Hydro One Networks Inc.

7th Floor, South Tower 483 Bay Street Toronto, Ontario M5G 2P5 www.HydroOne.com Tel: (416) 345-5393 Fax: (416) 345-5870

Joanne.Richardson@HydroOne.com

Joanne Richardson

Acting Director – Major Projects and Partnerships Regulatory Affairs



BY COURIER

February 12, 2015

Ms. Kirsten Walli Ontario Energy Board Suite 2700, 2300 Yonge Street Toronto, ON. M4P 1E4

Dear Ms. Walli:

EB-2013-0421 – Hydro One Networks' Section 92 – Supply to Essex County Transmission Reinforcement Project – Hydro One Updates to Prefiled Evidence

In accordance with Procedural Order 3, dated January 30, 2015, I am attaching two paper copies of Hydro One Networks' updated Application and Prefiled Evidence that was filed with the Board on January 22, 2014. The following exhibits were revised to reflect the result of the Board's Decision and Order on the threshold questions (dated December 16, 2014), 2015 approved Transmission rates and updated economic assumptions:

Exhibit A, Tab 1, Schedule 1
Exhibit A, Tab 3, Schedule 1
Exhibit B, Tab 4, Schedule 2
Exhibit B, Tab 4, Schedule 3
Exhibit B, Tab 5, Schedule 1
Exhibit B, Tab 5, Schedule 2

An electronic copy of the updated evidence has been filed using the Board's Regulatory Electronic Submission System (RESS) and the confirmation of successful submission slip is provided with this letter.

Sincerely,

ORIGINAL SIGNED BY JOANNE RICHARDSON

Joanne Richardson

Attach.

cc. EB-2013-0421 Intervenors (electronic only)

Hydro One Networks Inc.

7th Floor, South Tower Toronto, Ontario M5G 2P5
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Susan.E.Frank@HydroOne.com

Tel: (416) 345-5700 Susan.E.Frank@HydroOne.com

Susan Frank

Vice President and Chief Regulatory Officer Regulatory Affairs



BY COURIER

May 23, 2014

Ms. Kirsten Walli Ontario Energy Board Suite 2700, 2300 Yonge Street Toronto, ON. M4P 1E4

Dear Ms. Walli:

EB-2013-0421 - Hydro One Networks' Section 92 - Supply to Essex County Transmission Reinforcement Project - Hydro One Additional Evidence and Updates to Pre-filed Evidence

I am attaching two paper copies of the additional evidence with respect to Hydro One Networks' Application and Pre-filed Evidence that was filed with the Board on January 22, 2014. The draft System Impact Assessment and the draft Customer Impact Assessment have now been filed as Exhibit B, Tab 6, Schedules 3 and 4. Additionally, the following exhibits have been updated:

Exhibit A, Tab 1, Schedule 1	Pages 2 - 4
Exhibit A, Tab 3, Schedule 1	Pages 1, 2, and 4
Exhibit B, Tab 2, Schedule 1	Pages 1 and 3
Exhibit B, Tab 4, Schedule 2	Page 1
Exhibit B, Tab 4, Schedule 3	Pages 1, 4 - 16
Exhibit B, Tab 4, Schedule 5	Pages 6 - 7
Exhibit B, Tab 5, Schedule 2	Page 1
Exhibit B, Tab 6, Schedule 1	Pages 1 - 5

An electronic copy of both the additional evidence and the updated evidence have been filed using the Board's Regulatory Electronic Submission System (RESS) and the confirmation of successful submission slip is provided with this letter.

Sincerely,

ORIGINAL SIGNED BY SUSAN FRANK

Susan Frank

Attach.

cc. EB-2013-0421 Intervenors (electronic only)

Hydro One Networks Inc.

8th Floor, South Tower 483 Bay Street Toronto, Ontario M5G 2P5 www.HydroOne.com Tel: (416) 345-5700 Fax: (416) 345-5870 Cell: (416) 258-9383 Susan.E.Frank@HydroOne.com

Susan Frank

Vice President and Chief Regulatory Officer Regulatory Affairs



BY COURIER

January 22, 2014

Ms. Kirsten Walli Secretary Ontario Energy Board Suite 2700, 2300 Yonge Street P.O. Box 2319 Toronto, ON. M4P 1E4

Dear Ms. Walli:

EB-2013-0421 – Hydro One Networks' Section 92 – Supply to Essex County Transmission Reinforcement Project – Application and Evidence

I am attaching two (2) copies of the Hydro One Networks' Application and Prefiled Evidence in support of an Application pursuant to Section 92 of the Ontario Energy Board Act for an Order or Orders granting leave to construct 13 km of transmission line facilities in the Windsor – Essex area. Additionally, Hydro One requests that the Board endorse the methodology for allocation of upstream costs at the distribution level as proposed in this Application.

An electronic copy of the complete application has been filed using the Board's Regulatory Electronic Submission System (RESS) and the proof of successful submission slip is attached.

Hydro One Networks' contacts for service of documents associated with this Application are listed in Exhibit A, Tab 1, Schedule 1.

Sincerely,

ORIGINAL SIGNED BY SUSAN FRANK

Susan Frank

Attach

c. Charlene de Boer (electronic only)

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 1 Schedule 1 Page 1 of 5

APPLICATION

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ONTARIO ENERGY BOARD

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In the matter of the Ontario Energy Board Act, 1998;

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And in the matter of an Application by Hydro One Networks Inc. for an Order or
Orders granting leave to construct new transmission facilities ("Supply to Essex County
Transmission Reinforcement "SECTR" Project") in the Windsor – Essex region in

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southwestern Ontario.

1. The Applicant is Hydro One Networks Inc. ("**Hydro One**"), a subsidiary of Hydro One Inc. The Applicant is an Ontario corporation with its head office in the City of Toronto. Hydro One carries on the business, among other things, of owning and operating transmission facilities within Ontario.

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- 2. Hydro One hereby applies to the Ontario Energy Board ("**the Board**") pursuant to Section 92 of the *Ontario Energy Board Act, 1998* ("**the Act**") for an Order or Orders granting leave to construct approximately 13 kilometers of transmission line facilities in the Windsor Essex area. These facilities are required to:
- a) address electricity supply capacity needs in the Windsor Essex area;
- b) minimize the impact of major transmission outages to customers in the area; and
 - c) ensure that Hydro One is compliant with the IESO's Ontario Resource and Transmission Assessment Criteria.

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3. The proposed transmission project, between Leamington Junction (located along the Chatham Switching Station to Keith Transmission Station 230 kV corridor)

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 1 Schedule 1 Page 2 of 5

and a new transmission station, Leamington TS, in the municipality of 2 Leamington, includes:

- Construction of approximately 13 km of new 230 kV double-circuit line on steel lattice towers on a new ROW;
- Installation of optic ground wire ("OPGW") for system telecommunication purposes on top of the new 230 kV towers serving Leamington TS as well as new OPGW on the existing towers near Leamington Junction;
- Construction of a new Leamington TS.

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A map showing the general location of the proposed facilities is provided in Exhibit B, Tab 2, Schedule 2.

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The proposed in-service date is March 2018.

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4. The Ontario Power Authority ("OPA") has determined the need for the project and the alternatives that were considered as part of the integrated plan for the Windsor-Essex area. The OPA's evidence on the need for the project is filed at Exhibit B, Tab 1, Schedule 5.

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5. The total cost of the line facilities for which Hydro One is seeking approval is 20 estimate to be approximately \$45 million. The estimated cost of associated 21 station work with the SECTR Project is \$32 million. The details are provided in 22 Exhibit B, Tab 4, Schedule 2. The project economics as filed in Exhibit B, Tab 23 **4, Schedule 3** indicate that the project will result in no increase in the Line 24 Connection pool rate and a maximum increase of 0.50% in the Transformation 25 Connection pool rate (\$0.01 increase). It is estimated that there is a minimal 26 impact (0.01%) on the overall average Ontario consumer's electricity bill. 27

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 1 Schedule 1 Page 3 of 5

The OPA has provided an assessment of the appropriate apportionment of the costs associated with the SECTR Project. The analysis concludes that 22.5% should be allocated to transmission ratepayers due to system benefits and the remainder paid for by local load customers due to customer benefits. The OPA cost responsibility evidence is provided in **Exhibit B**, **Tab 4**, **Schedule 4**.

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In regard to the customer benefits and consistent with the OEB's "beneficiary pays" principle, Hydro One has proposed an allocation of costs at the distribution level for the transmission investments associated with the SECTR Project. This methodology ensures fairness in the allocation of upstream transmission costs and avoids cross-subsidization at the distribution level among beneficiaries.

Commencement of the SECTR project is contingent upon the Board endorsing the methodology as described in **Exhibit B, Tab 4, Schedule 5.**

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The SECTR Project is expected to have no significant environmental impacts. A
Class EA was completed for the Project under the Class Environmental
Assessment for Minor Transmission Facilities ("Class EA") approved by the
Ministry of the Environment ("MOE"). The Class EA process is described in
Exhibit B, Tab 6, Schedule 1.

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The Independent Electricity System Operator ("**IESO**") has provided a draft System Impact Assessment ("**SIA**") of the proposed facilities to assess the impact of these facilities on the IESO-controlled grid. The Draft SIA is filed as **Exhibit B, Tab 6, Schedule 3**.

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26 11. A Customer Impact Assessment ("CIA") in accordance with Hydro One's customer connection procedures, is filed as Exhibit B, Tab 6, Schedule 4.

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 1 Schedule 1 Page 4 of 5

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- 12. Hydro One has consulted stakeholders in the Windsor – Essex area to identify 1 potential concerns associated with the construction of the proposed transmission 2 The feedback received from stakeholders was considered and facilities. 3 incorporated into the preparation of this Application. The stakeholder 4 consultation process is described in Exhibit B, Tab 6, Schedule 5. 5 Municipalities, LDCs, the WindsorEssex Economic Development Corporation, 6 growers and their associations have provided letters of support that can be found 7 in Exhibit B, Tab 6, Schedule 2. Hydro One will continue to communicate with 8 stakeholders and the local community to ensure that potential concerns during the 9 10 construction and commissioning stages of the proposed facilities are addressed.
- Details on the Hydro One engagement process with neighbouring First Nation and Métis communities is filed in **Exhibit B, Tab 6, Schedule 6**.
- New permanent land rights on properties from Leamington Junction to
 Leamington TS will be required to accommodate the proposed transmission
 facilities. Temporary rights for construction purposes will also be required at
 specific locations along the corridor. Further information regarding the real estate
 needs to complete this project are provided in **Exhibit B, Tab 6, Schedule 7.**
- This Application is supported by written evidence which includes details of the Applicant's proposal for the transmission reinforcement work. The written evidence is prefiled as attached and may be amended from time to time prior to the Board's final decision on this Application. Further, the Applicant may seek meetings with Board Staff and intervenors in an attempt to identify and reach agreements to settle any issues arising out of this Application.

16. Hydro One requests a written hearing for this proceeding.

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 1 Schedule 1 Page 5 of 5

1	17.	Hydro One requests that a c	copy of all documents filed with the Board be served	
2		on the Applicant and the Applicant's counsel, as follows:		
3				
4	a)	The Applicant:		
5				
6		Ms. Erin Henderson		
7		Senior Regulatory Coordinato	r	
8		Hydro One Networks Inc.		
9				
10		Mailing Address:	7 th Floor, South Tower	
11			483 Bay Street	
12			Toronto, Ontario	
13			M5G 2P5	
14		Telephone:	(416) 345-4479	
15		Fax:	(416) 345-5866	
16		Electronic access:	regulatory@HydroOne.com	
17				
18	b)	The Applicant's counsel:		
19				
20		Michael Engelberg		
21		Assistant General Counsel		
22		Hydro One Networks Inc.		
23			ab.	
24		Mailing Address:	15 th Floor, North Tower	
25			483 Bay Street	
26			Toronto, Ontario	
27			M5G 2P5	
28		Telephone:	(416) 345-6305	
29		Fax:	(416) 345-6972	
30		Electronic access:	mengelberg@HydroOne.com	

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 2 Schedule 1 Page 1 of 4

EXHIBIT LIST

2

<u>Exh</u>	<u>Tab</u>	<u>Schedule</u>	Contents
<u>A</u>			Administration
	1	1	Application
	2	1	Exhibit List
	3	1	Summary of Prefiled Evidence
	4	1	Procedural Orders/Affidavits/Correspondence
	5	1	Notices of Motion
<u>B</u>			Applicant's Prefiled Evidence
	1	1	Project Location and Existing Transmission System
		2	Map of Existing Facilities
		3	Schematic Diagram of Existing Facilities
		4	Need for the Proposed Facilities
		5	OPA Evidence on Need and Alternatives
		6	IESO ORTAC Requirements
	2	1	Description of the Proposed Facilities
		2	Map of Proposed Facilities
		3	Schematic Diagram of Proposed Facilities
		4	Cross Section of the Tower Types - Existing and Proposed

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 2 Schedule 1 Page 2 of 4

<u>Exh</u>	<u>Tab</u>	Schedule	Contents		
<u>B</u>	3	1	Alternatives Considered		
	4	1	Project Costs, Economics, and Other Public Interest Considerations		
		2	Project Costs		
		3	Project Economics		
		4	OPA Cost Responsibility Evidence		
		5	Proposed Cost Allocation Methodology at the Distribution Level for Upstream Transmission Investments		
			Attachment 1: Transmission System Code Including Appendix 5		
		6	Other Public Interest Considerations		
	5	1	Construction and Project Administration		
		2	Table Showing Proposed Construction and In-Service Schedule		
	6	1	Other Matters / Agreements / Approvals		
		2	Letters of Endorsement		
	Attachment 1: Municipality of Learnington				
			Attachment 2: Town of Kingsville		
			Attachment 3: County of Essex		
			Attachment 4: Ontario Greenhouse Vegetable Growers Association		
			Attachment 5: Nature Fresh Farms		
			Attachment 6: Orangeville Farms		

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 2 Schedule 1 Page 3 of 4

<u>Exh</u>	<u>Tab</u>	<u>Schedule</u>	Contents	
<u>B</u>	6	2	Attachment 7: Essex Powerlines Corp.	
			Attachment 8: WindsorEssex Economic Development Corporation	
			Attachment 9: Entegrus Powerlines Inc.	
		3	IESO's System Impact Assessment	
		4	Customer Impact Assessment	
		5	Stakeholder and Community Consultation	
			Attachments 1: Example of Municipal and County Officials Correspondence	
			Attachment 2-3: Newspaper Advertisement & Flyer for PIC 1	
			Attachment 4-5: Newspaper Advertisement & Flyer for PIC 2	
			Attachment 6-7: Newspaper Advertisement & Direct Mail Postcard for PIC 3	
			Attachment 8: Sample Comment Form	
			ttachment 9: Notice of Completion of the Draft ESR	
			attachment 10: Minister Letter to Hydro One Dated May 18, 2010	
			Attachment 11: Example of Municipal and County Officials Update	
			Attachment 12: Notification to Potentially Affected Property Owners	
		6	First Nations & Métis Engagement	
			Attachment 1: First Nations and Métis Potential Interest Correspondence	

Attachment 2: October 09, 2013 Hydro One Letter to Ministry of Energy

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 2 Schedule 1 Page 4 of 4

<u>Exh</u>	<u>Tab</u>	Schedule	Contents
<u>B</u>	6	6	Attachment 3: November 04, 2013 Ministry of Energy Letter to Hydro One
			Attachment 4: Hydro One Engagement Activities
		7	Land Matters
			Attachment 1: Offer to Grant an Easement

Attachment 2: Off Corridor Temporary Access and Access Road

Attachment 3: Temporary Construction License Agreement

Attachment 4: Damage Claim Agreement and Release

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 3 Schedule 1 Page 1 of 5

SUMMARY OF PREFILED EVIDENCE

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- 3 Hydro One Networks Inc. ("Hydro One") is applying to the Board for an order granting
- leave to construct transmission facilities in the Windsor Essex area pursuant to Section
- 5 92 of the *Ontario Energy Board Act*, 1998 ("**the Act**").

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- 7 The proposed facilities, to be constructed, owned and operated by Hydro One are as
- described in **Exhibit B**, **Tab 2**, **Schedule 1**. A map showing the location of the proposed
- 9 transmission facilities is provided in **Exhibit B**, **Tab 2**, **Schedule 2**.

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- 11 The planned in-service date for the Supply to Essex Country Transmission
- Reinforcement ("SECTR") Project is March 2018. A construction schedule for the
- project is shown at **Exhibit B**, **Tab 5**, **Schedule 2**.

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- The evidence identifies near-term supply capacity and other reliability needs in the
- Windsor Essex region. Specifically, there is a need for additional supply capacity in
- the Kingsville–Leamington 115 kV subsystems, and a need to minimize the impact of
- supply interruptions to customers in the J3E-J4E subsystem. Currently the J3E-J4E
- subsystem does not comply with the IESO's Ontario Resource and Transmission
- 20 Assessment Criteria restoration criteria. Further evidence on need is found in **Exhibit B**,
- Tab 1, Schedule 4 and Exhibit B, Tab 1, Schedule 5.

- The Independent Electricity System Operator ("IESO") has provided a Draft System
- Impact Assessment ("SIA") for the SECTR Project. It is filed as Exhibit B, Tab 6,
- 25 **Schedule 3**.

Updated: 2015-02-12 EB-2013-0421 Exhibit A Tab 3 Schedule 1 Page 2 of 5

- A Customer Impact Assessment ("CIA"), in accordance with Hydro One's customer 1
- 2 connection procedures, is filed as **Exhibit B**, **Tab 6**, **Schedule 4**.

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- The total cost of the SECTR Line Project is estimated to be \$77 million. The proposed 4
- new transmission facilities will be included in both the line connection pool and the 5
- transformation connection pool revenue requirements as the new facilities will address 6
- both system needs and load customer needs. Details of the project economics are filed in 7
- Exhibit B, Tab 4, Schedule 3. 8

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In conjunction with the Hydro One application to the Board for an order granting leave to construct transmission facilities, Hydro One also requests that the Board endorse the proposed cost allocation methodology at the distribution level for the customer-related transmission investments associated with the SECTR Project provided in Exhibit B, Tab **4, Schedule 5**. This methodology, modelled on cost responsibility provisions of the Transmission System Code, ensures fairness in the allocation of upstream transmission costs and avoids cross-subsidization at the distribution level among beneficiaries. In an effort to ensure regulatory certainty for ratepayers (including Hydro One Distribution, embedded local distribution companies and large commercial distributon customers) a decision on a methodology for allocating, at the distribution level, the upstream customer-related investment costs is required in order for Hydro One to proceed with the 20 SECTR Project.

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- The design of the proposed facilities is in accordance with good utility practice and meets 23
- the requirements of the *Transmission System Code* for licensed transmitters in Ontario. 24

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 3 Schedule 1 Page 3 of 5

The SECTR Project is subject to the *Class Environmental Assessment for Minor Transmission Facilities* process, in accordance with the Ontario *Environmental Assessment Act*. Agency and public comments received during the draft Environmental Study Report review and comment period were addressed and documented in the final ESR, which was filed with the Ministry of the Environment in July 2010. Prior to construction, Hydro One will obtain all regulatory approvals, licences and permits, as required. Details on the environmental assessment process are filed in **Exhibit B, Tab 6,**

Schedule 1.

Hydro One has consulted with affected property owners and stakeholders in the project study area. The purpose of the consultation was to identify potential concerns associated with the construction activities of the proposed transmission facilities. The feedback received from stakeholders was considered and incorporated into the preparation of this Application. Details regarding the consultation process are filed as **Exhibit B**, **Tab 6**, **Schedule 5**. Hydro One will continue to work with the local community and landowners and will ensure that potential concerns identified as part of the Environmental Approval process and during the construction phase are addressed.

Hydro One is undertaking an engagement process with neighbouring First Nations communities. In 2008 Hydro One advised the Ontario Ministry of Aboriginal Affairs ("MAA") and Indian and Northern Affairs Canada ("INAC") of the SECTR project and requested input on First Nation and Métis interests in the area. The MAA advised that the project did not appear to be located in an area where First Nation existing or asserted rights could be impacted by the SECTR Project. INAC determined that Specific Claims have been submitted by Caldwell First Nation, Walpole Island First Nation, Chippewas of Kettle and Stony Point, Chippewas of the Thames First Nation, Oneida Nation of the Thames, Munsee-Delaware Nation, and Moravian of the Thames First Nation. In addition, they recommended that Hydro One apprise Aamjiwnaang First Nation of the

Updated: 2014-05-23 EB-2013-0421 Exhibit A Tab 3 Schedule 1 Page 4 of 5

- SECTR Project. Further information on Hydro One's engagement process with First
- 2 Nations and Métis is filed in **Exhibit B, Tab 6, Schedule 6**.

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- 4 Hydro One requests a written hearing for this proceeding and submits that the evidence
- supports granting the requested Order based on the following grounds:
- The need for additional supply in the Windsor-Essex area and the need to minimize the impact of supply interruptions has been established;
- There are no adverse system or anticipated customer impacts from the project;
 - The project will be fully compliant with the relevant codes, rules and licences;
 - There will be a minor customer total bill impact (approximately 0.01%) as a result of the new line facilities.

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- In order for the proposed project to proceed, it must be considered to be in the "public interest". Subsection 96(2) of the Act specifies that, for section 92 purposes, "the Board shall only consider the interests of consumers with respect to prices and the reliability and quality of electricity service" and "where applicable and in a manner consistent with the policies of the Government of Ontario, the promotion of the use of renewable energy sources." Hydro One submits that the proposed facilities are in the public interest because:
- The existing capability of the transmission system in the Windsor Essex area is not sufficient to serve the anticipated future electricity demand resulting from population growth and economic activity;
 - The SECTR Project is a cost-effective solution to achieving this objective;
- The need for the SECTR Project has been determined by the OPA and the Project is supported by multiple parties in the Windsor Essex area. The support of these parties is documented in 9 letters of endorsement provided in **Exhibit B, Tab 6,**Schedule 2;

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 3 Schedule 1 Page 5 of 5

- There will be no material impact on the price of electricity; and
- The cost responsibility methodology proposed is consistent with the Transmission
- 3 System Code and the Ontario Energy Board's "beneficiary pays" principles
- 5 For the reasons provided above, Hydro One respectfully submits that the proposed
- transmission line facilities should be approved under section 92 of the Act. Accordingly,
- 7 Hydro One requests an Order from the Board pursuant to section 92 of the Act granting
- 8 leave to construct the proposed transmission line facilities. In addition, Hydro One
- 9 requests that the Board endorse the methodology for allocation of upstream costs at the
- distribution level as set out in this Application.

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 4 Schedule 1 Page 1 of 1

PROCEDURAL ORDERS/AFFIDAVITS/CORRESPONDENCE

Filed: 2014-01-22 EB-2013-0421 Exhibit A Tab 5 Schedule 1 Page 1 of 1

NOTICES OF MOTION

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 1 Page 1 of 4

PROJECT LOCATION AND EXISTING TRANSMISSION SYSTEM

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1.0 PROJECT LOCATION

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5 The Supply to Essex County Transmission Reinforcement ("SECTR") Project described

6 in Exhibit B, Tab 2, Schedule 1, is located in the Windsor - Essex region of

7 Southwestern Ontario.

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9 The Windsor - Essex region comprises the Town of Amherstburg, Town of Essex, Town

of Kingsville, Town of Lakeshore, Town of La Salle, Municipality of Leamington,

Township of Pelee, Town of Tecumseh, City of Windsor, and western portions of the

Municipality of Chatham-Kent. Electricity distribution in the region is carried out by

ENWIN Powerlines Ltd., Essex Powerlines Corporation, Essex-Lakeshore-Kingsville

(E.L.K.) Inc., Entegrus Power Lines Inc., and Hydro One Distribution.

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A map of the existing facilities is provided in **Exhibit B**, **Tab 1**, **Schedule 2**, and a

schematic electrical diagram of the existing facilities is provided in **Exhibit B**, **Tab 1**,

Schedule 3.

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2.0 EXISTING TRANSMISSION FACILITIES IN WINDSOR – ESSEX

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22 The 230 kV and 115 kV transmission lines in the Windsor – Essex region provide supply

to load stations, connect generating stations to the bulk electricity system, and connect

the Ontario transmission system with the Michigan transmission system. The main

25 transmission corridor in the region provides for the connection of the region with the rest

of the Hydro One system at Chatham Switching Station ("SS") in the Municipality of

27 Chatham-Kent. Two 230 kV double-circuit lines, C21J/C23Z and C22J/C24Z, run east-

west in this corridor, located south of Highway 401, from Chatham SS to Sandwich

Junction in the Town of Lakeshore. The circuits are reconfigured at this location and 230

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 1 Page 2 of 4

- kV double-circuit line C21J/C22J continues west to Keith TS in Windsor, while 230 kV
- double-circuit line C23Z/C24Z runs northwest in another corridor to Lauzon TS in
- 3 Windsor.

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- 5 The main 115 kV transmission corridor runs through the city of Windsor from Keith TS
- 6 through Essex TS to Lauzon TS. Double-circuit line J3E/J4E located in this corridor
- 7 connects Keith TS with Essex TS, and double-circuit line Z1E/Z7E connects Essex TS
- with Lauzon TS. Other 115 kV transmission corridors provide for circuits K2Z and K6Z.
- 9 115 kV circuits E8F and E9F running from Essex TS to Ford Windsor MTS are
- underground cables and provide supply to four stations dedicated to the automotive
- industry.

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- The major transmission station in the Windsor-Essex region is Keith TS which provides
- an inter-connection with the Michigan transmission system via 230 kV circuit J5D and an
- in-line phase shifter. The two 230 kV stations in the region, Keith TS and Lauzon TS,
- connect the region's 115 kV network to the 230 kV transmission system via two 230/115
- kV autotransformers in each station.

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- There are six customer-owned generating plants in the region connecting at the 230 kV
- and 115 kV levels: Brighton Beach CGS, West Windsor Power CGS, East Windsor CGS,
- 21 Windsor TransAlta CGS, Gosfield WFCGS and Pointe-Aux-Roches WFCGS with a
- combined contract capacity of 927 MW.

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- Voltage support is provided in the region by capacitor banks at Keith TS, Lauzon TS,
- 25 Crawford TS, Essex TS, Kingsville TS, Walker TS, Belle River TS and Malden TS.

- 27 Post contingency thermal and voltage concerns exist in the Windsor Essex region, and
- these concerns are managed with a Special Protection System ("SPS"), the Windsor Area
- 29 Special Protection Scheme. This SPS assists in managing thermal overload by splitting

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 1 Page 3 of 4

- the bus at Essex TS, rejection of generation at Brighton Beach CGS, and rejection of load
- at Kingsville TS and Belle River TS. The SPS assists in managing voltage concerns by
- rejecting load at Kingsville TS following the detection of sustained low voltage at the
- 4 station.

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- For the purpose of this evidence, the transmission system in the Windsor-Essex area can
- be divided into the following nested subsystems (see Figure 1 below):

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- The Kingsville-Leamington Subsystem: customers are supplied from Kingsville TS.
 - The J3E-J4E Subsystem: customers supplied from the 230/115 kV autotransformers at Keith TS and Lauzon TS via the 115 kV system, as well as customers supplied directly from Lauzon TS via 230/27.6 kV transformers. The Kingsville-Leamington

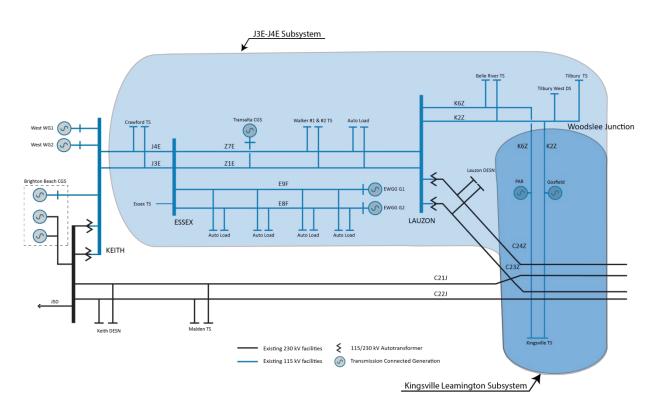
subsystem is nested within the J3E-J4E subsystem.

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Although part of the overall Windsor–Essex region, Keith TS and Malden TS which are supplied from circuits C21J and C22J are not included in any of the subsystems as there are no supply adequacy issues associated with them.

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 1 Page 4 of 4

Figure 1: Subsystems representation



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Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 2 Page 1 of 2

MAP OF EXISTING FACILITIES



Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 3 Page 1 of 1

SCHEMATIC DIAGRAM OF EXISTING FACILITIES

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Tilbury W DS Belle Rv TS Tilbury Windsor Walker Ford TS Brighton TransAlta TS Essex Beach K6Z Crawford Pte_Aux Roches WF 😊+ Essex J1B J3E Z1E K2Z J4E Z7E E8F J20B J2N E9F W Windsor Lauzon Windsor Chrysler GM C23Z Ford Ford MTS Windsor Annex Windsor C24Z TS MTS MTS MTS C21J J5D C22J Sandwich **Chatham SS** Junction **Keith TS** Malden Gosfield TS Legend WF 230 kV 115 kV Kingsville TS

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 4 Page 1 of 6

NEED FOR THE PROPOSED FACILITIES

1.0 BACKGROUND

5 This Schedule describes the need to reinforce the transmission system in the Windsor -

6 Essex region to address transmission capacity, restoration and congestion issues in the

7 area.

The Windsor – Essex region has a well-established history in manufacturing and farming, in particular greenhouse vegetable production. The region is a major regional load centre in Ontario, and had a combined peak demand of over 1,000 MW in the years before 2008 but has been below 1,000 MW since 2008, a reflection of the severe economic downturn in the region. However, future demand growth in the region is forecast and is expected to be largely driven by the load growth in the Kingsville-Leamington subsystem. The growth in demand in this subsystem is largely attributable to projected growth in the greenhouse sector (as indicated by customer connection requests and the current outlook for expansion of existing greenhouse operations) and anticipated growth from new operations. This area is well known for its greenhouses and has the largest concentration of greenhouse vegetable production in North America. This concentration of greenhouses is expected to intensify over the next five years.

The recent closure of the Heinz plant in Leamington is not expected to have a significant impact on the area demand forecast, reaffirmed by the Mayor of Leamington in his letter of support available for reference at **Exhibit B**, **Tab 6**, **Schedule 2 Attachment 1**

The OPA, in the 2007 Integrated Power System Plan ("**IPSP**") report, identified a preferred plan involving transmission reinforcement to address reliability needs related to the transmission system in the Windsor-Essex area. In 2008 Hydro One commenced

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project development work, including environmental assessment, for the reinforcement of the transmission system to address these needs. In 2010, development activities were put on hold as a result of substantial reduction in the load in the region following the 2008 economic downturn. However, as stated in the OPA need evidence, referenced in **Exhibit B, Tab 1, Schedule 5,** recent studies based on the latest demand forecast confirm that the system inadequacies identified in earlier studies will worsen over the next 20 years and there is a need to proceed with the transmission improvements.

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2.0 NEED

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The OPA has provided evidence on the need for the Supply to Essex County Transmission Reinforcement ("SECTR") Project in Exhibit B, Tab 1, Schedule 5 ("OPA Need Evidence"). This evidence has identified near-term supply capacity and other reliability needs in the Windsor – Essex region. Specifically, there is a need for additional supply capacity in the Kingsville–Leamington 115 kV subsystem, and a need to minimize the impact of supply interruptions to customers in the J3E-J4E subsystem.

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3.0 RELEVANT TRANSMISSION PLANNING GUIDELINES

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The IESO's Ontario Resource and Transmission Assessment Criteria ("ORTAC") (see Exhibit B, Tab 1, Schedule 6) establishes the technical criteria for assessing the adequacy and security of the IESO controlled grid, and for assessing the need for transmission system enhancements. ORTAC requires that the transmission system must be planned to meet certain criteria. The transmission planning criteria that pertain to the need for the transmission reinforcement proposed (i.e., a new 230/27.6 kV Leamington TS and a new 230 kV two-circuit supply line) in this application are as follows:

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i. Transmission Equipment Thermal Overload Criteria – All line and equipment loadings shall be within their continuous ratings and within their long-term emergency ratings with one element out of service.

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- 5 The OPA Need Evidence shows that in the Kingsville-Leamington subsystem circuit
- 6 K6Z would be overloaded in the summer period following the outage of circuit K2Z.
- Also in this subsystem, the Kingsville TS is close to its thermal capacity following the
- 8 outage of one transformer.

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i. Voltage Performance Criteria – The voltages at all buses are to be within ORTAC specified limits before and after a recognized contingency. In addition, bus voltage change following a recognized contingency must be within specified limits.

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The OPA Need Evidence shows that in the Kingsville-Leamington subsystem, circuit K2Z would not be capable of supporting adequate bus voltages following the outage of circuit K6Z.

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ii. Load Restoration Criteria – All load interrupted following a contingency must be restored within approximately 8 hours. If the load amount exceeds 150 MW, the amount in excess of 150 MW must be restored in 4 hours. If the load amount exceeds 250 MW, the amount in excess of 250 MW must be restored in 30 minutes.

22

As stated in the OPA Need Evidence, there is insufficient restoration capability in the J3E-J4E subsystem to restore all the load interrupted following a contingency involving double-circuit 230 kV circuits C23Z and C24Z. By 2017, up to 125 MW of the load interrupted cannot be restored.

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4.0 PROJECT CATEGORIZATION

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4.1 Project Classification (Development, Connection, Sustainment)

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Per the Board's Filing Guidelines, the first stage of project categorization is the classification of a project as development, connection, or sustainment:

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• Development projects are those for providing (i) an adequate supply capacity and/or maintaining an acceptable or prescribed level of customer or system reliability for load growth meeting increased stresses on the system; or (ii) enhancing system efficiency such as minimizing congestion on the transmission system and reducing system losses.

• Connection projects are those for providing connection of a load or generation customer or group of customers to the transmission system.

• Sustainment projects are those for maintaining the performance of the transmission network at its current standard or replacing end-of-life facilities on a "like for like" basis.

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Based on the above criteria the SECTR Project is classified as a Development and Connection Project, as it incorporates elements of these two project types:

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- 22 The development part of the project is to:
- provide supply capacity increase for meeting the needs of the Kingsville-Leamington subsystem into the long-term;
- minimize the impact of supply interruptions to customers in the Windsor Essex region; and,
- relieve congestion of generation connected at Keith TS.

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- The connection part of the project is to:
- provide for the connection of expected new load in the Kingsville Leamington area
 to the transmission system.

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4.2 Need Classification

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- 7 The second stage of project categorization is to distinguish whether the project need is
- 8 determined beyond the control of the Applicant ("non-discretionary") or determined at
- 9 the discretion of the Applicant ("discretionary"). Non-discretionary projects may be
- triggered or determined by such things as:

11

- a) mandatory requirement to satisfy obligations specified by regulatory organizations including NPCC/NERC or by the Independent Electricity System Operator (IESO);
- b) a need to connect new load (of a distributor or large user) or new generation (connection);
- 16 c) a need to address equipment loading or voltage/short circuit stresses when their rated 17 capacities are exceeded;
- d) projects identified in a Board or provincial government approved plan;
- e) projects that are required to achieve provincial government objectives that are prescribed in governmental directives or regulations; and
- f) a need to comply with direction from the Ontario Energy Board in the event it is determined that the transmission system's reliability is at risk.

23

- The SECTR Project is considered non-discretionary, as it will:
- Enable ORTAC requirements to be met;
- accommodate new load; and,
- mitigate circuit overloading where the load level has exceeded capacity.

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The following table captures these two dimensions of the project categorization.

		PROJECT NEED	
		Non-discretionary	Discretionary
Project Class	Development	X	
Troject class	Connection	X	

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OPA EVIDENCE ON NEED AND ALTERNATIVES

Supply to Essex County Transmission Reinforcement Project

Ontario Power Authority

January, 2014













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1 1 Executive Summary

- 2 Near-term supply capacity and restoration needs have been identified in the Windsor-Essex area.
- 3 Demand in the Kingsville-Leamington subsystem has exceeded the supply capacity in recent
- 4 years and is expected to continue to exceed the supply capacity over the 20 year forecast period.
- 5 In addition, the J3E-J4E subsystem, which covers a large portion of the Windsor-Essex area,
- 6 does not comply with prescribed Ontario Resource and Transmission Assessment Criteria
- 7 ("ORTAC") restoration criteria. To address these needs, the Ontario Power Authority ("OPA")
- 8 recommends an integrated package composed of 1) conservation and demand management,
- 9 2) distributed generation resources, and 3) transmission reinforcements in the Windsor-Essex
- 10 area.
- 11 Conservation and demand management along with distributed generation resources are important
- contributors to the integrated solution for addressing the needs of the Windsor-Essex area.
- Together, these resources are expected to offset more than 90% of the growth in the area
- 14 between 2014 and 2033.
- 15 The balance of the Windsor-Essex area's needs can be addressed by the new Supply to Essex
- 16 County Transmission Reinforcement ("SECTR") project, plus planned sustainment work in the
- area. The SECTR project consists of the installation of a new 230 kV-supplied transformer
- station ("TS) near Learnington (approximately \$32 million) connected to the existing C21J/C22J
- circuits via a new 13 km double-circuit 230 kV connection line (approximately \$45 million).
- The estimated completion date for the SECTR project is 2016. In conjunction with transferring
- 21 the majority of the load from the existing Kingsville TS to the new Leamington TS, the
- 22 Kingsville TS will be downsized, increasing the cost effectiveness of the overall solution.
- 23 Together these facilities will meet the supply capacity needs of the Kingsville-Leamington area
- over the forecast period. The addition of a new supply point will also substantially meet the
- restoration needs of the J3E-J4E subsystem.
- 26 It is the OPA's view that this integrated solution is a cost-effective and technically-effective
- solution for meeting the capacity and reliability needs of the Windsor-Essex area. This
- 28 integrated solution benefits both local customers and transmission ratepayers. The OPA
- 29 therefore proposes that the cost of the project be allocated between local customers and

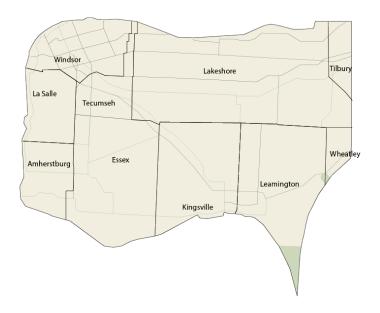
- transmission ratepayers in accordance with the Ontario Energy Board's ("Board") beneficiary
- 2 pays principle, as explained in Exhibit B, Tab 4, Schedule 4.

2 Introduction

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- 4 The Windsor-Essex area, for the purpose of regional planning encompasses the City of Windsor
- 5 and Essex County in southwestern Ontario. It includes the City of Windsor, the Municipality of
- 6 Leamington, the Town of Amherstburg, the Town of Essex, the Town of Kingsville, the Town of
- 7 Lakeshore, the Town of LaSalle, the Town of Tecumseh, and the Township of Pelee, as well as
- 8 the western portion of the Municipality of Chatham-Kent. This area is shown in Figure 1 below.

9 Figure 1: The Windsor-Essex Regional Planning Study Area



10

11 Source: OPA

- The population in the area is about 400,000¹ people and has been steady over recent years.² The
- Windsor-Essex area has a long history as an industrial hub of Ontario, owing largely to the long-

¹ Population counts, for Canada, provinces and territories, census divisions, population centre size groups and rural areas, 2011 Census, Statistics Canada. At https://www12.statcan.gc.ca/census-recensement/2011/dp-pd/hlt-fst/pd-pl/Table-Tableau.cfm?LANG=Eng&T=703&SR=1&S=80&O=A&RPP=99&CMA=0&PR=35.

- term presence of several automotive manufacturing facilities. It also has a strong agri-business
- 2 centered around the towns of Kingsville and Leamington.
- 3 In terms of electricity use, the Windsor-Essex area had a peak electricity demand of
- 4 approximately 800 MW in the summer of 2013. Five local distribution companies ("LDCs")
- 5 provide distribution service in the area, including EnWin Utilities Ltd. (serving the City of
- 6 Windsor), Essex Powerlines Corporation, E.L.K. Energy Inc., Entegrus Inc., and Hydro One
- 7 Distribution. Of these five, EnWin Utilities Ltd. and Hydro One Distribution are connected
- 8 directly to the transmission system, while the remainder are embedded within the Hydro One
- 9 distribution system.
- Planning to meet the electrical needs of a large area or region is done through a regional planning
- process that considers the interrelated needs of the region over a 20 year planning horizon and
- seeks to address them through an integrated range of solutions. The plan, termed an Integrated
- 13 Regional Resource Plan ("IRRP"), takes into consideration, among other things, the electricity
- requirements, anticipated growth and existing electricity infrastructure. The outcome of the
- regional planning process is an integrated plan to guide electricity infrastructure investments,
- resource development and procurement decisions for the region.
- Prior to the formalization of the IRRP planning process, regional planning activities were
- undertaken in the Windsor-Essex area. The first regional plan was developed as part of the
- OPA's 2007 Integrated Power System Plan. That plan identified three aspects of the electricity
- supply in this area that were not in compliance with the Ontario Independent Electricity System
- Operator's ("IESO") reliability planning standards: 1) inadequate supply capacity in the east part
- of the region, 2) unreliable load restoration capability for the overall Windsor-Essex area supply,
- and 3) inadequate transmission capacity for delivering the available generation capacity located
- in the west part of Windsor to the Ontario grid. A number of solutions to address these
- 25 inadequacies were identified, including conservation measures, and a transformer station in the
- 26 Leamington area.

² The population of the City of Windsor has been steady between 2009 and 2012. See *Population of census metropolitan areas, 2009 to 2012*, Statistics Canada. At http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/demo05a-eng.htm.

- 1 Shortly thereafter, the economic downturn in 2008 and 2009 had a significant impact on
- 2 electricity demand in the Windsor-Essex area; peak demand in the area was reduced by nearly
- 3 20%. In light of this, development activities associated with the proposed Learnington TS were
- 4 placed on hold. In the intervening years, the electricity demand and other developments in the
- 5 Windsor-Essex area have been monitored closely.
- 6 In 2010 a regional planning group was formed consisting of representatives of the five LDCs in
- 7 the area, as well as Hydro One Transmission, the IESO and the OPA. An updated assessment of
- 8 the reliability needs for the 20 year period to 2030 was presented to the working group in the
- 9 summer of 2011. At that time, demand in the area had not recovered sufficiently from the
- economic downturn, and the study concluded that there was no immediate need for augmenting
- the existing electricity supply in the area. Accordingly, the working group recommended
- continued monitoring of demand growth in the area and implementation of minor improvements
- on the distribution system.
- Based on updated customer and LDC demand information, Hydro One Distribution is now
- forecasting robust growth for agri-business (greenhouse expansions) in the Kingsville-
- 16 Learnington area. Based on this current demand forecast, a recent study confirms that the system
- inadequacies identified in the earlier studies will worsen and there is a need to proceed with the
- demand and supply side improvements that were earlier identified.
- 19 The purpose of this evidence is to explain the reliability needs which have re-emerged in the
- 20 Windsor-Essex area, and to recommend an integrated solution i.e. conservation and demand
- 21 management ("CDM") and distributed generation ("DG"), along with transmission and
- 22 distribution investments to address these needs. Based on expected growth in electricity
- 23 demand in the Windsor-Essex area, these recommended solutions will provide an adequate level
- of capacity to serve the increased forecast demand and improve the reliability of overall
- electricity supply in the area to 2033 or beyond.

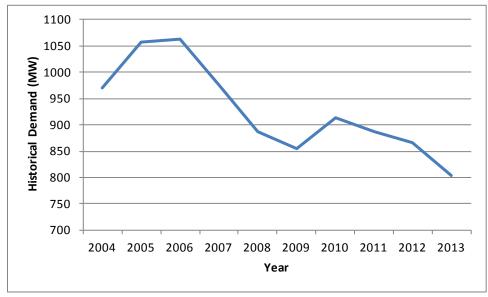
3 Historical and Forecast Electricity Demand

2 3.1 Historical Electricity Demand in the Windsor-Essex Area

- 3 Figure 2 shows the historical peak net demand for electricity recorded for the Windsor-Essex
- 4 area from 2004 to 2013. Since peaking at approximately 1,060 MW in the summer of 2006,
- 5 peak electricity demand has declined to approximately 800 MW in 2013, representing a
- 6 reduction of about 24%. The economic downturn beginning in 2008 contributed to this
- 7 reduction. The impacts of CDM achievement and DG development in the area have also been
- 8 contributing factors.

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9 Figure 2: Windsor-Essex Area Historical Electricity Demand³



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Source: OPA

12 A large concentration of automotive manufacturing facilities is located in the City of Windsor

and represents a major economic driver and electricity user within the Windsor-Essex area. This

sector has not been immune to the challenges facing Ontario's manufacturing sector, nor to the

economic downturn, both of which have resulted in a decline in electricity use.

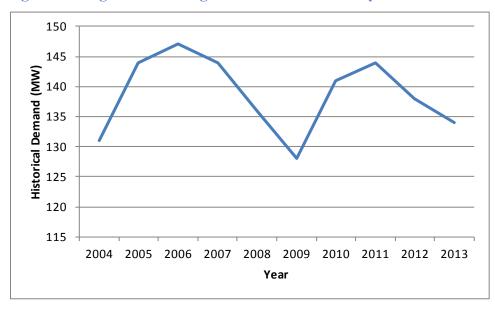
³ Historical electricity demand reflects the weather experienced at the time of system peak.

- 1 While the manufacturing sector continues to face recovery challenges in the Windsor-Essex area,
- 2 economic diversification is changing the region's growth and electricity use. The 2011 Windsor-
- 3 Essex Regional Economic Roadmap identifies nine industry groups that hold potential for the
- 4 Windsor-Essex region, including advanced manufacturing, tourism, and agri-business. Essex
- 5 County contains the largest concentration of greenhouse vegetable production in North
- 6 America.⁵ This sector is expected to experience major growth in the future, with much of the
- 7 activity taking place in the Kingsville-Leamington area.
- 8 As shown in Figure 3 below, peak demand in the Kingsville-Leamington area has experienced
- 9 similar fluctuations as the Windsor-Essex area since 2004. However, in 2013, the demand in the
- Kingsville-Learnington area was roughly the same as in 2004, whereas the demand in the
- 11 Windsor-Essex area as a whole was significantly lower as previously discussed. Similar to the
- broader Windsor-Essex area, the impact of CDM and DG has contributed to a reduction in peak
- demand in the Kingsville-Leamington area. Within the Kingsville-Leamington area, there was
- approximately 14 MW of effective capacity of distributed generation connected at Kingsville TS
- by the summer of 2013, none of which was connected in 2004.

⁴ Windsor-Essex Regional Economic Roadmap, Windsor Essex Economic Development Corporation, February 2011

⁵County of Essex website. At http://www.countyofessex.on.ca/wps/wcm/connect/COE/COE/ABOUT+ESSEX+COUNTY/.

Figure 3: Kingsville-Leamington Historical Electricity Demand⁶



3 Source: OPA

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4 3.2 Future Electricity Demand Outlook for the Windsor-Essex Area

- 5 The latest update of the area's electricity demand forecast indicates significant growth in the
- 6 Kingsville-Leamington area in east Essex due to planned greenhouse expansion. That growth is
- 7 predominantly attributable to forecast growth in the greenhouse sector as indicated by customer
- 8 connection requests received by Hydro One Distribution, the current outlook for expansion of
- 9 existing greenhouse operations, and anticipated growth from new operations. Such growth
- 10 expectations are based on approved and proposed development plans provided by the
- Municipalities of Leamington and Kingsville, and a survey completed by the Ontario
- Greenhouse Vegetable Growers on behalf of local greenhouse growers.
- Similarly, the population of Kingsville is expected to increase by 0.5% per year over the next
- decade, which is higher than the slight population decline expected in the Windsor-Essex area
- overall during the 2014 to 2033 planning horizon.

⁶ Historical electricity demand reflects the weather experienced at the time of system peak.

⁷ Windsor-Essex Economic Development Corporation website. At <u>www.choosewindsoressex.com</u>.

- 1 The future demand outlook for the Windsor-Essex area was translated into a summer peak gross
- 2 electricity demand forecast, which was developed by the area LDCs. That forecast was
- 3 influenced by a number of factors such as economic, household and population growth. Hydro
- 4 One Distribution has indicated that the recent announcement regarding the closure of a large
- 5 food processing facility in the area is not expected to have a material impact on the gross demand
- 6 forecast as demand for electricity at this facility was primarily during non-summer months.
- 7 The following sections discuss how CDM and DG contribute to the planning forecast developed
- 8 for the Windsor-Essex area's peak electricity demand.

9 3.3 Contribution of CDM and DG to the Electricity Demand Forecast

- 10 The OPA's planning forecast identifies the peak electricity demand that must be served by the
- transmission system. In developing the planning forecast, the gross demand forecast serves as
- the starting point. Next, the impact of CDM (defined as reducing or shifting electricity
- consumption), must be factored into future electricity usage. Finally, the impact of DG
- 14 (generation which is connected alongside load on the distribution system and has the effect of
- reducing the amount of demand that must be supplied via transformer stations and related
- transmission facilities) must be factored in.
- To summarize, the OPA, working with the LDCs, undertook the following process to assess the
- 18 Windsor-Essex area's planning forecast:

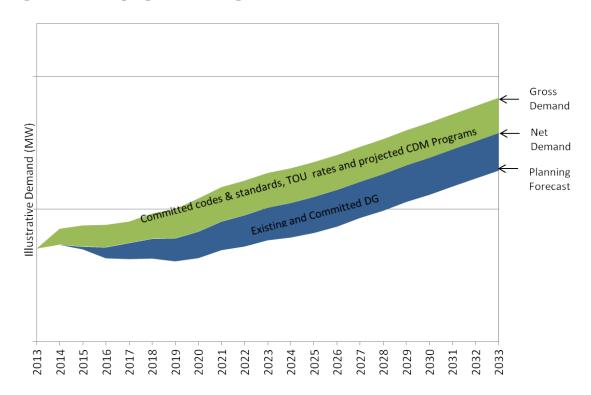
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- 19 (a) First, "gross demand" is established. Gross demand reflects the forecast developed by
 20 the area LDCs and is influenced by a number of factors such as economic, household and
 21 population growth.
 - (b) Second, the OPA estimates "net demand" by reducing the gross demand by expected savings from improved building codes and equipment standards, customer response to time-of-use pricing, and projected province-wide CDM programs.
 - (c) Lastly, the OPA determines the "planning forecast" by reducing net demand by the contribution in the area from existing, committed and forecast DG.
- 27 It should be noted that these forecasts reflect extreme weather conditions.
- 28 Gross demand, net demand, and the planning forecast are illustrated in Figure 4 below.

Figure 4: Developing the Planning Forecast



Source: OPA

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3.3.1 Developing Net Demand: Windsor-Essex Area Conservation Forecast

- 5 As noted above, the future demand outlook for the Windsor-Essex area was translated into a
- 6 gross demand forecast by the area LDCs. Next, the CDM forecast was used to determine the net
- 7 demand.
- 8 The OPA develops CDM savings forecasts to meet province-wide CDM targets. The expected
- 9 peak demand reduction from CDM in the Windsor-Essex area is then developed based on an
- allocation of the province-wide CDM savings forecast.
- In December 2013, Ontario's Long-Term Energy Plan ("2013 LTEP") established a long-term
- 12 conservation target of 30 TWh by 2032. In the near term, Ontario's LDCs have a peak demand
- reduction target of 1,330 MW to be achieved by 2014 and the government is currently
- developing a new "Conservation First" CDM Framework for 2015-2020, which will include
- assigning conservation goals to LDCs. The long-term conservation target is expected to offset
- most of the growth in electricity demand to 2032 in each regional area, including the Windsor-
- 17 Essex area.

- 1 The CDM targets are expected to be met by peak reductions achieved through improved building
- 2 codes and equipment standards, customer response to time-of-use pricing, and projected CDM
- 3 programs.
- 4 Based on an allocation of the province-wide CDM savings forecast to meet the 2013 LTEP
- 5 target, about 65 MW in peak demand reduction is expected to be achieved through improved
- 6 building codes and equipment standards and customer response to time-of-use pricing within the
- 7 Windsor-Essex area by 2033. An additional 107 MW in planned peak demand reduction is
- 8 expected to result from province-wide CDM programs in the Windsor-Essex by the same year.

9 3.3.2 Developing the Planning Forecast: Windsor-Essex Area Distributed Generation

- 10 Forecast
- 11 The DG forecast is used to determine the planning forecast. DG resource development in
- Ontario has been encouraged by the *Green Energy and Green Economy Act, 1998* and associated
- procurements, including the Feed-In Tariff ("FIT") program. These procurements take into
- consideration the system need for generation as well as cost.
- One aspect related to DG that should be noted is that wind and solar generation are variable
- resources, which are not always available at the time of system peak. Therefore, the full
- installed capacity of these facilities cannot be relied upon to meet the Windsor-Essex area's
- 18 requirements. The OPA estimates that the existing and contracted distributed renewable
- 19 generation (almost entirely made up of wind and solar resources) in the Windsor-Essex area will
- 20 contribute approximately 47 MW of effective capacity to meeting area peak demand in 2014. 8
- 21 In addition to the distributed renewable generation described above, Great Northern Tri-Gen is
- an 11 MW gas-fired combined heat and power ("CHP") generation station located at
- 23 Kingsville TS. In addition to producing electricity and heat, Great Northern Tri-Gen also
- 24 produces carbon dioxide for use in greenhouse operations. The recent growth in the Kingsville-
- Learnington greenhouse industry has led to local interest in this type of CHP application.
- 26 Finally, in 2013 the OPA received a directive from the Minister of Energy to continue procuring
- 27 additional renewable generation as part of the FIT program until 2017. These FIT procurements

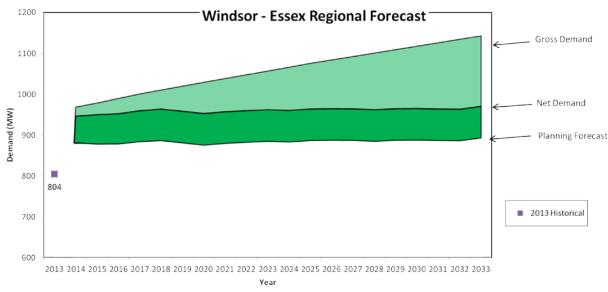
⁸ Effective capacity is the portion of installed capacity that contributes at the time of system peak.

- are subject to annual procurement targets of 200 MW from 2014 to 2017. Based on recently
- 2 completed FIT procurements, the OPA estimates that approximately 3% of each annual target
- 3 will be contracted in the Windsor-Essex area.
- 4 In total, approximately 80 MW of effective capacity is expected from DG resources in the
- 5 Winsor-Essex area by 2033. This contribution is added to the net forecast to generate the
- 6 planning forecast.

7 3.4 Windsor-Essex Regional and Kingsville-Leamington Area Planning Forecast

- 8 In this section, the planning forecast for the Windsor-Essex area and the Kingsville-Leamington
- 9 area are explained. The planning forecast for the Kingsville-Leamington area is particularly
- important since significant growth is anticipated to be concentrated in that area due to planned
- 11 greenhouse expansion.
- 12 The summer peak demand planning forecast of the Windsor-Essex area is shown in Figure 5,
- along with the gross demand and net demand for the area. Within the Windsor-Essex area, the
- planned peak demand reduction between 2014 and 2033 is approximately 150 MW from CDM,
- and approximately 15 MW from DG. The peak demand reduction from CDM and DG is
- expected to offset about 94% of the forecast gross demand growth in the area between 2014 and
- 17 2033.

1 Figure 5: Planning Forecast for the Windsor-Essex Area⁹

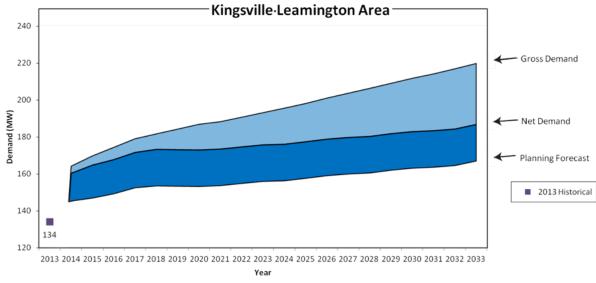


Source: OPA

- 4 Within the Windsor-Essex area, the strongest growth in electricity demand is expected in the
- 5 Kingsville-Leamington area. The summer peak demand planning forecast for this area is shown
- 6 in Figure 6 below. The planned peak demand reduction between 2014 and 2033 for Kingsville-
- 7 Leamington area is approximately 29 MW from CDM, and approximately 6 MW from DG. The
- 8 peak demand reduction from CDM and DG is expected to offset about 63% of the forecast gross
- 9 demand growth in the area between 2014 and 2033.

⁹ 2013 value reflects actual electricity demand and weather.

1 Figure 6: Planning Forecast for the Kingsville-Leamington Area 10



Source: OPA

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4 Windsor-Essex Area Electricity Supply

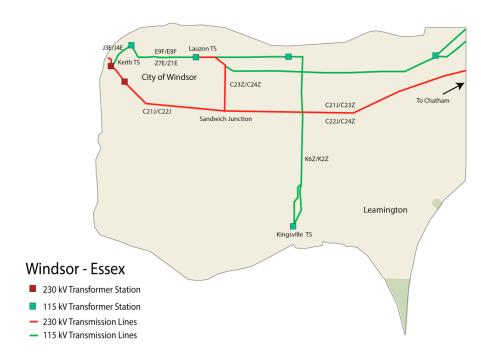
- 5 The Windsor-Essex area is supplied from a combination of generation located in the region and
- 6 from the Ontario grid via a network of 230 kV and 115 kV transmission lines and stations. The
- 7 following section will describe the salient aspects of this system, its capabilities and limitations.

8 4.1 Transmission in the Windsor-Essex Area

- 9 The transmission system serving the Windsor-Essex area is comprised of two major 230 kV
- transmission lines running from east to west through the area, and a number of 115 kV
- transmission lines as shown in Figure 7 below.

¹⁰ 2013 value reflects actual electricity demand and weather.

Figure 7: Windsor-Essex Area Transmission Facilities

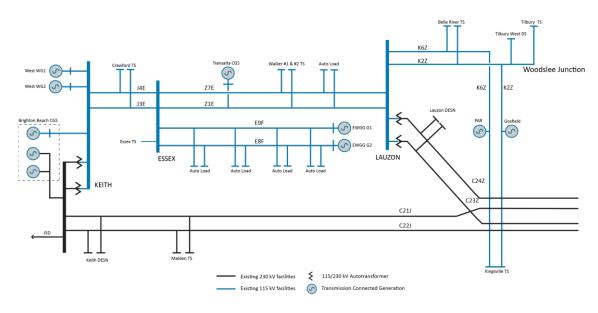


3 Source: OPA

2

- 4 The main 230 kV transmission corridor running east-west through the area connects the area to
- 5 the bulk transmission system at the Chatham Switching Station ("SS"), near the City of
- 6 Chatham. This corridor contains two 230 kV double-circuit transmission lines: C21J/C23Z and
- 7 C22J/C24Z. At Sandwich Junction (indicated in Figure 7) the 230 kV circuits are reconfigured
- 8 into C21J/C22J and C23Z/C24Z pairs, and these double-circuit lines proceed to Keith TS and
- 9 Lauzon TS respectively (the two main supply points for the Windsor-Essex area). Two
- autotransformers at each of Keith TS and Lauzon TS connect these stations to the 115 kV
- system, described in further detail below. The Ontario system is also interconnected with the
- Michigan electricity system through an interconnection at Keith TS, including an in-line phase
- 13 shifter.
- The City of Windsor is largely supplied by a 115 kV network between Keith TS and Lauzon TS.
- The urban network is connected to Keith TS and Lauzon TS via the transmission lines J3E/J4E
- and Z1E/Z7E, respectively. The area east of Windsor is supplied by two 115 kV transmission
- 17 lines, K2Z and K6Z, connected radially to Lauzon TS. This system supplies the communities of
- 18 Belle River, Kingsville, Leamington, Tilbury, and surrounding areas. The electrical connectivity
- 19 for the region is depicted in Figure 8 below.

Figure 8 Windsor - Essex Area Transmission System



2 3 Source: OPA

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- 4 Approximately 65% of the Windsor-Essex area's load is supplied by the 115 kV system, with the
- 5 remainder supplied by transformers connected directly to the 230 kV system. Given the large
- 6 proportion of load which is supplied by the 115 kV system, the reliability of supply via the two
- 7 supply points at Keith TS and Lauzon TS is especially important.

4.2 Transmission Connected Generation in the Windsor-Essex Area

- 9 In addition to the transmission supply in the Windsor-Essex area, there are four existing
- transmission connected natural gas-fired generating stations in the region: Brighton Beach
- Power Station ("Brighton Beach GS"), West Windsor Power, TransAlta Windsor and the East
- 12 Windsor Cogeneration Centre. These stations have a total generating capacity of approximately
- 13 787 MW. The largest of these is Brighton Beach GS, a combined cycle generating facility, with
- a capacity of 526 MW. The other three are CHP facilities with a total capacity of 261 MW.
- Over recent years, renewable generation has been playing an increasingly important role in
- meeting Ontario's energy needs. Major renewable energy investments began with three
- 17 Renewable Energy Supply ("RES") competitive procurement processes. Since then, the OPA
- has carried out a number of renewable procurement initiatives including the Renewable Energy
- 19 Standard Offer Program ("RESOP"), and the FIT program. Throughout this time there has been

- significant interest in renewable energy development in the Windsor-Essex area. To date, 100
- 2 MW of transmission connected wind generation with connection points inside the study area has
- 3 come into service.
- 4 As previously discussed, wind generation is an intermittent resource which is not always
- 5 available at the time of system peak. The full installed capacity of these wind facilities therefore
- 6 cannot be relied upon to meet the Windsor-Essex area's electricity needs. The OPA estimates
- 7 that the 100 MW of transmission connected wind generation will contribute approximately
- 8 16 MW of effective capacity to meeting area peak demand. 11
- 9 The transmission connected generating stations and their contract expiry dates (where
- applicable) are listed in Table 1, below. The West Windsor Power and TransAlta Windsor
- facilities both have expiry dates in 2016, the former prior to the summer peak demand period for
- that year, the latter after the peak of the year. Given their near-term expiry dates, these two
- facilities have not been assumed to be available over the 20 year planning horizon.

¹¹ As described in Section 3.3.2, effective capacity is that portion of installed capacity that contributes at the time of system peak.

Table 1: Transmission Connected Generation Facilities in the Windsor-Essex Area

Technology	Station Name	Contract Expiry Date	Connection Point	Contract Capacity (MW)	Summer Effective Capacity (MW)
Combined Cycle Generating Facility	Brighton Beach Power December Station 2024		Keith TS	541	526
Combined Heat and Power (CHP)	West Windsor Power	May 31, 2016	J2N (Keith TS)	128	107
	TransAlta Windsor	December 1, 2016	Z1E	74	74
	East Windsor Cogeneration Centre	November 5, 2029	E8F/E9F	84	80
Renewables	Gosfield Wind Project	January 12, 2029	K2Z	51	8
	Point Aux Roches Wind Farm	December 5, 2031	K6Z	49	8

2 3 Source: OPA

1

4 5 Reliability Needs in the Windsor-Essex Area

- 5 The IESO's ORTAC (Exhibit B, Tab 1, Schedule 6) establishes planning criteria and
- 6 assumptions for assessing the present and future reliability of Ontario's transmission system.
- 7 These criteria are used to assess the reliability needs of the Windsor-Essex area.

8 Supply Capacity

- 9 In accordance with ORTAC, the transmission system supplying a local area (i.e., subsystem)
- shall have sufficient capability under peak demand conditions to withstand specific outages
- prescribed by ORTAC while keeping voltages and line and equipment loading within applicable
- limits. More specifically, the maximum demand that can be supplied by the remaining system
- following the outage of a single element, as prescribed by ORTAC, is the "supply capacity" or

- 1 the "load meeting capability" ("LMC") of the system. ¹² For example, if a subsystem is served
- by a double-circuit transmission line, the LMC for the subsystem is the maximum demand that
- 3 can be supplied by the weaker of the two circuits.
- 4 Minimizing the Impact of Supply Interruptions
- 5 In accordance with ORTAC, in the event of a major outage (for example a contingency on a
- 6 double-circuit tower line resulting in the outage of both circuits), the transmission system shall
- 7 be planned to minimize the impact of supply interruptions to customers both by reducing the
- 8 number of customers affected by the outage and by restoring power to those affected within a
- 9 reasonable timeframe. ORTAC therefore prescribes service interruption standards for certain
- sized load centres following such major transmission outages. Specifically, it provides that
- following a major outage no more than 600 MW of load will be interrupted, and that for load
- pockets less than 600 MW, load be restored within the following timeframes:
- all load lost in excess of 250 MW must be restored within half an hour;
 - all load lost in excess of 150 MW must be restored within four hours; and
- all load lost in the area must be restored within eight hours. 13
- 16 Application of ORTAC Criteria
- 17 For the purpose of this evidence, the transmission system in the Windsor-Essex area can be
- divided into the two following "nested" subsystems:
 - The Kingsville-Leamington subsystem: customers supplied from Kingsville TS; and
- The J3E-J4E subsystem: customers supplied from the 230/115 kV autotransformers at
- 21 Keith TS and Lauzon TS via the 115 kV system, as well as customers supplied from the
- 22 230 kV Lauzon Dual Element Spot Network ("DESN").
- These two subsystems are shown in Figure 9 below. It is important to note that these two
- subsystems are overlapping, with the Kingsville subsystem nested within the other. Therefore,
- 25 where the demand for the J3E-J4E subsystem is referred to in this evidence it is inclusive of
- demand in the Kingsville-Learnington subsystem. Likewise, increasing supply to the Kingsville-
- Learnington subsystem will impact the supply and demand balance in the J3E-J4E subsystem.

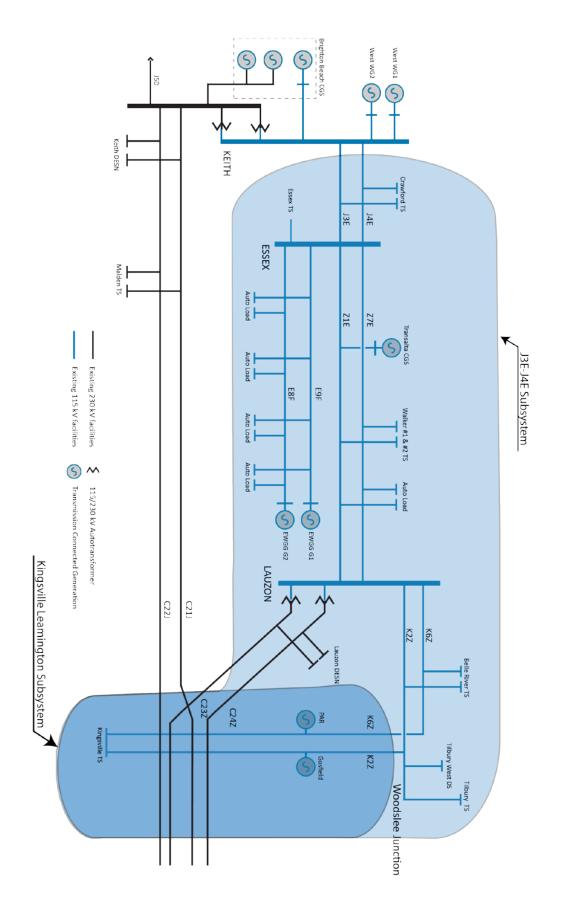
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¹² ORTAC.

¹³ ORTAC.

Figure 9: Windsor-Essex Area Subsystems for Determining Need



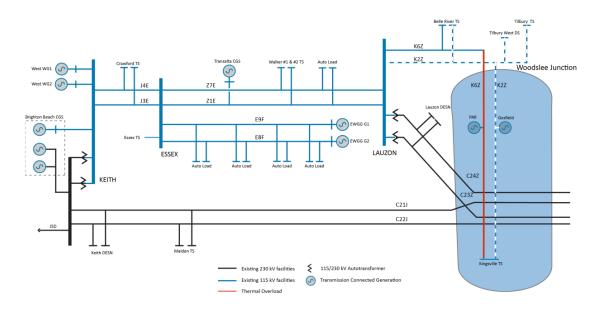
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Source: OPA

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- 1 Based on an application of the ORTAC criteria there are two reliability needs in the Windsor-
- 2 Essex area: (i) the need for additional supply capacity in the Kingsville-Leamington subsystem,
- and (ii) the need to minimize the impact of outages to customers in the J3E-J4E subsystem. The
- 4 following sections provide an overview of the capability of the existing Windsor-Essex
- 5 transmission system and the detailed needs of each subsystem.
- 6 5.1 Need for Additional Supply Capacity and Associated End-of-Life Replacement in the
- **Windsor-Essex Area: Kingsville-Leamington Subsystem**
- 8 Three supply capacity needs have been identified within the Kingsville-Leamington subsystem:
- 9 1. the planning forecast exceeds the thermal load meeting capability of the Kingsville TS
- 10 115 kV connection line;
- 11 2. the planning forecast for Kingsville TS exceeds the voltage limit; and
- 12 3. the planning forecast for Kingsville TS exceeds the station capability.
- 13 These three needs are described in further detail below.
- 14 The Kingsville-Leamington subsystem has an LMC of approximately 120 MW. This LMC is
- based on the thermal limit of the K6Z transmission line between Woodslee Junction and
- Kingsville TS following the loss of the K2Z transmission line. The voltage limitation at
- 17 Kingsville TS associated with this outage is also close to the 120 MW level. The following
- 18 figure shows the limiting K2Z contingency.

1 Figure 10: Kingsville-Leamington Subsystem Following the Critical Contingency

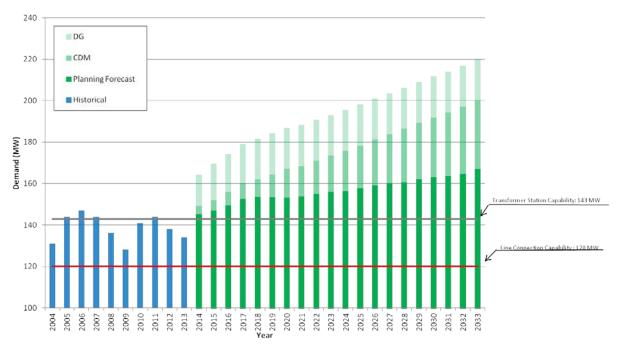


3 Source: OPA

- 4 As shown in Figure 11 below, during the summer months the peak demand has exceeded this
- 5 limit, requiring the use of operating measures. The figure shows that based on the planning
- 6 forecast, the Kingsville-Leamington area is expected to continue to exceed this LMC of 120 MW
- 7 for the forecast period.
- 8 In addition, Kingsville TS has a LMC of approximately 143 MW, also shown in Figure 11
- 9 below. This limit is based on the thermal capability of the remaining three transformers after the
- loss of one of the transformers at Kingsville TS. Based on the planning forecast, the Kingsville-
- Leamington area is expected to exceed the 143 MW transformer station LMC for the forecast
- 12 period.

1 Figure 11: Historical and Forecast Demand and Supply Capabilities in the Kingsville-

2 Leamington Subsystem



Source: OPA

3 4

- 5 As shown in Figure 11, the planning forecast of demand in the Kingsville-Leamington subsystem
- 6 will exceed the LMC for the area by 25 MW in 2014. This gap will increase to 46 MW by 2033.
- 7 Additional capacity is therefore required to meet current and future electricity demand in the
- 8 Kingsville-Leamington subsystem. Until additional capacity is provided, operating measures
- 9 such as an existing load rejection scheme (which is in violation of the ORTAC) will be required.
- 10 The existing system does not meet the ORTAC criteria for supply capacity.

11 Table 2: Summary of Capacity Needs in the Windsor-Essex Area

Limiting Elements	Contingency or Limitation	Limit (MW)	Need Date	
K6Z thermal limit	Loss of K2Z	120	Now	
Kingsville TS voltage limit	Loss of K6Z	132	Now	
Kingsville TS	Station Thermal Capacity	143	Now	

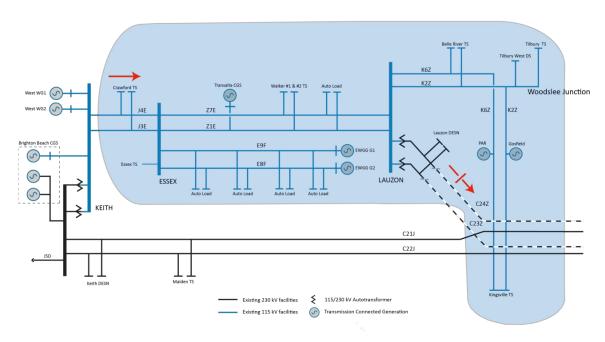
12 Source: OPA

- 1 In addition to the above supply capacity needs, there are other infrastructure replacement and
- 2 enhancements needed. There are currently four transformers at Kingsville TS. One of these
- 3 units was recently replaced, but the other three units are reaching their end-of-life and require
- 4 replacement in the near future. Additional distribution feeder positions are also required to
- 5 increase the capability of the distribution system in the Kingsville-Leamington area.
- 6 5.2 Need to Minimize the Impact of Supply Interruptions in Order to Meet ORTAC
- 7 Requirements in the Windsor-Essex Area: J3E-J4E Subsystem and Keith TS
- 8 Autotransformers
- 9 In addition to the above capacity needs, based on current and forecast demand, the J3E-J4E
- subsystem does not comply with the ORTAC restoration criteria.
- 5.2.1 Subsystem Configuration and Potential Contingencies
- The J3E-J4E subsystem is supplied by two double-circuit 230 kV transmission lines between
- 13 Chatham SS and Lauzon TS and Keith TS, respectively. The C23Z/C24Z double-circuit
- contingency is the most limiting outage for this subsystem. In the event of the loss of the
- 15 C23Z/C24Z transmission line, the Lauzon DESN station, which is directly connected to this line,
- is lost immediately. Subsequent to the outage, the 115 kV system must be supplied entirely
- through the path consisting of the Keith autotransformers and the J3E/J4E 115 kV transmission
- line. The thermal capacity of the two 230/115 kV autotransformers at Keith TS limits the supply
- to the 115 kV system to approximately 300 MW.
- 20 One of the Brighton Beach GS gas-fired generators is connected to the 115 kV bus at Keith TS
- between the Keith autotransformers and the J3E/J4E transmission line. The capability of the
- J3E/J4E line, which is higher than the capability of the Keith autotransformers, can be fully
- 23 utilized by a combination of supply from the transmission system and generation at Brighton
- Beach GS. Due to this arrangement, the thermal capacity of the J3E/J4E transmission line limits
- 25 the supply to the 115 kV system after the C23Z/C24Z double-circuit contingency to
- approximately 440 MW. Because this would not be enough to meet the peak demand on the
- 27 115 kV system, the existing load rejection scheme would reject sufficient load immediately
- following the outage to respect the ratings of J3E/J4E.

- 1 The amount of load rejection required will depend on whether or not all local generation is in
- 2 operation. For example, based on the planning forecast for 2017, following the loss of the
- 3 C23Z/C24Z double-circuit transmission line, a total of 245 MW of load is interrupted, consisting
- 4 of about 175 MW at Lauzon DESN and about 70 MW which is interrupted through load
- 5 rejection, assuming local gas and renewable generation sources are running. This represents
- 6 approximately 28% of the Windsor-Essex area electricity demand, and is a substantial amount of
- 7 demand to be interrupted following an outage. Following the contingency this load must be
- 8 restored within the period of time prescribed by ORTAC. The C23Z/C24Z contingency, and the
- 9 J3E-J4E subsystem which is affected by this contingency, are shown in Figure 12 below.

10 Figure 12: Windsor-Essex Area Transmission System Following an Outage to the

11 C23Z/C24Z Transmission Line



13 Source: OPA

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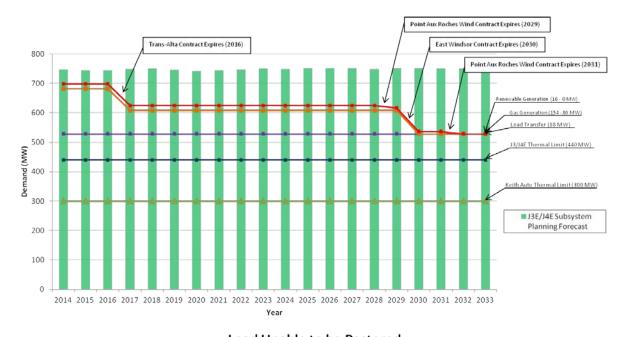
5.2.2 Existing System Lacks Sufficient Sources of Restoration Capability

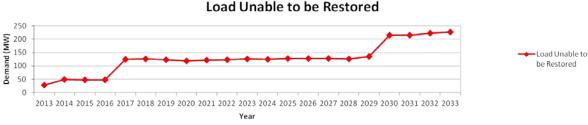
The existing system lacks the capability to restore power to customers in the J3E-J4E subsystem in accordance with the ORTAC criteria which specifies that load greater than 250 MW must be restored within half an hour, load greater than 150 MW must be restored within 4 hours, and all load interrupted must be restored within 8 hours.

- 1 There are three sources of restoration capability which have been identified in the J3E-J4E
- 2 subsystem: 1) gas-fired generation at Brighton Beach GS and in the J3E-J4E subsystem,
- 3 2) transferring load out of the J3E-J4E subsystem, and 3) transmission connected renewable
- 4 generation within the J3E-J4E subsystem. These three contributors are discussed further below.
- 5 As noted previously, one of the gas-fired generating units at Brighton Beach GS is connected to
- 6 the 115 kV bus at Keith TS. This generation capacity allows the capability of the J3E/J4E
- 7 transmission line to be fully utilized post-contingency.
- 8 In addition, there is currently 154 MW of gas-fired generation within the J3E-J4E subsystem,
- 9 consisting of East Windsor Cogeneration and TransAlta Windsor. The contract for one of these
- generators, TransAlta Windsor (74 MW), expires in December, 2016. Currently, there are no
- plans to extend this timeline. Beyond this date, the amount of gas-fired generation within the
- subsystem will be reduced to 80 MW. This 80 MW of effective generation will help supply
- demand in the J3E-J4E subsystem following a major transmission outage until the expiry of the
- East Windsor Cogeneration contract in November, 2029.
- 15 Hydro One has identified that there is a total of 88 MW of capability to transfer load supplied by
- the 115 kV system to stations supplied by the 230 kV system. This consists of 18 MW of
- transfer capability to Keith TS, 50 MW to Malden TS, and up to 20 MW of load at Tilbury
- 18 West DS which can be supplied by the N5K circuit (outside the Windsor-Essex area, near
- 19 Chatham). These transfer capabilities are based on the station capability of Keith TS and
- 20 Malden TS, and the capability of the N5K circuit.
- In addition, as noted in Section 4.2 there is 100 MW of transmission connected renewable
- 22 generation within the Kingsville-Leamington subsystem. It is reasonable to count on the
- effective capacity of 16 MW from these facilities for the purpose of providing restoration
- capability until the two contracts expire in 2029 and 2031 respectively.
- Figure 13 summarizes the above analysis. After 2016 there is a need for approximately 125 MW
- of additional restoration capability in order to fully restore the J3E-J4E subsystem following the
- 27 C23Z/C24Z double-circuit contingency. In addition to this need, the two autotransformers at
- 28 Keith TS are very close to reaching their end-of-life and need to be replaced in the near future.

1 Figure 13: J3E-J4E Subsystem Existing System Restoration Capability and Remaining

2 Requirement





Source: OPA

3 4

5

5.3 Additional Constraints that Would Benefit from an Integrated Solution

- 6 In addition to the needs identified in Sections 5.1 and 5.2, the following section describes two
- 7 further constraints in the Windsor-Essex area which could be addressed with an integrated
- 8 solution: (i) constraints on the operation of Brighton Beach GS, and (ii) limited short circuit
- 9 capability in the Kingsville-Leamington area, which limits the connection of additional
- distributed generation resources in the area. A solution which addressed these constraints in
- addition to the needs identified earlier in Section 5 would provide additional value.

12 5.3.1 Limitations on the Operation of Brighton Beach GS

- In addition to the ORTAC criteria described in Section 5, the OPA uses the Northeast Power
- 14 Coordinating Council ("NPCC") resource adequacy criteria to assess the peak capacity

- requirements for Ontario's system. These criteria provide that total system generation capacity
- 2 must be capable of meeting the peak hour requirement, plus an operating reserve margin. Based
- 3 on the province's demand forecast, these criteria establish when additional system supply
- 4 capacity is needed.
- 5 When transmission capability is limited it may not be possible to utilize all of the installed
- 6 capacity in a constrained area for meeting system demand. The 526 MW Brighton Beach GS is
- 7 connected at Keith TS. Due to the pre-contingency thermal rating of the J3E/J4E transmission
- 8 path, approximately 180 MW of this resource is constrained and cannot contribute to meeting
- 9 system capacity requirements.
- 10 The OPA's provincial forecast shows that Ontario will experience a capacity shortfall beginning
- around 2019. The 180 MW constrained capacity at Brighton Beach GS could, however, advance
- the need for system capacity resources. The capital cost of supplying 180 MW of peaking
- capacity is approximately \$160 million based on the cost of a simple cycle gas-fired generator.
- 14 Removing limitations on existing generation resources would reduce the longer-term need for
- additional peaking resources elsewhere in the province and, in the nearer term, would reduce
- 16 costs for all ratepayers. Based on the current local constraint, there could be additional hours
- throughout the year when congestion occurs on the J3E/J4E transmission path. In these hours
- alternative generation resources may be dispatched out of merit in order to meet Ontario's
- 19 electricity demand.
- 20 5.3.2 Enabling the Connection of Additional DG Resources
- 21 The recent history of distributed generation procurement in Ontario demonstrates that there is
- 22 potential for developing additional distributed generation in the Kingsville-Leamington area;
- 23 however, the existing Kingsville TS is currently very close to reaching the distribution short
- 24 circuit limit for the station.
- In 2009, Hydro One added a bus tie reactor at this station in order to increase the potential for
- 26 DG connections; however this additional short circuit capacity has almost been fully utilized.
- 27 Based on the remaining short circuit capability it is not possible to connect more than 10 MW of

- synchronous generation (e.g. CHP), or 44 MW of solar generation, beyond what is already
- 2 committed. 14
- 3 The government's 2013 LTEP highlights greenhouse operations as particularly suitable
- 4 candidates for CHP development and identifies a potential opportunity for a new CHP program
- 5 for greenhouse operations, agri-food and district energy projects. Mitigating short circuit
- 6 limitations in the Kingsville-Leamington area would enable local businesses to participate in this
- 7 initiative or other procurement processes.

8 5.4 Summary of Needs and Additional Constraints

- 9 The ORTAC-based needs in the Windsor-Essex area are summarized in Table 3 and the
- additional constraints in the Windsor-Essex area are summarized in Table 4.

11 Table 3: Summary of Windsor-Essex Area Reliability Needs

Subsystem	Need Type	Need Description	Need Date
Kingsville-		Forecast loading on K6Z exceeds the thermal load meeting capability	Now
Leamington Subsystem	Capacity to Meet Demand	Forecast at Kingsville TS exceeds the voltage limit	Now
		Forecast at Kingsville TS exceeds the station capability	Now
J3E-J4E Subsystem Minimize the Impact of Interruptions		J3E-J4E does not comply with the ORTAC service interruption criteria — i.e., restoration of all load within 8 hours	Now

Source: OPA

¹⁴ Each generation technology has a different short circuit contribution level per MW of nameplate capacity.

Table 4: Summary of the Additional Constraints in the Windsor-Essex Area

Subsystem	Description of Additional Constraints	Date	
Windsor-Essex Area	Peak deliverability limitation for Brighton Beach GS	Around 2019	
Kingsville-Leamington Subsystem	Limited short circuit capability for DG connections in the Kingsville-Leamington subsystem	Close to the limit now	

2 Source: OPA

3

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6 Integrated Solutions to Address the Needs in the Windsor-Essex Area

- 4 In considering potential solutions for addressing regional needs, the OPA first considers the
- 5 potential for additional CDM and DG (beyond the level which is reflected in the planning
- 6 forecast) to reduce demand over the forecast period. Reducing electricity demand can delay or
- 7 alleviate the need for investment in large-scale generation or transmission infrastructure.
- 8 The potential for demand reduction to mitigate the needs depends on the magnitude and timing
- 9 of the needs, as well as the feasibility and cost effectiveness of CDM and DG options in the
- region. If the potential for demand reduction is found to be insufficient then the OPA considers
- 11 large-scale generation and transmission alternatives. The latter types of investments typically
- provide large blocks of capacity and cannot be scaled. Where a transmission alternative is
- required, targeted demand reduction in the area may not be cost effective in addition to the large-
- scale alternative which can address the needs independently.
- In terms of the Windsor-Essex area's needs, CDM and DG in the Kingsville-Leamington area
- will reduce the supply capacity needs for that subsystem. Due to the overlapping nature of the
- subsystems these CDM and DG resources will also reduce the restoration needs for the J3E-J4E
- subsystem. Section 3 of this exhibit describes the CDM savings that are forecast to contribute to
- the planning forecast of Windsor-Essex area demand.
- 20 After reducing forecast demand within the Kingsville-Leamington subsystem by CDM and DG,
- a capacity gap of 25 MW exists in 2014, growing to 46 MW by 2033. In the J3E-J4E subsystem
- 22 there also remains a need for approximately 50 MW of restoration capability in 2014, rising to

- about 125 MW from 2017 to 2029, with a further increase over the remainder of the forecast
- 2 period.
- 3 The potential for incremental CDM or DG to address the remaining needs in the Windsor-Essex
- 4 area is described further in the following sections.

5 6.1 CDM Options

- 6 Demand in the Kingsville-Leamington area is forecast to increase significantly over the near
- 7 term. Based on the OPA's experience with CDM programs, the amount of planned CDM
- 8 forecast for the region, and the type and immediate timing of the needs, it is the OPA's view that
- 9 additional CDM is not a feasible means of fully addressing the Kingsville-Leamington area's
- 10 near-term needs. As a result, further solutions will be required.
- 11 The planning forecast reflects the extent to which CDM will contribute to the reliable supply of
- electricity to the Windsor-Essex area. This forecast shows that CDM is projected to address
- 52% of the long-term growth in the Kingsville-Leamington area. The amount of additional
- 14 CDM, however, that would be required to fully address the Kingsville-Leamington subsystem's
- near-term capacity needs is significant compared to the amount of demand reduction from
- projected CDM programs. As shown in the table below, seven times the 2016 projected amount
- of CDM would be required to meet the capacity gap in the Kingsville-Leamington area.

18 Table 5: Additional CDM Required to Address the Kingsville-Leamington Area Reliability

19 Needs

Subsystem	2016 Gross Demand (MW)	2016 Projected CDM Programs (MW)	Projected CDM Programs as % of 2016 Gross Demand	2016 Incremental CDM Required to Fully Meet Kingsville- Leamington Needs (MW)	Projected & Incremental CDM as % of Gross Demand
Kingsville- Leamington	174	5	3%	29	20%

20 Source: OPA

- 21 On November 12, 2010, the Ontario Energy Board established two mandatory CDM targets for
- each LDC: a 2014 net annual peak demand savings target and a 2011-2014 net cumulative
- energy savings target. LDCs are working towards meeting the targets. The local LDCs have

- 1 made good progress towards achieving their energy targets, with results indicating over 70%
- 2 achievement by the end of 2014. Although progress has been made by local LDCs towards
- achieving their peak demand targets, LDCs have identified a number of factors that have
- 4 contributed to lower demand savings than anticipated. ¹⁵
- 5 The OPA will continue to monitor opportunities for cost-effective CDM in the Windsor-Essex
- 6 area above currently planned amounts. For example over the longer term it may be feasible to
- 7 deliver targeted location-specific CDM programs or targeted marketing efforts for province-wide
- 8 CDM programs in order to achieve additional savings above currently planned CDM activities.
- 9 Potential opportunities could include, but are not limited to, efforts geared towards new and
- 10 expanded greenhouse operations and local demand response participation.
- 11 A number of CDM programs currently exist to encourage greenhouse participation in CDM
- initiatives. A new CDM framework extending to 2020 is in development and further CDM
- programs are expected. Going forward, the OPA will work with existing and new greenhouse
- operations to achieve the forecast CDM savings amounts. The OPA will also continue to
- monitor load growth and CDM achievement in the Windsor-Essex area and look for
- opportunities for further cost effective CDM to address reliability needs that may emerge over
- the long term.

18 6.2 Generation Options

- 19 Distributed Generation
- 20 Distributed generation is small-scale, distribution connected generation sited close to load
- 21 centres. As such, it helps supply local energy needs while at the same time contributing to
- meeting provincial demand. As described in Section 5.3.2, there is limited ability to connect
- 23 additional distributed generation at the existing Kingsville TS due to the distribution short circuit
- limit for the station. Incremental distributed generation is therefore not a feasible means of

 $\frac{\text{http://www.ontarioenergyboard.ca/OEB/Industry/Regulatory\%20Proceedings/Policy\%20Initiatives\%20and\%20Consultations/Conservation\%20and\%20Demand\%20Management\%20(CDM)/CDM\%20Code/CDM%20Strategies\%20Programs\%20and\%20Reports.}$

¹⁵ Δt

- addressing the capacity needs of the Kingsville-Leamington subsystem nor the restoration needs
- 2 of the J3E-J4E subsystem.
- 3 Transmission Connected Generation
- 4 Additional transmission connected generation in the Kingsville area cannot be accommodated
- 5 due to the limited short circuit capability in the area. Therefore, transmission connected
- 6 generation cannot meet the supply capacity needs in the Kingsville-Leamington subsystem.
- 7 The contract for the TransAlta Windsor generating station expires in December, 2016, reducing
- 8 the amount of generation capability within the J3E-J4E subsystem which is available for
- 9 restoration. Recontracting this gas-fired generation would help meet the restoration requirement
- in the J3E-J4E subsystem, but would leave a gap of approximately 76 MW of unmet restoration
- requirement. As noted in Section 4.2, the contract for West Windsor Power also expires in 2016,
- however, this generating station is connected to the Essex 115 kV bus and is therefore not part of
- the J3E-J4E subsystem. Large generation is therefore not a feasible means of addressing the
- restoration needs of the J3E-J4E subsystem. The OPA may proceed to negotiate a new contract
- for one or both of these facilities if the new contract results in cost and reliability benefits for
- 16 Ontario.

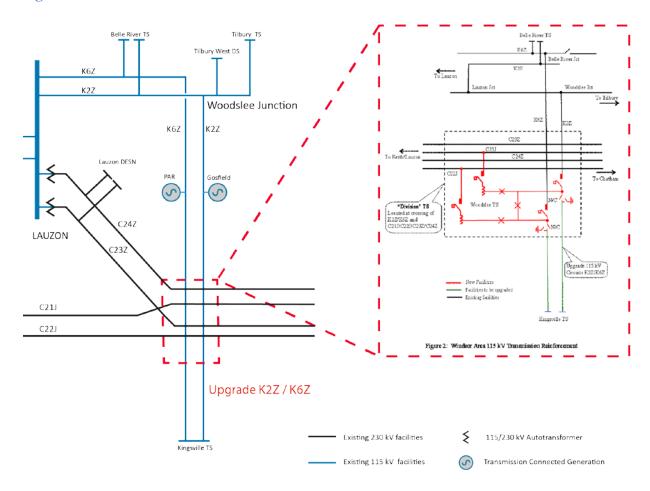
17 6.3 Transmission Options

- As indicated above, there is insufficient potential for conservation and local generation to fully
- address the reliability needs of the Windsor-Essex area by reducing the demand at Kingsville TS
- and in the J3E-J4E subsystem below the existing supply capacity and restoration capability
- 21 requirements. An alternative solution is required. Where a transmission alternative is required,
- targeted demand reduction in the area may not be cost-effective in addition to the large-scale
- 23 alternative which can address the needs independently.
- 24 The overlapping nature of the subsystems in the Windsor-Essex area, along with the coincident
- 25 timing of the area's reliability needs, means that addressing the reliability needs of the
- 26 Kingsville-Leamington area will also address the reliability needs of the J3E-J4E subsystem.
- 27 Two transmission reinforcement approaches could be used to address these needs: (i) reinforcing
- 28 the existing 115 kV system, or (ii) adding a new supply point to the area. These alternative
- approaches and their corresponding transmission investments are described in more detail below.

- 1 6.3.1 Strengthening the Existing 115 kV System
- 2 In order to upgrade the existing 115 kV system, upgrades would be required to address each of
- 3 the limitations identified in Table 2. These upgrades would consist of transmission line
- 4 reconductoring as well as station investments to address the thermal limitations. Mitigating the
- 5 voltage limitation in the Kingsville-Leamington subsystem would also require costly reactive
- 6 compensation. Accordingly, upgrading the existing 115 kV system was not considered further as
- 7 a means of strengthening the 115 kV system.
- 8 Alternatively, the 115 kV system can be strengthened by reconfiguring and reinforcing the
- 9 existing 115 kV transmission lines in the area ("Division TS alternative"). This could be
- 10 accomplished by:
- 1) building a new transformer station (Division TS) near Woodslee junction (where the
- 230 kV and 115 kV transmission lines cross) consisting of two 230/115 kV
- autotransformers, and required switchgear, supplied from the C21J and C22J 230 kV
- circuits (approximately \$64 million); and
- 15 2) upgrading the 115 kV connection line between Division TS and Kingsville TS
- 16 (approximately \$34 million).

Figure 14: Division TS Alternative

1



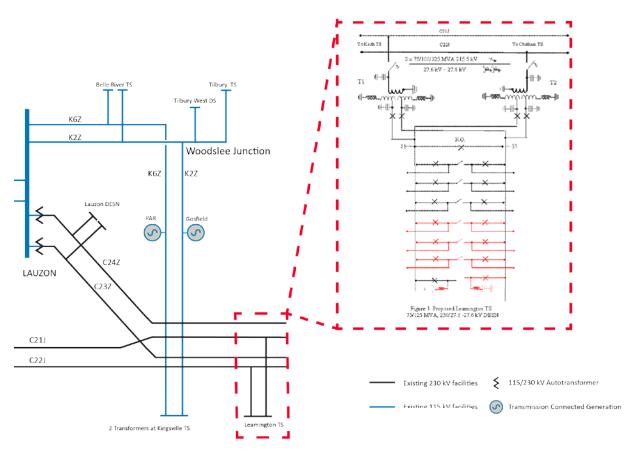
3 Source: OPA/IESO

- 4 As part of Hydro One's sustainment activities, the load meeting capability at the existing
- 5 Kingsville TS would be increased to 180 MW in conjunction with the end-of-life transformer
- 6 replacement. Two feeder positions would also be added at Kingsville TS to utilize the additional
- 7 station capacity. In addition, a like-for-like replacement of the two autotransformers at Keith TS,
- 8 which are reaching end-of-life, would support restoration capability via the Keith J3E/J4E
- 9 transmission path.
- Based on the planning forecast, increasing the load meeting capability of K6Z (item 2 above) and
- Kingsville TS (the sustainment activities described in the previous paragraph) would provide a
- supply capacity increase sufficient to meet the needs of the Kingsville-Leamington subsystem for
- the duration of the forecast period.

- 1 Reinforcing the 115 kV system through the addition of autotransformers at Division TS would
- 2 provide back-up supply to the Lauzon TS autotransformers in the event of the loss of the
- 3 C23Z/C24Z transmission line, providing adequate restoration capability for the J3E-J4E
- 4 subsystem. This reinforcement would also alleviate the voltage limitation in the Kingsville-
- 5 Leamington subsystem.
- 6 This alternative has the additional benefit of reducing the peak deliverability limitation for
- 7 Brighton Beach GS, however it does not increase the short circuit capability for DG connections
- 8 in the Kingsville-Leamington subsystem.
- 9 This alternative has a total cost of approximately \$97.2 million.
- 10 6.3.2 Adding a New Supply Point to the Area (Learnington TS Alternative)
- 11 A new 230 kV connected transformer station in the Leamington area ("Leamington TS") could
- be built to supply part of the Kingsville-Leamington area demand, which would be transferred
- from Kingsville TS. This could be accomplished by:
- 1) building a new 230 kV transformer station consisting of two 75/125 MVA transformers in the Leamington area (Leamington TS) (approximately \$32 million); and
- building a 13 km double-circuit 230 kV connection line on a new right-of-way between the 230 kV C21J and C22J circuits and the new Leamington TS (approximately \$45 million).
- Together these facilities are referred to as the "Supply to Essex County Transmission"
- 20 Reinforcement", or "SECTR" project.
- 21 Following the completion of the SECTR project, the existing Kingsville TS could be
- downsized by replacing only one of the three transformers which are approaching end-of-life.
- 23 Kingsville TS would therefore be reduced from its current size to a capacity of approximately
- 24 60 MW.
- 25 Similar to the Division TS alternative, a like-for-like replacement of the two
- autotransformers at Keith TS which are reaching end-of-life would support restoration
- 27 capability via the Keith J3E/J4E transmission path.

Figure 15: Leamington TS Alternative

1



3 Source: OPA/IESO

- 4 The SECTR project would have an in-service date of 2016. In 2016, approximately 95 MW of
- 5 the Kingsville-Leamington area planning demand would be transferred to the new
- 6 Leamington TS and the remainder of approximately 55 MW would remain at the downsized
- 7 Kingsville TS. Although the existing Kingsville TS would be downsized, the addition of
- 8 Leamington TS would provide a supply capacity increase sufficient to meet the needs of the
- 9 Kingsville-Leamington subsystem until 2033.
- 10 A second transformer station in the Kingsville-Leamington area would provide additional
- 11 flexibility for meeting increased demand across the geographic region currently served by
- Kingsville TS. Reducing the size of Kingsville TS as part of the anticipated end-of-life
- refurbishment is a cost-effective measure in keeping with the near-term needs for the region. If,
- in the long term, the Kingsville-Leamington area demand begins to increase beyond the current

- 1 forecast expectation, Kingsville TS could be expanded with two additional transformers,
- 2 consistent with the current configuration.
- 3 Transferring some of the Kingsville TS demand to a new 230 kV station would also reduce the
- 4 demand at Kingsville TS to within the voltage limitation.
- 5 The 95 MW of demand which would be transferred from Kingsville TS to Leamington TS in
- 6 2016 would correspondingly reduce the J3E-J4E subsystem demand to approximately 655 MW
- 7 that year. This is within approximately 30 MW of the restoration capability for the period up to
- 8 2030, as described in Section 5.2.1, however the restoration capability is expected to decline
- 9 beyond that date, due to the contract expiry date for the East Windsor Cogeneration Centre. As
- described in Section 3.2, most of the demand growth in the Windsor-Essex area is expected to
- occur in the Kingsville-Leamington area. With the addition of Leamington TS, the majority of
- this demand growth will occur outside the J3E-J4E subsystem, therefore the demand for the
- remainder of the J3E-J4E subsystem is expected to have very low growth and not significantly
- increase the requirement for restoration capability for the duration of the planning forecast. The
- restoration capability described in Section 5.2.1 is therefore able to substantially meet the
- reduced restoration need for the J3E-J4E subsystem.
- 17 The SECTR alternative has the additional benefits of reducing the peak deliverability limitation
- for Brighton Beach GS. The SECTR alternative also has the benefit of increasing the short
- 19 circuit capability for DG connections by adding new distribution capacity in the Kingsville-
- 20 Leamington subsystem.
- 21 This alternative has a total cost of approximately \$77.4 million.
- 22 6.3.3 Alternatives Comparison
- As indicated in Table 6 below, the alternatives described above meet, or substantially meet, the
- reliability needs in the Windsor-Essex area. The Learnington TS solution is the preferred
- 25 alternative based on a lower cost. This table also shows the additional benefits provided by each
- 26 solution.

1 Table 6: Transmission Alternatives Comparison

Needs			Alternatives	
Subsystem Need Type Need Description		Division TS	Leamington TS	
		Forecast loading on K6Z exceeds the thermal load meeting capability	√	√
Kingsville- Leamington Subsystem	Capacity to Meet Demand	Forecast at Kingsville TS exceeds the voltage limit	√	√
		Forecast at Kingsville TS exceeds the station capability	√	~
J3E-J4E Subsystem	Minimize the Impact of Interruptions	J3/4E does not comply with the ORTAC service interruption criteria	√	Substantially meets the need
Benefits				
Subsystem	Ben	efit Description		
Kingsville- Leamington Subsystem	Provides additional short circuit capability for DG connections in the Kingsville-Leamington subsystem		Does not provide additional short circuit capability	✓
J3E-J4E Subsystem	Reduces the peak deliverability limitation for generation connected at Keith TS		√	✓
	Cost			\$77.4 million

² Source: OPA

³ A more detailed breakdown of the cost components of the two alternatives is shown below.

Table 7: Cost of the Division TS Alternative

Facilities	Cost (\$ million)
Division TS consisting of two 230/115 kV autotransformers connecting circuits K2/6Z and C21/22J, and required switchgear	63.5
K2/6Z 115 kV line upgrade between Division TS and Kingsville TS	34.2
Division TS Alternative Cost	\$97.7 million

2 Source: OPA

1

3 Table 8: Cost of the Leamington TS Alternative

Facilities	Cost (\$ million)
Leamington TS DESN consisting of two 75/125 MVA transformers	32.1
Approximately 13 km of double-circuit 230 kV connection line between C21J /C22J and Leamington TS	45.3
Leamington TS Alternative Cost	\$77.4 million

4 Source: OPA

- 5 The construction of the SECTR project provides a new 230 kV supply point in the Kingsville-
- 6 Leamington area which increases supply capacity to the area. The SECTR project has a total
- 7 cost of \$77.4 million. The sustainment needs at the existing Kingsville TS have been integrated
- 8 into the overall solution resulting in a reduced capacity at Kingsville TS, increasing the cost
- 9 effectiveness of the overall solution.
- An advantage of the SECTR project is that it provides flexibility should growth in the
- 11 Kingsville-Leamington area exceed the current forecast, in which case Kingsville TS could be
- expanded to its current four transformer capacity. The Division TS alternative does not provide
- this flexibility for higher growth. The new 230 kV supply point at Leamington also provides an
- option for restoration in the event of an outage at Kingsville TS. An additional advantage of the
- 15 SECTR project is that it provides additional short circuit capability to make increased distributed

- 1 generation a feasible option for the Kingsville-Leamington area which the Division TS
- 2 alternative does not.
- 3 The anticipated growth in the overall Windsor-Essex area is focused in the eastern portion of the
- 4 region, in the area currently served by Kingsville TS. The SECTR project is the preferred
- 5 alternative to meet the growth expectations of this area, while also improving the ability to
- 6 restore the Windsor-Essex area after a major outage.

7 Recommended Integrated Solution for the Windsor-Essex Area

- 8 An integrated solution comprised of CDM and DG resources, and transmission investments,
- 9 including the SECTR project, is the recommended solution for addressing the reliability needs of
- the Windsor-Essex area. This integrated solution will meet, or substantially meet, all of the
- needs in the Windsor-Essex area over the 20 year planning horizon.
- 12 Conservation and demand management along with distributed generation resources are important
- contributors to this integrated solution. Together, these resources are expected to offset more
- than 90% of the growth in the Windsor-Essex area between 2014 and 2033.
- 15 The SECTR project addresses the supply capacity needs of the Kingsville-Leamington area over
- the forecast period. This solution also substantially addresses the restoration need for the large
- portion of the region which must be supplied by J3E/J4E after the double-circuit C23Z/C24Z
- outage. This project has a lower cost than the Division TS alternative which was also
- 19 considered.
- 20 It is the OPA's view that these facilities are a cost-effective and technically-effective solution for
- addressing the reliability needs and other constraints of the Windsor-Essex area.

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 1 Schedule 6 Page 1 of 62

1 IESO ONTARIO RESOURCE AND TRANSMISSION ASSESSMENT CRITERIA REQUIREMENTS



Ontario Resource and Transmission Assessment Criteria

Issue 5.0

This document is to be used to evaluate long-term system adequacy and connection assessments

Disclaimer

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Document ID IMO_REQ_0041

Document Name Ontario Resource and Transmission Assessment Criteria

Issue 5.0

Reason for Issue Released for Baseline 17.1

Effective Date August 22, 2007

Document Change History

Issue	Reason for Issue	Date
1.0	First release	June 4, 2003
2.0	Issue released for Baseline 10.0	September 10, 2003
3.0	Name and logo changed to IESO	September 14, 2005
4.0	Released for Baseline 15.0	March 8, 2006
5.0	Revised for Baseline 17.1	August 22, 2007

Related Documents

Document ID	Document Title

Document Control IMO_REQ_0041

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Table of Changes IMO_REQ_0041

Table of Changes

Reference (Section and Paragraph)	Description of Change	
Entire document	Name changed to Ontario Resource and Transmission Assessment Criteria. Defined terms were italicized. Document titles were reformatted as per section 1.4. Quotations were removed from words that are not documents.	
Section 1	Clarified the purpose, scope and users of the document. Added conventions section.	
Section 2	Clarified load modelling (sec 2.4) and contingency criteria (sec 2.7.1). Aligned section 2.7.1 with the criteria with NPCC document A-02 (section 5.0). Clarified study time periods, load forecasts and modelling, local area requirements, bulk power system and local area contingency studies.	
Section 3	Clarified special protection systems (sec 3.4.1). Clarified how system conditions were to be modelled including generation dispatch, stability conditions, permissible control actions and special control systems. Changed a section 3.1.1 to 3.1 and corrected references to 3.1.1.	
Section 4	Clarified P-V curves (sec 4.5.1). Clarified power transfer capability, precontingency voltage limits and voltage change limits, steady state voltage stability, lines and equipment loading and short circuit levels.	
Section 5	Updated section heading and all references to be "Transmission Connection Criteria".	
Section 6	Updated section heading and all references to be "Generation Connection Criteria". Clarified how transmission line ratings are calculated in the vicinity of wind farms.	
Section 7	Created a new section titled "7. Load Security and Restoration Criteria ". Clarified the effect of local generation when one element is out of service and when two elements are out of service. References to E-2 were deleted in section 7.2. Clarified control action criteria and application of restoration criteria.	
Section 8	Created a new section titled "Resource Adequacy Assessment Criterion". Changed title of document to "Ontario Resource and Transmission Assessment Criteria"	
Appendix E	Deleted	
References	Added documents referred to within this document	

1. Introduction

1.1 Purpose

The purpose of this document is to identify the technical criteria for use in the assessments of the *adequacy* and *security* of the *IESO-controlled grid* and to clarify how the *IESO* will apply the relevant *NPCC* and *NERC* standards and implement them within Ontario.

1.2 Scope

This document is to be used for assessing the current and future *adequacy* of the *IESO-controlled grid*, for conducting the *IESO's* 18-month outlooks, for identifying the need for system enhancements and for evaluating the effectiveness of planned generation and transmission enhancements. It does not identify operating or safety criteria.

1.3 Who Should Use This Document

This document is used by the *IESO* and may also be referred to by stakeholders and *market* participants to help them understand *IESO* criteria and further their connection assessment work.

1.4 Conventions

The standard conventions followed for market manuals are as follows:

- The word 'shall' denotes a mandatory requirement;
- Terms and acronyms used in this market manual including all Parts thereto that are italicized have the meanings ascribed thereto in Chapter 11 of the "Market Rules";
- Double quotation marks are used to indicate titles of legislation, publications, forms and other documents.

Any procedure-specific convention(s) shall be identified within the procedure document itself.

- End of Section -

1. Introduction IMO_REQ_0041

2. Study Parameters and Contingency Criteria

This section is intended to provide guidance in carrying out the technical studies to assess the *adequacy* of the *IESO-controlled grid* in order to meet general load growth and *connection assessment* requirements, and to ensure that *reliability* is within standards. It also includes contingency criteria consistent with *NERC* and *NPCC* standards.

These study parameters must be applied on the basis of good utility practice and judgment, taking into account the particular circumstances and characteristics of the part of the *IESO-controlled grid* that is being studied.

This section includes study guidelines for: study period, base case, load levels, power transfer capability, area flow requirements, contingency based assessment and study conditions.

2.1 Study Purpose

The purpose of conducting studies is to identify system deficiencies and to establish the requirements for a connection proposal to ensure it satisfies *reliability standards*.

A comparison of the results of power flow studies under normal and *outage* conditions (with normal and *outage* power flows) will determine:

- the need date for new transmission investment in the *IESO-controlled grid* to maintain the *reliability* of supply within standards; or,
- the acceptability of a connection proposal for a *connection assessment*.

The sensitivity of the need date to load growth rate, resource variations (e.g. approved *connection assessments*) and related system developments should be investigated. The results of this investigation should normally be given in terms of a range of dates within which there is a high confidence level that the connection proposal is acceptable or that additional *facilities* or enhancements will be required.

2.2 Study Period

The study period depends on the purpose of the assessment. When checking the reliability of long term projects and plans the study period must go out beyond the in-service date and include various years between the start and end dates of the study.

• For *connection assessments* for proposed load developments, the study period shall run from the planned in service date of the proposed *facility* up to 10 years into the future depending on the availability of load forecasts. Where the evaluation depends on factors or system developments

beyond the 10 year study period, the study period may need to be extended farther into the future.

- For *connection assessments* for generators, the study period shall run from the planned in service date of the proposed *facility* up to 10 years into the future depending on the availability of demand forecasts. Where the evaluation depends on factors or system developments beyond the 10 year study period, the study period may need to be extended farther into the future.
- For *connection assessments* for proposed *transmission* developments, the study period shall run from the planned in service date of the proposed *facility* up to 10 years into the future depending on the availability of load forecasts. Where the evaluation depends on factors or system developments beyond the 10 year study period, the study period may need to be extended farther into the future.
- For *NPCC* transmission reviews, the study period covers a 4 to 6 year look ahead period from the report date. These reviews are of three types: a comprehensive or full review, an intermediate or partial review and an interim review. Refer to *NPCC* document B-04, "Guidelines for *NPCC* AREA Transmission Reviews" for details.
- For *NPCC* resource adequacy reviews, the study period covers a 5 year look ahead period. These reviews are of two types: a comprehensive resource review and an annual interim review. Refer to *NPCC* document B-08, "Guidelines for Area Review of Resource Adequacy" for details.

Note that it is unnecessary to consider every year in the study period. The first and last years of the study period plus sufficient intermediate years to zero in on and bracket the critical year(s) is generally adequate.

2.3 Base Case

Master base cases are used as the starting point for all studies. The master base cases include all *connection assessment* projects that are approved, including those that did not require a formal *connection assessment* study. *Local area* details are added as appropriate. Information regarding base cases can be found on the *IESO's* Forecasts webpage.

The *IESO* Web site also provides firm and planned resource scenarios as described in each 18-Month Outlook.

Connection assessment studies are conducted using the master base cases. Long term assessment studies start with the master base cases and exclude less firm generation connection assessment projects per the planned resource scenario. The impact of adding approved connection assessment projects should be reviewed to identify if approved connection assessments improve or worsen any identified deficiency.

2.4 Load Forecasts and Load Modelling

The load levels used in the study shall be based on the latest forecast¹ consistent with the IESO's and the OPA's latest long-term forecast. Load forecast uncertainty should be taken into account by investigating the sensitivity of the need date to various items (e.g. higher and lower loads).

The summer or winter median growth forecast (based on normal weather) should be used depending on the peak loading conditions of the area being studied.

The sensitivity study should be done with high-growth extreme weather forecasts and low-growth normal weather forecasts, and with light load scenarios as required in order to stress the system. Under light load conditions, worst case ambient conditions should be assumed.

If a connection assessment applicant provides a detailed local forecast, that forecast should be used.

For *local area* assessments, the 18 month master base case should be modified to ensure the forecast is representative of the most recent peak load and power factors based on billing data. Local load should be modeled as accurately as possible and any local *embedded generator(s)* or large motor(s) should be included.

For assessment purposes the power factor is assumed to be 0.90 at the *defined meter point*. If an *embedded generator* is connected to a load bus, the 0.90 power factor is assumed with the generator out-of-service. In certain circumstances detailed load models may be required if they are expected to impact the *local area* performance.

Dispatchable load will be assumed to be consuming as required in order to stress the system.

Studies should be done with a load model representative of the actual load. For powerflow planning studies assessing the voltage stability of the bulk system, loads normally should be modelled as constant megavolt-amperes (MVA). In assessing voltage change limits and transient performance, a voltage dependent load model should be used. If specific information is not available, the load model in Ontario should be as indicated in the following table:

REAL 1	POWER	REACTIVE POWER		
Constant Constant Current Impedance		Constant Current	Constant Impedance	
(%)	(%)	(%)	(%)	
50	50	0	100	

Static Load Models for Simulation

Thus, in Ontario, a load model of P=50, 50, Q=0, 100 (e.g. P α V^{1.5}, and Q α V²) should be used. The load models for neighboring areas should be consistent with load models used in Reliability First Corporation (RFC), Midwest Regional Organization (MRO), and *NPCC* studies.

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¹ The IESO continues to produce 10-year demand forecasts using an econometric model. These forecasts are coordinated with OPA's multi-year end use forecasts and adjusted for Conservation and Demand Management (CDM).

2.5 Power Transfer Capability

A power transfer capability analysis should be performed throughout the study period taking into account the effects of planned *facilities*, the growth in loads, and the effects (if any), of various system generation patterns. The transfer limits should be determined for one or both directions of flow (as necessary).

With all transmission *facilities* in service, the power transfer capability is determined for the worst applicable contingency. Also, it will generally be necessary to determine the effects of seasonal variations (e.g., summer and winter line ratings) on the limits.

Generally, the transmission interface limits will be determined by one or more of the following post-contingency considerations:

- line and equipment loading must not exceed ratings,
- voltage declines must not exceed certain limits,
- machine and voltage angles must remain in synchronism, and
- voltages are stable (V-Q sensitivity is positive).

2.6 Local Area Requirements

Inter-area transmission is any circuit or group of transmission circuits interconnecting two areas of the *IESO-controlled grid*. Flows across the interface may either always be in one direction or in different directions at different times, in which case it may be necessary to consider each of the areas as the receiving area. The impact of *local area facilities* on inter-area transmission must be evaluated.

The magnitude and direction of future power flow requirements on the area studied should be determined for normal and contingency conditions. Peak, off-peak, and light load flow requirements should be considered.

With all transmission *facilities* in service (normal conditions), the schedule for generation in the receiving area should be based on the historically typical conditions. That is, for pre-contingency conditions, nuclear and run of river hydro-electric generation should be assumed at a level that is available 98% of the time. For example, on-peak conditions should be assessed with peaking hydro-electric generation plants, fossil plants and wind farms running at maximum output. Where *reliability* depends on local generation, sensitivity studies should be done to assess the impact of *outages* of local generation.

Load diversity and transmission losses should be given due consideration to ensure *facility* requirements are not overestimated.

2.7 Contingency-Based Assessment

The principal purpose of a system *adequacy/connection assessment* is to identify any areas where supply *reliability* may be at unacceptable risk. This could be due to a combination of factors such as load growth, load reduction, generation, or non-deliverability within a certain area.

The *IESO-controlled grid* must be planned with sufficient capability to withstand the loss of specified, representative and reasonably foreseeable contingencies at projected customer *demand* and anticipated transfer levels. Application of these contingencies should not result in any criteria violations, or the loss of a major portion of the system, or unintentional separation of a major portion of the system. The *IESO-controlled grid* shall be designed with sufficient capability to keep voltages, line and equipment loading within applicable limits for these contingencies

The *IESO*, as a member of *NPCC*, uses a contingency-based assessment to evaluate the *adequacy* and *security* of the bulk power system. The contingencies considered are identified in *NPCC* criteria A-02, "Basic Criteria for Design and Operation of Interconnected Power Systems". The *IESO* conducts studies with these contingencies applied throughout the *IESO-controlled grid*, assuming that *facilities* have not been designed to bulk power system standards, to test for the consequences. The *IESO* evaluates the study results to determine if a *facility* should be designated a bulk power system *facility*. If the consequence of the contingency has a significant adverse impact outside the *local area*, the *facilities* are deemed to be bulk power system *facilities* and must comply with *NPCC* criteria A-02, A-04, "Maintenance Criteria for Bulk Power System Protection" and A-05, "Bulk Power System Protection Criteria". *NPCC* Criteria are not applied in *local areas* where the consequence of faults or disturbances is well understood and restricted to a clearly defined set of *facilities* on the *IESO-controlled grid*.

NPCC extreme contingencies shall be assessed periodically in accordance with *Reliability* Coordinating Council criteria A-02, and guideline B-04, "Guideline for *NPCC* AREA transmission Reviews".

NPCC is in the process of developing the classification methodology for identifying the elements that constitute the bulk power system (reference *NPCC* A-10, "Classification of Bulk Power System Elements". The *IESO's* definition of the bulk power system will be consistent with *NPCC's* definition.

When conducting *connection assessments* or assessing system *adequacy*, various contingencies are applied to the *IESO-controlled grid* and their impact is evaluated. Different contingencies are evaluated for the bulk power system and *local areas*. For those parts of the *IESO-controlled grid* that are designated as bulk power system *facilities*, *NPCC* design criteria contingencies are applied, per Section 2.7.1. For those parts of the *IESO-controlled grid* that are designated as *local areas*, *local area* contingencies are applied, per Section 2.7.2.

In *local areas*, where the contingency propagates to a higher voltage level or causes a net load loss in excess of 1000MW, the *IESO* will apply the bulk power system contingencies described in section 2.7.1.

2.7.1 The Bulk Power System Contingency Criteria

In accordance with *NPCC* criteria A-02, the bulk power system portion of the *IESO-controlled grid* shall be designed with sufficient transmission capability to serve forecasted loads under the

conditions noted in this section. These criteria will also apply after any critical generator, transmission circuit, transformer, series or shunt compensating device or HVdc pole has already been lost, assuming that generation and power flows are adjusted between *outages* by the use of *ten-minute* operating reserve and where available, phase angle regulator control and HVdc control.

Stability of the bulk power system shall be maintained during and following the most severe of the contingencies stated below, with due regard to reclosing. The following contingencies are evaluated for the bulk power system portion of the *IESO-controlled grid*:

- a. A permanent three-phase fault on any generator, transmission circuit, transformer or bus section with normal fault clearing.
- b. Simultaneous permanent phase-to-ground faults on different phases of each of two adjacent circuits of a multiple circuit tower, with normal fault clearing. If multiple circuit towers are used only for station entrance and exit purposes, and if they do not exceed five towers at each station, this condition is an acceptable risk and therefore can be excluded.
- c. A permanent phase-to-ground fault on any transmission circuit, transformer or bus section with delayed fault clearing (This contingency covers a breaker failure).
- d. Loss of any element without a fault.
- e. A permanent phase-to-ground fault on a circuit breaker with normal fault clearing. (Normal fault clearing time for this condition may not always be high speed.) Note that this condition covers the blind spot on a breaker or on a bus section between a free standing current transformer (CT) and a breaker. It is included for completeness and is not intended to be more onerous than c) above (e.g. neither a stuck breaker nor a protection system failure need be considered for this type of contingency on account of the low probability of such an occurrence, therefore, there would normally be no reason to actually test for this condition).
- f. Simultaneous permanent loss of both poles of a direct current bipolar *facility* without an ac fault.
- g. The failure of a circuit breaker to operate when initiated by an *SPS* following: the loss of any element without a fault; or a permanent phase-to-ground fault, with normal fault clearing on any transmission circuit, transformer or bus section.

The bulk power system portion of the *IESO-controlled grid* shall be designed in accordance with these criteria and the *IESO's* local voltage control procedures and criteria, which shall be coordinated with adjacent *control areas*². Adequate reactive power resources and appropriate controls shall be installed in the *IESO-controlled grid* to maintain voltages within normal limits for predisturbance conditions, and within applicable *emergency* limits for the system conditions that exist following the contingencies specified above.

Line and equipment loadings shall be within normal limits for predisturbance conditions and within applicable *emergency* limits for the system conditions that exist following the contingencies specified above.

The *IESO-controlled grid* shall be designed to ensure that equipment capabilities are adequate for fault current levels with all transmission and *generation facilities* in service for all potential operating conditions. Procedures established to manage fault levels shall be coordinated with adjacent areas and regions².

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² Language and accountabilities used in NPCC A-2 is evolving. Terms such as control areas, areas, and regions should be interpreted broadly to include the meaning originally intended in A-2, until it is revised.

2.7.2 Local Area Contingencies

For *local areas* the *IESO-controlled grid* must exhibit acceptable performance following:

- a. the loss of an element without a fault, and
- b. a phase-to-phase-to-ground fault on any generator, transmission circuit, transformer, or bus section with normal fault clearing.

In the non bulk power system, the contingencies studied and the acceptability of involuntary load interruptions are dependent on the amount of load impacted. Typically only single-element contingencies are evaluated. The *IESO* defines a single-element as a single zone of protection. Double element contingencies are evaluated as per section 2.7.1.

2.7.3 Extreme Contingencies

NPCC criteria A-02 recognizes that the bulk power system can be subjected to extreme contingencies. Even though the probability of these situations is low, NPCC criteria states that analytical studies shall be conducted to determine the effect of certain extreme contingencies. In the case where an extreme contingency assessment concludes there are serious consequences, an evaluation of implementing a change to design or operating practices to address such contingencies must be conducted, and measures may be utilized where appropriate to reduce the likelihood of such contingencies or to mitigate the consequences indicated in the assessment of such contingencies.

2.7.4 Extreme System Conditions

The bulk power system can be subjected to abnormal system conditions with a low probability of occurring such as peak load conditions resulting from extreme weather conditions with applicable ratings of electrical elements or fuel shortages. An assessment to determine the impact of these conditions on expected steady-state and dynamic system performance shall be done in order to obtain an indication of system robustness or to determine the extent of a widespread adverse system response. After due assessment of extreme system conditions, measures may be utilized, where appropriate, to mitigate the consequences that are indicated as a result of testing for such system conditions.

2.8 Study Conditions

The system load and generation conditions under which the contingencies are assumed to occur are chosen on a deterministic basis to represent the reasonable worst case scenario. For loadflow and transient stability studies, the system should be studied with various pre-contingency conditions that stress the system. Various contingencies should then be evaluated to identify the most limiting contingencies and conditions. Typical sets of system conditions to evaluate in the study of the bulk power system and *local areas* are shown below. Not all conditions need to be evaluated. Studies should start with the one or two most stressful system conditions. If no deficiency is identified then no additional study is required. If a deficiency is identified, sensitivity studies should be done to further define the timing and magnitude of the deficiency. These additional conditions for long term assessments may include modifying the master base case to include approved connection approvals.

Various interface transfer levels should be considered to stress the system as required to uncover deficiencies.

Sample System Conditions to Evaluate in Studies for the Bulk Power System

Weather/Load	Generation	Transmission	Contingencies per Section 2.7.1
Median growth	All in service	All in service	All
extreme weather			
Median growth	2 units out of service	All in service	All
normal weather			
Median growth	All in service	1 element out of	All
normal weather		service	
Low growth	All in service	All in service	All
normal weather			
Light load	Reduced dispatch as	All in service	All
normal weather	required		

The purpose of the analysis is to identify the consequence of various scenarios up to two single contingencies, but not necessarily the worse possible contingencies under the worst load and ambient conditions.

Sample System Conditions to Evaluate in Studies for Local Areas

Weather/Load	Local Generation	Local Transmission	Contingencies per Section 2.7.2
Median growth extreme weather	Up to 2 local units out	All in service	All
	of service		
Median growth extreme weather	All in service	Any one element out	All
		of service	
Light load normal weather	Various scenarios	Various scenarios	All
Low growth normal weather	All in service	All in service	All

- End of Section -

3. System Conditions

The specific load and generation conditions and assumptions, applicable stability conditions, and permissible use of control actions for the area being studied are identified in the following sections.

3.1 Generation Dispatch

Generation is to be *dispatched* as required in order to stress the system so as to identify limitations of the *transmission* transfer capability.

3.2 Exports and Imports

All exports and imports should be taken into account to achieve the conditions of section 3.1. The pre-contingency level of the transfer selected should be based on the existing and projected *interconnection* capability. Combinations of maximum transactions coincident with high internal power flows should be considered in order to stress the import interface and to ensure studies evaluate the full range of power flow scenarios. In addition, the effect of bilateral *interconnection* assistance up to the tie-tine capability should be studied with all transmission *facilities* in service. Post-contingency tie flows that are different from the scheduled flows on phase-shifted ties or greater than the pre-contingency interface flow on unregulated ties may be permitted before adjustment provided they are within applicable limits (generally the 15 minute rating).

3.3 Stability Conditions

3.3.1 Contingencies

The system shall remain stable during and after the most severe of the contingencies listed in 2.7.1 and 2.7.2, with due regard to reclosing as per *NPCC* criteria A-02.

3.3.2 General Guidelines

The *NPCC* A-02 criteria do not stipulate the use of margin on transient stability limits. However, the *IESO* criteria require that all stability limits should be shown to be stable if the most critical parameter is increased by 10%. This is to account for modeling errors, metering errors and variations in *dispatch*.

The 10% increase can be simulated by generation or load changes even beyond the forecast load or generation capabilities provided it does not lead to invalid results. Negative values of local load is preferable to increasing local generation beyond its maximum capability.

3. System Conditions IMO REQ 0041

3.4 Permissible Control Actions

Following the occurrence of a contingency, the following control actions may be used to respect the loading, voltage decline, and stability limits referenced in this document:

- Generation Redispatch
- Automatic tripping of generation (generation rejection)
- Trip circuits open to change flow distributions
- Trip or redispatch dispatchable loads
- Switch reactors and/or capacitors out (switching in of capacitors in locations that are especially sensitive to voltage changes is to be done only in such a manner as to ensure minimal impact on customers, e.g., using independent pole operation (IPO) breakers)
- Operate phase shifters

In addition to the above control actions, automatic or manual tripping of *non-dispatchable load* may be considered for certain contingencies with one or more transmission elements out-of-service. Generally, *facilities* for the automatic tripping of load will only be acceptable as a stop gap measure to increase the power transfer capability across a bulk transmission interface to cope with temporary deficiencies.

The control actions that are permissible are shown below:

Permissible Control Actions Following Contingency

System Condition Prior to Contingency	Permissible Control Actions Following Contingency		
All elements in service	Generation Redispatch		
	Load Redispatch		
	Generation Rejection		
	Capacitor Switching		
	Reactor Switching		
	Open circuits to change flow distributions		
One or more transmission elements out	Generation redispatch including transactions		
of service	Generation Rejection		
	Capacitor Switching		
	Reactor Switching		
	Open circuits to change flow distributions		
	Load Rejection		

3.4.1 Special Protection System

A *special protection system* (*SPS*) is defined as a protection system designed to detect abnormal system conditions and take corrective action(s) other than the isolation of faulted elements. Such action(s) may include changes in load, generation, or system configuration to maintain system stability, acceptable voltages or power flows. The *NPCC* A-02 criteria provide for the use of a *SPS* under normal and *emergency* conditions.

A *SPS* shall be used judiciously and when employed, shall be installed consistent with good system design and operating policy. A *SPS* associated with the bulk power system may be planned to provide protection for infrequent contingencies, for temporary conditions such as project delays, for unusual combinations of system demand and outages, or to preserve system integrity in the event of severe outages or extreme contingencies. The reliance upon a *NPCC* type I *SPS* for *NPCC* A-2 design criteria contingencies with all transmission elements in service must be reserved only for transition periods while new transmission reinforcements are being brought into service. A *SPS* associated with the non-bulk portion of the power system may be planned to provide protection for a wider range of circumstances than a *SPS* associated with the bulk system.

The decision to employ a *SPS* shall take into account the complexity of the scheme and the consequences of correct or incorrect operation as well as its benefits. The requirements of *SPSs* are defined in *NPCC* criteria A-05, and in NPCC criteria A-11, "Special Protection System Criteria". With all transmission elements in service, continued reliance on a *SPS* is a trigger for considering additional transmission.

A SPS proposed in a connection assessment must have full redundancy and separation of the communication channels, and must satisfy the requirements of the NPCC Type I SPS criteria to be considered by the IESO.

Automatic Tripping of Generation (Generation Rejection)

Automatic tripping of generation via Generation Rejection Schemes (G/R) is an acceptable post-contingency response in limited circumstances as specified below in section 7.3, Control Action Criteria. Arming of G/R may be acceptable for selected contingencies provided the G/R corrects a *security* violation and results in an acceptable operating state.

- End of Section -

4. Pre and Post Contingency System Conditions

This section identifies the acceptable pre-and post-contingency response on the *IESO-controlled grid*. Criteria include:

- Power Transfer Capability
- Pre Contingency Voltage Limits
- Voltage Change Limits
- Transient Voltage Criteria
- Steady State Voltage Stability
- Congestion
- Line and Equipment Loading
- Short Circuit Levels

If studies indicate that any criterion in this section is not met, the *IESO* will either notify the *IESO*-administered market of a system inadequacy or inform the connection assessment proponent that the submitted proposal is not acceptable (i.e. that the proposal must be re-designed).

4.1 Power Transfer Capability

To evaluate the impact of a *connection assessment* on power flow across an interface, it is important to consider:

- The impact on the power flow caused by the introduction of a new limiting contingency (new elements introduce new contingencies); and
- The impact on power flow distribution over the interface (transfer capability) caused by the introduction of new *facilities* which change power flow distribution.

New or modified connections to the *IESO-controlled grid*, for example a new generator, may increase congestion on transmission *facilities* but will not be permitted to lower power transfer capability or operating *security limits* by 5% or more. This will be assessed on a case by case basis. The following are examples of changes that could affect the transfer capability or operating *security* limits:

- an increase in load or generation greater than or equal to 20 MVA;
- where the connectivity of the transmission system is changed and a new contingency is created;

- where the electrical characteristics of generation facilities are changed by greater than or equal to 5%, or exceed accepted design standards and tolerances, or are not in conformance with Appendix 4.2 of the Market Rules;
- where the electrical characteristics of a transmission facility change by greater than or equal to 10%;
- where the transfer capability is reduced by more than 5%; or
- where a new or modified SPS is proposed

4.2 Pre-Contingency Voltage Limits

Under pre-contingency conditions with all *facilities* in service, or with a critical element(s) out of service after permissible control actions and with loads modeled as constant MVA, the *IESO-controlled grid* is to be capable of achieving acceptable system voltages. The table below indicates the maximum and minimum voltages generally applicable. These values are obtained from Chapter 4 of the "Market Rules", and CSA standards for distribution voltages below 50 kV.

Nominal Bus Voltages

Nominal Bus Voltage (kV)	<u>500</u>	230	<u>115</u>	Transformer Stations, e.g. 44, 27.6, 13.8 kV
Maximum Continuous (kV)	550	250	127*	106%
Minimum Continuous (kV)	490	220	113	98%

^{*} Certain buses can be assigned specific maximum and minimum voltages as required for operations. In northern Ontario, the maximum continuous voltage for the 115kV system can be as high as 132kV.

- Transmission equipment must be able to interrupt fault current for voltages up to the *maximum* continuous rating.
- Transmission equipment must remain in service, and not automatically trip, for voltages up to 5% above the maximum continuous rating, for up to 30 minutes, to allow the system to be re-dispatched to return voltages within their normal range.

Transformer stations must have adequate under-load tap-changer or other voltage regulating *facilities* to operate continuously within normal variations on the *transmission system* and to operate in *emergencies* in accordance with transmission voltage ranges as listed in the table in section 4.3.

In general, system pre-contingency voltages used in planning studies should approximate existing system voltage profiles under similar load and generation conditions.

Voltages below 50kV shall be maintained in accordance with CSA 235 by the *transmitter* and/or *distributor*.

4.3 Voltage Change Limits

With all planned *facilities* in service pre-contingency, system voltage changes in the period immediately following a contingency are to be limited as follows:

Nominal Bus Voltage (kV)	<u>500</u>	230	<u>115</u>	<u>Transformer Station</u> <u>Voltages</u>				
				<u>44</u>	<u>27.6</u>	<u>13.8</u>		
% voltage change <u>before</u> tap changer action	10%	10%	10%	10%	10%	10%		
% voltage change <u>after</u> tap changer action	10%	10%	10%	5%	5%	5%		
AND within the range								
Maximum* (kV)	550	250	127	112% of nominal				
Minimum* (kV)	470	207	108	88% of nominal				

^{*}The maximum and minimum voltage ranges are applicable following a contingency. After the system is redispatched and generation and power flows are adjusted the system must return to within the maximum and minimum continuous voltages identified in section 4.2.

Before tap-changer action (immediate post-contingency period) a constant MVA load model can be used. If the voltage change exceeds the limits identified above, a voltage dependent load model should be used (e.g. P α V^{1.5}, and Q α V²). After tap-charger action a constant power load model should be assumed (e.g. the load will return to its pre-contingency level). In areas of the system where it is known that post-contingency voltages will remain depressed after tap-changer and other automatic corrective actions, or in situations where special control actions are proposed (e.g., blocking of under-load tap-changers), the use of variable loads in the longer term post-contingency period may be acceptable.

In cases where voltage rises are a possibility (e.g., islanded generators), transient stability tests should be carried out as a check to ensure that realistic reactive additions are appropriate and that customer equipment will not be exposed to excessive voltages after the transient post-contingency period. The occurrence of a voltage rise for loss of a system element is rare but voltage rises after reclosure operations, especially where capacitor or reactor switching are involved, are relatively common and should be checked. Voltage rises should not result in bus voltages higher than the maximum values indicated in the above table. Not only is equipment damage a concern at such high voltages but, in addition, it may not be safe to carry out breaker switching operations to reduce the voltages to acceptable levels. Capacitor breakers at locations where excessive voltages are possible should be designed for appropriately higher operating voltages.

4.3.1 Reactive Element Switching Change

Reactive devices should be sized to ensure that voltage declines or rises at *delivery point* buses on switching operations will not to exceed 4% of steady state rms voltage before tap changer action using a voltage dependent load model (e.g. $P \propto V^{1.5}$, and $Q \propto V^2$).

4.3.2 Capacitive Element Switching Change

Capacitive devices include HV capacitors, LV capacitors, SVCs, series capacitors, and synchronous condensers.

Capacitive devices should be sized to ensure that voltage declines or rises at *delivery point* buses on switching operations will not exceed 4% of steady state rms voltage for line switching operations per Chapter 4 of the "Market Rules". This 4% is based on load flows before tap changer action using a voltage dependent load model (e.g. P α V^{1.5}, and Q α V²).

4.4 Transient Voltage Criteria

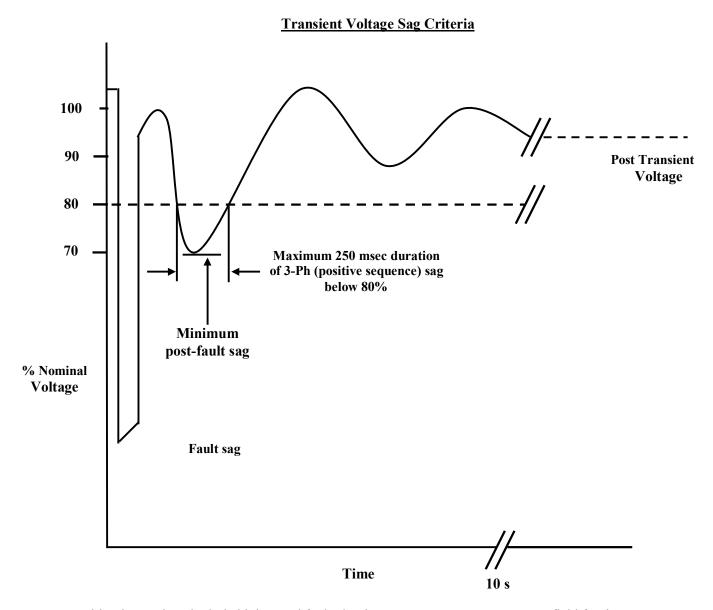
In cases where protection or control coordination may be an issue, or where significant induction motor load is present, time domain simulations should be conducted to assess the dynamic voltage performance. These simulations should cover a time frame in which ULTCs operate (<30 seconds) and should include modeling of devices which affect voltage stability (such as induction motors, ULTCs, switched shunts, generator field current limiters, etc). Per section 3.3.1, due regard should be given to reclosure operations in the simulation.

For transient voltage performance, studies should be done with a load model representative of the actual load. If that information is not available, the standard voltage dependent load model of P=50, 50, Q=0, 100 is to be used (see section 2.4 Load Forecasts and Load Modelling).

This criterion is not intended to be used as a standard of utility supply to individual customers, nor used for transmission and distribution protection design. Rather it is intended to avoid uncontrolled, significant load interruption that may lead to unintended *transmission system* performance. The starting voltage, sag and duration of post-fault transient undervoltages are a measure of the system strength, and its ability to recover promptly.

The following transient voltage criteria are to be used to evaluate system performance. The *IESO* will conduct periodic review of the IEEE standards and relevant literature to monitor the need to revise this section.

The minimum post-fault positive sequence voltage sag must remain above 70% of nominal voltage and must not remain below 80% of nominal voltage for more than 250 milliseconds within 10 seconds following a fault. Specific locations or grandfathered agreements may stipulate minimum post-fault positive sequence voltage sag criteria higher than 80%. IEEE standard 1346-1998 supports these limits.



Mitigation options include high-speed fault clearing, *special protection systems*, field forcing, transmission reinforcements and transmission interface transfer limits.

While the determination of whether a transient stability test is stable or unstable is generally straightforward, issues such as transient load shakeoff, high voltage tripping of capacitors, and undamped oscillatory behaviour in the post-transient period should be considered using the following guidelines:

- occasional tests should be run out to about thirty seconds first swing stability does not guarantee transient stability;
- high voltage swings will generally be considered acceptable unless the magnitude or duration of the high voltage swing could be sufficient to cause capacitor tripping. Typical maximum voltage and duration of swing to avoid damage to and tripping of high voltage capacitors are identified

below. The magnitude of the high voltage swing must be less than the capacitor breaker rating multiplied by the factor in the following table for the duration indicated.

Duration	Maximum Permissible Voltage			
	(Multiplying Factor To Be Applied to Rated RMS Voltage)			
½ cycle	3.00			
1 cycle	2.70			
6 cycles	2.20			
15 cycles	2.00			
1 second	1.70			
15 seconds	1.40			

4.5 Steady State Voltage Stability

Adequate voltage performance under 4.4 above does not guarantee system voltage stability. Steady state stability is the ability of the *IESO-controlled grid* to remain in synchronism during relatively slow or normal load or generation changes and to damp out oscillations caused by such changes.

The following checks are carried out to ensure system voltage stability for both the pre-contingency period and the steady state post-contingency period:

- Properly converged pre- and post-contingency powerflows are to be obtained with the critical parameter increased up to 10% with typical generation as applicable;
- All of the properly converged cases obtained must represent stable operating points. This is to be
 determined for each case by carrying out P-V analysis at all critical buses to verify that for each
 bus the operating point demonstrates acceptable margin on the power transfer as shown in the
 following section; and
- The damping factor must be acceptable (the real part of the eigenvalues of the reduced Jacobian matrix are positive).

The following sections provide more information on damping factor, use of P-V curves to identify stability limits, and dynamic voltage performance simulations.

4.5.1 Power – Voltage (P-V) Curves

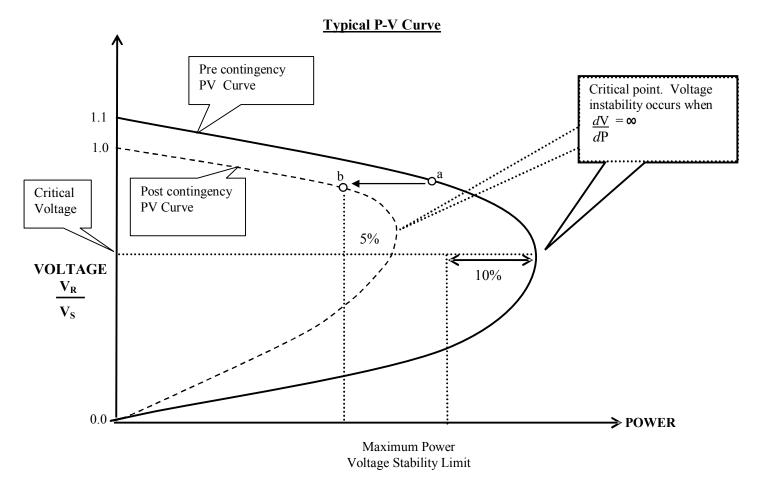
To generate the P-V curve, loads should be modeled as constant MVA. In specific situations, if good data is available, voltage dependent loads and tap-changer action may be modeled in detail to assess the system voltage performance following the contingency and automatic equipment actions but before manual operator intervention.

Power flow programs can be used to generate a P-V curve. In certain situations it may be desirable to manually generate a P-V curve to take into account specific remedies available.

A sample P-V curve is shown below. The critical point of the curve, or voltage instability point, is the point where the slope of the P-V curve is vertical. As illustrated, the maximum acceptable precontingency power transfer must be the lesser of:

- a pre-contingency power transfer (point a) that is 10% lower than the voltage instability point of the pre-contingency P-V curve, and
- a pre-contingency transfer that results in a post-contingency power flow (point b) that is 5% lower than the voltage instability point of the post-contingency curve

The P-V curve is dependent on the power factor. Care must be taken that the worst case P-V curve is used to identify the stability limit.



4.5.2 Damping Factor

The damping factor provides a measure of the steady-state stability margin of a power system. The damping factor can be derived from an eigenvalue state-space model of the power system. The damping factor (x) is:

$$\xi = \frac{-\delta}{\sqrt{\delta^2 + \omega^2}}$$

where δ and ω are the real and imaginary parts of the critical eigenvalue. If δ is negative, the oscillations will decay. Where the eigenvalues are not available δ and ω may be measured from time domain simulations by assuming that the oscillations are exponentially damped sinusoids in a second order system.

The damping factor determines the rate of decay of the amplitude of the oscillation. The following table provides pre and post contingency damping factor requirements.

System ConditionDamping FactorPre-Contingency> 0.03Post-contingency¹> 0.00Post-Contingency²> 0.01Following Repreparation of the system³> 0.03

Acceptable Damping Factors

- 1. Before automatic intervention
- 2. Following automatic intervention. Studies should assume **NO** manual intervention
- 3. Following all permissible control actions identified in section 3.4

For critical cases, there should be evidence of strong damping of system oscillations within about 10 seconds, otherwise, simulations should be run out to about 20 seconds and all modes of oscillations should show adequate damping behaviour. For swings characterized by a single dominant mode of oscillation, the damping can be calculated directly from the oscillation envelope; a 15% decrement between cycles is required to meet the damping factor criteria.

4.6 Congestion

Congestion is the condition under which the trades that *market participants* wish to implement exceed the capability of the *IESO-controlled grid*. It usually requires the system operator to adjust the output of generators, decreasing it in one area to relieve the constraint and to increase it in another to continue to meet customer *demand*.

For long term *adequacy* assessments, congestion should be flagged where observed. Congestion is flagged as the amount of time that interface flows exceed 100% of their limit where the limit has been increased by the use of applicable *SPSs*. Locational pricing data, where available, may be used to assess historical congestion costs.

4.7 Line and Equipment Loading

4.7.1 General Guidelines

All line and equipment loading limits, the limited time associated emergency ratings and the ambient conditions assumed in determining the ratings are defined by the equipment owner. Long-term emergency ratings are generally a 10-day limited time rating for transformers, and a continuous or 50 hour /year rating for transmission circuits. Short-term emergency ratings are generally 15-minute or 30-minute limited time ratings for transformers and transmission circuits. For each assessment, the applicable ratings will be confirmed with the equipment owner.

4.7.2 Loading Criteria

All line and equipment loads shall be within their continuous ratings with all elements in service and within their long-term emergency ratings with any one element out of service. Immediately following contingencies, lines may be loaded up to their short-term emergency ratings where control actions such as re-dispatch, switching, etc. are available to reduce the loading to the long-term emergency ratings.

It is assumed that for the bulk power system, loading conditions and control actions are available to reduce the loading to the long-term emergency rating or less within 15 minutes.

Circuit breakers, current transformers, disconnect switches, buses and all other system elements must not be restrictive.

The ratings of tie lines are governed by agreements between the *facility* owners. The criteria to direct operation of the lines are governed by agreements between the system or market operators.

4.8 Short Circuit Levels

Short circuit studies are to be carried out with all existing *generation facilities* in service and with all *connection assessments* that have been approved, including those that did not require a formal *connection assessment* study. System voltages are to be assumed to be at the maximum acceptable system voltage identified in Section 4.2. The latest information from neighbouring systems that may have an impact on short circuit studies (including *NPCC* SS-38 and *NERC* MMWG representation) is to be used to define relevant *interconnection* assumptions. Short circuit levels must be within the maximum short circuit levels and duration specified in the Ontario Energy Board's (OEB's) "Transmission System Code".

No margin is used when comparing the short circuit value to *facility* ratings.

The *IESO* will accept make before break switching operations that temporarily increase fault levels beyond breaker interrupting capability as long as affected equipment owners are willing to accept the risk and its consequences.

4.9 Station Layout

Guidance on transformer and switching station layout is provided in Appendix B. The guidelines provide an acceptable way towards meeting the contingency criteria of section 2.7. However, other configurations and station layouts that meet those criteria are also acceptable.

- End of Section -

5. Transmission Connection Criteria

The term "transmission connection" is applied to any *facility* that establishes or modifies a connection to the *IESO-controlled grid* such that a *connection assessment* is required.

5.1 New or Modified Facilities

New or modified *facilities* must satisfy all *NERC* standards, Regional *Reliability* Council Criteria, and the requirements of the OEB's "Transmission System Code", the "Market Rules" and associated standards, policies, and procedures.

New or modified *facilities* must not materially reduce the level of *reliability* of existing *facilities*. Specifically:

- facilities within a common zone of protection, such as line taps or bus sections, must be built to meet or exceed the affected transmitter's standards prevailing at the time of construction;
- the *security* and dependability of protection equipment that forms a common zone of protection, or of protections that are required to operate in a coordinated fashion, must be of a standard of *reliability* that is equal to or higher than the *reliability standards* specified in the OEB's "Transmission System Code" prevailing at the relevant time;
- facilities, such as line taps, that significantly increase the line length and thereby its exposure to faults, may be required to use circuit breakers and separate zones of protection to limit the additional exposure to existing connections; and
- new or modified connections must not materially reduce the existing transfer capability of the *IESO-controlled grid*, and must not impose additional restrictions on the deployment of existing *connection facilities*.

5.2 Effect on Existing Facilities

New or modified connections must not materially reduce the load-meeting capability of existing *facilities*.

New or modified connections must not restrict the capability of existing *generation facilities* or loads to deliver to or receive power from the *IESO-controlled grid*.

Where there would be insufficient transmission capability to deliver the maximum registered capacity to the *IESO-controlled grid* while recognizing applicable contingency criteria:

- the proposal must be re-designed, e.g. the maximum registered capacity must be reduced to a level that can be delivered;
- the transmission facilities must be refurbished or replaced; or
- *special protection systems (SPS)*, in limited circumstances, may be utilized to mitigate the effects of contingencies on the transmission *facilities*.

- End of Section -

6. Generation Connection Criteria

Transmission to incorporate new generation is defined as those new circuits that connect the generator to the *IESO-controlled grid*, plus any reinforcements to the *IESO-controlled grid* required as a direct and sole result of the new generation. With the new generation at its maximum output, all load levels should be considered.

6.1 Voltage Change

The loss of a generating *facility* due to a single-element contingency involving any element upstream of the generator bus (e.g. line or step-up transformer) should respect the voltage change criteria in section 4.3.

6.2 Wind Power

- For the purposes of *transmission system adequacy* and *connection assessments*, wind powered generators are to be treated as *non-dispatchable* (intermittent) units which are operating up to their maximum output.
- For *connection assessments*, transmission line ratings will be calculated using 15km/h winds, instead of the typical 4km/h, within the vicinity of the wind farm and, with the approval of the *transmission* asset owner, out to a 50 km radius.

Guidance on technical requirements related to wind turbine performance and wind farm station layout is provided in Appendix C. The guidelines provide a design that satisfies the contingency criteria of section 2.7. However, other configurations and station layouts that meet those criteria are also acceptable.

As the *IESO* gains more experience with the operating characteristics of wind powered generators, the above criteria may be revised.

6.3 Synchronous Generation

Transmission *facilities* for incorporating new generation must meet the requirements of section 5. Guidance on technical requirements related to synchronous generator performance, station layout, and connection to the *IESO-controlled grid* is provided in Appendix D. The guidelines provide a design that satisfies the contingency criteria of section 2.7. However, other configurations and station layouts that meet those criteria are also acceptable.

6.4 Station Layout

Guidance on transformer and switching station layout is provided in Appendix B. The guidelines provide an acceptable way towards meeting the contingency criteria of section 2.7. However, other configurations and station layouts that meet those criteria are also acceptable.

- End of Section -

7. Load Security and Restoration Criteria

The long-term *transmission system* planning criteria below establish default levels of load *security* and load restoration. The application of a lower level of load *security* may be acceptable in the non bulk portions of the *IESO-controlled grid* provided the bulk power system adheres to *NERC* and *NPCC* standards. Different criteria may be used for the facilities beyond the load side of the *connection point* to the *transmission system* (notionally the defined point of sale).

7.1 Load Security Criteria

The *transmission system* must be planned to satisfy *demand* levels up to the extreme weather, median-economic forecast for an extended period with any one transmission element out of service. The *transmission system* must exhibit acceptable performance, as described below, following the design criteria contingencies defined in sections 2.7.1 and 2.7.2. For the purposes of this section, an element is comprised of a single zone of protection.

With all transmission *facilities* in service, equipment loading must be within continuous ratings, voltages must be within normal ranges and transfers must be within applicable normal condition stability limits. This must be satisfied coincident with an outage to the largest local generation unit.

With any one element out of service³, equipment loading must be within applicable long-term *emergency* ratings, voltages must be within applicable *emergency* ranges, and transfers must be within applicable normal condition stability limits. Planned load *curtailment* or load rejection, excluding voluntary *demand* management, is permissible only to account for local generation outages. Not more than 150MW of load may be interrupted by configuration and by planned load *curtailment* or load rejection, excluding voluntary *demand* management. The 150MW load interruption limit reflects past planning practices in Ontario.

With any two elements out of service⁴, voltages must be within applicable *emergency* ranges, equipment loading must be within applicable short-term *emergency* ratings and transfers must be within applicable *emergency* condition stability limits. Equipment loading must be reduced to the applicable long-term *emergency* ratings in the time afforded by the short-time ratings. Planned load *curtailment* or load rejection exceeding 150MW is permissible only to account for local generation outages. Not more than 600MW of load may be interrupted by configuration and by planned load *curtailment* or load rejection, excluding voluntary *demand* management. The 600MW load interruption limit reflects the established practice of incorporating up to three typical modern day distribution stations on a double-circuit line in Ontario.

³ For example, after a single-element contingency with all transmission elements in service pre-contingency.

⁴ For example, after a double-element contingency will all transmission elements in service pre-contingency or after a single-element contingency with one transmission element out of service pre-contingency.

7.2 Load Restoration Criteria

The *IESO* has established load restoration criteria for high voltage supply to a *transmission customer*. The load restoration criteria below are established so that satisfying the restoration times below will lead to an acceptable set of *facilities* consistent with the amount of load affected.

The *transmission system* must be planned such that, following design criteria contingencies on the *transmission system*, affected loads can be restored within the restoration times listed below:

- a. All load must be restored within approximately 8 hours.
- b. When the amount of load interrupted is greater than 150MW, the amount of load in excess of 150MW must be restored within approximately 4 hours.
- c. When the amount of load interrupted is greater than 250MW, the amount of load in excess of 250MW must be restored within 30 minutes.

These approximate restoration times are intended for locations that are near staffed centres. In more remote locations, restoration times should be commensurate with travel times and accessibility.

7.3 Control Action Criteria

The deployment of control actions and *special protection systems* must not result in material adverse effects on the bulk system.

The *transmission system* may be planned such that control actions such as generation re-dispatch, reactor and capacitor switching, adjustments to phase-shifter and HVdc pole flow, and changes to inter-Area transactions may be judiciously employed following contingencies to restore the power system to a secure state.

The reliance upon a *special protection system* must be reserved only for exceptional circumstances, such as to provide protection for infrequent contingencies, temporary conditions such as project delays, unusual combinations of system *demand* and *outages*, or to preserve system integrity in the event of severe *outages* or extreme contingencies.

Transmission expansion plans for areas that may have a material adverse effect on the interconnected bulk power system must not rely on *NPCC* Type I *special protection systems* with all planned transmission *facilities* in service.

7.4 Application of Restoration Criteria

Where a need is identified, for example via the *IESO's* outlooks or via the OPA's IPSP, *market* participants and the applicable transmitter will be notified of the need for a deliverability study.

Transmission customers and *transmitters* can consider each case separately taking into account the probability of the contingency, frequency of occurrence, length of repair time, the extent of hardship caused and cost. The *transmission customer* and *transmitter* may agree on higher or lower levels of *reliability* for technical, economic, safety and environmental reasons provided the bulk power system adheres to *NERC* and *NPCC* standards.

7.5 Exemptions to the Restoration Criteria

Where the *transmission customer(s)* and *transmitter(s)* agree that satisfying the security and restoration criteria on *facilities* not designated as part of the bulk system is not cost justified, they may jointly apply for an *exemption* to the *IESO*. In applying for this *exemption*, *transmission customer(s)* and *transmitter(s)* will identify the conditions (generally the timing and load level) under which they plan to satisfy the criteria. *IESO* will assess these on a case-by-case basis and grant the *exemption*, allowing a lower level of *reliability*, unless there is a material adverse effect on the *reliability* of the bulk power system.

End of Section

8. Resource Adequacy Assessment Criterion

8.1 Statement of Resource Adequacy Criterion

To assess the *adequacy* of resources in Ontario, the *IESO* uses the *NPCC* resource adequacy design criterion from *NPCC* A-02:

"Each Area's probability (or risk) of *disconnecting* any firm load due to resource deficiencies shall be, on average, not more than once in ten years. Compliance with this criterion shall be evaluated probabilistically, such that the loss of load expectation [LOLE] of *disconnecting* firm load due to resource deficiencies shall be, on average, no more than 0.1 day per year. This evaluation shall make due allowance for *demand* uncertainty, scheduled *outages* and deratings, *forced outages* and deratings, assistance over *interconnections* with neighboring Areas and Regions, *transmission transfer capabilities*, and capacity and/or load relief from available operating procedures."

8.2 Application of the Resource Adequacy Criterion

The *IESO* uses the General Electric Multi-Area Simulation (MARS) computer program to determine the reserve margin required to meet the *NPCC* resource adequacy criterion. A detailed load, generation, and transmission representation for 10 zones in Ontario is modeled in MARS. Simple representations are used for the five external *control areas*² to which Ontario *connects*.

The reserve margin is expressed as a percent of *demand* at the time of the annual peak where the LOLE is at or just below 0.1 days per year. A reserve margin calculated on this basis represents the minimum acceptable reserve level needed to meet the *NPCC* resource adequacy criterion. At least once per year, *IESO* will calculate the required reserve margin at the time of annual peak for the next five years and will *publish* this value.

For operational planning purposes, just meeting the *NPCC* criterion is considered sufficient since frequent forecast updates combined with significant *outage* flexibility, external economic supply potential and the availability of *emergency* operating procedures have historically provided sufficient "insurance" against residual supply risk.

For capacity planning purposes, where longer term decisions must be made, additional reserves to cover residual uncertainties and project delays may be appropriate. Also, the *IESO* does not consider *emergency* operating procedures for longer term capacity planning because the relief provided by these measures is intended for dealing with *emergencies* rather than being used as a surrogate resource. Regular triggering of *emergency* operating procedures rather than developing appropriate resources could lead to the erosion of these options through overuse. The extent to which all uncertainty is covered becomes an economic decision which should be guided by the *NPCC* criterion.

8.3 Resource Assumptions

The Ontario system has a resource mix comprised of a variety of fuel types. Assumptions about resource availability vary by fuel type. Generally, resource availability forecasts are based on median assumptions. A complete description of the resource assumptions used in the *IESO's adequacy* assessments can be found in the methodology document entitled, "Methodology to Perform Long Term Assessments". This document is *published* quarterly with the release of the 18-Month Outlook Resource Adequacy Assessments.

End of Section

Appendix A: IESO/NPCC/NERC Reliability Rule cross-reference

IESO/NPCC/NERC Reliability Rule Cross-Reference

Section	Ontario Criteria	NPCC Criteria	NERC Standard
Resource Adequacy	Available <i>Capacity Reserve</i> Margin Requirement	A-2	TPL-005, 006;
	Margin Requirement		MOD-016 to MOD- 021, 024, 025
Transmission Capability Planning Bulk Power System	Thermal Assessment	A-2	TPL-003;
	Voltage Assessment	A-2	FAC-001, 002
	Stability Assessment	A-2	
	Extreme Contingency Assessment	A-2	TPL-004
Transmission Capability Planning Non Bulk Local Areas	Thermal Assessment		TPL-003;
	Voltage Assessment		FAC-001, 002
	Stability Assessment		
	Supply Deliverability Level		TPL-004

- End of Section -

Appendix B: Guidelines for Station Layout

This Appendix provides a guide to desirable configurations. Variations from this guide are permissible provided that such variations comply with the criteria of sections 2.7 and 4.

The specification of station layout requires consideration of the number of breakers required to trip all infeeds to a fault. Increasing the number of breakers to clear a fault results in the relaying systems becoming more complex and increases the chance of failure to clear all infeeds to the fault.

It is not practical to calculate mathematically the optimum balance of complexity, *reliability* and cost in specifying station layout. Therefore, a review of existing practices has been made and compiled as a guide to show the maximum complexity that should normally be permitted in design of station layout or switching connections for transformers or circuits.

In general, the specification of station layout and the number of breakers needed to trip to clear faults should take into account the following:

- probability of failure
- reliability studies of the layout
- effect on the *IESO-controlled grid*
- nature and size of the load affected
- typical duration of a failure
- operating efficiency

B.1 OEB's Transmission System Code

Any new connection or modification of an existing station layout must meet the requirements of the "Market Rules" and the OEB's "Transmission System Code".

The OEB's "Transmission System Code" specifies that all customers must provide an isolating *disconnect* switch or device at the point or junction between the *transmitter* and the customer. This device is to physically and visually open the main current-carrying path and isolate the Customer's *facility* from the *transmission system*. Details are provided in Schedule F of the OEB's "Transmission System Code".

Schedule G of the OEB's "Transmission System Code" specifies that a high-voltage interrupting device (HVI) shall provide a point of isolation for the generator's station from the *transmission system*. The HVI shall be a circuit breaker unless the *transmitter* authorizes another device.

B.2 Analysis of System Connections

The key factors that must be considered when evaluating a switching or transformer station include:

• Security and quality of supply Relevant criteria are presented in section 4.

impacting *security* and quality of supply.

- Extendibility
 The design should allow for forecast need for future extensions if practical.
- Maintainability
 The design must take into account the practicalities of maintaining the substation and associated circuits. It should allow for elements to be taken out of service for maintenance without negatively
- Operational Flexibility
 The physical layout of individual circuits and groups of circuits must permit the required operation of the IESO-controlled grid.
- Protection Arrangements
 The design must allow for adequate protection of each system element
- Short Circuit Limitations
 In order to limit short circuit currents to acceptable levels, bus arrangements with sectioning facilities may be required to allow the system to be split or re-connected through a fault current limiting reactor.

The contingencies evaluated in assessing proposed station layout *adequacy* will be those outlined in section 2.7. The *IESO* will analyze the effect of various contingencies on the *adequacy* and *security* of the *IESO-controlled grid*. The *IESO* will also ensure that the proposed configuration allows for routine maintenance *outages* with minimal exposure to load interruption from subsequent contingencies. For example, for *facilities* classed as bulk power system, the *IESO* will examine the following contingencies for the proposed station layout:

- Fault on any element with delayed clearing because of a stuck breaker
- Maintenance *outage* on a breaker or bus followed by a single-element contingency

The resulting *IESO-controlled grid* performance must meet the criteria in section 4. As the *IESO-controlled grid* develops, the criteria under which a particular station layout is assessed may change (e.g. a *local area* station may become a bulk power system station).

The *IESO* will then evaluate the amount of load interrupted by single-element contingencies (or double circuit contingencies depending on the load level) with the proposed station layout". For example a *local area* switching station layout would be reviewed to ensure that a single-element or double circuit contingency would not result in an interruption that exceeds the criteria in section 7.1.

Evaluations of modifications to existing *facilities* will take into account the lower level of flexibility and layouts will be evaluated on the extent they meet the assessment criteria.

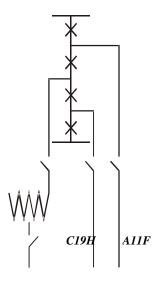
B.3 General Requirement's For Station Layouts

This section identifies general requirements for all station layouts based on *good utility practice* and operational efficiency. Acceptable system performance will dictate the acceptability of any proposed layout. This section provides the electrical single line diagram and does not reflect physical layouts. See section B.4 for information on physical layout.

B.3.1 "Breaker-And-A-Third" Layouts

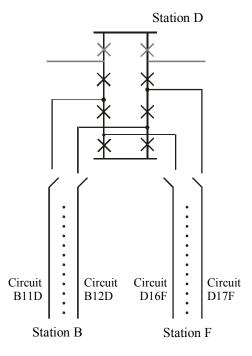
In "breaker-and-a-third" layouts the ideal location for autotransformers and generators is in the middle of the diameter as shown.

It is desirable to have one element (one autotransformer or one line) per position.



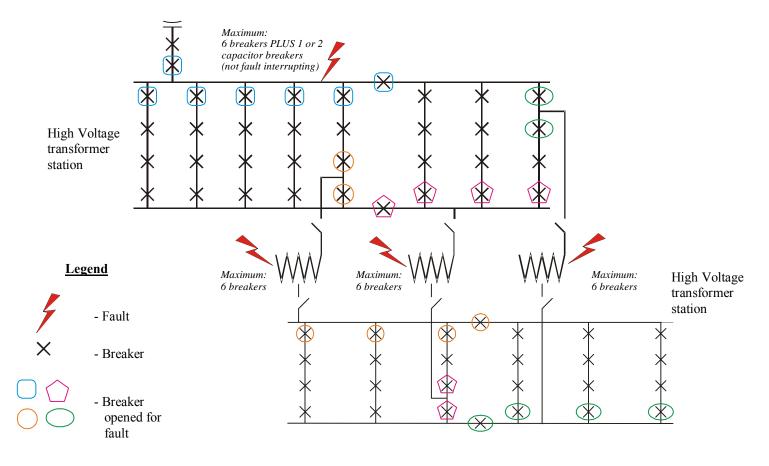
B.3.2 Bus Balance

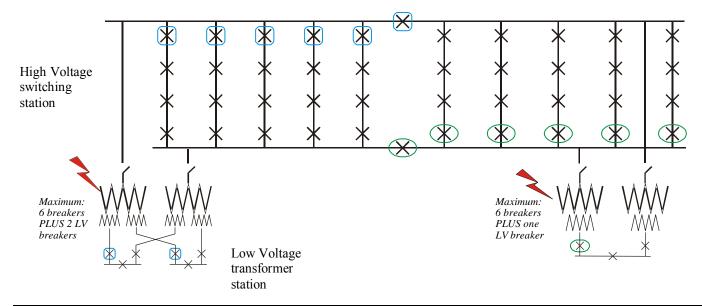
The ideal arrangement for a double circuit line is to terminate each circuit on different diameters positioned so that there is maximum flexibility and *security* for a variety of fault and operating scenarios.



B.3.3 Maximum Breakers

Station layout should be such that a maximum of 6 High Voltage (500kV, 230kV and 115kV) and up to 2 capacitor or 2 Low Voltage breakers are needed to trip following any fault (operation of the capacitor breaker does not involve interruption of fault current). The following layouts illustrate these rules.





B.3.4 Separation of Reactive Power Sources

The goal of a good station layout is to minimize the effect of a contingency. Thus a contingency should result in the fewest possible number of elements removed from service.

In this vein, only one supply element should be connected directly to a bus. The intent is that a single contingency not result in the loss of two VAR sources.

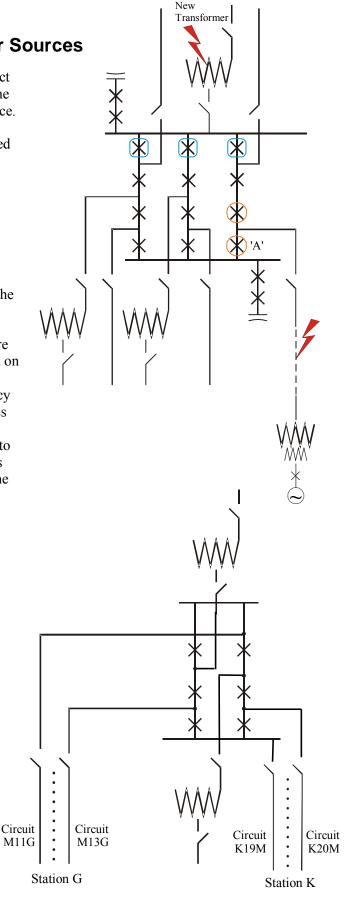
For example, when terminating a new autotransformer, generator, circuit, or capacitor bank onto a bus, a single element contingency should not result in the loss of the autotransformer or line and the simultaneous loss of the capacitor bank or generator. (It would be acceptable to connect a step-down transformer and capacitor bank to the same bus.)

Per B.3.1, the ideal location of a generator is in the centre of a diameter (where the autotransformers are connected on the layout shown). The generator termination at the location shown is not ideal. A single-element contingency with breaker failure would result in the simultaneous loss of the generator and capacitor bank. To determine the acceptability of the layout shown it would be necessary to conduct a transmission assessment to class the *facility* as either bulk power system or local and then to evaluate the performance of the *IESO-controlled grid* for the appropriate contingencies.

B.3.5 Ring Bus

A minimum of three diameters is desired. Alternatively if a ring bus is temporarily unavoidable, the station should be laid out for the future addition of another diameter.

During periods when breakers are out-of-service for maintenance, ring buses can impose significant operational constraints. The layout shown provides one way to optimize the layout of a ring bus and minimize the adverse effect of maintenance.

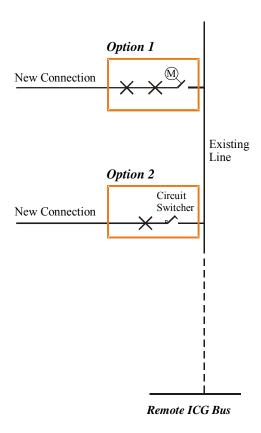


B.3.6 Connections Without Transfer Trip

Where the *connection point* to the *IESO-controlled grid* is sufficiently remote that transfer trip is impractical, either of the two options shown would be acceptable.

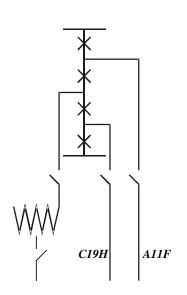
In Option 1, a line fault would initiate tripping of both breakers simultaneously, thereby addressing concerns about possible breaker failure if only a single breaker were used. This arrangement must include a motorized *disconnect* to provide 'physical' isolation of the new line from the *IESO-controlled grid*.

In Option 2, a line fault would initiate simultaneous operation of the single breaker and the circuit switcher. The integral *disconnect* switch of the circuit switcher would provide the required 'physical' isolation of the new line from the *IESO-controlled grid*.

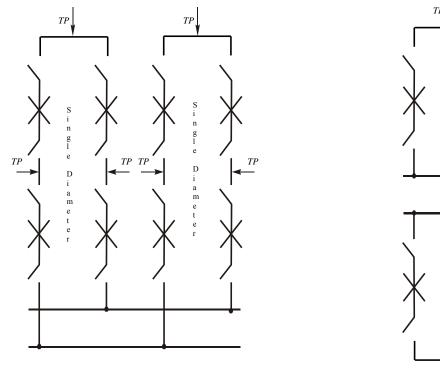


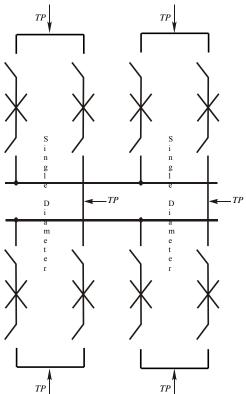
B.4 Physical Station Layouts

The electrical single line diagram of a "breaker-and-a-third" arrangement is shown. Typical physical layouts for "breaker-and-a-third" follow.



Typical Physical Arrangement for a Breaker-and-a-Third Layouts





TP = Termination Point for a transmission element such as a circuit, transformer, etc.

Overhead connections omitted for clarity

- End of Section -

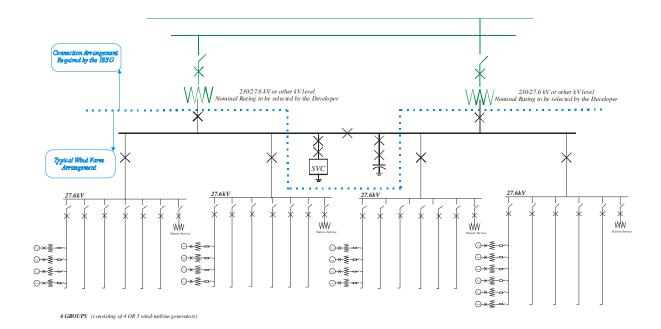
Appendix C: Wind Farms Connection Requirements

The following is intended to clarify the requirements for connection to the *IESO-controlled grid* of wind-generation proposals which are aimed at ensuring that the *reliability* of the system is preserved. This short list does not relieve proponents from any *market rule* obligation. *Transmitter* and *distributor* requirements are separate and are not addressed herein.

The key factors that must be evaluated when performing a *connection assessment* of a wind farm are:

- 1. Equipment must be suitable for continuous operation in the applicable transmission voltage range specified in Appendix 4.1 of the "Market Rules". Equipment must also be able to withstand overvoltage conditions during the short period of time (not more than 30 minutes) it takes to return the power system to a secure state. Plant auxiliaries must not restrict *transmission system* operation.
- 2. Generating units do not trip for contingencies except those that remove generation by configuration. This requires adequate low and high voltage ride through capability. If generating units trip unnecessarily, they will require enhanced ride-through capability to prevent such tripping or the *IESO* may restrict operation to avoid these trips.
- 3. Recognized contingencies within the wind-*generation facility*, except for transmission breaker failures, must not trip the connecting transmission circuit(s).
- 4. Induction generators are required to have the reactive power capabilities described in Appendix 4.2 Reference 1 of the "Market Rules". Induction generating units injecting power into the transmission system are required to have the same reactive capabilities as synchronous units that have similar apparent power ratings. They are required to have the capability to inject at the connection point to the IESO-controlled grid approximately 43.6 MVAr for every 90 MW of active power (0.9 power factor at the low voltage terminals of the connection point). The requirement to provide the entire range of reactive power for at least one constant transmission voltage limits the impedance of the connection between the generating units and the transmission system to about 13% impedance on the generator's rated output base. Generating units not injecting power into the transmission systems must be able to reduce reactive flow to zero at the point of connection and must have similar reactive capabilities as units connected to the transmission system. The IESO may require any reactive power deficiencies of facilities injecting into the transmission system to be corrected by reactive compensation devices.
 - For wind turbine technologies that have dynamic reactive power capabilities described in 4.2
 Reference 1 of the "Market Rules", additional shunt capacitors may be required to offset the
 reactive power losses over the wind farm collection system that are in excess of those allowed
 by the "Market Rules".
 - For wind turbine technologies that do not have dynamic reactive power capabilities described in 4.2 Reference 1 of the "Market Rules", dynamic reactive compensation (static var compensator) equivalent to the "Market Rules" requirement must be installed. In addition, shunt capacitors may be required to offset the reactive power losses that are in excess of those allowed by the "Market Rules", over the wind farm collection system.

- 5. *Facilities* shall have the capability to regulate voltage as specified by the *IESO*. Operation in any other mode of *regulation* (e.g. power factor or reactive power control) shall be subject to *IESO* approval.
- Facilities shall be installed to participate in any special protection system identified by the IESO
 during the CAA process. In most cases, this will be generation rejection and the associated
 telecommunication facilities.
- 7. Generating units will meet the voltage variation and frequency variation requirements described in Appendix 4.2 Reference 2 and Reference 3 of the "Market Rules".
- 8. Real-time monitoring must be provided to satisfy the requirements described in Appendix 4.15 and Appendix 4.19 of the "Market Rules".
- 9. *Revenue metering* must be provided to satisfy the Market Rule requirements. No commissioning power will be provided until the *revenue metering* installation is complete.
- 10. The *facility* does not increase the duty cycle of equipment such as load tap changing transformers or shunt capacitors beyond a level acceptable to the associated *transmitter* or *distributor*.
- 11. Line taps and step-up transformers connect to both circuits of a double-circuit-line (figure attached). The *facility* must be designed to balance the loading on both circuits of a double-circuit line.
- 12. Equipment must be designed so the adverse effects of failure on the *transmission system* are mitigated. This includes ensuring all transmission breakers fail in the open position.
- 13. Equipment must be designed so it will be fully operational in all reasonably foreseeable ambient conditions. This includes ensuring that certain types of breakers are equipped with heaters to prevent freezing.
- 14. The equipment must be designed to meet the applicable requirements of the OEB's "Transmission System Code" or the OEB's "Distribution System Code" in order to maintain the *reliability* of the grid. They include requirements identified by the *transmitter* for protection and telecommunication *facilities* and coordination with the exiting schemes. The protection systems for equipment connected to the *IESO-controlled grid* must be duplicated and supplied from separate batteries.
- 15. Disturbance monitoring equipment capable of recording the post-contingency performance of the *facility* must be installed. The quantities recorded, the sampling rate, the triggering method, and clock synchronization must be acceptable to the *IESO*.



Typical Configuration

Appendix D: Synchronous Generation Connection Requirements

The following summarizes the requirements for connection to the *IESO-controlled grid* of single-cycle or combined-cycle generation proposals of medium to large size which are aimed at ensuring that the *reliability* of the system is preserved. This short list does not relieve proponents from any market rule obligation. This document may be used by *market participants* to help them understand *IESO* criteria and further their *connection assessment* work.

Transmitter and distributor requirements are separate and are not addressed herein. The Proponent is expected to follow other approvals processes to ensure the other aspects of *reliability* such as detailed equipment design, environmental considerations, power quality, and safety are properly addressed.

Generating Unit Performance

Excitation System

The requirements for exciters on *generation unit* rated at 10 MVA or higher are listed in Reference 12 of Appendix 4.2 in the "Market Rules" as follows:

- A voltage response time not longer than 50 ms for a voltage reference step change not to exceed 5%;
- A positive ceiling voltage of at least 200% of the rated field voltage, and
- A negative ceiling voltage of at least 140% of the rated field voltage.

In addition, the requirements for power system stabilizers (PSS) are described in Reference 15 of Appendix 4.2:

• Each synchronous generating unit that is equipped with an excitation system that meets the performance requirements described above shall also be equipped with a power system stabilizer. The power system stabilizer shall, to the extent practicable, be tuned to increase damping torque without reducing synchronizing torque.

Governor

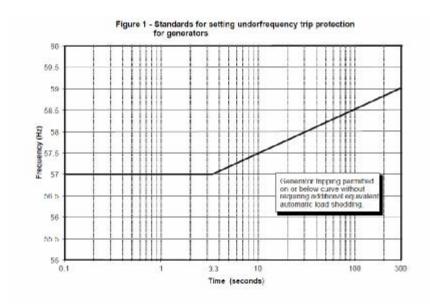
Reference #16 of Appendix 4.2 of the "Market Rules" requires that every synchronous generator unit with a name plate rating greater than 10 MVA or larger be operated with a speed governor, which shall have a permanent speed droop that can be set between 3% and 7% and the intentional dead band shall not be wider than \pm 36 mHz.

Automatic Voltage Regulator

Reference #13 of Appendix 4.2 of the "Market Rules" requires each synchronous generating unit to be equipped with a continuously acting *automatic voltage regulator* (AVR) that can maintain the terminal voltage under steady state conditions within $\pm 0.5\%$ of any voltage set point. Each synchronous *generation unit* shall regulate voltage except where permitted by the *IESO*.

Generator Underfrequency Performance

Reference #3 of Appendix 4.2 of the "Market Rules" requires that generating *facilities* be capable of operating continuously at full power for a system frequency range between 59.4 to 60.6 Hz. In accordance with *NPCC* criteria A-03, "Emergency Operation Criteria", generators shall not trip for under-frequency system conditions for frequency variations that are above the curve shown below. However, if this cannot be achieved, and if approved by the *IESO*, then automatic load shedding equivalent to the amount of generation to be tripped must be provided in the area. This criterion is required to ensure the stability of an island, if formed, and to avoid major under-frequency load shedding in the area.



Generation Facility Connection Options

The *IESO*, in its review of the various generation projects that propose to connect to the *IESO-controlled grid*, has developed typical connection arrangements for generation developments. Variations to the typical connection arrangements may be accepted by the *IESO* provided that *reliability* criteria are met and that the *connection assessment* studies prove that the system is not adversely affected. Connection of *generation facilities* larger than 500 MW that propose to use arrangements that are typical for the developments under 500 MW may be accepted subject to *IESO* approval.

Generation Facilities Rated between 250 MW and 500 MW

All projects rated between 250 MW and 500 MW are required to connect to two circuits (where available) and as a minimum provide one of the connectivity arrangements shown in Figure 1, 2 or 3. Station arrangements that connect two like elements next to each other separated by only one breaker should be avoided.

The configurations shown in Figure 1 and Figure 2 are suitable for coupled gas and steam turbines pairs.

• A contingency associated with one of the transmission lines will be cleared at the terminal stations and by the breaker on the corresponding generator line tap. If the post-contingency rating of the remaining line permits, the *facility* can remain connected to one circuit.

- A bus-tie breaker failure condition will send transfer trip to the line tap breakers and the entire *facility* will be tripped off. If the *IESO's* assessment indicates that tripping the entire generating *facility* will have a negative impact on the system then the *IESO* will recommend alternative connection arrangements.
- For the configuration in Figure 1, a contingency associated with one of the step-up transformers or a generator unit will be cleared by opening the bus-tie breaker and the HV synchronizing breaker.
- The configuration in Figure 2 is more economical because it allows the connection of two units via one step-up transformer but is less reliable since a contingency associated with one step-up transformer results in the loss of two generating units.
- For an *outage* associated with one of the HV breakers the entire *generation facility* could remain connected unless limited by equipment ratings, voltage, or stability.

For the connectivity shown in Figure 3:

- A contingency associated with one of the transmission lines will be cleared at the terminal stations and the corresponding breakers in the ring bus. If the post-contingency rating of the remaining line permits, the *facility* can remain connected to one circuit.
- An HV breaker failure contingency could trip two generating units or a line and a generating unit. If *IESO's* assessment indicates that tripping two generating units will have a negative impact on the system then the *IESO* will require either additional breakers to be installed or the size of the development to be reduced to an acceptable level.
- For an *outage* associated with one of the HV breakers the entire *generation facility* could remain operational unless limited by equipment ratings, voltage, or stability.

In addition the *generation facilities* will have to comply with the OEB's "Transmission System Code" requirements and other protection system requirements established by the *transmitter*.

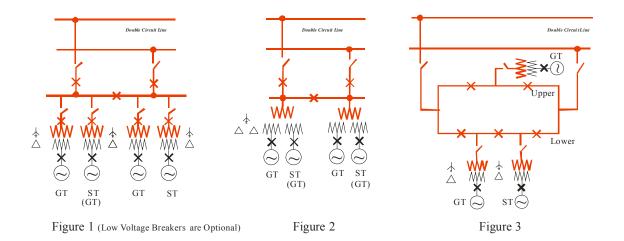
Generation Facilities Rated Above 500 MW

All projects rated above 500 MW are required to connect to at least two circuits and provide one of the connectivity arrangements shown in Figure 4 or Figure 5. Station arrangements that connect two like elements next to each other separated by only one breaker should be avoided.

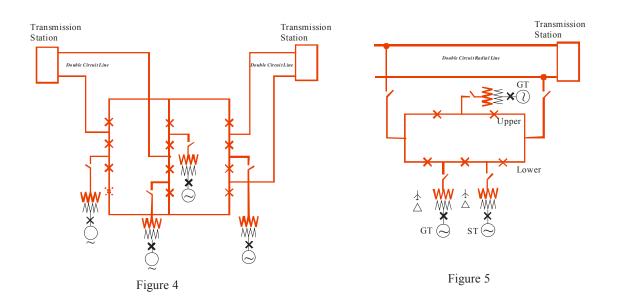
The full switchyard arrangement shown in Figure 4 is required when large generating *facilities* propose to connect to a main transmission corridor of considerable length that *connects* two transmission stations.

The ring bus arrangement shown in Figure 5 is acceptable when the development is connecting to a radial double circuit line.

Typical Connection Arrangements for Generation Facilities Rated between 250MW and 500 MW



Typical Connection Arrangements for Generation Facilities Rated Higher than 500 MW



End of Section

References

Document ID	Document Name	
NPCC A-01	Criteria for Review and Approval of Documents	
NPCC A-02	Basic Criteria for Design and Operation of Interconnected Power Systems	
NPCC A-04	Maintenance Criteria for Bulk Power System Protection	
NPCC A-05	Bulk Power System Protection Criteria	
NPCC A-11	Special Protection System Criteria	
NPCC B-04	Guideline for NPCC AREA transmission Review	
NPCC Criteria, Guides and Procedures can be found at http://www.npcc.org/document/abc.cfm		

- End of Document -

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DESCRIPTION OF THE PROPOSED FACILITIES

1.0 PROPOSED FACILITIES

The Hydro One proposed Supply to Essex County Transmission Reinforcement ("SECTR") Project will contribute to meeting the capacity needs of the Windsor – Essex region as well as minimize the impact of supply interruptions to customers in the region.

Four 230 kV transmission circuits C21J, C22J, C23Z and C24Z are currently in this corridor. The SECTR Project proposes to build a new double-circuit 230 kV transmission line that will originate from the Hydro One transmission corridor between Chatham SS and Sandwich Junction. Two new circuits will tap into circuits C21J and C22J approximately 20 km east of Sandwich Junction and extend south 13 km, along a new transmission corridor, to the Municipality of Leamington where a new transformer station (Leamington TS) will be located.

A map indicating the geographic location and a schematic diagram of the proposed facilities are provided in **Exhibit B**, **Tab 2**, **Schedule 2** and **Exhibit B**, **Tab 2**, **Schedule 3**, respectively. Illustrations of the transmission towers along this corridor are provided in **Exhibit B**, **Tab 2**, **Schedule 4**. The IESO's Draft System Impact Assessment ("SIA") is filed as **Exhibit B**, **Tab 6**, **Schedule 3**, and the Customer Impact Assessment ("CIA"), is filed as **Exhibit B**, **Tab 6**, **Schedule 4**.

The proposed project is consistent with the transmission solution recommended by the OPA for addressing the needs in the Windsor – Essex region. The need for the proposed facilities is described in **Exhibit B, Tab 1, Schedules 4 and 5**.

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- This application is seeking OEB approval to allow for the reinforcement of Hydro One's
- transmission line facilities, with the following work:
- Construct approximately 13 km of new 230 kV double-circuit line on a new ROW
- between the new Leamington TS and new taps on 230 kV circuits C21J and C22J
- between Chatham TS and Sandwich Junction at a location approximately 20 km from
- 6 Sandwich Junction;
 - Installation of Optic Ground Wire ("**OPGW**") on new and existing towers.

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The proposed facilities are subject to section 92 approval.

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- In conjunction with this line work, Hydro One will also complete the following station
- work:
 - Build a new 230/27.6 kV Learnington TS in the Municipality of Learnington.

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- The new transmission line facilities and station work will address the near- and medium-
- term needs of the Windsor-Essex area, and are a major element in addressing longer-term
- needs in the region.

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2.0 DETAILS OF THE PROPOSED FACILITIES

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- The proposed facilities will be owned and operated by Hydro One. The following is the
- specific work and facilities required as part of the proposed project:

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Line Work

- Build approximately 13 km of new 230 kV double-circuit line on a new ROW
- between the new Learnington TS and new taps on 230 kV circuits C21J and C22J
- between Chatham TS and Sandwich Junction at a location approximately 20 km from
- Sandwich Junction. The new circuits will tap from existing tower 225 on circuit

Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 2 Schedule 1 Page 3 of 3

- 1 C21J and new tower 465b on circuit C22J. This tapping location will be known as
- 2 Leamington Junction.
- Install OPGW on top of the new 230 kV towers serving Learnington TS as well as new OPGW on the existing C21J/C23Z towers (near Learnington Junction) to be used for tapping into the existing OPGW splice box.

6 7

Station Work

Build a new Leamington TS near the NW corner of Hwy 77 and Mersea Road 6 in
 the Municipality of Leamington. The new station will consist of two 230/27.6 – 27.6
 kV 75/100/125 MVA step-down transformers and associated 27.6 kV switchgear and
 feeder positions.

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The planned in-service date for the proposed facilities is March 2017.

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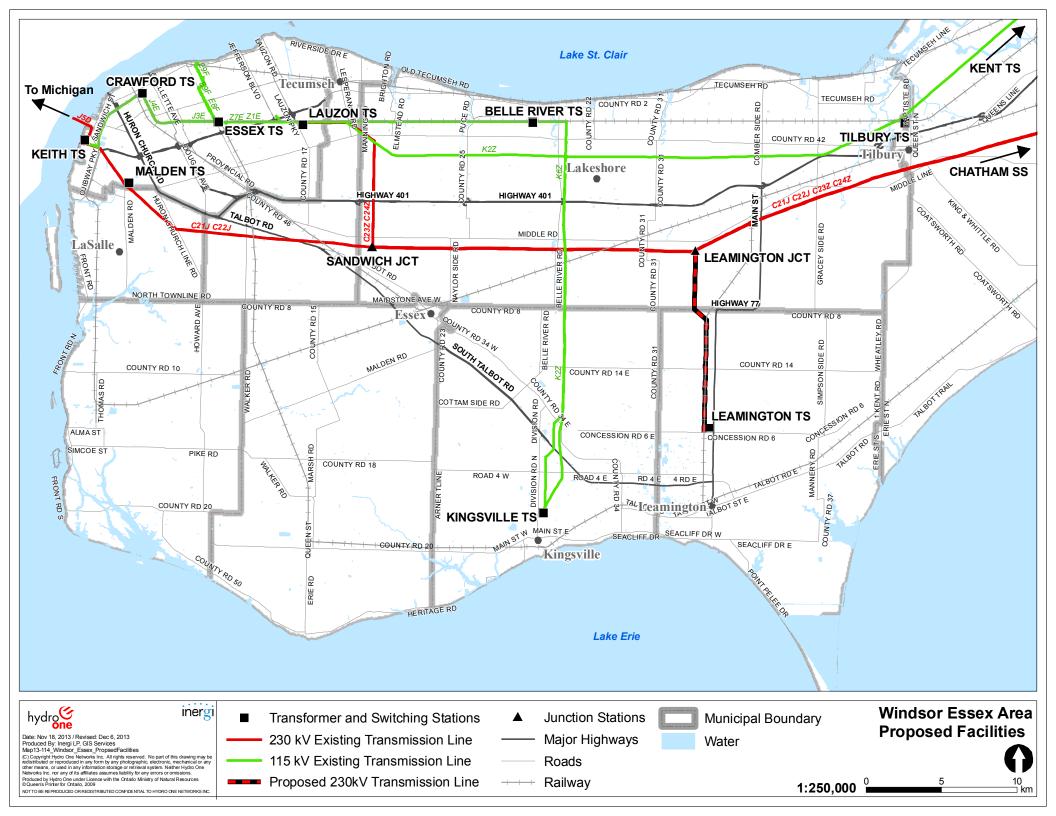
13

Upon completion of this project, some load will be transferred from Kingsville TS to 15 Learnington TS. The transfer of sufficient demand supplied from the 115 kV system in 16 the Kingsville-Leamington subsystem to the 230 kV system in the Kingsville-17 Leamington area will address the reliability needs of the Windsor – Essex region as 18 identified in Exhibit B, Tab 1, Schedule 5. As a result of this load transfer only one of 19 the three end-of-life 115/27.6 kV 25/33/42 MVA transformers at Kingsville TS will be 20 replaced using Hydro One's Sustainment program. The other two will be 21 decommissioned and not replaced. 22

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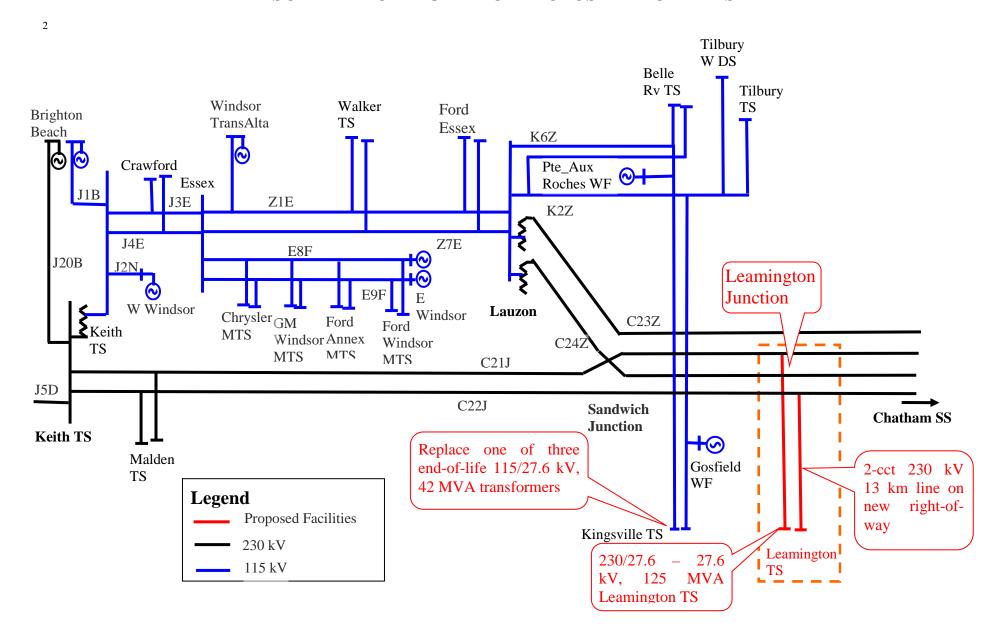
MAP OF PROPOSED FACILITIES

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SCHEMATIC DIAGRAM OF PROPOSED FACILITIES



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CROSS SECTION OF THE TOWER TYPES - EXISTING AND PROPOSED

L=20'

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ALTERNATIVES CONSIDERED

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- For information on Alternatives Considered, please refer to the OPA's evidence filed in
- Exhibit B, Tab 1, Schedule 5.

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PROJECT COSTS, ECONOMICS, AND OTHER PUBLIC INTEREST CONSIDERATIONS

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4 This set of exhibits describes the costs of the proposed facilities and the economics of the

5 project including the economic feasibility, rate impacts, and benefits to Ontario electricity

6 consumers. Other public interest considerations are also discussed.

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8 Under the *OEB Act*, 1998, "public interest" is defined to mean the interest of consumers

with respect to price and the reliability and quality of electricity service, and where

applicable in a manner consistent with the policies of the Government of Ontario, the

promotion of the use of renewable energy sources. Consumers, as defined by the

Transmission System Code, are persons using, for their own consumption, electricity that

they did not generate and whose facilities are connected to a transmission system.

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PROJECT COSTS

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The estimated capital cost of the Supply to Essex County Transmission Reinforcement ("SECTR") Project, including overheads and capitalized interest is shown below:

6	Table 1 Cost of Line Work	
7 8	Cost of Line work	Estimated Cost
9		(\$000's)
10	Planning & Estimating	\$1,500
11	Line Protection Facilities	0
12	Property ¹	11,709
13	Project Management	630
14	Engineering	966
15	Procurement	9,736
16	Construction	9,724
17	Removals	2,268
18	Contingencies ²	2,078
19	Costs before Overhead and AFUDC	\$38,611
20	Overhead ³	5,390
21	Capitalized Interest ⁴	1,286
22	Total Line Work	\$45,287

¹ Property includes costs for temporary rights along the ROW.

² Contingencies also include contingency on removal costs of \$181K

³ Overhead costs allocated to the project are for asset management and corporate services costs. These costs are charged to capital projects through a standard overhead capitalization rate. As such they are considered "Indirect Overheads". Hydro One does not allocate any project activity to "Direct Overheads" but rather charges all other costs directly to the project.

⁴ Capitalized interest is calculated using the Board's approved interest rate methodology (EB-2006-0117) to the projects' forecast monthly cash flow and carry-forward closing balance from the preceding month.

Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 4 Schedule 2 Page 2 of 5

1	Table 2 Cost of Station Work	
2	Cost of Station Work	Estimated Cost
4		(\$000's)
5	Planning & Estimating	\$373
6	Property (Land has been acquired)	\$627
7	Project Management	\$431
8	Engineering	\$1,840
9	Procurement	\$16,090
10	Construction	\$5,064
11	Commissioning	\$1,135
12	Removals	\$0
13	Contingencies	\$2,361
14	Costs before Overhead and Interest	\$27,921
15	Overhead ³	\$3,431
16	Capitalized Interest ⁴	\$770
17	Total Station Work	\$32,122

19 The cost of the line and station work provided above allows for the schedule of approval,

design and construction activities provided in Exhibit B, Tab 5, Schedule 2.

1.0 RISKS AND CONTINGENCIES

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As with most projects, there is some risk associated with estimating costs. Hydro One's cost estimate includes an allowance for contingencies in recognition of these risks.

Based on past experience, the estimate for this project work includes allowances in the contingencies to cover the following potential risks:

Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 4 Schedule 2 Page 3 of 5

- Cancellation or delays in obtaining required power and telecommunications system
- outages (needed for the line upgrade work and commissioning activities);
- Construction equipment failures;
 - Material delivery delay due to procurement or vendor issues;
- Activities or materials of a minor nature, not included in the estimate preparation;
- Labour hours deviating from the estimate.
- 8 Cost contingencies that have not been included, due to the unlikelihood or uncertainty of
- 9 occurrence, include:

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- Mitigation costs due to addressing any issues associated with having a Union Gas
 pipeline parallel to the new ROW;
- Labour disputes;
- Delays in obtaining regulatory approvals, permits and licences;
- Delays in property rights acquisitions;
- Safety or environmental incidents;
- Unexpected First Nations/Métis interests;
- Significant changes in costs of materials since the estimate preparation;

2.0 COSTS OF COMPARABLE PROJECTS

The OEB Filing Requirements for Electricity Transmission and Distribution Applications

22 (EB-2006-0170), Chapter 4, requires the applicant to provide a cost comparable project

constructed by the applicant. Table 2 below shows the cost, construction and technical

24 comparison of the SECTR Project to the Hurontario Station and Transmission Line

25 Reinforcement ("**HSTLR**") Project (EB-2006-0215).

27 For the purpose of context, Hydro One recently (2010) placed in-service a new double-

circuit 230 kV transmission line from Hurontario SS to Cardiff TS as part of the HSTLR

Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 4 Schedule 2 Page 4 of 5

- Project. The HSTLR Project was chosen as a good "apples-to-apples" comparison to the
- 2 SECTR Project because of its similar construction conditions and design. Both projects
- have a double-circuit 230 kV transmission line supplying a transmission station. Key
- 4 project information on the two projects is provided in Table 2 below.

5

- The total cost per km is based on the comparable costs of the two projects. The main
- 7 drivers of the variance in comparable costs are:
- The Leamington Junction to Leamington TS ROW corridor is situated adjacent to a
- 9 Union Gas pipeline which introduces some risk whereas the HSTLR project was
- already located on land designated for utility use with no pipeline adjacent to it. This
- results in higher construction costs for SECTR;
- The HSTLR Project costs were incurred over the 2007 to 2010 period as compared to
- SECTR Project costs which reflect costs for the period 2014 to 2016. Significant
- increases in material and equipment prices occurred over the intervening period;
- The SECTR Project includes as a contingency a cost of relocating 6.8 km of
- distribution lines located in the ROW deemed as interference for the 230kV
- transmission lines.

- Note that the HSTRL Project did not require any acquisition of additional land or land
- 20 rights.

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Table 2
Costs of Comparable Projects

	Costs of Comparable Frojec	
	Supply To Essex Transmission Reinforcement Project (estimate)	Hurontario Stn. And Transmission Line Reinforcement Project
Project		(actual)
Technical	230 kV double circuits on single structures	230 kV double circuits on single structures
	Generally install steel lattice	Generally install steel lattice tower
	tower structures	structures
Length (km)	13 km	4.2 km
Project Surroundings	Mostly urban agricultural, residential & commercial	Mostly rural & urban residential & commercial
Environmental Issues	None	None
In-Service Date	2016-05-31	2010-03-30
Total Project Cost	\$47,555k	\$10,002K
Less: Non-Comparable Costs		
Property ^{1,2}	\$13,752k	\$0k
Planning & Estimating ¹	\$1,500k	\$0k
	\$32,303k	\$10,002k
Total Comparable Project Costs		
Total Cost/km	\$2.5M/km	\$2.4M/km

Associated contingency, overhead & capitalized interest are included

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² SECTR requires acquisition of property rights whereas no property was purchased for HSTLR as it was

⁵ located on land designated for utility use already

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PROJECT ECONOMICS

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1.0 ECONOMIC FEASIBILITY

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The proposed transmission work for the Supply to Essex County Transmission 5 Reinforcement ("SECTR") Project comprises line assets and related station assets. The 6 transformation assets, which include establishing a new Leamington TS will be included 7 in the Transformation Connection Pool for rate-making purposes. The line assets, which 8 include a new 230 kV double-circuit line between the new Leamington TS and new taps 9 on 230 kV circuits between Chatham TS and Sandwich Junction, will be included in the 10 Line Connection Pool. More details concerning the assignment of costs is provided in 11 section 2.0 below. 12

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See Exhibit B, Tab 2, Schedule 1, for detailed information on the proposed work. A Discounted Cash Flow ("DCF") calculation has been completed for each pool consistent with the economic evaluation requirements of the Transmission System Code to determine whether a capital contribution is required. For the Line Connection Pool capital contributions totaling \$31.2 million, plus HST, are required and for the Transformation Connection Pool capital contributions totaling \$8.2 million, plus HST, are required.

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Capital Contribution Required			Total
in \$ millions, excluding HST	Line Pool	Transformation Pool	
Hydro One Distribution	31.2	8.2	39.4
Total	31.2	8.2	39.4

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As the sole transmission-connected customer in the project area, Hydro One Distribution is responsible for the capital contribution related to the project, as noted in the table

Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 4 Schedule 3 Page 2 of 17

above. In order to help recover the capital contribution from other project beneficiaries

2 within Hydro One's distribution system (i.e., embedded LDCs and commercial

3 customers), Hydro One is proposing a methodology for the allocation of project costs

among them, See Exhibit B, Tab 4, Schedule 5 for the proposed methodology for

allocation of customer-related project costs among distribution-system beneficiaries.

2.0 COST RESPONSIBILITY

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Line Connection

The line cost of the SECTR Project is \$45.3M. This includes the cost of building

approximately 13 km of new 230 kV double-circuit line on a new right-of-way,

installation of optic ground wire, providing connections to the new circuits and right-of-

way acquisition.

Transformation Connection

The transformation cost of the SECTR Project is \$32.1M. This includes the cost of

establishing a new Leamington TS, providing the station with two 230/27.6 – 27.6 kV

20 75/100/125 MVA step-down transformers, associated 27.6 kV switchgear and feeder

positions and property acquisition.

Cost Allocation

The OPA has determined that the SECTR Project will address both system needs and

load customer needs. In accordance with the beneficiary pays principle, the OPA has

recommended that load customers pay 77.5% of the SECTR cost (see Exhibit B, Tab 4,

Schedule 4 for more details). Since the realization of the system benefit is due to both

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the line connection and transformation components of the SECTR Project it is

recommended that 77.5% of the line connection cost of the project (77.5% of \$45.3M)

and 77.5% of the transformation cost of the project (77.5% of \$32.1M) be assigned to the

4 customer.

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With the establishment of Leamington TS sufficient load will be transferred from Kingsville TS to Leamington TS. This will reduce the need for the current four transformers at Kingsville TS to two transformers. Three of the transformers at Kingsville TS are at end-of-life with planned replacement in 2015 (under Hydro One Transmission's Sustainment program). With the planned load transfer to Leamington TS, only one of these three transformers will need to be replaced. The estimated cost to replace three transformers is \$18M, while the estimated cost to replace one transformer and reconfigure the station to a two-transformer station is \$12M. This represents a \$6M reduction in cost due to the SECTR Project. Given that 77.5% of the cost of SECTR is assigned to the customer, this same percentage of the savings due to SECTR is to be credited to the customer for economic evaluation purposes. Since the cost reduction is at the transformation level, the credit is to be given to the customer at the transformation pool. There would also be a net saving of OM&A costs from maintaining a two-transformer station rather a four-transformer station at Kingsville TS.

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The table below indicates the cost responsibility for the elements of work to be done on the project.

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Exhibit B Tab 4 Schedule 3 Page 4 of 17

1

Cost Responsibility		Cost Resp		
in \$ million, excluding	Cost of Work	Customers	Pool	Capital
HST	(per B-4-2)			Contribution
Transmission Line	45.3 ¹	35.1	10.2	31.2
Facilities				
Station Facilities	32.1	20.2^{2}	11.9	8.2
Total	77.4	55.3	22.1	39.4

2.1 **Line Connection Pool**

A 25-year discounted cash flow analysis for the Line Connection facilities is provided in 5

Table 1 below. The results indicate that the forecast incremental revenues are expected 6

to be insufficient to pay for the incremental capital and operating costs and therefore a

capital contribution will be required. The capital contribution is estimated to be \$31.2 8

million for Hydro One Distribution, the sole transmission connected customer. 9

Transformation Connection Pool 2.2

A 25-year discounted cash flow analysis for the Transformation Connection facilities is provided in Table 2 below. The results indicate that the forecast incremental revenues are expected to be insufficient to pay for the incremental capital and operating costs and therefore a capital contribution will be required. The capital contribution is estimated to be \$8.2 million for Hydro One Distribution.

¹ Line costs of \$45.3 million include \$43.0 million of up front capital costs plus \$2.3 million removal costs

² \$20.2 million = (\$32.1 million station facilities costs less \$6 million Kingsville cost reduction) x 77.5%

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3.0 RATE IMPACT ASSESSMENT

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- 3 The analysis of the Line Connection Pool and Transformation Connection Pool rate
- 4 impacts has been carried out on the basis of Hydro One's transmission revenue
- 5 requirement for the year 2015, and the most recently approved Ontario Transmission
- Rate Schedules. As none of the costs are Network-pool-related, based on the criteria
- used to allocate transmission costs to the three pools as approved by the Board in its RP-
- 8 1999-0044 decision, the Network Pool revenue requirement would be unaffected by the
- 9 new facilities.

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Line Connection Pool

Based on the Line Connection Pool incremental cash flows associated with the net capital 12 cost of the project, \$11.8 million (\$43.0 million gross cost less \$31.2 million capital 13 contribution), there will be a change in the Line Connection pool revenue requirement 14 once the project's impacts are reflected in the transmission rate base, net of capital 15 contribution, at the projected March 2018 in-service date. Over a 25-year time horizon, 16 the Line Connection Pool rate will remain flat at the current rate of \$0.86/kW/month. The 17 maximum revenue deficiency related to the proposed line facilities will be \$0.7 million in 18 the year 2020, which will result in a 0% (after rounding) rate impact in that year. The 19 detailed analysis illustrating the calculation of the incremental line revenue deficiency 20 and rate impact is provided in Table 3 below. 21

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Transformation Connection Pool

Based on the Transformation Connection Pool incremental cash flows associated with the net capital cost of the project, \$23.9 million (\$32.1 million gross cost less \$8.2 million capital contribution), there will be a change in the Transformation Connection Pool revenue requirement once the project's impacts are reflected in the transmission rate base, net of capital contribution, at the projected March 2018 in-service date. Over a 25Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 4 Schedule 3 Page 6 of 17

year time horizon, the Transformation Connection Pool rate will initially rise by 1

cent/kw/month, from the current rate of \$2.00/kW/month to \$2.01/kW/month before

falling back to the current rate. The maximum revenue deficiency related to the proposed

transformation facilities will be \$1.0 million in the year 2020. This will result in a

5 maximum rate impact of 0.50% in that year. The detailed analysis illustrating the

calculation of the incremental transformation revenue deficiency and rate impact is

7 provided in Table 4 below.

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9 <u>Impact on Typical Residential Customer</u>

Adding the costs of the new facilities to the respective pools will cause a slight increase in a typical residential customer's rates. The table below shows this result for a typical

residential customer who is under the Regulated Price Plan ("**RPP**").

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A. Typical monthly bill (Residential R1 in a high density zone at 1,000 kWh per month with winter commodity prices.)	\$189.00 per month
B. Transmission component of monthly bill	\$14.04 per month
C. Line and Transformation Pool share of Transmission component	\$5.83 per month
D. Impact on Line and Transformation Pool Provincial Uniform Rates (Tables 3 and 4. Combined Impact of Line 0.00% and Transformation 0.50%)	0.37%
E. Increase in Transmission costs for typical monthly bill (C x D)	\$0.02 per month or \$0.26 per year
F. Net increase on typical residential customer bill (E / A)	0.01%

14 Notes:

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1. Values rounded to two significant digits.

2. Typical monthly bill reflects interim rates pending Decision & Order for 2015-2019 Distribution Custom Rate Application EB-2013-0416

EB-2013-0421

Exhibit B Tab 4

Schedule 3

Page 7 of 17

Table 1 – DCF Analysis, Hydro One Distribution, Line Pool, page

Date:	9-Feb-15						SUMM		NTRIBUTION		NS				
Project #	17503							Line Po	ol - Estimated	d cost					
Facility Name: Description: Customer:		Supply to Essex County 1 Line Pool Capital Contribution		ement											
Customer.		riyaro Orie Distributori	In-Service												
		Month	Date - Mar-31	Mar-31	Project year end Mar-31	Mar-31	Mar-31	Mar-31	-> Mar-31	Mar-31	Mar-31	Mar-31	Mar-31	Mar-31	Mar-3
		Year	2018 0	2019	2020 2	2021 3	<u>2022</u>	2023 5	2024 6	2025 7	2026 8	2027 9	2028 10	2029	2030
Revenue & Expense Forecast			· ·												
Load Forecast (MW) Load adjustments (MW)				38.2 0.0	39.2 0.0	40.1 0.0	41.0 0.0	42.0 <u>0.0</u>	42.9 0.0	43.9 0.0	44.8 <u>0.0</u>	45.8 <u>0.0</u>	46.8 0.0	47.7 0.0	4
				38.2	39.2	40.1	41.0	42.0	42.9	43.9	44.8	45.8	46.8	47.7	4
Tariff Applied (\$/kW/Month) Incremental Revenue - \$M				0.86	0.86	0.86 0.4	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.
Removal Costs - \$M			(1.8)												
On-going OM&A Costs - \$M Municipal Tax - \$M			0.0	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0.0) (0.1)	(0 (0
Net Revenue/(Costs) before taxes - \$M			(1.8)	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0
Income Taxes Operating Cash Flow (after taxes) - \$M			0.5 (1.3)	0.2 0.4	0.4 0.6	0.4 0.6	0.3 0.6	0.3 0.6	0.3 0.5	0.2 0.5	0.2 0.5	0.2 0.5	0.2 0.5	0.1 0.5	<u>0</u>
Operating Cash Flow (after taxes) - \$10		Cumulative PV @	(1.5)	0.4	0.0	0.0	0.0	0.0	0.5	0.5	0.5	0.5	0.5	0.5	_
PV Operating Cash Flow (after taxes) - \$M	(A)	5.83% 5.3	(4.2)	0.4	0.6	0.5	0.5	0.4	0.4	0.4	0.2	0.2	0.2	0.2	
PV Operating Cash Flow (after taxes) - \$M	(A)	5.3	(1.3)	0.4	0.6	0.5	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	<u>0</u>
Capital Expenditures - \$M Upfront - capital cost before overhea	I- A AFLIDO		(29.6)												
- Overheads	ids & AFUDC		(29.6)												
- AFUDC			(1.0)												
Total upfront capital expenditures On-going capital expenditures			(33.3)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	C
PV On-going capital expenditures			0.0												
Total capital expenditures - \$M Capital Expenditures - \$M			(33.3)												
PV CCA Residual Tax Shield - \$M			0.1												
PV Working Capital - \$M			(0.0)												
PV Capital (after taxes) - \$M	(B)	(33.2)	(33.2)												
Cumulative PV Cash Flow (after taxes) - \$M (A) + (B)	(27.9)	(34.5)	(34.1)	(33.5)	(33.0)	(32.5)	(32.1)	(31.7)	(31.3)	(31.0)	(30.7)	(30.4)	(30.1)	(29
		Discounted Cash Flov	/ Summary												
Economic Study Horizon - Years:		25	Julillary												
Discount Rate - %		5.83%													
Discount Rate - 76		Before		After											
		Cont SM	-	Cont	-	Impact SM									
PV Incremental Revenue		6.5		6.5											
PV OM&A Costs PV Municipal Tax		(2.0) (1.9)		(2.0) (1.9)											
PV Income Taxes		(0.7)		(0.7)		0.0									
PV CCA Tax Shield PV Capital - Upfront		3.5 3.3)	(33.3)	0.2		(3.3)									
Add: PV Capital Contribution PV Capital - On-going		0.0 (33.3) 0.0	31.2	(2.1) 0.0		31.2									
PV Working Capital		(0.0)	_	(0.0)	_										
PV Surplus / (Shortfall)		(27.9)	-	(0.0)	-	27.9									
Profitability Index*		0.2		1.0											
Notes:	ning positel 9 s	ada an dianasal / DV/ of ant "-"		namital 9 avec - 1	an diananal										
*PV of total cash flow, excluding net capital expenditure & on-g	jung capital & proce	eus on ulsposal / PV or net capital	expenditure & on-going of	apital & proceeds	un ulsposal										

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Table 1 – DCF Analysis, Hydro One Distribution, Line Pool, page 2

 Date:
 9-Feb-15

 Project #
 17503

SUMMARY OF CONTRIBUTION CALCULATIONS Line Pool - Estimated cost

Facility Name: Description: Customer:	Supply to Essex County 1 Line Pool Capital Contribution Hydro One Distribution		ement											
		,	: P	roject year ende	hezilannı alized	from In-Service	Date							
	Month Year	Mar-31 <u>2031</u>	Mar-31 2032	Mar-31 <u>2033</u>	Mar-31 2034	Mar-31 2035	Mar-31 2036	Mar-31 2037	Mar-31 2038	Mar-31 2039	Mar-31 2040	Mar-31 <u>2041</u>	Mar-31 2042	Mar-31 2043
Revenue & Expense Forecast		13	14	15	16	17	18	19	20	21	22	23	24	25
Load Forecast (MW)		49.7	50.6	51.6	52.6	53.7	54.6	55.5	56.5	57.6	58.6	59.6	60.7	61.8
Load adjustments (MW)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		49.7	50.6	51.6	52.6	53.7	54.6	55.5	56.5	57.6	58.6	59.6	60.7	61.8
Tariff Applied (\$/kW/Month)		0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Incremental Revenue - \$M		0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Removal Costs - \$M														
On-going OM&A Costs - \$M		(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0
Municipal Tax - \$M		(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1
Net Revenue/(Costs) before taxes - \$M		0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5
Income Taxes		<u>0.1</u>	0.1	0.1	0.0	0.0	0.0	0.0	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.1
Operating Cash Flow (after taxes) - \$M		<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	0.4	0.4	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>
PV Operating Cash Flow (after taxes) - \$M (A	A)	0.2	0.2	<u>0.2</u>	0.2	0.2	0.2	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>	<u>0.1</u>
Capital Expenditures - \$M														
Upfront - capital cost before overheads & A	AFUDC													
- Overheads - AFUDC														
Total upfront capital expenditures														
On-going capital expenditures		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PV On-going capital expenditures														
Total capital expenditures - \$M Capital Expenditures - \$M														
PV CCA Residual Tax Shield - \$M														
PV Working Capital - \$M														
PV Capital (after taxes) - \$M (B	3)													
Cumulative PV Cash Flow (after taxes) - \$M (A) + (E	3)	(29.7)	(29.5)	(29.3)	(29.1)	(28.9)	(28.8)	(28.6)	(28.5)	(28.4)	(28.2)	(28.1)	(28.0)	(27.9

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Table 2 – DCF Analysis, Hydro One Distribution, Transformation Pool, page 1 SUMMARY OF CONTRIBUTION CALCULATIONS

Date: 6	i-Feb-15					SUMI	WARY OF CO	NIKIBUTION	CALCULATIO	INS				
Project # 1	7503						Transformati	on Pool - Est	imated cost					
Facility Name:	Supply to Essex	County Transmission Reinfor	cement											
Description:	Transformation	Pool Capital Contribution												
Customer:	Hydro One Dist	ibution												
		In-Service												
		Date Mar-31	< Mar-31	Project year end	ded - annualized Mar-31			> Mar-31	1404	14 04	1404	1404	Mar-31	1404
	Month Year	Mar-31 2018	2019	Mar-31 2020	2021	Mar-31 2022	Mar-31 2023	2024	Mar-31 2025	Mar-31 2026	Mar-31 2027	Mar-31 2028	2029	Mar-31 2030
	Teal	0	1	2	3	4	5	6	7	8	9	10	11	12
Revenue & Expense Forecast														
Load Forecast (MW)			38.2	39.2	40.1	41.0	42.0	42.9	43.9	44.8	45.8	46.8	47.7	48.
Load adjustments (MW)			0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
			38.2	39.2	40.1	41.0	42.0	42.9	43.9	44.8	45.8	46.8	47.7	48
Tariff Applied (\$/kW/Month)			2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.0
Incremental Revenue - \$M			0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.
Removal Costs - \$M		0.0												
On-going OM&A Costs - \$M Municipal Tax - \$M		0.0	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0.0 (0.1)	0. (0.
Net Revenue/(Costs) before taxes - \$M		0.0	0.8	0.9	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.
Income Taxes		0.0 0.0	(0.0)	0.9	0.5	0.5	0.5	0.0	0.0	(0.0)	(0.0)	(0.1)	(0.1)	(<u>0.</u>
Operating Cash Flow (after taxes) - \$M		0.0	0.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.
	Cumulative PV													-
	5.83%													
PV Operating Cash Flow (after taxes) - \$M (A		0.0	0.8	0.9	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.5	<u>0.</u>
Conital Funanditures CM														
Capital Expenditures - \$M Upfront - capital cost before overheads & A	NEUDC	(17.2)												
Overheads	4FUDC	(2.4)												
- AFUDC		(0.7)												
Total upfront capital expenditures		(20.2)												
On-going capital expenditures		(=)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
PV On-going capital expenditures		0.0												
Total capital expenditures - \$M		(20.2)												
Capital Expenditures - \$M														
PV CCA Residual Tax Shield - \$M		0.1												
PV Working Capital - \$M		0.0												
PV Capital (after taxes) - \$M (E	3) (20.1)	(20.1)												
	-	=												
Cumulative PV Cash Flow (after taxes) - \$M (A) + (E	3) (7.0)	(20.1)	<u>(19.3)</u>	<u>(18.4)</u>	<u>(17.5)</u>	(16.7)	<u>(15.9)</u>	(15.2)	<u>(14.5)</u>	<u>(13.9)</u>	(13.3)	(12.7)	(12.2)	<u>(11.</u>
	Discounted Ca	sh Flow Summary												
Economic Study Horizon - Years:	25													
Discount Rate - %	5.83%													
1	Before		After											
	Cont		Cont		Impact									
	\$M	-	\$M	-	\$M									
PV Incremental Revenue	15.1		15.1											
PV OM&A Costs	0.0		0.0											
PV Municipal Tax	(1.1		(1.1)											
PV Income Taxes	(3.7		(3.7)		(0.0)									
PV CCA Tax Shield PV Capital - Upfront	(20.2)	(20.2)	1.8		(1.2)									
Add: PV Capital Contribution	0.0 (20.2)		(12.0)		8.2									
PV Capital - On-going	0.0		0.0											
PV Working Capital	0.0		0.0	-										
PV Surplus / (Shortfall)	(7.0	<u>.</u>	0.0	-	7.0									
Profitability Index*	0.7		1.0											
Notes: *PV of total cash flow, excluding net capital expenditure & on-going cap	nital & proceeds on disposal / PV of	net canital expenditure & co-coina	canital & proceeds	on disposal										
	p p. soccos on disposal / F V OI	oxponuncio a dirgong		Lopooui										

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Table 2 – DCF Analysis, Hydro One Distribution, Transformation Pool, page 2

Date:	6-Feb-15	
Project #	17503	

SUMMARY OF CONTRIBUTION CALCULATIONS
Transformation Pool - Estimated cost

Facility Name: Description:	Supply to Essex County Tran Transformation Pool Capital		ement											
Customer:	Hydro One Distribution													
				Project year end		f l- Ci	Dete							
	Month	Mar-31	< F Mar-31	Mar-31	ed - annualized Mar-31	Mar-31	Date Mar-31	-> Mar-31	Mar-31	Mar-31	Mar-31	Mar-31	Mar-31	Mar-31
	Year	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
		13	14	15	16	17	18	19	20	21	22	23	24	25
Revenue & Expense Forecast														
Load Forecast (MW)		49.7	50.6	51.6	52.6	53.7	54.6	55.5	56.5	57.6	58.6	59.6	60.7	61.
Load adjustments (MW)		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<u>0.</u>
		49.7	50.6	51.6	52.6	53.7	54.6	55.5	56.5	57.6	58.6	59.6	60.7	61.
Tariff Applied (\$/kW/Month)		2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.0
Incremental Revenue - \$M		1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.4	1.4	1.4	1.5	1.
Removal Costs - \$M														
On-going OM&A Costs - \$M		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
Municipal Tax - \$M		(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	(0.1)	<u>(0.</u>
Net Revenue/(Costs) before taxes - \$M		1.1	1.1	1.2	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.
Income Taxes		(0.1)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	(0.3)	(0.3)	(0.3)	(0.3)	(0.
Operating Cash Flow (after taxes) - \$M		<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.1</u>	<u>1.1</u>	<u>1.</u>
PV Operating Cash Flow (after taxes) - \$M (A)		0.5	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.3	<u>0.3</u>	<u>0.3</u>	0.3	<u>0.</u>
Capital Expenditures - \$M														
Upfront - capital cost before overheads & AFUDC - Overheads - AFUDC														
Total upfront capital expenditures														
On-going capital expenditures		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.
PV On-going capital expenditures														
Total capital expenditures - \$M Capital Expenditures - \$M														
PV CCA Residual Tax Shield - \$M														
PV Working Capital - \$M														
PV Capital (after taxes) - \$M (B)														
, , , , , , , , , , , , , , , , , , , ,														
Cumulative PV Cash Flow (after taxes) - \$M (A) + (B)		(11.2)	(10.7)	(10.3)	(9.9)	(9.5)	(9.1)	(8.8)	(8.4)	(8.1)	(7.8)	(7.5)	(7.2)	(7.

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$Table\ 3-Revenue\ Requirement\ and\ Line\ Pool\ Rate\ Impact,\ page\ 1$

	Revenue Requirement	and Line Pool Rate Impact			(After Capital C	ontribution)						
Supply to Essex County Transmission Reinforcement		Project YE 31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Calculation of Incremental Revenue Requirement (\$ millions)		2019 1	2020 2	2021 3	2022 4	2023 5	2024 6	2025 7	2026 8	2027 9	2028 10	2029 11	2030 12
In-service date Capital Cost	31-Mar-18 43.0												
Less: Capital Contribution Required	(31.2)												
Net Project Capital Cost	11.8												
Average Rate Base		5.8	11.6	11.4	11.2	11.1	10.9	10.7	10.6	10.4	10.3	10.1	9.9
Incremental OM&A Costs		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grants in Lieu of Municipal tax		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Depreciation		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Interest and Return on Rate Base		0.4	0.8	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Income Tax Provision		0.0	(0.0)	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
REVENUE REQUIREMENT PRE-TAX		0.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Incremental Revenue		0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.5	0.5	0.5
SUFFICIENCY/(DEFICIENCY)		(0.4)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.7)	(0.6)	(0.6)	(0.6)
Line Pool Revenue Requirement including sufficiency/(deficiency)	Base Year 207	208	208	208	208	208	208	208	208	208	208	208	208
Line GW	242	242	242	242	242	242	242	242	242	242	243	243	243
Line Pool Rate (\$/kw/month)	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86	0.86
Increase/(Decrease) in Line Pool Rate (\$/kw/month), relative to base ye	ar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RATE IMPACT relative to base year		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Assumptions													
Incremental OM&A		\$1.5 k per new km of line each	year.										
Grants in Lieu of Municipal tax	0.42%	Transmission system average											
Depreciation	2.00%	Reflects 50 year average service						_					
Interest and Return on Rate Base	6.60%	Includes OEB-approved ROE o			98% on LT debt.	40/4/56 equity/5	ST debt/ LT debt	split					
Income Tax Provision	26.50%	2015 federal and provincial cor		x rate									
Capital Cost Allowance	8.00%	100% Class 47 assets except for	or Land										

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Table 3 – Revenue Requirement and Line Pool Rate Impact, page 2

(After Capital Contribution) Revenue Requirement and Line Pool Rate Impact Supply to Essex County Transmission Reinforcement 31-Mar 31-Mar 31-Mar 31-Mar 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 Calculation of Incremental Revenue Requirement (\$ millions) 24 13 14 17 19 20 22 23 In-service date 31-Mar-18 Capital Cost 43.0 Less: Capital Contribution Required (31.2)Net Project Capital Cost Average Rate Base 9.8 9.6 9.4 9.3 9.1 9.0 8.8 8.6 8.5 8.3 8.1 8.0 7.8 Incremental OM&A Costs 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.2 0.2 0.5 Grants in Lieu of Municipal tax 0.2 Depreciation Interest and Return on Rate Base 0.6 0.6 0.6 0.6 0.6 0.5 0.6 0.6 0.6 0.6 0.5 0.5 0.1 0.1 Income Tax Provision 0.1 REVENUE REQUIREMENT PRE-TAX Incremental Revenue SUFFICIENCY/(DEFICIENCY) (0.6) (0.6) (0.6) (0.5) (0.5) (0.5) (0.5) (0.5) (0.5) 207 242 208 208 208 Line Pool Revenue Requirement including sufficiency/(deficiency) 208 208 208 208 243 243 243 243 243 243 243 243 243 243 Line Pool Rate (\$/kw/month) 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 0.86 Increase/(Decrease) in Line Pool Rate (\$/kw/month), relative to base year 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 RATE IMPACT relative to base year 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00%

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Table 4 – Revenue Requirement and Transformation Pool Rate Impact, page 1

	Revenue Requirement	and Transformation Pool Ra	ate Impact		(After Capital C	ontribution)						
Supply to Essex County Transmission Reinforcement	_	Project YE 31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar	31-Mar
Calculation of Incremental Revenue Requirement (\$ millions)		2019 1	2020 2	2021 3	2022 4	2023 5	2024 6	2025 7	2026 8	2027 9	2028 10	2029 11	2030 12
In-service date Capital Cost	31-Mar-18 32.1												
Less: Capital Contribution Required	(8.2)												
Net Project Capital Cost	23.9												
Average Rate Base		11.7	23.2	22.7	22.3	21.8	21.3	20.9	20.4	19.9	19.5	19.0	18.5
Incremental OM&A Costs		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Grants in Lieu of Municipal tax Depreciation		0.1 0.5	0.1 0.5	0.1 0.5	0.1 0.5	0.1 0.5	0.1 0.5	0.1 0.5	0.1	0.1	0.1	0.1	0.1
Interest and Return on Rate Base		0.5	0.5 1.5	0.5 1.5	0.5 1.5	1.4	1.4	1.4	0.5 1.3	0.5 1.3	0.5 1.3	0.5 1.3	0.5 1.2
Income Tax Provision		(0.0)	(0.2)	(0.1)	(0.1)	(0.0)	(0.0)	0.0	0.0	0.1	0.1	0.1	0.1
REVENUE REQUIREMENT PRE-TAX		1.4	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Incremental Revenue		0.9	0.9	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.2
SUFFICIENCY/(DEFICIENCY)		(0.4)	(1.0)	(1.0)	(1.0)	(1.0)	(1.0)	(0.9)	(0.9)	(0.9)	(0.9)	(0.8)	(0.8)
Transformation Pool Revenue Requirement including sufficiency/(d Transformation GW Transformation Pool Rate (\$/kw/month) Increase/(Decrease) in Transformation Pool Rate (\$/kw/month), rel	206 2.00	414 207	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.01 0.00	415 207 2.00 0.00
RATE IMPACT relative to base year		0.00%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.50%	0.00%
Assumptions Incremental OM&A Grants in Lieu of Municipal tax Depreciation Interest and Return on Rate Base Income Tax Provision Capital Cost Allowance		Nil Transmission system average Reflects 50 year average servi Includes OEB-approved ROE of 2015 federal and provincial con 100% Class 47 assets except f	of 9.3%, 2.16% or porate income ta	n ST debt, and 4.			ST debt/ LT debt :	split					

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1

Table 4 – Revenue Requirement and Transformation Pool Rate Impact, page 2

Revenue Requirement and Transformation Pool Rate Impact (After Capital Contribution) Supply to Essex County Transmission Reinforcement 31-Mar 31-Mar 31-Mar 31-Mar 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 24 Calculation of Incremental Revenue Requirement (\$ millions) 13 14 17 19 20 22 23 In-service date 31-Mar-18 Capital Cost 32.1 Less: Capital Contribution Required (8.2) Net Project Capital Cost Average Rate Base 18.1 17.6 17.1 16.7 16.2 15.7 15.3 14.8 14.3 13.8 13.4 12.9 12.4 Incremental OM&A Costs 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 Grants in Lieu of Municipal tax 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 Depreciation Interest and Return on Rate Base 1.2 1.1 1.1 1.0 0.9 0.9 1.2 1.1 1.0 1.0 0.9 0.9 0.8 0.2 0.2 0.2 0.2 0.2 0.2 0.2 Income Tax Provision REVENUE REQUIREMENT PRE-TAX Incremental Revenue 1.3 1.3 1.4 1.4 1.4 SUFFICIENCY/(DEFICIENCY) (0.8) (0.7) (0.7) (0.6) (0.6) (0.5) (0.5) (0.4) (0.4) 415 414 414 Transformation Pool Revenue Requirement including sufficiency/(deficiency) 413 414 414 414 414 Transformation GW 206 207 207 207 207 207 207 207 207 Transformation Pool Rate (\$/kw/month) 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 2.00 Increase/(Decrease) in Transformation Pool Rate (\$/kw/month), relative to base year 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 RATE IMPACT relative to base year 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00% 0.00%

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Exhibit B Tab 4

Schedule 3

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Table 5 – Derivation of Load used in DCF, page 1

	Annual Non-Coincident Peak Load Forecast for SECTR Project													
Relevant SECTR Loads		2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Kingsville TS (with 2 transformers)	MW	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
Leamington TS	MW	116.5	117.7	118.9	120.2	121.4	122.7	123.9	125.2	126.5	127.8	129.1	130.4	131.7
Load sub-total	MW	170.5	171.7	172.9	174.2	175.4	176.7	177.9	179.2	180.5	181.8	183.1	184.4	185.7
Current Capacity (Kingsville TS with 4 transformers)	MW	120	120	120	120	120	120	120	120	120	120	120	120	120
Load in excess of capacity, calendar-year basis	MW	50.5	51.7	52.9	54.2	55.4	56.7	57.9	59.2	60.5	61.8	63.1	64.4	65.7
PLI-adjustment	_	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
PLI-adjusted load in excess of capacity	MW	38.0	38.9	39.9	40.8	41.7	42.7	43.6	44.6	45.5	46.5	47.5	48.5	49.5
Adjusted for in-service month:														
Project Year*			1	2	3	4	5	6	7	8	9	10	11	12
			March 31,											
			2017 to	2018 to	2019 to	2020 to	2021 to	2022 to	2023 to	2024 to	2025 to	2026 to	2027 to	2028 to
			March 30,											
			2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029

40.1

41.0

42.0

42.9

43.9

44.8

45.8

46.8

47.7

48.7

Note:

Load in excess of capacity, project-year basis

1

^{*} Project-year load = 3/12 of current year load + 9/12 of previous calendar-year load, based on March 31, 2018 in-service date

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1 2

Table 5 – Derivation of Load used in DCF, page 2

				Ar	nnual Non-C	oincident P	eak Load Fo	orecast for S	SECTR Proje	ect			
Relevant SECTR Loads	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Kingsville TS (with 2 transformers)	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
Learnington TS	132.9	134.2	135.6	136.9	138.3	139.4	140.7	142.1	143.5	144.9	146.3	147.7	149.2
Load sub-total	186.9	188.2	189.6	190.9	192.3	193.4	194.7	196.1	197.5	198.9	200.3	201.7	203.2
Current Capacity (Kingsville TS with 4 transformers)	120	120	120	120	120	120	120	120	120	120	120	120	120
Load in excess of capacity, calendar-year basis	66.9	68.2	69.6	70.9	72.3	73.4	74.7	76.1	77.5	78.9	80.3	81.7	83.2
PLI-adjustment	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%	75%
PLI-adjusted load in excess of capacity	50.4	51.4	52.4	53.4	54.4	55.2	56.3	57.3	58.3	59.4	60.4	61.5	62.6
Adjusted for in-service month:													
Project Year*	13	14	15	16	17	18	19	20	21	22	23	24	25
	March 31,	March 31,	March 31,	March 31,	March 31,	March 31,	March 31,	March 31,	March 31,				
	2029 to	2030 to	2031 to	2032 to	2033 to	2034 to	2035 to	2036 to	2037 to	2038 to	2039 to	2040 to	2041 to
	March 30,	March 30,	March 30,	March 30,	March 30,	March 30,	March 30,	March 30,	March 30,				
	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042
Load in excess of capacity, project-year basis	49.7	50.6	51.6	52.6	53.7	54.6	55.5	56.5	57.6	58.6	59.6	60.7	61.8

Note:

^{*} Project-year load = 3/12 of current year load + 9/12 of previous calendar-year load, based on March 31, 2018 in-service date

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$Table\ 6-DCF\ Assumptions$

S

Tourselesian action and bounds (C	ED	do alal tanananda ala	_	
Transmission rates are based on current O	EB-approved uniform prov	incial transmission rate	es.	
		Monthly Ra Transformatio Line	te (\$ per kW) n 2.00 0.86	
Grants in lieu of Municipal tax (% of up-fron	nt capital			
expenditure, a proxy for property value):			0.42%	Based on Transmission syste average
Income taxes:				
Basic Federal Tax Rate -				
% of taxable income:		2015	15.00%	Current rate
Ontario corporation income tax -				
% of taxable income:		2015	11.50%	Current rate
Capital Cost Allowance Rate:				
Class 47 costs		2015	8%	Current rate
After-tax Discount rate:			5.83%	Based on OEB-approved ROE 9.3% on common equity and 2. on short-term debt, 4.98% forec cost of long-term debt and 40/ equity/debt split, and current enacted income tax rate of 26.
Other Assumptions:				
Estimated Incremental OM&A:	Project specifi	io (\$ k):		

3

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 4 Schedule 4 Page 1 of 9

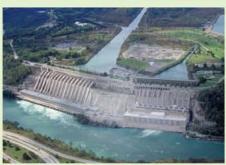
OPA COST RESPONSIBILITY EVIDENCE

Recommended
Cost Allocation Treatment
for the Supply to Essex
County Transmission
Reinforcement

Ontario Power Authority

January, 2014













Contents

1	Executive Summary	. 2
	Introduction and Purpose	
3	Assessment of Transmission Options for Meeting the Reliability and Other Needs of the Windsor-Essex Area	
	3.1 Reliability Needs/Additional Constraints in the Windsor-Essex Area and Associated Beneficiaries.	
	3.2 Recommended Transmission Reinforcement	. 5
4	Recommended Cost Allocation Treatment	. 6

1 1 Executive Summary

- 2 As described in Exhibit B, Tab 1, Schedule 5, the most cost-effective solution for addressing the
- 3 reliability needs of the Windsor-Essex area is an integrated solution which includes the
- 4 construction of the Supply to Essex County Transmission Reinforcement ("SECTR") project.
- 5 The SECTR project involves the construction of transmitter-owned connection facilities that will
- 6 benefit both local load customers and the system more broadly.
- 7 The specific purpose of this evidence is to identify the benefits that the SECTR project will
- 8 deliver to load customers and the broader system, and to propose an appropriate apportionment
- 9 of the costs for the project between load customers and transmission ratepayers. The proposed
- apportionment is consistent with the Board's beneficiary pays principle.
- 11 It is the OPA's view that the most appropriate way to apportion the costs of the SECTR project
- between load customers and transmission ratepayers based on the Board's beneficiary pays
- principle, is to apportion the total cost by reference to the costs that load customers and
- transmission ratepayers would otherwise have to pay if they were to individually address
- customer and system needs, rather than addressing them through the proposed integrated
- solution. The proposed cost allocation methodology is described in more detail in Section 4
- below.

18 2 Introduction and Purpose

- 19 On October 18, 2012, the Ontario Energy Board ("Board") issued its Report of the Board –
- 20 A Renewed Regulatory Framework for Electricity Distributors: A Performance Based Approach
- 21 (the "RRFE report"). In the RRFE report, the Board concludes that a reconsideration of cost
- responsibility rules prescribed by the Transmission System Code ("TSC") is desirable to
- facilitate the effective implementation of regional planning initiatives. Specifically, in the RRFE
- report, the Board endorses "... a shift in emphasis away from the 'trigger' pays principle to the
- 25 'beneficiary' pays principle." The OPA agrees with the Board's proposed shift to a beneficiary

¹ RRFE report, page 43.

- 1 pays approach, which the OPA believes will encourage more cost effective electricity system
- 2 planning decisions.
- 3 On August 26, 2013 the Board issued its *Notice of Amendments to Codes* which, among other
- 4 things, proposed the elimination of Section 6.3.6 (the "otherwise planned" provision) in the TSC
- 5 and its replacement with new Sections 6.3.8A, 6.3.8B and 6.3.8C.² These proposed amendments
- 6 reflect the shift to a beneficiary pays approach to regional planning. Under the proposed new
- 7 Sections 6.3.8A, 6.3.8B and 6.3.8C, the transmitter shall not require customer(s) to make a
- 8 capital contribution in relation to the modification of transmitter-owned connection facilities
- 9 when an assessment³ undertaken at the request of the transmitter, determines that the
- 10 construction or modification of transmitter-owned connection facilities that exceed the capacity
- needs of the triggering load customer(s) is a more cost effective means of meeting reliability
- needs in the area than the construction or modification of the transmitter's network facilities, or
- the construction or modification of the transmitter's network facilities in combination with the
- construction or modification of transmitter-owned connection facilities. In such cases, the
- transmitter is to attribute to the load customer(s) only the cost of constructing or modifying
- transmitter-owned connection facilities to the extent required to meet the needs of the load
- 17 customer(s).
- 18 The purpose of this evidence is to provide an assessment of the appropriate apportionment of the
- 19 costs associated with the recommended investments in transmitter-owned connection facilities in
- 20 the Windsor-Essex area consistent with the Board's proposed change from a 'trigger' pays to
- 21 'beneficiary' pays approach and proposed amendments to the TSC. This evidence identifies the

² At http://www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/407265/view/Notice Amend %20TSC%20and%20DSC regional%20infrastructure%20planning 20130826.PDF.

³ While the Board's proposed amendments suggest that the Independent Electricity System Operator ("IESO") is the appropriate party to undertake such an assessment, it is the view of the IESO and the OPA that the OPA is the most appropriate party to undertake an assessment of this type, as noted in the submissions of both parties to the Board on the proposed code amendments. The OPA routinely undertakes independent assessments of the alternatives to address a given power system need, including a comparison of the cost effectiveness of different options. In its EB-2011-0043 submission dated September 9, 2013, the OPA indicated that it would benefit from the input of the IESO regarding reliability considerations in completing these assessments. Accordingly, this cost responsibility evidence has been prepared by the OPA, in consultation with the IESO.

- 1 customer and broader system benefits associated with the SECTR project, and recommends an
- 2 appropriate apportionment of costs between benefiting load customers and transmission
- 3 ratepayers.
- 4 This evidence is premised upon Exhibit B, Tab 1, Schedule 5, wherein the OPA explains why an
- 5 integrated solution including the construction of the SECTR project is the most cost effective
- 6 means of addressing customer and system reliability needs and other constraints in the Windsor-
- 7 Essex area.

8 3 Assessment of Transmission Options for Meeting the Reliability and Other

- 9 Needs of the Windsor-Essex Area
- 10 The following section summarizes the reliability needs and other constraints of the Windsor-
- 11 Essex area, as well as the recommended transmission reinforcement to address these needs and
- constraints, as described in Exhibit B, Tab 1, Schedule 5.

13 3.1 Reliability Needs/Additional Constraints in the Windsor-Essex Area and Associated

- 14 Beneficiaries
- 15 There are two near-term reliability needs in the Windsor-Essex area: (i) additional supply
- 16 capacity is required to accommodate growth in electricity demand in the Kingsville-Leamington
- subsystem, and (ii) improvements are needed to minimize the impact of supply interruptions to
- customers in the broader J3E-J4E subsystem following a major 230 kV transmission outage.⁴
- 19 In addition, there are two further constraints in the Windsor-Essex area that would be beneficial
- 20 to address: (i) reducing limitations on the operation of generation at Brighton Beach Power
- 21 Station ("Brighton Beach GS"); and (ii) enabling the connection of additional distributed
- 22 generation in the Kingsville/Leamington area.⁵
- Two of these needs/constraints are system related and addressing them will benefit transmission
- ratepayers. Those needs/constraints are: (i) the need to minimize the impact of supply
- interruptions to customers, and (ii) the benefit of relieving limitations to the operation of

⁴ See Exhibit B, Tab 1, Schedule 5, Section 5.1 and 5.2.

⁵ See Exhibit B, Tab 1, Schedule 5, Section 5.3.

- 1 Brighton Beach GS. Table 1 below provides a summary of the needs/constraints of the Windsor-
- 2 Essex area, and identifies the beneficiaries of investments to address these limitations.

3 Table 1: Windsor-Essex Area Reliability Needs/Additional Constraints and Benefitting

4 Parties

	Need/Benefit	Subsystem	Beneficiary
Broader System	Need to Minimize the Impact of Supply Interruptions	J3E-J4E Subsystem	Most Transmission Ratepayers in the Windsor-Essex Area
Benefits	Benefit of Reducing Limitations on the Operation of Brighton Beach GS	Windsor-Essex Area	All Ontario Ratepayers
	Need for Additional Capacity to Meet Electricity Demand	Kingsville-Leamington Subsystem	Load Customers
Customer Benefits	Benefit of Enabling the Connection of Additional Distributed Generation in the Kingsville/Leamington Area	Kingsville-Leamington Subsystem	Local Generation Developers

5 Source: OPA

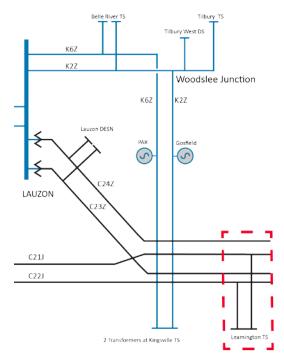
6 3.2 Recommended Transmission Reinforcement

- 7 As shown in Exhibit B, Tab 1, Schedule 5, the most cost-effective solution for addressing
- 8 customer and system reliability needs in the Windsor-Essex area is an integrated solution
- 9 comprised of conservation and demand management, distributed generation, and transmission
- investments, including the construction of the SECTR project. The SECTR project consists of a
- new 230 kV Learnington transformer station ("TS") and an associated 13 km double-circuit
- 12 230 kV transmission line at a total cost of approximately \$77.4 million. 6 These transmission
- facilities are shown in Figure 1 below.

⁶ As noted in Exhibit B, Tab 1, Schedule 5, Section 6.3, investments to replace end-of-life transmission facilities in the Windsor-Essex area are also planned — i.e., a like-for-like replacement of the two autotransformers at Keith TS which are reaching end-of-life (\$24.7 million) and replacing one of the three transformers which are approaching end-of-life at Kingsville TS (\$12 million).

Figure 1: SECTR Project

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3 Source: OPA

2

- 4 Other transmission alternatives, such as network-facility investments in new 230/115 kV
- 5 autotransformers were considered, but found to be less cost effective than the recommended
- 6 SECTR project.⁷

7 4 Recommended Cost Allocation Treatment

- 8 It is the OPA's view that the most appropriate way to apportion costs between load customers
- 9 and transmission ratepayers in accordance with the Board's beneficiary pays principle is to
- apportion the cost of the SECTR project by reference to the costs that load customers and
- 11 ratepayers would have to pay were customer and system needs to be individually addressed,
- rather than addressed through the proposed integrated SECTR project.
- 13 In this regard, if the broader system restoration needs and limitations on the operation of
- Brighton Beach GS were to be individually addressed, the following transmission upgrades
- would be required, at a total cost of approximately \$22.5 million:

⁷ See Exhibit B, Tab 1, Schedule 5, Section 6.3.1.

- upgrading the J3E/J4E circuits from Keith TS to Essex TS to 1,600 amps (\$15.5 million);
- installing 50 MVar of reactive support in the Windsor-Essex area (\$5 million); and
- replacing the end-of-life autotransformers at Keith TS with 250 MVA units, rather than a like-for-like replacement with 125 MVA units (incremental cost of \$2 million).
- 5 Likewise, if load customers in the Windsor-Essex area were to individually address the supply
- 6 capacity needs of the Kingsville-Leamington subsystem they would be required to implement the
- 7 SECTR project a new 230 kV Leamington TS and an associated 13 km double-circuit 230 kV
- 8 transmission line at a total cost of approximately \$77.4 million. This would also provide
- 9 opportunities for additional distributed generation connections in the area. The total cost
- therefore of individually addressing system and customer needs in the Windsor-Essex area is
- approximately \$99.9 million.
- By comparison, the proposed integrated SECTR project will address both load customer and
- system needs/constraints at a reduced cost of approximately \$77.4 million (i.e., \$22.5 million
- less than the combined individual solutions). That is because the SECTR project, by
- providing for an alternate source of supply in the Windsor-Essex the area avoids the need for,
- and associated cost of, upgrading the J3E/J4E circuits, installing reactive support, and increasing
- the size of the Keith autotransformers.
- In accordance with the beneficiary pays principle, the OPA proposes that the SECTR project
- 19 costs should be allocated in proportion to what load customers and transmission ratepayers
- 20 would respectively have had to contribute towards the combined cost of individual solutions.
- 21 Under this proposed allocation, approximately 77.5% of the SECTR costs would be paid for by
- local load customers (\$77.4 million/\$99.9 million) and approximately 22.5% by transmission
- ratepayers (\$22.5 million/\$99.9 million). This, in the OPA's view, is a fair method of allocating
- 24 the total project costs based on the beneficiary pays principle, as both load customers and
- 25 transmission ratepayers realize cost savings.
- 26 This methodology demonstrates the benefit that load customers and transmission ratepayers
- 27 receive through a regional planning process that focuses on the most cost-effective integrated
- solution for addressing customer and system needs. In this respect, both load customers and
- 29 transmission ratepayers save by addressing their respective needs through an integrated solution,
- 30 the SECTR project, rather than individually.

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PROPOSED COST ALLOCATION METHODOLOGY AT THE DISTRIBUTION LEVEL FOR UPSTREAM TRANSMISSION INVESTMENTS

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1.0 INTRODUCTION

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The construction of the new transformer station and associated transmission line in the Windsor-Essex area will require capital contributions from benefiting customers, consistent with the Ontario Energy Board's "beneficiary pays" principle. Based on the Ontario Power Authority's ("OPA") assessment, provided in Exhibit B, Tab 4, Schedule 4, that certain system benefits will result from this investment, only that portion of the total investment cost associated with customer benefits, as opposed to system benefits, will be attributed to connecting customers.

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As the sole transmission-connected customer in this case, Hydro One Distribution will be required under the Transmission System Code² ("TSC") to provide a capital contribution, net of incremental revenues less incremental operating costs, to Hydro One Transmission towards the cost of the new transmission connection facilities. In accordance with section 6.3.1 of the TSC, Hydro One Transmission has determined the required capital contribution by performing an economic evaluation using the methodology set out in Appendix 5 of the TSC (see Exhibit B, Tab 4, Schedule 3).

_

¹ Certain costs associated with the end-of-life transformer replacement work at Kingsville TS that are avoided as a result of the SECTR project would also qualify as system benefit costs.

² The Ontario Energy Board's (the "Board") *Transmission System Code* ("TSC"), dated June 10, 2010, along with Appendix 5 of the TSC, and the Board's *Notice of Amendments to Codes – Amendments to the Transmission System Code and the Distribution System Code*, dated August 26, 2013, are attached as Attachment 1.

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2.0 UPSTREAM TRANSMISSION COST ALLOCATION

The capital contribution required to be paid to Hydro One Transmission represents an upstream transmission cost to the project beneficiaries at the distribution level. To ensure a fair allocation of this upstream cost, Hydro One Distribution takes guidance from the relevant provisions of the TSC. Hydro One Distribution will perform economic evaluations based on the methodology set out in Appendix 5 of the TSC to allocate, at the distribution level, portions of this capital contribution to all distributors operating in Hydro One Distribution's service area (including Hydro One Distribution itself) that benefit from the project, based on each distributor's load forecast.

For purposes of these economic evaluations, Hydro One Distribution will attribute a portion of the project cost to each distributor in proportion to that distributor's non-coincident incremental peak load requirements, consistent with section 6.3.15 of the TSC. The results of these economic evaluations, which take into consideration the expected transmission revenues that will be generated according to each distributor's load forecast, will form the basis for the apportionment.

In turn, each distributor will need to further apportion its share of the capital contribution within its own service area. Each distributor will perform an economic evaluation for each of its customers in the General Service, Sub-Transmission or equivalent rate class that requests a new or expanded connection ("**new large customer**"). The distributor will also perform an additional economic evaluation for its ratepayers generally. The results of these economic evaluations, performed based on the methodology set out in Appendix 5 of the TSC, will determine the proportion of the capital contribution that each new large customer and ratepayers of that distributor will be required to pay.

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2.1 Benefiting Customers

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- The following distributors will benefit from the Supply to Essex County Transmission
- 4 Reinforcement ("SECTR") project, as proposed in Exhibit B, Tab 2, Schedule 1, and
- are expected to make a capital contribution towards the transmission investment, subject
- 6 to an economic evaluation:

7

- Hydro One Distribution
- Essex Powerlines Corporation
- E.L.K. Energy Inc.
 - Entegrus Powerlines Inc.

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The distributors listed above who are customers of Hydro One Distribution will be required to provide a 25-year load forecast and a security deposit to Hydro One Distribution, and to also execute a Capital Cost Recovery Agreement with Hydro One Distribution prior to the commencement of construction of the new transmission connection facilities.

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The new large customers³ of each of the four distributors listed above will also be required to make a capital contribution towards the transmission investment through their respective distributors. These customers will also be required to provide a 25-year load forecast and a security deposit, and to execute a Capital Cost Recovery Agreement with their respective distributors prior to the commencement of construction of the new transmission connection facilities.

³ For clarity, 'new large customers' include members of the *Ontario Greenhouse Vegetable Growers Association*.

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2.2 Economic Evaluation True-ups

Hydro One Distribution will perform true-ups on all capital contributions collected from distributors in relation to this project, based on the approach set out in sections 6.5.3–

5 6.5.11 of the TSC. These true-ups will apply the same methodology as was used to carry

out the initial economic evaluation (discussed in section 2.0 above), and the same inputs

except for load, which will be based on the actual load up to the true-up point and on an

updated load forecast for the remainder of the economic evaluation period.

For consistency with the treatment of the overall capital contribution payable by Hydro One Distribution to Hydro One Transmission, an economic horizon of 25 years will be used, with true-up points (consistent with TSC provisions) at the end of each of the fifth and tenth years of operation, and at the end of the fifteenth year of operation if actual load is twenty percent higher or lower than the intial load forecast at the end of the tenth year of operation. Where the true-up shows that the distributor's actual load and updated load forecast is lower than the load in the initial load forecast, the distributor will be required to make a payment to make up the shortfall, adjusted appropriately to reflect the time value of money. Where the true-up shows that the actual load and updated load forecast is higher than the load in the initial load forecast, the excess revenue will be posted as a credit to the distributor in a notional account. Any credit balance remaining in the notional account after the last true-up will be rebated to the distributor, adjusted to reflect the time value of money.

Each distributor (including Hydro One Distribution) will, in turn, perform true-ups on all capital contributions collected from new large customers and ratepayers in similar fashion.

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2.3 Unforecasted Capacity Assignments

Hydro One Distribution will provide a refund on a capital contribution collected at the distribution level from a distributor in relation to this project in situations where capacity from the new transmission connection facilities is assigned to another distributor with a previously unforecasted capacity requirement. The refund methodology will be based on the approach set out in sections 6.3.17 and 6.3.17A of the TSC. The approach involves providing a refund to a customer where excess capacity on a new facility is assigned to another customer within fifteen years after the date on which the facility comes into service. Hydro One Distribution will collect a capital contribution from the subsequent customer to cover the amount of the refund. Hydro One Distribution will determine the amount of the refund to the initial customer by calculating a revised capital contribution amount using the economic evaluation methodology set out in Appendix 5 of the TSC.

Distributors (including Hydro One Distribution) will provide refunds on capital contributions collected from new large customers and ratepayers in similar fashion.

2.4 Load vs. Generation

As noted in the OPA's assessment of need for this area in **Exhibit B**, **Tab 1**, **Schedule 5**, the greenhouse growers in the region have indicated strong interest in developing distributed generation through investments in combined heat and power generation. The SECTR Project is therefore expected to serve a mix of load and generation customers. It is Hydro One's assumption that the net incremental coincident peak flow triggering the need for the new facilities is caused by incremental *load*, as opposed to generation. Hydro One has therefore based its cost allocation approach on load customer cost responsibility provisions, consistent with the guidance in section 6.3.16 of the TSC.

Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 4 Schedule 5 Page 6 of 8

3.0 SUMMARY OF COST ALLOCATION APPROACH

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- The approach to allocating the costs and required capital contributions in this project is a
- 4 five-step process:

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- 1. Hydro One Transmission invests in new transmission connection facilities in the amount of the project cost.
- 2. The project cost is allocated between system benefit (no capital contribution required) and customer benefit (capital contribution required).
- 3. At the transmission level, Hydro One Distribution, as the sole transmission-connected customer for the proposed facilities, pays a capital contribution to Hydro One Transmission, in accordance with an economic evaluation performed on the customer benefit portion of the project cost.
- 4. At the distribution level, Hydro One Distribution performs economic evaluations to allocate the capital contribution among all benefiting distributors (including Hydro One Distribution itself).
- 5. Benefiting distributors (including Hydro One Distribution), in turn, perform economic evaluations to further apportion each distributor's share of the capital contribution among its own new large customers and ratepayers.

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Hydro One will also allocate the associated project facility costs, such as distribution feeders, to the Project's beneficiaries.

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4.0 ILLUSTRATIVE EXAMPLE

- For additional clarity, the following example illustrates the proposed approach to allocate the upstream transmission cost of a hypothetical capital investment by Hydro One
- 28 Transmission of \$175 million—\$75 million of which is assessed to be for system
- benefit—to meet the capacity needs of three distributors (one of which is Hydro One

Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 4 Schedule 5 Page 7 of 8

Distribution and the other two are embedded customers of Hydro One Distribution),

totaling 200 megawatts of non-coincident incremental peak load. Economic evaluations,

which take into consideration projected revenues associated with customers' load

forecasts, are performed to determine the total capital contribution payable at the

5 transmission level, and the allocation at the distribution level of that total capital

contribution among the three distributors and their respective distribution customers.

In this example, the total capital contribution payable at the transmission level, as determined through an economic evaluation performed by Hydro One Transmission, is \$80 million. At the distribution level, economic evaluations performed by Hydro One Distribution allocate this total capital contribution among the three distributors (including Hydro One Distribution itself). The economic evaluations in this example are assumed to result in allocations of 50%, 40% and 10% for Hydro One Distribution, Embedded Distributor A, and Embedded Distributor B, respectively. To allocate each distributor's capital contribution among that distributor's own customers, an economic evaluation is performed by the particular distributor for each of its new large customers, as well as an additional economic evaluation for its ratepayers generally. In this example, the results of these economic evaluations are assumed to yield the capital contribution allocations shown in the diagram and table below. Although not shown in the diagram and table below, capital contribution allocations are calculated separately for each new large customer. Capital contribution allocations for ratepayers are absorbed into the respective distributors' revenue requirements and recovered through rates.

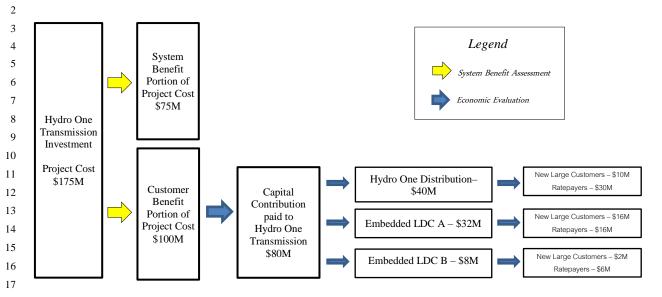
Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 4 Schedule 5 Page 8 of 8

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Flow of Costs Diagram (Illustrative Only)



Cost Responsibility Table (Illustrative Only)

Distributor	Non-Coincident Incremental Peak Load (MW)	Attributed Project Cost (Input to Economic Evaluation) (\$M)	Capital Contribution Allocation Percentage based on Economic Evaluation	Capital Contribution (\$M)			
Hydro One	90	45	50%	40	New Large Customers	10	
Distribution					Ratepayers	30	
Embedded LDC A	80	40	40%	32	New Large Customers	16	
					Ratepayers	16	
Embedded LDC B	30	15	10%	8		New Large Customers	2
Embedded LDC B			10%		Ratepayers	6	
TOTAL	200	100	100%	80			

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 4 Schedule 6 Page 1 of 1

OTHER PUBLIC INTEREST CONSIDERATIONS

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1.0 AVAILABILITY, RELIABILITY, AND QUALITY IMPACTS

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The Windsor – Essex region is a major regional load centre in Ontario with a well-

6 established history in manufacturing and greenhouse vegetable production. Both the

regional load and local generation are of the order of 1,000 MW.

8

The transmission system in the region includes 230 kV circuits C23Z and C24Z between

10 Chatham SS and Lauzon TS, C21J and C22J between Chatham SS and Keith TS; and 115

kV circuits J3E and J4E between Keith TS and Essex TS, Z1E and Z7E between Essex

TS and Lauzon TS, E8F and E9F between Essex TS and Ford Windsor MTS, and K2Z

and K6Z which connect Kingsville TS, Belle River TS and Tilbury TS to Lauzon TS.

Post contingency thermal and voltage concerns in the region are managed with a Special

15 Protection System ("SPS"), the Windsor Area Special Protection Scheme. The

transmission system in the area requires reinforcement.

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18 Hydro One intends to undertake the required work with in-house construction resources,

augmented by outsourcing as required. Request for proposals for any required

20 equipment, materials and services will be tendered for public bids and posted on Hydro

One's website.

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Based on the supporting evidence included in this application, Hydro One submits that

24 availability, reliability and quality of electricity service will be maintained or improved.

Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 5 Schedule 1 Page 1 of 2

CONSTRUCTION AND PROJECT ADMINISTRATION

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Hydro One can achieve a March 2018 in-service date for the proposed transmission 3 facilities work assuming that the Board grants leave to construct approval for the 4

proposed facilities by June 2015. 5

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To complete the project, Hydro One will:

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Install approximately 13 kilometers of new 230 kV double-circuit steel lattice tower transmission line between Learnington Junction (located along the Chatham SS to Keith TS 230 kV corridor) and Learnington TS to provide additional load supply capacity at Leamington TS. The number and locations of the new structures will be optimized;

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Install Optical Ground Wire ("**OPGW**") on top of the new 230 kV towers serving Learnington TS as well as new OPGW on the existing C21J/C23Z towers (near Leamington Junction) to be used for tapping into the existing OPGW splice box;

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Connect the proposed new Leamington TS DESN station into the existing fiber SONET ("Synchronous Optical Networking") network between Chatham SS and Malden TS as part of Windsor Area Fiber Ring, for telecommunication and control purposes;

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Ensure prudent measures are taken to reduce EMF at ground levels, which is 24 achieved via circuit phasing optimization; 25

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Review and update easement documents and road authority occupation agreements to meet current and future requirements; 28

Updated: 2015-02-12 EB-2013-0421 Exhibit B Tab 5 Schedule 1 Page 2 of 2

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- Obtain additional property rights where required;
- Determine the environmental approvals and/or permits required for the proposed
 undertaking;
- Carry out line construction activities that include setting up construction yards, construction crew mobilization at sites, building access roads and stringing pads on the existing right-of-way ("ROW"), installing gates and fences, clearing trees and brush from the ROW (if required), removing the existing structures and conductors, installing new reinforced concrete foundations, erecting new steel lattice towers and poles, stringing new conductors, removal of access road and stringing pads, restoration of the lands, and demobilization of construction crews.
- Carry out protection works at Leamington TS, Malden TS, Chatham SS and J.C.

 Keith TS by adding new line protection relays and associated devices.
- Build station facilities at the new Leamington TS. The station facilities will consist of two 75/100/125 MVA 230/27.6-27.6 kV step-down transformers, breakers, capacitor banks, disconnect switches and associated facilities, ground switches, rigid and strain buses, steel structures, foundations, protection and control building, cabling as well as grading, drainage, spill control system, and fencing.
- A project schedule showing the tasks leading up to the in-service date is provided in Exhibit B, Tab 5, Schedule 2.

Updated: 2015-02-12 EB-2013-0421

EB-2013-042 Exhibit B Tab 5 Schedule 2 Page 1 of 1

PROPOSED CONSTRUCTION AND IN-SERVICE SCHEDULE

TASK	START	FINISH	
Submit Section 92		January 2014	
Projected Section 92 Approval	January 2014	June 2015	
Prepare and Sign CCRA	June 2015	May 2016	
STATIONS			
Order Station Power Transformers	December 2015	December 2015	
Detailed Engineering	May 2016	March 2017	
Tender and Award Other Major Station Equipment	August 2016	November 2016	
Receive Major Station Equipment	February 2017	July 2017	
Construction	September 2016	February 2018	
Commissioning	October 2017	March 2018	
LINES			
Property Rights Acquisition	January 2016	October 2016	
Detailed Engineering	May 2016	December 2016	
Tender & Award Structural Steel	June 2016	October 2016	
Receive Structural Steel	March 2017	April 2017	
Construction	October 2016	March 2018	
In Service		March 2018	

Updated: 2014-05-23

EB-2013-0421 Exhibit B Tab 6 Schedule 1 Page 1 of 5

OTHER MATTERS / AGREEMENTS / APPROVALS

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1.0 SYSTEM IMPACT ASSESSMENT ("SIA")

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Under the Market Rules, any party planning to construct a new or modified connection to the IESO-controlled grid must request an IESO SIA of these facilities. The IESO draft SIA for the SECTR Project is filed as **Exhibit B, Tab 6, Schedule 3**. The assessment concludes that the proposed connection of the project is expected to have no material adverse impact on the reliability of the integrated power system and that the Project

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The IESO assessment addresses the impact of the proposed facilities on system operating voltage, system operating flexibility, and on the ability of other connections to deliver or withdraw power supply from the IESO-controlled grid.

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2.0 CUSTOMER IMPACT ASSESSMENT ("CIA")

improves the supply capacity needs of the Windsor area.

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The Hydro One CIA, in accordance with its customer connection procedures, is filed as **Exhibit B, Tab 6, Schedule 4**. The CIA indicates that this transmission reinforcement will not materially affect short-circuit levels at customer transmission connection points and it will have no material adverse reliability impact on existing customers in the area.

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3.0 STAKEHOLDER AND COMMUNITY CONSULTATION

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Hydro One conducted stakeholder and community consultation to provide information about the project and give people opportunities to ask questions and provide feedback. The government ministries, agencies, municipal staff and elected officials, and residents in a defined study area were consulted through personal contact, e-mail or direct mailing, Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 6 Schedule 1 Page 2 of 5

newspaper notices, the establishment of a project website

- 2 (http://www.HydroOne.com/Projects/SupplyEssex/Pages/EssexCounty.aspx) and Public
- Information Centres ("**PICs**"). The feedback received through the consultation process
- 4 regarding potential construction effects on the natural environment, agriculture, and the
- 5 neighbouring property owners was considered and incorporated as appropriate. The
- details of Hydro One's stakeholder consultation process are described in **Exhibit B**, **Tab**
- **6, Schedule 5**.

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Hydro One carried out a parallel engagement process with neighbouring First Nations and Métis communities as described in **Exhibit B, Tab 6, Schedule 6**.

4.0 ENVIRONMENTAL ASSESSMENT

The proposed Supply to Essex County Transmission Reinforcement ("SECTR") Project falls within the definition of the projects covered under the Hydro One (1992) "Class Environmental Assessment for Minor Transmission Facilities" ("Class EA"), which is approved under the Environmental Assessment Act ("EA Act") by the Ministry of the Environment ("MOE").

- 20 The Class EA process that was completed for this Project included:
- Collection of environmental and socio-economic features within the study area;
- Identification of any environmental effects of the proposed transmission facilities and the corresponding mitigation measures;
- Consultation with the public and stakeholders (e.g. federal and provincial ministries, municipal officials and property owners) to further identify issues and concerns with the project and to address those concerns through mitigation; and
 - Engagement with First Nations communities.

Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 6 Schedule 1 Page 3 of 5

Between the official Notice of Commencement of the project in 2008 and the Notice of

Completion of the draft ESR in 2010, Hydro One conducted comprehensive public and

government agency consultation to inform stakeholders about the SECTR Project as well

as identify and resolve potential concerns (see Exhibit B, Tab 6, Schedule 5 for further

5 information on Stakeholder and Community Consultation). Engagement with First

Nations communities to respond to and consider their issues and concerns was also

undertaken during this time and as mentioned earlier is further discussed at Exhibit B,

8 Tab 6, Schedule 6.

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A draft Environmental Study Report ("ESR") was made available for public review and comment for approximately 30 calendar days starting February 11 and ending March 12, 2010.

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Agency and public comment letters received during this period were addressed and documented in the final ESR as required by the Class EA process. Two Part II Order requests for a higher level of assessment, i.e. Individual Environmental Assessment were received. Both requests were based on the assumption that the Project would contribute to or service future developments of industrial wind farms in Essex County or anywhere within the Great Lakes Basin and its watershed. In letters dated May 18, 2010, the Minister of the Environment responded to the individuals stating that the purpose of the Project is to satisfy the increasing electricity demand and facilitate the connection of new customers who use electricity in the vicinity. He noted that electrical generation projects, including industrial wind farms, are planned and developed by third party companies and are not within the scope of this Class EA and that a separate approval process exists for these projects.

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Comments and issues raised during the review period along with the requests for an Individual EA were documented in the final ESR which was filed with the MOE on July 22, 2010. Through filing the final ESR, Hydro One has complied with the *EA Act* for the

Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 6

Schedule 1 Page 4 of 5

- SECTR Project. There is no expiration for the Class EA although there is an amendment
- 2 process that may include public participation if there is a change in the project. Prior to
- construction, Hydro One will seek all regulatory approvals, licences and permits as
- 4 required.

5.0 COMPLIANCE WITH INDUSTRY STANDARDS AND CODES

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- 7 The proposed facilities will be constructed, owned and operated by Hydro One. The
- 8 design and maintenance of these facilities will be in accordance with good utility
- 9 practice, as established in the *Transmission System Code*.

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6.0 LAND MATTERS

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- The proposed line will connect the future Leamington Transformer Station ("TS") and
- tower structure 225 (Leamington Junction) to the Chatham Switching Station and Keith
- 15 TS corridor. Details on land requirements, existing and required land rights, and the
- process for acquiring the required land rights is provided in **Exhibit B**, **Tab 6**, **Schedule**
- 17 **7.**

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7.0 OTHER APPROVAL REQUIREMENTS

- Hydro One will address all federal, provincial and municipal requirements of the
- construction process, including:
- Environmental Compliance Approval for noise from the Ministry of Environment
- under the *Environmental Protection Act*;
- Environmental Compliance Approval for drainage from the Ministry of Environment
- under the *Environmental Protection Act*;
- Agreements for pipeline crossings from Union Gas;
- Fisheries Act and Endangered Species Act requirements;

Updated: 2014-05-23 EB-2013-0421 Exhibit B Tab 6 Schedule 1 Page 5 of 5

- A building permit from the Municipality of Leamington;
- Stage 2 Archaeological Assessment for the station site and the line; and
- Entrance permits from the Municipality of Leamington and Township of Lakeshore.

5 Hydro One will also voluntarily comply with Municipal Site Development Plan

6 requirements and municipal noise bylaws.

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 2 Page 1 of 1

LETTERS OF ENDORSEMENT

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- The following letters have been obtained from parties in the Windsor Essex area
- 4 endorsing the SECTR Project.
 - Attachment 1: Municipality of Leamington
 - Attachment 2: Town of Kingsville
 - Attachment 3: County of Essex
 - Attachment 4: Ontario Greenhouse Vegetable Growers Association
 - Attachment 5: Nature Fresh Farms
 - Attachment 6: Orangeville Farms
 - Attachment 7: Essex Powerlines Corporation
 - Attachment 8: WindsorEssex Economic Development Corporation
 - Attachment 9: Entegrus Powerlines Inc.



THE CORPORATION OF THE MUNICIPALITY OF LEAMINGTON

111 Erie Street North, Leamington, ON, Canada N8H 2Z9 Telephone (519) 326-5761 • Fax (519) 326-2481

OFFICE OF THE MAYOR

John Paterson Email: jpaterson@leamington.ca

December 19, 2013

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 1 Page 1 of 2

Mr. Mike Penstone
Vice President
Network Development & Regional Planning
Hydro One Networks Inc.

VIA EMAIL

Dear Mr. Penstone:

Re: Proposed Learnington Transmission Station - "Leave to Construct" Application, Section 92 of the Ontario Energy Board Act 1998

Please accept this letter in support of Hydro One Networks Inc. Section 92 application to the Ontario Energy Board (OEB) to construct a new transmission station on Mersea Road 6 in the Municipality of Leamington and further construct a 13-km double circuit 230 kilovolt (kV) transmission line on a new corridor to connect the new station to the existing 230 kV transmission line south of Highway 401 in the Town of Lakeshore.

The new transmission line is badly needed to service existing businesses in our area that require uninterrupted hydro service. It is further needed to accommodate our industrial and agricultural growth, specifically in the greenhouse industry.

Learnington and area represents the largest cluster of greenhouse production in North America with over 2000 acres. Currently in the Learnington area, we have large acreages of greenhouse construction that cannot proceed without investment from the electricity distributor.

Our partners in the greenhouse sector industry and services have provided appropriate support information to Hydro One to substantiate the need to construct the infrastructure required for the Leamington area so we can continue to grow.

The recent announcement with respect to the closure of the H.J. Heinz Company does not take away the need to construct the badly required infrastructure. Heinz utilized and exported its own hydro and were not importing any significant amount of hydro over the last several years.

The implication of not constructing the new infrastructure is harmful to our existing and future businesses.

In the greenhouse industry alone, it is estimated that failure to provide electricity to the underserviced area would result in \$300 Million of construction going to the United States of America.

The expansion of the hydro infrastructure to the proposed transmission station in Leamington is critical, and as Mayor I would urge OEB to approve Hydro One's application in this regard.

Leamington Council is in support of the application and would ask that if there are any further questions in this regard, please do not hesitate to contact the undersigned.

Yours truly,

John Paterson Mayor

/kms

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THE CORPORATION OF THE TOWN OF KINGSVILLE

2021 Division Road North Kingsville, Ontario N9Y 2Y9

Phone: (519) 733-2305 Fax: (519) 733-8108 www.kingsville.ca EB-2013-0421

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 2

Page 1 of 4

OFFICE OF THE MAYOR

Sent via Email (Community.Relations@HydroOne.com)

January 6, 2014

Mr. Mike Penstone, Vice-President, Network Development & Regional Planning Hydro One Networks Inc. 483 Bay St.; South Tower; 7th Floor Toronto, ON M5G 2P5

Dear Sir:

RE: Kingsville Town Council Letter of Support for new Transformer Station (Hydro One's Supply to Essex County Transmission Reinforcement Project)

Correspondence from Ms. Carrie-Lynn Ognibene, Sr. Advisor, Corporate Relations, Hydro One Networks Inc. dated December 10, 2013 (copy enclosed) was presented to Kingsville Council at its Regular Meeting held on Monday, December 16, 2013.

Kingsville Town Council <u>unanimously</u> supported Hydro One's intent to seek Ontario Energy Board approval for new electricity transmission facilities in Leamington and Lakeshore in order to address both future growth in electricity demand and anticipated expansion in the local agricultural sector. In Kingsville, we also see this reinforcement project as an improvement to the reliability of our current system which relies heavily on our existing 150kV TS.

We look forward to hearing from you as the application moves forward. Our community would be most interested in being kept up to date and involved in the public hearing process as we proceed in the future.

Yours very truly

Mayor Nelson Santos

/sik

Encl.

Hydro One Networks Inc. Corporate Relations 483 Bay St., South Tower, 7th Fl. Toronto, ON M5G 2P5





www.HydroOne.com

December 10, 2013

Mayor Nelson Santos and Members of Council Town of Kingsville 2021 Division Road North Kingsville, ON N9Y 2Y9

VIA EMAIL



Dear Mayor Santos & Council:

Hydro One to seek approval to build Leamington Transformer Station (TS)

I am writing to update you on the status of Hydro One's Supply to Essex County Transmission Reinforcement Project. Hydro One completed the Environmental Assessment for this project in 2010 following an extensive consultation process. Due to economic conditions at that time, Hydro One decided to defer seeking Ontario Energy Board (OEB) approval to build the project until the Ontario Power Authority (OPA) had an opportunity to further review the long-term electricity needs of the Windsor-Essex area.

The OPA, in its regional supply planning discussions with Hydro One and the local distribution companies (LDCs) in Essex County, has determined that new transmission facilities are needed in the Kingsville/Learnington area to address future growth in electricity demand and anticipated expansion in the local agricultural sector. The new facilities would also contribute to improved reliability of electricity supply in the broader Windsor-Essex region.

As noted in Ontario's updated Long-Term Energy Plan, Achieving Balance, released on December 2, 2013, Hydro One has resumed planning for the Leamington TS and associated connector line. Hydro One intends to file a "Leave to Construct" application with the OEB early in 2014 seeking approval under Section 92 of the Ontario Energy Board Act, 1998 to construct the facilities shown on the attached map. The project would include: a new transformer station on Hydro One-owned property on Mersea Road 6 adjacent to the municipal utility corridor in the Municipality of Leamington; and a new 13-kilometre double circuit 230 kilovolt (kV) transmission line on a new corridor to connect the station to the existing 230 kV transmission line south of Highway 401 in the Town of Lakeshore. Cost recovery for the transmission expansion will also be established during the approvals process.

As with the environmental assessment process, the OEB's review of Hydro One's "Leave to Construct" application will include opportunities for public involvement, in this case through a formal hearing process. Hydro One will be communicating with local stakeholders and potentially-affected property owners in the coming weeks to inform them of our intent to seek approval to construct these facilities.

Following receipt of Hydro One's application, the OEB will issue a *Notice of Application and Hearing* which will outline the process for those who wish to be involved in the public hearing. Hydro One will publish the Notice in local and regional newspapers and send it to all project stakeholders, potentially-affected property owners and interested parties.

LDCs in the Windsor-Essex support this project. We'd appreciate if Council would also communicate its support for this project by way of a letter which we would include with our application to the OEB. The letter may be addressed to Mike Penstone, Vice-President, Network Development & Regional Planning, Hydro One Networks Inc., and sent electronically via Communty.Relations@HydroOne.com.

In the interim, background information including the final Environmental Study Report for this project can be viewed on Hydro One's website at www.HydroOne.com/Projects. If you have any question or wish to request a meeting with Hydro One representatives, please don't hesitate to contact me at 416-345-5130.

Sincerely,

Carrie-Lynn Ognibene

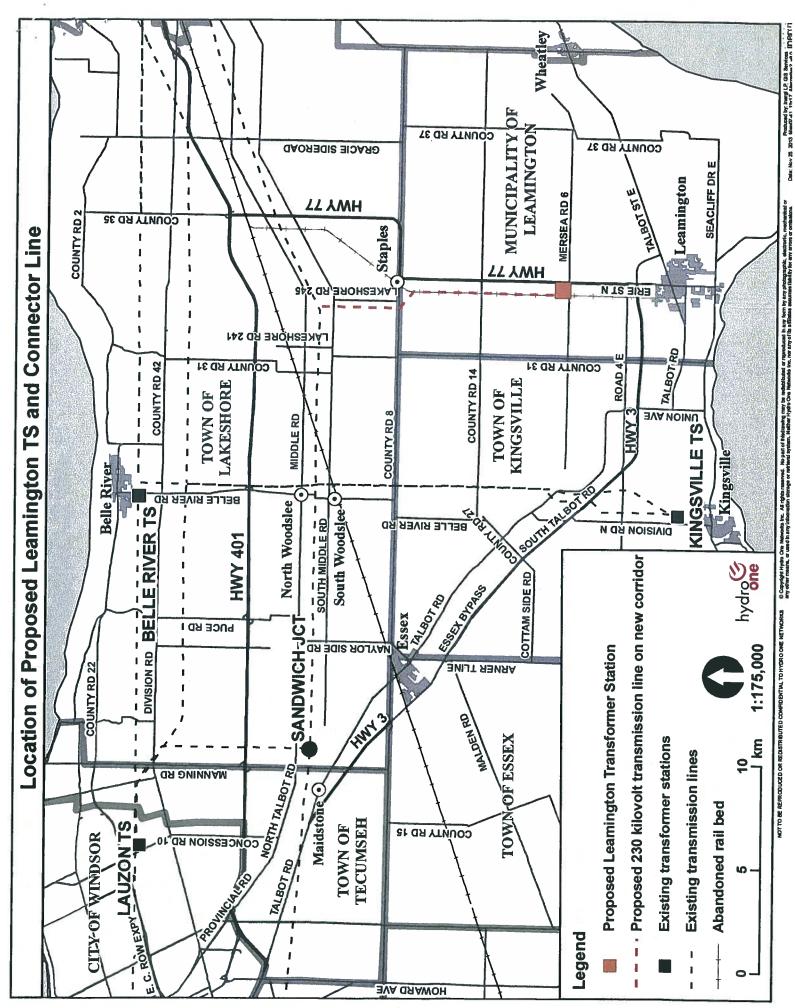
Sr. Advisor, Corporate Relations

Chlquibene

Attachment

cc Mr. Dan DiGiovanni, Chief Administrative Officer

Ms. Ruth Orton-Pert, Director of Corporate Services/Clerk







Tom Bain Warden – County of Essex

January 6, 2014

Mr. Mike Penstone, Vice-President Network Development & Regional Planning Hydro One Networks Inc. (Community.Relations@HydroOne.com)

Dear Mr. Penstone:

Re: Leamington Transformer Station

On behalf of the Corporation of the County of Essex, I am pleased to support the "Leave to Construct" application by Hydro One for the construction of a new transfer station on Mersea Road 6 in the Municipality of Leamington and a new 13-kilometre double circuit 230 kilovolt (kV) transmission line on a new corridor to connect the station to the existing 230 kV transmission line south of Highway 401 in the Town of Lakeshore.

These improvements will tremendously assist the Town of Kingsville and Municipality of Leamington with future growth potential in electricity demand and also assist with expansion of the agricultural sector.

The County of Essex is fully supportive of Hydro One's application which we feel will assist in future development of not only Kingsville and Leamington but the broader Essex-Windsor region as well.

Sincerely,

Tom Bain

Essex County Warden

Jan Bain

TB:sw



Ontario Greenhouse Vegetable Growers 32 Seneca Road Leamington, Ontario N8H 5H7 (519) 326-2604 / 1-800-265-6926 (519) 326-7842 Fax www.ontariogreenhouse.com Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 4 Page 1 of 1

January 20, 2014

Susan Frank
Chief Regulatory Officer, Hydro One
483 Bay Street
7th Floor
Toronto, Ontario, M5G 2P5

To whom it may concern,

The Ontario greenhouse vegetable sector represents one of the fastest growing parts of Canadian agriculture. With an estimated \$750 million in farmgate sales in 2013 and a consistent track record of growth, the sector is a valuable contributor to the Ontario economy. Over the past 20 years, the greenhouse sector has shown consistent growth expanding at a compounded average of 6.1% per year. This growth rate has increased recently with an additional 480 acres being put into production in the last three years. Expectations are that growth will continue into the future provided that the business climate in Ontario is supportive.

Projecting even a conservative 5% annual compounded growth, an additional 660 acres could come into production in the next five years generating an additional \$205 million in farmgate sales. This expansion would contribute \$580 million to the Ontario economy and generate approximately \$2 million in property tax revenues. Much of this expansion is destined for Essex County, however, currently expansion in this region is being stalled due to limited access to energy. As a result, many growers are considering growth opportunities outside of Ontario, particularly in nearby American states which have mounted aggressive investment attraction initiatives including energy pricing incentives.

Energy costs account for one-third of operating expenses in greenhouse operations, and securing a reliable and affordable source of energy is of key importance to our sector. With this is mind the Ontario Greenhouse Vegetable Growers, the association representing all Ontario greenhouse vegetable farmers has strongly encouraged Hydro One to make application to construct a new transmission line to service the southern part of Essex County. This line will be crucial to the continued growth and success of the Ontario greenhouse vegetable sector, and to its ability to continue to contribute to growth of the Ontario economy. We understand that such projects are capital intensive and it is our hope that cost allocation will proceed in a manner that is fair to both load consumers and Ontario rate payers, and that is cost competitive with electricity supply packages being offered outside of the province.

Sincerely,

Don Taylor - Chair, OGVG

Dw Tay



Nature Fresh Farms Sales Inc.

634 Mersea Road 7, RR#5, Leamington, ON N8H 3V8 Phone: 519-326-1111 Fax: 519-326-2070

> Filed: 2014-01-22 EB-2013-0421

Exhibit B-6-2

January 13, 2014 Attachment 5

Page 1 of 1

Susan Frank
Chief Regulatory Officer, Hydro One
483 Bay Street
7th Floor
Toronto, Ontario, M5G 2P5

Ms. Frank,

As president of Nature Fresh Farms, the largest independent greenhouse grower in Canada with 132 acres of greenhouses, I write this letter in support of the efforts of the OGVG & Hydro One to bring in a new transmission line to service the growing needs of our business, the greenhouse industry in general, and the broader regions of Essex & Chatham Kent.

I would also like to underscore the importance of the OGVG request to ensure that capital cost allocation will proceed in a manner that is fair to both load consumers and Ontario rate payers, and that it is competitive with markets in surrounding jurisdictions.

Regards,

Peter Quiring
President, Nature Fresh Farms



627 Rd. 14, R.R. #5 Leamington, ON N8H 3V8 519 322 0400 519 322 4733 www.orangelinefarms.com Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 6 Page 1 of 1

January 13, 2014

Susan Frank Chief Regulatory Officer, Hydro One 483 Bay Street 7th Floor Toronto, Ontario, M5G 2P5

To whom it may concern,

The Ontario greenhouse vegetable sector represents one of the fastest growing parts of Canadian agriculture. With close to \$800 million in farmgate sales in 2013 and a consistent track record of growth, the sector is a valuable contributor to the Ontario economy. Over the past 20 years, the greenhouse sector has shown consistent growth expanding at a compounded average of 6.1% per year. This growth rate has increased recently with an additional 353 acres being put into production in the last two years. Expectations are that growth will continue into the future provided that the business climate in Ontario is supportive.

Projecting even a conservative 5% annual compounded growth, an additional 630 acres could come into production in the next five years generating an additional \$220 million in farmgate sales. This expansion would contribute \$620 million to the Ontario economy and generate approximately \$1.9 million in property tax revenues. Much of this expansion is destined for Essex County, however, currently expansion in this region is being stalled due to limited access to energy. As a result, many growers are considering growth opportunities outside of Ontario, particularly in nearby American states which have mounted aggressive investment attraction initiatives including energy pricing incentives.

Energy costs account for one-third of operating expenses in greenhouse operations, and securing a reliable and affordable source of energy is of key importance to our sector. With this is mind the Ontario Greenhouse Vegetable Growers, the association representing all Ontario greenhouse vegetable farmers has strongly encouraged Hydro One to make application to construct a new transmission line to service Essex County. This line will be crucial to the continued growth and success of the Ontario greenhouse vegetable sector, and to its ability to continue to contribute to growth of the Ontario economy. We understand that such projects are capital intensive and it is our hope that cost allocation will proceed in a manner that is fair to both load consumers and Ontario rate payers, and that is cost competitive with electricity supply packages being offered outside of the province.

Sincerely,

Duffy Kniaziew, President

Orangeline Farms Limited

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 7 Page 1 of 1



December 2, 2013

Hydro One Networks Inc Network Development and Regional Planning 483 Bay Street Toronto, Ontario M5G 2P5

Attention: Mike Penstone

Re: New Learnington Transmission line and Transformation Station

Dear Mike;

This letter is confirmation that Essex Powerlines Corporation is fully supportive of Hydro One Networks Inc. building a new transformer station in Leamington and a new double circuit 230 kilovolt (kV) line on a new corridor to connect the station to the existing 230 kV lines south of Highway 401. The area has been in need of a new transformer station due to considerable growth in the area especially in the green house industry. We look forward to working with Hydro One on this project.

Sincerely,

Richard Dimmel, CMA General Manager 519-737-9811 ext 214 519-737-7064 fax

rdimmel@essexpowerlines.ca

cc: Mark Alzner, Essex Powerlines Corporation Dave Dunn, Essex Powerlines Corporation Raymond Tracey, Essex Power Corporation AMHERSTBURG ESSEX KINGSVILLE LAKESHORE LASALLE LEAMINGTON PELEE ISLAND TECUMSEH WINDSOR

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 8 Page 1 of 2

January 21, 2014

Ms. Susan Frank Chief Regulatory Officer Hydro One 483 Bay Street, 7th Floor Toronto, ON M5G 2P5

Dear Ms. Frank,

On behalf of the WindsorEssex Economic Development Corporation, I wish to express our support for the construction of a new transformer station and 230 kV transmission line in the Municipality of Leamington. This investment would allow for growth in the region, specifically in the greenhouse industry which has significant electricity needs.

The Development Corporation has been working with community stakeholders in Leamington and Kingsville since the cancellation of the planned construction of a new transformer station was announced several years ago. We have continued to support the communities' efforts to have the cancellation reconsidered.

Although the recent recession had a significant impact on the City of Windsor and adjacent municipalities, largely due to the area's reliance on the automotive industry, Kingsville and Leamington were impacted to a far lesser degree. Continued growth in the greenhouse industry had a very positive effect on the economies of these two municipalities during that time and it continues to do so.

Already the largest greenhouse cluster in North America, this sector is poised for further growth. Having added over 170 acres of new greenhouses in 2012 alone, plans are in place to increase the cluster by 500 additional acres in the next five years. Many local greenhouse growers are also looking to move to year-round production which would require grow lights during the winter months. Currently there is not enough power available to support grow lights.

Growth in the greenhouse sector will support additional growth in the Essex County economy as a whole, with increased employment and increased sales by greenhouse suppliers. There is also the potential to attract new companies to supply the greenhouse sector. The investment in a new transformer station and transmission line in Leamington will not only facilitate this growth, it will provide significant financial returns.



700 California, Suite 200, Centre for Engineering Innovation, Windsor, ON N9B 2Z2

In our efforts to attract new investment to Essex County, and the Municipality of Leamington in particular, we must be able to assure potential investors of adequate electricity supply for their operations. This is an early requirement for virtually all of our business attraction clients. We are currently working to mitigate the effects of the upcoming closure of the H.J. Heinz plant in Leamington by encouraging companies to expand into the area. Successful business attraction efforts may result in new companies that employ fewer people than Heinz employed, but have much higher power requirements. The inability to assure business attraction clients of an adequate power supply would certainly have a negative effect on potential new investment projects.

We trust that this investment in a new transformer station will receive all necessary support and will proceed in a timely fashion.

Sincerely,

Rakesh Naidu

Chief Operating Officer

\ld\supportletters\hydroone-transformerleamington-jan14



Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-2 Attachment 9 Page 1 of 2

Entegrus Powerlines Inc. 320 Queen St. (P.O. Box 70) Chatham, ON N7M 5K2 Phone: (519) 352-6300 Toll Free: 1-866-804-7325 entegrus.com

January 21st, 2014

Mike Penstone
Hydro One Networks Inc
Network Development and Regional Planning
483 Bay Street
Toronto, Ontario
M5G 2P5

Re: Letter of Support - Leamington TS

As a member of the Windsor-Essex Regional Planning Region, Entegrus Powerlines ("Entegrus") is highly focused on the quality of power delivered to its customers in the Windsor-Essex regional the community of Wheatley.

Wheatley, in particular, has suffered in recent years from below average power quality. This is a function of the community's location at the end of a long distribution feeder ("3M3") from the Kingsville Transmission Station ("TS"). Long feeders are naturally more exposed and susceptible to various issues caused by storms, voltage regulation constraints, car accidents and so forth.

Entegrus is aware that the Integrated Regional Resource Plan (IRRP) currently underway for Windsor-Essex contemplates the construction by Hydro One Transmission ("Hydro One") of a new TS situated in Leamington. This TS would resolve capacity and load issues on the distribution and transmission systems for Leamington and surrounding communities. Entegrus further believes that a Leamington TS would ultimately lead to better quality of electrical delivery to our customers in Wheatley due to the reduction in the feeder length distance.

At the time of the writing of this letter, the cost allocation from Hydro One to the affected Windsor-Essex Planning Region member distributors is unknown. In this regard, Entegrus intends to seek intervenor status in Hydro One's upcoming application to the Ontario Energy Board for the Leave to Construct. As an intervenor, the intent of Entegrus would be to focus primarily on the proposed cost allocation methodology.

The approved methodology and cost allocation to Entegrus will heavily influence our ongoing support of the project, in order to ensure that our customers are subject to an equitable distribution of costs. Under the assumption that there is a mutually satisfactory outcome on this matter, Entegrus will be pleased to continue to support and work with



Hydro One in the construction of Leamington TS and the associated distribution and transmission modifications.

Entegrus remains ready to support Hydro One throughout the OEB proceedings and thereafter in an effort to deliver a long overdue solution to Windsor-Essex Region's power quality and capacity issues.

Sincerely

D. Charron P. Eng., President, Entegrus Powerlines

cc: Jim Hogan, CEO, Entegrus Inc.

David Ferguson, Director of Regulatory & Administration

Filed: 2014-05-23 EB-2013-0421 Exhibit B Tab 6 Schedule 3 Page 1 of 74

IESO'S SYSTEM IMPACT ASSESSMENT

2

1





System Impact Assessment Report

CONNECTION ASSESSMENT & APPROVAL PROCESS

Second Draft

CAA ID: 2013-507

Project: Leamington TS - Supply to Essex County Transmission Reinforcement Project

Applicant: Hydro One Networks Inc.

Market Facilitation Department Independent Electricity System Operator

Date: May 9, 2014

Document Name System Impact Assessment Report

Issue Second Draft

Reason for Issue Draft

Effective Date May 9, 2014

System Impact Assessment Report

Acknowledgement

The IESO wishes to acknowledge the assistance of Hydro One in completing this assessment.

Disclaimers

IESO

This report has been prepared solely for the purpose of assessing whether the connection applicant's proposed connection with the IESO-controlled grid would have an adverse impact on the reliability of the integrated power system and whether the IESO should issue a notice of conditional approval or disapproval of the proposed connection under Chapter 4, section 6 of the Market Rules.

Conditional approval of the proposed connection is based on information provided to the IESO by the connection applicant and Hydro One at the time the assessment was carried out. The IESO assumes no responsibility for the accuracy or completeness of such information, including the results of studies carried out by Hydro One at the request of the IESO. Furthermore, the conditional approval is subject to further consideration due to changes to this information, or to additional information that may become available after the conditional approval has been granted.

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed project to the IESO-controlled grid. However, the conditional approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant and the IESO in accordance with Chapter 4, section 6 of the Market Rules. The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this report to the connection applicant, the connection applicant must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to the connection applicant. Although the IESO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that the most recent version of this report is being used.

Hydro One

The results reported in this report are based on the information available to Hydro One, at the time of the study, suitable for a System Impact Assessment of this connection proposal.

The short circuit and thermal loading levels have been computed based on the information available at the time of the study. These levels may be higher or lower if the connection information changes as a result of, but not limited to, subsequent design modifications or when more accurate test measurement data is available.

This study does not assess the short circuit or thermal loading impact of the proposed facilities on load and generation customers.

In this report, short circuit adequacy is assessed only for Hydro One circuit breakers. The short circuit results are only for the purpose of assessing the capabilities of existing Hydro One circuit breakers and identifying upgrades required to incorporate the proposed facilities. These results should not be used in the design and engineering of any new or existing facilities. The necessary data will be provided by Hydro One and discussed with any connection applicant upon request.

The ampacity ratings of Hydro One facilities are established based on assumptions used in Hydro One for power system planning studies. The actual ampacity ratings during operations may be determined in real-time and are based on actual system conditions, including ambient temperature, wind speed and project loading, and may be higher or lower than those stated in this study.

The additional facilities or upgrades which are required to incorporate the proposed facilities have been identified to the extent permitted by a System Impact Assessment under the current IESO Connection Assessment and Approval process. Additional project studies may be necessary to confirm constructability and the time required for construction. Further studies at more advanced stages of the project development may identify additional facilities that need to be provided or that require upgrading.

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Executive Summary

Conditional Approval for Connection

Hydro One Networks Inc. (the "connection applicant") has proposed to develop Leamington TS – Supply to Essex County Transmission Reinforcement Project (the "project"), in Leamington, Ontario. The project will consist of two 75/100/125 MVA, 215.5/27.6/27.6 kV transformers connecting to 230 kV circuits C21J and C22J via a 13 km 230 kV double circuit overhead tap line. Some of the load at Kingsville TS, which is connected to 115 kV circuits K2Z and K6Z, will be transferred to the project. Hydro One is considering the following two load transfer options:

- A. Retain four transformers with 124 MW of load at Kingsville TS and transfer the remaining Kingsville load to the project.
- B. Retain two transformers with 54 MW of load at Kingsville TS and transfer the remaining Kingsville load to the project.

The planned in-service date of the project is May 2016.

This assessment concludes that the proposed project, subject to the requirements specified in this report, is expected to have no material adverse impact on the reliability of the integrated power system. Therefore, the IESO recommends that a Notification of Conditional Approval for Connection be issued for Leamington TS – Supply to Essex County Transmission Reinforcement Project subject to the implementation of the requirements outlined in this report.

Findings and Recommendations

Findings

The Project:

- 1. The project improves the supply capacity needs of the Windsor area.
- 2. The proposed connection arrangement and equipment for the project are acceptable to the IESO. The proposed 230 kV connection equipment meet the requirements and standards in the Market Rules and Transmission System Code (TSC).
- 3. Under certain outage conditions, there is a potential for reverse power flow on the project's transformers. This is not a concern for the IESO. See recommendation 2 for Hydro One.

Kingsville Load Transfer Options:

The two load transfer options, A & B, from Kingsville TS to the project were compared for their impact on the Windsor 230 kV and 115 kV systems under 2026 summer peak load conditions. The following findings were identified based on the study results:

4. With option B for loss of K2Z, post-contingency loading on circuit K6Z and 115 kV voltages at Kingsville TS are within the *Ontario Resource and Transmission Assessment Criteria (ORTAC)* without the need of any control action.

Executive Summary CAA 2013-507

With option A for loss of K2Z, post-contingency loading above the short term emergency rating (STE) on circuit K6Z and low 115 kV voltages at Kingsville TS will occur. Arming the Lauzon load rejection (L/R) scheme as part of the Windsor Area Special Protection Scheme (SPS) to reject load at Kingsville will mitigate these issues. However, this control action is a violation of the *ORTAC* criteria. Hence, option B is better than option A.

With two transformers retained at Kingsville in option B, for loss of one transformer, post-contingency loading above the 10-day long term rating (LTR) will occur on the remaining transformer with the more limiting rating. Should option B be retained, Hydro One has indicated that they have plans to replace this transformer with a new transformer that has a higher 10-day LTR.

- 5. With option A or B and high flows east or west between Keith TS and Chatham SS, which represent past historical maximum transfers, post-contingency thermal loadings and voltages in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions. With option B, the post-contingency loadings are lower and less control actions are required. Hence, option B is better than option A.
- 6. With option A or B and high flows east or west between Keith TS and Chatham SS, the incorporation of the project is not expected to have adverse impact on import/export capability via circuit J5D.
- 7. With option A or B, the load restoration capability of the Windsor 115 kV system is improved following the simultaneous loss of double circuits C23Z and C24Z. Option B is better, as it allows all forecasted load that is lost following this contingency to be restored.
- 8. With option B, the simultaneous loss of double circuits C21J and C22J will interrupt load at Malden TS and the project of up to 237 MW for the 2016-2026 period which is within the *ORTAC* criteria.

Findings 9 and 10 below were observed when respecting the North American Electric Reliability Corporation (NERC) TPL-001-04 Bulk Electric System (BES) Planning Performance Events based on NERC's new definition of the BES effective in Ontario July 1, 2014.

- 9. With options A or B, high flows east from Keith TS to Chatham SS and all elements in-service, for a Lauzon T1L7 breaker failure, multiple control actions are needed to mitigate post-contingency thermal loadings in the Windsor 115 kV system, as this contingency is not included in the Lauzon L/R scheme which is part of the Windsor Area SPS.
- 10. With options A or B, high flows east or west between Keith TS and Chatham SS and all elements inservice, for the loss of double circuit Z1E and Z7E, control actions were taken to mitigate post-contingency over-voltages on the Lauzon 115 kV system. With option A, the Lauzon L/R scheme as part of the Windsor Area SPS was armed to switch out the Kingsville capacitors. However, switching out the Lauzon capacitor post-contingency would be a better control action. With option B, the Lauzon capacitor was switched out-service pre-contingency as there were no control actions available post-contingency. This resulted in lower voltages on the Lauzon 230 kV and 115 kV systems compared to option A.

Recommendations

- 1. It is recommended that Hydro One choose Kingsville load transfer option B rather than option A. Option A is however, an improvement compared to keeping all of the load at Kingsville.
- 2. It is recommended that Hydro One assess the reverse power flow on the project's transformers and confirm that there is no unacceptable tripping or loading concern on the transformers.

Recommendations 3 and 4 below are required for respecting the NERC TPL-001-04 BES Planning Performance Events based on NERC's new definition of the BES effective in Ontario July 1, 2014.

- 3. It is recommended that Hydro One consider expanding the Lauzon L/R scheme as part of the Windsor Area SPS to include the Lauzon T1L7 breaker failure which is a NERC TPL-001-04 BES Planning Performance Event so that load rejection (L/R) can be armed for this contingency. This would provide greater operating flexibility.
- 4. It is recommended that Hydro One consider adding the selection of the Lauzon capacitor to be tripped for the Z1E+Z7E contingency which is a contingency that is already included in the Lauzon L/R scheme as part of the Windsor Area SPS. This would provide greater operating flexibility.

IESO's Requirements for Connection

Connection Applicant Requirements

Project Specific Requirements: The following *specific* requirements are applicable for the incorporation of the project. Specific requirements pertain to the level of reactive compensation needed, operation restrictions, special protection system, upgrading of equipment and any project specific items not covered in the *general* requirements.

- (1) Hydro One is required to review the relay settings of the 230 kV circuits C21J and C22J. Any modifications made to protections after this SIA is finalized must be submitted to the IESO at least six (6) months before any modifications are to be implemented on the existing protection systems.
- (2) The simultaneous loss of double circuits C21J and C22J will interrupt load at Malden TS and the project of up to 237 MW for the 2016 to 2026 period which is within the *ORTAC* criteria. Hydro One and the affected Local Distribution Companies (LDCs) are expected to work together to ensure that up to 87 MW of load can be restored within approximately 4 hours and up to 237 MW of load can be restored within approximately 8 hours as per the *ORTAC* criteria.

General Requirements: The connection applicant shall satisfy all applicable requirements and standards specified in the Market Rules and the TSC. The following requirements summarize some of the general requirements that are applicable to the project, and are presented in detail in section 2 of this report.

- 1. As currently assessed the project does not fall within the Northeast Power Coordinating Council's (NPCC) definition of Bulk Power System (BPS). As such, the project will not have any elements classified as BPS and will not have to meet any NPCC reliability obligations.
- 2. NERC's new definition of the BES will be effective in Ontario July 1, 2014. As currently assessed, based on this new definition, the project will not have any elements classified as BES and will not have to meet any NERC reliability obligations.
- 3. The project is required to meet obligations and requirements of the Market Rules.
- 4. The connection applicant shall ensure that the project's 230 kV connection equipment is capable of continuously operating between 220 kV and 250 kV, as specified in Appendix 4.1 of the Market Rules. Any protective relay settings must be set to ensure that equipment remains in-service for voltages up to 5% above the maximum continuous value.
- 5. The connection applicant shall ensure that the project's 230 kV connection equipment is designed to be fully operational in all reasonably foreseeable ambient temperature conditions. The connection equipment must also be designed so that the adverse effects of its failure on the IESO-controlled grid are mitigated.

Executive Summary CAA 2013-507

6. The connection applicant shall ensure that the project's 230 kV connection equipment is designed to withstand the fault levels in the local area. If any future system changes result in an increased fault level higher than the equipment's capability, the connection applicant is required to replace the equipment with higher rated equipment capable of withstanding the increased fault level, up to maximum fault level specified in Appendix 2 of the TSC.

- 7. The connection applicant shall install and maintain facilities and equipment at the project to provide 3% and 5% voltage reduction within five minutes of receipt of direction from the IESO.
- 8. The connection applicant shall have the capability to maintain the power factor at the defined meter point of the project within the range of 0.9 lagging and 0.9 leading.
- 9. The connection applicant is required to install under frequency load shedding (UFLS) facilities at the project to allow for the detection of under-frequency conditions and the selection and tripping of load via circuit breakers.
 - The connection applicant is required to ensure that the UFLS targets specified in Section 10.4.6 of Chapter 5 of the Market Rules and Section 4.5 of Market Manual 7.4 are met after the addition of the proposed project. During the IESO Market Entry/Facility Registration process, the connection applicant is required to submit a revised schedule of under-frequency tripping selections and their related load amounts for each applicable shedding stage that will satisfy the UFLS targets.
- 10. The connection applicant shall ensure that the telemetry requirements for the project are satisfied as per the applicable Market Rules requirements. The determination of telemetry quantities and telemetry testing will be conducted during the IESO Market Entry/Facility Registration process.
- 11. If revenue metering equipment is being installed as part of this project, the connection applicant should be aware that revenue metering installations must comply with Chapter 6 of the IESO Market Rules. For more details the connection applicant is encouraged to seek advice from their Metering Service Provider (MSP) or from the IESO metering group.
- 12. The connection applicant shall ensure that the project's protection systems are designed to satisfy all the requirements of the TSC.
 - As currently assessed by the IESO, the project is not considered essential to the power system and therefore does not require redundant protection systems in accordance with section 8.2.1a of the TSC.
 - The project's protection systems must also only trip the appropriate equipment required to isolate the fault. The project shall have the capability to ride through routine switching events and design criteria contingencies in the grid that do not disconnect the project by configuration.
 - The connection applicant shall have adequate provision in the project's design of protections and controls to allow for future installation of Special Protection Scheme (SPS) equipment. Should a new SPS be installed or an existing SPS be expanded to improve the transfer capability into the area or to accommodate transmission reinforcement projects, the facility may be required to participate in the SPS system and to install the necessary protection and control facilities to affect the required actions. These SPS facilities must comply with the NPCC Reliability Reference Directory #7 for Type 1 SPS.
- 13. The connection applicant is currently a restoration participant. The connection applicant is required to update its restoration participant attachment to include details regarding the project. For more details please refer to the Market Manual 7.8. Details regarding restoration participant requirements will be finalized in the IESO Market Entry/Facility Registration process.
- 14. The connection applicant must initiate and complete the IESO Market Entry/Facility Registration process for this project in a timely manner before IESO final approval for connection is granted.
 - Equipment data must be provided to the IESO at least seven months before energization to the IESO-controlled grid. The IESO will confirm that the data for the equipment installed meets the Market Rules requirements and matches or exceeds the performance predicted in this assessment.

If the submitted data differs materially from the ones used in this assessment, then further analysis of the project will need to be done by the IESO.

At the sole discretion of the IESO, performance tests may be required at transmission facilities. The objectives of these tests are to demonstrate that equipment performance meets the IESO requirements, and to confirm models and data are suitable for IESO purposes.

Project Description CAA 2013-507

1. Project Description

Hydro One Networks Inc. (the "connection applicant") has proposed to develop Leamington TS – Supply to Essex County Transmission Reinforcement Project (the "project"), in Leamington, Ontario. This new transformer station will connect to 230 kV circuits C21J and C22J at about 49.1 km from Chatham SS via a 13 km double circuit 230 kV overhead tap line. Some of the load at Kingsville TS, connected to 115 kV circuits K2Z and K6Z, will be transferred to the project. Hydro One is considering the following two load transfer options:

- A. Retain four transformers with 124 MW of load at Kingsville TS and transfer the remaining Kingsville load to the project.
- B. Retain two transformers with 54 MW of load at Kingsville TS and transfer the remaining Kingsville load to the project.

Figure 1 shows the single-line diagram of the proposed project. The station will consist of two 75/100/125 MVA, 215.5/27.6/27.6 kV transformers each with a 230 kV disconnect switch on the high voltage side of the transformer. The 27.6 kV buses will be separated by a normally open bus-tie breaker and a shunt capacitor bank rated at 21.6 Mvar@28.8 kV will be installed on one of the 27.6 kV buses. The load will be fed from a total of six feeders. The planned in-service date is May 31, 2016.

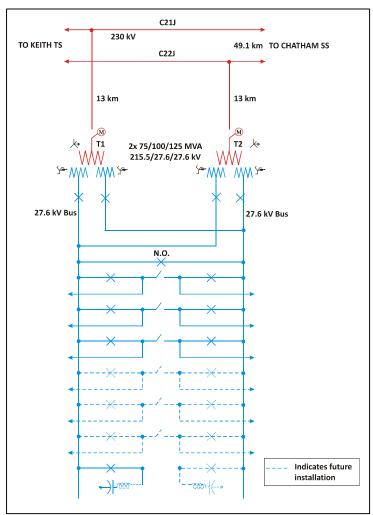


Figure 1: Single Line Diagram of Leamington TS
- End of Section -

2. General Requirements

The connection applicant shall satisfy all applicable requirements and standards specified in the Market Rules and the TSC. The following sections highlight some of the general requirements that are applicable to the project.

2.1 Reliability Standards

As currently assessed the project does not fall within the NPCC definition of BPS. As such, the project will not have any elements classified as BPS and will not have to meet any NPCC reliability obligations.

NERC's new definition of the BES will be effective in Ontario July 1, 2014. As currently assessed, based on this new definition, the project will not have any elements classified as BES and will not have to meet any NERC reliability obligations.

The project is required to meet obligations and requirements of the Market Rules. The project's BPS and BES classifications will be re-evaluated by the IESO as the electrical system evolves.

2.2 Voltage Requirements

Appendix 4.1 of the Market Rules states that under normal operating conditions, the voltages in the 230 kV system in IESO-controlled grid are maintained within the range of 220 kV to 250 kV. Thus, the project's 230 kV connection equipment must have a maximum continuous voltage rating of at least 250 kV.

Any protective relay settings must be set to ensure that connection equipment remains in-service for voltages up to 5% above the maximum continuous value specified in Appendix 4.1 of the Market Rules, to allow the power system to recover from transient disturbances.

2.3 Connection Equipment Design

The connection applicant shall ensure that the project's 230 kV connection equipment is designed to be fully operational in all reasonably foreseeable ambient temperature conditions. The connection equipment must also be designed so that the adverse effects of its failure on the IESO-controlled grid are mitigated.

2.4 Fault Levels

The TSC requires connection equipment connecting to the transmission system be designed to withstand the fault levels in the area where the equipment is installed. Thus, the connection applicant shall ensure that the project's connection equipment is designed to withstand the fault levels in the area. If any future system changes result in an increased fault level higher than the equipment's capability, the connection applicant is required to replace the equipment with higher rated equipment capable of withstanding the increased fault level, up to maximum fault level specified in the TSC. Appendix 2 of the TSC establishes the maximum fault levels for the transmission system.

For the 230 kV system, the maximum 3 phase symmetrical fault level is 63 kA and the maximum single line to ground symmetrical fault level is 80 kA (usually limited to 63 kA).

General Requirements CAA 2013-507

2.5 Voltage Reduction Facilities

Appendix 4.3 of the Market Rules requires that distributors connected to the IESO-controlled grid with directly connected load facilities of aggregated rating of 20 MVA or more and with the capability to regulate distribution voltage under load, shall install and maintain facilities and equipment to provide voltage reduction capability. Voltage reduction capability represents the capability of reducing demand by lowering the customer voltage by 3% and 5% within five minutes of receipt of direction from the IESO. This is required to achieve load reduction during periods when supply resources are limited. The voltage reduction capability can be achieved by installing under-load tap changers (ULTC) at the project.

2.6 Power Factor

Appendix 4.3 of the Market Rules requires connected wholesale customers and distributors connected to the IESO-controlled grid to have the capability to maintain the power factor within the range of 0.9 lagging and 0.9 leading as measured at the defined meter point of the project.

2.7 Under Frequency Load Shedding Facilities

The connection applicant has an aggregate peak load at all its owned facilities, including the proposed project that is greater than 25 MW. Thus, the connection applicant is required to participate in the UFLS program according to Section 4.5 of the Market Manual Part 7.4.

The connection applicant is required to install UFLS facilities at the proposed project to allow for the detection of under-frequency conditions and the selection and tripping of load via circuit breakers.

The connection applicant must select 35% of aggregate peak load among its owned facilities for underfrequency tripping, based on a date and time specified by the IESO that approximates system peak, according to section 10.4 of Chapter 5 of the Market Rules.

As the connection applicant has a peak load of 100 MW or greater at all its owned facilities, the UFLS relay connected loads shall be set to achieve the amounts to be shed stated in the following table:

UFLS Stage	Frequency Threshold (Hz)	Total Nominal Operating Time (s)	Load Shed at stage as % of Connection Applicant's Load	Cumulative Load Shed at stage as % of Connection Applicant's Load
1	59.5	0.3	7 – 9	7 – 9
2	59.3	0.3	7 – 9	15 – 17
3	59.1	0.3	7 – 9	23 – 25
4	58.9	0.3	7 - 9	32 - 34
Anti-Stall	59.5	10.0	3 – 4	35 - 37

The requirements in the table above are currently under review. The IESO will notify the connection applicant of any impending changes to which the connection applicant will have to comply.

Capacitor banks connected to the same facility as the load should be shed by UFLS relay at 59.5 Hz with a time delay of 3 seconds.

The maximum load that can be connected to any single UFLS relay is 150 MW to ensure that the inadvertent operation of a single under-frequency relay during the transient period following a system disturbance does not lead to further system instability.

2.8 IESO Telemetry Data

In accordance with Section 7.5 of Chapter 4 of the Market Rules, the connection applicant shall provide to the IESO the applicable telemetry data for the project as listed in Appendix 4.17 of the Market Rules on a continual basis. The data shall be provided in accordance with the performance standards set forth in Appendix 4.22, subject to Section 7.6A of Chapter 4 of the Market Rules. The whole telemetry list will be finalized during the IESO Market Entry/Facility Registration process.

The connection applicant must install monitoring equipment that meets the requirements set forth in Appendix 2.2 of Chapter 2 of the Market rules. As part of the IESO Market Entry/Facility Registration process, the connection applicant must also complete end to end testing of all necessary telemetry points with the IESO to ensure that standards are met and that sign conventions are understood. All found anomalies must be corrected before IESO final approval to connect any phase of the project is granted.

2.9 Revenue Metering

If revenue metering equipment is being installed as part of the project, the connection applicant should be aware that revenue metering installations must comply with Chapter 6 of the IESO Market Rules. For more details the connection applicant is encouraged to seek advice from their Metering Service Provider (MSP) or from the IESO metering group.

2.10 Protection Systems

The connection applicant shall ensure that the project's protection systems are designed to satisfy all the requirements of the TSC. New protection systems must be coordinated with the existing protection systems.

As currently assessed by the IESO, the project is not considered essential to the power system and therefore does not require redundant protection systems in accordance with section 8.2.1a of the TSC. In the future, as the electrical system evolves, the project may be designated as essential by the IESO. In that case these redundant protections systems would have to satisfy all requirements of the TSC, and in particular, they could not use common components, common battery banks or common secondary CT or PT windings.

The project's protection systems must only trip the appropriate equipment required to isolate the fault. After the facility begins commercial operation, if an improper trip of the 230 kV circuit(s) C21J and C22J occurs due to events within the facility, the facility may be required to be disconnected from the IESO-controlled grid until the problem is resolved.

The project shall have the capability to ride through routine switching events and design criteria contingencies in the grid that do not disconnect the project by configuration. Standard fault detection, auxiliary relaying, communication, and rated breaker interrupting times are to be assumed.

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As currently assessed by the IESO, the project is not required to be part of an SPS. However, the connection applicant is required to have adequate provision in the design of protections and controls at the facility to allow for future installation of Special Protection Scheme (SPS) equipment. Should a future SPS be installed or an existing SPS be expanded to improve the transfer capability in the area or to accommodate transmission reinforcement projects, the facility may be required to participate in the SPS system and to install the necessary protection and control facilities to affect the required actions. These SPS facilities must comply with the NPCC Reliability Reference Directory #7 for Type 1 SPS. In particular, if the SPS is designed to have 'A' and 'B' protection at a single location for redundancy, they must be on different non-adjacent vertical mounting assemblies or enclosures. Two independent trip coils are required on the breakers selected for L/R.

2.11 Restoration Requirements

The connection applicant is currently a restoration participant. The connection applicant is required to update its restoration participant attachment to include details regarding the project. For more details please refer to the Market Manual 7.8. Details regarding restoration participant requirements will be finalized in the IESO Market Entry/Facility Registration process.

As currently assessed by the IESO, this facility is not classified as a Key Facility that is required to establish a Basic Minimum Power System following a system blackout. Key Facility and Basic Minimum Power System are terms defined in the NPCC Glossary of Terms.

2.12 IESO Market Entry/Facility Registration

The connection applicant must initiate and complete the IESO Market Entry/Facility Registration process for the project in a timely manner before IESO final approval for connection is granted.

Equipment data must be provided to the IESO at least seven months before energization to the IESO-controlled grid, to allow the IESO to incorporate this project into IESO work systems and to perform any additional reliability studies. The data may be shared with other reliability entities in North America as needed to fulfill the IESO's obligations under the Market Rules, NPCC and NERC rules.

The IESO will confirm that the data for the equipment installed meets the Market Rules requirements and matches or exceeds the performance predicted in this assessment. If the submitted data differs materially from the ones used in this assessment, then further analysis of the project will need to be done by the IESO.

At the sole discretion of the IESO, performance tests may be required at transmission facilities. The objectives of these tests are to demonstrate that equipment performance meets the IESO requirements, and to confirm models and data are suitable for IESO purposes

3. Data Verification

3.1 Connection Arrangement

The connection arrangement of the project, as shown in Figure 1, will not reduce the level of reliability of the integrated power system and is, therefore, acceptable to the IESO.

3.2 Equipment Data

The connection equipment specifications were assessed based on the information provided by the connection applicant.

3.2.1 Tap Line

Table 1: 230 kV Overhead Tap Line

Length (km)	Maximum Operating	Summer Ratings (A) 35°C 4 km/h			Positive Sequence Impedance (pu, $S_B = 100 \text{ MVA}$, $V_B = 220 \text{ kV}$)			
(KIII)	(kV)	Cont	LTE	STE	R	Х	В	
13	250	1060	1400	1900	0.002168	0.01332	0.021006	

3.2.2 230 kV Disconnect Switch

Table 2: Specifications of the 230 kV Disconnect Switch

Number to be installed Maximum Continuous Voltage Rating (kV)		Continuous Current Rating (A)	Short Circuit Symmetrical Rating (kA)		
2	250	To be provided by Hydro One	63		

The 230 kV disconnect switch has a maximum continuous voltage rating of 250 kV and a short circuit symmetrical rating of 63 kA which meet the requirements and standards in the Market Rules and TSC.

3.2.3 230 kV Transformer

Table 3: Specifications of the 230 kV Transformer

1124	Transformation	Rating (MVA)	Positive Sequence		Configurat	High Voltage ULTC	
Unit	(kV)	(ONAN/ONAF/OFAF)	Impedance (pu) S _B = 62.5 MVA	Н	L	Т	Tap Changer
T1/T2	215.5/27.6-27.6	75/100/125	HT: 0.00487+j0.17867 HL: 0.00489+j0.17750 LT: 0.0199+j0.32559	Yg		Zig-zag Grounded through 1.5 ohm reactor	215.5 ± 40 kV in ± 16 steps

Data Verification CAA 2013-507

3.2.4 Shunt Capacitor

Table 4: Specifications of the 27.6 kV Shunt Capacitor

Rated Capacitance at Rated Voltage (Mvar)	Rated Voltage (kV)	Nominal System Voltage (kV)		
21.6	28.8	27.6		

4. Fault Level Assessment

As the LV winding of the transformers is configured Zigzag and there is no major synchronous motor load to be supplied, the project will not change the fault levels in its surrounding area for both 3-phase and L-G faults. Thus, short circuits studies were not conducted.

5. Protection Impact Assessment

A Protection Impact Assessment (PIA) was completed by Hydro One to examine the impact of the project on existing transmission system protections. A copy of the Protection Impact Assessment can be found in Appendix C of this report.

No changes to the existing protection settings at Keith TS and Chatham SS are required due to the incorporation of the project as the increase in apparent impedance is negligible. The existing zone 1 protection settings at Keith TS will cover the whole 13 km overhead line tap that connects the facility to the IESO-controlled grid. The existing zone 2 protection settings at Chatham SS and Keith TS will reach into a portion of the transformers at the facility.

The incorporation of the project will require installation of new communication links and modifications to the existing C21J and C22J protection systems at Keith TS and Chatham SS. Dual communication links between the project and one of Keith TS or Chatham SS are required to send transfer trip signals

The proposed protection changes will have no material adverse impact on reliability of the IESO-controlled grid.

Hydro One must submit any protection modifications that are different from those considered in this SIA at least six (6) months before any modifications are to be implemented on the existing protection systems. If those modifications result in adverse reliability impacts, mitigation solutions must be developed.

6. Impact on System Reliability

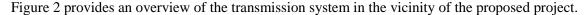
The technical studies focused on identifying the impact of the project on the reliability of the IESO-controlled grid. They include a thermal loading assessment of local transmission lines and transformers and a voltage assessment of local buses under specific flow conditions.

6.1 Existing System

The Windsor area is bounded by 230 kV circuits C23Z and C24Z from Chatham to Lauzon, C21J and C22J from Chatham to Keith and J5D from Keith to Michigan. There are three wind generating stations Comber West and East connected to C23Z and C24Z respectively, Port Alma I and II connected to C24Z and Dillon connected to C23Z. The Windsor 115 kV area load is supplied from Lauzon 230/115 kV autotransformers T1 and T2, Keith 230/115 kV autotransformers T11 and T12, West Windsor GS G1 and G2, East Windsor G1 and G2, Windsor TransAlta CGS G1 and G2, Brighton Beach CGS G1A, Pointe Aux Roches WGS and Goshen WGS.

The Windsor area is summer peaking and is susceptible to a variety of operational problems including pre-contingency voltage instability, post-contingency voltage decline and thermal overload. As a result, a number of special protection schemes are employed to facilitate operation of the area which are all included as part of the Windsor Area Special Protection Scheme (SPS). This SPS includes contingency based generation rejection and cross-tripping scheme at Keith TS, a contingency based load rejection scheme at Lauzon TS, under-voltage load rejection scheme at Kingsville TS and high voltage switching scheme at Kingsville TS.

Past completed SIAs relating to new or modified connections in the Windsor area have identified thermal overload and under-voltage concerns. Thermal overloads on circuits K2Z or K6Z and under-voltages at Kingsville have been previously identified in SIA 2008-332. Thermal overloads or congestion on circuits J3E, J4E and Keith T12 have been highlighted in previous SIAs (2005-203, 2007-268, 2008-343, 2010-381, 2010-382, 2010-383, 2010-405).



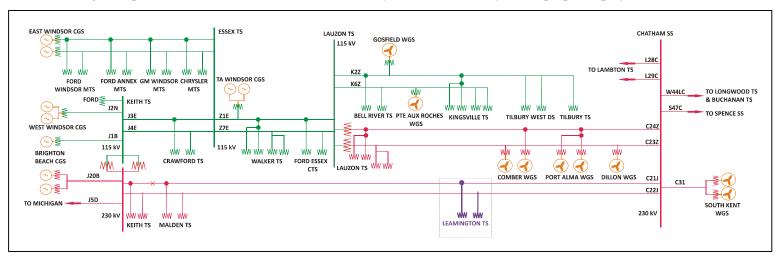


Figure 2: Transmission System in the vicinity of Leamington TS

6.2 Assumptions

In this assessment, the 2014 summer base case was used with the following assumptions:

(1) **Transmission facilities**: All existing transmission facilities and future proposed transmission system upgrades with 2016 in-service dates or earlier were assumed in-service.

Of the proposed transmission system upgrades, the following were not assumed in-service:

- Transformer Replacement at Keith TS (2007-265)
- Tilbury West DS Second 115 kV Connection (2008-332)
- (2) **Generation facilities:** All existing and committed major generation facilities with 2016 in-service dates or earlier were assumed in-service unless otherwise specified.
- (3) **Load Facilities:** All major load facilities with 2016 in-service dates or earlier were assumed inservice.
- (4) **Load Forecast:** Hydro One provided the extreme weather coincident peak load forecast after conservation from 2016 to 2026 for the project and the stations in its vicinity in the Windsor 230 / 115 kV area. For the purposes of the study any embedded generation at these stations was assumed out of service. The load forecast for the Windsor 230/115 kV area is displayed in Table 5.

Table 5: Load Forecast for Windsor 230/115 kV area stations

Station	Load Forecast (MW)										
Station	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026
Belle River TS	45.4	46.0	46.5	47.0	47.5	48.0	48.6	49.1	49.6	50.1	50.6
Chrysler MTS	32.7	32.7	32.8	32.8	32.9	32.9	33.0	33.1	33.1	33.2	33.2
Crawford TS	66.1	66.3	66.5	66.8	67.0	67.3	67.5	67.7	68.0	68.2	68.5
Essex TS	54.3	54.6	54.8	55.0	55.2	55.4	55.6	55.9	56.1	56.3	56.5
Ford Annex MTS	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
Ford Essex CTS	8.0	8.0	8.1	8.1	8.1	8.1	8.1	8.2	8.2	8.2	8.2
* Ford Windsor MTS	17.6	17.6	17.6	17.7	17.7	17.8	17.8	17.8	17.9	17.9	17.9
G.M.Windsor MTS	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Keith TS T1	5.6	5.7	5.7	5.8	5.8	5.9	6.0	6.0	6.1	6.2	6.2
Tilbury TS	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tilbury West DS	17.5	17.6	17.6	17.7	17.8	17.9	18.0	18.1	18.1	18.2	18.3
Walker TS #1	74.1	74.3	74.6	74.8	75.0	75.3	75.5	75.7	75.9	76.2	76.4
Walker MTS #2	86.5	86.7	87.0	87.2	87.5	87.8	88.0	88.3	88.5	88.8	89.1
Kingsville TS – Option A	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0
Kingsville TS – Option B	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0
Leamington TS – Option A	22.5	26.9	28.4	29.9	31.5	33.0	34.6	36.2	37.8	39.4	41.0
Leamington TS – Option B	92.5	96.9	98.4	99.9	101.5	103.0	104.6	106.2	107.8	109.4	111.0
Keith TS T22/T23	44.0	44.3	44.6	45.0	45.5	46.0	46.5	47.0	47.5	48.0	48.5
Malden TS	119.0	119.7	120.5	121.2	121.9	122.6	123.3	124.1	124.8	125.5	126.2
Lauzon TS	185.3	186.2	187.1	188.0	188.9	189.8	190.7	191.6	192.4	193.3	194.2
TOTAL	911.7	919.7	924.9	930.1	935.4	940.9	946.3	951.9	957.1	962.6	967.9

^{*} The Windsor area motor plants were assumed in full production at the time of the summer peak. Hence, the forecast at Ford Windsor MTS was assumed to be close to the 2013 historical peak load at this station as opposed to the load at the coincident peak

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As seen from the load forecast, Hydro One is considering the following two load transfer options:

- A. Retain four transformers with 124 MW of load at Kingsville TS and transfer the remaining Kingsville load to the project.
- B. Retain two transformers with 54 MW of load at Kingsville TS and transfer the remaining Kingsville load to the project.
- (5) Load power factor: The power factor was assumed to be 0.9 at the high-voltage buses of the project
- (6) **Base cases:** Four base cases with 2026 summer peak load, under various generation dispatches and load transfer options A & B were used. The generation dispatch was chosen to stress the 230 kV circuits C21J and C22J under high flow east and west conditions. The base cases employed the following assumptions:
 - The Ontario demand was assumed 27,820 MW, and the demand in the Western zone was assumed 3,001 MW based on the extreme weather summer peak load forecast available to the IESO for the year 2026;
 - Load level at individual stations in the vicinity of the project were set to the forecasted load level for 2026 as shown in Table 5;
 - The Windsor 115 kV area was assumed closed in this study which means that there is a continuous path between the 115 kV transmission path between Lauzon TS and Keith TS;
 - The Windsor area SPS was assumed in-service;
 - Under high flow east conditions, the import from Michigan on J5D and the Brighton Beach
 output was maximized to achieve a high flow east on the C21J and C22J circuits while not
 violating the continuous rating of circuits J3E and J4E pre-contingency. In addition, the rest of
 the generation in the Windsor 230 and 115 kV area was dispatched at full output to stress the
 C21J and C22J circuits flowing east.
 - Under high flow west conditions, the export to Michigan on J5D was assumed to be 400 MW based on historical data. In addition, low wind was assumed with all wind generation out of service and all gas generation dispatched at full output in the Windsor 230 and 115 kV area with the exception of Brighton Beach. At Brighton Beach, one unit was assumed out of service and the other two units were dispatched in order to stress the C21J, C22J, C23Z and C24Z circuits flowing west to the maximum historical levels.
 - With load transfer option B (54 MW of load at Kingsville), the Lauzon capacitor was required to be switched out of service and the Keith capacitor was switched in-service pre-contingency in order to maintain acceptable voltages pre- and post-contingency. This was done to avoid post-contingency over-voltages on the Lauzon 115 kV system for the double circuit loss of Z1E and Z7E which is a NERC TPL-001-4 Bulk Electric System Planning Performance Event as there were no control actions available post-contingency. This will be discussed further in Section 6.6.

Table 6 lists the generation dispatch, load assumption at Kingsville, 115 kV capacitor statuses and the flow on J5D, C21J and C22J for the four scenarios, S1, S2, S3 and S4,that were studied:

Table 6: Base case scenarios

Scenario	S1	S2	S3	S4
Condition	High flow east	High flow east	High flow west	High flow west
Condition	Option A	Option B	Option A	Option B
Flow on J5D (+ out of Ontario)	- 137 MW	- 137 MW	388 MW	388 MW
Flow on C21J and C22J at Chatham	-222 MW	-186 MW	494 MW	527 MW
Brighton Beach	530 MW	530 MW	186 MW	186 MW
West Windsor	116 MW	116 MW	116 MW	116 MW
TA Windsor	69 MW	69 MW	69 MW	69 MW
East Windsor	90 MW	90 MW	90 MW	90 MW
Gosfield	50 MW	50 MW	0 MW	0 MW
Pointe Aux Roches	49 MW	49 MW	0 MW	0 MW
Comber East and West	166 MW	166 MW	0 MW	0 MW
Port Alma I & II	202 MW	202 MW	0 MW	0 MW
Dillon	78 MW	78 MW	0 MW	0 MW
South Kent	269 MW	269 MW	0 MW	0 MW
Kingsville TS load in 2026	124 MW	54 MW	124 MW	54 MW
115 kV Capacitor Status	Keith Cap O/S	Keith Cap I/S	Keith Cap O/S	Keith Cap I/S
113 RV Capacitor Status	Lauzon Cap I/S	Lauzon Cap O/S	Lauzon Cap I/S	Lauzon Cap O/S

6.3 Contingencies

Contingencies were performed based on the NERC TPL-001-4 BES Planning Performance Events. All four scenarios were subjected to the same contingencies for voltage and thermal analysis.

The following is the list of all contingencies simulated for thermal and voltage analysis.

Table 7: List of Simulated Contingencies

N-1 Contingencies (All elements I/S – Single Contingencies)							
C21J /C22J	C23Z / C24Z	J5D	J20B				
C31	J3E/J4E	Z1E / Z7E	J1B				
J2N	Keith A Bus	K2Z	K6Z				
N-2: Tower Contingencies (All elements I/S – Double Contingencies)							
C21J+C23Z	C21J+C22J	C22J+C24Z	C23Z+C24Z				
J3E+J4E	Z1E+Z7E						
N-2: Bre	aker Failure (BF) Contingencies	(All elements I/S – Double Conti	ngencies)				
J20B + C22J- Keith 230 HL20 BF	J5D + C22J – Keith 230 HL5 BF	J20B + Keith A Bus – Keith 230 AL20 BF	J5D + Keith A Bus – Keith 230 AL5 BF				
C21J + Keith A Bus - Keith 230 C21J BF	C21J + Chatham D Bus – Chatham 230 DL21 BF	C23Z + Chatham D Bus – Chatham 230 DL23 BF	C31 + Chatham D Bus – Chatham 230 DL31 BF				
C22J+J2N – Keith T12P BF	J1B+J2N — Keith L1P BF	J3E+J2N – Keith L3P BF	Keith A Bus +J2N – Keith T11P BF				
J4E+J1B – Keith L1L4 BF	Z7E+C23Z – Lauzon T1L7 BF	C24Z+Lauzon cap – Lauzon T2K BF					

N-1-1: Contingencies (Outage condition + contingency)												
J20B+C21J Keith A Bus + C23Z/C24Z Keith A Bus + C22J Keith A Bus +J1B												
Chatham K Bus + loss of Chatham D Bus	C22J open ended at Chatham + Keith C21J IBO	C21J open ended at Chatham + Keith C21J IBO	Z7E + C21J									
Z7E + C24Z	J3E+C21J	J3E + C23Z/C24Z	J3E+Z7E									

6.4 Permissible Control Actions

In the Windsor area, permissible control actions can be used to manage thermal or voltage concerns following the contingencies listed in Table 7. These include generation re-dispatch or curtailment of imports or exports on circuit J5D within 15 minutes following contingencies and arming of the Windsor Area SPS. Listed below are some of the control actions available with the Windsor Area SPS:-

- Kingsville transformer switching This is part of the Kingsville high voltage switching scheme which switches back in a third transformer at Kingsville TS following the loss of two of the four transformers at Kingsville TS.
- Mode A Essex Bus Split- This is part of the Keith generation rejection and cross-tripping scheme
 which splits the Essex bus by opening Essex breakers L1L9, L7L8 and T6Z for contingencies
 included in the scheme. This split results in circuits J3E, J4E, E8F and E9F being supplied from Keith
 TS and circuits Z1E, Z7E and load at Essex TS being supplied from Lauzon TS.
- Brighton Beach generation rejection (BB G/R) –This is part of the Keith generation rejection and cross-tripping scheme which rejects Brighton Beach units that are armed for contingencies included in the scheme.
- Kingsville load rejection (L/R) This is part of the Lauzon load rejection scheme which provides selection of load to be rejected at Kingsville TS in two stages for contingencies included in the scheme with each stage consisting of half the Kingsville load.
- Bell River load rejection (L/R) This is part of the Lauzon load rejection scheme for which all the load at Bell River TS can be rejected for contingencies included in the scheme.
- Kingsville capacitor switching This is part of the Lauzon load rejection scheme which provides
 selection of capacitors at Kingsville TS to be switched out in two stages for contingencies included in
 the scheme with each stage consisting of two Kingsville capacitors.

6.5 Thermal Assessment and Load Security

The Ontario Resources and Transmission Assessment Criteria (ORTAC) specify the following criteria for load security on thermal loading of transmission facilities:

Criterion I: With all the transmission facilities in service, equipment loading must be within

continuous ratings.

Criterion II: With one element out of service, equipment loading must be within applicable long-

term ratings and not more than 150 MW of load may be interrupted by configuration. Planned load curtailment or load rejection, excluding voluntary demand management, is

permissible only to account for local generation outages.

Criterion III: With two elements out of service, equipment loading must be within applicable short-

term emergency ratings. The equipment loading must be reduced to the applicable long-term emergency ratings in the time afforded by the short-time ratings. Planned load curtailment or load rejection exceeding 150 MW is permissible only to account for local generation outages. Not more than 600 MW of load may be interrupted by configuration

and by planned load curtailment.

Table 8 lists the thermal ratings of the monitored circuits in Amperes and transformers in MVA that were provided by Hydro One. The circuit's conductor ratings were calculated for summer weather conditions with ambient temperature of 35°C and wind speed of 4 km/h. The continuous ratings for the conductors were calculated at the lower of the sag temperature or 93°C operating temperature. The LTE ratings for the conductors were calculated at the lower of the sag temperature or 127°C operating temperature. The STE ratings were calculated at the sag temperature with 100% continuous pre-load.

Table 8: Circuit Section and Transformer Summer Thermal Ratings

Circuit/	Circuit	Section	Continuous	LTE	STE
Transformer	From	То	A/MVA	A/MVA	A/MVA
C21J	Keith TS	Malden TS	840	1020	1100
C21J	Malden TS	Sandwich JCT	840	1020	1100
C21J	Sandwich JCT	Leamington TS	1060	1370	1570
C21J	Leamington TS	Chatham SS	1060	1370	1570
C22J	Keith TS	Malden TS	840	1020	1100
C22J	Malden TS	Sandwich JCT	840	1050	1150
C22J	Sandwich JCT	Leamington TS	840	1020	1100
C22J	Leamington TS	Chatham SS	840	1020	1100
C23Z	Lauzon TS	Sandwich JCT	1060	1400	1900
C23Z	Sandwich JCT	Comber WF JCT	1060	1400	1840
C23Z	Comber WF JCT	KEPA WF JCT	1060	1400	1840
C23Z	KEPA WF JCT	Dillon RWEC JCT	1060	1400	1690
C23Z	Dillon RWEC JCT	Chatham SS	1060	1400	1690
C24Z	Lauzon TS	Sandwich JCT	1060	1400	1900
C24Z	Sandwich JCT	Comber WF JCT	840	1040	1130
C24Z	Comber WF JCT	KEPA WF JCT	840	1040	1130
C24Z	KEPA WF JCT	Chatham SS	840	1020	1100
J3E	Keith TS	Crawford JCT	810	1070	1390
J3E	Crawford JCT	Essex TS	810	1070	1390
J4E	Keith TS	Crawford JCT	810	1000	1090
J4E	Crawford JCT	Essex TS	810	1000	1090
Z1E	Essex TS	Windsor Transalta JCT	970	1260	1430
Z1E	Windsor Transalta JCT	Walker JCT	970	1260	1430
Z1E	Walker JCT	Jefferson JCT	870	1140	1390
Z1E	Jefferson JCT	Lauzon TS	910	1190	1370
Z7E	Essex TS	Walker JCT	970	1260	1430
Z7E	Walker JCT	Jefferson JCT	870	1140	1390
Z7E	Jefferson JCT	Lauzon TS	910	1190	1370
Lauzon T1			250	296.8	364.2
Lauzon T2			250	296.8	364.2
Keith T11			115	180.3	224.5
Keith T12			115	160.3	187.5

6.5.1 Kingsville Local Supply

Kingsville TS is connected to 115 kV radial circuits K2Z and K6Z through four transformers with two transformers on each circuit. For loss of one of the circuits, the Kingsville load is supplied by the remaining two transformers connected to the companion circuit.

Thermal analysis was performed to compare the two load transfer options from Kingsville. The loading on K6Z for loss of K2Z is presented below as K6Z has lower thermal ratings than K2Z. Under option A, with four transformers and 124 MW of load at Kingsville, for the loss of K2Z the two remaining transformers are above their combined summer 10-day LTR of 112 MVA. This overload can be mitigated by using the Kingsville transformer switching control action in option A. Under option B, with two transformers and 54 MW of load at Kingsville, for the loss of K2Z the remaining transformer with the more limiting rating is above its summer 10-day LTR of 54.5 MVA. Hydro One has indicated that for option B they have plans to replace this transformer with a new transformer that has a higher 10-day LTR.

Table 9 shows a comparison of the two load transfer options from Kingsville TS to the project with the Kingsville transformer switching control action used in option A.

Table 9: Thermal Loading on K6Z for the two load transfer options

Circuit	Circuit 5	Section	LTE	STE		ption A: 12 ansformers		Option B: 54 MW with 2 transformers at Kingsville		
Circuit					К			62 MW ville L/R	K2Z	
	From	То	Α	Α	Α	% LTE	Α	% LTE	Α	% LTE
K6Z	Lauzon TS	Lauzon JCT	1070	1200	728.9	68.1	316.2	29.5	427.1	39.9
K6Z	Lauzon JCT	Rourke Line JCT	1070	1200	728.9	68.1	316.2	29.5	427.2	39.9
K6Z	Rourke Line JCT	Belle River TS	620	640	260.1	42	243.3	39.2	259.7	41.9
K6Z	Belle River JCT	Rourke Line JCT	1070	1200	479.4	44.8	104.8	9.8	252.4	23.6
K6Z	Pte-Aux-Roches WF JCT	Belle River JCT	620	730	479.7	77.4	104.4	16.8	253	40.8
K6Z	Kingsville TS	Pte-Aux-Roches WF JCT	580	590	665.7	114.8	322.8	55.7	331.4	57.1

From Table 9 it is noticed that under option A for loss of K2Z, there are post-contingency overloads above the short-term emergency rating on a section of circuit K6Z that supplies Kingsville TS. The Lauzon load rejection (L/R) scheme which is part of the Windsor Area SPS can be used in this scenario to reject half the load at Kingsville (62 MW) and reduce the loading within the LTE rating of K6Z. However, this is a violation of the *ORTAC* criteria as with one element out of service, equipment loading must be within applicable long-term ratings, and any load rejection is permissible only to account for local generation outages. Since there are no generation outages in this scenario, load rejection is not permitted. Under option B for this scenario, there is no overload condition on K6Z. Hence, option B is the recommended option.

6.5.2 High Flow East Conditions

All elements in-service: Pre-contingency

The pre-contingency thermal loading for the two load transfer options from Kingsville under high flow east (HFE) conditions, which represent past historical maximum transfers, in scenarios S1 and S2 are presented in Table 10. The pre-contingency flows on all monitored elements are within their continuous ratings for both load transfer options under HFE conditions. The flows are in Ampere for circuits and MVA for transformers.

Table 10: Pre-contingency thermal loading under HFE conditions - All Elements I/S

Circuit/	Circuit :	Section	Continuous		I MW at sville	S2- 54 MW at Kingsville			
Transformer	From	То	A/MVA	A/MVA	% Cont	A/MVA	% Cont		
C21J	Keith TS	Malden TS	840	499.2	59.4	538	64		
C21J	Malden TS	Sandwich JCT	840	358.5	42.7	391.6	46.6		
C21J	Sandwich JCT	Leamington TS	1060	355.5	33.5	389.4	36.7		
C21J	Leamington TS	Chatham SS	1060	314.2	29.6	290.1	27.4		
C22J	Keith TS	Malden TS	840	493.5	58.7	531.6	63.3		
C22J	Malden TS	Sandwich JCT	840	353.7	42.1	385.6	45.9		
C22J	Sandwich JCT	Leamington TS	840	350.5	41.7	383.2	45.6		
C22J	Leamington TS	Chatham SS	840	310.1	36.9	286.9	34.2		
C23Z	Lauzon TS	Sandwich JCT	1060	223.9	21.1	216.4	20.4		
C23Z	Sandwich JCT	Comber WF JCT	1060	216.4	20.4	207.2	19.5		
C23Z	Comber WF JCT	KEPA WF JCT	1060	155.2	14.6	188.5	17.8		
C23Z	KEPA WF JCT	Dillon RWEC JCT	1060	146.1	13.8	180.1	17		
C23Z	Dillon RWEC JCT	Chatham SS	1060	286.5	27	332.8	31.4		
C24Z	Lauzon TS	Sandwich JCT	1060	284.1	26.8	263.8	24.9		
C24Z	Sandwich JCT	Comber WF JCT	840	279	33.2	257.2	30.6		
C24Z	Comber WF JCT	KEPA WF JCT	840	145.6	17.3	157.4	18.7		
C24Z	KEPA WF JCT	Chatham SS	840	476.4	56.7	523.3	62.3		
J3E	Keith TS	Crawford JCT	810	803.2	99.2	755.9	93.3		
J3E	Crawford JCT	Essex TS	810	609.9	75.3	547.5	67.6		
J4E	Keith TS	Crawford JCT	810	778.8	96.2	726.2	89.7		
J4E	Crawford JCT	Essex TS	810	630.6	77.8	575	71		
Z1E	Essex TS	Windsor Transalta JCT	970	410.1	42.3	313.4	32.3		
Z1E	Windsor Transalta JCT	Walker JCT	970	727	74.9	643.6	66.3		
Z1E	Walker JCT	Jefferson JCT	870	399.2	45.9	267.5	30.7		
Z1E	Jefferson JCT	Lauzon TS	910	387.3	42.6	251.7	27.7		
Z7E	Essex TS	Walker JCT	970	719.3	74.2	652.8	67.3		
Z7E	Walker JCT	Jefferson JCT	870	396.9	45.6	263.3	30.3		
Z7E	Jefferson JCT	Lauzon TS	910	385.5	42.4	248.2	27.3		
Lauzon T1			250	50.3	20.1	70.1	28		
Lauzon T2			250	34.4	13.7	49.5	19.8		
Keith T11			115	50.3	43.7	34.9	30.4		
Keith T12			115	56.7	49.3	39.4	34.3		

Post-contingency

Table 14 to Table 19 in Appendix A show the post-contingency flows for the monitored circuits for scenarios S1 and S2 under HFE conditions following contingencies listed in Table 7. The simulation results show that the post-contingency thermal loadings in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions. For scenario S2 with Kingsville load transfer option B, the post-contingency loadings are lower and less control actions are required. Hence, option B is better than option A.

Under scenarios S1 and S2 for the Lauzon T1L7 breaker failure which results in the loss of circuits Z7E and C23Z shown in Table 16 and Table 17 respectively, multiple control actions are needed to mitigate post-contingency thermal loadings in the Windsor 115 kV system. Arming load rejection as part of the Lauzon L/R scheme in the Windsor Area SPS for loss of Z7E or C23Z with all elements in-service and all local generation in-service was not considered. This is not allowed based on the *ORTAC* criteria, where load rejection is permissible only to account for local generation outages when one element is out of service. It is recommended that Hydro One consider expanding the Lauzon L/R scheme as part of the Windsor Area SPS to include the Lauzon T1L7 breaker failure which is a NERC TPL-001-04 BES Planning Performance Event so that load rejection (L/R) can be armed for this contingency. This would provide greater operating flexibility.

Load Restoration

For the loss of double circuits C23Z and C24Z, the load at Lauzon is tripped and can be restored by opening the 230 kV disconnect switches at Lauzon on the C23Z and C24Z circuits and closing the 115 kV and 27.6 kV transformer breakers at Lauzon. This was studied as it shows a comparison in the capability to restore load on the Windsor 115 kV system with the two load transfer options.

Under HFE conditions with 194.2 MW of load at Lauzon for the year 2026, it was found that 102 MW of load at Lauzon can be restored in scenario S1 and 160 MW of load at Lauzon can be restored in scenario S2 without additional load transfers out of the Windsor 115 kV system. However, there is capability to transfer 68 MW of load supplied by the Windsor 115 kV system to the 230 kV system and 20 MW of load supplied by the Windsor 115 kV system to the Scott 115 kV system depending on the loading within that system. Transferring 68 MW of load from the Windsor 115 kV to the 230 kV system will enable all the load to be restored in scenario S2. Hence option B is better than option A as it allows all the load at Lauzon to be restored.

Sensitivity Studies: With no TA Windsor and West Windsor Generation Facilities

Sensitivity studies were performed under HFE conditions without the TA Windsor and West Windsor generation facilities in-service given that their contracts are expiring in 2016. These results are not presented in this report but summarized below.

Without these facilities in-service, the Brighton Beach output can be maximized and imports can be kept similar to that in scenarios S1 and S2. Studies show that under these conditions the post-contingency thermal loadings in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions. When compared to scenarios S1 and S2, the post-contingency thermal loading on the Keith transformers are higher and the post-contingency thermal loading on the J4E/J3E and Z1E/Z7E circuits are lower. For these conditions with Kingsville load transfer option A, a lot more control actions would need to be taken under outage conditions which include precontingency control actions followed by automatic and manual actions post-contingency. Hence, option B is better than option A.

6.5.3 High Flow West Conditions

All elements in-service: Pre-contingency

The pre-contingency thermal loading for the two load transfer options from Kingsville under high flow west (HFW) conditions, which represent past historical maximum transfers, in scenarios S3 and S4 are presented in Table 11. The pre-contingency flows on all monitored elements are within their continuous ratings for both load transfer options under HFW conditions. The flows are in Ampere for circuits and MVA for transformers.

Table 11: Pre-contingency thermal loading under HFW conditions - All Elements I/S

Circuit/ Transformer	-contingency thermal		Continuous	S3 - 124	I MW at sville	S4- 54 MW at Kingsville		
	From	То	A/MVA	A/MVA	% Cont	A/MVA	% Cont	
C21J	Keith TS	Malden TS	840	394.2	46.9	349.1	41.6	
C21J	Malden TS	Sandwich JCT	840	551.8	65.7	506.5	60.3	
C21J	Sandwich JCT	Leamington TS	1060	550.9	52	506	47.7	
C21J	Leamington TS	Chatham SS	1060	599	56.5	644.4	60.8	
C22J	Keith TS	Malden TS	840	385.9	45.9	342	40.7	
C22J	Malden TS	Sandwich JCT	840	543.5	64.7	498.9	59.4	
C22J	Sandwich JCT	Leamington TS	840	542.8	64.6	498.7	59.4	
C22J	Leamington TS	Chatham SS	840	591.2	70.4	636	75.7	
C23Z	Lauzon TS	Sandwich JCT	1060	544.1	51.3	504.1	47.6	
C23Z	Sandwich JCT	Comber WF JCT	1060	541.7	51.1	501.1	47.3	
C23Z	Comber WF JCT	KEPA WF JCT	1060	538.9	50.8	497.8	47	
C23Z	KEPA WF JCT	Dillon RWEC JCT	1060	537.5	50.7	496.1	46.8	
C23Z	Dillon RWEC JCT	Chatham SS	1060	535.9	50.6	494.2	46.6	
C24Z	Lauzon TS	Sandwich JCT	1060	538	50.8	499	47.1	
C24Z	Sandwich JCT	Comber WF JCT	840	535.9	63.8	496.2	59.1	
C24Z	Comber WF JCT	KEPA WF JCT	840	533.3	63.5	493.1	58.7	
C24Z	KEPA WF JCT	Chatham SS	840	526.9	62.7	484.8	57.7	
J3E	Keith TS	Crawford JCT	810	449.8	55.5	442.8	54.7	
J3E	Crawford JCT	Essex TS	810	235.6	29.1	221.2	27.3	
J4E	Keith TS	Crawford JCT	810	413.7	51.1	395.8	48.9	
J4E	Crawford JCT	Essex TS	810	268.7	33.2	271.3	33.5	
Z1E	Essex TS	Windsor Transalta JCT	970	159	16.4	81.5	8.4	
Z1E	Windsor Transalta JCT	Walker JCT	970	341	35.2	270.3	27.9	
Z1E	Walker JCT	Jefferson JCT	870	141.7	16.3	132.6	15.2	
Z1E	Jefferson JCT	Lauzon TS	910	156.1	17.2	152.8	16.8	
Z7E	Essex TS	Walker JCT	970	346	35.7	332.4	34.3	
Z7E	Walker JCT	Jefferson JCT	870	159.2	18.3	142.7	16.4	
Z7E	Jefferson JCT	Lauzon TS	910	173.6	19.1	163.2	17.9	
Lauzon T1			250	118	47.2	100.5	40.2	
Lauzon T2			250	115.5	46.2	98.2	39.3	
Keith T11			115	17	14.8	31.5	27.4	
Keith T12			115	19.1	16.6	35.5	30.9	

Post-contingency

Table 20 to Table 25 in Appendix A show the post-contingency flows for the monitored circuits for scenarios S3 and S4 under HFW conditions following contingencies listed in Table 7. The simulation results show that the post-contingency thermal loadings in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions. For scenario S2 with Kingsville load transfer option B, the post-contingency loadings are lower and less control actions are required. Hence, option B is better than option A.

Load Restoration

Load restoration at Lauzon was analyzed following the loss of double circuits C23Z and C24Z similar to the description provided earlier in section 6.5.2 under HFE conditions.

Under HFW conditions with 194.2 MW of load at Lauzon for the year 2026, it was found that 10 MW of load at Lauzon can be restored in scenario S3 and 86 MW of load at Lauzon can be restored in scenario S4 without any additional load transfers out of the Windsor 115 kV system. Taking into account the load transfer capability discussed in section 6.5.2, with 68 MW of load transferred from the Windsor 115 kV system to the 230 kV system and with the generation at Pte Aux Roches and Gosfield in-service at full output, all the load can be restored in scenario S4. Hence option B is better than option A as it allows all the load at Lauzon to be restored.

Reverse Power Flow

Reverse power flow through the project's transformers was observed in all four scenarios S1 to S4 with the maximum reverse power flow in scenario S3 for the outage combinations with C21J or C22J open at Chatham and the inadvertent breaker open (IBO) of C21J at Keith. There were no post-contingency thermal or voltage violations observed for these outage combinations in all four scenarios.

In scenario S3 for the outage combination with C22J open at Chatham and IBO of C21J at Keith, the maximum reverse power flow of 44 MW through the project's transformers was observed. Under these conditions, the reverse power flow through the Malden transformer is 7 MW and would increase to 14 MW without the incorporation of the project.

In addition in scenario S3, for the outage combination with C21J open at Chatham and IBO of C21J at Keith, the reverse power flow through the project's transformer is 33 MW. Under these conditions, without the incorporation of the project there is no reverse power flow at Malden TS.

It is recommended that Hydro One assess the reverse power flow on the project's transformers and confirm that there is no unacceptable tripping or loading concern on the transformers.

Sensitivity Studies: With no TA Windsor and West Windsor Generation Facilities

Sensitivity studies were performed under high flow west conditions without the TA Windsor and West Windsor generation facilities in-service given that their contracts are expiring in 2016. These results are not presented in this report but summarized below

Without these facilities in-service, the Brighton Beach output can be increased to make up for this generation while keeping the total flow out of Chatham on circuits C21J,C22J, C23Z and C24Z similar to that in scenarios S3 and S4. Studies show that under these conditions the post-contingency thermal loadings in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions. When compared to scenarios S3 and S4, the post-contingency thermal loading on the Keith transformers and J4E/J3E circuits are higher and the post-contingency thermal loading on the C22J and Z1E circuits are lower. For these conditions with Kingsville load transfer option A, a lot more control actions would need to be taken under outage conditions which include precontingency control actions followed by automatic and manual actions post-contingency. Hence, option B is better than option A.

6.5.4 Load Tripped by Configuration

To assess that *ORTAC* load security criteria will be met after the incorporation of the project, the total amount of load tripped by configuration for loss of either one or two elements that involve the project was examined.

Single contingencies involving the loss of C21J or C22J result in no load interruption at Malden TS and the project.

The simultaneous loss of double circuits C21J and C22J will interrupt load at Malden TS and the project of up to 237 MW for the 2016 to 2026 period based on the Hydro One load forecast under option B. The interrupted load does not exceed 600 MW and is within the *ORTAC* criteria.

The *ORTAC* load restoration criteria states that all load must be restored within approximately 8 hours and the amount of load in excess of 150 MW must be restored within approximately 4 hours. This means that of the load that is interrupted for loss of C21J and C22J as mentioned above, up to 87 MW of load will need to be restored within approximately 4 hours and up to 237 MW of load will need to be restored within approximately 8 hours. Hydro One and the affected Local Distribution Companies (LDCs) are expected to work together to ensure that these load restoration targets can be achieved.

6.6 Voltage Assessment

The *ORTAC* states that with all facilities in service pre-contingency, or with a critical element out of service after permissible control actions, the following criteria shall be satisfied:

- The pre-contingency voltages on 230 kV buses must not be less than 220 kV and no greater than 250 kV and 115kV buses must not be less than 113 kV and no greater than 127 kV:
- The post-contingency voltages on 230 kV buses must not be less than 207 kV and no greater than 250 kV and 115 kV buses must not be less than 108 kV and no greater than 127 kV; and
- The voltage change following a contingency must not exceed 10% pre-ULTC and 10% post-ULTC on both 115 kV and 230 kV buses.

All the loads were modeled as constant MVA unless otherwise specified.

6.6.1 Kingsville Local Supply

Voltage Analysis was performed to compare the two load transfer options from Kingsville. The loss of K2Z is presented in Table 12 below as the voltage declines are greater for the loss of K2Z than K6Z. Under option A, the Kingsville transformer switching control action was used so that the loading on the remaining Kingsville transformers do not exceed their summer 10-day LTR as discussed earlier in Section 6.5.1.

		Option A: 124 MW with 4 transformers at Kingsville										Option B: 54 MW with 2 transformers at Kingsville					
Bus Name	Pre-		* K2Z – 62 MW Kingsville L/R							Pre-	K2Z						
	cont.	Pre-	Pre-ULTC Post-ULTC		Pre-U	Pre-ULTC Post			cont.	Pre-ULTC		Post-ULTC					
	kV	kV	%	kV	%	kV	%	kV	%		kV	%	kV	%			
Lauzon 115 kV	122.7	122.1	-0.53	121.8	-0.78	124.4	1.37	124.2	1.18	121.1	120.4	-0.52	120.5	-0.44			
Bell River K6Z 115 kV	120.9	117.1	-3.11	116.3	-3.84	124.3	2.82	123.6	2.26	119.4	115.8	-3.00	116.1	-2.74			
Pointe Aux Roches 115	120.5	116.2	-3.56	115.2	-4.44	124.6	3.34	123.8	2.70	119.1	115.1	-3.42	115.4	-3.16			
Kingsville K6Z 115 kV	117.3	109.1	-6.97	106.8	-8.92	125.5	7.02	124.1	5.81	116.9	109.2	-6.64	109.5	-6.37			

Table 12: Voltage Results for loss of K2Z with the two load transfer options

From Table 12 it is noticed that with option A, the post-contingency voltage at Kingsville is below 108 kV for loss of K2Z with the load at Kingsville converted both pre and post ULTC. Note that in this scenario without the Kingsville transformer switching control action, the voltage at Kingsville would be even lower. The Lauzon L/R scheme which is part of the Windsor Area SPS can be used in this scenario to reject half the load at Kingsville (62 MW) to bring the voltage above 108 kV.

However, this is a violation of the *ORTAC* criteria as with one element out of service, equipment loading must be within applicable long-term ratings, and any load rejection is permissible only to account for local generation outages. Since there are no generation outages in this scenario, load rejection is not permitted.

Under option B the post-contingency voltages are above 108 kV which is within the *ORTAC* criteria. Hence option B is the recommended option. Note that under option B, with 54 MW of load at Kingsville, the Lauzon capacitor was switched out of service pre-contingency to avoid high voltages at Lauzon post-contingency for the loss of Z1E+Z7E with all elements in-service.

6.6.1 High Flow East or West Conditions

The pre- and post-contingency voltage results for scenarios S1 and S2 under HFE conditions following contingencies listed in Table 7 are presented in Table 26 to Table 31 in Appendix B. The pre- and post-contingency voltage results for scenarios S3 and S4 under HFW conditions following contingencies listed in Table 7 are presented in Table 32 to Table 37 in Appendix B.

Study results show that for all four scenarios S1, S2, S3 and S4 the pre and post-contingency voltages in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions.

In all four scenarios for the loss of double circuit Z1E and Z7E, control actions were taken to mitigate post-contingency over-voltages on the Lauzon 115 kV system. For scenarios S1 and S3 with Kingsville load transfer option A, the Lauzon L/R scheme as part of the Windsor Area SPS was armed to switch out the Kingsville capacitors. However, switching out the Lauzon capacitor would be a better control action. For scenarios S2 and S4 with Kingsville load transfer option B, the Lauzon capacitor was switched outservice pre-contingency and the Keith capacitor was switched in-service pre-contingency to maintain acceptable voltages pre- and post —contingency as there were no control actions available post-contingency. This resulted in lower voltages on the Lauzon 230 kV and 115 kV systems compared to scenarios S1 and S3 even though more load was transferred out of Kingsville in scenarios S2 and S4.

Therefore under both load transfer options A or B, It is recommended that Hydro One consider adding the selection of the Lauzon capacitor to be tripped for the Z1E+Z7E contingency which is a contingency that is already included in the Lauzon L/R scheme as part of the Windsor Area SPS. This would provide greater operating flexibility.

^{*} Kingsville load was converted for this contingency both Pre and Post ULTC

Sensitivity Studies: With no TA Windsor and West Windsor Generation Facilities

Sensitivity studies were performed under high flow east or west conditions without the TA Windsor and West Windsor generation facilities in-service given that their contracts are expiring in 2016. These results are not presented in this report but summarized below.

Without these facilities in-service, the pre- and post-contingency voltage in the Windsor 230 and 115 kV systems remain within applicable *ORTAC* criteria with the utilization of appropriate control actions. However when compared to scenarios S1, S2, S3 and S4, the pre and post-contingency voltages are lower and voltage changes are higher without these facilities in-service.

6.7 Switching Studies

The *ORTAC* states that reactive devices should be sized to ensure that voltage declines or rises at delivery point buses on switching operations will not exceed 4% of steady-state rms voltage before tap changer action using a voltage dependent load model.

The switching of the proposed capacitor bank of 21.6 Mvar @ 28.8 kV was tested under various outage conditions for the two different load transfer options A and B at 2026 load levels. Table 13 shows the capacitor switching results for the project's 230 kV buses. In all studied scenarios, the voltage change following the capacitor switching is within the prescribed 4% permissible voltage change limit.

Table 13: Capacitor Switching Study for Leamington TS

			Load transf	er optio	n A				Load transf	er option	В		
230 kV Bus	Lea	mingtor	C21J	Lea	Leamington C22J			amington	C21J	Lea	Leamington C22J		
Outage	Cap Cap Change		Cap O/S	Cap I/S	Change	nge Cap Cap O/S I/S		Change	Cap O/S	Cap I/S	Change		
Condition	kV	kV %		kV	kV %		kV	kV	%	kV	kV	%	
None	236.7	238.2	0.66%	236.6	238.1	0.66%	229.9	231.4	0.67%	229.7	231.3	0.67%	
C22J Chatham end open	232.2	233.9	0.72%	230.2	232.4	0.96%	224.8	226.5	0.73%	221.2	223.3	0.98%	
C22J Keith end open	235.2	236.7	0.66%	235.1	237.0	0.82%	229.8	231.4	0.67%	229.0	230.9	0.82%	
J5D	235.5	237.7	0.92%	235.4	237.6	0.93%	229.0	231.2	0.94%	228.8	231.0	0.94%	
C21J				227.3	229.7	1.06%				217.1	219.3	1.04%	
C22J	227.6	230.0	1.06%				216.5	218.8	1.07%				

Appendix A Thermal Loading

Table 14: Thermal loading with all elements in-service for single contingencies – Scenario S1

Circuit/	Circuit	Section	LTE	STE	C2:	2J	C23	3Z	* J3E (Mode A I	Essex Bus Split)	* Z7E (E	BB G/R)	Keith A	A Bus
Xformer	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	819.5	80.3	521	51.1	718.8	70.5	423.6	41.5	0	0
C21J	Malden TS	Sandwich JCT	1020	1100	525.7	51.5	382.1	37.5	570	55.9	289.7	28.4	48	4.7
C21J	Sandwich JCT	Leamington TS	1370	1570	523.3	38.2	379	27.7	568.3	41.5	285.8	20.9	41.5	3
C21J	Leamington	Chatham SS	1370	1570	445.9	32.6	338.6	24.7	522.9	38.2	248.9	18.2	40.3	2.9
C22J	Keith TS	Malden TS	1020	1100	0	0	514.8	50.5	710.6	69.7	418.5	41	799.7	78.4
C22J	Malden TS	Sandwich JCT	1050	1150	0	0	377	35.9	562.5	53.6	285.7	27.2	534.4	50.9
C22J	Sandwich JCT	Leamington TS	1020	1100	0	0	373.6	36.6	560.5	55	281.7	27.6	532	52.2
C22J	Leamington	Chatham SS	1020	1100	0	0	334.1	32.8	515.7	50.6	245.7	24.1	432.9	42.4
C23Z	Lauzon TS	Sandwich JCT	1400	1900	226.8	16.2	0	0	566.2	40.4	293	20.9	219	15.6
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	218.7	15.6	0	0	562.8	40.2	287.1	20.5	210.7	15
C23Z	Comber WF	KEPA WF JCT	1400	1840	170.4	12.2	0	0	368.8	26.3	153.1	10.9	171.3	12.2
C23Z	KEPA WF JCT	Dillon RWEC	1400	1690	161.3	11.5	0	0	366.3	26.2	147.7	10.6	162.4	11.6
C23Z	Dillon RWEC	Chatham SS	1400	1690	302.8	21.6	0	0	250.9	17.9	233.8	16.7	308.6	22
C24Z	Lauzon TS	Sandwich JCT	1400	1900	282.6	20.2	426.6	30.5	640.4	45.7	360.7	25.8	273.7	19.5
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	277	26.6	421	40.5	637.8	61.3	356.6	34.3	267.9	25.8
C24Z	Comber WF	KEPA WF JCT	1040	1130	154.8	14.9	269.3	25.9	443.4	42.6	193.3	18.6	150.8	14.5
C24Z	KEPA WF JCT	Chatham SS	1020	1100	491.3	48.2	437.9	42.9	239.9	23.5	407.9	40	498.5	48.9
J3E	Keith TS	Crawford JCT	1070	1390	820	76.6	886.2	82.8	0	0	661.7	61.8	838.5	78.4
J3E	Crawford JCT	Essex TS	1070	1390	630.6	58.9	685.8	64.1	0	0	458.3	42.8	648.6	60.6
J4E	Keith TS	Crawford JCT	1000	1090	797.2	79.7	863.1	86.3	531.3	53.1	634.1	63.4	815.5	81.6
J4E	Crawford JCT	Essex TS	1000	1090	649.4	64.9	707.2	70.7	163.8	16.4	482.3	48.2	667.7	66.8
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	438.7	34.8	454.5	36.1	347.3	27.6	800.6	63.5	454.5	36.1
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	751.4	59.6	787.1	62.5	87.6	6.9	1129.7	89.7	768.7	61
Z1E	Walker JCT	Jefferson JCT	1140	1390	427.9	37.5	402.7	35.3	412.5	36.2	559.9	49.1	441.5	38.7
Z1E	Jefferson JCT	Lauzon TS	1190	1370	416.2	35	385.1	32.4	433.7	36.4	550.5	46.3	429.3	36.1
Z7E	Essex TS	Walker JCT	1260	1430	741.8	58.9	793.8	63	43	3.4	0	0	759.6	60.3
Z7E	Walker JCT	Jefferson JCT	1140	1390	425.8	37.4	396.4	34.8	426	37.4	0	0	439	38.5
Z7E	Jefferson JCT	Lauzon TS	1190	1370	414.6	34.8	379.2	31.9	447	37.6	0	0	427.3	35.9
Lauzon T1			296.8	364.2	56.7	19.1	0	0	126.2	42.5	41.8	14.1	58.6	19.8
Lauzon T2			296.8	364.2	39.7	13.4	56.6	19.1	146.4	49.3	46.6	15.7	39.9	13.4
Keith T11			180.3	224.5	104.8	58.1	64.5	35.8	77.6	43	80.5	44.7	0	0
Keith T12			160.3	187.5	0	0	72.7	45.3	87.5	54.6	90.8	56.6	114.5	71.4

^{*} Control Action shown in brackets

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Table 15: Thermal loading with all elements in-service for single contingencies – Scenario S2

Circuit/	Circuit	Section	LTE	STE	C2:	2J	C23	3Z	*J3E-(Mode A E	ssex Bus Split)	* Z7E-(BB G/R)		Keith A Bus	
Xformer	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	897.9	88	568.7	55.8	729	71.5	456.9	44.8	0	0
C21J	Malden TS	Sandwich JCT	1020	1100	588.6	57.7	423.8	41.6	577.5	56.6	314.3	30.8	40.3	4
C21J	Sandwich JCT	Leamington TS	1370	1570	587.3	42.9	421.4	30.8	576.2	42.1	311.4	22.7	33.5	2.4
C21J	Leamington	Chatham SS	1370	1570	401.6	29.3	324.6	23.7	461	33.7	226.9	16.6	116.6	8.5
C22J	Keith TS	Malden TS	1020	1100	0	0	561.6	55.1	720.5	70.6	451.3	44.2	853.6	83.7
C22J	Malden TS	Sandwich JCT	1050	1150	0	0	417.3	39.7	569.3	54.2	309.1	29.4	575	54.8
C22J	Sandwich JCT	Leamington TS	1020	1100	0	0	414.7	40.7	567.8	55.7	306.1	30	573.1	56.2
C22J	Leamington	Chatham SS	1020	1100	0	0	320.9	31.5	455.1	44.6	224.8	22	408.8	40.1
C23Z	Lauzon TS	Sandwich JCT	1400	1900	218.6	15.6	0	0	515.8	36.8	268.5	19.2	211.6	15.1
C23Z	Sandwich JCT	Comber WF	1400	1840	208.9	14.9	0	0	510.6	36.5	261.1	18.7	201.7	14.4
C23Z	Comber WF	KEPA WF JCT	1400	1840	207.6	14.8	0	0	327.8	23.4	171.2	12.2	211.4	15.1
C23Z	KEPA WF JCT	Dillon RWEC	1400	1690	199.5	14.2	0	0	324	23.1	161.8	11.6	203.5	14.5
C23Z	Dillon RWEC	Chatham SS	1400	1690	354.5	25.3	0	0	232.4	16.6	276.1	19.7	362.3	25.9
C24Z	Lauzon TS	Sandwich JCT	1400	1900	259.1	18.5	394.7	28.2	585	41.8	328.8	23.5	249.5	17.8
C24Z	Sandwich JCT	Comber WF	1040	1130	251.7	24.2	387.7	37.3	580.9	55.9	323.5	31.1	241.9	23.3
C24Z	Comber WF	KEPA WF JCT	1040	1130	179	17.2	259.3	24.9	390.4	37.5	179.1	17.2	177.9	17.1
C24Z	KEPA WF JCT	Chatham SS	1020	1100	544.6	53.4	497.3	48.8	309.4	30.3	456.1	44.7	553.6	54.3
J3E	Keith TS	Crawford JCT	1070	1390	782.4	73.1	828.5	77.4	0	0	639.2	59.7	805.5	75.3
J3E	Crawford JCT	Essex TS	1070	1390	577.2	53.9	613.6	57.3	0	0	422	39.4	600.4	56.1
J4E	Keith TS	Crawford JCT	1000	1090	754.4	75.4	797.4	79.7	533.9	53.4	604.9	60.5	777.5	77.8
J4E	Crawford JCT	Essex TS	1000	1090	602.4	60.2	643.5	64.4	172.4	17.2	455.5	45.6	625.8	62.6
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	352.2	28	361	28.7	364.9	29	683.6	54.3	374	29.7
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	680.6	54	704.3	55.9	70.9	5.6	1015.3	80.6	703.1	55.8
Z1E	Walker JCT	Jefferson JCT	1140	1390	308.7	27.1	291.3	25.5	419.4	36.8	263.6	23.1	328.5	28.8
Z1E	Jefferson JCT	Lauzon TS	1190	1370	293.2	24.6	270.3	22.7	441.4	37.1	249.6	21	312.5	26.3
Z7E	Essex TS	Walker JCT	1260	1430	686.4	54.5	731.9	58.1	54.8	4.3	0	0	709.1	56.3
Z7E	Walker JCT	Jefferson JCT	1140	1390	304.8	26.7	281	24.6	433.1	38	0	0	324.1	28.4
Z7E	Jefferson JCT	Lauzon TS	1190	1370	290	24.4	260.2	21.9	454.9	38.2	0	0	308.7	25.9
Lauzon T1			296.8	364.2	78.6	26.5	0	0	108.7	36.6	53	17.8	81.5	27.5
Lauzon T2			296.8	364.2	57.1	19.2	86.8	29.2	123.8	41.7	45.4	15.3	59	19.9
Keith T11			180.3	224.5	76.1	42.2	45.4	25.2	74.5	41.3	62.8	34.8	0	0
Keith T12			160.3	187.5	0	0	51.2	32	84	52.4	70.8	44.2	88.1	54.9

^{*} Control Actions shown in brackets

Table 16: Thermal loading with all elements in-service for double contingencies - Scenario S1

Circuit/ Xformer	(former		LTE	STE	C21J+C23Z		* C21J- (Lower	* C21J+C22J (Lower BB to 417 MW post)		C22J+C24Z		C23Z+C24Z		* Keith T11P BF: Keith A Bus + J2N – (Lower imports to 80 MW post)		* Lauzon T1L7 BF: Z7E+C23Z – (BB G/R and manually shed 62 MW at Kingsville post)	
	From	То	A/ MVA	A/ MVA	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	
C21J	Keith TS	Malden TS	1020	1100	0	0	0	0	873.5	85.6	593.1	58.2	0	0	446.1	43.7	
C21J	Malden TS	Sandwich	1020	1100	0	0	0	0	582.2	57.1	455.8	44.7	59.9	5.9	314.3	30.8	
C21J	Sandwich	Leamington	1370	1570	0	0	0	0	579.8	42.3	452.5	33	54.9	4	310.2	22.6	
C21J	Leamington	Chatham SS	1370	1570	0	0	0	0	503.8	36.8	412.6	30.1	57.2	4.2	274	20	
C22J	Keith TS	Malden TS	1020	1100	821.5	80.5	0	0	0	0	585.8	57.4	694.9	68.1	440.6	43.2	
C22J	Malden TS	Sandwich	1050	1150	534.4	50.9	0	0	0	0	449.6	42.8	449.5	42.8	309.9	29.5	
C22J	Sandwich	Leamington	1020	1100	531.6	52.1	0	0	0	0	446.2	43.7	446.6	43.8	305.7	30	
C22J	Leamington	Chatham SS	1020	1100	459.7	45.1	0	0	0	0	407.1	39.9	357.4	35	270.5	26.5	
C23Z	Lauzon TS	Sandwich	1400	1900	0	0	202	14.4	403.1	28.8	0	0	282.2	20.2	0	0	
C23Z	Sandwich	Comber WF	1400	1840	0	0	191.5	13.7	396	28.3	0	0	275.8	19.7	0	0	
C23Z	Comber WF	KEPA WF	1400	1840	0	0	234.7	16.8	263.1	18.8	0	0	155.6	11.1	0	0	
C23Z	KEPA WF	Dillon	1400	1690	0	0	227	16.2	257.9	18.4	0	0	150	10.7	0	0	
C23Z	Dillon	Chatham SS	1400	1690	0	0	390.6	27.9	303.6	21.7	0	0	249.7	17.8	0	0	
C24Z	Lauzon TS	Sandwich	1400	1900	385.1	27.5	229.3	16.4	0	0	0	0	347.5	24.8	462.5	33	
C24Z	Sandwich	Comber WF	1040	1130	378.3	36.4	221.2	21.3	0	0	0	0	343.1	33	457.8	44	
C24Z	Comber WF	KEPA WF	1040	1130	253.9	24.4	190.4	18.3	0	0	0	0	187.2	18	292.3	28.1	
C24Z	KEPA WF	Chatham SS	1020	1100	497.8	48.8	583.3	57.2	0	0	0	0	426.1	41.8	391.2	38.4	
J3E	Keith TS	Crawford	1070	1390	946	88.4	991.1	92.6	935.4	87.4	778.9	72.8	674.5	63	683.7	63.9	
J3E	Crawford	Essex TS	1070	1390	745.8	69.7	807.1	75.4	737	68.9	567.5	53	482.2	45.1	478.1	44.7	
J4E	Keith TS	Crawford	1000	1090	921.4	92.1	970.3	97	911.6	91.2	748.4	74.8	650.4	65	656.6	65.7	
J4E	Crawford	Essex TS	1000	1090	767.7	76.8	824.1	82.4	757.7	75.8	596	59.6	501.6	50.2	502.3	50.2	
Z1E	Essex TS	Windsor Transalta	1260	1430	519.4	41.2	616.8	49	516.2	41	327	26	299.3	23.8	828	65.7	
Z1E	Windsor Transalta	Walker JCT	1260	1430	851.5	67.6	930.3	73.8	845.6	67.1	663	52.6	603.6	47.9	1163.1	92.3	
Z1E	Walker JCT	Jefferson	1140	1390	467.7	41	596.8	52.4	464.6	40.8	269.1	23.6	309.5	27.2	506.5	44.4	
Z1E	Jefferson	Lauzon TS	1190	1370	450.1	37.8	583.2	49	447.4	37.6	251	21.1	302.6	25.4	491.1	41.3	
Z7E	Essex TS	Walker JCT	1260	1430	856.5	68	919.3	73	849.2	67.4	676.1	53.7	593.1	47.1	0	0	
Z7E	Walker JCT	Jefferson	1140	1390	461.4	40.5	593.4	52.1	459.3	40.3	262.4	23	310.5	27.2	0	0	
Z7E	Jefferson	Lauzon TS	1190	1370	444.1	37.3	580.1	48.7	442.5	37.2	244.8	20.6	304.2	25.6	0	0	
LauzonT1			296.8	364.2	0	0	89.6	30.2	83.2	28	0	0	44.1	14.8	0	0	
LauzonT2			296.8	364.2	83.6	28.2	64.6	21.8	0	0	0	0	44.4	14.9	32.8	11.1	
Keith T11			180.3	224.5	72.8	40.4	179.6	99.6	146.3	81.1	47.6	26.4	0	0	84.7	47	
Keith T12			160.3	187.5	82.1	51.2	0	0	0	0	53.6	33.5	159.1	99.3	95.5	59.6	

^{*} Control Actions shown in brackets

Table 17: Thermal loading with all elements in-service for double contingencies – Scenario S2

Circuit/ Xformer		Section W	LTE	STE	C21J+		C21J+ (Lower 505 MV	C22J BB to	C22J+		C23Z+		Keith T1 Keith A	Bus +	Lauzon T Z7E+C23Z – (I lower TA Wil MW p	BB G/R and ndsor to 58
	From	То	A/ MVA	A/ MVA	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE	A/ MVA	% LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	0	0	963.5	94.5	662.9	65	0	0	470	46.1
C21J	Malden TS	Sandwich	1020	1100	0	0	0	0	656.6	64.4	519.4	50.9	44.1	4.3	330.5	32.4
C21J	Sandwich	Leamington	1370	1570	0	0	0	0	655.1	47.8	516.9	37.7	37.9	2.8	327.3	23.9
C21J	Leamington	Chatham SS	1370	1570	0	0	0	0	471.5	34.4	420	30.7	123.5	9	249	18.2
C22J	Keith TS	Malden TS	1020	1100	919.1	90.1	0	0	0	0	654.3	64.1	817.9	80.2	463.8	45.5
C22J	Malden TS	Sandwich	1050	1150	614.2	58.5	0	0	0	0	511.5	48.7	545.9	52	325	31
C22J	Sandwich	Leamington	1020	1100	612.6	60.1	0	0	0	0	508.8	49.9	543.9	53.3	321.6	31.5
C22J	Leamington	Chatham SS	1020	1100	440.6	43.2	0	0	0	0	414.9	40.7	385	37.7	246.6	24.2
C23Z	Lauzon TS	Sandwich	1400	1900	0	0	233.8	16.7	370	26.4	0	0	242.2	17.3	0	0
C23Z	Sandwich	Comber WF	1400	1840	0	0	228.4	16.3	361.3	25.8	0	0	233.9	16.7	0	0
C23Z	Comber WF	KEPA WF	1400	1840	0	0	310.8	22.2	266	19	0	0	178.8	12.8	0	0
C23Z	KEPA WF	Dillon	1400	1690	0	0	304.2	21.7	260.3	18.6	0	0	169.7	12.1	0	0
C23Z	Dillon	Chatham SS	1400	1690	0	0	475.5	34	352.4	25.2	0	0	305.7	21.8	0	0
C24Z	Lauzon TS	Sandwich	1400	1900	362.4	25.9	220.2	15.7	0	0	0	0	296.5	21.2	504.5	36
C24Z	Sandwich	Comber WF	1040	1130	354.2	34.1	209.9	20.2	0	0	0	0	290.5	27.9	498.9	48
C24Z	Comber WF	KEPA WF	1040	1130	261.7	25.2	250.4	24.1	0	0	0	0	166.7	16	334	32.1
C24Z	KEPA WF	Chatham SS	1020	1100	559.9	54.9	668.8	65.6	0	0	0	0	491.3	48.2	414.9	40.7
J3E	Keith TS	Crawford	1070	1390	882.3	82.5	1007.	94.2	884.9	82.7	692.7	64.7	681.1	63.7	757.6	70.8
J3E	Crawford	Essex TS	1070	1390	669.1	62.5	810.7	75.8	672.9	62.9	473.2	44.2	471	44	545.7	51
J4E	Keith TS	Crawford	1000	1090	852.7	85.3	983	98.3	856.2	85.6	656.5	65.6	650.8	65.1	731.2	73.1
J4E	Crawford	Essex TS	1000	1090	697.1	69.7	832.3	83.2	699.7	70	509.8	51	499.2	49.9	571.6	57.2
Z1E	Essex TS	Windsor Transalta	1260	1430	420.3	33.4	595.6	47.3	427.6	33.9	216.4	17.2	237.4	18.8	950.6	75.4
Z1E	Windsor Transalta	Walker JCT	1260	1430	766	60.8	921.7	73.1	773.8	61.4	543.9	43.2	566.9	45	1246.9	99
Z1E	Walker JCT	Jefferson	1140	1390	354.4	31.1	549	48.2	362.8	31.8	156.9	13.8	198.9	17.5	326.5	28.6
Z1E	Jefferson	Lauzon TS	1190	1370	333.7	28	532.2	44.7	342.3	28.8	139.8	11.8	185.6	15.6	283.7	23.8
Z7E	Essex TS	Walker JCT	1260	1430	793.6	63	921.4	73.1	798.8	63.4	599.2	47.6	576.7	45.8	0	0
Z7E	Walker JCT	Jefferson	1140	1390	344.7	30.2	543.9	47.7	353.6	31	141.5	12.4	196.9	17.3	0	0
Z7E	Jefferson	Lauzon TS	1190	1370	324.2	27.2	527.5	44.3	333.4	28	124.6	10.5	184.7	15.5	0	0
LauzonT1			296.8	364.2	0	0	125.5	42.3	120.4	40.6	0	0	60.9	20.5	0	0
LauzonT2			296.8	364.2	114.2	38.5	99	33.4	0	0	0	0	45.7	15.4	45.7	15.4
Keith T11			180.3	224.5	51.8	28.7	178	98.7	107.9	59.9	36.8	20.4	0	0	84.1	46.6
Keith T12			160.3	187.5	58.4	36.4	0	0	0	0	41.5	25.9	145	90.4	94.8	59.2

^{*} Control Actions shown in brackets

Table 18: Thermal loading under outage contingencies – Scenario S1

Circuit/ Xformer		t Section	LTE	STE	* Keith A J1B – (l imports MW p	lower to 155 oost)	Keith A	4Z	* Z7E+ (After 1 st lower im 0 MW an 460 M	outage ports to ad BB to //W)	lower imports 478 MW and 1 MW + Arm 62 L/R for next	(After 1 st outage to 0 MW, BB to TA Windsor to 44 2 MW Kingsville t contingency)
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE /MVA
C21J	Keith TS	Malden TS	1020	1100	0	0	0	0	0	0	367.7	36.1
C21J	Malden TS	Sandwich JCT	1020	1100	65.8	6.5	47.3	4.6	0	0	243.6	23.9
C21J	Sandwich JCT	Leamington TS	1370	1570	61.3	4.5	39.4	2.9	0	0	238.8	17.4
C21J	Leamington	Chatham SS	1370	1570	66.2	4.8	42	3.1	0	0	208	15.2
C22J	Keith TS	Malden TS	1020	1100	649.2	63.6	861.8	84.5	541.9	53.1	363	35.6
C22J	Malden TS	Sandwich JCT	1050	1150	412.9	39.3	588.6	56.1	273.4	26	240.1	22.9
C22J	Sandwich JCT	Leamington TS	1020	1100	409.6	40.2	586	57.5	269	26.4	235.1	23
C22J	Leamington	Chatham SS	1020	1100	325.2	31.9	483.1	47.4	224.9	22	205.5	20.1
C23Z	Lauzon TS	Sandwich JCT	1400	1900	300.7	21.5	388.4	27.7	276.5	19.8	425.5	30.4
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	294.6	21	381.1	27.2	270.3	19.3	420	30
C23Z	Comber WF	KEPA WF JCT	1400	1840	164.4	11.7	253.8	18.1	152.3	10.9	261	18.6
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	159	11.4	248.5	17.8	146.7	10.5	256.7	18.3
C23Z	Dillon RWEC	Chatham SS	1400	1690	242.5	17.3	304.6	21.8	249.5	17.8	253.6	18.1
C24Z	Lauzon TS	Sandwich JCT	1400	1900	366.8	26.2	0	0	342.2	24.4	0	0
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	362.5	34.9	0	0	338	32.5	0	0
C24Z	Comber WF	KEPA WF JCT	1040	1130	202.5	19.5	0	0	182.9	17.6	0	0
C24Z	KEPA WF JCT	Chatham SS	1020	1100	413	40.5	0	0	427.4	41.9	0	0
J3E	Keith TS	Crawford JCT	1070	1390	638.2	59.6	951.6	88.9	695.5	65	781	73
J3E	Crawford JCT	Essex TS	1070	1390	447.2	41.8	753.1	70.4	493	46.1	576.2	53.9
J4E	Keith TS	Crawford JCT	1000	1090	614.5	61.4	927.8	92.8	668.1	66.8	752.9	75.3
J4E	Crawford JCT	Essex TS	1000	1090	465.6	46.6	774.1	77.4	517.2	51.7	601.7	60.2
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	273.8	21.7	531.4	42.2	869.3	69	1025.8	81.4
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	570.1	45.2	861.1	68.3	1197.4	95	1237.4	98.2
Z1E	Walker JCT	Jefferson JCT	1140	1390	291.2	25.5	479.5	42.1	611.1	53.6	570.2	50
Z1E	Jefferson JCT	Lauzon TS	1190	1370	286.3	24.1	462.2	38.8	598.2	50.3	551.1	46.3
Z7E	Essex TS	Walker JCT	1260	1430	558.4	44.3	864.8	68.6	0	0	0	0
Z7E	Walker JCT	Jefferson JCT	1140	1390	293.4	25.7	474	41.6	0	0	0	0
Z7E	Jefferson JCT	Lauzon TS	1190	1370	289.4	24.3	457.1	38.4	0	0	0	0
Lauzon T1			296.8	364.2	45.8	15.4	89.2	30.1	42.3	14.3	50.3	17
Lauzon T2			296.8	364.2	50	16.8	0	0	42.3	14.3	0	0
Keith T11			180.3	224.5	0	0	0	0	43.4	24.1	58.4	32.4
Keith T12			160.3	187.5	159.2	99.3	155.4	97	48.9	30.5	65.8	41.1

^{*} Control Actions shown in brackets

Table 18: Thermal loading under outage contingencies – Scenario S1 (continued)

Circuit/ Xformer	Circui	t Section	LTE	STE	* J3E+Z7E- outage Imports t and BB to	(After 1 st lower o 0 MW 305 MW)	* J3E+C2: 1st outag Imports and BB to	1J- (After ge lower to 0 MW 305 MW)	imports to 0 MW o + Arm 62 MW Kii Bell River L/R for	r 1st outage lower and BB to 260 MW agsville & 50 MW next contingency)
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE /MVA
C21J	Keith TS	Malden TS	1020	1100	235.6	23.1	0	0	227.2	22.3
C21J	Malden TS	Sandwich JCT	1020	1100	138.3	13.6	0	0	144.9	14.2
C21J	Sandwich JCT	Leamington TS	1370	1570	131.2	9.6	0	0	137.4	10
C21J	Leamington	Chatham SS	1370	1570	125.8	9.2	0	0	115.2	8.4
C22J	Keith TS	Malden TS	1020	1100	232.1	22.8	403.5	39.6	223.3	21.9
C22J	Malden TS	Sandwich JCT	1050	1150	135.7	12.9	165.5	15.8	142.1	13.5
C22J	Sandwich JCT	Leamington TS	1020	1100	128.6	12.6	158.9	15.6	134.5	13.2
C22J	Leamington	Chatham SS	1020	1100	124.5	12.2	147	14.4	114.2	11.2
C23Z	Lauzon TS	Sandwich JCT	1400	1900	376.6	26.9	373.4	26.7	503.4	36
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	371.8	26.6	368.4	26.3	498.7	35.6
C23Z	Comber WF	KEPA WF JCT	1400	1840	207.1	14.8	208.2	14.9	325.1	23.2
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	202.9	14.5	203.8	14.6	321.5	23
C23Z	Dillon RWEC	Chatham SS	1400	1690	207.8	14.8	216.5	15.5	265	18.9
C24Z	Lauzon TS	Sandwich JCT	1400	1900	447.4	32	443	31.6	0	0
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	444	42.7	439.5	42.3	0	0
C24Z	Comber WF	KEPA WF JCT	1040	1130	267.2	25.7	265.5	25.5	0	0
C24Z	KEPA WF JCT	Chatham SS	1020	1100	345	33.8	355.1	34.8	0	0
J3E	Keith TS	Crawford JCT	1070	1390	0	0	0	0	0	0
J3E	Crawford JCT	Essex TS	1070	1390	0	0	0	0	0	0
J4E	Keith TS	Crawford JCT	1000	1090	967.4	96.7	955.1	95.5	994.8	99.5
J4E	Crawford JCT	Essex TS	1000	1090	595.7	59.6	600.5	60.1	631.5	63.2
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	460.8	36.6	174.1	13.8	155.8	12.4
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	789.1	62.6	419.7	33.3	425.6	33.8
Z1E	Walker JCT	Jefferson JCT	1140	1390	448.1	39.3	228.9	20.1	200.1	17.6
Z1E	Jefferson JCT	Lauzon TS	1190	1370	466.4	39.2	235.3	19.8	205.6	17.3
Z7E	Essex TS	Walker JCT	1260	1430	0	0	401.7	31.9	415	32.9
Z7E	Walker JCT	Jefferson JCT	1140	1390	0	0	239	21	209.6	18.4
Z7E	Jefferson JCT	Lauzon TS	1190	1370	0	0	246	20.7	215.4	18.1
Lauzon T1			296.8	364.2	60.3	20.3	60	20.2	19.9	6.7
Lauzon T2			296.8	364.2	76.2	25.7	74.9	25.3	0	0
Keith T11			180.3	224.5	50.5	28	46.7	25.9	53.4	29.6
Keith T12			160.3	187.5	57	35.5	52.6	32.8	60.2	37.6

^{*} Control Actions shown in brackets

Table 19: Thermal loading under outage contingencies – Scenario S2

Circuit/ Xformer	Circui	t Section	LTE	STE	Keith A b		Keith A C24	łZ	* Z7E+ (After 1 st lower Im 0 MW ar 513 N	outage ports to ad BB to	lower imports 478 MW and TA MW + Arm 27 L/R for next	After 1 st outage to 0 MW, BB to A Windsor to 44 MW Kingsville contingency)
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE /MVA
C21J	Keith TS	Malden TS	1020	1100	0	0	0	0	0	0	401.4	39.4
C21J	Malden TS	Sandwich JCT	1020	1100	52.6	5.2	40.3	4	0	0	265.9	26.1
C21J	Sandwich JCT	Leamington TS	1370	1570	47.7	3.5	31.7	2.3	0	0	262.1	19.1
C21J	Leamington	Chatham SS	1370	1570	138.3	10.1	109.1	8	0	0	200.6	14.6
C22J	Keith TS	Malden TS	1020	1100	736.9	72.2	930.5	91.2	681.8	66.8	396	38.8
C22J	Malden TS	Sandwich JCT	1050	1150	479.1	45.6	641.7	61.1	378.2	36	261	24.9
C22J	Sandwich JCT	Leamington TS	1020	1100	476.8	46.7	639.7	62.7	376.2	36.9	257.1	25.2
C22J	Leamington	Chatham SS	1020	1100	329.6	32.3	471.7	46.2	263.4	25.8	199.1	19.5
C23Z	Lauzon TS	Sandwich JCT	1400	1900	259.2	18.5	356.7	25.5	245.9	17.6	436.4	31.2
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	251.5	18	347.8	24.8	237.3	17	429.6	30.7
C23Z	Comber WF	KEPA WF JCT	1400	1840	174.8	12.5	270.9	19.4	188.2	13.4	280.2	20
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	165.4	11.8	261.6	18.7	179.1	12.8	275.2	19.7
C23Z	Dillon RWEC	Chatham SS	1400	1690	288	20.6	357.5	25.5	315.2	22.5	296.3	21.2
C24Z	Lauzon TS	Sandwich JCT	1400	1900	317.2	22.7	0	0	297.5	21.3	0	0
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	311.6	30	0	0	291.3	28	0	0
C24Z	Comber WF	KEPA WF JCT	1040	1130	175.1	16.8	0	0	173.4	16.7	0	0
C24Z	KEPA WF JCT	Chatham SS	1020	1100	469.9	46.1	0	0	499.8	49	0	0
J3E	Keith TS	Crawford JCT	1070	1390	635.3	59.4	904.1	84.5	707.8	66.2	791.4	74
J3E	Crawford JCT	Essex TS	1070	1390	423.3	39.6	692.2	64.7	494	46.2	574.8	53.7
J4E	Keith TS	Crawford JCT	1000	1090	604	60.4	875.3	87.5	676.1	67.6	759.1	75.9
J4E	Crawford JCT	Essex TS	1000	1090	452.7	45.3	719.1	71.9	524	52.4	606.3	60.6
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	187	14.8	446.3	35.4	843.8	67	1005.1	79.8
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	516.6	41	792	62.9	1180.1	93.7	1235.9	98.1
Z1E	Walker JCT	Jefferson JCT	1140	1390	155.1	13.6	381.2	33.4	428.4	37.6	342.5	30
Z1E	Jefferson JCT	Lauzon TS	1190	1370	144.5	12.1	360.7	30.3	404.9	34	302.5	25.4
Z7E	Essex TS	Walker JCT	1260	1430	527.8	41.9	817	64.8	0	0	0	0
Z7E	Walker JCT	Jefferson JCT	1140	1390	155.1	13.6	371.9	32.6	0	0	0	0
Z7E	Jefferson JCT	Lauzon TS	1190	1370	146	12.3	351.6	29.6	0	0	0	0
Lauzon T1			296.8	364.2	55.7	18.8	127	42.8	64.8	21.8	72.7	24.5
Lauzon T2			296.8	364.2	45.1	15.2	0	0	49.1	16.6	0	0
Keith T11			180.3	224.5	0	0	0	0	25.9	14.4	50.2	27.8
Keith T12			160.3	187.5	138.1	86.2	118.5	74	29.2	18.2	56.6	35.3

^{*} Control Actions shown in brackets

Table 19: Thermal loading under outage contingencies – Scenario S2 (continued)

Circuit/ Xformer	Circui	t Section	LTE	STE	* J3E+Z7I outag Imports and BB to	E- (After 1 st e lower to 0 MW o 335 MW)	* J3E+C21. 1st outage Imports to and BB to 3	I- (After e lower o 0 MW 335 MW)	lower impor to 260 M Kingsville & L/R for n	– (After 1st outage ts to 0 MW and BB W + Arm 27 MW t 50 MW Bell River ext contingency)
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE /MVA
C21J	Keith TS	Malden TS	1020	1100	286.5	28.1	0	0	198.5	19.5
C21J	Malden TS	Sandwich JCT	1020	1100	156.3	15.3	0	0	109.1	10.7
C21J	Sandwich JCT	Leamington TS	1370	1570	151.5	11.1	0	0	101.6	7.4
C21J	Leamington	Chatham SS	1370	1570	118.7	8.7	0	0	164.6	12
C22J	Keith TS	Malden TS	1020	1100	282.9	27.7	519.8	51	194.8	19.1
C22J	Malden TS	Sandwich JCT	1050	1150	152.6	14.5	218.4	20.8	104.6	10
C22J	Sandwich JCT	Leamington TS	1020	1100	147.7	14.5	215.8	21.2	97	9.5
C22J	Leamington	Chatham SS	1020	1100	118.6	11.6	207.5	20.3	163.8	16.1
C23Z	Lauzon TS	Sandwich JCT	1400	1900	338.1	24.2	331.4	23.7	516.7	36.9
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	331.9	23.7	325.1	23.2	511.2	36.5
C23Z	Comber WF	KEPA WF JCT	1400	1840	189.3	13.5	187.2	13.4	338.8	24.2
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	184.1	13.2	182	13	334.7	23.9
C23Z	Dillon RWEC	Chatham SS	1400	1690	243.1	17.4	247.2	17.7	291.5	20.8
C24Z	Lauzon TS	Sandwich JCT	1400	1900	403.4	28.8	396.1	28.3	0	0
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	398.8	38.4	391.5	37.6	0	0
C24Z	Comber WF	KEPA WF JCT	1040	1130	233.8	22.5	229.2	22	0	0
C24Z	KEPA WF JCT	Chatham SS	1020	1100	399.9	39.2	406.4	39.8	0	0
J3E	Keith TS	Crawford JCT	1070	1390	0	0	0	0	0	0
J3E	Crawford JCT	Essex TS	1070	1390	0	0	0	0	0	0
J4E	Keith TS	Crawford JCT	1000	1090	962.5	96.2	932.8	93.3	994.7	99.5
J4E	Crawford JCT	Essex TS	1000	1090	573.3	57.3	548	54.8	607.9	60.8
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	387.9	30.8	60.2	4.8	28.7	2.3
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	725.4	57.6	354.4	28.1	367.2	29.1
Z1E	Walker JCT	Jefferson JCT	1140	1390	247.5	21.7	110.1	9.7	47.1	4.1
Z1E	Jefferson JCT	Lauzon TS	1190	1370	281.3	23.6	125.3	10.5	67.5	5.7
Z7E	Essex TS	Walker JCT	1260	1430	0	0	370.2	29.4	412	32.7
Z7E	Walker JCT	Jefferson JCT	1140	1390	0	0	124.8	10.9	57	5
Z7E	Jefferson JCT	Lauzon TS	1190	1370	0	0	140	11.8	78.2	6.6
Lauzon T1			296.8	364.2	57	19.2	56.1	18.9	39.2	13.2
Lauzon T2			296.8	364.2	63.4	21.4	61.5	20.7	0	0
Keith T11			180.3	224.5	34.6	19.2	32.5	18	37.4	20.7
Keith T12			160.3	187.5	39	24.3	36.6	22.8	42.2	26.3

^{*} Control Actions shown in brackets

Table 20: Thermal loading with all elements in-service for single contingencies – Scenario S3

Table 20	· Incima io	ading with an		.5 III-5CI	vice ioi	singic (continge	ilcics -	- Beenar	10 55	Г		T	
Circuit/ Xformer	Circui	t Section	LTE	STE	C2:	IJ	C2:	3Z	J3	E	27	E	Keith /	A bus
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	479.7	47	382.3	37.5	394.8	38.7	0	0
C21J	Malden TS	Sandwich JCT	1020	1100	0	0	637.8	62.5	539.9	52.9	552.7	54.2	256.8	25.2
C21J	Sandwich JCT	Leamington TS	1370	1570	0	0	637	46.5	539	39.3	551.7	40.3	255.2	18.6
C21J	Leamington	Chatham SS	1370	1570	0	0	685.4	50	587.4	42.9	599.9	43.8	349.7	25.5
C22J	Keith TS	Malden TS	1020	1100	422.8	41.4	470.4	46.1	374.2	36.7	386.5	37.9	616.2	60.4
C22J	Malden TS	Sandwich JCT	1050	1150	726.1	69.1	628.2	59.8	531.8	50.6	544.3	51.8	672.5	64
C22J	Sandwich JCT	Leamington TS	1020	1100	725.9	71.2	627.8	61.5	531.2	52.1	543.6	53.3	672.1	65.9
C22J	Leamington	Chatham SS	1020	1100	826.6	81	676.3	66.3	579.7	56.8	592	58	673.4	66
C23Z	Lauzon TS	Sandwich JCT	1400	1900	619	44.2	0	0	568.1	40.6	545	38.9	567.5	40.5
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	616.7	44.1	0	0	565.5	40.4	542.6	38.8	565.1	40.4
C23Z	Comber WF	KEPA WF JCT	1400	1840	614	43.9	0	0	562.6	40.2	539.8	38.6	562.3	40.2
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	612.6	43.8	0	0	561	40.1	538.3	38.5	560.8	40.1
C23Z	Dillon RWEC	Chatham SS	1400	1690	610.9	43.6	0	0	559.3	39.9	536.6	38.3	559.1	39.9
C24Z	Lauzon TS	Sandwich JCT	1400	1900	611.9	43.7	842.7	60.2	561.9	40.1	539	38.5	561.2	40.1
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	609.8	58.6	840.5	80.8	559.5	53.8	536.8	51.6	559	53.7
C24Z	Comber WF	KEPA WF JCT	1040	1130	607.3	58.4	837.5	80.5	556.8	53.5	534.2	51.4	556.4	53.5
C24Z	KEPA WF JCT	Chatham SS	1020	1100	600.7	58.9	828.2	81.2	549.5	53.9	527.6	51.7	549.7	53.9
J3E	Keith TS	Crawford JCT	1070	1390	334.5	31.3	733.3	68.5	0	0	473.4	44.2	407.8	38.1
J3E	Crawford JCT	Essex TS	1070	1390	111	10.4	516.8	48.3	0	0	252.5	23.6	191.5	17.9
J4E	Keith TS	Crawford JCT	1000	1090	291.3	29.1	699.2	69.9	802.1	80.2	434	43.4	370.5	37
J4E	Crawford JCT	Essex TS	1000	1090	157.9	15.8	548.8	54.9	426.1	42.6	291.1	29.1	226.6	22.7
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	196.6	15.6	271.5	21.6	173.3	13.8	354.1	28.1	167.2	13.3
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	202.1	16	614	48.7	312.4	24.8	696.6	55.3	298.2	23.7
Z1E	Walker JCT	Jefferson JCT	1140	1390	223.5	19.6	208.1	18.3	162.7	14.3	303.5	26.6	167.3	14.7
Z1E	Jefferson JCT	Lauzon TS	1190	1370	243.9	20.5	187.9	15.8	179.6	15.1	333.3	28	184.6	15.5
Z7E	Essex TS	Walker JCT	1260	1430	220.8	17.5	646.8	51.3	316.4	25.1	0	0	301.7	23.9
Z7E	Walker JCT	Jefferson JCT	1140	1390	239	21	199.4	17.5	180.5	15.8	0	0	184.8	16.2
Z7E	Jefferson JCT	Lauzon TS	1190	1370	259.1	21.8	179.9	15.1	197	16.6	0	0	201.8	17
Lauzon T1			296.8	364.2	147.4	49.7	0	0	125.6	42.3	117.9	39.7	127.7	43
Lauzon T2			296.8	364.2	144.4	48.7	124.2	41.8	122.9	41.4	115.4	38.9	125	42.1
Keith T11			180.3	224.5	43.1	23.9	38.7	21.4	22.5	12.5	18	10	0	0
Keith T12			160.3	187.5	48.6	30.3	43.6	27.2	25.4	15.8	20.3	12.7	52.6	32.8

Table 21: Thermal loading with all elements in-service for single contingencies – Scenario S4

14070 21		ading with an	[5 111 5 5 1	1100 101	<u> </u>		7110108		10 0 .				
Circuit/ Xformer		t Section	LTE	STE	C2:		C23		J3		27		Keith <i>i</i>	
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	425.7	41.7	340.9	33.4	351.4	34.4	0	0
C21J	Malden TS	Sandwich JCT	1020	1100	0	0	583.4	57.2	498	48.8	509	49.9	247.8	24.3
C21J	Sandwich JCT	Leamington TS	1370	1570	0	0	583	42.6	497.6	36.3	508.5	37.1	246.4	18
C21J	Leamington	Chatham SS	1370	1570	0	0	721.6	52.7	635.9	46.4	647.1	47.2	428.1	31.2
C22J	Keith TS	Malden TS	1020	1100	356.4	34.9	417.7	40.9	334.1	32.8	344.3	33.8	553.4	54.3
C22J	Malden TS	Sandwich JCT	1050	1150	636.8	60.7	574.7	54.7	490.5	46.7	501.3	47.7	620.5	59.1
C22J	Sandwich JCT	Leamington TS	1020	1100	637.6	62.5	574.6	56.3	490.5	48.1	501.1	49.1	620.5	60.8
C22J	Leamington	Chatham SS	1020	1100	917.6	90	712.1	69.8	627.6	61.5	638.6	62.6	714.6	70.1
C23Z	Lauzon TS	Sandwich JCT	1400	1900	579.4	41.4	0	0	525.1	37.5	504.5	36	517.1	36.9
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	576.6	41.2	0	0	521.9	37.3	501.4	35.8	514.1	36.7
C23Z	Comber WF	KEPA WF JCT	1400	1840	573.4	41	0	0	518.2	37	497.8	35.6	510.7	36.5
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	571.8	40.8	0	0	516.4	36.9	496.1	35.4	509	36.4
C23Z	Dillon RWEC	Chatham SS	1400	1690	569.9	40.7	0	0	514.3	36.7	494.1	35.3	507.1	36.2
C24Z	Lauzon TS	Sandwich JCT	1400	1900	573.1	40.9	780.2	55.7	519.9	37.1	499.6	35.7	511.8	36.6
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	570.6	54.9	777.6	74.8	516.9	49.7	496.6	47.8	509	48.9
C24Z	Comber WF	KEPA WF JCT	1040	1130	567.6	54.6	774.3	74.4	513.5	49.4	493.3	47.4	505.9	48.6
C24Z	KEPA WF JCT	Chatham SS	1020	1100	559.4	54.8	763.7	74.9	503.8	49.4	484.2	47.5	497.3	48.8
J3E	Keith TS	Crawford JCT	1070	1390	359.7	33.6	689.4	64.4	0	0	476	44.5	421.4	39.4
J3E	Crawford JCT	Essex TS	1070	1390	170.8	16	463.6	43.3	0	0	254.8	23.8	201.5	18.8
J4E	Keith TS	Crawford JCT	1000	1090	306.5	30.6	647.4	64.7	773.7	77.4	427.7	42.8	373.6	37.4
J4E	Crawford JCT	Essex TS	1000	1090	223.2	22.3	506.2	50.6	391.1	39.1	306	30.6	252.9	25.3
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	212.6	16.9	196.2	15.6	111.8	8.9	326.9	25.9	106.2	8.4
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	151.5	12	548.5	43.5	246.6	19.6	653.9	51.9	244.7	19.4
Z1E	Walker JCT	Jefferson JCT	1140	1390	273.3	24	162.4	14.2	159.9	14	266.2	23.3	157.7	13.8
Z1E	Jefferson JCT	Lauzon TS	1190	1370	293	24.6	145.3	12.2	180.9	15.2	308.1	25.9	177.9	15
Z7E	Essex TS	Walker JCT	1260	1430	254.1	20.2	603.6	47.9	304.1	24.1	0	0	309.5	24.6
Z7E	Walker JCT	Jefferson JCT	1140	1390	281.8	24.7	146.3	12.8	171.7	15.1	0	0	168	14.7
Z7E	Jefferson JCT	Lauzon TS	1190	1370	301.7	25.4	129.3	10.9	192.8	16.2	0	0	188.5	15.8
Lauzon T1			296.8	364.2	129.3	43.6	0	0	106.7	36	99.9	33.7	106	35.7
Lauzon T2			296.8	364.2	126.6	42.7	95.5	32.2	104.4	35.2	97.7	32.9	103.6	34.9
Keith T11			180.3	224.5	58.9	32.7	17.5	9.7	35.5	19.7	30.2	16.8	0	0
Keith T12			160.3	187.5	66.4	41.4	19.8	12.3	40	25	34.1	21.3	77.4	48.3

Table 22: Thermal loading with all elements in-service for double contingencies – Scenario S3

Circuit/ Xformer	Circui	t Section	LTE	STE	C21J+	C23Z	C21J+	C22J	C22J+	C 24Z	C23Z+	C24Z	* Lauzon Z7E+C23Z – Windsor to pos	(Lower TA o 44 MW
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	0	0	561.8	55.1	641.3	62.9	483.9	47.4
C21J	Malden TS	Sandwich JCT	1020	1100	0	0	0	0	865.2	84.8	799.5	78.4	642.2	63
C21J	Sandwich JCT	Leamington TS	1370	1570	0	0	0	0	865.1	63.1	798.5	58.3	641.5	46.8
C21J	Leamington	Chatham SS	1370	1570	0	0	0	0	966	70.5	846.1	61.8	690.1	50.4
C22J	Keith TS	Malden TS	1020	1100	564	55.3	0	0	0	0	629.7	61.7	474.6	46.5
C22J	Malden TS	Sandwich JCT	1050	1150	864.9	82.4	0	0	0	0	787.7	75	632.6	60.2
C22J	Sandwich JCT	Leamington TS	1020	1100	864.9	84.8	0	0	0	0	787	77.2	632.2	62
C22J	Leamington	Chatham SS	1020	1100	965.8	94.7	0	0	0	0	834.7	81.8	680.9	66.8
C23Z	Lauzon TS	Sandwich JCT	1400	1900	0	0	692.1	49.4	982	70.1	0	0	0	0
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	0	0	689.6	49.3	979.9	70	0	0	0	0
C23Z	Comber WF	KEPA WF JCT	1400	1840	0	0	686.6	49	976.9	69.8	0	0	0	0
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	0	0	685	48.9	975.2	69.7	0	0	0	0
C23Z	Dillon RWEC	Chatham SS	1400	1690	0	0	683.1	48.8	973.1	69.5	0	0	0	0
C24Z	Lauzon TS	Sandwich JCT	1400	1900	968.8	69.2	684.1	48.9	0	0	0	0	880.1	62.9
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	966.8	93	681.8	65.6	0	0	0	0	877.9	84.4
C24Z	Comber WF	KEPA WF JCT	1040	1130	964	92.7	679.1	65.3	0	0	0	0	874.9	84.1
C24Z	KEPA WF JCT	Chatham SS	1020	1100	954.7	93.6	671.2	65.8	0	0	0	0	865.2	84.8
J3E	Keith TS	Crawford JCT	1070	1390	637.1	59.5	227.2	21.2	624.1	58.3	1003.6	93.8	786.9	73.5
J3E	Crawford JCT	Essex TS	1070	1390	414.8	38.8	80	7.5	401.5	37.5	8.008	74.8	566.8	53
J4E	Keith TS	Crawford JCT	1000	1090	599.6	60	174.5	17.5	586.6	58.7	978.4	97.8	751.7	75.2
J4E	Crawford JCT	Essex TS	1000	1090	451.2	45.1	116.3	11.6	438	43.8	823.6	82.4	600.5	60
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	157.3	12.5	316.8	25.1	144.9	11.5	573.3	45.5	1003.3	79.6
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	509.7	40.5	81.7	6.5	495.1	39.3	907.2	72	1253.9	99.5
Z1E	Walker JCT	Jefferson JCT	1140	1390	98.6	8.6	361.8	31.7	85.7	7.5	507.9	44.6	356.8	31.3
Z1E	Jefferson JCT	Lauzon TS	1190	1370	77.3	6.5	382.3	32.1	64.5	5.4	488.6	41.1	316.7	26.6
Z7E	Essex TS	Walker JCT	1260	1430	548.4	43.5	90.2	7.2	539.4	42.8	922.7	73.2	0	0
Z7E	Walker JCT	Jefferson JCT	1140	1390	86.8	7.6	375.6	32.9	73.8	6.5	500.8	43.9	0	0
Z7E	Jefferson JCT	Lauzon TS	1190	1370	65.9	5.5	396	33.3	53.1	4.5	481.9	40.5	0	0
Lauzon T1			296.8	364.2	0	0	179.1	60.3	176.3	59.4	0	0	0	0
Lauzon T2			296.8	364.2	171.5	57.8	175.6	59.2	0	0	0	0	134.9	45.4
Keith T11			180.3	224.5	16	8.9	154.2	85.5	26.9	14.9	96.5	53.5	46.5	25.8
Keith T12			160.3	187.5	18	11.2	0	0	0	0	108.8	67.9	52.4	32.7

^{*} Control Actions shown in brackets

Table 23: Thermal loading with all elements in-service for double contingencies – Scenario S4

Circuit/ Xformer		t Section	LTE	STE	C21J+C (Lower e to 208 M	23Z – exports	C21J+		C22J+		C23Z+		Lauzon T Z7E+0	
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	0	0	481.3	47.2	563.9	55.3	424.7	41.6
C21J	Malden TS	Sandwich JCT	1020	1100	0	0	0	0	771	75.6	722	70.8	582.7	57.1
C21J	Sandwich JCT	Leamington TS	1370	1570	0	0	0	0	771.7	56.3	721.2	52.6	582.2	42.5
C21J	Leamington	Chatham SS	1370	1570	0	0	0	0	1053.2	76.9	859.3	62.7	721.1	52.6
C22J	Keith TS	Malden TS	1020	1100	436.7	42.8	0	0	0	0	553.6	54.3	416.7	40.9
C22J	Malden TS	Sandwich JCT	1050	1150	720.8	68.7	0	0	0	0	711.2	67.7	574	54.7
C22J	Sandwich JCT	Leamington TS	1020	1100	721.6	70.7	0	0	0	0	710.8	69.7	573.9	56.3
C22J	Leamington	Chatham SS	1020	1100	1002	98.2	0	0	0	0	847.9	83.1	711.6	69.8
C23Z	Lauzon TS	Sandwich JCT	1400	1900	0	0	640.3	45.7	900.1	64.3	0	0	0	0
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	0	0	637.2	45.5	897.6	64.1	0	0	0	0
C23Z	Comber WF	KEPA WF JCT	1400	1840	0	0	633.6	45.3	894.3	63.9	0	0	0	0
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	0	0	631.8	45.1	892.5	63.7	0	0	0	0
C23Z	Dillon RWEC	Chatham SS	1400	1690	0	0	629.6	45	890.2	63.6	0	0	0	0
C24Z	Lauzon TS	Sandwich JCT	1400	1900	886	63.3	633.3	45.2	0	0	0	0	793.5	56.7
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	883.5	85	630.5	60.6	0	0	0	0	790.7	76
C24Z	Comber WF	KEPA WF JCT	1040	1130	880.3	84.6	627.2	60.3	0	0	0	0	787.1	75.7
C24Z	KEPA WF JCT	Chatham SS	1020	1100	869.6	85.3	617.4	60.5	0	0	0	0	775.6	76
J3E	Keith TS	Crawford JCT	1070	1390	623.1	58.2	290.5	27.2	609.5	57	883.1	82.5	715.7	66.9
J3E	Crawford JCT	Essex TS	1070	1390	396.9	37.1	188.4	17.6	383.4	35.8	662.4	61.9	488.2	45.6
J4E	Keith TS	Crawford JCT	1000	1090	577.8	57.8	235.7	23.6	564	56.4	847.1	84.7	672.1	67.2
J4E	Crawford JCT	Essex TS	1000	1090	443.8	44.4	223.8	22.4	430.6	43.1	697	69.7	532.6	53.3
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	140.7	11.2	338.3	26.8	131	10.4	403.5	32	859.5	68.2
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	471.1	37.4	46.8	3.7	457.2	36.3	760.3	60.3	1202.8	95.5
Z1E	Walker JCT	Jefferson JCT	1140	1390	149.8	13.1	395	34.7	147	12.9	348.8	30.6	284.5	25
Z1E	Jefferson JCT	Lauzon TS	1190	1370	144.4	12.1	415.2	34.9	142.8	12	327.4	27.5	247.1	20.8
Z7E	Essex TS	Walker JCT	1260	1430	547.8	43.5	180.1	14.3	534.9	42.4	803.5	63.8	0	0
Z7E	Walker JCT	Jefferson JCT	1140	1390	135.4	11.9	405	35.5	132.8	11.6	335.9	29.5	0	0
Z7E	Jefferson JCT	Lauzon TS	1190	1370	130.9	11	425.3	35.7	130.5	11	314.6	26.4	0	0
Lauzon T1			296.8	364.2	0	0	157.6	53.1	140.5	47.4	0	0	0	0
Lauzon T2			296.8	364.2	134.9	45.5	154.4	52	0	0	0	0	96.5	32.5
Keith T11			180.3	224.5	7.5	4.2	178.5	99	17.2	9.5	61	33.8	19.3	10.7
Keith T12			160.3	187.5	8.5	5.3	0	0	0	0	68.8	42.9	21.7	13.5

^{*} Control Actions shown in brackets

Table 24: Thermal loading under outage conditions – Scenario S3

Circuit/ Xformer		t Section	LTE	STE	J20B+		J3E+	Z7E	Keith A C2:		* J3E+C23Z - outage, Arr Kingsville & Bell River L/ conting	n 62 MW & 50 MW R for next
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	383.4	37.6	0	0	442.6	43.4
C21J	Malden TS	Sandwich JCT	1020	1100	0	0	541.2	53.1	277.7	27.2	600.2	58.8
C21J	Sandwich JCT	Leamington TS	1370	1570	0	0	540.3	39.4	276	20.1	599.2	43.7
C21J	Leamington	Chatham SS	1370	1570	0	0	588.7	43	379.9	27.7	647	47.2
C22J	Keith TS	Malden TS	1020	1100	472.2	46.3	375.3	36.8	738.6	72.4	433.6	42.5
C22J	Malden TS	Sandwich JCT	1050	1150	781.4	74.4	533	50.8	775.7	73.9	591.1	56.3
C22J	Sandwich JCT	Leamington TS	1020	1100	781.1	76.6	532.4	52.2	775.5	76	590.4	57.9
C22J	Leamington	Chatham SS	1020	1100	883.2	86.6	581	57	767.8	75.3	638.5	62.6
C23Z	Lauzon TS	Sandwich JCT	1400	1900	641.4	45.8	569.2	40.7	0	0	0	0
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	639.1	45.7	566.5	40.5	0	0	0	0
C23Z	Comber WF	KEPA WF JCT	1400	1840	636.4	45.5	563.4	40.2	0	0	0	0
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	635	45.4	561.8	40.1	0	0	0	0
C23Z	Dillon RWEC	Chatham SS	1400	1690	633.3	45.2	560	40	0	0	0	0
C24Z	Lauzon TS	Sandwich JCT	1400	1900	633.9	45.3	563	40.2	922.5	65.9	753.6	53.8
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	631.9	60.8	560.6	53.9	920.5	88.5	751.3	72.2
C24Z	Comber WF	KEPA WF JCT	1040	1130	629.5	60.5	557.7	53.6	917.6	88.2	748.5	72
C24Z	KEPA WF JCT	Chatham SS	1020	1100	622.8	61.1	550	53.9	908.3	89.1	739.8	72.5
J3E	Keith TS	Crawford JCT	1070	1390	313	29.3	0	0	669.9	62.6	0	0
J3E	Crawford JCT	Essex TS	1070	1390	88.9	8.3	0	0	449.9	42.1	0	0
J4E	Keith TS	Crawford JCT	1000	1090	267.4	26.7	844.2	84.4	633.9	63.4	943	94.3
J4E	Crawford JCT	Essex TS	1000	1090	140.2	14	461.2	46.1	484.4	48.4	576.6	57.7
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	209.1	16.6	295.2	23.4	197.7	15.7	192.3	15.3
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	168.2	13.3	640.2	50.8	546.5	43.4	392.3	31.1
Z1E	Walker JCT	Jefferson JCT	1140	1390	245.1	21.5	355.2	31.2	136.3	12	151.3	13.3
Z1E	Jefferson JCT	Lauzon TS	1190	1370	266	22.4	389	32.7	115.5	9.7	160.4	13.5
Z7E	Essex TS	Walker JCT	1260	1430	204.6	16.2	0	0	580.6	46.1	391.2	31.1
Z7E	Walker JCT	Jefferson JCT	1140	1390	259.3	22.7	0	0	126.4	11.1	167.4	14.7
Z7E	Jefferson JCT	Lauzon TS	1190	1370	280	23.5	0	0	106.3	8.9	177.1	14.9
Lauzon T1			296.8	364.2	154.2	51.9	125.3	42.2	0	0	0	0
Lauzon T2			296.8	364.2	151.1	50.9	122.7	41.3	154.4	52	96.4	32.5
Keith T11			180.3	224.5	49.8	27.6	22.5	12.5	0	0	8.4	4.7
Keith T12			160.3	187.5	56.2	35	25.3	15.8	50.8	31.7	9.5	5.9

^{*} Control Actions shown in brackets

Table 25: Thermal loading under outage conditions – Scenario S4

Circuit/ Xformer	Circui	t Section	LTE	STE	J20B+	C21J	J3E+	Z7E	Keith A C23		1st outd Lauzon ca 54 MW Ki	3Z – (After ige place ip I/S +arm ingsville L/R intingency)
	From	То	A/MVA	A/MVA	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE	A/MVA	%LTE
C21J	Keith TS	Malden TS	1020	1100	0	0	343.4	33.7	0	0	402.5	39.5
C21J	Malden TS	Sandwich JCT	1020	1100	0	0	500.7	49.1	266	26.1	559.5	54.8
C21J	Sandwich JCT	Leamington TS	1370	1570	0	0	500.3	36.5	264.5	19.3	559	40.8
C21J	Leamington	Chatham SS	1370	1570	0	0	638.7	46.6	454.8	33.2	696.8	50.9
C22J	Keith TS	Malden TS	1020	1100	397.2	38.9	336.5	33	661.2	64.8	394.7	38.7
C22J	Malden TS	Sandwich JCT	1050	1150	689.9	65.7	493.1	47	711.2	67.7	551.1	52.5
C22J	Sandwich JCT	Leamington TS	1020	1100	690.5	67.7	493.1	48.3	711.3	69.7	550.9	54
C22J	Leamington	Chatham SS	1020	1100	976.4	95.7	630.4	61.8	797.3	78.2	687.6	67.4
C23Z	Lauzon TS	Sandwich JCT	1400	1900	600.6	42.9	525.6	37.5	0	0	0	0
C23Z	Sandwich JCT	Comber WF JCT	1400	1840	597.9	42.7	522.1	37.3	0	0	0	0
C23Z	Comber WF	KEPA WF JCT	1400	1840	594.8	42.5	518.3	37	0	0	0	0
C23Z	KEPA WF JCT	Dillon RWEC JCT	1400	1690	593.2	42.4	516.4	36.9	0	0	0	0
C23Z	Dillon RWEC	Chatham SS	1400	1690	591.3	42.2	514.2	36.7	0	0	0	0
C24Z	Lauzon TS	Sandwich JCT	1400	1900	594	42.4	520.5	37.2	838.8	59.9	745.8	53.3
C24Z	Sandwich JCT	Comber WF JCT	1040	1130	591.5	56.9	517.3	49.7	836.2	80.4	743.5	71.5
C24Z	Comber WF	KEPA WF JCT	1040	1130	588.7	56.6	513.7	49.4	833	80.1	740.5	71.2
C24Z	KEPA WF JCT	Chatham SS	1020	1100	580.6	56.9	503.3	49.3	822.5	80.6	731.6	71.7
J3E	Keith TS	Crawford JCT	1070	1390	341.4	31.9	0	0	649.3	60.7	0	0
J3E	Crawford JCT	Essex TS	1070	1390	169	15.8	0	0	423	39.5	0	0
J4E	Keith TS	Crawford JCT	1000	1090	287.3	28.7	830	83	605.5	60.6	951.3	95.1
J4E	Crawford JCT	Essex TS	1000	1090	218.4	21.8	452.4	45.2	467.9	46.8	570.9	57.1
Z1E	Essex TS	Windsor Transalta JCT	1260	1430	246	19.5	268	21.3	161.2	12.8	124.2	9.9
Z1E	Windsor Transalta JCT	Walker JCT	1260	1430	143.2	11.4	599.8	47.6	504.2	40	370.7	29.4
Z1E	Walker JCT	Jefferson JCT	1140	1390	308.8	27.1	329	28.9	144.5	12.7	88.6	7.8
Z1E	Jefferson JCT	Lauzon TS	1190	1370	328.3	27.6	372	31.3	133	11.2	102.3	8.6
Z7E	Essex TS	Walker JCT	1260	1430	242.8	19.3	0	0	565.2	44.9	392.1	31.1
Z7E	Walker JCT	Jefferson JCT	1140	1390	316.8	27.8	0	0	128.9	11.3	105.9	9.3
Z7E	Jefferson JCT	Lauzon TS	1190	1370	336.7	28.3	0	0	118.3	9.9	119.8	10.1
Lauzon T1			296.8	364.2	135.9	45.8	106.6	35.9	0	0	0	0
Lauzon T2			296.8	364.2	133.1	44.8	104.3	35.1	117.9	39.7	91	30.7
Keith T11			180.3	224.5	66.2	36.7	33.8	18.7	0	0	9.2	5.1
Keith T12			160.3	187.5	74.7	46.6	38.1	23.8	18.8	11.8	10.4	6.5

^{*} Control Actions shown in brackets

Appendix B Voltage Assessment

Table 26: Voltage assessment results with all elements in-service for single contingencies – Scenario S1

Table 20. Voltag	Pre-			1J				3Z				BE				7E			Keith	A Bus	
Bus Name	Cont.	Pre-l	ULTC	Post-	ULTC	Pre-U	ILTC	Post-l	JLTC	Pre-	ULTC	Post-	ULTC	Pre-l	JLTC	Post-	ULTC	Pre-U	LTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	235.2	233.3	-0.82	233.4	-0.77	234.7	-0.23	234.9	-0.14	235.2	-0.03	235.3	0.01	235.0	-0.11	235.0	-0.10	234.6	-0.26	234.6	-0.25
Malden C21J 230 kV	235.3					234.8	-0.21	235.1	-0.12	235.2	-0.04	235.3	-0.01	235.1	-0.11	235.1	-0.10	240.1	2.04	240.1	2.04
Malden C22J 230 kV	235.4	233.1	-0.98	233.2	-0.92	234.9	-0.21	235.1	-0.12	235.3	-0.04	235.4	0.00	235.1	-0.11	235.1	-0.10	234.6	-0.30	234.7	-0.30
Leamington C21J 230 kV	237.9					237.9	0.01	238.1	0.11	237.6	-0.11	237.7	-0.08	237.7	-0.09	237.7	-0.08	241.0	1.33	241.0	1.33
Leamington C22J 230 kV	237.9	235.6	-1.01	235.7	-0.96	238.0	0.01	238.2	0.11	237.7	-0.11	237.8	-0.08	237.7	-0.09	237.8	-0.08	237.4	-0.24	237.4	-0.24
Lauzon C23Z 230 kV	232.1	232.0	-0.05	232.0	-0.03					230.4	-0.75	230.6	-0.65	231.8	-0.13	231.9	-0.10	231.9	-0.10	231.9	-0.10
Lauzon C24Z 230 kV	231.6	231.5	-0.03	231.5	-0.02	223.3	-3.56	225.7	-2.55	229.8	-0.76	230.1	-0.66	231.3	-0.14	231.3	-0.10	231.4	-0.09	231.4	-0.09
Chatham 230 kV	242.9	243.4	0.18	243.4	0.19	243.7	0.32	244.0	0.44	242.6	-0.15	242.6	-0.12	242.8	-0.05	242.8	-0.04	243.3	0.17	243.3	0.17
Keith 115 kV	124.1	123.7	-0.31	123.7	-0.29	122.9	-0.97	123.2	-0.74	124.0	-0.04	124.2	0.08	123.6	-0.38	123.6	-0.35	123.5	-0.44	123.5	-0.44
Crawford J3E 115 kV	122.6	122.3	-0.30	122.3	-0.28	120.8	-1.47	121.3	-1.11					122.0	-0.56	122.0	-0.51	122.2	-0.38	122.2	-0.38
Crawford J4E 115 kV	122.8	122.5	-0.29	122.5	-0.28	121.0	-1.47	121.4	-1.16	121.5	-1.11	121.8	-0.89	122.2	-0.56	122.2	-0.51	122.4	-0.38	122.4	-0.38
Essex 115 kV	122.0	121.7	-0.25	121.7	-0.24	119.6	-1.96	120.1	-1.52	120.6	-1.11	120.8	-0.96	121.1	-0.73	121.2	-0.67	121.6	-0.31	121.6	-0.31
Windsor Transalta 115 kV	122.0	121.7	-0.25	121.7	-0.24	119.6	-1.96	120.2	-1.52	120.7	-1.10	120.9	-0.95	121.1	-0.74	121.2	-0.69	121.7	-0.30	121.7	-0.30
Walker Z1E 115 kV	122.0	121.7	-0.25	121.7	-0.24	119.5	-2.01	120.1	-1.56	120.6	-1.10	120.8	-0.95	121.0	-0.83	121.0	-0.77	121.6	-0.30	121.6	-0.30
Walker Z7E 115 kV	121.9	121.6	-0.25	121.6	-0.24	119.5	-2.02	120.0	-1.56	120.6	-1.11	120.8	-0.96					121.6	-0.30	121.6	-0.30
Ford Essex Z1E 115 kV	122.5	122.2	-0.23	122.2	-0.21	119.5	-2.40	120.2	-1.87	121.2	-1.02	121.4	-0.88	122.0	-0.37	122.1	-0.32	122.1	-0.27	122.1	-0.27
Ford Essex Z7E 115 kV	122.5	122.2	-0.23	122.2	-0.21	119.5	-2.41	120.2	-1.87	121.2	-1.02	121.4	-0.88					122.1	-0.27	122.1	-0.27
Lauzon 115 kV	122.7	122.4	-0.22	122.5	-0.20	119.5	-2.58	120.2	-2.01	121.5	-0.98	121.7	-0.85	122.5	-0.16	122.6	-0.11	122.4	-0.26	122.4	-0.26
Bell River K2Z 115 kV	122.1	121.8	-0.22	121.8	-0.21	118.9	-2.65	119.6	-2.05	120.9	-1.01	121.0	-0.87	121.9	-0.16	122.0	-0.11	121.8	-0.26	121.8	-0.26
Bell River K6Z 115 kV	120.9	120.6	-0.24	120.6	-0.22	117.5	-2.81	118.3	-2.13	119.6	-1.07	119.8	-0.92	120.7	-0.17	120.8	-0.12	120.6	-0.28	120.6	-0.28
Kingsville K2Z 115 kV	118.9	118.6	-0.21	118.6	-0.20	115.9	-2.52	116.7	-1.84	117.7	-0.96	117.9	-0.83	118.7	-0.16	118.7	-0.11	118.6	-0.25	118.6	-0.25
Kingsville K6Z 115 kV	117.3	117.0	-0.26	117.0	-0.25	113.6	-3.15	114.6	-2.29	115.9	-1.19	116.1	-1.03	117.1	-0.19	117.1	-0.13	116.9	-0.31	116.9	-0.31
Tilbury West 115 kV	119.8	119.5	-0.21	119.5	-0.20	116.7	-2.54	117.5	-1.93	118.6	-0.97	118.8	-0.83	119.6	-0.16	119.6	-0.11	119.5	-0.25	119.5	-0.25
Kent 115 kV	119.9	119.7	-0.21	119.7	-0.20	116.9	-2.54	117.6	-1.93	118.8	-0.97	118.9	-0.83	119.7	-0.16	119.8	-0.11	119.6	-0.25	119.6	-0.25

Table 27: Voltage assessment results with all elements in-service for single contingencies – Scenario S2

Table 27. Voltag	Pre-		C2					3Z				BE	•			7E			Keith	A Bus	
Bus Name	Cont.	Pre-l	JLTC	Post-	ULTC	Pre-U	ILTC	Post-l	JLTC	Pre-	ULTC	Post-	ULTC	Pre-	JLTC	Post-	ULTC	Pre-U	LTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	234.2	232.0	-0.94	232.2	-0.84	233.7	-0.23	233.9	-0.13	234.2	0.01	234.3	0.06	234.0	-0.11	234.0	-0.10	233.7	-0.22	233.7	-0.22
Malden C21J 230 kV	234.2					233.7	-0.21	233.9	-0.11	234.2	0.00	234.3	0.04	233.9	-0.11	234.0	-0.10	237.3	1.32	237.3	1.32
Malden C22J 230 kV	234.2	231.4	-1.20	231.7	-1.07	233.7	-0.21	234.0	-0.11	234.2	0.00	234.3	0.04	234.0	-0.11	234.0	-0.10	233.5	-0.30	233.5	-0.30
Leamington C21J 230 kV	235.2					235.2	0.02	235.5	0.13	235.0	-0.09	235.1	-0.05	235.0	-0.10	235.0	-0.09	237.5	0.96	237.5	0.96
Leamington C22J 230 kV	235.2	229.8	-2.31	230.2	-2.12	235.3	0.02	235.5	0.13	235.0	-0.09	235.1	-0.04	235.0	-0.10	235.0	-0.09	234.3	-0.37	234.3	-0.37
Lauzon C23Z 230 kV	229.9	229.6	-0.11	229.7	-0.08					228.0	-0.84	228.3	-0.68	229.2	-0.31	229.3	-0.26	229.6	-0.13	229.6	-0.13
Lauzon C24Z 230 kV	229.5	229.3	-0.09	229.3	-0.06	221.1	-3.65	223.7	-2.53	227.6	-0.84	227.9	-0.69	228.8	-0.31	228.9	-0.26	229.2	-0.11	229.2	-0.11
Chatham 230 kV	241.9	242.1	0.10	242.2	0.13	242.8	0.36	243.1	0.48	241.5	-0.15	241.6	-0.11	241.7	-0.08	241.7	-0.07	242.1	0.08	242.1	0.08
Keith 115 kV	123.8	123.3	-0.36	123.4	-0.32	122.5	-1.01	122.8	-0.77	123.9	0.14	124.1	0.27	123.4	-0.34	123.4	-0.30	123.3	-0.40	123.3	-0.39
Crawford J3E 115 kV	121.9	121.5	-0.34	121.6	-0.30	120.1	-1.52	120.5	-1.17					121.3	-0.49	121.4	-0.44	121.5	-0.36	121.5	-0.36
Crawford J4E 115 kV	122.1	121.7	-0.34	121.8	-0.30	120.3	-1.52	120.7	-1.17	120.8	-1.11	121.1	-0.85	121.5	-0.49	121.6	-0.43	121.7	-0.36	121.7	-0.36
Essex 115 kV	120.9	120.5	-0.30	120.6	-0.26	118.4	-2.02	119.0	-1.57	119.3	-1.32	119.5	-1.11	120.1	-0.65	120.2	-0.57	120.5	-0.31	120.5	-0.30
Windsor Transalta 115 kV	120.9	120.6	-0.30	120.6	-0.26	118.5	-2.02	119.0	-1.58	119.3	-1.30	119.6	-1.10	120.1	-0.67	120.2	-0.59	120.6	-0.30	120.6	-0.30
Walker Z1E 115 kV	120.8	120.5	-0.30	120.5	-0.26	118.3	-2.08	118.9	-1.62	119.3	-1.30	119.5	-1.10	119.9	-0.78	120.0	-0.70	120.5	-0.30	120.5	-0.30
Walker Z7E 115 kV	120.8	120.4	-0.30	120.5	-0.26	118.3	-2.08	118.8	-1.62	119.2	-1.30	119.5	-1.10					120.4	-0.30	120.4	-0.30
Ford Essex Z1E 115 kV	121.0	120.7	-0.28	120.7	-0.24	118.0	-2.49	118.6	-1.95	119.6	-1.19	119.8	-0.99	120.4	-0.53	120.4	-0.46	120.7	-0.28	120.7	-0.28
Ford Essex Z7E 115 kV	121.0	120.6	-0.28	120.7	-0.24	118.0	-2.49	118.6	-1.95	119.5	-1.19	119.8	-0.99					120.6	-0.28	120.6	-0.28
Lauzon 115 kV	121.1	120.8	-0.27	120.8	-0.24	117.8	-2.68	118.5	-2.10	119.7	-1.14	119.9	-0.95	120.6	-0.42	120.7	-0.36	120.8	-0.27	120.8	-0.27
Bell River K2Z 115 kV	120.5	120.2	-0.28	120.2	-0.24	117.2	-2.74	117.9	-2.12	119.1	-1.17	119.3	-0.96	120.0	-0.43	120.1	-0.36	120.2	-0.28	120.2	-0.28
Bell River K6Z 115 kV	119.4	119.1	-0.28	119.1	-0.25	116.1	-2.81	116.8	-2.17	118.0	-1.20	118.3	-0.98	118.9	-0.44	119.0	-0.37	119.1	-0.28	119.1	-0.28
Kingsville K2Z 115 kV	118.6	118.3	-0.23	118.3	-0.20	115.9	-2.26	116.5	-1.78	117.4	-0.97	117.6	-0.80	118.2	-0.35	118.2	-0.30	118.3	-0.23	118.3	-0.23
Kingsville K6Z 115 kV	116.9	116.6	-0.29	116.7	-0.25	113.6	-2.88	114.3	-2.23	115.5	-1.23	115.8	-1.00	116.4	-0.45	116.5	-0.38	116.6	-0.29	116.6	-0.29
Tilbury West 115 kV	118.7	118.4	-0.25	118.5	-0.22	115.8	-2.49	116.4	-1.95	117.5	-1.06	117.7	-0.88	118.3	-0.39	118.3	-0.33	118.4	-0.25	118.4	-0.25
Kent 115 kV	118.9	118.6	-0.25	118.6	-0.22	115.9	-2.49	116.6	-1.95	117.6	-1.06	117.8	-0.88	118.4	-0.39	118.5	-0.33	118.6	-0.25	118.6	-0.25

Table 28: Voltage assessment results with all elements in-service for double contingencies – Scenario S1

Bus Name	Pre- Cont.			+C23Z			C22J+					+C24Z		8-		+J4E		* Z1E capaci	tor sw	- (Kings vitching os. out	g with
bus Nume		Pre-l	ULTC	Post-	ULTC	Pre-U	ILTC	Post-l	JLTC	Pre-	ULTC	Post-	ULTC	Pre-	JLTC	Post-	ULTC	Pre-U	LTC	Post-	-ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	235.2	232.6	-1.12	233.0	-0.95	232.9	-0.98	233.2	-0.85	235.6	0.15	235.6	0.15	235.4	0.05	235.4	0.06	234.9	-0.15	234.9	-0.15
Malden C21J 230 kV	235.3					232.6	-1.14	233.0	-1.00	235.8	0.20	235.8	0.21	235.2	-0.06	235.2	-0.05	234.9	-0.19	234.9	-0.19
Malden C22J 230 kV	235.4	232.4	-1.26	232.8	-1.07					235.8	0.21	235.9	0.21	235.2	-0.05	235.3	-0.04	234.9	-0.18	234.9	-0.18
Leamington C21J 230 kV	237.9					235.6	-0.95	235.9	-0.81	239.7	0.79	239.7	0.78	236.3	-0.66	236.4	-0.64	237.0	-0.38	237.0	-0.38
Leamington C22J 230 kV	237.9	235.5	-1.02	235.9	-0.85					239.8	0.80	239.8	0.79	236.5	-0.62	236.5	-0.59	237.1	-0.35	237.1	-0.36
Lauzon C23Z 230 kV	232.1					223.4	-3.74	225.9	-2.68					226.4	-2.46	226.8	-2.26	230.1	-0.85	229.8	-0.97
Lauzon C24Z 230 kV	231.6	223.3	-3.57	225.7	-2.54									225.6	-2.58	226.1	-2.39	234.2	1.12	234.2	1.14
Chatham 230 kV	242.9	244.4	0.59	244.7	0.73	244.7	0.75	245.1	0.88	247.1	1.71	247.0	1.69	241.2	-0.69	241.3	-0.65	242.5	-0.18	242.5	-0.18
Keith 115 kV	124.1	122.4	-1.34	122.7	-1.07	121.8	-1.82	122.2	-1.53	123.1	-0.78	123.2	-0.74	125.5	1.16	125.5	1.16	123.7	-0.34	123.7	-0.34
Crawford J3E 115 kV	122.6	120.4	-1.83	120.9	-1.45	119.9	-2.21	120.4	-1.82	121.1	-1.23	121.2	-1.16					122.4	-0.20	122.4	-0.19
Crawford J4E 115 kV	122.8	120.6	-1.82	121.1	-1.45	120.1	-2.21	120.6	-1.82	121.3	-1.22	121.4	-1.16					122.6	-0.20	122.6	-0.19
Essex 115 kV	122.0	119.2	-2.27	119.8	-1.80	118.9	-2.56	119.5	-2.07	119.9	-1.68	120.0	-1.59	118.7	-2.68	119.0	-2.48	121.9	-0.11	121.9	-0.10
Windsor Transalta 115 kV	122.0	119.3	-2.27	119.8	-1.81	118.9	-2.56	119.5	-2.06	120.0	-1.69	120.1	-1.60	118.8	-2.66	119.0	-2.46				
Walker Z1E 115 kV	122.0	119.1	-2.33	119.7	-1.85	118.8	-2.61	119.4	-2.10	119.9	-1.74	120.0	-1.65	118.7	-2.66	119.0	-2.46				
Walker Z7E 115 kV	121.9	119.1	-2.33	119.7	-1.85	118.7	-2.61	119.4	-2.11	119.8	-1.74	119.9	-1.65	118.7	-2.67	118.9	-2.47				
Ford Essex Z1E 115 kV	122.5	119.2	-2.70	119.8	-2.15	118.9	-2.95	119.6	-2.36	119.9	-2.12	120.0	-2.01	119.4	-2.54	119.6	-2.33				
Ford Essex Z7E 115 kV	122.5	119.2	-2.71	119.8	-2.15	118.9	-2.95	119.6	-2.36	119.9	-2.12	120.0	-2.01	119.3	-2.54	119.6	-2.34				
Lauzon 115 kV	122.7	119.2	-2.87	119.9	-2.28	118.9	-3.09	119.7	-2.47	119.9	-2.29	120.0	-2.17	119.7	-2.49	119.9	-2.28	125.9	2.64	126.0	2.70
Bell River K2Z 115 kV	122.1	118.5	-2.95	119.3	-2.32	118.2	-3.18	119.0	-2.52	119.2	-2.35	119.4	-2.22	119.0	-2.56	119.3	-2.32	124.8	2.20	124.8	2.23
Bell River K6Z 115 kV	120.9	117.1	-3.13	118.0	-2.42	116.8	-3.38	117.7	-2.64	117.9	-2.49	118.1	-2.31	117.6	-2.72	118.0	-2.42	118.0	-2.37	117.7	-2.68
Kingsville K2Z 115 kV	118.9	115.5	-2.81	116.4	-2.11	115.3	-3.03	116.1	-2.30	116.2	-2.24	116.5	-2.01	116.0	-2.44	116.4	-2.11	115.9	-2.46	116.3	-2.14
Kingsville K6Z 115 kV	117.3	113.2	-3.51	114.2	-2.61	112.9	-3.78	113.9	-2.86	114.0	-2.79	114.4	-2.49	113.7	-3.04	114.2	-2.62	110.8	-5.55	110.1	-6.11
Tilbury West 115 kV	119.8	116.4	-2.84	117.1	-2.20	116.1	-3.06	116.9	-2.39	117.1	-2.26	117.3	-2.10	116.8	-2.46	117.1	-2.20	120.3	0.45	120.5	0.62
Kent 115 kV	119.9	116.5	-2.83	117.3	-2.19	116.3	-3.05	117.1	-2.39	117.2	-2.26	117.4	-2.09	117.0	-2.46	117.3	-2.19	120.5	0.45	120.7	0.62

^{*} Control Actions shown in brackets

Table 28: Voltage assessment results with all elements in-service for double contingencies – Scenario S1 (continued)

	Pre-			30 DL23 tham D				30 DL21 tham D				T2K BF uzon c		L		T1L7 BI C23Z	F:
Bus Name	Cont.	Pre-	ULTC	Post-	ULTC	Pre-U	JLTC	Post-l	JLTC	Pre-l	ULTC	Post-	ULTC	Pre-	JLTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	235.2	233.3	-0.83	233.6	-0.71	232.4	-1.21	232.6	-1.10	234.0	-0.54	234.3	-0.39	234.4	-0.37	234.7	-0.24
Malden C21J 230 kV	235.3	233.3	-0.88	233.5	-0.76					234.1	-0.51	234.5	-0.37	234.5	-0.34	234.8	-0.22
Malden C22J 230 kV	235.4	233.3	-0.88	233.6	-0.76	231.9	-1.46	232.2	-1.33	234.2	-0.51	234.5	-0.37	234.6	-0.34	234.8	-0.22
Leamington C21J 230 kV	237.9	234.8	-1.30	235.1	-1.16					237.3	-0.24	237.7	-0.07	237.6	-0.12	237.9	0.02
Leamington C22J 230 kV	237.9	234.9	-1.30	235.2	-1.16	232.7	-2.19	233.1	-2.04	237.4	-0.24	237.8	-0.07	237.7	-0.12	238.0	0.02
Lauzon C23Z 230 kV	232.1					229.3	-1.19	229.7	-1.02	220.2	-5.12	223.5	-3.69				
Lauzon C24Z 230 kV	231.6	220.7	-4.71	223.7	-3.41	229.0	-1.12	229.3	-0.99					221.7	-4.25	224.8	-2.93
Chatham 230 kV	242.9	238.6	-1.78	239.0	-1.62	238.4	-1.88	238.7	-1.73	243.3	0.16	243.8	0.36	243.5	0.22	243.8	0.38
Keith 115 kV	124.1	122.3	-1.39	122.7	-1.08	123.2	-0.71	123.3	-0.63	121.8	-1.80	122.3	-1.44	122.4	-1.39	122.7	-1.07
Crawford J3E 115 kV	122.6	120.2	-1.97	120.8	-1.52	121.7	-0.80	121.8	-0.72	119.3	-2.69	120.0	-2.18	120.1	-2.08	120.7	-1.62
Crawford J4E 115 kV	122.8	120.4	-1.96	121.0	-1.52	121.9	-0.80	122.0	-0.72	119.5	-2.69	120.2	-2.17	120.3	-2.08	120.9	-1.62
Essex 115 kV	122.0	118.9	-2.52	119.6	-1.94	120.9	-0.87	121.0	-0.78	117.7	-3.55	118.5	-2.88	118.6	-2.76	119.4	-2.16
Windsor Transalta 115 kV	122.0	118.9	-2.52	119.7	-1.94	121.0	-0.87	121.1	-0.78	117.7	-3.55	118.5	-2.89	118.6	-2.79	119.4	-2.18
Walker Z1E 115 kV	122.0	118.8	-2.59	119.6	-1.99	120.9	-0.89	121.0	-0.79	117.5	-3.65	118.4	-2.96	118.4	-2.97	119.1	-2.34
Walker Z7E 115 kV	121.9	118.8	-2.59	119.5	-2.00	120.9	-0.89	121.0	-0.80	117.5	-3.66	118.3	-2.98				
Ford Essex Z1E 115 kV	122.5	118.7	-3.05	119.6	-2.35	121.3	-0.97	121.4	-0.86	117.2	-4.35	118.1	-3.54	118.4	-3.29	119.4	-2.48
Ford Essex Z7E 115 kV	122.5	118.7	-3.05	119.6	-2.35	121.3	-0.97	121.4	-0.86	117.1	-4.35	118.1	-3.54				
Lauzon 115 kV	122.7	118.7	-3.26	119.6	-2.51	121.5	-1.00	121.6	-0.89	117.0	-4.65	118.1	-3.79	118.5	-3.43	119.6	-2.53
Bell River K2Z 115 kV	122.1	118.0	-3.35	119.0	-2.55	120.8	-1.03	121.0	-0.91	116.3	-4.79	117.4	-3.85	117.8	-3.53	119.0	-2.58
Bell River K6Z 115 kV	120.9	116.6	-3.56	117.7	-2.62	119.6	-1.09	119.7	-0.97	114.8	-5.09	116.0	-4.04	116.4	-3.75	117.7	-2.65
Kingsville K2Z 115 kV	118.9	115.1	-3.19	116.2	-2.21	117.7	-0.98	117.8	-0.87	113.4	-4.58	115.0	-3.23	114.9	-3.36	116.2	-2.24
Kingsville K6Z 115 kV	117.3	112.6	-3.98	114.1	-2.74	115.9	-1.22	116.0	-1.08	110.6	-5.72	112.1	-4.44	112.4	-4.20	114.0	-2.77
Tilbury West 115 kV	119.8	115.9	-3.22	116.9	-2.37	118.6	-0.99	118.7	-0.88	114.3	-4.61	115.5	-3.54	115.7	-3.39	116.9	-2.40
Kent 115 kV	119.9	116.1	-3.22	117.1	-2.37	118.7	-0.99	118.9	-0.88	114.4	-4.60	115.7	-3.54	115.9	-3.39	117.1	-2.39

Table 29: Voltage assessment results with all elements in-service for double contingencies – Scenario S2

Table 29: Voltage	Pre-			+C23Z				+C24Z				+C24Z				+J4E			Z1E-	+Z7E	
Bus Name	Cont.	Pre-l	JLTC	Post-	ULTC	Pre-L	JLTC	Post-l	JLTC	Pre-	JLTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	234.2	231.3	-1.25	231.7	-1.05	231.6	-1.13	232.0	-0.93	234.5	0.11	234.5	0.11	234.8	0.27	234.9	0.29	234.5	0.11	234.5	0.11
Malden C21J 230 kV	234.2					230.9	-1.38	231.5	-1.15	234.6	0.16	234.6	0.16	234.6	0.16	234.6	0.18	234.3	0.07	234.3	0.07
Malden C22J 230 kV	234.2	230.7	-1.48	231.3	-1.26					234.6	0.16	234.6	0.17	234.6	0.17	234.7	0.19	234.4	0.08	234.4	0.08
Leamington C21J 230 kV	235.2					230.0	-2.23	230.7	-1.90	237.0	0.77	237.0	0.76	234.1	-0.47	234.2	-0.44	235.0	-0.07	235.0	-0.07
Leamington C22J 230 kV	235.2	229.7	-2.34	230.5	-2.02					237.1	0.79	237.0	0.78	234.2	-0.43	234.3	-0.40	235.1	-0.05	235.1	-0.04
Lauzon C23Z 230 kV	229.9					220.9	-3.92	223.7	-2.70					223.5	-2.80	224.0	-2.55	232.9	1.29	232.9	1.29
Lauzon C24Z 230 kV	229.5	220.9	-3.76	223.5	-2.59									222.9	-2.89	223.4	-2.65	231.9	1.03	231.9	1.03
Chatham 230 kV	241.9	243.2	0.54	243.6	0.71	243.6	0.70	244.1	0.89	246.2	1.77	246.1	1.75	240.4	-0.63	240.5	-0.58	242.2	0.11	242.2	0.11
Keith 115 kV	123.8	122.0	-1.43	122.4	-1.15	121.5	-1.85	121.9	-1.53	122.6	-0.96	122.6	-0.93	126.2	1.94	126.2	1.95	124.2	0.37	124.2	0.38
Crawford J3E 115 kV	121.9	119.6	-1.92	120.1	-1.53	119.2	-2.28	119.7	-1.85	120.2	-1.45	120.2	-1.40					122.9	0.81	122.9	0.82
Crawford J4E 115 kV	122.1	119.8	-1.92	120.3	-1.53	119.4	-2.27	119.9	-1.85	120.4	-1.45	120.4	-1.40					123.1	0.81	123.1	0.82
Essex 115 kV	120.9	118.0	-2.39	118.6	-1.90	117.7	-2.66	118.3	-2.13	118.5	-1.96	118.6	-1.90	116.4	-3.67	116.7	-3.44	122.4	1.21	122.4	1.22
Windsor Transalta 115 kV	120.9	118.0	-2.39	118.6	-1.90	117.7	-2.66	118.3	-2.13	118.5	-1.96	118.6	-1.91	116.5	-3.64	116.8	-3.40				
Walker Z1E 115 kV	120.8	117.9	-2.45	118.5	-1.95	117.6	-2.72	118.2	-2.17	118.4	-2.02	118.5	-1.96	116.4	-3.64	116.7	-3.40				
Walker Z7E 115 kV	120.8	117.8	-2.45	118.4	-1.96	117.5	-2.72	118.1	-2.18	118.3	-2.03	118.4	-1.97	116.4	-3.65	116.7	-3.41				
Ford Essex Z1E 115 kV	121.0	117.5	-2.85	118.2	-2.27	117.3	-3.09	118.0	-2.46	118.0	-2.46	118.1	-2.40	116.9	-3.38	117.2	-3.13				
Ford Essex Z7E 115 kV	121.0	117.5	-2.85	118.2	-2.28	117.2	-3.09	118.0	-2.47	118.0	-2.46	118.1	-2.40	116.9	-3.38	117.2	-3.14				
Lauzon 115 kV	121.1	117.4	-3.03	118.2	-2.42	117.1	-3.26	117.9	-2.59	117.9	-2.66	117.9	-2.59	117.1	-3.26	117.4	-3.01	123.3	1.79	123.3	1.79
Bell River K2Z 115 kV	120.5	116.8	-3.10	117.5	-2.45	116.5	-3.34	117.3	-2.62	117.2	-2.72	117.3	-2.63	116.5	-3.34	116.8	-3.05	122.7	1.86	122.7	1.86
Bell River K6Z 115 kV	119.4	115.6	-3.19	116.4	-2.57	115.3	-3.42	116.2	-2.69	116.1	-2.79	116.2	-2.69	115.3	-3.43	115.6	-3.18	122.1	2.23	122.1	2.23
Kingsville K2Z 115 kV	118.6	115.5	-2.57	116.3	-1.91	115.3	-2.76	116.0	-2.19	115.9	-2.25	116.0	-2.20	115.3	-2.76	115.7	-2.41	120.4	1.54	120.4	1.55
Kingsville K6Z 115 kV	116.9	113.1	-3.27	113.7	-2.75	112.8	-3.51	113.7	-2.76	113.6	-2.86	113.7	-2.76	112.8	-3.51	113.0	-3.38	119.6	2.26	119.6	2.27
Tilbury West 115 kV	118.7	115.4	-2.82	116.1	-2.19	115.1	-3.03	115.9	-2.41	115.8	-2.47	115.9	-2.41	115.1	-3.03	115.5	-2.74	120.7	1.68	120.7	1.68
Kent 115 kV	118.9	115.5	-2.82	116.3	-2.19	115.3	-3.03	116.0	-2.41	116.0	-2.47	116.0	-2.41	115.3	-3.03	115.6	-2.74	120.9	1.68	120.9	1.68

Table 29: Voltage assessment results with all elements in-service for double contingencies – Scenario S2 (continued)

Tuble 251 younge	Pre-			30 DL2: tham D				30 DL21 tham D		Lauzo	n T1L7	BF: Z7E	+C23Z
Bus Name	Cont.	Pre-	ULTC	Post-	ULTC	Pre-L	JLTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	234.2	232.2	-0.84	232.6	-0.69	231.1	-1.34	231.5	-1.17	233.4	-0.36	233.7	-0.22
Malden C21J 230 kV	234.2	232.1	-0.89	232.4	-0.74					233.4	-0.34	233.7	-0.20
Malden C22J 230 kV	234.2	232.1	-0.89	232.5	-0.74	230.3	-1.68	230.8	-1.47	233.4	-0.34	233.7	-0.20
Leamington C21J 230 kV	235.2	232.1	-1.34	232.5	-1.15					234.9	-0.12	235.3	0.04
Leamington C22J 230 kV	235.2	232.1	-1.33	232.5	-1.15	226.8	-3.56	227.8	-3.16	235.0	-0.11	235.3	0.05
Lauzon C23Z 230 kV	229.9					227.0	-1.25	227.9	-0.88				
Lauzon C24Z 230 kV	229.5	218.3	-4.86	221.7	-3.39	226.8	-1.17	227.4	-0.89	219.0	-4.56	222.6	-3.01
Chatham 230 kV	241.9	237.6	-1.77	238.1	-1.57	237.1	-1.97	237.9	-1.66	242.5	0.24	242.9	0.42
Keith 115 kV	123.8	122.0	-1.43	122.4	-1.11	122.8	-0.75	123.0	-0.61	122.1	-1.39	122.5	-1.05
Crawford J3E 115 kV	121.9	119.5	-2.02	120.0	-1.56	120.9	-0.84	121.1	-0.67	119.4	-2.07	120.0	-1.57
Crawford J4E 115 kV	122.1	119.7	-2.01	120.2	-1.55	121.1	-0.84	121.3	-0.67	119.6	-2.07	120.2	-1.57
Essex 115 kV	120.9	117.8	-2.59	118.5	-2.00	119.8	-0.90	120.0	-0.71	117.6	-2.74	118.4	-2.10
Windsor Transalta 115 kV	120.9	117.8	-2.59	118.5	-2.00	119.8	-0.90	120.1	-0.71	117.6	-2.79	118.3	-2.13
Walker Z1E 115 kV	120.8	117.6	-2.66	118.4	-2.05	119.7	-0.91	120.0	-0.71	117.2	-3.00	118.0	-2.32
Walker Z7E 115 kV	120.8	117.6	-2.66	118.3	-2.06	119.7	-0.92	119.9	-0.72				
Ford Essex Z1E 115 kV	121.0	117.2	-3.15	118.1	-2.43	119.8	-0.99	120.1	-0.77	116.7	-3.58	117.7	-2.71
Ford Essex Z7E 115 kV	121.0	117.2	-3.15	118.0	-2.43	119.8	-1.00	120.1	-0.77				
Lauzon 115 kV	121.1	117.0	-3.36	117.9	-2.60	119.8	-1.03	120.1	-0.79	116.4	-3.83	117.6	-2.88
Bell River K2Z 115 kV	120.5	116.4	-3.44	117.3	-2.62	119.2	-1.05	119.5	-0.80	115.8	-3.92	117.0	-2.90
Bell River K6Z 115 kV	119.4	115.2	-3.53	116.2	-2.68	118.1	-1.08	118.4	-0.82	114.6	-4.03	115.9	-2.96
Kingsville K2Z 115 kV	118.6	115.2	-2.85	116.0	-2.20	117.5	-0.87	117.8	-0.67	114.7	-3.24	115.7	-2.43
Kingsville K6Z 115 kV	116.9	112.7	-3.62	113.7	-2.75	115.7	-1.11	116.0	-0.83	112.1	-4.13	113.4	-3.02
Tilbury West 115 kV	118.7	115.0	-3.13	115.9	-2.42	117.6	-0.96	117.9	-0.74	114.5	-3.57	115.6	-2.68
Kent 115 kV	118.9	115.2	-3.13	116.0	-2.41	117.8	-0.96	118.0	-0.74	114.7	-3.56	115.7	-2.67

Table 30: Voltage assessment results under outage conditions – Scenario S1

Table 50: Voltage	KEITH A Bus O/S			us + C2				+ Keith H		J3E O/S		J3E -	+ C24Z		C21J Chatham end open			n end o 21J IBO	•
Bus Name	Pre- Cont.	Pre-l	JLTC	Post-	ULTC	Pre-l	JLTC	Post-	ULTC	Pre- Cont.	Pre-l	JLTC	Post-	ULTC	Pre- Cont.	Post-	ULTC	Pre-l	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	234.6	234.2	-0.20	234.3	-0.13					235.3	234.5	-0.31	235.0	-0.12	234.3	234.0	-0.15	234.0	-0.15
Malden C21J 230 kV	240.1	240.8	0.26	241.1	0.39	231.2	-3.71	232.9	-2.99	235.3	234.6	-0.29	235.1	-0.10	234.2	234.0	-0.09	234.0	-0.07
Malden C22J 230 kV	234.7	234.2	-0.18	234.4	-0.10					235.4	234.7	-0.29	235.1	-0.10	234.5	233.9	-0.25	233.9	-0.25
Leamington C21J 230 kV	241.0	241.8	0.30	242.1	0.42	235.1	-2.45	236.2	-2.00	237.7	237.6	-0.05	238.1	0.17	234.2	234.6	0.15	234.6	0.17
Leamington C22J 230 kV	237.4	237.5	0.05	237.7	0.16					237.8	237.7	-0.04	238.2	0.17	237.4	236.4	-0.42	236.4	-0.42
Lauzon C23Z 230 kV	231.9					231.5	-0.17	231.6	-0.13	230.6	220.2	-4.51	224.3	-2.74	232.3	232.2	-0.06	232.2	-0.06
Lauzon C24Z 230 kV	231.4	222.8	-3.69	225.4	-2.59	230.8	-0.24	230.9	-0.20	230.1					231.8	231.7	-0.05	231.7	-0.05
Chatham 230 kV	243.3	244.3	0.39	244.6	0.52	243.9	0.24	244.1	0.32	242.6	243.4	0.31	244.0	0.55	243.7	243.5	-0.05	243.5	-0.05
Keith 115 kV	123.5	122.1	-1.19	122.4	-0.91	122.9	-0.54	122.9	-0.53	124.2	122.8	-1.11	123.4	-0.62	123.9	123.8	-0.07	123.8	-0.07
Crawford J3E 115 kV	122.2	120.1	-1.69	120.6	-1.29	121.7	-0.35	121.8	-0.33						122.5	122.4	-0.07	122.4	-0.07
Crawford J4E 115 kV	122.4	120.3	-1.68	120.8	-1.29	121.9	-0.35	122.0	-0.33	121.8	119.0	-2.26	120.1	-1.32	122.7	122.6	-0.07	122.6	-0.07
Essex 115 kV	121.6	119.0	-2.16	119.6	-1.67	121.4	-0.18	121.4	-0.16	120.8	117.1	-3.07	118.5	-1.95	121.9	121.8	-0.07	121.8	-0.07
Windsor Transalta 115 kV	121.7	119.0	-2.16	119.6	-1.67	121.4	-0.18	121.5	-0.15	120.9	117.2	-3.07	118.5	-1.95	121.9	121.8	-0.07	121.8	-0.07
Walker Z1E 115 kV	121.6	118.9	-2.22	119.5	-1.71	121.4	-0.17	121.4	-0.15	120.8	117.0	-3.13	118.4	-1.99	121.9	121.8	-0.07	121.8	-0.07
Walker Z7E 115 kV	121.6	118.9	-2.22	119.5	-1.72	121.3	-0.18	121.4	-0.15	120.8	117.0	-3.13	118.4	-1.99	121.8	121.7	-0.07	121.7	-0.07
Ford Essex Z1E 115 kV	122.1	118.9	-2.62	119.7	-2.03	122.0	-0.13	122.0	-0.10	121.4	117.1	-3.52	118.6	-2.27	122.4	122.3	-0.07	122.3	-0.07
Ford Essex Z7E 115 kV	122.1	118.9	-2.62	119.7	-2.03	122.0	-0.13	122.0	-0.10	121.4	117.1	-3.52	118.6	-2.27	122.4	122.3	-0.07	122.3	-0.07
Lauzon 115 kV	122.4	119.0	-2.80	119.7	-2.17	122.3	-0.11	122.3	-0.08	121.7	117.2	-3.69	118.8	-2.40	122.6	122.5	-0.07	122.5	-0.07
Bell River K2Z 115 kV	121.8	118.3	-2.88	119.1	-2.21	121.6	-0.11	121.7	-0.08	121.0	116.4	-3.80	118.1	-2.43	122.0	121.9	-0.07	121.9	-0.07
Bell River K6Z 115 kV	120.6	116.9	-3.05	117.8	-2.31	120.4	-0.12	120.5	-0.08	119.8	114.9	-4.05	116.8	-2.53	120.8	120.7	-0.08	120.7	-0.08
Kingsville K2Z 115 kV	118.6	115.3	-2.74	116.2	-2.00	118.5	-0.10	118.5	-0.07	117.9	113.6	-3.64	115.7	-1.86	118.8	118.7	-0.07	118.7	-0.07
Kingsville K6Z 115 kV	116.9	112.9	-3.42	114.0	-2.49	116.8	-0.13	116.8	-0.09	116.1	110.8	-4.55	112.9	-2.74	117.2	117.1	-0.09	117.1	-0.09
Tilbury West 115 kV	119.5	116.2	-2.76	117.0	-2.09	119.3	-0.11	119.4	-0.07	118.8	114.4	-3.66	116.2	-2.16	119.7	119.6	-0.07	119.6	-0.07
Kent 115 kV	119.6	116.3	-2.76	117.1	-2.09	119.5	-0.11	119.5	-0.07	118.9	114.6	-3.66	116.4	-2.16	119.9	119.8	-0.07	119.8	-0.07

Table 31: Voltage assessment results under outage conditions – Scenario S2

Table 31. Voltage	KEITH A Bus O/S			us + C2				+ Keith H		J3E O/S		J3E -	+ C24Z		C21J Chatham end open			n end o	•
Bus Name	Pre- Cont.	Pre-L	JLTC	Post-	ULTC	* Pre-	ULTC	Post-I	JLTC	Pre- Cont.	Pre-l	JLTC	Post-	ULTC	Pre- Cont.	Post-	ULTC	Pre-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	233.7	233.2	-0.20	233.4	-0.12					234.3	233.5	-0.34	234.1	-0.11	233.1	232.4	-0.29	232.6	-0.21
Malden C21J 230 kV	237.3	238.0	0.29	238.3	0.42	227.1	-4.30	224.3	-5.47	234.3	233.5	-0.32	234.1	-0.09	232.7	223.8	-3.85	225.7	-3.01
Malden C22J 230 kV	233.5	233.1	-0.18	233.3	-0.10					234.3	233.6	-0.32	234.1	-0.09	233.1	231.9	-0.51	232.2	-0.41
Leamington C21J 230 kV	237.5	238.2	0.33	238.6	0.46	228.8	-3.65	226.1	-4.80	235.1	234.9	-0.09	235.5	0.18	230.5	223.4	-3.12	225.2	-2.31
Leamington C22J 230 kV	234.3	234.5	0.05	234.7	0.16					235.1	234.9	-0.09	235.6	0.19	234.6	231.7	-1.22	232.1	-1.05
Lauzon C23Z 230 kV	229.6					229.3	-0.13	229.1	-0.21	228.3	217.0	-4.96	221.9	-2.83	230.2	229.8	-0.14	229.9	-0.11
Lauzon C24Z 230 kV	229.2	220.6	-3.77	223.2	-2.63	228.8	-0.19	228.6	-0.26	227.9					229.8	229.5	-0.13	229.5	-0.10
Chatham 230 kV	242.1	243.1	0.42	243.4	0.55	242.4	0.13	241.9	-0.10	241.6	242.3	0.29	243.1	0.60	242.8	242.4	-0.17	242.5	-0.14
Keith 115 kV	123.3	121.8	-1.22	122.1	-0.95	122.7	-0.50	122.6	-0.52	124.1	122.6	-1.24	123.3	-0.65	123.6	123.4	-0.14	123.5	-0.10
Crawford J3E 115 kV	121.5	119.4	-1.72	119.9	-1.35	121.1	-0.34	121.1	-0.36						121.8	121.6	-0.14	121.7	-0.11
Crawford J4E 115 kV	121.7	119.6	-1.72	120.1	-1.35	121.3	-0.34	121.3	-0.36	121.1	118.1	-2.49	119.4	-1.38	122.0	121.8	-0.14	121.9	-0.11
Essex 115 kV	120.5	117.9	-2.21	118.4	-1.74	120.3	-0.18	120.3	-0.22	119.5	115.4	-3.44	117.1	-2.09	120.8	120.6	-0.14	120.7	-0.11
Windsor Transalta 115 kV	120.6	117.9	-2.22	118.5	-1.74	120.3	-0.18	120.3	-0.21	119.6	115.5	-3.45	117.1	-2.09	120.8	120.7	-0.14	120.7	-0.11
Walker Z1E 115 kV	120.5	117.7	-2.27	118.3	-1.79	120.3	-0.18	120.2	-0.21	119.5	115.3	-3.51	117.0	-2.13	120.7	120.6	-0.14	120.6	-0.11
Walker Z7E 115 kV	120.4	117.7	-2.28	118.2	-1.80	120.2	-0.18	120.2	-0.21	119.5	115.3	-3.51	116.9	-2.14	120.7	120.5	-0.14	120.5	-0.11
Ford Essex Z1E 115 kV	120.7	117.4	-2.69	118.1	-2.13	120.5	-0.13	120.5	-0.17	119.8	115.1	-3.94	116.8	-2.46	120.9	120.8	-0.15	120.8	-0.12
Ford Essex Z7E 115 kV	120.6	117.4	-2.69	118.1	-2.13	120.5	-0.13	120.4	-0.17	119.8	115.1	-3.94	116.8	-2.46	120.9	120.7	-0.15	120.8	-0.12
Lauzon 115 kV	120.8	117.3	-2.88	118.0	-2.28	120.6	-0.11	120.6	-0.15	119.9	115.0	-4.13	116.8	-2.61	121.0	120.9	-0.15	120.9	-0.12
Bell River K2Z 115 kV	120.2	116.6	-2.95	117.4	-2.31	120.0	-0.11	120.0	-0.14	119.3	114.3	-4.24	116.2	-2.62	120.5	120.3	-0.15	120.3	-0.12
Bell River K6Z 115 kV	119.1	115.5	-3.03	116.2	-2.42	119.0	-0.11	118.9	-0.14	118.3	113.1	-4.36	115.1	-2.68	119.4	119.2	-0.15	119.2	-0.12
Kingsville K2Z 115 kV	118.3	115.4	-2.44	116.2	-1.79	118.2	-0.09	118.2	-0.12	117.6	113.5	-3.49	115.0	-2.20	118.5	118.4	-0.12	118.4	-0.10
Kingsville K6Z 115 kV	116.6	113.0	-3.10	113.6	-2.60	116.5	-0.11	116.4	-0.15	115.8	110.6	-4.48	112.6	-2.74	116.9	116.7	-0.16	116.8	-0.13
Tilbury West 115 kV	118.4	115.3	-2.68	116.0	-2.06	118.3	-0.10	118.3	-0.14	117.7	113.2	-3.84	114.8	-2.42	118.7	118.5	-0.14	118.6	-0.11
Kent 115 kV	118.6	115.4	-2.68	116.2	-2.06	118.5	-0.10	118.4	-0.14	117.8	113.3	-3.84	115.0	-2.42	118.8	118.7	-0.14	118.7	-0.11

^{*} Learnington and Malden load was converted for this contingency Pre-ULTC

Table 32: Voltage assessment results with all elements in-service for single contingencies – Scenario S3

Table 32: Voltag	Pre-		C2				C2				JS	<u> </u>		9		BE			Z	7E			Keith	A Bus	
Bus Name	Cont.	Pre-	ULTC	Post-	ULTC	Pre-U	ILTC	Post-l	JLTC	Pre-	ULTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC	Pre-U	ILTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	232.1	230.1	-0.83	230.3	-0.77	230.0	-0.87	230.7	-0.57	238.2	2.63	237.8	2.48	231.8	-0.11	232.0	-0.04	231.7	-0.16	231.7	-0.14	232.1	0.00	232.1	0.00
Malden C21J 230 kV	232.3					230.3	-0.87	231.0	-0.57	238.5	2.67	238.2	2.50	232.1	-0.12	232.2	-0.05	232.0	-0.16	232.0	-0.14	237.2	2.08	237.2	2.08
Malden C22J 230 kV	232.3	229.9	-1.02	230.1	-0.94	230.2	-0.88	230.9	-0.58	238.5	2.69	238.1	2.52	232.0	-0.12	232.2	-0.05	231.9	-0.16	231.9	-0.14	232.4	0.06	232.4	0.06
Leamington C21J 230 kV	236.1					234.1	-0.83	234.9	-0.50	242.5	2.73	242.1	2.58	235.6	-0.19	235.8	-0.12	235.7	-0.14	235.8	-0.12	239.3	1.35	239.3	1.36
Leamington C22J 230 kV	235.8	233.1	-1.17	233.2	-1.11	233.8	-0.85	234.6	-0.51	242.4	2.80	242.0	2.64	235.4	-0.19	235.5	-0.12	235.5	-0.14	235.5	-0.12	236.5	0.28	236.5	0.28
Lauzon C23Z 230 kV	230.6	230.0	-0.23	230.1	-0.21					236.1	2.41	235.4	2.11	228.2	-1.00	228.7	-0.81	230.0	-0.25	230.1	-0.19	230.8	0.12	230.8	0.12
Lauzon C24Z 230 kV	230.3	229.7	-0.26	229.8	-0.24	216.1	-6.20	220.4	-4.30	236.0	2.46	235.3	2.16	228.0	-1.01	228.5	-0.82	229.8	-0.25	229.9	-0.19	230.6	0.11	230.6	0.11
Chatham 230 kV	243.4	244.5	0.45	244.6	0.47	242.2	-0.49	243.1	-0.13	248.6	2.13	248.3	1.98	242.7	-0.30	242.9	-0.23	243.2	-0.10	243.2	-0.08	244.4	0.41	244.4	0.41
Keith 115 kV	123.9	123.4	-0.41	123.4	-0.38	121.8	-1.70	122.5	-1.12	125.8	1.52	125.6	1.37	123.8	-0.13	123.9	0.02	123.4	-0.41	123.5	-0.36	123.8	-0.09	123.8	-0.09
Crawford J3E 115 kV	122.7	122.2	-0.34	122.3	-0.31	119.6	-2.52	120.6	-1.71	124.6	1.56	124.3	1.38					121.9	-0.59	122.0	-0.52	122.6	-0.04	122.6	-0.04
Crawford J4E 115 kV	122.9	122.5	-0.33	122.5	-0.31	119.8	-2.52	120.8	-1.71	124.8	1.56	124.6	1.37	121.5	-1.19	121.8	-0.90	122.2	-0.59	122.3	-0.52	122.9	-0.04	122.9	-0.04
Essex 115 kV	122.2	121.9	-0.26	121.9	-0.24	118.2	-3.30	119.4	-2.27	124.2	1.61	123.9	1.39	120.7	-1.25	121.0	-1.00	121.3	-0.77	121.4	-0.68	122.2	0.01	122.2	0.02
Windsor Transalta 115 kV	122.3	121.9	-0.26	122.0	-0.23	118.2	-3.32	119.5	-2.28	124.2	1.60	123.9	1.38	120.7	-1.25	121.0	-1.00	121.3	-0.79	121.4	-0.70	122.3	0.01	122.3	0.02
Walker Z1E 115 kV	122.2	121.9	-0.26	121.9	-0.23	118.1	-3.39	119.3	-2.33	124.2	1.63	123.9	1.40	120.7	-1.25	121.0	-1.00	121.1	-0.89	121.2	-0.79	122.2	0.02	122.2	0.02
Walker Z7E 115 kV	122.1	121.8	-0.26	121.8	-0.24	118.0	-3.39	119.3	-2.33	124.1	1.63	123.8	1.41	120.6	-1.25	120.9	-1.00					122.1	0.02	122.1	0.02
Ford Essex Z1E 115 kV	122.6	122.3	-0.24	122.3	-0.22	117.8	-3.94	119.2	-2.73	124.8	1.78	124.5	1.53	121.1	-1.21	121.4	-0.97	122.0	-0.49	122.1	-0.40	122.6	0.04	122.6	0.05
Ford Essex Z7E 115 kV	122.6	122.3	-0.24	122.3	-0.22	117.7	-3.94	119.2	-2.73	124.8	1.79	124.4	1.53	121.1	-1.21	121.4	-0.97					122.6	0.04	122.6	0.05
Lauzon 115 kV	122.8	122.5	-0.24	122.5	-0.21	117.6	-4.18	119.2	-2.90	125.1	1.85	124.7	1.59	121.3	-1.20	121.6	-0.96	122.4	-0.31	122.5	-0.23	122.8	0.06	122.8	0.06
Bell River K2Z 115 kV	122.1	121.8	-0.24	121.9	-0.22	116.8	-4.32	118.5	-2.95	124.5	1.91	124.1	1.62	120.6	-1.24	120.9	-0.98	121.7	-0.32	121.8	-0.23	122.2	0.06	122.2	0.06
Bell River K6Z 115 kV	121.1	120.8	-0.26	120.8	-0.23	115.5	-4.61	117.5	-3.02	123.6	2.03	123.2	1.68	119.5	-1.32	120.0	-0.96	120.7	-0.34	120.8	-0.25	121.2	0.06	121.2	0.06
Kingsville K2Z 115 kV	117.3	116.9	-0.30	116.9	-0.27	111.0	-5.36	113.5	-3.25	120.0	2.34	119.4	1.85	115.5	-1.52	115.6	-1.38	116.8	-0.39	116.9	-0.29	117.3	0.07	117.3	0.07
Kingsville K6Z 115 kV	117.3	116.9	-0.31	116.9	-0.27	110.9	-5.43	113.4	-3.27	120.0	2.37	119.4	1.86	115.5	-1.54	116.2	-0.94	116.8	-0.40	116.9	-0.29	117.4	0.07	117.4	0.07
Tilbury West 115 kV	118.8	118.5	-0.28	118.5	-0.25	113.0	-4.88	115.0	-3.17	121.3	2.14	120.9	1.76	117.1	-1.39	117.4	-1.18	118.4	-0.36	118.5	-0.26	118.9	0.06	118.9	0.07
Kent 115 kV	119.0	118.6	-0.27	118.7	-0.25	113.2	-4.87	115.2	-3.16	121.5	2.14	121.0	1.76	117.3	-1.39	117.5	-1.18	118.5	-0.36	118.6	-0.26	119.0	0.06	119.0	0.07

Table 33: Voltage assessment results with all elements in-service for single contingencies – Scenario S4

Table 33. Voltag	Pre-			1J				3Z			J5	<u> </u>				BE			Z	7E			Keith	A Bus	
Bus Name	Cont.	Pre-	ULTC	Post-	ULTC	Pre-U	ILTC	Post-l	JLTC	Pre-	JLTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC	Pre-l	ULTC	Post-	ULTC	Pre-L	JLTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	231.3	229.0	-0.99	229.2	-0.88	229.6	-0.73	230.2	-0.47	237.0	2.49	236.9	2.42	231.1	-0.07	231.3	0.00	230.9	-0.18	230.9	-0.15	231.4	0.05	231.4	0.06
Malden C21J 230 kV	231.4					229.7	-0.73	230.4	-0.46	237.3	2.53	237.1	2.45	231.2	-0.08	231.4	-0.01	231.0	-0.18	231.1	-0.16	234.3	1.23	234.3	1.23
Malden C22J 230 kV	231.4	228.4	-1.26	228.7	-1.13	229.7	-0.74	230.3	-0.47	237.2	2.54	237.1	2.47	231.2	-0.08	231.3	-0.01	230.9	-0.18	231.0	-0.16	231.6	0.09	231.6	0.10
Leamington C21J 230 kV	233.5					231.9	-0.68	232.6	-0.36	239.7	2.68	239.6	2.61	233.1	-0.18	233.2		233.1	-0.18	233.1	-0.16	235.5	0.87	235.5	0.87
Leamington C22J 230 kV	233.2	227.2			-2.34	231.6	-0.69	232.3	-0.37	239.6	2.74	239.4	2.67	232.8	-0.18	232.9	-0.11	232.8	-0.18	232.8	-0.16	233.8	0.25	233.8	0.25
Lauzon C23Z 230 kV	228.7	227.8	-0.37	228.0	-0.31					233.9	2.26	233.6	2.14	226.1	-1.14	226.5	-0.96	227.6	-0.48	227.8	-0.40	229.0	0.15	229.0	0.15
Lauzon C24Z 230 kV	228.5	227.6	-0.39	227.7	-0.34	215.2	-5.83	219.5	-3.95	233.8	2.31	233.5	2.19	225.9	-1.15	226.3	-0.96	227.4	-0.48	227.6	-0.40	228.8	0.14	228.8	0.15
Chatham 230 kV	242.3	243.0	0.30	243.2	0.35	241.5	-0.34	242.4	0.01	247.3	2.07	247.2	2.01	241.6	-0.32	241.7	-0.26	241.9	-0.16	242.0	-0.14	243.1	0.33	243.1	0.33
Keith 115 kV	123.9	123.2	-0.52	123.3	-0.47	122.0	-1.52	122.6	-1.03	125.7	1.46	125.6	1.40	123.9	0.02	124.1	0.18	123.4	-0.40	123.4	-0.34	123.8	-0.01	123.8	-0.01
Crawford J3E 115 kV	122.2	121.6	-0.46	121.7	-0.41	119.4	-2.28	120.2	-1.60	124.0	1.49	123.9	1.39					121.5	-0.58	121.6	-0.50	122.2	0.02	122.2	0.02
Crawford J4E 115 kV	122.4	121.9	-0.46	121.9	-0.41	119.7	-2.28	120.5	-1.60	124.3	1.48	124.2	1.43	120.9	-1.25	121.3	-0.96	121.7	-0.58	121.8	-0.49	122.5	0.02	122.5	0.02
Essex 115 kV	121.3	120.8	-0.39	120.9	-0.34	117.6	-3.03	118.7	-2.16	123.1	1.51	123.0	1.42	119.4	-1.53	119.7	-1.29	120.4	-0.76	120.5	-0.65	121.4	0.06	121.4	0.06
Windsor Transalta 115 kV	121.4	120.9	-0.39	120.9	-0.34	117.7	-3.04	118.7	-2.17	123.2	1.51	123.1	1.42	119.5	-1.53	119.8	-1.28	120.4	-0.79	120.5	-0.67	121.4	0.06	121.4	0.06
Walker Z1E 115 kV	121.3	120.8	-0.39	120.8	-0.34	117.5	-3.11	118.6	-2.22	123.1	1.53	123.0	1.44	119.4	-1.53	119.7	-1.28	120.2	-0.91	120.3	-0.79	121.3	0.06	121.3	0.06
Walker Z7E 115 kV	121.2	120.7	-0.39	120.8	-0.34	117.4	-3.11	118.5	-2.21	123.0	1.53	122.9	1.45	119.3	-1.53	119.6	-1.28					121.2	0.06	121.2	0.06
Ford Essex Z1E 115 kV	121.3	120.9	-0.37	121.0	-0.32	116.9	-3.63	118.2	-2.60	123.3	1.65	123.2	1.56	119.6	-1.46	119.9	-1.22	120.5	-0.71	120.6	-0.61	121.4	0.08	121.4	0.08
Ford Essex Z7E 115 kV	121.3	120.9	-0.37	120.9	-0.32	116.9	-3.63	118.2	-2.60	123.3	1.66	123.2	1.56	119.6	-1.46	119.8	-1.22					121.4	0.08	121.4	0.08
Lauzon 115 kV	121.4	120.9	-0.36	121.0	-0.31	116.7	-3.86	118.0	-2.77	123.5	1.71	123.3	1.61	119.7	-1.42	119.9	-1.19	120.6	-0.63	120.8	-0.52	121.5	0.09	121.5	0.09
Bell River K2Z 115 kV	120.8	120.3	-0.37	120.4	-0.32	116.0	-3.96	117.4	-2.80	122.9	1.75	122.8	1.63	119.0	-1.46	119.3	-1.21	120.0	-0.64	120.1	-0.54	120.9	0.09	120.9	0.09
Bell River K6Z 115 kV	120.0	119.5	-0.38	119.6	-0.33	115.2	-4.03	116.6	-2.85	122.1	1.78	122.0	1.66	118.2	-1.49	118.5	-1.23	119.2	-0.65	119.3	-0.55	120.1	0.09	120.1	0.10
Kingsville K2Z 115 kV	117.3	116.8	-0.40	116.9	-0.34	112.3	-4.23	113.7	-3.03	119.5	1.87	119.3	1.75	115.4	-1.56	115.7	-1.30	116.5	-0.68	116.6	-0.57	117.4	0.10	117.4	0.10
Kingsville K6Z 115 kV	117.4	116.9	-0.40	117.0	-0.34	112.4	-4.24	113.8	-3.01	119.6	1.87	119.4	1.75	115.6	-1.56	115.9	-1.30	116.6	-0.69	116.7	-0.57	117.5	0.10	117.5	0.10
Tilbury West 115 kV	118.1	117.6	-0.39	117.7	-0.34	113.2	-4.16	114.6	-2.99	120.3	1.84	120.1	1.73	116.3	-1.53	116.6	-1.28	117.3	-0.67	117.4	-0.56	118.2	0.10	118.2	0.10
Kent 115 kV	118.3	117.8	-0.39	117.9	-0.34	113.3	-4.16	114.7	-2.99	120.4	1.84	120.3	1.73	116.4	-1.53	116.7	-1.28	117.5	-0.67	117.6	-0.56	118.4	0.10	118.4	0.10

Table 34: Voltage assessment results with all elements in-service for double contingencies – Scenario S3

Bus Name	Pre- Cont.			+C23Z				-C24Z				+C24Z				+J4E		* Z1E capaci	tor sw	- (Kings vitching os. out	g with
bus ivallie		Pre-l	JLTC	Post-	ULTC	Pre-L	ILTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC	Pre-	ULTC	Post-	ULTC	Pre-L	ILTC	Post-	-ULTC
	kV	kV	%	kV	%	kV	%														
Keith 230 kV	232.1	227.8	-1.85	228.9	-1.37	228.4	-1.56	229.4	-1.15	230.5	-0.67	230.6	-0.63	232.5	0.18	232.6	0.25	231.9	-0.06	231.9	-0.06
Malden C21J 230 kV	232.3					228.1	-1.81	229.2	-1.36	230.9	-0.62	231.0	-0.59	232.7	0.14	232.8	0.22	232.2	-0.04	232.2	-0.04
Malden C22J 230 kV	232.3	227.4	-2.09	228.6	-1.58					230.8	-0.63	230.9	-0.60	232.6	0.15	232.8	0.23	232.2	-0.04	232.2	-0.04
Leamington C21J 230 kV	236.1					230.8	-2.22	232.0	-1.72	236.2	0.06	236.2	0.07	235.4	-0.28	235.8	-0.13	236.3	0.12	236.3	0.11
Leamington C22J 230 kV	235.8	230.4	-2.31	231.6	-1.77					235.8	0.02	235.9	0.03	235.2	-0.26	235.6	-0.11	236.1	0.12	236.1	0.12
Lauzon C23Z 230 kV	230.6					213.5	-7.41	219.5	-4.81					221.0	-4.13	222.9	-3.33	229.3	-0.56	229.1	-0.62
Lauzon C24Z 230 kV	230.3	213.3	-7.42	219.3	-4.81									220.7	-4.19	222.6	-3.38	233.1	1.18	233.1	1.21
Chatham 230 kV	243.4	243.3	-0.06	244.6	0.46	242.2	-0.49	243.5	0.03	247.5	1.69	247.5	1.68	240.8	-1.07	241.4	-0.84	244.0	0.22	244.0	0.22
Keith 115 kV	123.9	120.9	-2.40	122.0	-1.52	120.7	-2.63	121.9	-1.63	122.3	-1.34	122.4	-1.21	125.5	1.26	125.5	1.30	123.6	-0.27	123.6	-0.26
Crawford J3E 115 kV	122.7	118.7	-3.25	120.1	-2.07	118.5	-3.43	120.0	-2.14	120.1	-2.10	120.3	-1.89					122.3	-0.29	122.3	-0.28
Crawford J4E 115 kV	122.9	118.9	-3.25	120.4	-2.07	118.7	-3.43	120.3	-2.14	120.3	-2.10	120.5	-1.93					122.6	-0.29	122.6	-0.28
Essex 115 kV	122.2	117.2	-4.06	119.0	-2.60	117.1	-4.19	119.0	-2.64	118.8	-2.76	119.1	-2.52	116.3	-4.80	117.4	-3.89	121.8	-0.32	121.8	-0.31
Windsor Transalta 115 kV	122.3	117.3	-4.08	119.1	-2.61	117.1	-4.21	119.0	-2.65	118.9	-2.78	119.2	-2.53	116.4	-4.79	117.5	-3.89				
Walker Z1E 115 kV	122.2	117.1	-4.15	118.9	-2.66	117.0	-4.28	118.9	-2.70	118.7	-2.83	119.0	-2.58	116.3	-4.80	117.4	-3.89				
Walker Z7E 115 kV	122.1	117.0	-4.15	118.9	-2.65	116.9	-4.28	118.8	-2.70	118.7	-2.83	119.0	-2.58	116.3	-4.80	117.4	-3.89				
Ford Essex Z1E 115 kV	122.6	116.8	-4.76	118.8	-3.06	116.6	-4.87	118.8	-3.09	118.6	-3.25	119.0	-2.97	116.8	-4.73	117.9	-3.79				
Ford Essex Z7E 115 kV	122.6	116.7	-4.76	118.8	-3.06	116.6	-4.87	118.8	-3.09	118.6	-3.25	118.9	-2.97	116.8	-4.73	117.9	-3.79				
Lauzon 115 kV	122.8	116.6	-5.03	118.8	-3.24	116.5	-5.13	118.8	-3.26	118.6	-3.43	118.9	-3.13	117.0	-4.69	118.2	-3.75	125.0	1.80	125.1	1.86
Bell River K2Z 115 kV	122.1	115.8	-5.20	118.1	-3.29	115.7	-5.30	118.1	-3.31	117.8	-3.54	118.2	-3.19	116.2	-4.84	117.5	-3.82	123.9	1.42	123.9	1.46
Bell River K6Z 115 kV	121.1	114.4	-5.56	117.0	-3.39	114.3	-5.67	117.0	-3.41	116.5	-3.78	117.1	-3.33	114.9	-5.18	116.3	-3.96	117.8	-2.78	117.6	-2.91
Kingsville K2Z 115 kV	117.3	109.7	-6.48	112.9	-3.68	109.5	-6.60	112.9	-3.71	112.1	-4.39	112.9	-3.70	110.2	-6.02	112.2	-4.34	112.9	-3.68	113.2	-3.45
Kingsville K6Z 115 kV	117.3	109.6	-6.56	112.9	-3.69	109.4	-6.69	112.9	-3.72	112.1	-4.44	112.9	-3.72	110.1	-6.10	112.1	-4.38	109.9	-6.25	109.6	-6.52
Tilbury West 115 kV	118.8	111.8	-5.88	114.6	-3.56	111.7	-5.99	114.5	-3.59	114.1	-3.99	114.6	-3.51	112.3	-5.47	113.9	-4.16	118.1	-0.59	118.3	-0.45
Kent 115 kV	119.0	112.0	-5.88	114.7	-3.56	111.8	-5.99	114.7	-3.58	114.2	-3.99	114.8	-3.50	112.4	-5.47	114.0	-4.16	118.2	-0.59	118.4	-0.45

^{*} Control Actions shown in brackets

Table 34: Voltage assessment results with all elements in-service for double contingencies – Scenario S3 (continued)

Table 34: Voltag	Pre-	Chat	tham 2	30 DL23	BF:	Chat	ham 2	30 DL21 :ham D I	BF:	L	auzon	T2K BF	:		auzon	T1L7 BI	
Bus Name	Cont.	1 Pre-	-ULTC	Post-	ULTC	Pre-U	ILTC	Post-I	JLTC	² Pre-	ULTC	Post-	ULTC	1 Pre-	-ULTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	232.1	227.7	-1.89	228.5	-1.52	228.3	-1.63	228.5	-1.52	229.6	-1.06	229.7	-1.02	229.7	-1.02	230.4	-0.73
Malden C21J 230 kV	232.3	227.7	-1.99	228.6	-1.62					229.9	-1.06	229.9	-1.03	230.0	-1.02	230.6	-0.73
Malden C22J 230 kV	232.3	227.6	-1.99	228.5	-1.62	227.7	-1.95	228.1	-1.81	229.8	-1.06	229.9	-1.03	229.9	-1.03	230.5	-0.74
Leamington C21J 230 kV	236.1	229.7	-2.71	230.6	-2.30					233.8	-0.97	233.7	-0.99	233.8	-0.97	234.5	-0.64
Leamington C22J 230 kV	235.8	229.4	-2.73	230.3	-2.32	228.6	-3.06	228.9	-2.93	233.5	-0.99	233.4	-1.01	233.5	-0.98	234.3	-0.66
Lauzon C23Z 230 kV	230.6					224.7	-2.55	225.2	-2.32	218.0	-5.45	217.4	-5.68				
Lauzon C24Z 230 kV	230.3	211.5	-8.20	216.8	-5.89	224.4	-2.58	224.9	-2.35					214.4	-6.94	219.1	-4.87
Chatham 230 kV	243.4	235.5	-3.25	236.6	-2.81	237.3	-2.52	237.5	-2.42	242.0	-0.59	241.8	-0.66	241.9	-0.62	242.8	-0.26
Keith 115 kV	123.9	120.9	-2.46	121.7	-1.78	122.3	-1.28	122.5	-1.15	121.2	-2.18	121.4	-2.07	121.3	-2.07	122.0	-1.51
Crawford J3E 115 kV	122.7	118.5	-3.36	119.7	-2.45	120.9	-1.48	121.0	-1.32	118.8	-3.16	119.0	-3.00	118.9	-3.03	119.9	-2.27
Crawford J4E 115 kV	122.9	118.8	-3.36	119.9	-2.49	121.1	-1.47	121.3	-1.32	119.0	-3.16	119.2	-3.05	119.2	-3.02	120.1	-2.26
Essex 115 kV	122.2	117.0	-4.21	118.4	-3.13	120.2	-1.66	120.4	-1.48	117.2	-4.10	117.4	-3.96	117.4	-3.93	118.5	-2.99
Windsor Transalta 115 kV	122.3	117.1	-4.23	118.4	-3.15	120.2	-1.67	120.4	-1.48	117.2	-4.12	117.4	-3.98	117.4	-3.99	118.6	-3.03
Walker Z1E 115 kV	122.2	116.9	-4.31	118.3	-3.21	120.1	-1.70	120.4	-1.51	117.1	-4.21	117.2	-4.06	117.1	-4.21	118.3	-3.22
Walker Z7E 115 kV	122.1	116.8	-4.31	118.2	-3.20	120.0	-1.70	120.3	-1.50	117.0	-4.21	117.2	-4.06				
Ford Essex Z1E 115 kV	122.6	116.5	-4.93	118.1	-3.69	120.3	-1.89	120.5	-1.68	116.6	-4.89	116.8	-4.74	116.7	-4.78	118.2	-3.57
Ford Essex Z7E 115 kV	122.6	116.5	-4.93	118.0	-3.69	120.3	-1.89	120.5	-1.68	116.6	-4.89	116.8	-4.74				
Lauzon 115 kV	122.8	116.4	-5.21	118.0	-3.91	120.4	-1.97	120.6	-1.75	116.4	-5.19	116.6	-5.04	116.6	-5.03	118.2	-3.73
Bell River K2Z 115 kV	122.1	115.6	-5.33	117.3	-3.97	119.6	-2.04	119.9	-1.79	115.6	-5.36	115.9	-5.13	115.8	-5.15	117.5	-3.79
Bell River K6Z 115 kV	121.1	114.6	-5.36	116.2	-4.08	118.5	-2.17	118.9	-1.87	114.2	-5.73	114.7	-5.32	114.8	-5.18	116.4	-3.88
Kingsville K2Z 115 kV	117.3	110.9	-5.45	112.1	-4.39	114.3	-2.52	114.8	-2.08	109.4	-6.68	110.4	-5.86	111.1	-5.26	112.4	-4.16
Kingsville K6Z 115 kV	117.3	110.9	-5.46	112.1	-4.41	114.3	-2.55	114.8	-2.09	109.3	-6.76	110.4	-5.90	111.1	-5.28	112.4	-4.18
Tilbury West 115 kV	118.8	112.3	-5.50	113.7	-4.28	116.1	-2.29	116.5	-1.97	111.6	-6.06	112.1	-5.61	112.5	-5.32	114.0	-4.07
Kent 115 kV	119.0	112.4	-5.50	113.9	-4.27	116.2	-2.29	116.6	-1.96	111.7	-6.06	112.3	-5.60	112.6	-5.31	114.1	-4.06

¹⁾ Kingsville load was converted for this contingency Pre-ULTC

²⁾ Lauzon load was converted for this contingency Pre-ULTC

Table 35: Voltage assessment results with all elements in-service for double contingencies – Scenario S4

	Pre-		C21J+	+C23Z			C22J+	-C24Z			C23Z	+C24Z			J3E	+J4E			Z1E-	+ Z 7E	
Bus Name	Cont.	Pre-l	ULTC	Post-	ULTC	Pre-U	ILTC	Post-l	JLTC	Pre-	ULTC	Post-	ULTC	* Pre-	ULTC	Post-	ULTC	Pre-l	JLTC	Post-	ULTC
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	231.3	227.1	-1.82	228.1	-1.37	227.6	-1.57	228.5	-1.18	230.3	-0.42	230.3	-0.40	232.2	0.39	232.5	0.51	232.1	0.37	232.1	0.35
Malden C21J 230 kV	231.4					227.1	-1.89	228.1	-1.45	230.6	-0.36	230.6	-0.35	232.2	0.33	232.5	0.46	232.4	0.41	232.3	0.38
Malden C22J 230 kV	231.4	226.4	-2.13	227.6	-1.64					230.5	-0.37	230.5	-0.36	232.1	0.33	232.4	0.47	232.3	0.41	232.2	0.38
Leamington C21J 230 kV	233.5					225.6	-3.39	227.0	-2.78	234.3	0.34	234.3	0.34	232.9	-0.26	233.5	-0.01	235.1	0.67	234.9	0.62
Leamington C22J 230 kV	233.2	224.9	-3.53	226.5	-2.87					233.9	0.31	233.9	0.31	232.6	-0.24	233.2	0.00	234.8	0.67	234.6	0.62
Lauzon C23Z 230 kV	228.7					213.6	-6.61	218.5	-4.46					217.0	-5.12	219.8	-3.87	235.2	2.83	234.5	2.56
Lauzon C24Z 230 kV	228.5	212.6	-6.95	217.7	-4.72									216.7	-5.16	219.6	-3.91	234.2	2.49	233.6	2.21
Chatham 230 kV	242.3	242.3	-0.02	243.4	0.46	241.4	-0.37	242.6	0.09	246.9	1.87	246.8	1.86	239.4	-1.19	240.3	-0.84	244.6	0.95	244.4	0.87
Keith 115 kV	123.9	121.2	-2.16	121.9	-1.54	121.2	-2.14	122.0	-1.51	122.4	-1.15	122.5	-1.08	126.5	2.11	126.5	2.17	124.6	0.57	124.5	0.56
Crawford J3E 115 kV	122.2	118.6	-2.94	119.6	-2.09	118.7	-2.87	119.7	-2.03	119.9	-1.88	120.0	-1.78					123.2	0.84	123.2	0.84
Crawford J4E 115 kV	122.4	118.9	-2.93	119.9	-2.09	118.9	-2.86	120.0	-2.02	120.1	-1.88	120.3	-1.78					123.5	0.84	123.5	0.84
Essex 115 kV	121.3	116.8	-3.69	118.1	-2.63	117.0	-3.57	118.2	-2.53	118.2	-2.56	118.3	-2.44	113.0	-6.86	114.8	-5.36	122.6	1.10	122.6	1.11
Windsor Transalta 115 kV	121.4	116.8	-3.71	118.1	-2.65	117.0	-3.59	118.3	-2.54	118.2	-2.57	118.4	-2.45	113.0	-6.85	114.9	-5.35				
Walker Z1E 115 kV	121.3	116.7	-3.78	118.0	-2.69	116.8	-3.65	118.1	-2.59	118.1	-2.62	118.2	-2.50	113.0	-6.83	114.8	-5.33				
Walker Z7E 115 kV	121.2	116.6	-3.78	117.9	-2.69	116.7	-3.65	118.0	-2.59	118.0	-2.62	118.1	-2.50	112.9	-6.84	114.7	-5.33				
Ford Essex Z1E 115 kV	121.3	116.1	-4.34	117.6	-3.10	116.3	-4.18	117.7	-2.97	117.6	-3.06	117.8	-2.92	113.5	-6.50	115.2	-5.05				
Ford Essex Z7E 115 kV	121.3	116.1	-4.34	117.6	-3.10	116.2	-4.18	117.7	-2.97	117.6	-3.06	117.8	-2.92	113.4	-6.50	115.2	-5.05				
Lauzon 115 kV	121.4	115.8	-4.59	117.4	-3.29	116.0	-4.42	117.6	-3.14	117.4	-3.25	117.6	-3.11	113.7	-6.35	115.4	-4.92	124.7	2.71	124.3	2.40
Bell River K2Z 115 kV	120.8	115.1	-4.71	116.8	-3.33	115.3	-4.53	116.9	-3.18	116.8	-3.33	117.0	-3.15	112.9	-6.50	114.8	-4.98	124.2	2.84	123.8	2.52
Bell River K6Z 115 kV	120.0	114.2	-4.80	115.9	-3.39	114.5	-4.61	116.1	-3.24	115.9	-3.39	116.2	-3.21	112.2	-6.51	113.9	-5.07	124.0	3.34	123.6	3.02
Kingsville K2Z 115 kV	117.3	111.4	-5.04	113.0	-3.59	111.6	-4.84	113.2	-3.43	113.1	-3.56	113.3	-3.40	109.6	-6.54	110.9	-5.39	120.9	3.09	120.5	2.76
Kingsville K6Z 115 kV	117.4	111.5	-5.06	113.2	-3.58	111.7	-4.86	113.4	-3.42	113.2	-3.57	113.4	-3.38	109.7	-6.56	111.1	-5.36	121.4	3.41	121.0	3.07
Tilbury West 115 kV	118.1	112.2	-4.96	113.9	-3.54	112.5	-4.77	114.1	-3.38	114.0	-3.51	114.1	-3.35	110.2	-6.67	111.8	-5.31	121.6	2.97	121.2	2.64
Kent 115 kV	118.3	112.4	-4.96	114.1	-3.54	112.6	-4.77	114.3	-3.38	114.1	-3.50	114.3	-3.35	110.4	-6.66	112.0	-5.30	121.8	2.97	121.4	2.64

^{*} Kingsville load was converted for this contingency Pre-ULTC

Table 35: Voltage assessment results with all elements in-service for double contingencies – Scenario S4 (continued)

Table 33. Voltag	Pre-	Chat	ham 2	30 DL23	BF:	Chatham 230 DL21 BF: C21J + Chatham D Bus				Lauzon T1L7 BF: Z7E+C23Z				
Bus Name	Cont.	Pre-ULTC		Post-	ULTC	Pre-U	JLTC	Post-l	JLTC	Pre-	ULTC	Post-ULTC		
	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	
Keith 230 kV	231.3	227.0	-1.87	228.0	-1.44	227.1	-1.81	227.6	-1.59	228.9	-1.01	229.8	-0.64	
Malden C21J 230 kV	231.4	226.9	-1.97	227.9	-1.53					229.1	-1.02	230.0	-0.63	
Malden C22J 230 kV	231.4	226.8	-1.97	227.8	-1.53	226.3	-2.20	226.8	-1.95	229.0	-1.03	229.9	-0.64	
Leamington C21J 230 kV	233.5	227.1	-2.74	228.3	-2.23					231.2	-1.00	232.2	-0.54	
Leamington C22J 230 kV	233.2	226.8	-2.75	228.0	-2.24	222.6	-4.56	223.5	-4.17	230.8	-1.01	231.9	-0.55	
Lauzon C23Z 230 kV	228.7					222.8	-2.60	223.4	-2.32					
Lauzon C24Z 230 kV	228.5	209.3	-8.39	215.4	-5.73	222.5	-2.63	223.1	-2.35	211.4	-7.51	217.5	-4.80	
Chatham 230 kV	242.3	234.5	-3.24	235.8	-2.71	235.9	-2.66	236.3	-2.49	240.7	-0.67	241.9	-0.16	
Keith 115 kV	123.9	120.9	-2.42	121.7	-1.71	122.2	-1.35	122.4	-1.20	121.2	-2.10	122.1	-1.41	
Crawford J3E 115 kV	122.2	118.0	-3.40	119.3	-2.40	120.3	-1.54	120.5	-1.36	118.4	-3.12	119.6	-2.13	
Crawford J4E 115 kV	122.4	118.3	-3.39	119.5	-2.40	120.6	-1.54	120.8	-1.36	118.6	-3.12	119.8	-2.13	
Essex 115 kV	121.3	116.0	-4.33	117.6	-3.07	119.2	-1.71	119.5	-1.51	116.3	-4.11	117.8	-2.84	
Windsor Transalta 115 kV	121.4	116.1	-4.36	117.6	-3.09	119.3	-1.72	119.5	-1.52	116.3	-4.18	117.8	-2.90	
Walker Z1E 115 kV	121.3	115.9	-4.44	117.4	-3.15	119.1	-1.74	119.4	-1.54	115.9	-4.43	117.5	-3.11	
Walker Z7E 115 kV	121.2	115.8	-4.44	117.4	-3.15	119.1	-1.74	119.3	-1.54					
Ford Essex Z1E 115 kV	121.3	115.1	-5.11	116.9	-3.64	119.0	-1.92	119.3	-1.69	114.9	-5.33	116.9	-3.68	
Ford Essex Z7E 115 kV	121.3	115.1	-5.12	116.9	-3.64	119.0	-1.92	119.3	-1.69					
Lauzon 115 kV	121.4	114.8	-5.42	116.7	-3.86	119.0	-1.99	119.3	-1.76	114.4	-5.73	116.6	-3.94	
Bell River K2Z 115 kV	120.8	114.1	-5.56	116.1	-3.91	118.3	-2.04	118.6	-1.79	113.7	-5.88	116.0	-3.98	
Bell River K6Z 115 kV	120.0	113.2	-5.66	115.2	-3.98	117.5	-2.08	117.8	-1.82	112.8	-5.99	115.1	-4.06	
Kingsville K2Z 115 kV	117.3	110.3	-5.95	112.3	-4.23	114.7	-2.18	115.0	-1.93	109.9	-6.29	112.2	-4.31	
Kingsville K6Z 115 kV	117.4	110.4	-5.97	112.5	-4.20	114.8	-2.19	115.1	-1.92	110.0	-6.31	112.4	-4.28	
Tilbury West 115 kV	118.1	111.2	-5.85	113.2	-4.17	115.6	-2.15	115.9	-1.90	110.8	-6.19	113.1	-4.25	
Kent 115 kV	118.3	111.3	-5.85	113.3	-4.16	115.7	-2.15	116.0	-1.90	110.9	-6.19	113.2	-4.24	

Table 36: Voltage assessment results under outage conditions – Scenario S3

Table 30: Volta	KEITH A Bus O/S	KFITH Δ Rus + C237							C23Z		CHATHAM D Bus O/S			M D BU		C21J Chatham end open	Keith C211 IRO			
Bus Name	Pre- Cont.	Pre-l	JLTC	Post-ULTC		Pre- Cont.	* Pre-ULTC		Post-ULTC		Pre- Cont.	Pre-ULTC		Post-ULTC		Pre- Cont.	Post-ULTC		Pre-ULTC	
	kV	kV	%	kV	%	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	232.1	230.3	-0.78	231.0	-0.46	232.0	230.5	-0.63	230.5	-0.63	229.7	228.9	-0.36	229.2	-0.22	231.3	231.1	-0.09	231.1	-0.09
Malden C21J 230 kV	237.2	234.9	-0.95	236.1	-0.47	232.2	230.8	-0.63	230.7	-0.64	229.8	228.9	-0.36	229.3	-0.22	231.2	230.8	-0.21	230.7	-0.21
Malden C22J 230 kV	232.4	230.5	-0.81	231.3	-0.48	232.2	230.7	-0.63	230.7	-0.64	229.7	228.9	-0.36	229.2	-0.22	231.4	231.1	-0.13	231.1	-0.13
Leamington C21J 230 kV	239.3	237.2	-0.84	238.4	-0.37	235.8	234.6	-0.51	234.4	-0.59	231.8	230.8	-0.42	231.1	-0.30	232.0	231.5	-0.20	231.5	-0.20
Leamington C22J 230 kV	236.5	234.4	-0.88	235.4	-0.47	235.5	234.3	-0.52	234.1	-0.61	231.5	230.5	-0.42	230.8	-0.30	234.3	233.6	-0.31	233.6	-0.31
Lauzon C23Z 230 kV	230.8					228.7					225.9	216.7	-4.09	218.6	-3.24	230.5	230.4	-0.04	230.4	-0.04
Lauzon C24Z 230 kV	230.6	214.2	-7.10	219.8	-4.67	228.5	217.1	-4.99	215.5	-5.68	225.7	216.4	-4.12	218.3	-3.26	230.2	230.1	-0.04	230.1	-0.04
Chatham 230 kV	244.4	243.0	-0.58	244.2	-0.11	242.9	242.6	-0.11	242.2	-0.28	237.0					244.9	244.7	-0.07	244.7	-0.07
Keith 115 kV	123.8	121.1	-2.15	122.2	-1.29	123.9	122.3	-1.34	122.4	-1.22	122.9	121.3	-1.27	121.8	-0.91	123.7	123.6	-0.04	123.6	-0.04
Crawford J3E 115 kV	122.6	118.9	-3.03	120.3	-1.90						121.4	119.2	-1.80	119.8	-1.31	122.5	122.5	-0.04	122.5	-0.04
Crawford J4E 115 kV	122.9	119.2	-3.02	120.6	-1.90	121.8	118.5	-2.69	118.8	-2.46	121.6	119.5	-1.80	120.1	-1.31	122.8	122.7	-0.04	122.7	-0.04
Essex 115 kV	122.2	117.5	-3.86	119.2	-2.48	121.0	116.5	-3.69	116.6	-3.58	120.7	117.9	-2.33	118.6	-1.71	122.1	122.1	-0.04	122.1	-0.04
Windsor Transalta 115 kV	122.3	117.5	-3.88	119.2	-2.49	121.0	116.6	-3.70	116.7	-3.60	120.7	117.9	-2.35	118.7	-1.72	122.2	122.1	-0.04	122.1	-0.04
Walker Z1E 115 kV	122.2	117.4	-3.96	119.1	-2.54	121.0	116.4	-3.75	116.6	-3.65	120.7	117.8	-2.39	118.5	-1.76	122.1	122.1	-0.04	122.1	-0.04
Walker Z7E 115 kV	122.1	117.3	-3.96	119.0	-2.54	120.9	116.4	-3.75	116.5	-3.65	120.6	117.7	-2.39	118.5	-1.75	122.0	122.0	-0.04	122.0	-0.04
Ford Essex Z1E 115 kV	122.6	117.0	-4.56	119.0	-2.96	121.4	116.4	-4.14	116.4	-4.09	120.8	117.5	-2.79	118.3	-2.07	122.5	122.5	-0.04	122.5	-0.04
Ford Essex Z7E 115 kV	122.6	117.0	-4.57	119.0	-2.96	121.4	116.4	-4.14	116.4	-4.09	120.8	117.4	-2.79	118.3	-2.07	122.5	122.5	-0.04	122.5	-0.04
Lauzon 115 kV	122.8	116.9	-4.83	119.0	-3.14	121.6	116.4	-4.31	116.4	-4.28	120.9	117.3	-2.97	118.3	-2.20	122.7	122.7	-0.04	122.7	-0.04
Bell River K2Z 115 kV	122.2	116.1	-4.99	118.3	-3.20	120.9	115.5	-4.47	115.7	-4.34	120.2	116.5	-3.07	117.5	-2.24	122.1	122.0	-0.04	122.0	-0.04
Bell River K6Z 115 kV	121.2	114.7	-5.34	117.2	-3.29	120.0	114.1	-4.86	114.6	-4.49	119.2	115.2	-3.33	116.4	-2.31	121.1	121.0	-0.05	121.0	-0.05
Kingsville K2Z 115 kV	117.3	110.0	-6.22	113.2	-3.56	115.6	109.4	-5.43	110.0	-4.90	115.2	110.6	-3.99	112.3	-2.53	117.2	117.1	-0.05	117.1	-0.05
Kingsville K6Z 115 kV	117.4	110.0	-6.29	113.1	-3.58	116.2	109.3	-5.94	110.4	-4.94	115.2	110.5	-4.04	112.2	-2.54	117.2	117.2	-0.05	117.2	-0.05
Tilbury West 115 kV	118.9	112.2	-5.65	114.8	-3.45	117.4	111.5	-4.99	111.8	-4.73	116.8	112.7	-3.54	114.0	-2.44	118.8	118.7	-0.05	118.7	-0.05
Kent 115 kV	119.0	112.3	-5.64	114.9	-3.45	117.5	111.7	-4.99	112.0	-4.73	117.0	112.8	-3.54	114.1	-2.44	118.9	118.8	-0.05	118.8	-0.05

^{*} Lauzon load was converted for this contingency Pre-ULTC

Table 37: Voltage assessment results under outage conditions – Scenario S4

Table 37: Volta	KEITH A Bus + C23Z				J3E O/S			C23Z		CHATHAM D Bus O/S	CHATHAM D BUS + CHATHAM K BUS				C21J Chatham end open	am C21J Chatham end open				
Bus Name	Pre- Cont.	Pre-l	JLTC	Post-ULTC		Pre- Cont.	* Pre-ULTC		Post-ULTC		Pre- Cont.	Pre-ULTC		Post-ULTC		Pre- Cont.	Post-ULTC		Pre-ULTC	
	kV	kV	%	kV	%	kV	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%	kV	%
Keith 230 kV	231.4	230.1	-0.58	230.6	-0.35	231.3	230.2	-0.48	230.2	-0.45	229.0	228.3	-0.31	228.5	-0.22	230.2	229.6	-0.26	229.8	-0.16
Malden C21J 230 kV	234.3	232.7	-0.69	233.6	-0.30	231.4	230.3	-0.47	230.4	-0.44	228.9	228.2	-0.33	228.4	-0.23	230.0	221.3	-3.76	223.0	-3.02
Malden C22J 230 kV	231.6	230.2	-0.60	230.7	-0.36	231.3	230.2	-0.48	230.3	-0.45	228.8	228.1	-0.32	228.3	-0.22	230.2	229.2	-0.41	229.5	-0.30
Leamington C21J 230 kV	235.5	234.1	-0.60	235.0	-0.21	233.2	232.5	-0.33	232.4	-0.35	229.2	228.1	-0.49	228.3	-0.38	228.7	220.9	-3.39	222.6	-2.66
Leamington C22J 230 kV	233.8	232.3	-0.64	233.0	-0.31	232.9	232.1	-0.34	232.1	-0.37	228.9	227.8	-0.48	228.1	-0.38	231.2	228.6	-1.11	229.0	-0.96
Lauzon C23Z 230 kV	229.0					226.5					224.3	216.1	-3.66	217.5	-3.02	228.6	228.2	-0.18	228.3	-0.14
Lauzon C24Z 230 kV	228.8	214.4	-6.32	219.1	-4.27	226.3	216.2	-4.46	215.5	-4.79	224.1	215.8	-3.68	217.3	-3.03	228.4	228.0	-0.18	228.1	-0.13
Chatham 230 kV	243.1	242.3	-0.35	243.2	0.04	241.7	241.9	0.09	241.7	-0.01	236.0					244.0	243.4	-0.23	243.5	-0.20
Keith 115 kV	123.8	121.7	-1.75	122.4	-1.19	124.1	122.7	-1.14	122.8	-0.99	122.8	121.5	-1.07	121.8	-0.85	123.5	123.4	-0.13	123.4	-0.08
Crawford J3E 115 kV	122.2	119.1	-2.54	120.0	-1.77						121.0	119.1	-1.52	119.5	-1.21	122.0	121.8	-0.14	121.8	-0.09
Crawford J4E 115 kV	122.5	119.4	-2.54	120.3	-1.77	121.3	118.4	-2.35	118.8	-2.08	121.2	119.4	-1.52	119.8	-1.21	122.2	122.1	-0.14	122.1	-0.09
Essex 115 kV	121.4	117.4	-3.31	118.5	-2.34	119.7	115.8	-3.27	116.0	-3.12	119.9	117.5	-1.97	118.0	-1.57	121.2	121.0	-0.14	121.0	-0.10
Windsor Transalta 115 kV	121.4	117.4	-3.33	118.6	-2.36	119.8	115.9	-3.28	116.0	-3.13	119.9	117.5	-1.99	118.0	-1.58	121.2	121.0	-0.14	121.1	-0.10
Walker Z1E 115 kV	121.3	117.2	-3.39	118.4	-2.41	119.7	115.7	-3.33	115.9	-3.18	119.8	117.4	-2.03	117.9	-1.61	121.1	121.0	-0.15	121.0	-0.10
Walker Z7E 115 kV	121.2	117.1	-3.39	118.3	-2.40	119.6	115.6	-3.33	115.8	-3.18	119.7	117.3	-2.03	117.8	-1.61	121.0	120.9	-0.15	120.9	-0.10
Ford Essex Z1E 115 kV	121.4	116.7	-3.94	118.0	-2.81	119.9	115.4	-3.69	115.6	-3.59	119.7	116.8	-2.37	117.4	-1.89	121.3	121.1	-0.15	121.1	-0.11
Ford Essex Z7E 115 kV	121.4	116.6	-3.94	118.0	-2.81	119.8	115.4	-3.69	115.5	-3.59	119.7	116.8	-2.37	117.4	-1.89	121.2	121.0	-0.15	121.1	-0.11
Lauzon 115 kV	121.5	116.4	-4.18	117.9	-2.99	119.9	115.3	-3.85	115.4	-3.77	119.6	116.6	-2.52	117.2	-2.02	121.3	121.1	-0.16	121.2	-0.12
Bell River K2Z 115 kV	120.9	115.7	-4.29	117.2	-3.02	119.3	114.6	-3.97	114.8	-3.81	119.0	115.9	-2.60	116.6	-2.04	120.7	120.5	-0.16	120.6	-0.12
Bell River K6Z 115 kV	120.1	114.9	-4.37	116.4	-3.08	118.5	113.7	-4.04	113.9	-3.88	118.2	115.1	-2.65	115.8	-2.08	119.9	119.7	-0.17	119.8	-0.12
Kingsville K2Z 115 kV	117.4	112.0	-4.59	113.5	-3.27	115.7	110.8	-4.24	111.0	-4.13	115.4	112.2	-2.77	112.9	-2.21	117.2	117.0	-0.17	117.0	-0.13
Kingsville K6Z 115 kV	117.5	112.1	-4.60	113.7	-3.25	115.9	110.9	-4.26	111.1	-4.11	115.5	112.3	-2.79	113.0	-2.20	117.3	117.1	-0.17	117.2	-0.13
Tilbury West 115 kV	118.2	112.9	-4.52	114.4	-3.22	116.6	111.7	-4.17	111.8	-4.07	116.3	113.1	-2.72	113.7	-2.18	118.0	117.8	-0.17	117.9	-0.12
Kent 115 kV	118.4	113.0	-4.51	114.6	-3.22	116.7	111.9	-4.16	112.0	-4.07	116.4	113.3	-2.72	113.9	-2.18	118.2	118.0	-0.17	118.0	-0.12

^{*} Lauzon load was converted for this contingency Pre-ULTC

Appendix C Protection Impact Assessment



483 Bay Street Toronto, Ontario M5G 2P5

PROTECTION IMPACT ASSESSMENT

LIMINGTON TS

NEW 75/125MVA 215.5/27.6/27.6KV TRANSFORMER STATIONS

PCT - 517

Executive Summary

Date: November 19, 2013

Prepared by:

P&C Planning Group

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Disclaimer

This Protection Impact Assessment has been prepared solely for the IESO for the purpose of assisting the IESO in preparing the System Impact Assessment for the proposed connection of the proposed generation facility to the IESO-controlled grid. This report has not been prepared for any other purpose and should not be used or relied upon by any person, including the connection applicant, for any other purpose.

This Protection Impact Assessment was prepared based on information provided to the IESO and Hydro One by the connection applicant in the application to request a connection assessment at the time the assessment was carried out. It is intended to highlight significant impacts, if any, to affected transmission protections early in the project development process. The results of this Protection Impact Assessment are also subject to change to accommodate the requirements of the IESO and other regulatory or legal requirements. In addition, further issues or concerns may be identified by Hydro One during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with the Transmission System Code legal requirements, and any applicable reliability standards, or to accommodate any changes to the IESO-controlled grid that may have occurred in the meantime.

Hydro One shall not be liable to any third party, including the connection applicant, which uses the results of the Protection Impact Assessment under any circumstances, whether any of the said liability, loss or damages arises in contract, tort or otherwise.

Revision History

Revision	Date	Change
RO	November 19, 2013	Released

Revision: RO

EXECUTIVE SUMMARY

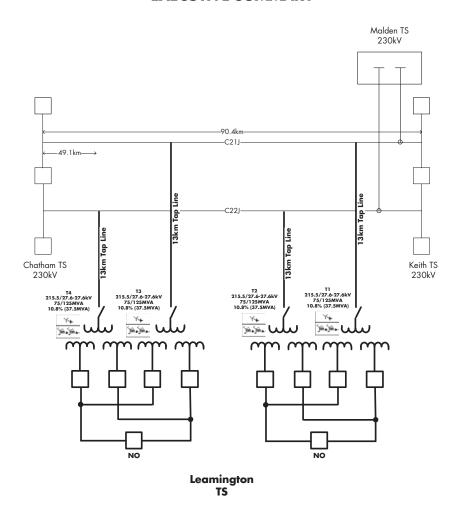


Figure #1 – Leamington TS on HONI Circuits C21J and C22J (This figure is to be used for illustrative purpose only.)

The installation of the proposed DESN station connection is feasible as long as the proposed changes/additions are made.

PROTECTION HARDWARE

Existing protection "A" POTT and "B" POTT schemes of terminal stations have to be modified to receive the transfer trip signal from Leamington TS. Hardware addition may be required.

PROTECTION SETTING

Zone settings changes at both terminal stations are not required.

TELECOMMUNICATIONS

New dual communication links between Learnington TS and one of the terminal stations are required to send transfer trip signals. The cascading to the other terminal and other tapped facilities will be required.

Modifications in existing schemes at the selected terminal station are required to receive and cascade the transfer trip signals.

LEAMINGTON TS SITE

Standard transformer protections are required that are compliant with the requirements of Transmission System Code.

New communication links between Leamington TS and both terminal stations are required.

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Revision: RO

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CUSTOMER IMPACT ASSESSMENT

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CUSTOMER IMPACT ASSESSMENT

SUPPLY TO ESSEX COUNTY TRANSMISSION REINFORCEMENT PROJECT

		Plan/Project #	: AR 17503
		Revision:	Draft
		Date:	May 9, 2014
Issued by:	Netwo		Development Department t & Regional Planning Division Inc.
Prepared by	:		Reviewed by:
Hamid Ham Senior Engi Transmissio	neer/Office		Ibrahim El Nahas, P.Eng. Manager - Transmission Planning Transmission System Development

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DISCLAIMER

This Customer Impact Assessment was prepared based on preliminary information available about the proposed Supply to Essex County Transmission Reinforcement Project, consisting of construction of a 230/27.6-27.6 kV, 75/125 MVA transformer station in the Town of Learnington and construction of a connecting 13 km, double-circuit, 230 kV overhead transmission line between the new station and the existing 230 kV transmission lines. This report is intended to highlight significant impacts, if any, to affected transmission customers early in the project development process and thus allow an opportunity for these parties to bring forward any concerns that they may have, including those needed for the review of the connection and for any possible application for Leave to Construct. Subsequent changes to the required modifications or the implementation plan may affect the impacts of the proposed connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are subject to change to accommodate the requirements of the IESO and other regulatory or municipal authority requirements. The fault levels computed as part of this Customer Impact Assessment are meant to assess current conditions in the study horizon and are not intended to be for the purposes of sizing equipment or making other project design decisions. Many other factors beyond the existing fault levels go into project design decisions.

Hydro One Networks Inc. shall not be liable, whether in contract, tort or any other theory of liability, to any person who uses the results of the Customer Impact Assessment under any circumstances whatsoever for any damages arising out of such use unless such liability is created under some other contractual obligation between Hydro One Networks Inc. and such person.

EXECUTIVE SUMMARY

Hydro One is planning the reinforcement of the supply to Essex County to address the supply capacity needs in the Windsor – Essex region, minimize the impact of outages, and ensure compliance with IESO's Ontario Resource and Transmission Assessment Criteria. These needs were identified in a planning study carried out by the Ontario Power Authority with input from Hydro One, the IESO and the Local Distribution Companies in the region. This Customer Impact Assessment (CIA) is concerned with the potential impact of this plan on the area customers.

The plan consists of:

- Construction of a 230/27.6-27.6 kV, 75/100/125 MVA DESN station in the Town of Leamington
- Construction of a connecting 13 km, double-circuit, 230 kV overhead transmission line from the Leamington station to the existing Chatham-Keith circuits C21J and C22J.
- Installation of Optic Ground Wire (OPGW) on the towers of the new line and existing C21J/C23Z towers (near Leamington Junction).

An assessment of voltage performance and loading capability of the transmission facilities in the area has been carried out and documented in an IESO System Impact Assessment (SIA) Draft Report of the proposed transmission reinforcement, "Leamington TS - Supply to Essex County Transmission Reinforcement Project", CAA ID 2013-507, May 9, 2014. The report concludes that with the allowed operation measures (use of Windsor SPS) voltage performance of all connection points remains within the Market Rules requirements and the thermal loading of the facilities remains within their ratings. The thermal overloads that require the use of operating measures are less significant with the incorporation of this project compared to the existing situation (without this project).

The following potential impacts on existing customers in the area are reviewed is this CIA:

- Short circuit impact
- Impact on customer power supply reliability.

The findings of this CIA are as follows:

- 1. The plan has no significant impact on Short-Circuit Levels in the area since it does not introduce additional sources of short circuit current. The distributed generators that are expected to connect to the low-voltage side of the new Learnington station are those that were previously planned to connect to the Kingsville station.
- 2. The plan does not result in deterioration of the area's customer power supply reliability. The new 13 km line tap to the existing Chatham-Keith circuits will marginally increase their exposure to faults; however, this will not result in increased disruptions to customers in normal conditions.
- 3. The plan will result in reduced frequency and amount of armed load rejection that would be required in the event of 230 kV supply interruption to Lauzon TS.

CUSTOMER IMPACT ASSESSMENT SOUTH-ESSEX COUNTY TRANSMISSION REINFORCEMENT

1.0 INTRODUCTION

1.1 Background

The Ontario Power Authority (**OPA**) conducted a planning study for the Windsor - Essex region, with input from Hydro One Networks Inc (**Hydro One**), the Independent Electricity System Operator (**IESO**) and area Local Distribution Companies, to assess the supply adequacy and security in the region. The study identified the need to increase supply capacity in the region, minimize the impact of outages, and ensure compliance with IESO's Ontario Resource and Transmission Assessment Criteria (ORTAC). A map of the region is shown in Figure 1.

This Customer Impact Assessment (CIA) examines the impact of the recommended plan which consists of:

• Leamington DESN Station

A new 230/27.6-27.6 kV, 75/100/125 MVA DESN transformer station will be built in the Town of Leamington. Six feeders will initially be provided at the station, and some load will be transferred to the new station from Kingsville TS.

• Leamington DESN Connection Line

This new Leamington station will be supplied by a new 13 km 230 kV double-circuit overhead line which will be tapped from the existing Chatham to Keith circuits C21J and C22J at about 20 km east of Sandwich Junction.

A schematic diagram of the existing and proposed facilities is shown in Figure 2.

As part of the Connection Assessment and Approval (**CAA**) process, the IESO has carried out System Impact Assessment (**SIA**) of the proposed transmission reinforcement and has documented the findings in the draft SIA report CAA ID 2013-507, "Leamington TS - Supply to Essex County Transmission Reinforcement Project", dated May 9, 2014.

Hydro One has carried out this CIA to assess the impact that the proposed transmission reinforcement may have on facilities owned by load and generation customers in the Windsor-Essex area. This is in accordance with the requirements of the Ontario Energy Board Transmission System Code.

1.2 <u>Customer List</u>

Table 1 lists all transmission customers in the Windsor-Essex area.

Table 1: Transmission Customers in Area

No.	Station	Supply Circuits	
			Connected Customer
1	Keith TS		Brighton Beach Power LP
		230 kV C21J, C22J, J5D	West Windsor Power
		115 kV J3E, J4E, J1B, J2N	Enwin Powerlines Ltd.
			Essex Power Corp.
			Hydro one Networks Inc.
2	Lauzon TS	230 kV C23Z, 24Z	Enwin Powerlines Ltd.
			Hydro One Networks Inc.
3	Malden TS	230 kV C21J, C22J	Enwin Powerlines Ltd.
			Essex Power Corp.
			Hydro One Networks Inc.
4	Essex TS	115 kV J3E, J4E Z1E, Z7E	Enwin Powerlines Ltd.
5	Crawford TS	115 kV J3E, J4E	Enwin Powerlines Ltd.
6	Chrysler MTS, General Motors	115 kV E8F, E9F	Enwin Powerlines Ltd.
	MTS, Ford Annex MTS, Ford		
	Windsor MTS	445144545	
7	Walker TS	115 kV Z1E, Z7E	Enwin Powerlines Ltd.
8	Walker MTS #2	115 kV Z1E, Z7E	Enwin Powerlines Ltd.
9	Ford Essex CTS	115 kV Z1E, Z7E	Enwin Powerlines Ltd.
10	Windsor TransAlta CGS	115 kV Z1E	TransAlta Energy Corporation
11	Belle River TS	115 kV K2Z, K6Z	Hydro One Networks Inc.
12	Kingsville TS	115 kV K2Z, K6Z	E.L.K. Energy Inc.
			Essex Power Corp.
			Hydro One Networks Inc.
13	Tilbury TS	115 kV K2Z	Hydro One Networks Inc.
14	Tilbury West DS	115 kV K2Z	Hydro One Networks Inc.
15	Comber WFCGS	230 kV C23Z, C24Z	Comber Wind LP
16	Port Alma #1 WFCGS	230 kV C23Z, C24Z	Kruger Energy Port Alma LP
17	Port Alma #2 WFCGS	230 kV C23Z, C24Z	Kruger Energy Port Alma LP
18	Dillon WFCGS	230 kV C23Z	Raleigh Wind Power Partnership
19	Gosfield WFCGS	115 kV K2Z	Gosfield Wind LP
20	Pte-Aux Roches WFCGS	115 kV K6Z	Pte-Aux Roches Wind Inc.
21	East Windsor CGS	115 kV E8F and E9F	East Windsor Cogeneration LP

2.0 **Customer Impact Assessment Scope**

The purpose of this CIA is to assess the potential impacts of the proposed new transmission facilities on the existing connected load and generation customers in the Windsor Essex area. This is in accordance with the requirements of the Ontario Energy Board Transmission System Code.

A review of the following potential impacts on existing customers is conducted in this CIA:

- Short circuit impact at the connection point
- Impact on customer power supply reliability

3.0 SHORT-CIRCUIT STUDY ANALYSIS

The proposed transmission reinforcement has no significant impact on Short-Circuit Levels in the area since.

- a) It does not create new or reinforced connection to the existing sources of short circuit current, i.e., it does not change the "Fault Impedance" in the area.
- b) It does not add new sources of short circuit current. The distributed generators that are expected to connect to the low-voltage side of the new Leamington station are those that were previously planned to connect to the Kingsville station.

The impact of potential new generation that may apply in the future to connect to Leamington station or its connecting lines will be assessed at that time.

4.0 SUPPLY RELIABILITY TO CUSTOMERS

With the incorporation of the proposed plan, up to 95 MW of load will be transferred from Kingsville TS, which is supplied from the 115 kV transmission in the Windsor-Essex area, to the new Learnington TS, which will be supplied from the 230 kV transmission. The loads transferred will be primarily from within, and east of, the Town of Leamington. This transfer will alleviate concerns of thermal overload of the Kingsville TS supply circuits K2Z and K6Z following the loss of either supply circuit, and therefore eliminate the need for special operating measures at Kingsville TS such as opening of the bus tie breaker in the summer months when the station load exceeds line capability. It will also alleviate low voltage concerns at Kingsville TS for which the Windsor Area SPS is currently used to reject load at the station.

With the establishment of Leamington TS, loads in, and to the east of the Town of Leamington will be closer to the supply station. This will improve the reliability for these loads by reducing their exposure to supply interruptions caused by faults in the distribution system.

The transfer of load to Learnington TS will ease the loading on the Windsor-Essex 115 kV transmission facilities, which would require load rejection in the event of 230 kV supply interruption to Lauzon TS. With reduced loading on the 115 kV circuits, the frequency and the amount of arming of load rejections in the area to protect the system for double-circuit faults on the Chatham-Lauzon circuits will be reduced.

The new 13 km Learnington DESN tap lines will marginally increase the exposure of the existing 90 km circuits C21J and C22J to faults. However, under normal conditions, this will not deteriorate the reliability of supply for the customers since the system is always operated such that the loss of these two lines will not violate the system reliability requirements.

As a result of the above observations, it is expected that the plan will not result in deterioration of the area's customer power supply reliability.

The IESO SIA report concludes that the projects do not adversely affect the reliability of the grid. It further concludes that with the use of operating measures, thermal loading of transmission facilities remain within their capabilities, and that voltage performance at customer connection

points meets Market Rules requirements. This project will result in improvement of the system performance compared to the existing system.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This CIA report describes the impact of the proposed South-Essex County Transmission Reinforcement on the customers in the area.

The short-circuit levels at customer transmission connection points will not be materially affected as a result of this transmission reinforcement.

The proposed transmission reinforcement has no material adverse reliability impact on existing customers in the area.

The voltage assessment as reported in the SIA document shows that voltage performance remains within the Planning Criteria for all the scenarios studied.



Figure 1: Map of Windsor – Essex Area: Existing Facilities

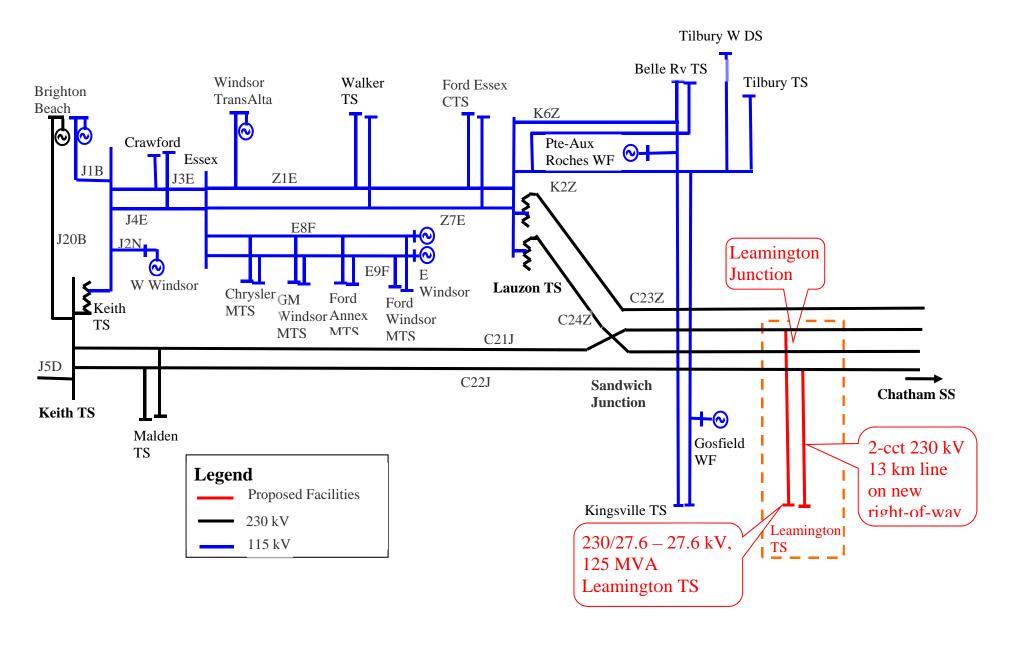


Figure 2: Schematic Diagram of Existing and Proposed Transmission Facilities

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STAKEHOLDER AND COMMUNITY CONSULTATION

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1.0 INTRODUCTION

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Stakeholder and community consultation with respect to the Supply to Essex County 5 Transmission Reinforcement ("SECTR") Project began when the OPA in the 2007 6 Integrated Power System Plan identified the need for the Project. However, as a 7 result of the 2008/09 economic downturn the project was suspended until 2013 when 8 the OPA reaffirmed the need for the project (see Exhibit B, Tab 1, Schedule 5, page 9 6). As such, consultation activities have been two-phased. This exhibit will begin by 10 discussing stakeholder and community consultation activities as they occurred during 11 the EA approval and initial consultation for this project that began in 2008. In section 12 7.0 of this exhibit, information is provided on recent stakeholder and community 13 consultation actitivities related to the recommencement of the SECTR Project in 14 2013. 15

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2.0 BACKGROUND

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The SECTR Project was planned in accordance with the *Class Environmental Assessment for Minor Transmission Facilities*, approved by the Ministry of the Environment under the provincial *Environmental Assessment Act*. Hydro One began working on the project in 2007, and initiated the EA and consultation for this project in 2008. The Class EA was completed in 2010 with the submission of a final Environmental Study Report ("**ESR**") to the Ministry of the Environment.

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Due to the economic downturn that occurred shortly after the Class EA was initiated, the need for new facilities in Windsor-Essex region continued to be re-assessed by the Ontario Power Authority ("**OPA**") throughout the Class EA process. Upon Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 5 Page 2 of 22

- completing the Class EA in 2010, Hydro One decided to suspend the project until the
- 2 OPA undertook a further review of the long-term electricity needs in the Windsor-
- 3 Essex area.

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- In summer 2011, the Municipality of Leamington's Economic Development Officer
- 6 convened a meeting on behalf of the Ontario Greenhouse Vegetable Growers
- Association ("**OGVG**") with representatives of Hydro One, the OPA and Union Gas.
- 8 The OGVG took the opportunity to present information on the projected expansion of
- 9 the greenhouse sector in the Leamington area in the next five years and the growers'
- anticipated requirements for water, electricity and natural gas. Subsequent discussions
- among these parties and representatives of the provincial government and the
- Windsor-Essex Economic Development Commission have taken place over the last
- 13 few years.

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- In summer 2013, the OPA based on updated load forecast information from local
- distribution companies ("LDCs") in Essex County including Hydro One, confirmed
- the need for additional transmission facilities in the Learnington area. Thus, Hydro
- One began preparing this application seeking OEB approval to construct a new 230
- kV transmission line on a new right-of-way to connect Leamington station to the
- existing 230 kV transmission system.

- 22 This exhibit summarizes Hydro One's consultation process during the Class EA
- process from 2008 to 2010, the input received and the outcomes. A full accounting of
- the consultation process is documented in the final ESR, which is posted on the
- 25 Supply to Essex County Transmission Reinforcement webpage
- at www.HydroOne.com/Projects. Hydro One has also carried out an engagement
- process with First Nation communities as described in **Exhibit B**, **Tab 6**, **Schedule 6**.

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- This exhibit also summarizes the communications Hydro One has undertaken to
- 2 inform community stakeholders and potentially-affected property owners that the
- 3 Company intends to seek OEB approval to construct the SECTR Project at this time.

3.0 PUBLIC CONSULTATION OBJECTIVES AND APPROACH

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Hydro One develops customized public and stakeholder communications and 6 consultation programs for individual projects following the guidelines set out in the 7 Ontario Ministry of the Environment's Code of Practice for Consultation in 8 Ontario's Environmental Assessment Process (2007). The intent of the public 9 consultation process is to identify and inform affected and potentially-affected 10 propery owners, stakeholders, government agencies and ministries and members of 11 the general public about the project. The consultation process is initiated as early as 12 possible to allow for the identification of potential issues. In order to complete the 13 Class EA process and prior to filing the "Leave to Construct" application with the 14 OEB, Hydro One attempts to address and resolve all issues. 15

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Several fundamental principles underpin Hydro One's approach to communication and consultation, including: early, ongoing and timely communications; clear and complete project information and documentation; open, transparent, and flexible communications and consultation processes; and respectful dialogue with all stakeholders.

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- Hydro One uses a variety of methods to communicate with identified stakeholders about a proposed undertaking and to establish the opportunity for two-way communication. For this Class EA project, communications vehicles included:
 - newspaper advertisements

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- correspondence, phone calls and meetings with local elected officials, municipal
 staff and government agency representatives, local interest groups, and members
 of the public
- Canada Post ad mail or direct mail notices to directly-affected property owners and those in close proximity to the facilities Hydro One is proposing to build
- a project website at www.HydroOne.com/projects
- a designated contact person for ongoing communication via email at Community.Relations@HydroOne.com or via a toll-free number (1-877-345-6799)
 - three series of public information centres two in 2008 and one in 2009
- an independently-facilitated workshop in 2009 with potentially-affected property owners to look at alternative transmission line routing options in the Staples area.

Once a project receives all required approvals, it moves into the design and construction phase. Hydro One's practice is to continue communicating with affected property owners and area residents, local officials and government agency representatives to keep them informed of project activities and to respond to any questions or concerns in a timely fashion.

4.0 CONTACT WITH STAKEHOLDERS AND THE PUBLIC

The OPA actively supported Hydro One in communicating information relative to the need for the project. OPA staff accompanied members of Hydro One's project team to meetings with municipal officials and briefings for local MPPs, and attended the three series of Public Information Centres ("**PICs**"),

The Windsor-Essex area LDCs also participated in OPA-led regional planning meetings and in meetings Hydro One convened with municipal officials at key

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- milestones of the Class EA process. Ongoing communication, primarily by email,
- between Hydro One and the LDCs ensured they were kept informed of project
- decisions and consultation activities and aware of all communications being sent to
- 4 their municipal shareholders and the public. Letters of support received from Essex
- 5 Powerlines Corporation and Entegrus Powerlines Inc. have been provided as **Exhibit**
- 6 6, Tab 2, Schedule 2 Attachments 7 and 9.

4.1 Municipal and County Officials

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Hydro One's consultation programs are designed to ensure municipal elected officials and staff receive advance notice and copies of any communications being sent to the public (ads, direct mail flyers, etc.). This "no surprises" approach allows municipal officials to understand any potential issues that might arise and assists them in responding to constituent inquiries about the project and knowing how to direct inquiries to Hydro One's website or project contact person for further information. Municipal officials are also encouraged to attend Hydro One PICs, to invite Hydro One to appear before Council, and to contact members of Hydro One's project team at any time with questions or comments.

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On March 4, 2008, prior to initiating the Class EA for this project, Hydro one convened an initial meeting of OPA and Windsor-Essex LDC representatives, the Mayors, chief administrative officers and senior planning officials from the municipalities in the project study areas. Included in the meeting were representatives from: the Municipality of Leamington; the Town of Lakeshore; the Town of Kingsville; the Town of Tecumseh, as well as the County of Essex.

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At this first Municipal/LDC meeting, the OPA presented an overview of the electricity supply needs in the Windsor-Essex area and the potential solutions that had been developed in consultation with Hydro One and the LDCs to meet these needs. Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 5 Page 6 of 22

The OPA advised that while local generation and energy conservation initiatives

- 2 could help, new transmission facilities (either of two proposed options defined as
- Alternative 1 and 2) would also have to be part of the supply solution for the region.
- 4 Please refer to Exhibit B, Tab 6, Schedule 5, Attachment 1 for a high level
- description of the proposed options as provided to municipal and county officials.
- 6 Hydro One outlined the scope for the upcoming Class EA, the proposed public
- 7 consultation process, and the regulatory approvals that would be required to move the
- 8 project forward. The OPA's and Hydro One's presentations are posted on the project
- 9 website at www.HydroOne.com/projects.

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Municipal leaders understood the need for the project and indicated their general support for the undertaking. They commented that investment in electricity infrastructure would facilitate future economic development in Windsor and Essex County, and could provide capacity to accommodate additional local distributed generation. Officials from the Municipality of Leamington favoured a new transformer station in Leamington (Alternative #2) as they felt it would benefit the expanding greenhouse growers' sector. They also noted that the municipality owns a utility corridor (an abandoned rail bed) on which Hydro One could locate the new transmission line provided that future plans for a recreational path system on the corridor would be compatible.

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Officials from the Town of Kingsville also preferred Alternative #2. While Alternative #1 would upgrade the transmission line into Kingsville TS, they understood this alternative would also require upgrading distribution structures along Road 2 in Kingsville. They noted that the Town's long-term plans to upgrade Road 2 to an urban cross-section are already complicated by the presence of municipal drains and distribution structures on both sides of the road.

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A second meeting of the Municipal/LDC group was held on June 23, 2008. Hydro One summarized public input received at the first series of PICs in April, and reviewed the decision-making process for selecting Alternative #2 (the Leamington TS) as the preferred transmission option. Hydro One also indicated that the preferred option would be presented and discussed with members of the public at a second series of PICs to be held in July 2008 in the Town of Tecumseh and the Municipality of Leamington. The OPA's and Hydro One's presentations are posted on www.HydroOne.com/projects.

Prior to the second series of PICs, Hydro One and the OPA gave presentations to the municipal councils of Leamington and Kingsville on July 7, 2008, and the councils of Lakeshore and Tecumseh on July 8, 2008. A copy of this Council presentation is posted on www.HydroOne.com/projects. Hydro One used the opportunity to present its recommended transmission alternative, provide information about the upcoming PICs on July 23 and 24, 2008 and explain the next steps in the Class EA process. Comments were received and questions were answered on: the preferred alternatives; EMF concerns; the possibility for distributed generation connection points; local jobs during the construction phase; and compatible secondary land uses along the proposed right-of-way.

On July 22, 2008, the Municipality of Leamington forwarded to Hydro One a petition signed by 35 property owners of Lots 8 (former Mersea Township) opposed to one of the two alternative transmission line routes proposed by Hydro One. The petition stated: "(we) strongly object to the placement of the high tension hydro line upon our properties. As taxpayers we paid for the municipality to purchase the old railway bed which was for utilities. This property was purchased for this reason and should be utilized for this purpose".

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- At a special meeting of Council on June 29, 2009, Hydro One met with Leamington
- planning and technical staff to review the information to be displayed at the PIC on
- July 16, 2009 regarding the proposed transformer station site and centre line for the
- transmission line to connect the station to the existing 230 kV transmission system.
- 5 Hydro One offered a similar presentation to the Town of Lakeshore, which decided
- 6 instead to have staff attend the PIC.

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- 8 Throughout the Class EA process, Hydro One collected a broad range of information
- through email, telephone calls and meetings from staff at the municipalities within the
- study area. This information greatly contributed to an understanding of the
- environmental features and socio-economic characteristics of the area, and was
- valuable input for Hydro One's decision–making process.

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- 14 Information about the project status and public consultation events was also provided
- to the County of Essex and to the other municipalities in Essex County, (Township of
- Pelee; Town of Amhurstburg; Town of LaSalle) although these municipalities were
- not in the study area for any of the proposed facilities.

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- Please refer to **Exhibit B, Tab 6, Schedule 5, Attachment 1** for examples of the
- 20 correspondence sent to municipal and county officials (using Learnington as an
- example) at key stages of the project.

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- A letter of support for the project from the Municipality of Learnington is attached in
- **Exhibit B, Tab 6, Schedule 2, Attachment 1**. Additionally, letters of support from
- 25 the Town of Kingsville and the County of Essex are provided in Exhibit B, Tab 6,
- Schedule 2, Attachments 2 and 3 respectively.

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4.2 Members of Provincial Parliament ("MPPs")

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- The project area fell within three provincial ridings: Chatham--Kent--Leamington,
- Essex, and Windsor--Tecumseh (for the Sandwich Junction x Lauzon TS portion of
- 5 the study). The MPPs for these ridings were notified in advance of all public
- 6 communications about the project and invited to the public information centres.
- 7 Hydro One also briefed the MPPs and their constituency staff at key stages of the
- project. Hydro One sent correspondence to MPPs in 2009 similar to those in **Exhibit**
- B, Tab 6, Schedule 5 Attachment 1.

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4.3 Government Agencies (federal and provincial) and Conservation Authorities

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Prior to introducing the project to local stakeholders and members of the public in 2008, Hydro One informed and sought input on the proposed undertaking from a broad range of provincial government ministries and agencies, federal departments, local public and Catholic district school boards, and two conservation authorities-Essex and Region Conservation Authority and the Lower Thames Valley Conservation Authority. The government agencies were kept informed of project status throughout the consultation process and made aware of all public and stakeholder consultation events. The list of government agencies and copies of correspondence sent to them can be found in the appendices of the final ESR, posted at www.HydroOne.com/projects.

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4.4 Community and Special Interest Groups

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Hydro One identified and provided project information to a broad range of local community and special interest groups, and invited them to provide input and to participate in public consultation events. These groups included: Carolinian Canada; Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 5 Page 10 of 22

- 1 Christian Farmers Federation of Ontario; Citizens Environmental Alliance; Essex
- 2 County Field Naturalists Club; Essex County Stewardship Network; Essex Federation
- of Agriculture; Little River Watershed; Little River Enhancement Group; Ontario
- Federation of Agriculture; Ontario Greenhouse Vegetable Growers' Association; TD
- 5 Friends of the Environment Foundation.

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4.5 Other Companies with infrastructure in the project area

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Hydro One consulted with companies that have infrastructure in the project area to
determine whether the proposed undertaking could potentially affect their existing
facilities or those being planned. Among the companies contacted were: Brookfield
Renewable Power; CN Rail; Wind Prospect Inc.; Talisman Energy; TransCanada
Corp.; Union Gas Ltd.; and the Windsor Airport.

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Hydro One was aware that Union Gas has a natural gas pipeline along the utility corridor in Leamington and planned to build an additional pipeline along the corridor in the future. Hydro One met with representatives from Union Gas to ensure that the proposed 230 kV transmission would be compatible with their existing and proposed pipelines. A corrosion study conducted by an independent consultant was commissioned by Hydro One, and with Union Gas' cooperation, mitigation measures were developed. Hydro One also exchanged information with Brookfield Power about its proposed wind turbines for the area (now built) which limited potential transmission line routing options north of County Road 8 in the Town of Lakeshore.

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5.0 PUBLIC INFORMATION CENTRES

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5.1 Schedule and Notification

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- 5 Hydro One held three series of Public Information Centres ("**PIC**") in 2008 and 2009.
- Various methods were used to notify the local community, stakeholders and
- potentially affected property owners about the project. For all PICs, invitations were
- 8 extended to members of all municipal councils in the study area, the Essex County
- 9 Council, government agencies, and all individuals and groups who had requested to
- be updated via the project mailing list.

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First round of PICs

- Three PICs were held at the outset of the study: April 16, 2008 at the Millen
- 14 Community Centre in Woodslee; April 17, 2008 at the Royal Canadian Legion
- Branch 84 in Leamington; and April 18, 2008 at the Tecumseh Arena. The purpose
- of these initial PICs was to introduce the proposed project and two alternative
- transmission options using maps and displays, to explain the Class EA and OEB
- approvals process, and to collect information and input from local property owners
- and members of the community that might assist the team in identifying issues and
- 20 concerns and determining the preferred transmission option.

- More than 8,500 flyers were delivered by Canada Post Admail to residences and
- business in the study areas. Newspaper advertisements announcing commencement of
- the Class EA and first round of PICs were placed in the following local newspapers
- between April 9 and April 16, 2008: Belle River Lakeshore News; Essex Free Press;
- 26 Kingsville Reporter; Leamington Post; Tecumseh Shoreline Week; Tecumseh
- 27 Tribune; Tilbury Times; Wheatley Journal; Windsor Star; and Le Rempart (Windsor)
- for a French-language advertisement. A copy of the newspaper advertisement and a

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- copy of the flyer for PIC #1 are attached as Exhibit B, Tab 6, Schedule 5
- 2 Attachments 2 and 3.

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- Second round of PICs
- 5 This series consisted of two PICs on: July 23, 2008 at the Royal Canadian Legion
- 6 Branch 84, Leamington; and July 24, 2008 at the Tecumseh Arena. These PICs
- 7 provided Hydro One with the opportunity to present the preferred transmission option
- 8 (Alternative #2) that had been identified in part with input received during the first
- series of PICs. Members of the project team also solicited information on potential
- sites for a new transformer station in Leamington and on the alternative transmission
- line routes to connect the station to the existing 230 kV system.

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- Approximately 6,500 flyers were distributed by Canada Post Admail to residents and
- businesses within the study area for a new transformer station in the Municipality of
- Leamington. About 750 flyers were sent by personally–addressed direct mail (using
- information provided by the municipalities) to all property owners within 120 metres
- of the two alternative transmission line routes Hydro One identified in Leamington
- and Lakeshore, as well as the existing transmission corridor between Sandwich
- Junction and Lauzon TS. Newspaper ads ran from July 15 23, 2008 in the same
- local newspapers used to notify for the previous round of PICS. A copy of the
- newspaper advertisement and a copy of the flyer for PIC #2 are attached as **Exhibit**
- B, Tab 6, Schedule 5 Attachments 4 and 5.

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Third round of PICs

- 25 The third round consisted of a single PIC on July 16, 2009 at the Lebanese Club in
- Learnington. The main focus of this PIC was to present Hydro One's preferred site
- for the new transformer station in the Municipality of Leamington and the preferred
- route for the transmission line that would connect the station to the existing 230 kV
- transmission lines that run parallel to Highway 401 in the Town of Lakeshore.

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- Notice in the form of a large postcard was delivered via Canada Post Admail to more
- than 2000 residents and businesses in the vicinity of the proposed facilities in the
- 3 Municipality of Leamington and Town of Lakeshore. Newspaper advertisements
- were placed from July 8-13, 2009 in the following newspapers: Leamington Post;
- 5 Leamington Shopper; Lakeshore News; Windsor Star. A copy of the newspaper
- advertisement and a copy of the direct-mail postcard for PIC #3 are attached as
- **Exhibit B, Tab 6, Schedule 5 Attachments 6 and 7.**

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5.2 Public Information Centre Format

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The PICs were held in an open house format where visitors could drop in anytime between 4 p.m. and 8 p.m. After signing in at the registration desk, visitors were provided with handouts of the display panels and a comment form on which they could record their feedback both on the project in general and on the PIC. Hydro One and OPA employees were on hand to speak one-on-one with visitors about the proposed project and to answer their questions. A sample copy of a comment form is attached as **Exhibit B, Tab 6, Schedule 5 Attachment 8**.

Hydro One has extensive experience in organizing open house-format PICs. An open house, as opposed to a public meeting, provides a friendly and informal way for all visitors to learn about a proposed project and how it might affect them, and gives each participant the opportunity to ask questions and provide feedback one-on-one or in small groups to members of Hydro One's project team and technical or subject-matter experts.

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Hydro One uses table-sized aerial photographs of the project study area which allow property owners to see their properties in relation to the facilities that Hydro One is proposing. Information panels are also displayed to address many aspects of the project such as: the need for the project; the facilities being proposed; environmental features in the area; the environmental assessment process; criteria for evaluating

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alternative routes or sites for the proposed facilities; the regulatory (OEB) approval

and public hearing process; public consultation and how interested parties can

provide input; the project schedule; and information about electric and magnetic

4 fields. The maps and display panels from the three series of PICs are posted

on www.HydroOne.com/projects.

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5.3 PIC Attendance and Summary of Feedback

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First Round of PICs: April 16, 17 and 22, 2008

A total of 77 individuals attended the first round of PICs and 31 comment forms were received. Attendance was highest in Woodslee (April 16) and Leamington (April 17).

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The majority who attended the Woodslee PIC lived in or close to the study area for transmission Alternative #1, which proposed the construction of a new transformer station in South Woodslee. In general, the comments at this PIC were highly in favour of transmission Alternative #2, which would see a new transformer station built in Leamington. Local residents expressed the following concerns about having a new transformer station built in their community (Alternative #1): disruption/destruction of the quality of life in their community; suggestions to find an alternative location for the transformer station; potential effects on wildlife; EMF issues; aesthetics; potential depreciation of property values; and stringent timeline concerns. Most visitors indicated their desire to be kept informed of project status.

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Conversely, a majority of the visitors at the Leamington PIC supported a new transformer station in their community (Alternative #2) and could see the potential benefits of the project, such as improved reliability of electrical service, opportunities for local business and industry, etc. Comments and concerns focused on: routing the new transmission line along the existing municipal utility corridor; considering opportunities for co-generation and access to the provincial grid as part of the

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- planning process; compatibility of walking/biking on the existing municipal utility
- 2 corridor if the proposed transmission line is located there; use of steel poles instead of
- lattice towers; and maintenance around tower sites. Again, most visitors wanted to be
- 4 kept informed of project status.

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- 6 Fourteen individuals dropped into the Tecumseh PIC (April 22, 2008). While the
- 7 need for, and importance of, new electricity infrastructure was recognized, visitor
- 8 comments related primarily to concerns about EMFs and being kept informed about
- 9 the study.

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- Overall, the comments received from the first round of PICs indicated a general
- preference for Alternative 2 (Leamington TS/connector line and additional
- transmission line between Sandwich Junction and Lauzon TS).

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- Second Round of PICs: July 23 and 24, 2008
- Over the course of the two days of the second round of PICs to discuss Alternative 2,
- a total of 77 individuals attended and 23 written comments forms were received.

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- 19 Fifty-nine individuals attended the Leamington PIC (July 23, 2008) -- the majority
- being residents living in the study area. A variety of issues were raised by participants
- including: the need for the proposed facilities; occasional flooding in the study area;
- potential impacts on irrigation systems; the possibility of radio/cellular interference;
 - proximity of the Alternative transmission line routes (both A&B) to houses; and
 - concerns regarding the use of the abandoned rail bed as an electricity transmission
- corridor given the presence of water and gas pipelines; and the potential to bury the
- transmission line. Overall, a preference was shown for Alternative Route A on the
- basis that the abandoned rail bed had been purchased by the municipality for use as a
- utility corridor.

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As previously noted, a day prior to the Leamington PIC, Hydro One was served with 1 2 a petition signed by 35 residents opposed to the alternative transmission line route B and supporting alternative route A which would utilize in part the municipally-owned 3 utility corridor. This view was also subsequently supported by the Essex County 4 Federation of Agriculture ("ECFA"), in a letter dated Dec 4, 2008, stating that 5 6 "preservation of farmland is a primary goal", and asking Hydro One to "seriously consider the unused railroad access to erect these hydro towers". The ECFA also 7 suggested that "the impact on landowners be minimized by placing structures near 8 property lines with access roads positioned with the least amount of farmland 9 sacrificed". 10

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Eighteen individuals attended the Tecumseh PIC (July 24, 2008), the majority of whom were residents from the study area. In general, comments and questions related to EMF issues, safety issues, property values and the Class EA process. Some attendees asked about tower locations.

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Third Round PIC: July 16, 2009

Sixty-three individuals attended the third round PIC in Leamington including the 18 CAO and Planner for the Town of Lakeshore and the Director of Community 19 Services and one Councilor from the Municipality of Leamington. Ten written 20 comment forms were submitted. Comments generally related to: landowner 21 compensation; property values; visual/noise effects of a new transformer station; 22 weed invasion onto neighbouring farms (an organic farm in particular); and interest in 23 proposed towers types and dimensions. Several residents, greenhouse owners and 24 representatives from a wind turbine company expressed support for the project. 25

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A group of landowners from the Town of Lakeshore proposed a refinement to Hydro
One's proposed transmission line route north of County Road 8 in Staples. It was
suggested that the transmission line route be moved from the east side of Lakeshore

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Road 245 to the west side, and if possible to run along mid-concession (between 1 Lakeshore Road 245 and Lakeshore Road 243). This was of particular interest to a 2 property owner who farms land on the east side of Lakeshore Road 245 and also to 3 residents who live on the west side of the road who indicated they'd prefer to have the 4 line in their back yards instead of having to see it from the front of their homes. In 5 6 order to explore potential route refinements in more detail and to understand what criteria the community would consider important in evaluating the alternative routes, 7 Hydro One committed to holding a workshop to which all potentially-affected 8 landowners would be invited as well as representatives from the Essex County 9 Federation of Agriculture and Town of Lakeshore. Please refer to Section 4.4 for 10

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Following PIC#3, Hydro One worked to identify other technically feasible routing options in the Staples area. Hydro One also met with Brookfield Power to verify the company's leases and schedule for wind turbines in the area. It was confirmed that routing a transmission line mid-concession between Lakeshore Road 245 and Lakeshore Road 243 would not be feasible; however, changes in Brookfield Power's plans would permit a potential route somewhere between mid-concession and Lakeshore Road 245. It was determined that the alignment for this alternative route would also change the way the route would cross properties between Leamington Concession 11 and County Road 8.

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5.4 Workshop on Transmission Line Route Alternatives

further information on this workshop.

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Hydro One held the workshop on October 29, 2009 from 7 p.m. – 9 p.m. at the Comber Community Centre. The workshop was led by an independent facilitator. Invitations were sent to 50 potentially-affected property owners within the defined study area, stakeholders, First Nation communities and government agencies. Seventeen participants attended, of which 13 were potentially-affected property

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- owners. Two representatives from the Essex County Federation of Agriculture, one
- representative from the Walpole Island First Nation, and one representative from
- 3 Brookfield Power were also in attendance.

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- 5 The majority of those in attendance favoured moving the proposed transmission line
- 6 route to the west side of Lakeshore Rd 245, so that it is in the backyard of the homes
- located on the west side of that road. As a result of this feedback, Hydro One revised
- 8 its preferred route and communicated the change to the Municipality of Leamington
- and the Township of Lakeshore. The new preferred route alignment was documented
- in the draft ESR which was circulated for public review in early 2010.

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- The workshop agenda, presentation materials, workshop discussion and outcomes are
- contained in the facilitator's Workshop Report, which is appended to the final ESR
- and can be viewed at www.HydroOne.com/projects.

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5.5 Completion of the Class Environmental Assessment Process

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- 18 Consistent with the Class EA process, Hydro One prepared a draft Environmental
- 19 Study Report and made it available for a 30-day public review and comment period
- beginning February 11, 2010, and ending March 12, 2010. A Notice of Completion of
- the Draft ESR advertisement (the "Notice") was placed during the week of February
- 8, 2010 in the same newspapers that were used throughout the consultation process. A
- copy of the advertisement is attached as **Exhibit B**, **Tab 6**, **Schedule 5 Attachment**
- **9**.

- The Notice advised interested parties that the draft ESR could be downloaded or
- viewed on Hydro One's website, and that hard copies of the document were available
- for viewing at the public locations noted in the advertisement. The Notice also
- 29 provided information on the process and timelines for interested parties to submit

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comments on the draft ESR and the rights of individuals to submit a Part II Order to

- the Minister of the Environment requesting that the project be subjected to a higher
- 3 level of assessment (an Individual Environmental Assessment). An advance copy of
- 4 the Notice was emailed to all key stakeholders, including municipal leaders, MPPs,
- and municipal staff and interest groups. All individuals on Hydro One's project
- 6 contact list received a copy of the Notice either by email or mail.

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Hydro One received four submissions on the draft ESR relating to the Sandwich 8 Junction to Lauzon TS portion of the study from: CAW Legal Services on behalf of two residents in the City of Windsor; the Ministry of Transportation; the former 10 Ontario Realty Corporation; and the Town of Tecumseh. Two submissions relating to 11 the Leamington TS and connector line were received from: The Ministry of 12 Transportation ("MTO") and the Ministry of the Environment ("MOE"). The MTO 13 had no concerns with the project. The MOE commented on Hydro One's acoustic 14 assessment for the proposed Learnington TS. Hydro One responded that all issues 15 related to noise at the proposed Leamington TS would be discussed with the MOE 16 during the Certificate of Approval ("C of A") review period and that the application 17 process for the Air and Noise C of A would determine whether mitigation measures 18 (such as noise attenuation measures) would be required. 19

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Two Part II Order requests were received asking that the Class EA be elevated to an Individual EA. The first Part II Order request was received via email by the MOE's Environmental Assessment and Approvals Branch on March 16, 2010 from a concerned resident of the Town of Kingsville. A second Part II Order request was later directed to the MOE in support of the first request. The issues and concerns raised in both Part II Order requests related to the possible construction of Industrial Wind Turbines in Lake Erie, and as such were not relevant to the Supply to Essex County Transmission Reinforcement Class EA. Hydro One responded to both requestors and to the MOE that the primary purpose of the Supply to Essex County

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- 1 Transmission Reinforcement was to address reliability of electricity supply issues and
- to provide additional capacity for the area to meet present and future demand. In a
- letter to Hydro One dated May 18, 2010, the Minister of the Environment indicated
- 4 that a decision had been made and that an Individual EA for the project would not be
- required. A copy of this letter has been attached as **Exhibit B. Tab 6, Schedule 5**
- 6 Attachment 10.

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- 8 Hydro One incorporated all comments into the final ESR and the Class EA process
- was completed with the submission of the final ESR to the MOE on July 22, 2010.

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6.0 SUMMARY OF KEY ISSUES AND HYDRO ONE'S RESPONSES

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- All issues presented during the consultation phase and during the public review period for the draft ESR are fully documented in Section 4, Public and Government
- 15 Consultation, of the final ESR, which is posted on www.HydroOne.com.

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7.0 NOTIFICATION BASED ON RECOMMENCEMENT OF SECTR PROJECT PER OPA NEED IDENTIFICATION

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- As mentioned, during the pause over the course of the project, communication was
- 21 re-established by the local community and its economic development committee to
- explore and reconsider the need for the SECTR Project.

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- In summer 2013, the OPA reconfirmed the need for additional transmission facilities
- in the Leamington area. Thus, Hydro One began preparing this application seeking
- OEB approval to construct a new 230 kV transmission line on a new right-of-way to
- 27 connect Learnington station to the existing 230 kV transmission system.

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Given the passage of time between the completion of the Class EA and identification 1 2 from the OPA of the need for new transmission facilities in the Leamington area, Hydro One notified local officials, potentially-affected property owners and other 3 local stakeholders that Hydro One was proceeding with a "Leave to Construct" 4 application for the Leamington TS and associated connector line. Attached as 5 **Exhibit B, Tab 6, Schedule 5 Attachment 11** is a copy of the letter sent to the 6 Municipality of Learnington. Similar letters were sent to the County of Essex, the 7 Town of Lakeshore, and the Town of Kingsville, the local MPPs, and other local 8 agencies and stakeholders. Hydro One also notified potentially-affected property 9 owners based on an up-to-date title search. A copy of the property owner letter is 10 attached as Exhibit B, Tab 6, Schedule 5, Attachment 12. 11 Hydro One and the OPA have held a number of recent discussions with LDCs 12 regarding the updating of load forecast information and proposed cost recovery 13 models for the project. On January 6, 2014, the Windsor-Essex Economic 14 Development Corporation (EDC) facilitated a meeting via conference call with 15 municipal officials from the Municipality of Learnington and the Town of Kingsville, 16 representatives of Hydro One (Transmission and Distribution) and the Windsor-Essex 17 LDCs, and a representative of the OGVG and some of its individual members in the 18 project area. The meeting provided Hydro One with an opportunity to confirm its 19 commitment to making the investment in the local area and to outline the timeline for 20 filing an application with the OEB seeking leave to construct approvals to build the 21 project. A letter of support was requested from the parties involved and those letters 22 are provided and in **Exhibit B, Tab 6, Schedule 2**. Additionally, Hydro One and the 23 OPA participated in a subsequent meeting with LDCs, the OGVG and other 24 interested parties to further describe and explain the project cost responsibility as 25 outlines in Exhibit B, Tab 4, Schedule 4 and the cost allocation methodology at the 26 distribution level in the context of this Project as outlined in Exhibit B, Tab 4, 27 Schedule 5. 28

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- Hydro One will meet with LDCs, the OGVC and individual greenhouse growers
- shortly following the submission of the leave to construct application to confirm load
- 3 forecasts, as this information will be important in determining capital contributions
- 4 for this project.

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From: OGNIBENE Carrie-Lynn

Sent: Monday, April 07, 2008 3:02 PM

To: dduncan.mpp.co@liberal.ola.org; bcrozier.mpp.co@liberal.ola.org; phoy.mpp.co@liberal.ola.org

Cc: CANCILLA Enza; DOREY Steve

Subject: Hydro One Class EA and Public Information Centres



Essex AD ENGLISH.pdf



Essex Flyer Final.pdf

Minister Duncan, Mr. Crozier, and Mr. Hoy:

I am writing to provide some advance information to your constituency staff on Hydro One advertisements and flyers being distributed this week to announce a Class Environmental Assessment (EA) to reinforce the electricity transmission system serving Essex County. The alternatives we are considering as part of our *Supply to Essex County Class EA* are located within your ridings, and are described in the attached ad and flyer, and also on our project website at www.HydroOneNetworks.com/newprojects.

Hydro One will be hosting three public information centres to discuss this project with area residents: April 16 in Woodslee; April 17 in Leamington; and April 22 in Tecumseh. The newspaper ad begins running this week in local newspapers serving the eastern part of Essex County. It will also appear in the Windsor Star on Thursday, April 10. A French version will run in Le Rempart on Wednesday, April 9.

The flyer is being delivered this week via Canada Post unaddressed mail to approximately 8,500 households within the project study areas, including those properties within 500 metres of the existing transmission rights-of-way between Woodslee and Kingsville Transformer Station and between Sandwich Junction and Lauzon Transformer Station.

Representatives from Hydro One and the Ontario Power Authority provided an overview of the need for transmission system investments and the Class EA project on March 4, 2008 to the Mayors and senior staff of the Towns of Tecumseh, Leamington, Kingsville and Lakeshore. The County Warden and Planning Director also attended. The presentations given at the March 4 meeting are posted in the Public Consultation section on the project web page.

Our project team would like to offer you and your staff a briefing on this project, either in your riding or alternatively at Queen's Park. I will be following up with your staff to determine your needs and availability.

In the interim, any calls received from constituents on this project may be directed to Hydro One's community information line at 1-877-345-6799, or by email to: community.relations@HydroOne.com.

If you have any questions, please feel free to contact me directly.

Sincerely,

Carrie-Lynn Ognibene

Senior Advisor, Corporate Relations Hydro One Networks Inc. 483 Bay Street, 8th Floor, South Tower Toronto, ON M5G 2P5

Tel: 416-345-5130 or 1-877-345-6799

You are invited to a Public Information Centre Supply to Essex County - Class Environmental Assessment

Working to meet Essex County's future electricity needs

Hydro One is initiating a Class Environmental Assessment (EA) to reinforce the transmission system that supplies Essex County and Windsor to ensure an adequate and reliable supply of electricity for the future. As a first step, Hydro One will evaluate alternative options for meeting the needs of the eastern part of the County. The need for new and/or upgraded high-voltage electrical facilities has been confirmed by the Ontario Power Authority, the agency responsible for planning long-term electricity supply in Ontario, in consultation with local distribution companies and Hydro One.

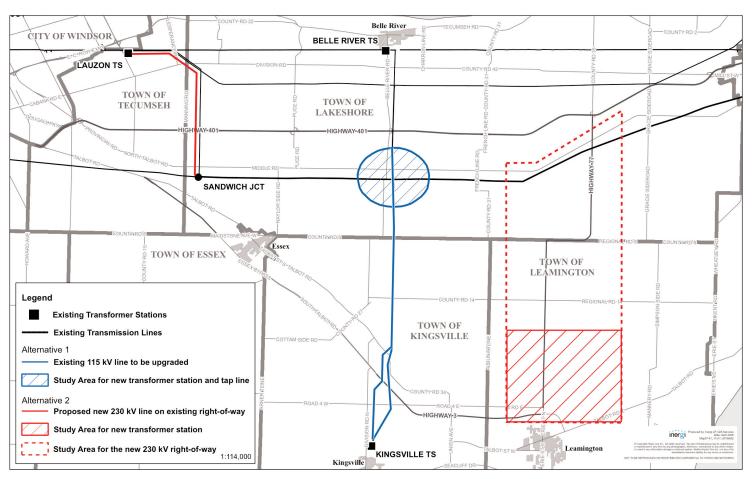
Alternative Transmission Options under consideration

Alternative 1:

- Construct a new transformer station and associated "tap" line in the Woodslee area in the Town of Lakeshore;
- Upgrade the capacity of the existing 115 kV transmission circuits between the proposed station and Kingsville Transformer Station, and replace the wood pole structures on this existing right-of-way.

Alternative 2:

- Construct a new transformer station north of Learnington and a new 230 kV transmission line on a new right-of-way to connect the proposed station to the existing 230 kV line that runs east-west, south of Hwy 401;
- Construct a new 230 kV transmission line on the existing Hydro One-owned right-of-way between Sandwich Junction and Lauzon Transformer Station in the Town of Tecumseh.



Project Approval Requirements

This project is subject to provincial *Environmental Assessment Act* approval in accordance with the *Class Environmental Assessment for Minor Transmission Facilities* and also requires "Leave to Construct" approval under Section 92 of the *Ontario Energy Board Act*.

Public Information Centres

Your feedback will help Hydro One identify a preferred option for meeting Essex County's electricity needs. Please visit one of our upcoming Public Information Centres to learn more about this project. Hydro One's project team and representatives from the Ontario Power Authority will be on hand to discuss the need for new facilities and the project alternatives with you.

Wed. April 16, 4-8 p.m.

Millen Community Centre 88 South Middle Road, Woodslee

Thurs. April 17, 4-8 p.m.

Royal Canadian Legion, Br. 84 14 Orange Street, Leamington

Tues. April 22, 4-8 p.m.

Tecumseh Arena 12021 McNorton Street, Tecumseh

For More Information, contact

Carrie-Lynn Ognibene, Hydro One Community Relations

Tel: 1-877-345-6799

Email: Community.Relations@HydroOne.com

Website: www.HydroOneNetworks.com/newprojects



Hydro One invites you to a Public Information Centre

Supply to Essex County – Class Environmental Assessment Project

Hydro One Networks (Hydro One) invites you to an open house to learn more about its plans to upgrade its electricity transmission facilities in Essex County.

Investing in electricity supply infrastructure to meet future needs

Hydro One owns and operates the high-voltage transmission system that supplies Ontario's major customers and local distributing companies. Hydro One is initiating a Class Environmental Assessment (EA) to determine the preferred option for reinforcing the transmission system that supplies Essex County and Windsor to ensure an adequate and reliable supply for the future. As a first step in this process, Hydro One's Supply to Essex County Class EA will focus on evaluating alternative options for meeting the needs of the eastern part of Essex County.

The need for investment in new and/or upgraded high-voltage electrical facilities in Windsor and Essex County has been confirmed by the Ontario Power Authority, the agency responsible for planning long-term electricity supply in Ontario, in consultation with local distribution companies and Hydro One.

Alternatives under consideration

As part of the Class EA, Hydro One is seeking input on the following two alternative options:

Alternative 1:

- Construction of a new 230 kilovolt (kV) to 115 kV autotransformer station and associated 'tap' line in the Woodslee area in the Town of Lakeshore. The study area for identifying potential station sites is shown on the enclosed Alternative 1 map.
- Upgrading the existing 115 kV transmission circuits between the proposed station and Hydro One's Kingsville Transformer Station. This would involve replacing the existing conductor (wires) with higher capacity conductor and replacing the wood pole structures on the existing transmission right-of-way.

Alternative 2:

- Construction of a new 230 kilovolt (kV) to 27.6 kV transformer station north of Learnington.
- Construction of a new 230 kV transmission line on a new right-of-way to connect the
 proposed station to Hydro One's existing 230 kV transmission line which runs east-west, south
 of Hwy 401. The study areas for identifying potential station sites and potential routes for the
 new 230 kV transmission line are shown on the enclosed Alternative 2 map.
- Construction of a new 230 kV transmission line between Sandwich Junction and Hydro One's Lauzon Transformer Station in the Town of Tecumseh, as shown on the map. This new section of 230 kV line would be built within the existing Hydro One-owned right-of-way.

continued on reverse

Supply to Essex County – Class Environmental Assessment Project

Project Approval Requirements

The proposed Supply to Essex County project is subject to provincial *Environmental Assessment Act* approval in accordance with the Class Environmental Assessment for Minor Transmission Facilities. The project is also subject to "Leave to Construct" approval from the Ontario Energy Board, under Section 92 of the *Ontario Energy Board Act*.

Public consultation and participation is a key part of both the Class EA and the Ontario Energy Board review processes for this project. Your input at all stages of the project is factored into our decision-making. It contributes to Hydro One's understanding of local issues and concerns associated with a proposed undertaking and helps us recommend the best ways to plan and construct new facilities.

Public Information Centres

Please visit one of our upcoming Public Information Centres, listed below, to learn more about this project. Members of Hydro One's project team and representatives from the Ontario Power Authority will be on hand to discuss the need for new facilities and the project alternatives with you.

Wed. April 16

4:00 – 8:00 p.m. Millen Community Centre 88 South Middle Road Woodslee

Thurs. April 17

4:00 – 8:00 p.m. Royal Canadian Legion, Br. 84 14 Orange Street Leamington

Tues. April 22

4:00 – 8:00 p.m. Tecumseh Arena 12021 McNorton Street Tecumseh

A second series of Public Information Centres will be held later this spring after Hydro One has conducted an analysis of the alternatives based on technical, environmental and socio-economic considerations and input received from the public and community stakeholders. At that time, Hydro One will present its preferred alternative and seek public input on its recommendation.

For More Information

If you have questions, or wish to be added to the project mailing list, please contact: Carrie-Lynn Ognibene

Hydro One Community Relations

Tel: 1-877-345-6799

Email: Community.Relations@HydroOne.com

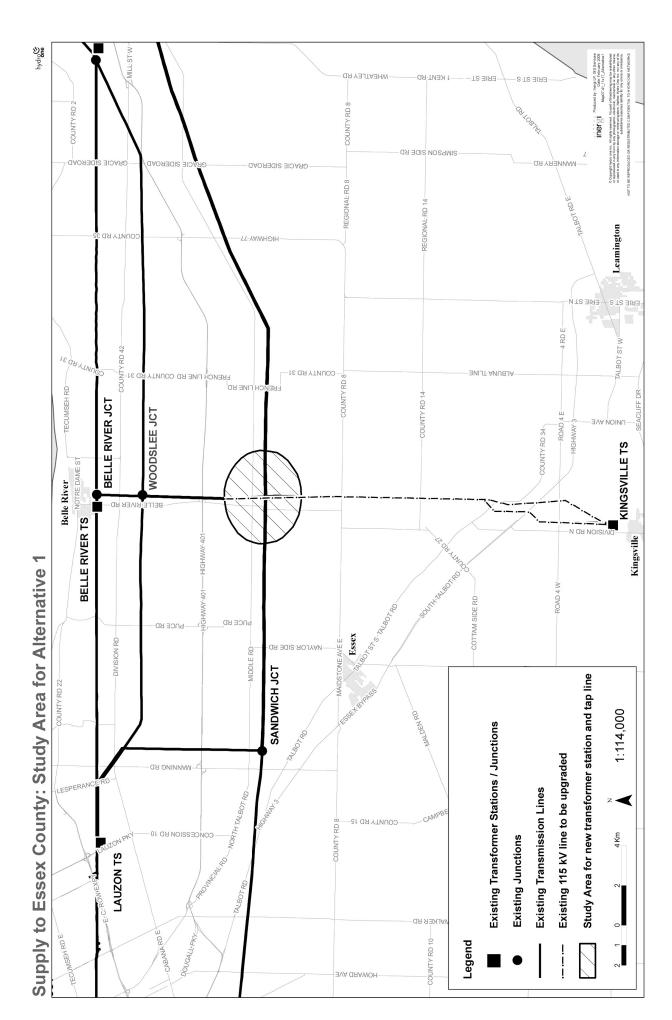
Website: www.HydroOneNetworks.com/newprojects

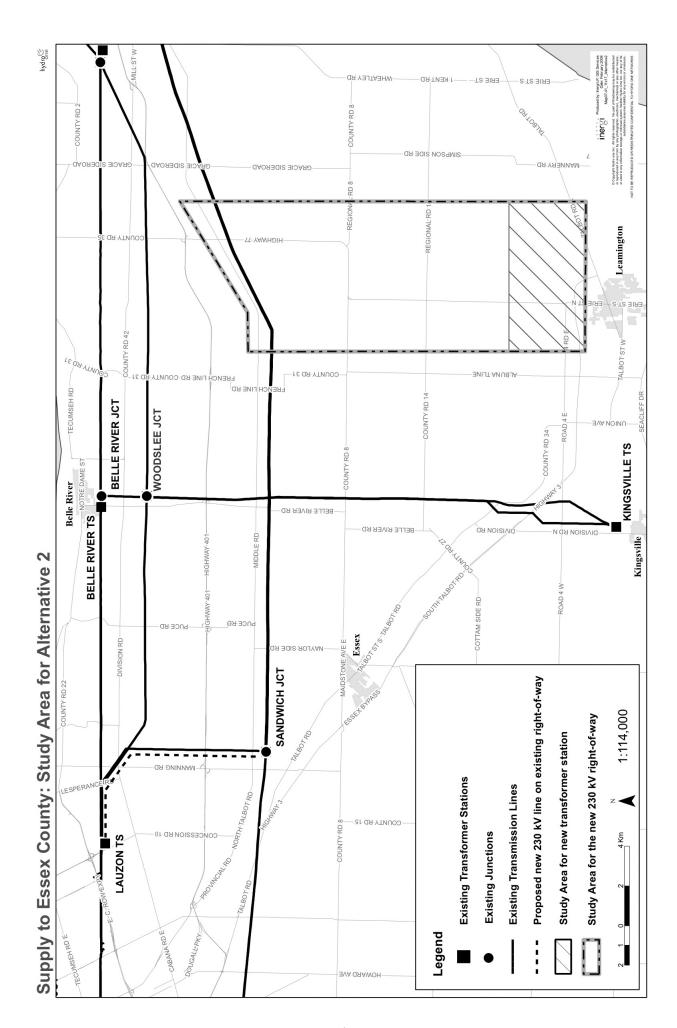
(look under Supply to Essex County)

Additional information is also available on the Ontario Power Authority's website at: www.powerauthority.on.ca/WindsorEssex



Partners in Powerful Communities





You are invited to a Public Information Centre Supply to Essex County - Class Environmental Assessment Benefit B-6-5

Working to meet Essex County's future electricity needs

Hydro One is initiating a Class Environmental Assessment (EA) to reinforce the transmission system that supplies Essex County and Windsor to ensure an adequate and reliable supply of electricity for the future. As a first step, Hydro One will evaluate alternative options for meeting the needs of the eastern part of the County. The need for new and/or upgraded high-voltage electrical facilities has been confirmed by the Ontario Power Authority, the agency responsible for planning long-term electricity supply in Ontario, in consultation with local distribution companies and Hydro One.

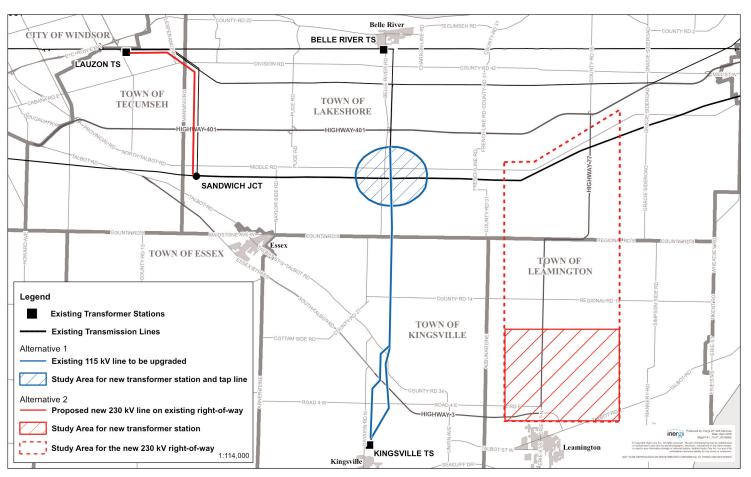
Alternative Transmission Options under consideration

Alternative 1:

- Construct a new transformer station and associated "tap" line in the Woodslee area in the Town of Lakeshore;
- Upgrade the capacity of the existing 115 kV transmission circuits between the proposed station and Kingsville Transformer Station, and replace the wood pole structures on this existing right-of-way.

Alternative 2:

- Construct a new transformer station north of Learnington and a new 230 kV transmission line on a new right-of-way to connect the proposed station to the existing 230 kV line that runs east-west, south of Hwy 401;
- Construct a new 230 kV transmission line on the existing Hydro One-owned right-of-way between Sandwich Junction and Lauzon Transformer Station in the Town of Tecumseh.



Project Approval Requirements

This project is subject to provincial *Environmental Assessment Act* approval in accordance with the *Class Environmental Assessment for Minor Transmission Facilities* and also requires "Leave to Construct" approval under Section 92 of the *Ontario Energy Board Act*.

Public Information Centres

Your feedback will help Hydro One identify a preferred option for meeting Essex County's electricity needs. Please visit one of our upcoming Public Information Centres to learn more about this project. Hydro One's project team and representatives from the Ontario Power Authority will be on hand to discuss the need for new facilities and the project alternatives with you.

Wed. April 16, 4-8 p.m.

Millen Community Centre 88 South Middle Road, Woodslee

Thurs. April 17, 4-8 p.m.

Royal Canadian Legion, Br. 84 14 Orange Street, Leamington

Tues. April 22, 4-8 p.m.

Tecumseh Arena 12021 McNorton Street, Tecumseh

For More Information, contact

Carrie-Lynn Ognibene, Hydro One Community Relations

Tel: 1-877-345-6799

Email: Community.Relations@HydroOne.com

Website: www.HydroOneNetworks.com/newprojects



Hydro One invites you to a Public Information Centre

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5 Attachment 3 Page 1 of 4

Supply to Essex County – Class Environmental Assessment Project

Hydro One Networks (Hydro One) invites you to an open house to learn more about its plans to upgrade its electricity transmission facilities in Essex County.

Investing in electricity supply infrastructure to meet future needs

Hydro One owns and operates the high-voltage transmission system that supplies Ontario's major customers and local distributing companies. Hydro One is initiating a Class Environmental Assessment (EA) to determine the preferred option for reinforcing the transmission system that supplies Essex County and Windsor to ensure an adequate and reliable supply for the future. As a first step in this process, Hydro One's Supply to Essex County Class EA will focus on evaluating alternative options for meeting the needs of the eastern part of Essex County.

The need for investment in new and/or upgraded high-voltage electrical facilities in Windsor and Essex County has been confirmed by the Ontario Power Authority, the agency responsible for planning long-term electricity supply in Ontario, in consultation with local distribution companies and Hydro One.

Alternatives under consideration

As part of the Class EA, Hydro One is seeking input on the following two alternative options:

Alternative 1:

- Construction of a new 230 kilovolt (kV) to 115 kV autotransformer station and associated 'tap' line in the Woodslee area in the Town of Lakeshore. The study area for identifying potential station sites is shown on the enclosed Alternative 1 map.
- Upgrading the existing 115 kV transmission circuits between the proposed station and Hydro One's Kingsville Transformer Station. This would involve replacing the existing conductor (wires) with higher capacity conductor and replacing the wood pole structures on the existing transmission right-of-way.

Alternative 2:

- Construction of a new 230 kilovolt (kV) to 27.6 kV transformer station north of Leamington.
- Construction of a new 230 kV transmission line on a new right-of-way to connect the
 proposed station to Hydro One's existing 230 kV transmission line which runs east-west, south
 of Hwy 401. The study areas for identifying potential station sites and potential routes for the
 new 230 kV transmission line are shown on the enclosed Alternative 2 map.
- Construction of a new 230 kV transmission line between Sandwich Junction and Hydro One's Lauzon Transformer Station in the Town of Tecumseh, as shown on the map. This new section of 230 kV line would be built within the existing Hydro One-owned right-of-way.

continued on reverse

Supply to Essex County – Class Environmental Assessment Project

Project Approval Requirements

The proposed Supply to Essex County project is subject to provincial *Environmental Assessment Act* approval in accordance with the Class Environmental Assessment for Minor Transmission Facilities. The project is also subject to "Leave to Construct" approval from the Ontario Energy Board, under Section 92 of the *Ontario Energy Board Act*.

Public consultation and participation is a key part of both the Class EA and the Ontario Energy Board review processes for this project. Your input at all stages of the project is factored into our decision-making. It contributes to Hydro One's understanding of local issues and concerns associated with a proposed undertaking and helps us recommend the best ways to plan and construct new facilities.

Public Information Centres

Please visit one of our upcoming Public Information Centres, listed below, to learn more about this project. Members of Hydro One's project team and representatives from the Ontario Power Authority will be on hand to discuss the need for new facilities and the project alternatives with you.

Wed. April 16

4:00 – 8:00 p.m. Millen Community Centre 88 South Middle Road Woodslee

Thurs. April 17

4:00 – 8:00 p.m. Royal Canadian Legion, Br. 84 14 Orange Street Leamington

Tues. April 22

4:00 – 8:00 p.m. Tecumseh Arena 12021 McNorton Street Tecumseh

A second series of Public Information Centres will be held later this spring after Hydro One has conducted an analysis of the alternatives based on technical, environmental and socio-economic considerations and input received from the public and community stakeholders. At that time, Hydro One will present its preferred alternative and seek public input on its recommendation.

For More Information

If you have questions, or wish to be added to the project mailing list, please contact: Carrie-Lynn Ognibene

Hydro One Community Relations

Tel: 1-877-345-6799

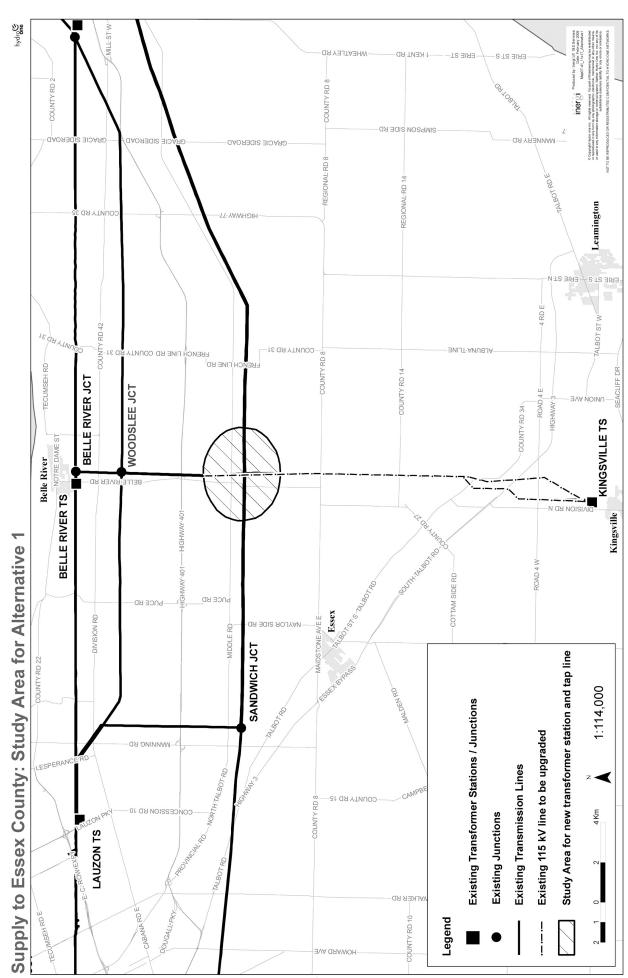
Email: Community.Relations@HydroOne.com

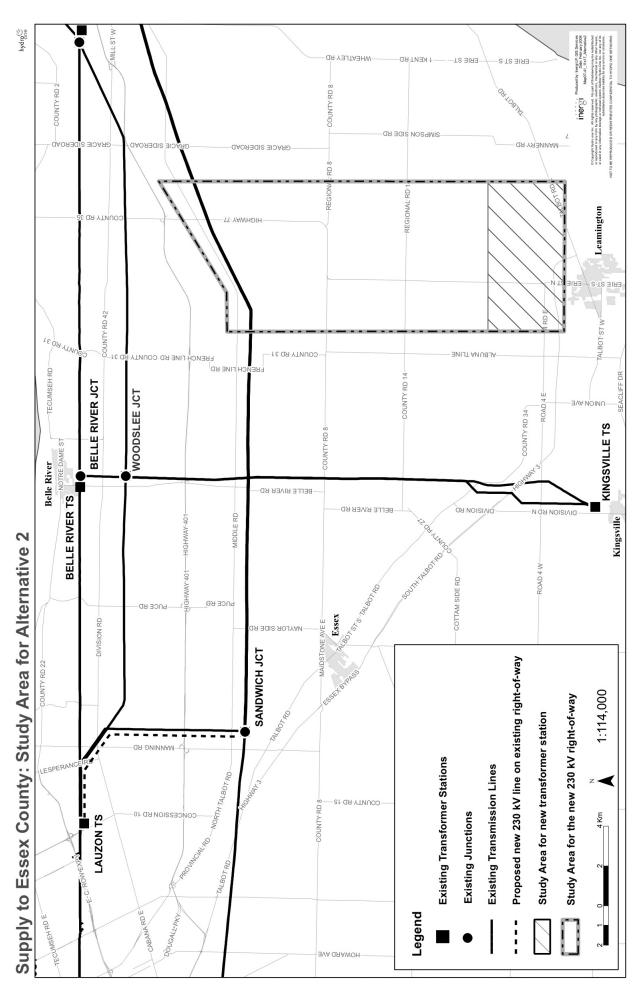
Website: www.HydroOneNetworks.com/newprojects

(look under Supply to Essex County)

Additional information is also available on the Ontario Power Authority's website at: www.powerauthority.on.ca/WindsorEssex







Supply to Essex County Class Environmental Assessment

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5 Attachment 4 Page 1 of 1

Notice of Public Information Centres #2

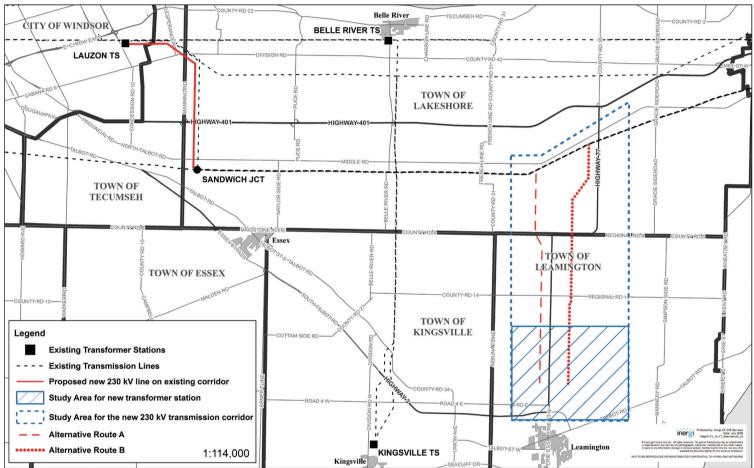
Hydro One identifies preferred transmission reinforcement plan for Essex County and Windsor

In April, Hydro One Networks (Hydro One) began a Class Environmental Assessment (EA) study of alternatives to reinforce electricity transmission facilities that serve the area. New facilities are needed to improve the reliability and security of electricity supply, and support growing electricity needs in eastern Essex County.

Two alternatives were reviewed with key stakeholders, and an initial series of public information centres was held to obtain community input. Following an analysis of technical, environmental, social, and cost factors, as well as public and stakeholder feedback, Hydro One selected a preferred alternative that represents a \$100 million investment in new transmission facilities. As shown on the map below, this would include:

- a new transformer station in the Leamington area
- a new 230 kilovolt (kV) transmission line on a new corridor to connect the proposed transformer station to the existing 230 kV lines that run east-west, south of Hwy 401; and
- an additional 230 kV line on the existing transmission corridor between Sandwich Junction and Lauzon Transformer Station (TS)

Supply to Essex County: Preferred Transmission Alternative



Next steps in Hydro One's Class EA process

- 1. Identify and evaluate potential transformer station sites in the Leamington area
- 2. Evaluate two potential transmission line routes (shown as Alternative Routes A and B on the map)
- 3. Collect detailed environmental information for the proposed transmission line on the existing corridor between Sandwich Junction and Lauzon TS

Public Information Centres

Public input is a key part of the Class EA process. Please visit one of our upcoming public information centres to learn more about the project, speak with Hydro One's project team, and provide your comments.

Wednesday, July 23

4:00 – 8:00 p.m.

Royal Canadian Legion, Branch 84
14 Orange Street, Leamington

Thursday, July 24

4:00 – 8:00 p.m. Tecumseh Arena 12021 McNorton Street, Tecumseh

For more information please contact:

Carrie-Lynn Ognibene

Hydro One Community Relations

Tel: 1-877-345-6799

Email: Community. Relations@HydroOne.com



Supply to Essex County Class Environmental Assessment ttachment 5 Page 1 of 2

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5

Hydro One Project Update and Notice of Public Information Centres #2

Hydro One Networks (Hydro One) has identified a preferred plan to reinforce electricity transmission facilities in Essex County.

In April, Hydro One began a Class Environmental Assessment (EA) study of two transmission alternatives to reinforce the electricity facilities that supply Essex County and Windsor. These were reviewed with local distribution companies, government agencies and municipal officials, and an initial series of public information centres was held in Woodslee, Leamington and Tecumseh to obtain community input. Following an analysis of technical, environmental, social, and cost factors, and public and stakeholder feedback, Transmission Alternative #2 was selected as the preferred alternative. It represents a better long-term solution for meeting growing electricity demand in the eastern part of the county while also increasing the reliability and security of the transmission system serving Windsor and Essex County.

The preferred Transmission Alternative #2 includes:

- a new transformer station in the Leamington area, and a new 230 kilovolt (kV) transmission line on a new corridor that would connect the proposed station to the existing 230 kV lines that run east-west, south of Hwy 401; and
- an additional 230 kV line on the existing transmission corridor between Sandwich Junction near Maidstone and Lauzon Transformer Station (TS) on Lauzon Road, south of the E.C. Row Expressway. Note: Alternative #1 consisted of a new transformer station in the Woodslee area and replacement of existing conductor (wire) and wood poles on the two existing 115 kV lines that supply Kingsville TS.

What happens next?

Hydro One will continue with the Class EA for the preferred transmission plan. This will involve:

- 1. Identifying and evaluating potential transformer station sites north of Leamington and close to the routes described below. The study area for the new transformer station is shown on Map 1 (see reverse);
- 2. Evaluating two potential transmission line routes in the Leamington/Lakeshore area, as shown on Map 1:
 - a. Alternative Route A would use a portion of the former rail bed owned by the Municipality of Leamington. This route would divert to the west of the community of Staples and then follow the east side of Concession Road 8 to join up with the existing east-west transmission corridor south of
 - b. Alternative Route B would be located approximately one kilometre east of Hwy 77 and would join up with the former rail bed north of County Road 8 to connect with the east-west transmission
- 3. Collecting detailed environmental information for the new transmission line on the existing corridor between Sandwich Junction and Lauzon TS, as shown on Map 2 (see reverse).

Public Information Centres

Public input is a key part of the EA process. Please visit one of our upcoming public information centres where members of Hydro One's project team can bring you up-to-date on the project and review route and site options for the proposed transmission facilities in your area.

Wednesday, July 23

4:00 - 8:00 p.m. Royal Canadian Legion, Branch 84 14 Orange Street, Leamington

Thursday, July 24

4:00 - 8:00 p.m. Tecumseh Arena 12021 McNorton Street, Tecumseh

For More Information

If you require further information or would like to be added to our project mailing list, please contact: Carrie-Lynn Ognibene

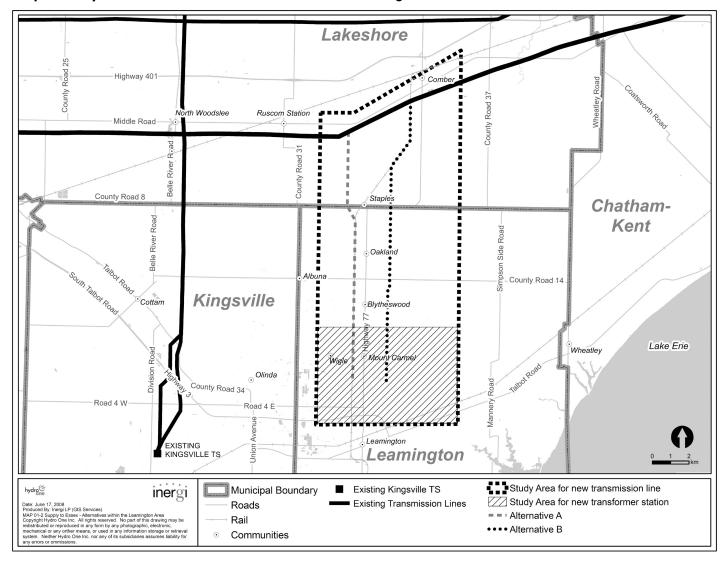
Hydro One Community Relations

Tel: 1-877-345-6799

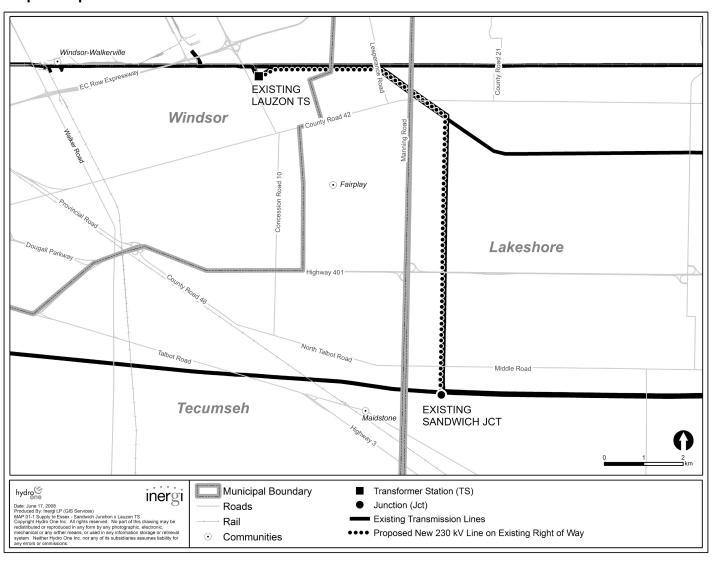
Email: Community.Relations@HydroOne.com



Map 1: Study Areas for New Transmission Facilities: Learnington / Lakeshore



Map 2: Proposed New Transmission Line: Sandwich JCT to Lauzon TS



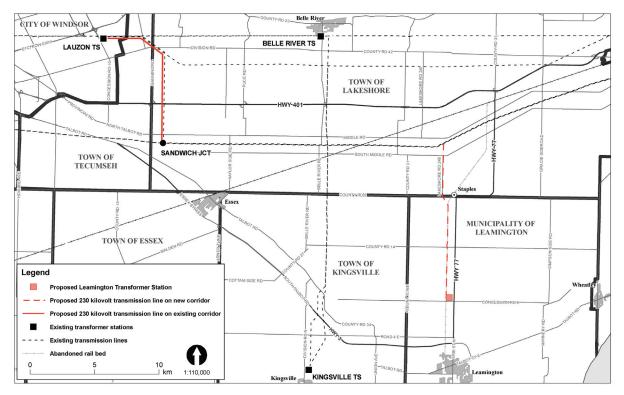
Project Update and Notice of Public Information Centre #3 - Leamington

Supply to Essex County Class Environmental Assessment (EA) Attachment 6

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5 Page 1 of 1

Hydro One is nearing completion of the Class Environmental Assessment (EA) to reinforce the electricity transmission system in Essex County. The following new facilities (see map) are proposed to ensure an adequate and reliable supply of power for the future:

- a new transformer station in Leamington and a new double circuit 230 kilovolt (kV) transmission line on a new corridor to connect the station to the existing 230 kV line south of Hwy 401. Hydro One has identified its preferred site for the proposed Leamington Transformer Station and preferred transmission line route following analysis of technical, environmental and socio-economic factors, and public and stakeholder feedback; and
- an additional 230 kV line on the existing transmission corridor between Sandwich Junction and Lauzon Transformer Station.



Public Information Centre #3 - Learnington

Public input is an important part of the EA process. Hydro One is holding a third public information centre to allow interested parties an opportunity to review display panels describing the project and maps of the preferred Leamington transformer station site and transmission line route. Hydro One representatives will be on hand to answer questions and collect feedback on the project.

Thursday, July 16 4 p.m. to 8 p.m. Lebanese Club 447 Hwy 77, Leamington

Next Steps

This fall, Hydro One will issue a draft Environmental Study Report (ESR) for a 30-day public and stakeholder review and comment period, as required by the Class EA process. An application will also be filed with the Ontario Energy Board (OEB) requesting "Leave to Construct" approval for the proposed facilities. Information on how interested parties may comment on the draft ESR and participate in the OEB review process for Hydro One's application will be advertised and also posted on the project website.

For more information, contact:

Carrie-Lynn Ognibene, Hydro One Community Relations

Tel: 1-877-345-6799

Email: Community.Relations@HydroOne.com



Hydro One invites you to Public Information Centre #3 2014-01 Supply to Essex County Class Environmental Assessment (EA)

EB-2013-0421 Communities

Exhibit B-6-5

Attachment 7

Dear Resident,

Hydro One invites you to our Public Information Centre (PIC) on July 16 at the Leamington Lebanese Club to review the proposed location for a new transformer station and preferred route for a new 230 kilovolt (kV) transmission line (see map on reverse). Drop in between 4 p.m. and 8 p.m. to learn more about the project and speak with our project team.

What's being proposed?

New electricity transmission facilities are needed to ensure an adequate and reliable supply of electricity for customers in eastern Essex County. Based on Hydro One's analysis of technical, environmental and socioeconomic factors, and public and stakeholder feedback, we are proposing:

• a new transformer station (Leamington TS) on the north side of Concession Road 6, just east of Leamington's utility corridor;

• a new double-circuit 230 kV transmission line on a new right-of-way to connect Leamington TS to the existing transmission lines near Hwy 401. The preferred route presented as Alternative A at PIC #2 last summer, would parallel the municipal utility corridor until just south of Staples. It would then divert to the west, and continue north along the east side of Lakeshore Road 245. Some property easement rights would be required.

For more information, please contact:

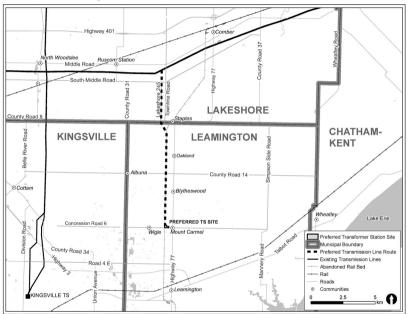
Carrie-Lynn Ognibene, Hydro One Community Relations

Tel: 1-877-345-6799

Email: Community.Relations@HydroOne.com



Proposed site for new Leamington Transformer Station and preferred route for new transmission line



You're invited to
Public Information Centre #3
Supply to Essex County Class EA

Thursday, July 16, 2009 4 p.m. – 8 p.m. Lebanese Club 447 Hwy 77, Leamington



COMMENT FORM

hydro Filed: 2014-01-22

EB-2013-0421 Exhibit B-6-5 Attachment 8 Page 1 of 2

Supply to Essex County

Public Information Centres April 16, 17, and 22, 2008

THANK YOU for attending Hydro One's Public Information Centre to discuss the plans for the reinforcements to the electricity transmission facilities in your area. Please take a moment to answer a few questions and note your thoughts, comments or questions below.

Please specify how you heard about the Public Information Centre:
□ Newspaper Ad
□ Flyer delivered to your home
□ Hydro One Website
Other
Were the information displays and maps helpful in explaining the project? Yes / No
How could they be improved?
□ Were Hydro One & Ontario Power Authority employees able to adequately answer your questions? Yes / No
Which transmission alternative to improve the supply to Essex County do you prefer? □ Alternative 1 (Woodslee area to Kingsville Transformer Station) □ Alternative 2 (Leamington area and Sandwich Junction to Lauzon Transformer Station)
Why do you prefer this alternative?
Please check here if you would like to be on the mailing list for this project and provide your contact information below.
Name:
Mailing Address & Postal Code:
Email:

Please give your comment form to one of Hydro One's representatives at the Public Information Centre, or send your comments to:

> Michelle Symeonides Hydro One Networks Inc. 483 Bay Street, 8th Floor, South Tower Toronto, Ontario M5G 2P5 Tel. (416) 345-6799; Fax: 416-345-6984

Email: Community.Relations@HydroOne.com

Please note any questions, comments, or concerns you may have regarding the information presented to you today on the reverse side of this form.

Supply to Essex County

Public Information Centres April 16, 17, and 22, 2008

Additional Comments or Questions:			
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Notice of Completion Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5 Supply to Essex County Transmission Reinforcement

Hydro One Networks Inc. (Hydro One) has completed the draft Environmental Study Report for the Supply to Essex County Transmission Reinforcement Project. Based on an analysis of technical, environmental and socio-economic factors, and public and stakeholder feedback, Hydro One is proposing the staged construction of the following new transmission facilities (see map) to reinforce the electricity transmission system in Essex County and ensure an adequate and reliable supply of power for the future:

- Stage 1: a new transformer station (TS) on Concession Road 6 in the Municipality of Leamington and a new double circuit 230 kilovolt (kV) transmission line on a new corridor to connect the station to the existing 230 kV lines south of Highway 401 in the Town of Lakeshore; and
- Stage 2: an additional double circuit 230 kV transmission line on the existing transmission corridor between Sandwich Junction and Lauzon TS in the City of Windsor.

This study was conducted in accordance with the Class Environmental Assessment for Minor Transmission Facilities, approved under the provincial Environmental Assessment Act. Construction of the proposed facilities is also subject to Section 92 of the Ontario Energy Board Act, 1998. Hydro One is planning to submit an application to the Ontario Energy Board later this year seeking approval to construct the first stage of this project, with a targeted in-service date of 2013 for the Leamington TS and connector line.

How to Submit Your Input

In accordance with the Class Environmental Assessment process, Hydro One is making the draft Environmental Study Report (ESR) available for public review and comment for 30 days, from February 11, 2010 to March 12, 2010. The draft ESR can be viewed or downloaded from Hydro One's website: www.HydroOne.com/projects. A copy of the draft ESR is available in the Clerk's department at the following municipal offices, and at the public libraries listed below.

Municipality of Learnington 38 Erie Street North Tel: 519-326-5761

Town of Lakeshore 419 Notre Dame Street Belle River

Tel: 519-728-2700

Town of Tecumseh 917 Lesperance Road Tel: 519-735-2184

Comber Library 6400 Main Street Tel: 519-687-2832

Kingsville Library 28 Division Street South Tel: 519-733-5620 Leamington Library 1 John Street Tel: 519-326-3441

Tecumseh Library 13675 St. Gregory's Road Tel: 519-735-3670

Forest Glade – Optimist Library 3211 Forest Glade Drive

Windsor

Tel: 519-255-6770

Woodslee Library 1925 South Middle Road Tel: 519-975-2433

Supply to Essex County: Preferred Transmission Alternative

GTY OF WINDSOR

LAUZON TS

BELLE RIVER TS

CONCESSED

TOWN OF
TECUMSEH

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Written questions or comments on the draft ESR must be received by Hydro One no later than 4:30 p.m. E.S.T. on Friday, March 12, 2010. Please address correspondence to:

Patricia Staite, Environmental Planner Hydro One Networks Inc. 483 Bay Street, South Tower, 4th Floor Toronto, ON M5G 2P5

Email: <u>patricia.staite@HydroOne.com</u> Tel: 1-877-345-6799; Fax: 416-345-6919

Hydro One will respond to and make best efforts to resolve any issues raised by concerned parties during the public review period. If no concerns are expressed, the ESR will be finalized and filed with the Ministry of the Environment. The project will be considered acceptable and will proceed as outlined in the draft ESR.

The Environmental Assessment Act has provisions that allow interested parties to ask for a higher level of assessment for a Class EA project if they feel that outstanding issues have not been adequately addressed by Hydro One. This higher level of assessment is referred to as a Part II Order request. Such requests must be addressed in writing to the Minister of the Environment and received no later than 4:30 p.m. E.S.T. on March 12, 2010, at the following address:

Ministry of the Environment 135 St. Clair Avenue West, 12th Floor Toronto, ON M4V 1P5

Please note that a duplicate copy of a Part II Order request must also be sent to Hydro One at the address noted above.



Ministry of the Environment

Office of the Minister

77 Wellesley Street West 11th Floor, Ferguson Block Toronto ON M7A 2T5 Tel.: 416 314-6790 Fax: 416 314-6748 Ministère de l'Environnement

Bureau du ministre

77, rue Wellesley Ouest 11° étage, édifice Ferguson Toronto ON M7A 2T5 Tél.: 416 314-6790 Téléc.: 416 314-6748



Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5 Attachment 10 Page 1 of 2

ENV1283MC-2010-1370

MAY 1 8 2010

Ms. Patricia Statie
Hydro One Networks Inc.
Environmental Planner
483 Bay Street, South Tower, 4th Floor
Toronto ON M5G 2P5

Dear Ms. Statie:

On February 23 and 24, 2010, I received two requests from members of the public that Hydro One Networks Inc. (Hydro One) be required to prepare an individual environmental assessment (EA) for the proposed Supply to Essex County Transmission Reinforcement Project (Project).

I am taking this opportunity to inform you that I have decided that an individual EA is not required. This decision was made after giving careful consideration to the issues raised in the request, the Project documentation, the provisions of the Class Environmental Assessment for Minor Transmission Facilities (Class EA), and other relevant matters required to be considered under subsection 16(4) of the *Environmental Assessment Act* (EAA). The reasons for my decision may be found in the attached letters to the requesters.

With this decision having been made, Hydro One may now proceed with the Project, subject to any other permits or approvals required. Hydro One must implement the Project in the manner it was developed and designed, as set out in the Draft Environmental Study Report (ESR) and inclusive of all mitigating measures and environmental and other provisions therein. In accordance with the Class EA, any commitments made to affected agencies or members of the public must be fulfilled and implemented as part of the proposed project.

Ms. Patricia Statie Page 2.

Lastly, I would like to ensure that Hydro One understands that failure to comply with the EAA, the provisions of the Class EA, and failure to implement the Project in the manner described in the Draft ESR, are contraventions of the EAA and may result in prosecution under section 38 of the Act. I am confident that Hydro One recognizes the importance and value of the EAA and will ensure that its requirements and those of the Class EA are satisfied.

Sincerely,

John Gerretsen

Minister of the Environment

EA File: 06-07 Supply to Essex County Transmission Reinforcement Project (Hydro One)

Hydro One Networks Inc. Corporate Relations483 Bay St., South Tower, 7th Fl.
Toronto, ON M5G 2P5

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-5 Attachment 11 Page 1 of 3

www.HydroOne.com

December 10, 2013

Mayor John Paterson and Members of Council Municipality of Learnington Learnington, ON N8H 2Z9

VIA EMAIL

Dear Mayor Paterson & Council:

Hydro One to seek approval to build Leamington Transformer Station (TS)

I am writing to update you on the status of Hydro One's Supply to Essex County Transmission Reinforcement Project. Hydro One completed the Environmental Assessment for this project in 2010 following an extensive consultation process. Due to economic conditions at that time, Hydro One decided to defer seeking Ontario Energy Board (OEB) approval to build the project until the Ontario Power Authority (OPA) had an opportunity to further review the long-term electricity needs of the Windsor-Essex area.

The OPA, in its regional supply planning discussions with Hydro One and the local distribution companies (LDCs) in Essex County, has determined that new transmission facilities are needed in the Kingsville/Leamington area to address future growth in electricity demand and anticipated expansion in the local agricultural sector. The new facilities would also contribute to improved reliability of electricity supply in the broader Windsor-Essex region.

As noted in Ontario's updated Long-Term Energy Plan, *Achieving Balance*, released on December 2, 2013, Hydro One has resumed planning for the Leamington TS and associated connector line. Hydro One intends to file a "Leave to Construct" application with the OEB early in 2014 seeking approval under Section 92 of the *Ontario Energy Board Act, 1998* to construct the facilities shown on the attached map. The project would include: a new transformer station on Hydro One-owned property on Mersea Road 6 adjacent to the municipal utility corridor in the Municipality of Leamington; and a new 13-kilometre double circuit 230 kilovolt (kV) transmission line on a new corridor to connect the station to the existing 230 kV transmission line south of Highway 401 in the Town of Lakeshore. Cost recovery for the transmission expansion will also be established during the approvals process.

As with the environmental assessment process, the OEB's review of Hydro One's "Leave to Construct" application will include opportunities for public involvement, in this case through a formal hearing process. Hydro One will be communicating with local stakeholders and potentially-affected property owners in the coming weeks to inform them of our intent to seek approval to construct these facilities.

Following receipt of Hydro One's application, the OEB will issue a *Notice of Application and Hearing* which will outline the process for those who wish to be involved in the public hearing. Hydro One will publish the Notice in local and regional newspapers and send it to all project stakeholders, potentially-affected property owners and interested parties.

LDCs in the Windsor-Essex area support this project. We'd appreciate if Council would also communicate its support for this project by way of a letter which we would include with our application to the OEB. The letter may be addressed to Mike Penstone, Vice-President, Network Development & Regional Planning, Hydro One Networks Inc., and sent electronically via Communty.Relations@HydroOne.com.

In the interim, background information including the final Environmental Study Report for this project can be viewed on Hydro One's website at www.HydroOne.com/Projects. If you have any questions or wish to request a meeting with Hydro One representatives, please don't hesitate to contact me at 416-345-5130.

Sincerely,

Carrie-Lynn Ognibene

Sr. Advisor, Corporate Relations

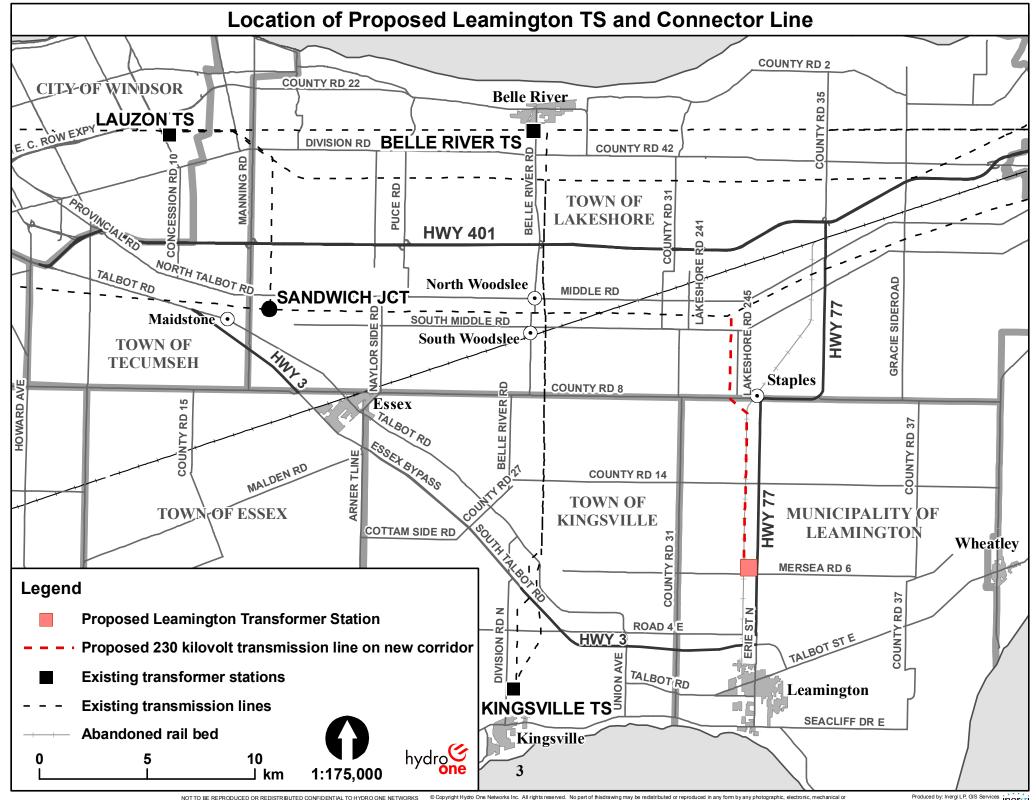
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Attachment

cc Mr. Bill Marck, Chief Administrative Officer

Ms. Kim Siddall, Manager of Corporate Services & Clerk

Ms. Tracey Pillon-Abbs, Director, Development Services





January 21, 2014

- <Owner name(s)>
- <Address Line 1>
- <Address Line 2>

Dear < Property Owner/Property Owners>:

Supply to Essex County Transmission Reinforcement Project Property Reference: <Legal Description>

This week, Hydro One Networks Inc. (Hydro One) will file an application with the Ontario Energy Board (OEB) seeking approval to construct a new transmission line in your area. The proposed 13-kilometre double circuit 230 kilovolt (kV) transmission line would be located on a new right-of way, as shown on the attached map. The line is needed to connect a new transformer station Hydro One is proposing to build on its property on Mersea Road 6 in the Municipality of Leamington with the existing 230 kV transmission line located south of Hwy 401 in the Town of Lakeshore. We are writing to you because the proposed transmission line route will likely affect your property.

Why is this project needed?

The proposed transformer station and connector line would address future growth in electricity demand and anticipated expansion in the local agricultural sector. They would also improve the reliability of electricity supply in the broader Windsor-Essex region. The need for the proposed facilities has been identified by the Ontario Power Authority in consultation with Hydro One and local distribution companies in the Windsor-Essex region. Ontario's updated Long-Term Energy Plan released in December 2013 also includes this project.

How would my property be affected?

If approved by the OEB, the proposed 13-kilometre transmission line would require a right-of-way width of approximately 130 feet (40 m). The standard lattice steel towers for this type of transmission line are approximately 120 feet (37 m) tall with a base footprint of 20 feet x 20 feet (6 m x 6m), and they would be located approximately 750 feet (300 m) apart. Hydro One will therefore need to acquire new property rights from private property owners along the transmission line route. Later this year, Hydro One will set up a property owner information session to discuss our land acquisition principles and practices.

How was the transmission line route determined?

The route for the transmission line was identified following an analysis of alternative routes and input from the community during the Class Environmental Assessment (EA) process conducted from 2008 to 2010. Hydro One held three series of public information centres in 2008 and 2009 to discuss the project with members of the community. A number of landowners in the Staples area also attended a workshop in October 2009 to review and provide input on alternative routes for the proposed transmission line. Hydro One submitted a final Environmental Study Report to the Ministry of the Environment in July 2010 to complete the Class EA process.

When would construction begin?

The OEB review of Hydro One's "Leave to Construct" application and the associated public hearing process could take six months to a year. We anticipate construction could begin in Spring 2015. Detailed engineering would begin following OEB approval.

How can I provide my input?

The OEB's review of Hydro One's "Leave to Construct" application includes opportunities for public involvement in the hearing process. The OEB is responsible for ensuring that the new transmission line is in the public interest and will consider the impacts upon consumers with respect to prices, as well as matters that concern the reliability and quality of electricity service.

Within the coming weeks the OEB will issue a *Notice of Application and Hearing* which will outline the process for participating in the public hearing. Hydro One will publish the Notice in local and regional newspapers and will mail it directly to you.

Working with You

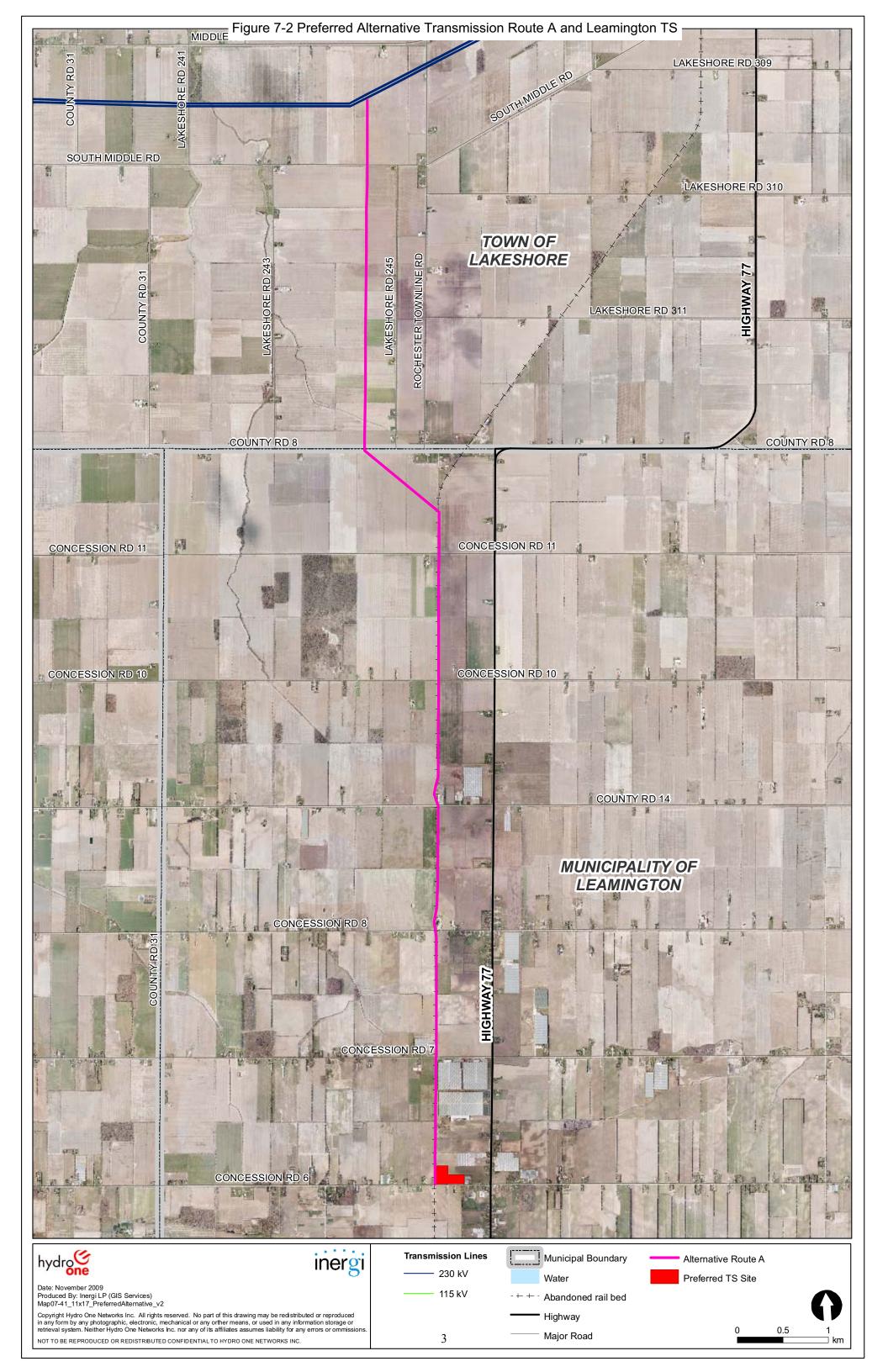
We are committed to keeping you informed of the status of this project. Upon project approval, we look forward to working closely with you to discuss property matters and to determine how construction of the transmission line can be scheduled to minimize disruption to you and your family.

In the interim, please visit www.HydroOne.com/Projects (under Supply to Essex County) for more information and to view the Environmental Study Report (July 2010) and Hydro One's "Leave to Construct" application. Please direct any questions or comments you may have to Hydro One Community Relations at 1-877-345-6799; or by email to: Community.Relations@HydroOne.com.

Sincerely,

Randy Church Manager, Project Development and Oversight Hydro One Networks Inc.

Attachment (map)



Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 6 Page 1 of 4

FIRST NATIONS & MÉTIS ENGAGEMENT

1.0 INTRODUCTION

affected by, the SECTR Project.

Hydro One recognizes the importance of early engagement with First Nations and Métis communities regarding the Supply to Essex County Transmission Reinforcement Project ("SECTR Project"). The following sets out Hydro One's process for engaging with First Nations and Métis communities who may have an interest in, or may be potentially

2.0 IDENTIFICATION OF FIRST NATIONS & MÉTIS COMMUNITIES

On February 22, 2008, Hydro One sent a letter including a Project Study Area Map to the Ontario Ministry of Aboriginal Affairs and Indian and Northern Affairs Canada (now known as Aboriginal Affairs and Northern Development Canada) requesting input on First Nations and/or Métis communities with potential interests in or who may be potentially affected by the SECTR Project. In a letter to Hydro One dated March 18, 2008, Indian and Northern Affairs Canada determined that Specific Claims have been submitted by Caldwell First Nation, Walpole Island First Nation, Chippewas of Kettle and Stony Point, Chippewas of the Thames First Nation, Oneida Nation of the Thames, Munsee-Delaware Nation, and Moravian of the Thames First Nation. In addition, they recommended that Hydro One apprise Aamjiwnaang First Nation of the SECTR Project. In a letter to Hydro One dated April 7, 2008, the Ontario Ministry of Aboriginal Affairs advised that "the project did not appear to be located in an area where First Nations may have existing or asserted rights that could be impacted by the Project". Please refer to Exhibit B, Tab 6, Schedule 6, Attachment 1 for copies of the above communications.

On October 09, 2013 Hydro One sent a letter including a Project Study Area Map to the Ontario Ministry of Energy indicating that Hydro One would be re-commencing work on

Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 6 Page 2 of 4

the SECTR Project. In this letter, Hydro One indicated that it intends to re-notify the

following communities; Caldwell First Nation, Walpole First Nation, Chippewas of

Kettle and Stony Point First Nation, Chippewas of the Thames First Nation, Oneida

Nations of the Thames, Munsee-Delaware Nation, Moravian of the Thames First Nation

and Aamjiwnaang First Nation of project re-commencement. In addition Hydro One

requested that the Ontario Ministry of Energy advise of additional First Nations interests

that may occur within the general vicinity of the SECTR Project area. Please refer to

Exhibit B, Tab 6, Schedule 6, Attachment 2 for a copy of this letter.

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On November 04, 2013 the Ontario Ministry of Energy provided a response to Hydro One advising that they concur with Hydro One's intentions to re-notify the list of communities provided by Hydro One on October 09, 2013. The Ministry of Energy recommended that Hydro One offer to meet with communities to discuss the proposed project, learn more about the leave-to-construct process, and to share any concerns or interest that they may have regarding the project. Please refer to **Exhibit B**, **Tab 6**, **Schedule 6**, **Attachment 3** for a copy of this letter.

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3.0 ENGAGEMENT PROCESS FOR FIRST NATIONS & MÉTIS COMMUNITIES

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Hydro One's First Nations and Métis engagement process is designed to provide relevant project information to neighbouring First Nations and Métis communities in a timely manner and for Hydro One to respond to and consider issues, concerns or questions raised by First Nations and Métis communities in a clear and transparent manner throughout the regulatory review processes (e.g., the Environmental Assessment ("EA") and OEB processes). Engagement activities with potentially impacted First Nations and Métis communities included:

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Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 6 Page 3 of 4

- Providing SECTR Project-related information to neighbouring First Nations and
 Métis communities including, project notification letters which describe the need and
 nature of the project. Ensuring that all publicly available information is also made
 available to these communities;
- Offering meetings with the First Nations and Métis communities to provide SECTR
 Project-related information, to identify concerns, issues or questions about the
 SECTR Project, and respond to questions and wherever possible, address concerns, in
 relation to the SECTR Project;
- Providing information, when requested, on the OEB's regulatory process, the EA process or any other decision-making processes applicable to the SECTR Project;
- Giving consideration to all issues and concerns raised by the First Nations and Métis communities as to how the SECTR Project may affect them;
 - Recording all forms of engagement with the First Nations and Métis communities, maintaining a record of the concerns and issues raised by the First Nations and Métis communities regarding the SECTR Project and Hydro One's responses thereto, and communicating the same with the Ministry of Energy.

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4.0 ENGAGEMENT TO DATE WITH FIRST NATIONS COMMUNITIES

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Please refer to **Exhibit B, Tab 6, Schedule 6, Attachment 4** for a description of Hydro One's engagement activities with First Nations.

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5.0 SUMMARY

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Hydro One is prepared to continue engagement efforts with these First Nations relating to the SECTR Project. To date, no major issues have been raised. Concerns raised by Caldwell First Nation and Hydro One's response are summarized in **Exhibit B**, **Tab 6**, Filed: 2014-01-22 EB-2013-0421 Exhibit B Tab 6 Schedule 6 Page 4 of 4

- Schedule 6, Attachment 4. Hydro One will work to resolve any issues or concerns in
- the event that anything should arise.

Hydro One Networks Inc.

483 Bay Street TCT12 Tel: 416–345-6597
Toronto, ON M5G1X6 Fax: 416-345-6919
mccormick.bj@hydroone.com Cell: 416-525-1051



Brian McCormick

Manager, Environmental Services and Approvals

February 22, 2008

Mr. Fred Hosking Senior Claims Analyst Department of Indian and Northern Affairs Specific Claims Branch 10 Wellington St. Room 1310 Gatineau Quebec K1A 0H4

RE: Supply to Essex County Class Environmental Assessment

Dear Mr. Hosking:

Hydro One Networks Inc. (Hydro One) is about to begin a project which would result in reinforcements to the electrical infrastructure to better serve residents and businesses in Essex County. The Ontario Power Authority has identified that there is an inadequate power supply capacity to the eastern portion of Essex County. This project will address increased electricity demand resulting from economic growth and development in this area and provide a more reliable supply of power for future demand.

Hydro One is initiating a Class Environmental Assessment (Class EA) with two distinct alternatives that would involve the construction of a new transformer station (TS) and the construction or upgrade of transmission lines in Essex County. The alternatives are as follows:

Alternative 1: Construct a new transformer station and tap line north of the Town of Kingsville and upgrade the existing 115kV line from the new transformer station to Kingsville TS. This is shown on the attached map – Supply to Essex County: Study Area for Alternative 1.

Alternative 2: Construct a new transformer station in the Learnington area and a new 230 kV transmission line from the transformer station to the existing transmission line that runs east from Sandwich Jct. The area being studied for the new station and line is shown on the attached map – Supply to Essex County: Study Area for Alternative 2. This alternative also requires the construction of a new 230 kV transmission line from Lauzon TS to Sandwich Junction (Jct) parallel to the existing transmission line on the Hydro One owned right-of-way which is also shown on the map.

The proposed undertaking is subject to provincial Environmental Assessment (EA) Act approval in accordance with the Class EA for Minor Transmission Facilities. The Class EA will involve the identification and comparative evaluation of the two alternatives. The project is also subject to "Leave to Construct" approval from the Ontario Energy Board (OEB). Contingent on the outcome of the Class EA and the OEB approval processes, the new facilities could be placed in service as early as Spring 2011.

Hydro One recognizes the need to begin consultation in the preliminary stages of project planning and has initiated consultation with regional and municipal representatives and government agencies.

Our first series of Public Information Centres (PICs) is tentatively scheduled for April 2008. The PICs will provide the interested parties the opportunity to learn more about the project, provide their input on project options, and discuss any issues or concerns with our project team. We will advise you of the details of the PIC via an invitation letter closer to the date. For our records, please complete and return the attached **Fax Back Form** indicating the appropriate contact person.

We would like information on whether there are any Aboriginal Reserves, land claims, interests or treaties of which we should be aware. Inquiries have also been sent to two other people in INAC: Mr. Fanklin Roy, Director, Litigation Management and Resolution Branch and Ms. Louise Trepanier, Director, Comprehensive Claims Branch.

Thank you for assisting us in this matter. If you have any questions regarding this project please feel free to contact me at (416) 345-6597 or Patricia Staite at (416) 345-6686.

Sincerely,

Brian McCormick

Manager, Environmental Services & Approvals

Cc. Lee Anne Cameron, Director, Aboriginal Affairs

Att.

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 416-345-6597

 Toronto, ON M5G1X6
 Fax:
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 mccormick.bj@hydroone.com
 Cell:
 416-525-1051



Brian McCormick

Manager, Environmental Services and Approvals

February 22, 2008

Ms. Louise Trepanier
Director
Department of Indian and Northern Affairs
Claims East of Manitoba, Comprehensive Claims Branch
10 Wellington St. Room 1310
Gatineau Quebec
K1A 0H4

RE: Supply to Essex County Class Environmental Assessment

Dear Ms. Trepanier:

Hydro One Networks Inc. (Hydro One) is about to begin a project which would result in reinforcements to the electrical infrastructure to better serve residents and businesses in Essex County. The Ontario Power Authority has identified that there is an inadequate power supply capacity to the eastern portion of Essex County. This project will address increased electricity demand resulting from economic growth and development in this area and provide a more reliable supply of power for future demand.

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We would like information on whether there are any Aboriginal Reserves, land claims, or treaties of which we should be aware. Inquiries have also been sent to two other people in INAC: Mr. Franklin Roy, Director, Litigation Management and Resolutions Branch and Mr. Fred Hosking, Senior Claims Analyst, Special Claims Branch.

Thank you for assisting us in this matter. If you have any questions regarding this project please feel free to contact me at (416) 345-6597, or Patricia Staite at (416) 345-6686.

Sincerely

Brian McCormick

Manager, Environmental Services & Approvals

Cc. Lee Anne Cameron, Director, Aboriginal Affairs

Att.

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 mccormick.bj@hydroone.com
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 416-525-1051



Brian McCormick

Manager, Environmental Services and Approvals

February 22, 2008

Mr. Franklin Roy Director Department of Indian and Northern Affairs Litigation Management and Resolution Branch 10 Wellington St. Room 1310 Gatineau Quebec K1A 0H4

RE: Supply to Essex County Class Environmental Assessment

Dear Mr. Roy:

Hydro One Networks Inc. (Hydro One) is about to begin a project which would result in reinforcements to the electrical infrastructure to better serve residents and businesses in Essex County. The Ontario Power Authority has identified that there is an inadequate power supply capacity to the eastern portion of Essex County. This project will address increased electricity demand resulting from economic growth and development in this area and provide a more reliable supply of power for future demand.

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Thank you for assisting us in this matter. If you have any questions regarding this project please feel free to contact me at (416) 345-6597 or Patricia Staite at (416) 345-6686.

Sincerely,

Brian McCormick

Manager, Environmental Services & Approvals

Cc. Lee Anne Cameron, Director, Aboriginal Affairs

Att.

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Brian McCormick

Manager, Environmental Services and Approvals

February 22, 2008

Mr. Alan Kary
Deputy Director
Ontario Ministry of Aboriginal Affairs
Policy and Relationships Branch
720 Bay Street 4th Floor
Toronto Ontario
M5G 2K1

RE: Supply to Essex County Class Environmental Assessment

Dear Mr. Kary:

Hydro One Networks Inc. (Hydro One) is about to begin a project which would result in reinforcements to the electrical infrastructure to better serve residents and businesses in Essex County. The Ontario Power Authority has identified that there is an inadequate power supply capacity to the eastern portion of Essex County. This project will address increased electricity demand resulting from economic growth and development in this area and provide a more reliable supply of power for future demand.

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Thank you for assisting us in this matter. If you have any questions regarding this project please feel free to contact me at (416) 345-6597, or Patricia Staite at (416) 345-6686.

Sincerely.

Brian McCormick

Manager, Environmental Services & Approvals

Cc. Lee Anne Cameron, Director, Aboriginal Affairs Att.

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 416-525-1051



Brian McCormick

Manager, Environmental Services and Approvals

February 22, 2008

Mr. Surrinder Singh Gill Policy Advisor Ontario Ministry of Aboriginal Affairs Policy and Relationships Branch 720 Bay Street 4th Floor Toronto Ontario M5G 2K1

RE: Supply to Essex County Class Environmental Assessment

Dear Mr. Gill:

Hydro One Networks Inc. (Hydro One) is about to begin a project which would result in reinforcements to the electrical infrastructure to better serve residents and businesses in Essex County. The Ontario Power Authority has identified that there is an inadequate power supply capacity to the eastern portion of Essex County. This project will address increased electricity demand resulting from economic growth and development in this area and provide a more reliable supply of power for future demand.

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Sincerely.

Brian McCormick

Manager, Environmental Services & Approvals

Cc. Lee Anne Cameron, Director, Aboriginal Affairs Att.

Stakeholder and First Nation Consultation Comments Documentation

Brian McCormick, Hyde Indian and Northern A Kevin Clement, A/ Direst Branch √ Mail Phon Affaires indiennes et du Nord Canad March 10, 2008 Brian McCormick Manager Environmental Hydro One Networks Ince 483 Bay Street, TCT13, TORONTO, ON M5G 25	ffairs Canada ector for Lynn Bernard e E-mail Indian and Northern Affairs Canada Services and Approvals North Tower		March 10, 2008 neral, Comprehensive Claims person
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March 10, 2008 Brian McCormick Manager Environmental Hydro One Networks Inc 483 Bay Street, TCT13, I TORONTO, ON M5G 28	Services and Approvals North Tower		
Dear Mr. McCormick:	Supply to Essex Count Class Environmental A	ssessment	prehensive Claims Branch, by mai
make any comments reg policies. This includes cla Nation against the Crowr Specific Claims Branch at (81 INAC- Comprehensive Crequest to be taken out o	arding potential or future aims under Canada's Spential For more information, I at (819) 994-2323 and the 9) 997-3582.	claims, or clain ecific Claims Po suggest you co Director Gene	ns filed under other departmental olicy or legal action by the First ontact the Director General of eral of Litigation Management and
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www.sinc-nac.go.ca

Yorra rentranca - Your Re

National Manager - Contribution

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MAR 1 8 2008

Brian McCormick Manager, Environmental Services & Approvals Hydro One Networks Inc. 483 Bay Street TCT12 TORONTO ON M5G 1X6

Dear Mr. McCormick:

Supply to Essex County Class Environmental Assessment Re:

I am writing in response to your letter of February 22, 2008, inquiring as to whether there are any First Nations that may have an interest in the above noted study area.

We have conducted a brief search of our records and determined that some specific claims have been submitted in the area of interest. The claims for that area have been submitted by the following First Nations:

Caldwell First Nation 10297 TALBOT ROAD, BLENHEIM ON NOP 1A0 (519) 676-5499

Walpole Island First Nation RR 3, WALLACEBURG ON N8A 4K9 (519) 627-1481

Chippewas of Kettle and Stony Point First Nation 6247 INDIAN LANE, RR#2 FOREST ON NON 1J0 (519)786-2125

Chippewas of the Thames First Nation RR 1, MUNCEY ON NOL 1YO (519) 289-5555

...12



Oneida Nation of the Thames RR 2, SOUTHWOLD ON NOL 2G0 (519) 652-3244

Munsee-Delaware Nation RR 1, MUNCEY ON NOL 1Y0 (519) 289-5396

Moravian of the Thames First Nation RR 3, THAMESVILLE ON NOP 2K0 (519) 692-3936

In addition, there is another First Nation in the general vicinity of your area of interest. You may wish to apprise them of your intentions.

Aamjiwnaang First Nation 978 TASHMOO AVENUE, SARNIA ON N7T 7H5 (519) 336-8410

For more information, you may wish to consult a "Public Information Status Report" on all claims which have been submitted to date. This information is available to the public on the Indian and Northern Affairs Canada (INAC) website and can be found at http://www.ainc-inac.gc.ca/ps/clm/pis_e.html.

It should be noted that the reports available on the INAC website are updated quarterly and therefore, you may want to check this site at regular intervals for updates. In accordance with legislative requirements, confidential information has not been disclosed.

Please rest assured that it is the policy of the Government of Canada as expressed in Outstanding Business: A Native Claims Policy that "in any settlement of specific native claims the government will take third party interests into account. As a general rule, the government will not accept any settlement which will lead to third parties being dispossessed."

We can only speak directly to claims filed under the Specific Claims Policy in the Province of Ontario. We cannot make any comments regarding potential or future claims, or claims filed under other departmental policies. This includes claims under Canada's Comprehensive Claims Policy or legal action by a First Nation against the Crown. I note you have already contacted INAC's Comprehensive Claims Branch and Litigation Management and Resolution Branch. In addition, you may wish to consult the unit responsible for Special Claims at (819) 994-6453.

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To the best of our knowledge, the information we have provided you is current and upto-date. However, this information may not be exhaustive with regard to your needs and you may wish to consider seeking information from other government and private sources (including Aboriginal groups). In addition, please note that Canada does not act as a representative for any Aboriginal group for the purpose of any claim or the purpose of consultation.

I hope this information will be of assistance to you. I trust that this satisfactorily addresses your concerns. If you wish to discuss this matter further please contact me at (819) 953-1940.

Yours sincerely,

Fred Hosking

Senior Claims Analyst Ontario Research Team Specific Claims Branch

res autochtones

Ministry of Aboriginal Affairs

720 Bay Street

4th Floor Toronto, ON M5G 2K1

Tel: (416) 326-4741 Fax: (416) 326-4017 Ministère des Affaires autochtones

720, rue Bay 4° étage Toronto, ON M5G 2K1

Tél: (416) 326-4741 Téléc: (416) 326-4017

website: www.aborginalaffairs.gov.on.ca

Reference: PAR 854 0708-544

APR = 7 2008

Brian McCormick
Manager, Environmental Services & Approvals
Hydro One
483 Bay Street TCT12
Toronto, ON M5G 1X6

Re: Essex County Electrical Infrastructure

Dear Mr. McCormick:

Thank you for your notice dated February 22, 2008, regarding the above noted project.

The responsibilities of the Ministry of Aboriginal Affairs (MAA) include conducting land claim and related negotiations on behalf of the Province. MAA can provide you with information about land claims that have been submitted to the Ministry, are currently in active negotiations, or are in the process of implementing a settlement agreement. We can also advise as to whether there is any litigation with an Aboriginal community that may be impacted by your project.

You should also be aware that many First Nations either have or assert rights to hunt and fish in their traditional territories. These territories often include lands and waters outside of a First Nation's reserve. As well, in some instances project work may impact archaeological and burial sites. First Nations with an interest in such archaeological sites may extend beyond those First Nations in the nearest vicinity of the proposed project.

With respect to your project, we have reviewed the brief materials you have provided, and can advise that this project appears not to be located in an area where First Nations may have existing or asserted rights that could be impacted by your project.

.../2

MAA is not the approval or regulatory authority for your project. You should consider the information provided in this letter in light of the statutes and guidance materials provided by the appropriate approval or regulatory authority for consultation requirements with Aboriginal communities on a project such as you are proposing. Should you have questions on the process please contact the appropriate ministry.

The Government of Canada sometimes receives claims that Ontario does not receive, or with which Ontario does not become involved. For information about possible claims in the area, MAA recommends the proponent contact the following federal contacts:

Mr. Fred Hosking Senior Claims Analyst Ontario Research Team Indian and Northern Affairs Canada 10 Wellington St. Gatineau, QC K1A 0H4 Tel: (819) 953-1940 Fax: (819) 997-9873 Mr. Kevin Clement A/Director, Financial Issues and Cost-Sharing Indian and Northern Affairs Canada 10 Wellington St. 8th Floor Gatineau, QC K1A 0H4 Tel: (819) 997-8369 Fax: (819) 997-9147

For federal information on litigation contact:

Jonathan Allen Litigation Team Leader for Ontario 1430-25 Eddy Street Gatineau, QC K1A 0H4 Tel: (819) 956-3181

Fax: (819) 956-3181

Yours truly,

Alan Kary

Deputy Director

Policy and Relationships Branch

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Page 1 of 3

Hydro One Networks Inc. 483 Bay Street Toronto, Ontario M5G 2P5 www.HydroOne.com lan.Jacobsen@HydroOne.com

Tel. No. 416-345-4360 Fax. No. 416-345-6600

October 9, 2013

Amy Gibson Manager, First Nation and Métis Policy and Partnerships Office Ministry of Energy 880 Bay Street, 3rd Floor Toronto, Ontario M7A 2C1

Dear Ms. Gibson:

RE: Supply to Essex County Transmission Reinforcement project: Leamington TS

Hydro One Networks Inc. (HONI) completed the Class Environmental Assessment for the Supply to Essex County Reinforcement Project in July 2010. This project is divided into two stages, with the first stage being the construction of a new 230 kilovolt (kV) to 27.6 kV transformer station in the Municipality of Leamington and associated double circuit 230 kV connection. The second stage is to construct a new double circuit 230 kV transmission line on the existing corridor between Lauzon Transformer Station and Sandwich Junction.

Hydro One is planning to file for "Leave to Construct" approval from the Ontario Energy Board (OEB) under Section 92 of the Ontario Energy Board Act (OEB Act) in December for the first stage (see the attached map).

In early 2008, as part of the First Nation and Métis consultation, HONI sent letters to the Ministry of Aboriginal Affairs (MAA) and Indian and Northern Affairs Canada (INAC) seeking their direction regarding First Nation and Métis interests within the vicinity of the project area. MAA advised that the project did not appear to be located in an area where First Nations may have exiting or asserted rights that could be impacted by the project. INAC determined that there were no comprehensive claims in Essex County, Ontario. INAC-Comprehensive claims branch did not have any specific interest in the project and requested to be taken off the mailing list. In subsequent communication INAC confirmed the following First Nations have submitted specific claims in the study area of the project:

- Caldwell First Nation
- Walpole First Nation
- Chippewas of Kettle and Stony Point First Nation
- Chippewas of the Thames First Nation
- Oneida Nations of the Thames
- Munsee-Delaware Nation
- Moravian of the Thames First Nation
- Aamjiwnaang First Nation

All First Nation communities noted by INAC were sent a project notification letter, invitations to public information centers #1, #2, #3 and a Workshop. Follow-up phone calls were also made to the Chief or designated contact offering to meet and discuss the project. The Draft Environmental Study Report for the project was also sent. HONI intends to notify the same First Nation communities that we are filing for the Leave to Construct. If you are aware of other First Nation communities that may have interest in the Project area, please let us know.

We would be pleased to discuss this project with you if you would like more information. Should there be any update to the project information provided above, I will ensure you are promptly informed.

Sincerely,

lan Jacobsen

Sr. Manager, First Nation and Métis Relations

c: Brian McCormick, Environmental Services & Approvals (Hydro One Networks Inc.)
Heather Levesque, Manager Consultation Unit, Ministry of Aboriginal Affairs

Encl.

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Ministry of Energy

880 Bay Street 3rd Floor Toronto ON M7A 2C1

Tel: (416) 327-2116 Fax: (416) 327-3344

Ministère de l'Énergie

880, rue Bay 3° étage Toronto ON M7A 2C1

Tél: (416) 327-2116 Téléc: (416) 327-3344

Ontario

First Nation and Métis Policy and Partnerships Office

November 4, 2013

Christine Goulais Senior Manager, First Nation and Métis Relations Hydro One Networks Inc. 483 Bay Street, TCT5, South Tower Toronto, ON M5G 2P5

Re: Supply to Essex County Transmission Reinforcement Project

Dear Ms. Goulais:

Thank you for your October 9, 2013 letter to inform me about the Hydro One Network Inc. ("Hydro One") plans to file for a leave-to-construct approval to proceed with the Essex County Transmission Reinforcement project.

I understand from your letter that Hydro One has completed the necessary environmental assessment ("EA") work for this project in 2010 under the Class EA for Minor Transmission Facilities. I further understand that Hydro One will be acquiring easement rights on both private and public lands.

I concur with your intentions to notify the First Nation communities that you have listed in your incoming letter. In addition, I recommend that these communities be offered the opportunity to meet with Hydro One staff to discuss the proposed project, learn more about the leave-to-construct process, and share any concerns or interests that they may have with the project.

I also recommend that Hydro One maintain a record of its interactions with the First Nation communities that it has identified for notification. I request that you notify me if information emerges suggesting an adverse impact on any community, as appropriate.

Please do not hesitate to contact me if you have any further questions or wish to discuss this matter in more detail.

Sincerely,

any Oisson.

Amy Gibson Manager First Nation and Métis Policy and Partnerships Office

c: Brian McCormick, Manager Environmental Services and Approvals, Hydro One Networks Inc.

Heather Levecque, Manager Consultation Unit, Ministry of Aboriginal Affairs

	Contacts with First Nations Communities					
First Nation	Type of Correspondence	Fax-back returned	Follow-up			
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation sent	No	Hydro One called First Nation on June 3, 2008 to follow-up on the Notice of Commencement. The Chief was unavailable to discuss. Hydro One followed up a second time by phone on June 6, 2008 and left a voicemail.			
	Invitation to PIC#2 sent July 7, 2008					
Chippewas of the Thames	Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		Hydro One follow up phone call made on June 9, 2009 regarding May 7, 2009 correspondence. Voicemail was left.			
	Invitation to PIC#3 sent July 3, 2009					
	Invitation to landowner workshop sent Oct. 14, 2009					
	Letter providing Project update sent November 29, 2013					
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation	No	Hydro One called June 6, 2008 and left a message with administration.			
	Invitation to PIC#2 sent July 7, 2008					
Oneida Nation of the Thames	Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		Hydro One follow up phone call made on June 9, 2009 regarding May 7, 2009 correspondence. Voicemail left with Chief.			
	Invitation to PIC#3 sent July 3, 2009					
	Invitation to landowner workshop sent Oct. 14, 2009					
	Letter providing Project update sent November 29, 2013					
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation sent	No	Chief followed up with Hydro One via phone call on April 15, 2008. Hydro One followed up with First Nation on June 6, 2008 regarding Project. Hydro One agreed to re-send project information.			
Munsee-Delaware Nation	Invitation to PIC#2 sent July 7, 2008 Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009 Invitation to PIC#3 sent July 3, 2009		Hydro One followed up with Chief on June 9, 2009 and left a voicemail.			
	Invitation to Pic#3 sent July 3, 2009 Invitation to landowner workshop sent Oct. 14, 2009					

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1	Letter providing Project update sent		
	November 29, 2013		
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation sent	No	Hydro One followed up via phone call on June 6, 2008 and left a voicemail.
	Invitation to PIC#2 sent July 7, 2008		
			Hydro One followed up via phone call on April 20, 2009. Chief returned phone call to Hydro One on April 21, 2009. Hydro One returned phone call on April 22, 2009, April 30, 2009, and again on May 5, 2009. Messages left.
	Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		On May 12, 2009, Hydro One emailed the Chief information regarding the Project. On May 13, 2009, Councilor of the First Nation phoned Hydro One and Hydro One explained content of email sent to Chief. May 24, 2009, Hydro One received email from First Nation. On May 28, 2009 Hydro One emailed the Chief to offer a meeting to discuss the project further. June 8 and 9, 2009, Hydro One called the First Nation to follow up on request to meet to discuss the project further. Messages left.
	Invitation to PIC#3 sent July 3, 2009		First Nation expressed concern regarding compensation for farmers, and requested a hard copy of the ESR be mailed.
	Invitation to landowner workshop sent Oct. 14, 2009		
Caldwell First Nations			On November 29, 2013 the Chief responded to Hydro One via email requesting a meeting to discuss the Project. Hydro One responded via phone and email on December 13, 2013 to coordinate a meeting between Hydro One and Caldwell First Nation. On January 10, 2014, Hydro One met with the Chief and one Elected Representative of Caldwell First Nation to discuss the Project and share information. The following information was discussed: Hydro One's Supply to Essex Reinforcement Project was reviewed and the Section 92 Application to the Ontario Energy Board was discussed. Caldwell First Nation had expressed concerns with regards to Electric and Magnetic Fields (EMF), bird fatalities, archaeology, planting of native species and Hydro One's process for removal of potentially contaminated soil.
			Regarding EMF - Hydro One shared that as the distance from the line increases, the EMF decreases and therefore it is low at the edge of the right-of-way. Subsequent to the meeting, Hydro One provided Caldwell First Nation with a Health Canada fact sheet regarding EMF. Health Canada monitors scientific research on EMFs and human health as part of its mission to help Canadians maintain and improve their health.
	Letter providing Project update sent November 29, 2013		Regarding electrocution of birds, Hydro One shared that this is not a common occurrence on Hydro One facilities because of the configuration of the equipment, although it infrequently may happen. Birds hitting the wires are more common. When Hydro One has been informed of situations where birds commonly have hit wires on either the transmission lines or distribution lines, Hydro One has put "flappers" or bird diverters on the wires to make them more visible to birds.
			Regarding Archeology, Hydro One shared that a Stage 1 archaeological study has been completed for the Supply to Essex Reinforcement Project and Hydro One will be completing a Stage 2 study when approval has been received to do further planning. Hydro One has committed to discuss with Caldwell First Nation following approvals whether Caldwell First Nation would like to have their Archaeological monitors involved in the study.
			Regarding the planting of native species Hydro One responded that when possible, Hydro One uses native species for planting. There are some exceptions, but planting native species is Hydro One's preference. Hydro One offered to discuss planting plans with Caldwell First Nation regarding the Supply to Essex project once Hydro One begins developing planting plans.
			Regarding Hydro One's soil disposal process, Hydro One explained that all the soil is tested prior to disposal and follows all laws and government guidelines with regards to contaminated soil.
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation sent	No	Hydro One followed up via phone with First Nation on May 27, 2008 to discuss project further. Voicemail left.
	Invitation to PIC#2 sent July 7, 2008		
Moravian of the Thames (Delaware Nation)	Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		Hydro One followed up via phone on June 9, 2009 and left a voicemail.
	Invitation to PIC#3 sent July 3, 2009 Invitation to landowner workshop sent Oct. 14, 2009		
	Letter providing Project update sent November 29, 2013		

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	Notice of Commencement sent April 9, 2008 and PIC#1 invitation sent Invitation to PIC#2 sent July 7, 2008	No	May 27, 2008, Hydro One followed up via phone and discussed the Project with the Chief. Additional information requested by the Chief was sent via email on May 27, 2008.
	Invitation to PIC#2 sent July 7, 2008		
Bkejwanong Territory (Walpole Island)	Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		On June 9, 2009 Hydro One followed up via phone regarding the May 7, 2009 package sent from Hydro One. On July 17, 2009 the First Nation left a voicemail with Hydro One. On July 20, 2009 Hydro One returned phone call and left voicemail. On July 21, 2009, the First Nation contacted Hydro One via phone requesting past correspondence and project information be shared with the First Nation. On July 23, 2009 Hydro One sent the information requested. Hydro One followed up with a phone call on July 31, 2009 to ensure information was received. Voicemail left.
	Invitation to PIC#3 sent July 3, 2009		
	Invitation to landowner workshop sent Oct. 14, 2009		
	Letter providing Project update sent November 29, 2013		
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation.	No	Hydro One followed up via phone on June 6, 2008 and left a voicemail.
	Invitation to PIC#2 sent July 7, 2008.		
Chippewas of Kettle and Stony Point	Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		Hydro One followed up via phone call on June 8, 2009 and left a message for the Chief and a separate message for the First Nation Liaison Coordinator.
1	Invitation to PIC#3 sent July 3, 2009		
	Invitation to landowner workshop sent		
	Oct. 14, 2009 Letter providing Project update sent		
	November 29, 2013		
	Notice of Commencement sent April 9, 2008 and PIC#1 invitation sent	No	Hydro One followed up via phone call on June 6, 2008 and left a voicemail.
Aamjiwnaang	Invitation to PIC#2 sent July 7, 2008 Letter with information on the selection of the preferred transmission line location and Transformer Station Site sent May 7, 2009		Hydro One followed up via phone call on June 8, 2009 and left a voicemail.
	Invitation to PIC#3 sent July 3, 2009 Invitation to landowner workshop sent		
1	Oct. 14, 2009		
	Letter providing Project update sent November 29, 2013		

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LAND MATTERS

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1.0 DESCRIPTION OF LAND REQUIRED

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- 5 The proposed Supply to Essex County Transmission Reinforcement Project, for which
- 6 Hydro One is seeking approval, will involve constructing a new 230 kV overhead
- transmission line on steel lattice towers along a new corridor. The proposed line will
- 8 connect the future Leamington Transformer Station ("TS") and tower structure 225
- 9 (Leamington Junction) on the Chatham Switching Station ("SS") and Keith TS corridor,
- a distance of approximately 13 kilometres.

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- The proposed corridor from Leamington Junction to Leamington TS will be a combination of:
- provincially-owned property whose title is held by the Ministry of Infrastructure, and managed by Infrastructure Ontario (no land rights required);
- easement rights on municipally owned and private properties (new land rights required);
 - municipal road corridors (no land rights required).

18 19

- New permanent land rights on properties from Leamington Junction to Leamington TS will be required to accommodate the proposed transmission facilities. Temporary rights for construction purposes will also be required at specific locations along the corridor.
- 23

2.0 DESCRIPTION OF NEW LAND RIGHTS REQUIRED

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- The proposed corridor crosses approximately 39 privately-owned properties from Leamington Junction to Leamington TS, for which new land rights are required. The
- properties traversed by the corridor are mainly agricultural, including a number of

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- greenhouse operations, with some rural residential, recreational land uses, and limited
- 2 commercial/industrial uses. Easement rights will also be required along a corridor
- formerly used as a rail line and owned by the Municipality of Leamington.

4

- 5 The transmission line crosses eight municipal road allowances owned by the
- 6 Municipality of Leamington and the Town of Lakeshore. No land rights are required for
- these crossings. The line will not intersect any rail lines/rail spurs currently in operation.

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3.0 LAND ACQUISITION PROCESS

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Hydro One will be acquiring new easement rights along the Chatham SS to Keith TS corridor to Leamington TS. Hydro One's approach will be to secure these new rights through voluntary property settlements. Where mutually acceptable resolution is not possible, Hydro One will rely on the legislated expropriation process. Hydro One will initiate specific discussions with affected property owners after filing the section 92 application. Initial meetings with senior staff in affected municipalities have taken place along the route.

18

Additional temporary working rights will be required, but these are not expected to be significant. Temporary property rights may be required when crossing or paralleling existing or planned utilities (e.g., pipelines, power lines) or other planned infrastructure (e.g., highways), and building construction access roads and working pads. These requirements will be determined and confirmed at the engineering design stage. Access agreements with landowners will be required.

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- Copies of the Offer to Grant an Easement, Off-Corridor Temporary Access and Access Road, Temporary Construction License Agreement for construction staging, and a
- Damage Claim Agreement and Release Form which will be used as the basis for

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- compensation related to construction impacts such as crop damage, are included (please
- refer to Exhibit B, Tab 6, Schedule 7, Attachments 1, 2, 3 and 4 respectively).

3

- 4 Landowners have been informed of this project as part of the stakeholder and community
- 5 consultation process described in Exhibit B, Tab 6, Schedule 5, as well as in the EA
- approval process. They will also be notified as part of the OEB's Section 92 Notice of
- 7 Application requirements.

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OFFER TO GRANT AN EASEMENT TO HYDRO ONE NETWORKS INC.

I, INSERT NAME (the "Transferor"),

Being the owner of *INSERT LEGAL DESCRIPTION OF PROPERTY* (herein called the "Lands") in consideration of payment of the sum of \$*INSERT VALUE* (*INSERT VALUE*) (THE "**OFFER CONSIDERATION**"), and other good and valuable consideration (the sufficiency of which consideration is hereby acknowledged), hereby covenants and agrees as follows:

- 1. (a) THE Transferor hereby grants to Hydro One Networks Inc. its successors and assigns (the "Transferee") the exclusive right, irrevocable during the periods of time below specified in paragraph 2, (the "Offer") to purchase, free from all encumbrances and upon the terms and conditions hereinafter set out, the perpetual rights, easements and privileges set out in the Transfer and Grant of Easement document (the "Transfer of Easement" annexed hereto as Schedule "A" (the "Rights") in, through, under, over, across, along and upon that portion of the above Lands as shown as INSERT DESCRIPTION (the "Strip").
 - (b) THE purchase price for the Rights shall be the sum of *INSERT VALUE* **DOLLARS (\$ INSERT VALUE)** lawful money of Canada to be paid by cash or uncertified cheque to the Transferor on Closing (the "**Purchase Price**").
- 2. THIS Offer may be accepted by the Transferee any time within 60 Days from the date of this Agreement by a letter delivered or facsimile transmission or mailed postage prepaid and registered, to the Transferor at the address set out in paragraph 12. If this Offer is not accepted within this time frame, this Agreement and everything herein contained shall be null, void and of no further force or effect. If this Offer is accepted by the Transferee in the manner aforesaid, this Agreement and the letter accepting such Offer shall then become a binding contract between the parities, and the same shall be completed upon the terms herein provided for.
- 3. THE Transfer of Easement arising from the acceptance of this Offer shall be executed and delivered to the Transferee on or before the One Hundred and Twentieth (120th) day after the date of Transferee's acceptance of this Offer (the "Closing") and time shall in all respects be of the essence hereof.
- 4. IF the Transferee accepts the Offer herein: a) the Transferee shall not grant or transfer an easement or permit, or create any encumbrance over or in respect of the Strip prior to registration of the Transfer of Easement, and b) the Transferee has permission to approach prior encumbrancers or any third parties who have existing interests in the strip to obtain all necessary consents, postponements or subordinations (in registrable form) from all current and future prior encumbrancers and third parties, if necessary, consenting to this Transfer of Easement, and/or postponing their respective rights, title and interest so as to place such Rights and Transfer of Easement in first priority on title to the Strip.
- 5. TITLE to the Strip shall at Closing be good and free from all registered restrictions, charges, liens, easements and encumbrances of any kind whatsoever except for those matters disclosed in Schedule "B" annexed hereto.
- 6. The Transfer of Easement and all ancillary documents necessary to register same on title shall be prepared by and at the expense of the Transferee and shall be substantially in the form as the annexed Schedule "A". The Transferor hereby covenants and agrees that the Transferee may, at its option, register this Agreement or Notice thereof, and the Transfer of Easement on title to the Lands, and the Transferor hereby covenants and agrees to execute, at not further cost or condition to the Transferee, such other instruments, plans and documents as may reasonably be required by the transferee to effect registration of this Agreement or Notice thereof prior to closing and the Transfer of Easement at any time hereafter.
- 7. THE Transferor covenants and agrees with Transferee that it has the right to convey the Rights without restriction and that Transferee will quietly possess and enjoy the Rights and that the Transferor will execute upon request such further assurances of the Rights as may be requisite to give effect to the provisions of this Agreement.
- 8. AS of the date of the Transferee's acceptance of the Offer, the Transferor grants to the Transferee, in consideration of the Offer Consideration, free from all encumbrances, easements and restrictions the following unobstructed and exclusive rights, easements, rights of way, covenants, agreements and privileges in, through, under, over, across, along and upon the Strip:
 - (a) To enter and lay down, install, construct, erect, maintain, open, inspect, add to, enlarge, alter, repair and keep in good condition, move, remove, replace, reinstall, reconstruct, relocate, supplement and operate and maintain at all times in, through, under, over, across, along and upon the strip an electrical transmission system and telecommunications system consisting in both instances of pole structures, steel towers, anchors, guys and braces and all such

aboveground or underground lines, wires, cables, telecommunication cables, grounding electrodes, conductors, apparatus, works accessories, associated material and equipment, and appurtenances pertaining to or required by either such system (all or any of which are herein individually or collectively called the "Works") as in the opinion of the Transferee are necessary or convenient thereto for use as required by Transferee in its undertaking from time to time, or a related business venture.

- (b) To enter on and selectively cut or prune, and to clear and keep clear, and remove all trees (subject to compensation to Owners for merchantable wood values), branches, bush and shrubs and other obstructions and materials in, over or upon the Strip, and without limitation, to cut and remove all leaning or decayed trees located on the Lands whose proximity to the Works renders them liable to fall and come in contact with the Works or which may in any way interfere with the safe, efficient or serviceable operation of the Works or this easement by the Transferee.
- (c) To conduct all engineering, legal surveys, and make soil tests, soil compaction and environmental studies and audits in, under, on and over the Strip as the Transferee in its discretion considers requisite.
- (d) To erect, install, construct, maintain, repair and keep in good condition, move, remove, replace and use bridges and such gates in all fences which are now or may hereafter be on the Strip as the Transferee may form time to time consider necessary.
- (e) To clear the Strip and keep it clear of all buildings, structures and other obstructions of any nature whatever including removal of any materials which in the opinion of the Transferee are hazardous to the line. Notwithstanding the foregoing, in all cases where in the sole discretion of the Transferee the safe operation and maintenance of the line is not endangered or interfered with, the Transferor from time to time or the person or persons entitled thereto, may with prior written approval of the Transferee, at his or her own expense, construct and maintain roads, lanes, walks drains, sewers, water pipes, oil and gas pipelines, and fences (not to exceed 2 metres in height) on or under the Strip or any portion thereof, provided that prior to commencing any such installation, the Transferor shall give the Transferee 30 days notice in writing so as to enable Transferee to have a representative inspect the site and be present during the performance of the work and that the Transferor complies with any instructions which may be given by such representative in order that such work may be carried out ins such a manner as not to endanger, damage or interfere with the line.
- (f) To enter on, and exit from, and to pass and repass at any and all times in, over, along, upon, across, through and under the Strip and so much of the Lands as may be reasonably necessary, at all reasonable times, for the Transferee and its respective officers, employees, workers, permittees, servants, agents, contractors and subcontractors, with or without vehicles, supplies, machinery, plant, material and equipment for all purposes necessary or convenient to the exercise and enjoyment of the said rights and easement subject to payment by the Transferee of compensation for any crop or other physical damage only to the Land caused by the exercise of this right of entry and passageway; and
- (g) To remove, relocate and reconstruct the line on or under the Strip, subject to payment by the Transferee of additional compensation for any damage caused thereby.
- 9. THE Transferor consents to Transferee, its respective officers, employees, agents, contractors, subcontractors, workers and permittees or any of them entering on, exiting and passing and repassing in, on, over, along, upon, across, through and under the Strip and so much of the Lands as may be reasonably necessary, at all reasonable times after the date of the Agreement until such time as this Offer is accepted and the purchase is completed with or without all plant, machinery, material, supplies, vehicles, and equipment, for all purposes necessary or convenient to the exercise and enjoyment of the Rights, subject to compensation afterwards for any crop or other physical damage only to the Lands or permitted structures sustained by the Transferor caused by the exercise of this right of entry and passageway.
- 10. THIS Agreement and Grant of Easement Rights shall both be subject to the condition that the provisions of the *Planning Act*, R.S.O. 1990, c. P. 13, as amended, have, in the opinion of Transferee, been satisfactorily complied with. If after consultation with Provincial agencies and Municipalities, Hydro One Networks Inc., decides that the provisions of the *Planning Act*, R.S.O., c.P. 13, and amendments thereto, have not been or cannot be complied with, it may, at its option, cancel this Agreement.

- 11. ANY documents or money payable hereunder may be tendered upon the parties hereto or their respective solicitors and money may be tendered by negotiable uncertified cheque or cash
- 12. ANY acceptance of this Offer, demand, notice or other communication to be given in connection with this Agreement shall be given in writing and shall be given by personal deliver, by registered mail postage prepaid, or by facsimile transmission, addressed to the recipient as follows:

TO TRANSFEROR: TO TRANSFEREE:

Hydro One Networks Inc.

NAME Real Estate Services

ADDRESS PO BOX 1050

PHONE NUMBER Milton, ON, L9T 5B9

Attention: Fax:

or to such other address, facsimile number or individual as may be designated by notice given by either party to the other. Any acceptance of this offer, demand notice or other communication shall be conclusively deemed to have been given when actually received by the addressee or upon the second day after the day of mailing.

- 13. THE Transferor represents that he is not now and at the time of Closing shall not be a spouse within the meaning of the *Family Law Act*, R.S.O. 1990, c.F. 3, as amended, failing which, the Transferor shall cause this Agreement and all related documents to be accepted and consented to in writing by the spouse of the Transferor to the satisfaction of the Transferee and at not further cost or condition.
- 14. IN the event of and upon acceptance of this Offer by Hydro One Networks Inc. in manner aforesaid this Agreement and the letter accepting such Offer shall then become a binding contract of sale and purchase between the parties, and the same shall be completed upon the terms herein provided for.
- 15. HYDRO ONE NETWORKS INC. will covenant and agree with the Transferor to indemnify and save harmless the Transferor, his tenants, or other lawful occupiers of the Strip for any loss, damage and injury caused by the acceptance of the Offer and the granting and thereafter of Rights or anything done pursuant thereto or arising from any accident (not including any Act of God) that would not have happened but for the presence of its line on the Strip, provided, however, that Hydro One Networks Inc. shall not be liable to the extent to which such loss, damage, or injury is caused or contributed to by the neglect or default of the Transferor, his tenants, guests, invitees or other lawful occupiers of the Strip or their servants, agents, or workmen.
- 16. THE Transferor covenants and agrees that if and before the Transferor sells, transfers, assigns, disposes (or otherwise parts with possession) of all or part of the Lands to a third party(the "Third Party") the Transferor shall use best efforts to ensure that the third party assumes the burden and benefit of this Agreement, and agrees to be bound by it. Accordingly the Transferor covenants and agrees to use best efforts to obtain from the Third Party a written acknowledgement and agreement that the Third Party is aware of this Agreement and will continue to be bound by the terms, conditions and stipulations of this Agreement.
- 17. ALL covenants herein contained shall be construed to be several as well as joint, and wherever the singular and the masculine are used in this Agreement, the same shall be construed as meaning the plural or the feminine or neuter, where the context or the identity of the Transferor/Transferee so requires.
- 18. THE burden and benefit of this Agreement shall run with the Strip and the works and undertaking of the Transferee and shall be binding upon and enure to the befit of the parties hereto and their respective heirs, executors, administrators, successors and assigns.

IN WITNESS WHEREOF Agreement, thisda			has hereunto , 2012.	set	his	hand	and	seal	to	this
SIGNED, SEALED AND DELIVERED)))	In the p	resence of							

INSERT NAME

SIGNED, SEALED AND DELI	VERED	
In the presence of)	Consent Signature & Release of
)	Transferor's Spouse, if non-owner
)	
)	
)	

SCHEDULE "A"

TRANSFER AND GRANT OF EASEMENT

The Transferor is the owner in fee simple and in possession of *INSERT LEGAL DESCRIPTION OF PROPERTY* (The "Lands").

The Transferee has erected, or is about to erect, certain Works (as more particularly described in paragraph 1(a) in, through, under, over, across, along and upon the Lands.

- 1. THE Transferor hereby grants and conveys to Hydro One Networks Inc., its successors and assigns the rights and easement, free from all encumbrances and restrictions, the following unobstructed and exclusive rights, easements, rights-of-way, covenants, agreements and privileges in perpetuity (the "Rights") in, through, under, over across, along and upon that portion of the Lands of the Transferor described herein as INSERT DESCRIPTION (the "Strip") for the following purposes:
- (a) To enter and lay down, install, construct, erect, maintain, open, inspect, add to, enlarge, alter, repair and keep in good condition, move, remove, replace, reinstall, reconstruct, relocate, supplement and operate and maintain at all times in, through, under, over, across, along and upon the Srip an electrical transmission system and telecommunications system consisting in both instances of pole structures, steel towers, anchors, guys and braces and all such aboveground or underground lines, wires, cables, telecommunications cables, grounding electrodes, conductors, apparatus, works, accessories, associated material and equipment, and appurtenances pertaining to or required by either such system (all or any of which are herein individually or collectively called the ("Works") as in the opinion of the Transferee are necessary or convenient thereto for use as required by Transferee in its undertaking from time to time, or a related business venture.
- (b) To enter on and selectively cut or prune, and to clear and keep clear, and remove all trees (subject to compensation to Transferor for merchantable wood values), branches, bush and shrubs and other obstructions and materials, over or upon the Strip, and without limitation, to cut and remove all leaning or decayed trees located on the Lands whose proximity to the Works renders them liable to fall and come in contact with the Works or which may in any way interfere with the safe, efficient or serviceable operation of the Works or this easement by the Transferee.
- (c) To conduct all engineering, legal surveys, and make soil tests, soil compaction and environmental studies and audits in, under, on and over the Strip as the Transferee in its discretion considers requisite.
- (d) To erect, install, construct, maintain, repair and keep in good condition, move, remove, replace and use bridges and such gates in all fences which are now or may hereafter be on the Strip as the Transferee may from time to time consider necessary.
- (e) Except for fences and permitted paragraph 2(a) installations, to clear the Strip and keep it clear of all buildings, structures, erections, installations, or other obstructions of any nature (hereinafter collectively called the "obstruction") whether above or below ground, including removal of any materials and equipment or plants and natural growth, which in the opinion of the Transferee, endanger its Works or any person or property or which may be likely to become a hazard to any Works of the Transferee or to any person or property or which do or may in any way interfere with the safe, efficient or serviceable operation of the Works or this easement by the Transferee.
- (f) To enter on and exit by the Transferor's access routes and to pass and repass at all times in, over, along, upon and across the Strip and so much of the Lands as is reasonably required, for Transferee, its respective officers, employees, agents, servants, contractors, subcontractors, workmen and permittees with or without all plant machinery, material, supplies, vehicles and equipment for all purposes necessary or convenient to the exercise and enjoyment of this easement subject to compensation afterwards for any crop or other physical damage only to the Lands or permitted structures sustained by the Transferor caused by the exercise of this right of entry and passageway.
- (g) To remove, relocate and reconstruct the line on or under the Strip subject to payment by the Transferee of additional compensation for any damage caused thereby.
- 2. THE Transferor agrees that:
- (a) It will not interfere with any Works established on or in the Strip and shall not, without the Transferee's consent in writing erect or cause to be erected or permit in, under or upon the strip any obstruction or plant or permit any trees, bush, shrubs, plants or natural growth which does or may interfere with the Rights granted herein. The Transferor agrees it shall not, without the Transferee's consent in writing, change or

permit the existing configuration, grade or elevation of the Strip to be changed and the Transferor further agrees that no excavation or opening or work which may disturb or interfere with the existing surface of the Strip shall be done or made unless consent therefore in writing has been obtained from Transferee, provided however, that the Transferor shall not be required to obtain such permission in case of emergency. Notwithstanding the foregoing, in cases where in the reasonable discretion of the Transferee, there is no danger or likelihood of danger to the Works of the Transferee or to any persons or property and the safe or serviceable operation of this easement by the Transferee is not interfered with, the Transferor may at its expense and with the prior written approval of the Transferee, construct and maintain roads, lanes walks, drains, sewers water pipes, oil and gas pipelines, fences (not to exceed 2 metres in height) and service cables on or under the Strip (the "Installation") or any portion thereof; provided that prior to commencing such Installation, the transferor shall give to the Transferee thirty (30) days notice in writing thereof to enable the Transferee to have a representative present to inspect the proposed Installation during the performance of such work, and provided further that Transferor comply with all instructions given by such representative and that all such work shall be done to the reasonable satisfaction of such representative. In the event of any unauthorised interference aforesaid or contravention of this paragraph, or if any authorised interference, obstruction or Installation is not maintained in accordance with the Transferee's instructions or in the Transferee's reasonable opinion, may subsequently interfere with the Rights granted herein, the Transferee may at the Transferor's expense, forthwith remove, relocate, clear or correct the offending interference, obstruction, Installation or contravention complained of from the Strip, without being liable for any damages cause thereby.

- (b) notwithstanding any rule of law or equity, the Works installed by the Transferee shall at all times remain the property of the Transferee, notwithstanding that such Works are or may become annexed or affixed to the Strip and shall at anytime and from time to time be removable in whole or in part by Transferee.
- (c) no other easement or permission will be transferred or granted and no encumbrances will be created over or in respect to the Strip, prior to the registration of a Transfer of this grant of Rights.
- (d) The Transferor will execute such further assurances of the Rights in respect of this grant of easement as may be requisite.
- (e) The Rights hereby granted:
 - (i) shall be of the same force and effect to all intents and purposes as a covenant running with the Strip
 - (ii) is declared hereby to be appurtenant to and for the benefit of the Works and undertaking of the Transferee described in paragraph 1(a)
- 3. THE Transferee covenants and agrees to obtain at its sole cost and expense all necessary postponements and subordinations (in registrable form) from all current and future prior encumbrancers, postponing their respective rights, title and interest to the transfer of Easement herein so as to place such Rights and easement in first priority on title to the Lands.
- 4. THERE are no representations, covenants agreements, warranties and conditions in any way relating to the subject matter of this grant of Rights whether expressed or implied, collateral or otherwise except those set forth herein.
- 5. NO waiver of a breach or any of the covenants of this grant of Rights shall be construed to be a waiver of any succeeding breach of the same or any other covenant.
- 6. THE burden and benefit of this transfer of Rights shall run with the Strip and the Works and undertaking of the Transferee and shall extend to, be binding upon and enure to the benefit of the parties hereto and their respective heirs, executors, administrators, successors and assigns.

SCHEDULE "B" PERMITTED EMCUMBRANCES

NIL

Filed: 2014-01-22
EB-2013-0421
Exhibit B-6-7
Attachment 2
Page 1 of 3

Temporary Access and Temporary Access Road	Exhibit B-6-7 Attachment 2
THIS AGREEMENT made in duplicate theday of20XX	Page 1 of 3
Between: INSERT NAME OF OWNER (hereinafter referred to as the "Grantor") OF THE FIRST	PART

HYDRO ONE NETWORKS INC.

--- and ---

(hereinafter referred to "HONI")

OF THE SECOND PART

WHEREAS the Grantor is the owner in fee simple and in possession of certain lands legally described as, *INSERT LEGAL DESCRIPTION* (the "Lands").

WHEREAS HONI in connection with its [Insert Project Name] Project (the "Project") desires the right to enter onto the Lands in order to construct temporary access roads on, over and upon the Lands in order to access the construction site associated with the "Project.

WHEREAS the Grantor is agreeable in allowing HONI to enter onto the Lands for the purpose of constructing temporary access roads on, over and upon the Lands, subject to the terms and conditions contained herein.

NOW THEREFORE THIS AGREEMENT WITNESSETH that in consideration of the sum of *INSERT CONSIDERATION* to be paid by HONI to the Grantor, and the mutual covenants herein contained and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

- 1. The Grantor hereby grants, conveys and transfers to HONI in, over, along and upon that part of the Lands highlighted in yellow as shown in Schedule "A" attached hereto (the "Access Lands"), the rights privileges, and easements as follows:
 - (a) for the servants, agents, contractors and workmen of HONI at all times with all necessary vehicles and equipment to pass and repass over the Access Lands for the purpose of access to the construction site associated with the Project, subject to payment of compensation for damages to any crops caused thereby;
 - (b) to construct, use and maintain upon the Access Lands, a temporary road to the construction site associated with the Project, together with such gates, bridges and drainage works as may be necessary for HONI's purposes (collectively, the "Works"), all of which Works shall be removed by HONI upon completion of the construction associated with the Project.; and
 - (c) to cut and remove all trees, brush and other obstructions made necessary by the exercise of the rights granted hereunder
- 2. The term of this Agreement and the permission granted herein shall be XXXX from the date written above (the "Term"). HONI may, in its sole discretion, and upon 60 days notice to the Grantor, extend the Term for an additional length of time, which shall be negotiated between the parties.
- 3. Upon the expiry of the Term or any extension thereof, HONI shall repair any physical damage to the Access Lands and/or Lands resulting from HONI's use of the Access Lands and the permission granted herein; and, shall restore the Access Lands to its original condition so far as possible and practicable.
- 4. All agents, representatives, officers, directors, employees and contractors and property of HONI located at any time on the Access Lands shall be at the sole risk of HONI and the Grantor shall not be liable for any loss or damage or injury (including loss of life) to them or it however occurring except and to the extent to which such loss, damage or injury is caused by the negligence or willful misconduct of the Grantor.
- 5. HONI agrees that it shall indemnify and save harmless the Grantor from and against all claims, demands, costs, damages, expenses and liabilities (collectively the "Costs") whatsoever arising out of HONI's presence on the Access Lands or of its activities on or

in connection with the Access Lands arising out of the permission granted herein except to the extent any of such Costs arise out of or are contributed to by the negligence or willful misconduct by the Grantor.

6. Notices to be given to either party shall be in writing, personally delivered or sent by registered mail (except during a postal disruption or threatened postal disruption), telegram, electronic facsimile or other similar means of prepaid recorded communication to the applicable address set forth below (or to such other address as such party may from time to time designate in such manner):

TO HONI:

Hydro One Networks Inc. Real Estate Services 5th Floor 483 Bay Street South Tower Toronto, Ontario M5G 2P5

Attention: Fax:

TO GRANTOR:

- 7. Notices personally delivered shall be deemed to have been validly and effectively given on the day of such delivery. Any notice sent by registered mail shall be deemed to have been validly and effectively given on the fifth (5th) business day following the date on which it was sent. Any notice sent by telegram, electronic facsimile or other similar means of prepaid recorded communication shall be deemed to have been validly and effectively given on the Business Day next following the day on which it was sent. "Business Day" shall mean any day which is not a Saturday or Sunday or a statutory holiday in the Province of Ontario. This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable herein. The parties hereto submit themselves to the exclusive jurisdiction of the Courts of the Province of Ontario.
- 8. Any amendments, modifications or supplements to this Agreement or any part thereof shall not be valid or binding unless set out in writing and executed by the parties with the same degree of formality as the execution of this Agreement.
- 9. The burden and benefit of this Agreement shall run with the Lands and everything herein contained shall operate to the benefit of, and be binding upon, the respective heirs; successors, permitted assigns and other legal representatives, as the case may be, or each of the Parties hereto.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the day and year first above written.

SIGNED, SEALED & DELIVERED In the presence of:	OWNER:
Witness	
Withess	
Witness	
HYDRO ONE HST #	HYDRO ONE NETWORKS INC.
	By:
	Name:
	Title:
	I have authority to bind the Corporation

SCHEDULE "A"

PROPERTY SKETCH

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-7 Attachment 3 Page 1 of 4

TEMPORARY CONSTRUCTION LICENCE

THIS AGREEMENT made in duplicate X day of X 20XX the

BETWEEN:

HYDRO ONE NETWORKS (hereinafter called the "HONI") OF THE FIRST

PART

and

XXXXX (hereinafter called the

"Owner") OF THE SECOND

PART

WHEREAS:

(a) The Owner is the registered owner of lands legally described as *INSERT LEGAL DESCRIPTION* (the "Lands").

- (b) HONI will be constructing new electrical transmission facilities in the area highlighted in yellow on a portion of the Lands more particularly shown on Schedule "A" attached hereto (the "Project") and requires a portion of the Lands as a temporary construction area.
- (c) The Owner is agreeable in allowing HONI to enter onto the Lands and using a portion of the Lands for the purposes of a temporary construction area, which area is more particularly shown in red on Schedule "A" attached hereto in order to facilitate construction work on HONI's adjacent transmission corridor.

NOW THEREFORE THIS AGREEMENT WITNESSES THAT IN CONSIDERATION of the sum of Five Dollars (\$5.00) now paid by each party to the other and the respective covenants and agreements of the parties hereinafter contained (the receipt and sufficiency of which are hereby acknowledged by the parties hereto), the parties hereto agree as follows:

- 1. The Owner hereby grants to HONI the right to enter upon a portion of the Lands highlighted in red, being XX acres, for the purpose of a temporary construction area (the "Licenced Area").
- 2. HONI will pay the Owner the amount of *INSERT CONSIDERATION* for the rights granted herein (the "Licence Fee").
- 3. HONI agrees that it shall take all reasonable care in its construction practices. HONI agrees that it shall erect such barriers and take such other appropriate safety precautions (i.e. gating system), as may be reasonably required to effectively prevent death or injuries to persons or the Owner's property during the Term of this Agreement.

- 4. All agents, representatives, officers, directors, employees and contractors and property of HONI located at any time on the Licenced Area shall be at the sole risk of HONI and the Owner shall not be liable for any loss or damage or injury (including loss of life) to them or it however occurring except and to the extent to which such loss, damage or injury is caused by the negligence or willful misconduct of the Owner.
- 5. HONI agrees that it shall indemnify and save harmless the Owner from and against all claims, demands, costs, damages, expenses and liabilities (collectively the "Costs") whatsoever arising out of HONI's presence on the Lands or of its activities on or in connection with the Licenced Area arising out of the permission granted herein except to the extent any of such Costs arise out of the negligence or willful misconduct of the Owner.
- 6. This Agreement and the permission granted herein shall be for a XXXXX term commencing from XXXXX until XXXXX (the "Term").
- 7. This Agreement and the permission granted herein may be renewed by HONI on a month to month basis up to an additional one year term, upon the same terms and conditions contained herein, including the Licence Fee, which amount shall be pro-rated to a monthly amount if applicable, save and except any further right to renewal. In the event HONI desires to renew this Licence, it shall provide notice in writing to the Owner of its desire to renew the Licence, at least thirty (30) days prior to the end of the Term, or any renewal thereof.
- 8. Upon the expiry of this Licence, HONI shall remove all equipment and debris from the Licenced Area and shall restore the Licenced Areas to as close as is practicable to its original condition immediately prior to HONI's occupancy at HONI's sole cost and expense.
- 9. Any notice to be given to the Owner shall be in writing and shall be delivered by pre-paid registered post or by facsimile, at the address noted below:

	Attention: Fax No.:
in the case of the HONI, to:	

in the case of the Owner, to:

Attention: Fax No.:

Such notice shall be deemed to have been given, in, writing or delivered, on the date of delivery, and, where given by registered post, on the third business day following the posting thereof, and if sent by facsimile, the date of delivery shall be deemed to be the date of transmission if transmission occurs prior to 4:00 p.m. (Toronto time) on a business day and on the business day next following the date of transmission in any other case. It is understood that in the event of a threatened or actual postal disruption in the postal service in the postal area through which such notice must be sent, notice must be given in writing by

delivery or by facsimile, in which case notice shall be deemed to have been given as set out above. "Business day" shall mean any day which is not a Saturday or Sunday or a statutory holiday in the Province of Ontario.

- 10. This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable herein. The parties hereto submit themselves to the exclusive jurisdiction of the Courts of the Province of Ontario.
- 11. The burden and benefit of this Agreement shall run with the Lands and everything herein contained shall operate to the benefit of, and be binding upon, the respective heirs; successors, permitted assigns and other legal representatives, as the case may be, or each of the Parties hereto.
- 12. Any amendments, modification or supplement to this Agreement or any part thereof shall not be valid or binding unless set out in writing and executed by the parties with same degree of formality as the execution of this Agreement.

IN WITNESS WHEREOF the parties hereto have executed this Agreement by the hands of their duly authorized signing officers in that regard.

Per:
Name:
Title:
I have authority to bind the Corporation
HYDRO ONE NETWORKS INC.
Per:
Name:
Title:
I have authority to bind the Corporation

SCHEDULE "A"

Filed: 2014-01-22 EB-2013-0421 Exhibit B-6-7 Attachment 4 Page 1 of 2

Damage Claim

THIS MEMORANDUM OF AGREEMENT dated the

THIS MEMORANDUM OF AGREEMEN	IT dated the	day of	20XX
Between:			
		herein called the "	Claimant"
	-and-		
Hvdro One	e Networks	Inc.	
		herein called "HON	NI"
Witnesseth:			
The Claimant agrees to accept		(\$) in	full payment and
satisfaction of all claims or demands for damage	es of whatsoever	kind, nature or exten	it which may have
been done to date by HONI during the construc	•	•	
of HONI constructed on Lot(s)	, Co	ncession(s)	or
according to Registered Plan No	in the .		of
of which prop	perty the Claima	ant is the	and
WITNESS	CLAIMANT		
Name:	Name:		
_	Address:		
Address:			
	HYDRO ONE	NETWORKS INC.	
HYDRO ONE	Per:		
HST#	Name:		
	Title:		

I have authority to bind the Corporation

RELEASE AND WAIVER FULL AND FINAL RELEASE

IN CONSIDERATION of the payment or of the promise of payment to the undersigned of the aggregate sum of [INSERT SETTLEMENT AMOUNT] (\$), the receipt and sufficiency of which is hereby acknowledged, I/We, the undersigned, on behalf of myself/ourselves, my/our heirs, executors, administrators, successors and assigns (hereinafter the "Releasors"), hereby release and forever discharge HYDRO ONE NETWORKS INC., its officers, directors, employees, servants and agents and its parent, affiliates, subsidiaries, successors and assigns (hereinafter the "Releasees") from any and all actions, causes of action, claims and demands of every kind including damages, costs, interest and loss or injury of every nature and kind, howsoever arising, which the Releasors now have, may have had or may hereafter have arising from or in any way related to [INSERT DESCRIPTION OF THE DAMAGE CAUSED] on lands owned by [INSERT PROPERTY OWNER NAME] and specifically including all damages, loss and injury not now known or anticipated but which may arise or develop in the future, including all of the effects and consequences thereof.

AND FOR THE SAID CONSIDERATION, the Releasors further agree not to make any claim or take any proceedings against any other person or corporation who might claim contribution or indemnity under the provisions of the *Negligence Act* and the amendments thereto from the persons or corporations discharged by this release.

AND FOR THE SAID CONSIDERATION, the Releasors further agree not to disclose, publish or communicate by any means, directly or indirectly, the terms, conditions and details of this settlement to or with any persons other than immediate family and legal counsel.

AND THE RELEASORS hereby confirm and acknowledge that the Releasors have sought or declined to seek independent legal advice before signing this Release, that the terms of this Release are fully understood, and that the said amounts and benefits are being accepted voluntarily, and not under duress, and in full and final compromise, adjustment and settlement of all claims against the Releasees.

IT IS UNDERSTOOD AND AGREED that the said payment or promise of payment is deemed to be no admission whatsoever of liability on the part of the Releasees.

AND IT IS UNDERSTOOD AND AGREED that this Release may be executed in separate counterparts (and may be transmitted by facsimile) each of which shall be deemed to be an original and that such counterparts shall together constitute one and the same instrument, notwithstanding the date of actual execution.

IN '	WITNESS \	WHEREC	F, the	Releasors	have	hereunto	set	their	respective	hands	this	
day of					, 20XX.							
SIGNED, In the preser	SEALED nce of:	&	DELIV	ERED								
Witness						Name						
SIGNED, In the preser	SEALED nce of:	&	DELIV	ERED								
Witness								N	lame			