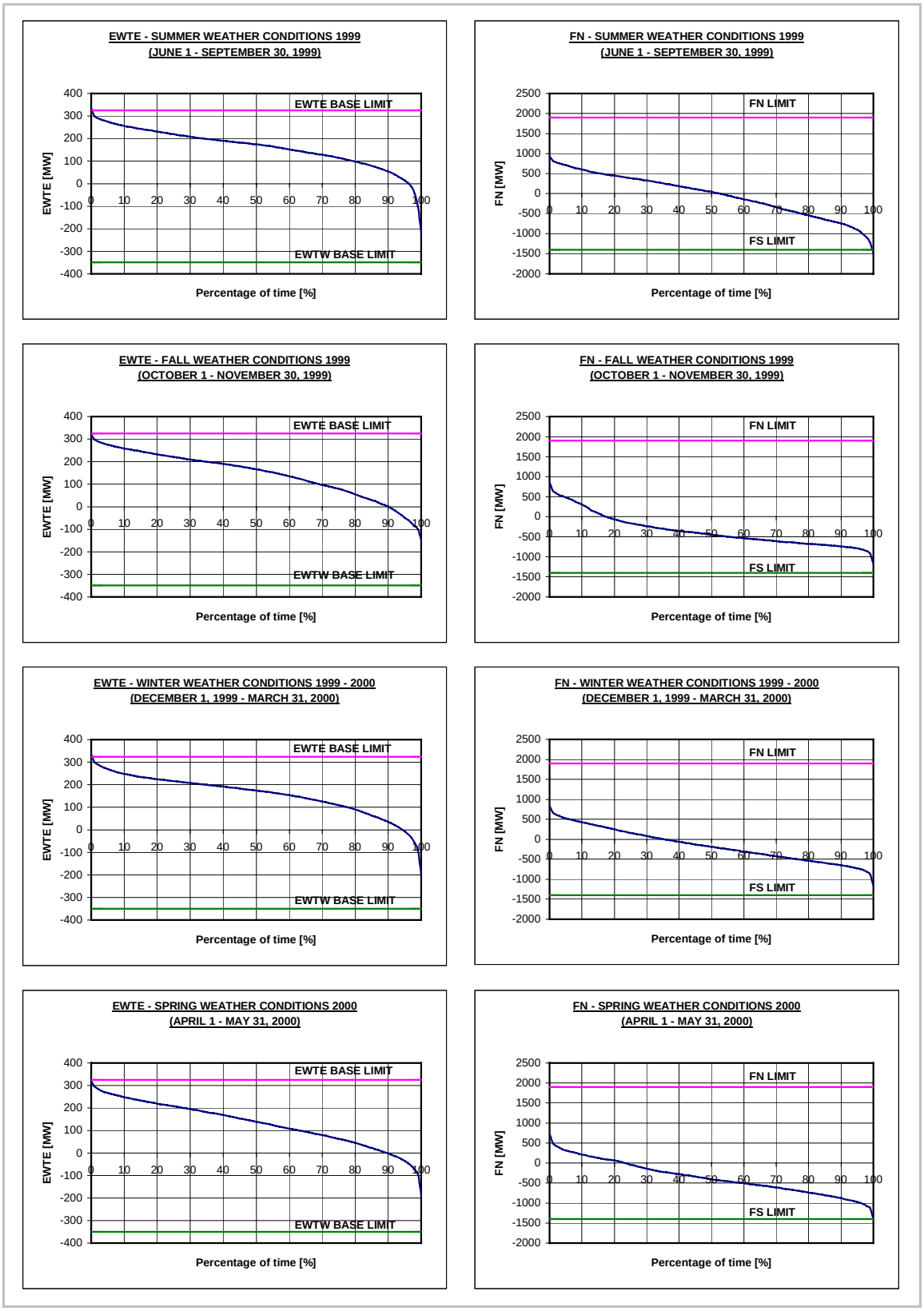
The East-West Transfer East (EWTE) and East-West Transfer West (EWTW) flows are functionally related to the power flows between Ontario and Manitoba (OMTE/OMTW etc.). In this relationship OMTE/OMTW flows can be generally thought of as the independent variables as they are under phase shifter control.

The maximum limits on the East-West tie are 325 MW to the east and 350 MW to the west. The EWTE and EWTW interfaces are constrained by stability limitations. A sample of historical flow distribution on the East West Ties is shown in the Figure D1.2.1.

The FN/FS Interface

The Flow South (FS) limit is 1,400 MW and the Flow North (FN) limit is 1,900 MW. The Flow North and Flow South interfaces are constrained by voltage and stability limits respectively. A sample of historical flow distribution on the Flow North / South interface is shown in the Figure D1.2.1.

Figure D1.2.1 – Historical Flow Distribution – EWTE/EWTW and FN/FS Interfaces



The CLAN/CLAS Interface

The Claireville North (CLAN) limit is 2,000 MW and the Claireville South (CLAS) limit is 1,000 MW.

The FABC Interface

The Flow Away From Bruce Complex (FABC) limit is a functional relationship with a number of other system parameters. With only a total of four Bruce units available (the other four are on indefinite outage) the FABC limit is high enough that it is never limiting. The FABC limit can also be improved through the use of generation rejection of Bruce units.

The FETT Interface

The FETT (Flow East Towards Toronto) interface limit is a function of a variety of parameters. Normally the limit is near its high end of about 5,700 MW. The interface is constrained by a combination of stability and thermal limits. There is no limit specified for flows to the west, as the level of flows expected in that direction will not cause system concerns. A sample of historical flow distribution on the FETT interface is shown in the Figure D1.2.2.

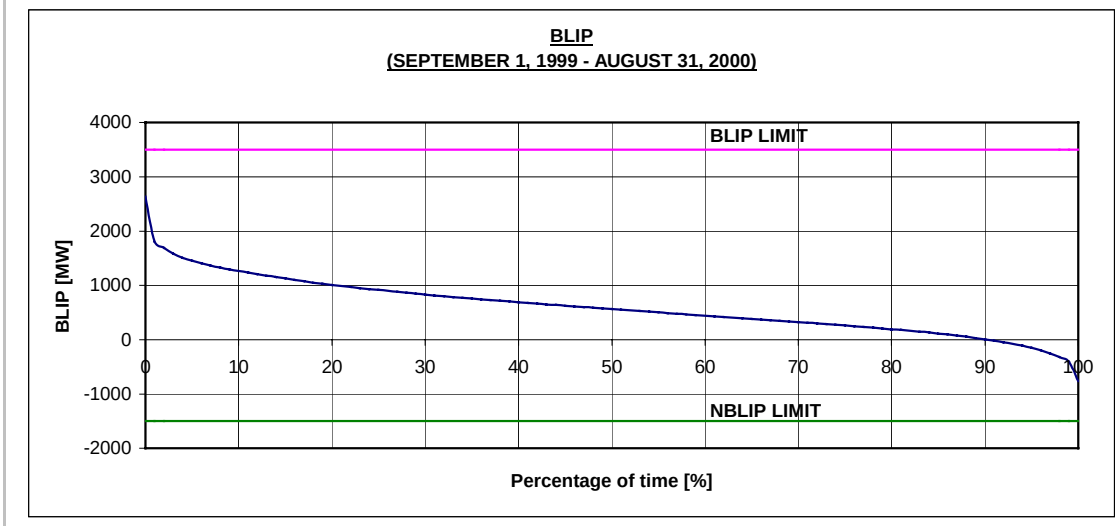
The QFW Interface

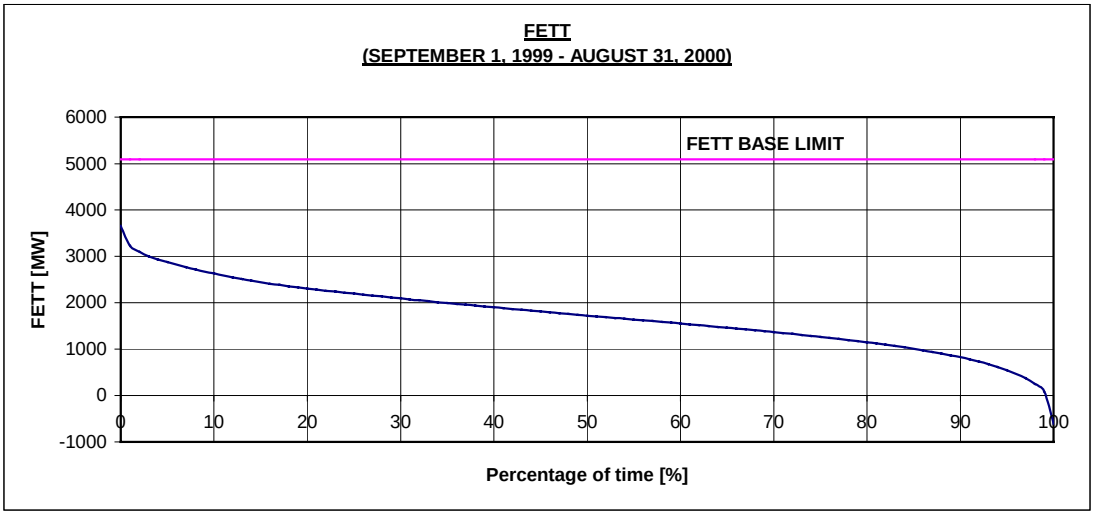
The QFW (Queenston Flow West) interface is limited to 2,000 MW for flows to the west in the winter. In the summer, the limit is 1,800 MW to the west. This interface is constrained by thermal limitations. There is no limit specified for flows to the east, as the level of flows expected in that direction will not cause system concerns. A sample of historical flow distribution on the QFW interface is shown in the Figure D1.2.2.

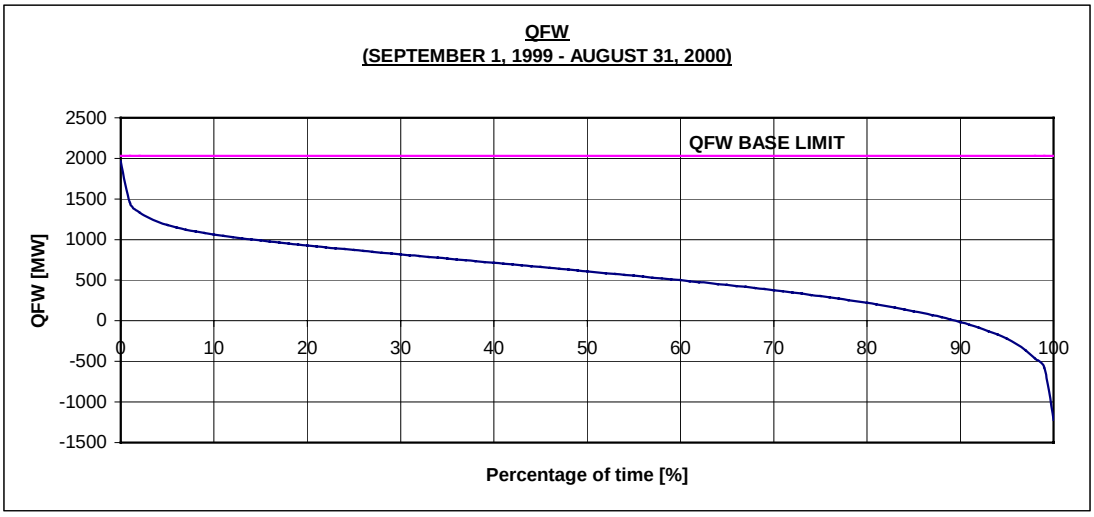
The BLIP/NBLIP Interface

The BLIP (Buchanan Longwood Input) interface is limited to 3,500 MW to the west due to stability limitations. The NBLIP interface limit is a function of a variety of parameters. Normally the limit is near its high end of about 1,500 MW; the interface is typically constrained by voltage limitations. A sample of historical flow distribution on the BLIP interface is shown in the Figure D1.2.2.

Figure D1.2.2 – Historical Flow Distribution – BLIP/NBLIP, FETT and QFW Interfaces







The FWIC Interface

This interface does not have a pre-defined limit. It is included in this study to provide a boundary for the creation of the East Zone to allow for specific forecasts for this region for such parameters as economic conditions for load growth, total resources, etc.

1.3 Transmission System Zones

The Ontario transmission system has been divided up into nine zones to facilitate the study. Zonal boundaries have been chosen to correspond with the interface definitions in Section 2.1.

Northwest Zone Characteristics

- The total resources generally exceed the peak primary demand.
- The generation is mainly hydroelectric with some coal
- The zone is externally connected to the Manitoba and Minnesota systems.
- Both interconnections are under phase shifter control.
- MAPP (Mid-Continent Area Power Pool) criteria (similar to NPCC) are observed in Manitoba and Minnesota and there is a plan to move toward MAPP criteria limits in the Northwest zone. For many years Manitoba has accepted Northwest zone limits based on criteria less stringent than MAPP, but recently Manitoba joined the MAPP reliability council and as a result Ontario is compelled accordingly.

Northeast Zone Characteristics

- The total resources generally exceed the peak primary demand.
- The generation is mainly hydroelectric with some cogeneration.
- The zone is externally connected to the Quebec grid.
- The interconnection with Quebec is radial.

Essa Zone Characteristics

- The total resources are much less than the peak primary demand.
- The generation is totally hydroelectric.
- There are no external interconnections.

East Zone Characteristics

- The total resources exceed the peak primary demand.
- The generation is a mix of hydroelectric, oil, and gas.
- The zone is externally connected to the Quebec grid.
- The interconnection with Quebec is radial.
- It is also externally connected to New York with phase shifter control.

Toronto Zone Characteristics

- The total resources are much less than the peak primary demand.
- The generation is mostly nuclear and coal.
- There are no external interconnections.

Bruce Zone Characteristics

- The total resources are much greater than the peak primary demand.
- The generation is mostly nuclear.
- There are no external interconnections.

Southwest Zone Characteristics

- The total resources are well balanced with the peak primary demand.
- The generation is mostly coal.
- There are no external interconnections.

West Zone Characteristics

- The total resources are slightly less than the peak primary demand.
- The generation is mostly coal.
- The interconnection with Michigan will be under phase shifter control, by June 2001.

Niagara Zone Characteristics

- The total resources are much higher than the peak primary demand.
- The generation is mostly hydroelectric.
- There is a free-flowing interconnection with New York.

1.4 Transmission System Interconnections' Capabilities and External Markets

The term interconnection is used to describe interfaces that join Ontario to other (external) control areas.

Ontario has interconnections with Manitoba, Minnesota, Quebec, Michigan, and New York.

Interconnection Definitions

Interconnection definitions are shown in Section 3.1.

Interconnection Limits

Interconnection limits are shown in Section 3.2.

Interconnection Characteristics

All of Ontario's non-radial interconnections are under phase-shifter control, except for Niagara New York.

New phase shifters will be installed on the Ontario – Michigan interconnection by June 2001. The purpose of the new phase shifters is to control a loop flow or parallel path flow called Lake Erie Circulation (LEC). LEC occurs naturally through a combination of transmission system impedance with interconnection-wide load/generation dispatch; it is measured as an unscheduled flow across the points of interconnection with New York, at Niagara Falls, and with Michigan. Much of the time, LEC enters Ontario at the New York Niagara interconnection and exits Ontario at the Michigan interconnection. Power flows associated with this condition are often greater than 500 MW; on occasion they exceed 1,000 MW. LEC flows also appear on and aggravate the BLIP and QFW interfaces as they are in a direct series path. With the incorporation of the new

phase shifters it is expected that the incidence of constrained operation of QFW will be greatly reduced.

The Ontario - Manitoba Interconnection

The OMTE and OMTW limits are both 288 MW in summertime, 300 MW in wintertime and are constrained by stability and thermal limitations.

The Ontario - Minnesota Interconnection

The MPFN and MPFS limits are 100 and 150 MW respectively and are constrained by stability and thermal limitations.

The Ontario - Michigan Interconnection

The Michigan interconnection is constrained by thermal limitations and will be under phase shifter control by June 2001.

Before June 2001:

During winter months, the limits are 1600 MW for flows into Ontario and 2,400 MW for flows out of Ontario. In the summer, the limits are 1,500 MW for flows into Ontario and 2,350 MW for flows out of Ontario.

After June 2001:

During winter months, the limits are 1800 MW for flows into Ontario and 2,450 MW for flows out of Ontario. In the summer, the limits are 1,765 MW for flows into Ontario and 2,450 MW for flows out of Ontario.

The Ontario - New York Niagara Interconnection

The New York Niagara interconnection, in the winter, is limited to 1,750 MW for flows into Ontario and 2,050 MW for flows out of Ontario. In the summer, the limit is 1,450 MW for flows into Ontario and 1,950 MW for flows out of Ontario. The interconnection is constrained by thermal limitations in the winter and summer.

The QFW interface is in series with the NY Niagara interconnection. All flows entering Ontario on the NY Niagara interconnection will also appear on the QFW interface; this includes purchases and parallel path flows. Based on past experience and studies, the QFW interface always hits its limit before the limit is reached on the NY Niagara interconnection for flows entering Ontario; as a result, the capability of the NY Niagara interconnection is never fully utilized.

Typically, when QFW hits its limit of 1,800 MW under summer conditions, the flow across the NY Niagara interconnection is 1,100 MW (its limit is 1,450 MW). Similarly, when QFW hits its limit of 2,000 MW under winter conditions, flow across the NY Niagara interconnection is 1,300 MW (its limit is 1,750 MW).

The Ontario - New York East Interconnection

The limit on this interconnection is 400 MW for flows into or out of Ontario. The interconnection is constrained by thermal limitations and is under the control of phase shifters.

The Ontario Northeast - Quebec Interconnection

The Quebec North interconnection is thermally limited to 78 MW under winter conditions and 64 MW under summer conditions, for flows into Ontario from radial generation in Quebec. For flows out of Ontario, the limit is 80 MW and this is simply based on the maximum amount of radial load available to be supplied in Quebec.

The Ontario East - Quebec Interconnection

The Quebec South interconnection is limited to 1,330 MW for flows into Ontario due to stability limitations and available radial generation. For flows out of Ontario the limit is 450 MW and is due to stability and thermal limitations.

2.0 Definitions and Limits of Ontario's Interfaces

2.1 Definitions of Ontario's Interfaces

(* signifies the measurement point)

Buchanan Longwood Input (BLIP) Interface consists of the following circuits:

B562L	Bruce A to Longwood* 500 kV
B563L	Bruce B to Longwood* 500 kV
N582L	Nanticoke to Longwood* 500 kV
D4W	Detweiler to Buchanan* 230 kV
D5W	Detweiler to Buchanan* 230 kV
M31W	Middleport to Buchanan* 230 kV
M32W	Middleport to Buchanan* 230 kV
M33W	Middleport to Buchanan* 230 kV

Negative Buchanan Longwood Input (NBLIP) Interface consists of the following circuits:

B562L	Longwood* to Bruce A 500 kV
B563L	Longwood* to Bruce B 500 kV
N582L	Longwood* to Nanticoke 500 kV
D4W	Buchanan* to Detweiler 230 kV
D5W	Buchanan* to Detweiler 230 kV
M31W	Buchanan* to Middleport 230 kV
M32W	Buchanan* to Middleport 230 kV
M33W	Buchanan* to Middleport 230 kV

Queenston Flow West (QFW) Interface consists of the following circuits:

Q23BM	Beck2* to Burlington and Middleport (Neale Junction) 230 kV
Q25BM	Beck2* to Burlington and Middleport (Neale Junction) 230 kV
Q24HM	Beck2* to Hamilton and Middleport (Hannon Junction) 230 kV
Q29HM	Beck2* to Hamilton and Middleport (Hannon Junction) 230 kV
Q30M	Beck 2 (Allanburg Junction*) to Middleport 230 kV

Flow East To Toronto (FETT) Interface consists of the following circuits:

B560V	Bruce A to Claireville* 500 kV
M570V	Milton to Claireville* 500 kV
M571V	Milton to Claireville* 500 kV
V586M	Middleport to Claireville* 500 kV
R14T	Trafalgar* to Richview 230 kV
R17T	Trafalgar* to Richview 230 kV
R19T	Trafalgar* to Richview 230 kV
R21T	Trafalgar* to Richview 230 kV
E8V	Orangeville to Essa* 230 kV
E9V	Orangeville to Essa* 230 kV

Flow North (FN) and Interface consists of the following circuits:

X503E Essa* to Hamner 500 kV
X504E Essa* to Hamner 500 kV
D5H Des Joachims* to Holden 230 kV

Flow South (FS) Interface consists of the following circuits:

X503E Hamner to Essa* 500 kV
X504E Hamner to Essa* 500 kV
D5H Holden to Des Joachims* 230 kV

East-West Transfer West (EWTW) Interface consists of the following circuits:

W21M Wawa* to Marathon 230 kV
W22M Wawa* to Marathon 230 kV

East-West Transfer East (EWTE) Interface consists of the following circuits:

W21M Marathon to Wawa* 230 kV
W22M Marathon to Wawa* 230 kV

Claireville North (CLAN) Interface consists of the following circuits:

E510V Claireville* to ESSA 500kV
E511V Claireville* to ESSA 500kV
B82V Claireville* to Brown Hill 230kV
B83V Claireville* to Brown Hill 230kV

Claireville South (CLAS) Interface consists of the following circuits:

E510V ESSA to Claireville* 500kV
E511V ESSA to Claireville* 500kV
B82V Brown Hill to Claireville* 230kV
B83V Brown Hill to Claireville* 230kV

Flow Away from Bruce Complex (FABC) Interface consists of the following circuits:

B560V Bruce* to Claireville 500kV
B561M Bruce* to Milton 500kV
B562L Bruce* to Longwood 500kV
B563L Bruce* to Longwood 500kV
B4V Bruce* to Orangeville 230kV
B5V Bruce* to Orangeville 230kV
B22D Bruce* to Detweiler 230kV
B23D Bruce* to Detweiler 230kV
B27S Bruce* to Owen Sound 230kV
B28S Bruce* to Owen Sound 230kV

Flow West Into Cherrywood (FWIC) Interface consists of the following circuits:

B540C Bowmanville to Cherrywood* 500kV
B541C Bowmanville to Cherrywood* 500kV
B542C Bowmanville to Cherrywood* 500kV
B543C Bowmanville to Cherrywood* 500kV
P15C Dobbin to Cherrywood* 230kV
C28C Chat Falls to Cherrywood* 230kV
H24C Havelock to Cherrywood* 230kV

H26C Havelock to Cherrywood* 230kV
M29C Merivale to Cherrywood* 230kV
B23C Belleville to Cherrywood* 230kV

2.2 Limits of Ontario's Interfaces

The Ontario major interfaces base limits, for all elements in service are shown in the Table D2.1.

Table D2.1 Ontario's Interface Base Limits

Interface	Operating Security Limits (MW)
BLIP	3500
NBLIP	1500
QFW	1800 Summer, 2000 Winter
FABC	5200, normally not limiting
FETT	5700
CLAN	2000
CLAS	1000
FN	1900
FS	1400
E-W	325 East, 350 West

3.0 Definitions and Limits of Ontario's Interconnections

3.1 Definitions of Ontario's Interconnections

The Ontario – Manitoba Interconnection

K21W Kenora 230 kV to Whiteshell 115 kV including combination voltage regulator and phase shifting transformer bank T7 at Whiteshell,

K22W Kenora 230 kV to Whiteshell 115 kV including combination voltage regulator and phase shifting transformer bank T8 at Whiteshell,

SK1 Rabbit Lake 115 kV to Seven Sisters 115 kV including an in-line voltage regulating transformer at Seven Sisters (radial operation only).

Ontario Manitoba Transfer West (OMTW) consists of the following circuits:

K21W Kenora* 230 kV to Whiteshell 230 kV
K22W Kenora* 230 kV to Whiteshell 230 kV

Ontario Manitoba Transfer East (OMTE) consists of the following circuits:

K21W Whiteshell 230 kV to Kenora* 230 kV
K22W Whiteshell 230 kV to Kenora* 230 kV

The Ontario – Minnesota interconnection

F3M Fort Frances 115 kV to International Falls 115 kV including two phase shifting transformers operated in series, T10 and T11, located at International Falls.

Minnesota Power Flow North (MPFN) consists of the following circuit:

F3M International Falls 115 kV to Fort Frances* 115 kV

Minnesota Power Flow South (MPFS) consists of the following circuit:

F3M Fort Frances* 115 kV to International Falls 115 kV

The Ontario – Quebec North interconnection consists of the following circuits:

D4Z Dymond* to Rapide Des Iles 115 kV,
H4Z Holden* to Kipawa 115 kV,

The Ontario – Quebec South interconnection consists of the following circuits:

X2Y Chenaux to Bryson 115 kV,
Q4C Chats Falls to Quoyon 230 kV,
P33C Chats Falls to Paugan 230 kV,
H9A Hawthorne to Maclaren 115 kV,
H2AR Hawthorne to Maclaren 115 kV,
B5D St. Isidore to Beauharnois 230 kV,
B31L St. Lawrence to Beauharnois 230 kV.

The Ontario – Michigan Interconnection consists of the following circuits:

Before June 2001:

B3N Scott* 230 kV to Bunce Creek 120 kV, including in-line autotransformer.
L4D Lambton* 230 kV to St. Clair 345 kV, including in-line autotransformer.

L51D Lambton* 230 kV to St. Clair 345 kV, including in-line autotransformer.
J5D Keith* 230 kV to Waterman 230 kV, including in-line combination voltage regulator and phase shifter SR5.

After June 2001:

B3N Scott* 230 kV to Bunce Creek 120 kV, including in-line autotransformer and phase shifter.
L4D Lambton* 230 kV to St. Clair 345 kV, including two autotransformers in parallel and phase shifter.
L51D Lambton* 230 kV to St. Clair 345 kV, including in-line autotransformer and phase shifter.
J5D Keith* 230 kV to Waterman 230 kV, including in-line combination voltage regulator and phase shifter SR5.

The Ontario – New York Interconnection at Niagara consists of the following 60 Hz circuits to the New York Power Authority (NYPA), and Niagara Mohawk (NiaMo):
BP76 Beck2 230 kV to Packard 230 kV (NiaMo), including in-line voltage regulating transformer R76,
PA27 Beck2 230 kV to Niagara Moses230 kV (NYPA), including in-line voltage regulating transformer R27,
PA301 Beck2 230 kV to Niagara Moses 345 kV (NYPA), including in-line 230 to 345 kV autotransformers T301,
PA302 Beck2 230 kV to Niagara Moses 345 kV (NYPA), including in-line 230 to 345 kV autotransformers T302,
BL104 Beck1 115 kV to Lockport 115 kV (NiaMo),

and the following two 25 Hz circuits

BSC105 Beck1 115 kV to Harper 69 kV (NiaMo), including an in-line 115 to 69 kV transformer at Parks TS,
BSH106 Beck G7 to Harper 69 kV (NiaMo).

The Ontario – New York Interconnection at St. Lawrence consists of the following 60 Hz circuits to the New York Power Authority (NYPA):
L33P St. Lawrence 230 kV to FDR Moses 230 kV (NYPA) including in-line voltage regulating transformer R33 and in-line phase shifting transformer PS33,
L34P St. Lawrence 230 kV to FDR Moses 230 kV (NYPA) including in-line combination voltage regulator and phase shifting transformer PSR34.

3.2 Limits of Ontario's Interconnections

The Ontario interconnection base limits, for all elements in service are shown in the Table D3.1.

Table D3.1 Ontario's Interconnection Limits

Interconnection	Limit (MW) Flows Out of Ontario MW	Limit (MW) Flows Into Ontario
Manitoba – Winter*	300	300
Manitoba – Summer*	288	288
Minnesota	150	100
Quebec North – Winter*	80	78
Quebec North – Summer*	80	64
Quebec South	450	1,330
New York East	400	400
New York Niagara – Winter*	2,050	1,750
New York Niagara – Summer*	1,950	1,450
Michigan – Winter*	2,400 / 2,450**	1,600 / 1,800**
Michigan – Summer*	2,350 / 2,450**	1,500 / 1,765**

*Seasonal Limits are based on thermal ratings and 75% of pre-load. Summer Limits apply from May 1 to October 31 and are based on 0-4 km/hr wind speed and 30 Deg.C ambient temperature (except on ties with Michigan, which are based on 35 Deg.C). Winter Limits apply from November 1 to April 30 and are based on 0-4 km/hr wind speed and 10 Deg.C ambient temperature.

** For the Ontario – Michigan Interconnection the displayed values are, respectively, before June 2001 and after June 2001 (the in service date of the phase shifters).

4.0 Plans – Hydro One

Table D4.1 Committed Plans - Hydro One

Committed Plans	Purpose	Description	Projected In-service
Establish connection to Maclaren Industries	Increase interconnection capacity to Hydro Quebec	Provide 230 kV interconnection via D5A	Sep. 2000
Install generation rejection scheme in the West System	Mitigate some of the impact of full compliance to NPCC, MAPP and NERC (this project deals with respecting loss of double circuit as single contingency).	Reject Atikokan GS for the loss of A21L/A22L or M23L/M24L. (Improve TEM and LE limits)	Nov. 2000
Install phase-shifters on the interconnection to Michigan	Control Lake Erie Circulation and increase import capability	845 MVA unit on L51D and L4D; Reconnect T7 auto to L4D for parallel operation with T8	Jun. 2001
Install shunt capacitor bank at Chatham SS	Increase load meeting capability for the Windsor area	230 kV Capacitor: 225 MVAR @ 249.4 kV	Jun. 2001
Refurbish Chatham SS	Replace end of life facilities	Replace 230 kV circuit breakers and associated equipment	Jul. 2001
Refurbish St Lawrence TS	Replace end of life facilities	Replace 230 kV circuit breakers and associated equipment	Jul. 2001
Refurbish L1S 115 kV line section	Transmission line refurbishment	Refurbish Crystal Falls GS x Warren DS	Dec. 2000

5.0 Planned Transmission Outages

Table D5.1 Transmission Outages Northwest Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
12	K3D Rabbit Lake x Vermilion Bay DS 115kV	18-Sep-00	30-Nov-00	Continuous	8		
13	ST5 Seven Sisters x Transcona 115kV	19-Sep-00	13-Oct-00	Continuous	8		
31	ST6 Seven Sisters x Transcona 115kV	02-Oct-00	13-Oct-00	Continuous	8		
74	D26A Dryden x Mackenzie 230kV	23-Oct-00	02-Nov-00	Continuous	1	250 MW OMTW; 225 MW TEM (Transfer East of Mackenzie)	Not Limiting for expected flow direction
95	WT34 Whiteshell x Transcona 115kV	06-Nov-00	01-Dec-00	Continuous	8		
96	907 Littlefork TS x SHAN 230kV	06-Nov-00	22-Nov-00	Continuous	None		
149	Whiteshell T8 failed	04-Jun-00	31-Dec-01	Continuous	None		

Table D5.2 Transmission Outages Northeast Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
11	L1S Verner DS x Warren DS 115kV	18-Sep-00	30-Nov-00	Continuous	None	5 MW D4Z or H4Z in Mode 2; 15 MW D4Z in Mode 3	
28	W2C Wawa x Chapleau MS 115kV	01-Oct-00	10-Oct-00	Continuous	1		
44	L22L25 Martindale 230kV	02-Oct-00	11-Oct-00	Continuous	8		
57	A24P Algoma x Mississagi 230kV	16-Oct-00	26-Oct-00	Continuous	None		
75	T28P Wells x Mississagi 230kV	23-Oct-00	27-Oct-00	Continuous	12		
97	X27A Hanmer x Algoma 230kV	06-Nov-00	24-Nov-00	Daily - PM only	0.5		
100	T27P Wells x Mississagi 230kV	13-Nov-00	24-Nov-00	Continuous	12		
110	P26W Mississagi x Wawa 230kV	27-Nov-00	08-Dec-00	Continuous	12	105 MW EWTE	May limit NW Zone Generation Dispatch

Table D5.3 Transmission Outages Essa Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
3	T5 Waubaushene 230kV	05-Sep-00	20-Oct-00	Continuous	48		
16	T2 Muskoka 230kV	25-Sep-00	06-Oct-00	Continuous	8		
32	S2S Meaford x Stayner 115kV	02-Oct-00	24-Nov-00	Continuous – No Weekends	4		
63	D4M Des Joachims GS x Minden 230kV	16-Oct-00	20-Oct-00	Continuous	3		
64	D4M Des Joachims GS x Minden 230kV	16-Oct-00	20-Oct-00	Continuous	8		

Table D5.4 Transmission Outages Bruce Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
33	T27 Bruce A 230kV	02-Oct-00	13-Oct-00	Continuous	8		
34	E BUS Bruce A 500kV	02-Oct-00	06-Oct-00	Continuous	8		
35	R27 Bruce A 28kV	02-Oct-00	13-Oct-00	Continuous	8		
58	T4L560 Bruce A 500kV	16-Oct-00	20-Oct-00	Continuous	4		
76	L560 BUS Bruce A 500kV	23-Oct-00	27-Oct-00	Continuous	8		
77	HT4 BUS Bruce A 500kV	23-Oct-00	27-Oct-00	Continuous	8		
90	T25 Bruce A 230kV	06-Nov-00	10-Nov-00	Continuous	8		
91	R25 Bruce A 28kV	06-Nov-00	10-Nov-00	Continuous	8		
92	L24T25 Bruce A 230kV	06-Nov-00	10-Nov-00	Continuous	8		

Table D5.5 Transmission Outages West Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
5	HL45 Buchanan 230kV	11-Sep-00	27-Oct-00	Continuous	None		
17	KL1 Scott 115kV	25-Sep-00	03-Oct-00	Continuous	None		
18	HL27 Scott 230kV	25-Sep-00	06-Oct-00	Continuous	None		
20	KT1L7 Seaforth 115kV	25-Sep-00	06-Oct-00	Continuous	None		
29	DL42 Longwood 230kV	01-Oct-00	07-Oct-00	Continuous	1		
30	L23L29 Chatham 230kV	01-Oct-00	13-Oct-00	Continuous	None		
36	L29 BUS Chatham 230kV	02-Oct-00	09-Oct-00	Daily - No Weekends	4		
37	PL6 Scott 115kV	02-Oct-00	12-Oct-00	Continuous	None		
45	L5L37 Buchanan 230kV	06-Oct-00	19-Oct-00	Continuous	None		
46	1K2 Buchanan 115kV	06-Oct-00	13-Oct-00	Continuous	None		
47	T4L5 Buchanan 115kV	09-Oct-00	20-Oct-00	Continuous	None		
52	T3 Crawford 115kV	13-Oct-00	29-Oct-00	Continuous	None		
53	J4C Keith TS x Crawford 115kV	14-Oct-00	18-Oct-00	Continuous	8		
54	1P2 Buchanan 115kV	14-Oct-00	20-Oct-00	Continuous	None		
55	T4 Crawford 115kV	14-Oct-00	29-Oct-00	Continuous	None		
56	KL29 Chatham 230kV	15-Oct-00	20-Oct-00	Continuous	None		
71	HL37 Buchanan 230kV	21-Oct-00	03-Nov-00	Continuous	None		
72	L5K Buchanan 115kV	21-Oct-00	27-Oct-00	Continuous	None		
73	DL21 Chatham 230kV	22-Oct-00	27-Oct-00	Continuous	None		
81	L9P Buchanan 115kV	28-Oct-00	03-Nov-00	Continuous	None		
83	L21L45 Chatham 230kV	29-Oct-00	03-Nov-00	Continuous	None		
89	KL45 Chatham 230kV	05-Nov-00	10-Nov-00	Continuous	None		
98	KL24 Chatham 230kV	12-Nov-00	17-Nov-00	Continuous	None		
103	DL28 Chatham 230kV	19-Nov-00	24-Nov-00	Continuous	None		
104	J5D Keith TS x Waterman 230kV	20-Nov-00	24-Nov-00	Continuous	1	100 MW FABC; 500 MW Positive BLIP & Negative BLIP; 400 MW OH-MICH & MICH-OH	Reduced Interconnection Capacity
109	L24L28 Chatham 230kV	24-Nov-00	01-Dec-00	Continuous	None		
111	B563L Bruce B x Longwood 500kV	27-Nov-00	15-Dec-00	Daily	2	700 MW FABC; 500 MW Negative BLIP; 500 MW FETT	Negative BLIP will reduce the interconnection import capability
112	K BUS Chatham 230kV	27-Nov-00	01-Dec-00	Continuous	4		
117	D BUS Chatham 230kV	04-Dec-00	08-Dec-00	Continuous	4		
140	W37 Buchanan x Talbot 230kV	02-Apr-01	13-Apr-01	Continuous	144		
147	W36 Buchanan x Talbot 230kV	16-Apr-01	27-Apr-01	Continuous	144		

Table D5.6 Transmission Outages Niagara Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
2	C2P Crowland x Port Colborne TS 115kV	13-Aug-00	17-Dec-00	Continuous	None		
6	B3 Burlington x Dundas 115kV	11-Sep-00	31-Oct-00	Continuous	1		
7	HL7 Allanburg 115kV	11-Sep-00	05-Oct-00	Continuous	None		
14	Q30M Beck 2 x Middleport 230kV	20-Sep-00	17-Nov-00	Continuous – No Weekends	2	100 MW FABC; 200 MW FETT 400 MW QFW	Not Limiting
19	D BUS Nanticoke 500kV	25-Sep-00	05-Oct-00	Continuous	1		
38	D1L29 Hamilton Beach 230kV	02-Oct-00	06-Oct-00	Continuous	24		
48	DL1 Allanburg 115kV	10-Oct-00	03-Nov-00	Continuous	None		
59	T8 Hamilton Beach 230kV	16-Oct-00	20-Oct-00	Continuous	8		
60	DL1 Allanburg 115kV	16-Oct-00	03-Nov-00	Continuous	None		
61	1D2 Beck 2 230kV	16-Oct-00	27-Oct-00	Continuous	None		
62	H8 BUS Hamilton Beach 115kV	16-Oct-00	20-Oct-00	Continuous	None		
78	B4 Burlington x Dundas 115kV	23-Oct-00	27-Oct-00	Continuous	4		
84	DK Newton 115kV	30-Oct-00	03-Nov-00	Continuous	12		
93	A36N Allanburg x Niagara Murray 115kV	06-Nov-00	16-Nov-00	Continuous	None		
102	D6V Detweiler x Orangeville 230kV	16-Nov-00	23-Nov-00	Daily	1		
105	T1 Hamilton Beach 230kV	20-Nov-00	24-Nov-00	Continuous	12		
106	A37N Allanburg x Niagara Murray 115kV	20-Nov-00	30-Nov-00	Continuous	None		
113	T7 Hamilton Beach 230kV	27-Nov-00	01-Dec-00	Continuous	12		
118	T6 Hamilton Beach 230kV	04-Dec-00	08-Dec-00	Continuous	12		
122	T5 Hamilton Beach 115kV	11-Dec-00	15-Dec-00	Continuous	12		
125	T8 Hamilton Beach 230kV	18-Dec-00	22-Dec-00	Continuous	12		
128	Q24HM Hamilton Beach x Dofasco Kenilworth CTS 230kV	15-Jan-01	19-Jan-01	Continuous	None		
130	Q29HM Hamilton Beach x Dofasco Kenilworth CTS 230kV	22-Jan-01	26-Jan-01	Continuous	None		

Table D5.7 Transmission Outages South Western Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
65	T11 Nanticoke 500kV	16-Oct-00	27-Oct-00	Continuous	96		

Table D5.8 Transmission Outages Toronto Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
4	DL511 Claireville 500kV	05-Sep-00	27-Oct-00	Continuous	96		
8	E511V Essa x Claireville 500kV	11-Sep-00	03-Nov-00	Daily	4	700 MW CLAN; 1200 MW FN (Normal); 100 MW FS with G/R	Flow North may become limiting at off peak hours requiring Northern generation to be operated
9	T4 Malvern 230kV	11-Sep-00	20-Oct-00	Continuous	48		
15	R21T Richview x HANJ 230kV	23-Sep-00	06-Oct-00	Continuous	12		
21	T3 Ellesmere 230kV	25-Sep-00	06-Oct-00	Continuous	4		
27	R19T HANJ x Richview 230kV	25-Sep-00	06-Oct-00	Continuous	12		
39	H BUS Cecil 115kV	02-Oct-00	06-Oct-00	Continuous	8		
40	E511V Essa x Claireville 500kV	02-Oct-00	06-Oct-00	Continuous	12		
41	L7L8 Cecil 115kV	02-Oct-00	27-Oct-00	Continuous	48		
49	KL561 Milton 500kV	10-Oct-00	17-Nov-00	Continuous	6	400 MW FETT	Not Limiting
66	T23 Scarboro 230kV	16-Oct-00	20-Oct-00	Continuous	4		
79	L24CR Lakeview GS x Cooksville x Richview 230kV	23-Oct-00	10-Nov-00	Continuous - No Weekends	2		
80	B560V Bruce A x Claireville 500kV	23-Oct-00	27-Oct-00	Continuous	8	850 MW FABC; 500 MW Negative BLIP; 500 MW FETT	Negative BLIP will reduce the interconnection import capability
82	T1 Markham MTS 1 230kV	28-Oct-00	05-Nov-00	Continuous	None		
85	L5D Leaside x Duplex 115kV	30-Oct-00	03-Nov-00	Continuous	8		Some Toronto area outages may be impactive due to coincident Toronto Zone Generator Outages scheduled in Oct and early Nov
86	T16 Claireville 500kV	30-Oct-00	03-Nov-00	Continuous	8	150 MW FETT	See above
101	T8P Pickering B 230kV	13-Nov-00	17-Nov-00	Continuous	4		
107	C4R Cherrywood x Malvern 230kV	20-Nov-00	08-Dec-00	Continuous	12	150 MW FETT	Not Limiting
108	C5R Cherrywood x Malvern 230kV	20-Nov-00	08-Dec-00	Continuous	12	150 MW FETT	Not Limiting
114	L540 BUS Cherrywood 500kV	27-Nov-00	01-Dec-00	Continuous	4		
115	B540C Bowmanville x Cherrywood 500kV	27-Nov-00	01-Dec-00	Continuous	4		
116	T2 Carlton 115kV	27-Nov-00	01-Dec-00	Continuous	None		
119	B541C Bowmanville x Cherrywood 500kV	04-Dec-00	08-Dec-00	Continuous	4		

(Table D5.8 continued)

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
120	L541 BUS Cherrywood 500kV	04-Dec-00	08-Dec-00	Continuous	4		
121	T3 Carlton 115kV	04-Dec-00	08-Dec-00	Continuous	None		
123	C4R Malvern x LEAJ 230	11-Dec-00	22-Dec-00	Continuous	12	150 MW FETT	Not Limiting
124	C5R Malvern x LEAJ 230	11-Dec-00	22-Dec-00	Continuous	12	150 MW FETT	Not Limiting
126	H35D Hamilton Beach x Dofasco Bay Front CTS 230kV	01-Jan-01	31-Jan-01	Continuous	None		

Table D5.9 Transmission Outages East Zone

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
1	T52 Lennox 500kV	07-Mar-99	15-Mar-01	FO	None		
22	D6 PTAW x Chalk River CTS 115kV	25-Sep-00	06-Oct-00	Continuous	4		
23	W6MC Stewartville x Marchwood MS 115kV	25-Sep-00	03-Nov-00	Continuous - No Weekends	4	140 MW Lower Madawaska Total	May bottle generation at local hydro plants unless coincident generator outages are scheduled
24	X522A Lennox x Hawthorne 500kV	25-Sep-00	06-Oct-00	Continuous - No Weekends	4	400 MW Flow Into Ottawa (FIO)	Not Limiting for Demand Levels in the Fall of Year 2000
25	L22 BUS St Lawrence 230kV	25-Sep-00	05-Oct-00	Continuous	6		
26	AL22 St Lawrence 230kV	25-Sep-00	15-Oct-00	Continuous	144		
42	L2L21 Hinchinbrooke 230kV	02-Oct-00	06-Oct-00	Continuous	1		
43	HL34 St Lawrence 230kV	02-Oct-00	06-Oct-00	Continuous	8		
50	X6 Chenaux x Cobden TS 115kV	10-Oct-00	27-Oct-00	Continuous	1		
51	X523A Lennox x Hawthorne 500kV	10-Oct-00	27-Oct-00	Continuous - No Weekends	4	400 MW Flow Into Ottawa (FIO)	Not Limiting for Demand Levels in the Fall of Year 2000
67	L22L27 Hinchinbrooke 230kV	16-Oct-00	20-Oct-00	Continuous	1		
68	HT5L31 Hawthorne 230kV	16-Oct-00	20-Oct-00	Continuous	4		
69	M5G Merivale x Lisgar TS 115kV	16-Oct-00	26-Oct-00	Continuous	24		
70	HL26 St Lawrence 230kV	16-Oct-00	12-Nov-00	Continuous	144		
87	L24A St Lawrence x Hawthorne 230kV	30-Oct-00	10-Nov-00	Continuous - No Weekends	4	100 MW FIO	Not Limiting for Demand Levels in the Fall of Year 2000
88	C27P Dobbin TS x BANN 230kV	30-Oct-00	03-Nov-00	Continuous	12	240 MW Flow Into Dobbin (FID); 30 MW FIO	Requires local generation support and/or Generator cross-tripping armed
138	G4 Darlington A 0kV	30-Mar-01	15-Apr-01	FO	0.1		
94	P4S Sidney TS x Port Hope 115kV	06-Nov-00	28-Dec-00	Continuous - No Weekends	4	75 MW FLOW Into Dobbin	Requires local generation support and/or Generator cross-tripping armed
99	L21L26 St Lawrence 230kV	12-Nov-00	08-Dec-00	Continuous	144		
127	L31L33 St Lawrence 230kV	02-Jan-01	26-Jan-01	Continuous	144		
129	B31L Beauharnois x St Lawrence 230kV	15-Jan-01	01-Feb-01	Continuous – No Weekends	None	400 MW Beauharnois Delivery Limit; 100 MW FIO	Reduced import Capability from Hydro Quebec from 800 MW to 400 MW at Beauharnois
131	L31 BUS St Lawrence 230kV	29-Jan-01	09-Feb-01	Continuous	6		
132	AL31 St Lawrence 230kV	29-Jan-01	23-Feb-01	Continuous	144		

(Table D5.9 continued)

Seq Id#	Element Description	Start	Finish	Outage Type	Recall Hours	Reduction in Limit	Impact
135	L24 BUS St Lawrence 230kV	26-Feb-01	09-Mar-01	Continuous	6		
136	L22L24 St Lawrence 230kV	26-Mar-01	19-Apr-01	Continuous	6		
141	KL520 Lennox 500kV	02-Apr-01	06-Apr-01	Continuous	4		
142	K BUS Lennox 500kV	02-Apr-01	06-Apr-01	Continuous	4		
143	T51 Lennox 500kV	02-Apr-01	06-Apr-01	Continuous	4		
148	H32L33 St Lawrence 230kV	23-Apr-01	17-May-01	Continuous	6		