APPLICATION OF
RES CANADA TRANSMISSION LP

FOR

DESIGNATION AS AN ELECTRICITY TRANSMITTER
TO
DEVELOP THE EAST-WEST TIE LINE

Filed: January 4, 2013

EB-2011-0140

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January 4, 2013

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Kirsten Walli
Board Secretary
Ontario Energy Board
2300 Yonge Street
27th Floor,Box 2319
Toronto ON M4P 1E4

Dear Ms. Walli:

Re: RES Canada Transmission LP
East-West Tie Line Designation Application
Ontario Energy Board File No. EB-2011-0140

We are writing to file, with the Ontario Energy Board (the "**Board**"), an electronic copy of RES Canada Transmission LP's ("**RES Transmission**") application for designation as an electricity transmitter to develop the East-West Tie Line (the "**Application**").

RES Transmission requests that certain documents in the Application be filed on a confidential basis, pursuant to Rule 10 of the Board's *Rules of Practice and Procedure* (the "**Rules**") and section 5 of the *Practice Direction on Confidential Filings* (the "**Practice Direction**"). The documents that pertain to this request are identified and summarized in the table below, together with their location in the Application.

List of Documents Filed in Confidence

Exhibit	Document Title	Document Summary	Confidential Portions of the Document
B-3-3	Access Road Classification Map	A map depicting potential new access roads, access roads that require upgrades, off-road access points, camps and laydown locations.	Entire Document

Exhibit	Document Title	Document Summary	Confidential Portions of the Document
H-6-2	Access Road Inventory Report	An inventory report classifying and detailing the condition of access roads in one to ten km segments	Entire Document
H-6-3	Access Road Classification Map	This is the same map as in Exhibit B-3-3	This is the same map as in Exhibit B-3-3
H-6-4	Staging Locations Map	A map depicting potential locations for the delivery and staging of construction materials	Entire Document
L-4-1	Environmental Assessment Plan	The Applicant's plan for conducting the environmental assessment for the East-West Tie Line	Only small portions relating to costs and field surveying strategy have been removed from the public version of this document. The confidential information has been highlighted in the confidential version of the Environmental Assessment Plan.
O-1-2	RES Group – Financial Statements	Financial Statements of Renewable Energy Systems Holdings Limited and its subsidiaries	Entire Document

(a) **proprietal information**

RES Transmission requests that the Access Road Classification Map, the Access Road Inventory Report, the Staging Locations Map and certain portions of the Environmental Assessment Plan (together, the "**Proprietal Information**") be considered confidential information, available to the viewed only by the Board, its staff and by external counsel and consultants who sign or have signed a Declaration and Undertaking in accordance with the Practice Direction. To be clear, RES Transmission requests that employees of other Registered Transmitters in the proceeding, in respect of whom the Board has accepted a Declaration and Undertaking as an exception to the general rule, not be given access to the Proprietal Information.

The Proprietal Information, in question, was acquired by RES Transmission at considerable expense, in respect of the development of the East-West Tie Line. Disclosure of this information could harm the competitive position of RES Transmission in connection with its commercial activities in Ontario. Moreover, its disclosure could be of value to and used by a competitor, in the event that RES Transmission is not successful in its Application.

(b) financial statements

RES Transmission requests that the financial statements of Renewable Energy Holdings Limited and its subsidiaries (collectively, the "**RES Group**") that are included at Exhibit O-1-2 of the Application, be held in the **strictest confidence,** made available only to the Board and its staff. To be clear, RES Transmission requests that the financial statements not be made available to any other party, including external counsel and consultants for another party, even if they signed or have signed a Declaration and Undertaking in accordance with the Practice Direction.

RES Transmission understands that in a public hearing, information that comprises part of the record on which a decision is to be made should be available to all parties, to the greatest extent possible. The Practice Direction recognizes this and seeks to strike a balance between the objectives of transparency and openness and the need to protect information that has been properly designated as confidential.

RES Group is a private entity in a highly competitive global industry and is not listed on any trading exchange. Accordingly, its financial statements are not publically available pursuant to continuing disclosure requirements. Disclosure of this information would be detrimental to RES Group and its affiliates; could breach existing confidentiality agreements; and could convey a significant advantage to competitors of the Applicant and its affiliates, all to the detriment of the RES Group and its affiliates.

RES Transmission understands that parties to this proceeding require access to some financial information to assess whether RES Transmission meets the financial capacity requirements in section 5 of the "Filing Requirements for Designation Applications" attached as Appendix A to the OEB's Phase 1 Decision and Order (July 12, 2011). To this end, RES Transmission has included, at Exhibit E-2-3, a Dunn and Bradstreet review that provides a third-party financial assessment of Renewable Energy System Holdings Ltd., the parent entity in the RES Group.

By allowing other parties in this proceeding to assess RES Transmission's financial position through the Dunn and Bradstreet Review, while maintaining the confidentiality of the RES Group financial statements, the Board would strike an appropriate balance between transparency and openness, on the other hand, and protecting sensitive information, on the other.

Pursuant to section 5.1 of the Practice Direction, the documents that RES Transmission seeks to file in confidence, are being delivered and filed with the Board in hand copy today. As required, the documents that are confidential in their entirety have been printed on colored paper; the Environmental Assessment Plan is only partly confidential and the confidential information in the hard copy has been highlighted.

Yours truly,

Fraser Milner Casgrain LLP

(signed) Helen T. Newland

Helen T. Newland

HTN/ko

Encls.
cc: All Registered Transmitters
All Intervenors
Mr. Jerry Vaninetti
Mr. Darrell Gerrard

TAB A-1-1

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
A			**Administration**	
	1	1	Index	
	1	2	List of Definitions	
B			**Application**	
	1	1	Designated Transmitter Application	ss. 1.1-1.5, 1.7, 5.8, 6.5, 6.6, 7.5
	2	1	Affidavit of Jerry Vaninetti	s. 1.6
	3	1	Project Overview Map	ss. 9.1, 9.3
	3	2	Maps of Alternative Routes Showing Categories of Required Land Rights	ss. 9.1, 9.3, 9.4
	3	3	Access Road Classification Map	s. 6.1
			APPLICANT EXPERIENCE AND CAPABITLITY	
C			**The Applicant**	
	1	1	Corporate Organization	ss. 2, 2.1
	1	2	Corporate Structure	s. 2.1
	1	3	MidAmerican Worldwide Platform Map	ss. 2.3, 2.4. 4.3
	1	4	RES America's Transmission Construction Brochure	ss. 2.3, 2.4. 4.3

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
D			**First Nation and Métis Participation**	
	1	1	Overview	ss. 3, 3.1, 3.2
	2	1	First Nation and Métis Participation Plan Report	s. 3.1
	2	2	Biography and Resume of John Beaucage	ss. 4.1, 4.3, 10.2
	3	1	First Nation and Métis Engagement Log	s. 3.1
E			**Applicant's Relevant Experience & Capabilities**	
	1	1	Overview	
	2	1	Financial Capability	ss. 2.4, 5, 5.1-5.3, 5.5, 5.6
	2	2	Representative List of Projects Financed	ss. 2.4, 4.3, 5.6, 5.7
	2	3	Dunn & Bradstreet Review	ss. 5.2, 5.3
	3	1	Design and Construction Capability	ss. 2.4, 4.1, 4.4, 8.10
	3	2	Representative List of Projects Designed and Constructed	ss. 2.4, 4.3, 7.4, 8.10
	3	3	RES Group Electricity Generation and Transmission Project Portfolio	s. 4.3
	4	1	Land Acquisition Capability	ss. 2.4, 4.4
	4	2	Land Acquisition – Representative List of Experience	ss. 2.4, 4.3

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
	3	1	Design, Development and Construction Team	s. 4.1
	3	2	Resumes of Design, Development and Construction Team	s. 4.2
	4	1	External Service Providers	ss. 1.8, 2.1, 4.1
	4	2	IESO Connection Assessment Support Consultants	
	5	1	Operation and Maintenance Plan	s. 4.1
			EAST-WEST TIE LINE PROPOSALS	
G			**Design and Construction Options**	
	1	1	Two Design Options	ss. 6, 6.1, 6.2, 6.4, 6.5
	2	1	Preferred Design vs. Reference Design Diagram	ss. 6.1, 6.4, 6.5
	3	1	Comparison Schematic of Wawa TS Upgrades for Preferred Design vs. Reference Design	ss. 6.1, 6.4, 6.5
	3	2	Comparison Schematic of Marathon TS Upgrades for Preferred Design vs. Reference Design	ss. 6.1, 6.4, 6.5
	3	3	Comparison Schematic of Lakehead TS Upgrades for Preferred Design vs. Reference Design	ss. 6.1, 6.4, 6.5
	4	1	Preferred Design – Staged Approach	ss. 6.1, 6.4, 6.5

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
	5	1	Project Line, Station and Interconnection Cost	ss. 6.1, 6.4, 6.5
	6	1	Technological Innovations	s. 6.5
	7	1	Applicant's Plan for Addressing Project's Challenges	ss. 4.5, 6.1
	8	1	Local Benefits	s. 6.5
H			**Preferred Design**	
	1	1	Overview – Preferred Design	ss. 6, 6.1, 6.4, 6.5
	2	1	Compliance with Specified Requirements	ss. 6.1, 6.2
	2	2	Table of Applicable Codes, Standards, Regulations and Procedures	s. 6.1
	2	3	IESO Feasibility Study	s. 6.4
	3	1	Affidavit of Darrell Gerrard – Preferred Design	s. 6.3
	4	1	Preferred Design - Conductor Ratings	s. 6.1
	4	2	Preferred Design – Conductor Interconnections	ss. 6.1, 6.4
	4	3	Preferred Design - Wawa TS Interconnection Schematic	ss. 6.1, 6.2, 6.4
	4	4	Preferred Design - Marathon TS Interconnection Schematic	ss. 6.1, 6.2, 6.4
	4	5	Preferred Design - Lakehead TS Interconnection Schematic	ss. 6.1, 6.2, 6.4

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
	5	1	Design Assumptions for Subsurface Conditions and Subsurface Properties	s. 6.1
	5	2	Tower Design Assumptions and Strength Specifications	s. 6.1
	5	3	Single-Circuit H-frame Tower Schematic	s. 6.1
	5	4	Single-Circuit Lattice Tower Schematic	s. 6.1
	6	1	Access Road Design Assumptions	s. 6.1
	6	2	Access Road Inventory Report	s. 6.1
	6	3	Access Road Classification Map	s. 6.1
	6	4	Staging Locations Map	s.6.1
I			**Reference Design**	
	1	1	Overview – Reference Option	s. 6, 6.2, 6.1, 6.4, 6.5
	2	1	Compliance with Specified Requirements	ss. 6.1, 6.2
	2	2	IESO Feasibility Study	s. 6.4
	3	1	Affidavit of Darrell Gerrard – Reference Design	s. 6.3
	4	1	Reference Design – Conductor Ratings	s. 6.1
	4	2	Reference Design – Conductor Interconnection	ss. 6.1, 6.2, 6.4
	4	3	Reference Design - Wawa TS Interconnection Schematic	ss. 6.1, 6.2, 6.4

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
	4	4	Reference Design - Marathon TS Interconnection Schematic	ss. 6.1, 6.2, 6.4
	4	5	Reference Design - Lakehead TS Interconnection Schematic	ss. 6.1, 6.2, 6.4
	5	1	Tower Design Assumptions and Strength Specifications	s. 6.1
	5	2	Double-Circuit Lattice Tower Schematic	s. 6.1
J			**Routing**	
	1	1	Description of Alternative Routes	ss. 9.3, 9.4
	2	1	Transmission Route Selection Method	s. 9.3
	3	1	Environmental Challenges of Proposed Routes	s. 9.3
	4	1	Project Overview Map	ss. 9.1, 9.3
K			**Land Matters**	
	1	1	Land Use Rights – Private	ss. 9.1, 9.3, 9.4
	2	1	Land Use Rights – Crown Lands	ss. 9.1, 9.3, 9.4
	3	1	Land Use Rights – Other	ss. 9.1, 9.3, 9.4
	3	2	RES America Letter	s. 9.1
	4	1	Plan for Obtaining Land Use Rights	ss. 9.1, 9.3, 9.4
	4	2	Land Valuation & Acquisition Plan	ss. 9.1, 9.3, 9.4

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
	5	1	Significant Issues Anticipated in Acquisition of Land Rights	ss. 9.1, 9.3, 9.4
	6	1	Maps of Alternative Routes Showing Categories of Required Land Rights	ss. 9.1, 9.3, 9.4
L			**Permits and Approvals**	
	1	1	Permitting Plan	s. 4.1
	1	2	List of Key Permits and Approvals	s. 4.1, 4.3
	2	1	Permits, Licences and Approvals Plan Report	ss. 9.1, 9.3
	3	1	Project Corridor Analysis and Critical Environmental Issues Assessment	ss. 9.1, 9.3
	4	1	Environmental Assessment Plan	ss. 4.1, 9.1, 9.3
M			**Consultation**	
	1	1	Overview	s. 9, 10
	2	1	Landowner, Municipality and Community Consultation Plan	s. 9.2
	3	1	First Nation and Métis Consultation Plan	s. 10.1
	3	2	List of Potentially Affected First Nation and Métis Communities	s. 10.1

Exhibit	Tab	Schedule	Contents	Reference to Filing Guidelines
N			**Project Schedule**	
	1	1	Project Schedule Overview	s. 7.2, 7.3
	1	2	Project Execution Chart	s. 7.1
	2	1	Development Phase – Schedule	s. 7.2
	2	2	Development Phase – Milestones	s. 7.2
	2	3	Development Phase – Schedule Risks and Mitigation Strategy	s. 7.2
	3	1	Construction Phase – Schedule	s. 7.3
	3	2	Construction Phase – Milestones	s. 7.3
	3	3	Construction Phase – Schedule Risks and Mitigation Strategy	s. 7.3
	4	1	Reporting Requirements	ss. 7.2, 7.3
	5	1	Innovative Practices to Accelerate Project Schedule	s. 7.5
O			**Financing Plan**	
	1	1	Overview	s. 5
	1	2	RES Group - Financial Statements	ss. 5.1, 5.3, 5.4, 5.5
	1	3	MidAmerican Group – Financial Statements	ss. 5.1, 5.3, 5.4, 5.5
P			**Project Cost**	
	1	1	Overview	s. 8

Exhibit	**Tab**	**Schedule**	**Contents**	**Reference to Filing Guidelines**
	2	1	Designations Costs	s. 8.1
	3	1	Development Phase – Overview	s. 8.2, 8.3, 8.4, 8.5, 8.6
	3	2	Development Phase – Budget & Underpinning Assumptions[1]	ss. 8.2, 8.4, 8.3, 8.6
	4	1	Construction Phase – Overview	ss. 8.7, 8.8, 8.9, 8.10, 8.11, 8.12
	4	2	Construction Phase – Budget & Underpinning Assumptions[2]	ss. 8.7, 8.8, 8.9, 8.11, 8.12
	4	3	Construction Phase – Cost of Required Transmission Station Modifications (Option B)	s. 8.7
	5	1	Risk Allocation Proposal	s. 8.5, 8.9, 8.11
	6	1	Annual Operation & Maintenance Budget – Overview	s. 8.12
	6	2	O&M Budget[3]	s. 8.12
	7	1	Example Calculations	s. 8

[1] In tabular form.
[2] In tabular form.
[3] In tabular form.

TAB A-1-2

LIST OF DEFINITIONS

°C	degrees celsius
ABA	Aboriginal Benefits Agreement
AC	Alternating Current
ACOE	United States Army Corps of Engineers
ACSR	Aluminum Conductor Steel-Reinforced Cable
ACSS/TW	Aluminum Conductor Steel-Supported, Trapezoidal Shaped Aluminum Strand Cable
AFUDC	Allowance for Funds Used During Construction
Agency	Canadian Environmental Assessment Agency
ALGP	Aboriginal Loan Guarantee Program
Applicant or RES Transmission	RES Canada Transmission LP
Application	The application of RES Canada Transmission LP for designation as an Electricity Transmitter to develop the East-West Tie line.
AUC	Alberta Utilities Commission
Bid Amount	The Applicant's bid amount for the EWTL pursuant to the Preferred Design over the Preliminary Preferred Route or the Reference Design over the Preliminary Preferred Route.
BLM	United States Department of Interior Bureau of Land Management
Board or OEB	Ontario Energy Board
Boreal Forest Region	The immediate northern shore of Lake Superior in Ontario that is largely forested by a variety of mixed coniferous assemblages.
BW	Bowmanton to Whitla

Camp Williams Project	This project consists of a new double-circuit 345 kV transmission line that extends approximately 18 km through the western portion of Salt Lake City Valley.
CB	Cassils to Bowmanton
CEAA	*Canadian Environmental Assessment Act, 2012*, S.C. 2012
Cedar Point Wind Farm	A 250.2 MW wind power generating facility with an associated 67.20 km, 230 kV generation transmission line.
CHD	Canadian Hydro Developers
COD	Project in-service date
Construction Phase	The construction phase commences on the date that LTC is filed to the Board and ends on the date that the EWTL is placed in service.
Consultation Program	A comprehensive and inclusive stakeholder consultation program developed by RES Canada Transmission LP
CP Rail	Canadian Pacific Railway
CPCN	Certificate of Public Convenience and Necessity
CPI	Statistics Canada Consumer Price Index
CREZ	Texas Competitive Renewable Energy Zone
CWIP	Calculation of Interest for Construction Work in Progress
Deferral Account	An account in which cash expenditures during the Development Phase may be recorded for future recovery in rates.
Designation Costs	Costs incurred to prepare the Application for designation and costs to participate in the designation proceedings before the Board and conduct pre-designation development work.
Development Phase	The development phase commences on the date that RES Transmission is designated as electricity transmitter to undertake development work in respect of the EWTL and ends on the date on which RES Transmission files a LTC with the Board for the EWTL.

DOE	United States Department of Energy
EA	Environmental Assessment
EIP	Aboriginal Economic Implementation Plan
EIS	Environmental Impact Statement
Environmental Assessment Plan	The Applicant's environmental assessment plan is included in Exhibit L-4-1.
EPC	Engineer Procure Construct
EPCM	Full service project planning and approvals, management and engineering, procurement, and construction management project team.
ERCOT	Electric Reliability Council of Texas
ERIS	Environmental Risk Information Service
ESA	Phase I Environmental Site Assessment
EUCPI	Statistics Canada Electric Utility Construction Price Index
EWTL or Project	East-West Tie Line
Exceptions	Those cost categories over which the Applicant has no or limited control as identified in Exhibit P-5-1.
FAA	United States Federal Aviation Administration
Feasibility Studies	IESO feasibility studies for the Preferred Design and the Reference Design.
FERC	United States Federal Energy Regulatory Commission
Filing Requirements	The Filing Requirements for Designation Applications attached as Appendix A to the Ontario Energy Board's Phase 1 Decision and Order dated July 12, 2011 (Board File No: EB-2011-0140).

First Nation and Métis Communities	Animbiigoo Zaagi'igan Anishinaabek First Nation (Lake Nipigon Ojibway) Biinjitiwaabik Zaaging Anishinaabek First Nation (Rocky Bay) Bingwi Neyaashi Anishinaabek (Sand Point First Nation) Fort William First Nation Ginoogaming First Nation Greenstone Métis Council (represented by MNO) Kiashke Zaaging Anishinaabek (Gull Bay) First Nation Long Lake No.58 First Nation Michipicoten First Nation Missanabie Cree First Nation Ojibways of Batchewana Ojibways of Garden River Ojibways of Pic River (Heron Bay First Nation) Pays Plat First Nation Pic Mobert First Nation Red Rock Indian Band Red Sky Independent Métis Nation (Red Sky) Superior North Shore Métis (represented by MNO) Thunder Bay Métis (represented by MNO)
FMC	Fraser Milner Casgrain LLP
FS	Factor of Safety
FTEs	Full Time Employee Equivalents
GAAP	Generally Accepted Accounting Principles
Gateway South Project	This project consists of approximately 680 km of single-circuit 500 kV transmission line from the future Aeolus Substation, near Medicine Bow, Wyoming to the new Clover Substation, near Mona, Utah.

Gateway West Project	This project will consist of approximately 1600 km of 230 kV, 345 kV and 500 kV transmission line, beginning at the Windstar Substation near Glenrock, Wyoming and terminating at Hemingway Substation southwest of Boise, Idaho.
GIS	Geographic Information System
Greenwich Wind Farm	A 99 MW wind power generating facility with an associated 9.90 km 230 kV double circuit overhead transmission line and a 38.40 km of 34.5 kV distribution line.
GW	gigawatts
Hydro One	Hydro One Networks Inc.
IBA	Impact Benefits Agreement
IDC	Interest during construction rate
IESO	Independent Electricity System Operator
JV	Joint Venture
kA	kiloampere
kcmil	1000 circular mils
km(s)	kilometre(s)
kN	kilonewton
kV	kilovolt
Lakehead TS	Lakehead Transformer Station, located near Thunder Bay which is the western terminus of the East-West Tie Line.
LTC	Leave to Construct
LTEP	Ontario Long Term Energy Plan
m	metre
MAG	Municipal Advisory Group

Marathon TS	Marathon Transformer Station, located near Marathon, to which the East-West Tie Line will connect.
MAT	MidAmerican Transmission LLC
MEC	MidAmerican Energy Company
MEHC	MidAmerican Energy Holdings Company
MEI	Ontario Ministry of Energy and Infrastructure
MidAmerican Group	MidAmerican Energy Holdings Company and its subsidiaries, which include MAT, MEC and PacifiCorp.
MISO	Midwest Independent Transmission System Operator
mm	millimetre
MNDMF	Ontario Ministry of Northern Development, Mines, and Forestry
MNO	Métis Nation of Ontario, represented by Greenstone Métis Council, Superior North Shore Métis and Thunder Bay Métis
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
Mona Oquirrh Project	A 160 km transmission line that consists of double-circuit 345 kV and single circuit 500 kV transmission lines from a 345/138 kV substation in central Utah to an existing 345 kV substation in the Salt Lake City area.
MOU	Memorandum of Understanding
MRO	Midwest Reliability Organization
MTC	MEHC Transmission Canada Limited Partnership
MVA	megavolt amperes
MVar	megavolt-ampere reactive
MW	megawatt
NEPA	United States National Environmental Policy Act

NERC	North American Electric Reliability Corporation
NHIC	The Ontario Ministry of Natural Resources' Natural Heritage Information Centre
NPCC	Northeast Power Coordinating Council Inc.
O&M	Operations and Maintenance
O&M Plan	A definitive operations and maintenance plan for the EWTL.
OEB Act	*Ontario Energy Board Act, 1998*, S.O. 1998, c. 15, Sched. B
OPA	Ontario Power Authority
Option 1	Preferred Design/Preliminary Preferred Route
Option 2	Preferred Design/ Reference Route
Option 3	Reference Design/Preliminary Preferred Route
Option 4	Reference Design/ Reference Route
Options	Options to Acquire a Permanent Transmission Easement
Pa	pascals
Participation Plan	The Applicant's First Nation and Métis Participation Plan as located in Exhibit D-2-1.
PCA or CEIA	Project Corridor Analysis and Critical Environmental Issues Assessment as included at Exhibit L-3-1.
Phase 1 Decision	The Ontario Energy Board's Phase 1 Decision and Order dated July 12, 2011
PIC	Public Information Center
Populus to Terminal Project	A 216 km double circuit 345 kV transmission line
PowerTel	PowerTel Utilities Contractors Limited

Preferred Design	The preferred design comprises an innovative, single-circuit 230 kV transmission line that meets or exceeds the Reference Design requirements. The preferred design is described in further detail in Exhibit H.
Preliminary Preferred Route	A 409 km route that parallels the existing Hydro One Transmission Line until it departs the line for 123 km
Project or EWTL	The East West Tie Line
Project Management Institute	An independent professional organization that specializes and is a resource to US companies regarding the practices used in the management and delivery of large infrastructure projects including, but not limited to, bulk electric power systems.
Project Management Plan	A detailed project management plan led by Mr. Jerry Vaninetti, which will include the following components: planning and delivery; environmental and permitting; regulatory and legal; communications and consultation; commercial and finance; and land control.
Project Management Team	The Applicant's project management team assembled to conduct the development and construction of the Project, who include: Jerry Vaninetti, Cory Blair, Darrell Gerrard, Todd Jensen, Ryan Henning, Ryan Flynn, Nicolas Muszynski and Venkata Bujimalla.
Reference Design	The Reference Design comprises a double-circuit 230 kV transmission line, as described by the Ontario Power Authority in its June 30, 2011 report on the long-term electricity outlook for the Northwest. The Reference Design is described in further detail in Exhibit I.
Reference Route	A 402 km route that parallels the existing 230 kV double circuit Hydro One Transmission Line from the Wawa TS to Lakehead TS line.
RES Americas	Renewable Energy Systems Americas Inc.
RES Canada	Renewable Energy Systems Canada Inc.
RES Canada GP	RES Canada Transmission GP Inc.
RES Group	Renewable Energy Systems Holdings Ltd. and its subsidiaries, which include RES Americas and RES Canada.

RES Transmission	An Ontario limited partnership formed for the purpose of pursuing opportunities in the electricity transmission sector in Ontario.
RFP	Requests for Proposals
ROE	Return on Equity
ROW	Right(s) of Way
Sigurd to Red Butte Project	A 272 km 345 kV transmission line.
Stantec	Stantec Consulting Limited
Study Area	An area of one km on either side of the Preliminary Preferred Route or Reference Route.
Subtracted Amount	For each year that the EWTL is in service, the value of its Board-approved rate base would be reduced by the amount of any cost underages.
SVC	Static Var Compensator
Talbot Wind Farm	A 99 MW wind power generating facility with an associated 9.90 km 230 kV generation transmission line.
ToR	Environmental Assessment Terms of Reference
Transmission Licence	RES Canada Transmission LP holds an electricity transmission licence (ET-2011-0282) dated July 28, 2011.
TS	Transformer Station
TSP	tubular steel poles
USGAAP	US General Accounting Principles
USFS	United States Department of Agriculture Forest Service
USFWS	United States Fish and Wildlife Service
VAr	Volt-ampere reactive

Wawa TS	Wawa Transformer Station, located near Wawa which is the eastern terminus of the East-West Tie Line
WECC	Western Electric Coordinating Council
Whirlwind Wind Farm	A 60 MW wind power generating facility with an associated 32.30 km 69 kV generation transmission line located in Whirlwind, Texas.

TAB B-1-1

IN THE MATTER OF sections 70 and 78 of the *Ontario Energy Board Act 1998*, S.O. 1998, c. 15 (Schedule B);

AND IN THE MATTER OF a Board-initiated proceeding to designate an electricity transmitter to undertake development work for a new electricity transmission line between Northeast and Northwest Ontario: the East-West Tie Line.

Application for Designation

A. The Applicant

1. RES Canada Transmission LP ("**RES Transmission**" or the "**Applicant**") is an Ontario limited partnership formed for the purpose of pursuing opportunities in the electricity transmission sector in Ontario. RES Transmission holds Electricity Transmission Licence ET-2011-0282 (the **"Transmission Licence**"), which permits RES Transmission to participate as a registered transmitter in this proceeding to designate a developer for the East-West Tie Line ("**EWTL**") or "**Project**"). This exhibit summarizes RES Transmission's application for designation as an electricity transmitter to develop the EWTL (the "**Application**").

2. Currently, RES Transmission does not own or operate any electricity transmission assets in Ontario and is not a "transmitter" within the meaning of the *Ontario Energy Board Act, 1998* ("**OEB Act**"). Accordingly, the Transmission Licence issued to RES Transmission will not be effective until the Ontario Energy Board ("**OEB**" or "**Board**") designates RES Transmission as a developer of transmission assets in Ontario pursuant to an OEB designation process or RES Transmission applies to amend Schedule 1 of its Transmission Licence to specify the facilities to be owned and/or operated by it, whichever is earlier.

3. At the time that RES Transmission applied for its Transmission Licence, Renewable Energy Systems Canada Inc. ("**RES Canada**") held a 99 percent limited partner interest in RES Transmission and RES Transmission's general

partner, RES Canada Transmission GP Inc. ("**RES Canada GP**"), held the remaining 1 percent interest. Effective October 26, 2012, however, MEHC Transmission Canada Limited Partnership ("**MTC**") acquired an interest in RES Transmission through the subscription of partnership units. As a result, RES Canada and MTC hold equal interests as limited partners in RES Transmission. RES Canada GP continues to hold the remaining interest as RES Transmission's general partner. A detailed description of the Applicant's ownership structure is included at Exhibit C-1-2.

4. RES Canada and its affiliate, Renewable Energy Systems America Inc. ("**RES Americas**"), are other subsidiaries of Renewable Energy Systems Holdings Ltd. (together with the subsidiaries of Renewable Energy Systems Holdings Ltd., collectively, the "**RES Group**"). RES Canada and RES Americas are in the business of developing and constructing renewable generation facilities and associated transmission facilities in Canada and the United States, respectively. They have developed and/or constructed over 5,700 megawatts ("**MW**") of renewable generation facilities in North America and 890 kilometres ("**km**") of transmission lines. In Ontario, RES Canada spent more than five years developing and constructing two large wind farms and their associated high voltage transmission facilities. The 99 MW Greenwich Wind Farm in northwestern Ontario interconnects, via a 10 km high-voltage transmission line, with Hydro One Network Inc.'s ("**Hydro One**") existing 230 kilovolt (**"kV"**) East-West Transmission line, at a point east of Thunder Bay, Ontario. The 99 MW Talbot Wind Farm in southwestern Ontario also interconnects with Hydro One facilities via a 10 km, 230 kV transmission line. In Alberta and Montana, subsidiaries of RES Canada and RES Americas, respectively, are near completion of the construction of the Montana-Alberta Tie-Line, a trans-border 345 km, 230 kV electricity transmission line that runs between Alberta and Montana. Recently, RES Canada was selected by the Independent Electricity System Operator ("**IESO**") to provide regulation services in Ontario.

5. MTC is an affiliate of MidAmerican Transmission, LLC ("**MAT**") which is, in turn, a wholly-owned subsidiary of MidAmerican Energy Holdings Company ("**MEHC**"), a Berkshire Hathaway company. MEHC, together with its subsidiaries (collectively, the "**MidAmerican Group**"), is a global leader in the production, transportation and delivery of energy from a variety of fuel sources, including coal, natural gas, wind, hydro, nuclear, geothermal, solar and biomass. The MidAmerican Group supplies and distributes electricity and natural gas to over seven million customers in the United States and the United Kingdom. It owns over $51 billion in assets (as of September 2012), including generation capacity of more than 22,000 MW and more than 30,000 km of high-voltage transmission lines. Currently, the MidAmerican Group is involved in the construction and/or development of more than 5,000 km of high-voltage transmission lines in North America.

6. The MidAmerican Group, through its subsidiary, PacifiCorp, owns and operates approximately 25,000 km of regulated electricity transmission lines in the United States, serving approximately 750 communities in six Western states. PacifiCorp's transmission system is interconnected with more than 80 generating plants and 15 adjacent control areas at 124 interconnection points. Through subsidiary MidAmerican Energy Company ("**MEC**"), the MidAmerican Group also owns approximately 3,500 km of transmission facilities in several Midwestern states. MEC is a transmission-owning member of the Midwest Independent Transmission System Operator, Inc. ("**MISO**").

7. Through MAT, the MidAmerican Group is also engaged in the development of non-vertically integrated electric transmission facilities in organized and traditional markets in the United States. This includes participation in joint ventures with Prairie Wind Transmission and Electric Transmission Texas, a developer, owner and operator of independent transmission facilities in the state

of Texas, including facilities that are part of the Competitive Renewable Energy Zone ("**CREZ**") program which connects renewable generation with load centres.

8. Details of the corporate ownership and organization of the Applicant are included in Exhibit C.

B. **The Applicant's Experience and Capabilities**

9. RES Transmission enjoys the benefit of the combined North American transmission experience of the MidAmerican Group and the RES Group. This experience translates into over 30,000 km of high voltage transmission lines and associated facilities, constructed in a wide array of terrain, and topographies, under challenging climate conditions and subject to many different regulatory regimes. Approaches that have proven to be efficient and effective on past projects undertaken by the RES Group and the MidAmerican Group, will be utilized by the Applicant in developing and constructing the EWTL.

10. The collective transmission experience of the MidAmerican Group and the RES Group is described, in detail, in Exhibit E.

C. **Project Management**

11. The Applicant has assembled an EWTL Project Team that has the depth, breadth and experience to develop, construct and operate the EWTL safely and reliably, in an expeditious, efficient and economical fashion. The Project Team includes experts in transmission design, transmission construction, land acquisition, permitting, environmental assessment, regulation, financing and First Nation and Métis consultation.

12. Jerry Vaninetti, President of RES Transmission, will lead the Project Team. Mr. Vaninetti is the Senior Vice President, Transmission, of RES Americas and has 40 years of management experience in the electricity industry, including ten years with a utility, 13 years in project development (mainly transmission), nine

years as a management consultant and eight years in energy transportation. Most recently, he managed two major transmission projects under development in the western U.S. Rocky Mountains: the Wyoming-Colorado Intertie Project (300 km of 345 kV transmission line) and the High Plains Express Project (3,500 km of 500 kV transmission line).

13. Mr. Vaninetti will be supported by Darrell Gerrard, Vice President of Transmission System Planning at MAT. Mr. Gerrard will be responsible for project planning and delivery management. Mr. Gerrard has 35 years of experience in planning, developing and managing electricity utility transmission systems.

14. The Project Management Team will be supported by other employees of the RES Group and the MidAmerican Group. The Applicant has budgeted for 5.1 to 6.5 full-time employee equivalents ("**FTEs**") for the development phase, up to the time a leave to construct application ("**LTC**") is filed with the Board; 6.6 to 8.0 FTEs during the LTC hearing phase; and a phased-in decrease from 6.1 to 3.5 FTEs, during the construction phase of the Project. The estimate of construction phase FTEs will be revised closer in time to the construction phase.

15. The Project Management Team will also be supported by Canadian consultants, advisors, and contractors that have assisted in conducting the Applicant's pre-designation studies and preparing this Application, including:

(i) Legal: Fraser Milner Casgrain LLP (Toronto, ON) ("**FMC**");

(ii) Environmental & Technical Consultant: Stantec Consulting Limited ("**Stantec**") (Guelph, ON & Vancouver, BC);

(iii) Construction Advisors: PowerTel Utilities Contractors Limited ("**PowerTel**") (Whitefish, ON);

(iv) Aboriginal Advisor: John Beaucage, former Grand Council Chief of the Anishinaabek Nation (Union of Ontario Indians) (Parry Sound, ON);

(v) Communications: Campbell Strategies Inc. (Toronto, ON);

(vi) First Nation Financing & Investment Advisor: Coxswain Row Capital Corp. (Toronto, ON);

(vii) Project Development: Juan Anderson (Thunder Bay, ON); and

(viii) Rate Regulation: JT Browne Consulting (Toronto, ON).

16. A project management plan (the "**Project Management Plan**") has been developed with regard to the specific management tasks that will be required in the development and construction phases of the Project. The Project Management Plan is described in Exhibit F-1-1.

D. First Nation and Métis Participation

17. First Nation and Métis participation is critical to the success of the Project. The Minister of Energy has identified 18 First Nation and Métis communities that may be affected by the EWTL. RES Transmission invited these communities to become involved in the development of its First Nation and Métis Participation Plan (the "**Participation Plan**"). The Participation Plan reflects the input that has been received from representatives of these communities, to-date.

18. The Applicant's Participation Plan describes and discusses the participation opportunities that will be available to First Nation and Métis communities in the event that the Applicant is the designated transmitter. The Applicant is prepared to offer as much as a $50 million investment opportunity to affected and interested First Nation and Métis communities, provided such investment, in total, does not exceed a 20 percent equity interest in the Applicant. Alternatively,

affected First Nation and Métis communities could choose to negotiate Impact Benefits Agreements (“**IBA**”) with the Applicant.

19. A summary of the key aspects of the Applicant’s Participation Plan is included at Exhibit D-1-1. A copy of the Participation Plan is included at Exhibit D-2-1. A copy of the Applicant’s current First Nation and Métis engagement log is included at Exhibit D-3-1.

E. <u>**The Applicant’s Design, Route and Cost Proposals**</u>

Design Options

20. The Applicant proposes two options for the design of the EWTL: a reference design option and a preferred design option.

(i) The reference design comprises a double-circuit 230 kV transmission line, as described by the Ontario Power Authority (the “**OPA**”) in its June 30, 2011 report on the long-term electricity outlook for the Northwest[1] (the “**Reference Design**”).

(ii) The preferred design comprises an innovative, single-circuit 230 kV transmission line (the “**Preferred Design**”) that meets or exceeds the Reference Design requirements. The IESO has completed a feasibility study to confirm the performance of the Preferred Design. This study is included at Exhibit H-2-3.

21. While both the Reference Design and the Preferred Design meet or exceed all applicable requirements with respect to transfer capacity, system performance

[1] Ontario Power Authority, “Long Term Electricity Outlook for the Northwest and Context for the East-West Tie Expansion” (June 30, 2011); the OPA assumes that the expanded East-West Transmission Line would comprise a new double-circuit 230 kV overhead transmission line.

and system reliability[2], the Preferred Design is a superior option for the following four overarching reasons:

(i) it has superior electrical performance attributes, including a total east-west transfer capacity of 684 MW compared to the 650 MW in the OPA's reference option and the Applicant's Reference Design;[3]

(ii) its upfront, overall cost of construction for the transmission line portion of the Project is $80 million less than for the Reference Design;[4]

(iii) it can be constructed and put into service more quickly than can the Reference Design;[5] and

(iv) it allows for increments of transfer capacity to be installed in five discrete stages, in the form of station upgrades, in order to meet system requirements as they materialize, thereby deferring and, thus, reducing costs to ratepayers; assuming that the five stages are installed over an eight year period, commencing in 2018, the total savings in owning and operation costs would be approximately $62.5 million.

22. The Preferred Design incorporates a number of unique design features intended to facilitate construction in a harsh environment that is characterized by challenging topography, numerous water crossings and long spans. These unique design features include: the use of high capacity, high efficiency conductors; a combination of simple, but robust, steel H-Frame towers and

[2] These requirements include the Board's minimum technical requirements and minimum design criteria for the Reference Option in attachments 1 and 2 of the Board's letter to Registered Electricity Transmitters, dated December 20, 2011; and the reliability and other standards of the IESO, the NERC and the NPCC.
[3] Details of the transfer capacity of the two design options are provided in Exhibits G, H and I.
[4] Details of the cost of constructing the two design options are included in Exhibit P.
[5] Details of the constructability of the Preferred Design are included at Exhibits G and H.

traditional lattice tower structures[6]; specialized grounding for lightning protection; and specialized tower designs at specific locations that will facilitate future interconnections of new transmission lines and new generation, at points between Thunder Bay and Nipigon, with minimal disruption to the operation of the EWTL.

A comparison of the Preferred Design and the Reference Design is included at Exhibit G. The detailed technical specifications and design assumptions that underpin the Preferred Design and the Reference Design are included at Exhibits H and I, respectively.

The Preferred Design Staging Options

23. The Reference Design requires that all facilities be constructed in the same time frame, making the full 650 MW transfer capacity available as soon as the EWTL is placed into service. Under the Preferred Design, the full transfer capacity (684 MW) could be installed at once or, alternatively, in stages, as system requirements materialize. The electricity demand scenarios that are included in the OPA's 2011 long-term electricity outlook for the Northwest indicate that the full 650 MW of transfer capacity that is stipulated in the OEB's definition of the EWTL, is unlikely to be required by the initial EWTL in-service date. It is far more likely that the need for this transfer capacity will develop over time. In these circumstances, it makes economic sense to construct only those facilities that will be required in the foreseeable future and defer the construction – and cost – of additional capacity to future periods. Table B-1, below, describes the staged approach that is possible under the Preferred Design.

[6] The traditional lattice towers are comparable to the 230 km high-profile lattice transmission towers currently used by Hydro One.

Table B-1: Staged Installation of Capacity

Stage	Facilities Added	Total Installed Transfer Capacity (MW)	Incremental Transfer Capacity Added (MW)
1	transmission line constructed from Wawa Transformer Station ("**TS**") to Lakehead TS with an interconnection at Marathon TS	387	
2	series compensation added between Wawa TS and Marathon TS	436	49
3	series compensation added between Marathon TS and Lakehead TD	484	48
4	shunt capacitors added at Lakehead TS and Marathon TS, static VAr compensator added at Marathon TS (without series compensation between Marathon TS and Lakehead TS as described in Stage 3)	614	130
5	stage 4 plus series compensation added between Marathon TS and Lakehead TS	684	70

24. The completion of Stage 1 would increase the total transfer capacity of the existing transmission corridor to 387 MW and improve system reliability, facilitating more efficient and cost-effective dispatch of existing generation resources. The completion of stages 2 through 5 involve the construction of transformer station and other upgrades. The stages could be constructed by Hydro One if and when system demand materializes. Each stage would take approximately two years to construct and more than one stage could be constructed in the same time frame, if necessary.

25. Adding transfer capacity in stages and only if and when required by system demand, as proposed in the Preferred Design, would defer or avoid altogether, the expenditure of the significant capital costs of stages 2 through 5. This would translate into substantial savings for Ontario ratepayers - $62.5 million, assuming installation over an eight year period. A graph that compares the OPA's estimate of the cost of constructing the Reference Design with the Applicant's estimate of

the cost of constructing its Preferred Design is included in Figure B-1 below. Table B-2 that follows Figure B-1 shows the magnitude of the capital costs deferred or avoided altogether for stages 2 through 5; these range between $55 million and $163 million.

Figure B-1: Project Line, Station and Interconnection Costs

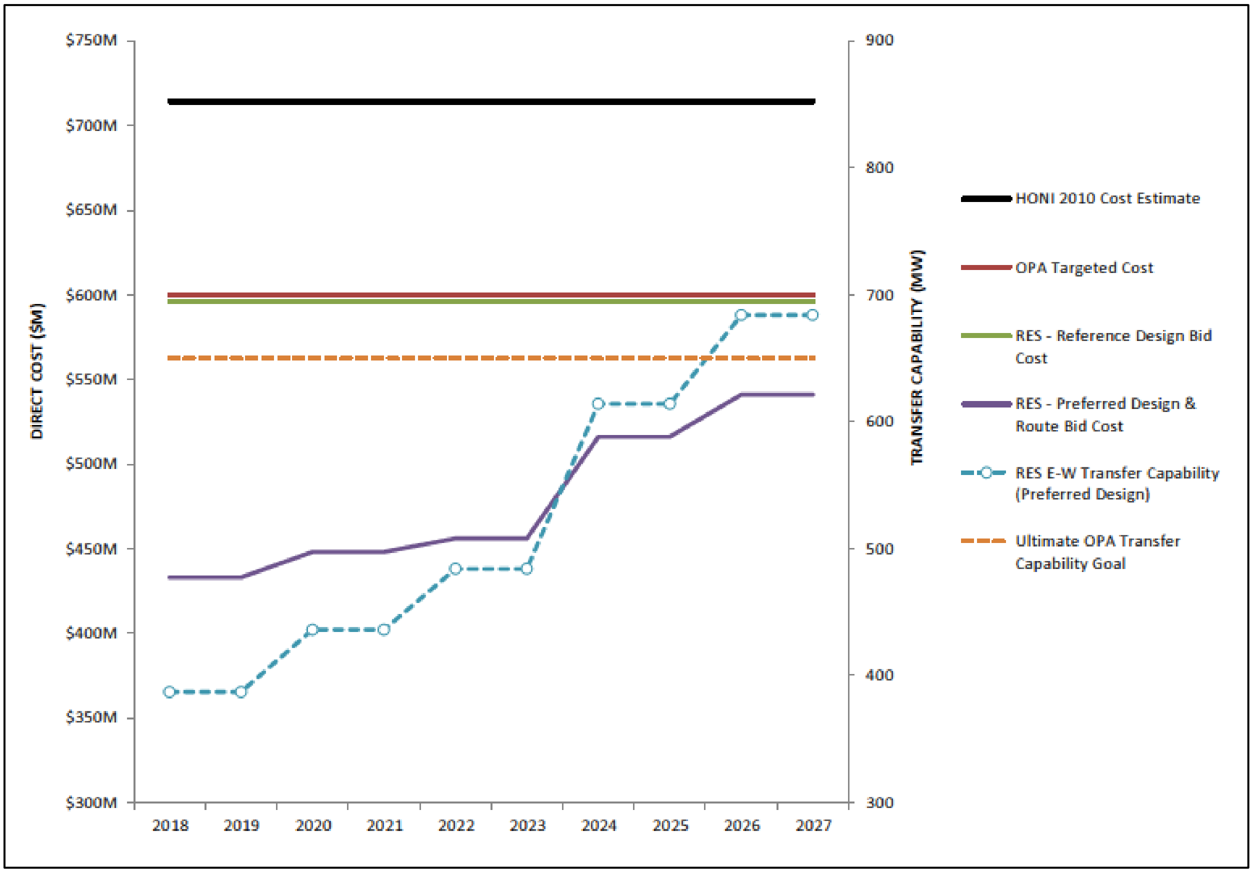


Table B-2:

Design Scenario for Preliminary Preferred Route	Circuits	Transfer Capacity (MW)	Bid Amount	Other Costs (Hydro One) ($M)	Total Costs ($M)	Avoided Costs ($M)	Incremental Cost ($M/MW)
Reference Design	2	650	$493	$103	$596	Base	NA
Preferred Design (Stage 1)	1	387	$413	$20	$433	$163	NA
Preferred Design (Stage 2)	1	436	$413	$35	$448	$148	$0.31
Preferred Design (Stage 3)	1	484	$413	$43	$456	$140	$0.17
Preferred Design (Stage 4)	1	614	$413	$103	$516	$80	$0.46
Preferred Design (Stage 5)	1	684	$413	$128	$541	$55	$0.36

Routing

26. The Applicant has identified two potential routes for the Project: the reference route, a 401 km route that adjoins Hydro One's existing East-West transmission line (the "**Reference Route**") and the preliminary preferred route, a 409 km route that departs from the corridor of Hydro One's existing East-West transmission line for 130 km (the "**Preliminary Preferred Route**").

27. Portions of the Reference Route would traverse First Nation reserve lands and 34.5 km of Pukaskwa National Park. The Preliminary Preferred Route avoids these areas, thereby reducing the impact on First Nation and Métis communities and on environmentally sensitive lands. This could, in turn, shorten the environmental assessment ("**EA**") and permitting process.

28. Land along the Reference Route and the Preliminary Preferred Route comprises primarily Crown lands (approximately 75%) managed by the Ontario Ministry of Natural Resources ("**MNR**") under the *Public Lands Act*. The remainder (approximately 25%) is owned in fee simple, by private landowners. The Applicant has identified as many as 161 private land parcels and 114 active

mining claims on Crown lands along each of the two routes under consideration. The Applicant plans to secure land right options and/or accommodation options from the MNR and from individual landowners during the development phase of the Project. Options with individual landowners would be exercised only after the Applicant had obtained the Board's leave to construct the EWTL.

29. Both the Preferred Design and the Reference Design can be installed along either of the Reference Route or the Preliminary Preferred Route. The Applicant has completed a desktop analysis of available information and spent more than 50 person-days in the field for the purpose of assessing the Reference Route and the Preliminary Preferred Route and their associated construction and access options. The Applicant will make its routing decision in the first year after designation. The precise final route will not be determined, however, until substantial progress has been made in the EA process, in consultation with local stakeholders and First Nation and Métis communities. The precise route, will be determined by the time of the LTC application and approved by the Board in the LTC Order.

30. Generalized maps of the routes, land rights and access roads for the EWTL are included in Exhibits B-3-1, B-3-2 and B-3-3, respectively. Detailed maps and descriptions of the Reference Route and the Preliminary Preferred Route are included in Exhibit J. A description of the existing land use rights and the Applicant's plan for acquiring these rights are included in Exhibit K.

Development Costs

31. The Applicant has identified a total of four design/route options, as follows:

(i) Preferred Design/Preliminary Preferred Route ("**Option 1**");

(ii) Preferred Design/Reference Route ("**Option 2**");

(iii) Reference Design/Preliminary Preferred Route ("**Option 3**"); and

(iv) Reference Design/Reference Route ("**Option 4**").

32. The Applicant has developed estimates for the total development costs for each of these four Options for the EWTL. These estimates are set out in Table B-3 below and are discussed, in detail, in Exhibit P-3.

Table B-3

PROJECT DEVELOPMENT COSTS (millions, $2013)			
Total	Low-$20.10	Budget -$21.50	High-$22.90

33. The Applicant's estimated budget for development costs for each of the four Options is $21.5 million. [7, 8] This amount comprises the sum of a low estimate of $20.1 million and a contingency/risk amount of $1.4 million.[9]

34. If the actual costs of development were to be less than the budgeted amount of $21.5 million, the Applicant would only seek to recover actual costs spent. For greater certainty, in the circumstances of a cost underage, RES Transmission would not seek to recover any portion of the underage amount.

35. If the actual costs of development were to be greater than the budgeted amount of $21.5 million, RES Transmission would seek to recover the actual costs incurred (i.e., budgeted amount plus overage) with one exception. The one exception relates to project management costs. The $21.5 million budget for development costs for each of the four design/route Options includes project management costs of up to $4.3 million. The Applicant is prepared to cap its

[7] Development costs are those costs incurred in the period from the date that RES Transmission is designated as an electricity transmitter to undertake development work in respect of the EWTL to the date on which it files a leave to construct ("**LTC"**) application with the Board for the EWTL (the "**Development Phase**").

[8] All cost estimates included in this Application are expressed in 2013 Canadian dollars unless otherwise indicated. The Applicant proposes that development costs specified in this Application be adjusted for inflation in accordance with the Consumers Price Index.

[9] The development cost estimate is discussed, in detail, in Exhibit P-3-1.

project management costs at $4.3 million. If the actual project management costs incurred in the Development Phase are less than $4.3 million, the Applicant's budgeted total development costs of $21.5 million will decrease by the underage. If, however, the actual project management costs incurred in the Development Phase are greater than $4.3 million, the Applicant is prepared to forego recovery of the overage.

36. RES Transmission acknowledges and accepts that if the Board, in this proceeding, were to accept as reasonable, the Applicant's development budget of $21.5 million, RES Transmission would still be required to demonstrate, in a future proceeding, that any overages of the development estimate it sought to recover, had been prudently incurred.

37. In this Application, RES Transmission is requesting that the Board establish a deferral account ("**Deferral Account**") in which cash expenditures during the Development Phase may be recorded for future recovery in rates.

38. The Applicant is also requesting that the OEB vary its usual methodology that prescribes interest rates for approved regulatory accounts (except for Construction Work in Progress ("**CWIP**" accounts)) under the Uniform System of Accounts as the sum of the Bankers' Acceptances three-month rate, as published on the Bank of Canada's website and 25 basis points. The Applicant is requesting that, instead, the OEB approve a blended debt/equity rate as follows: the sum of the ROE determined by the Board annually, on 40 percent of development expenditures, and the lesser of the deemed short-term debt rate (determined by the Board annually) or the Board-approved "interest during construction" rate, on 60 percent of development expenditures. The ongoing balance associated with this accrual would be tracked separately on the Applicant's financial statements.

39. The Applicant's request is underpinned by the following factors:

(i) the fact that the Applicant intends to finance Development Phase activities solely by equity contributions from its two sponsors; relative to the small amount of project level debt required to finance development costs, the origination and commitment fees associated with putting debt facilities in place would be prohibitive; moreover, without a revenue stream, obtaining debt financing at competitive rates would be difficult and costly; and

(ii) the fact that the Project will not be placed in service until a full five and one-half years after the commencement of the two-year Development Phase; the application of a rate that comprises only a short-term debt component is not appropriate in these circumstances because it is not consistent with the life cycle expected for the underlying regulatory asset (assuming the Deferral Account is not cleared until after the EWTL is place in service).

Construction Costs

40. The Applicant has developed estimates for the construction of the EWTL, for each of its four design/route Options. These estimates are set out in Table B-4 below and are discussed, in detail, in Exhibit P-4.

Table B-4: Construction Costs

		CONSTRUCTION COSTS (millions, $2013)[1]			
		Reference Route (401 km)		Preliminary Preferred Route (409 km)	
	Circuits	Range ($M)[2]	Base Amount[3] ($M)	Range($m)[2]	Base Amount[3] ($m)
Reference Design	2	$417.1-$512.9	$476.7	$422.6-$518.8	$472.2
Preferred Design	1	$340.8-$436.6	$400.4	$341.7-$437.7	$391.9

Notes:

1. Construction costs are those costs incurred in the period from the date on which RES Transmission files a LTC application for the EWTL to the date the Project is placed in service (the "**Construction Phase**").
2. Estimates assume an in-service date of December 31, 2018.
3. The base amount is the Applicant's low estimate for Construction Phase costs plus a reasonable contingency/risk amount.

Total Project Costs

41. Total Project costs – the sum of development and construction costs – are set out below in Table B-5.

Table B-5: Development and Construction Costs ($2013)

		Reference Route (401 km)		Preliminary Preferred Route (409 km)	
	Circuits	Range ($M)	Base Amount ($M)	Range ($M)	Base Amount ($M)
Reference Design	2	$437.2 - $535.8	$498.2	$442.7 - $541.7	$493.7
Preferred Design	1	$360.9 - $459.5	$421.9	$362.0 - $460.6	$413.4

Operating and Maintenance Costs

42. Annual operating and maintenance ("**O&M**") costs for the EWTL are estimated at $2.2 million. Certain annual or periodically recurring expenses that are not capitalized, such as payments to First Nation and Métis communities, would be in addition to this estimate.

Designation Costs

43. The Applicant does not intend to seek recovery of the costs incurred to prepare its Application for designation, participate in the designation proceedings before the Board and conduct pre-designation development work (collectively, the "**Designation Costs**"). It is estimated that Designation Costs will be $1.5 million.

Development and Construction Cost Proposal

44. The Applicant is prepared to develop, construct, own and operate any of the four design/route Options, as selected by the OEB. The Applicant is also prepared, at the option of the Board, to develop and construct either of Option 1 (Preferred Design/Preliminary Preferred Route) or Option 3 (Reference Design/Preliminary Preferred Route) for a firm cost of $413.4 million ($21.5 + $391.9) and $493.7 million ($21.5 + $472.2) (each, the "**Bid Amount**"), respectively, subject to approval of the Board, in a future proceeding at the appropriate time, of the following:

(i) for development costs that are expressed in this Application in 2013 dollars, an annual inflation adjustment based on the Statistics Canada Consumer Price Index ("**CPI**") for the period January 2013 to the date that an LTC application is filed;

(ii) for construction costs that are expressed in this Application in 2013 dollars, an annual inflation adjustment to the Bid Amount (minus the development cost) based on the Statistics Canada Electric Utility Construction Price Index ("**EUCPI**") for the period January 2013 to the date that the EWTL is placed in service;

(iii) an incentive rate methodology that rewards RES Transmission for completing the development and construction of the Project for less than its Bid Amount and penalizes RES Transmission for exceeding the Bid Amount, as follows:

- **costs underages:** for each year that the EWTL is in service, the value of its Board-approved rate base would be reduced by the amount of any cost underages (the "**Subtracted Amount**"). Sixty percent of the remainder would earn a return at the Board's deemed cost of long-term debt, determined annually, and 40 percent of the remainder would earn a return at the return on equity determined by the Board, annually ("**ROE**"). Forty percent of the Subtracted Amount would earn an incentive return equal to the sum of the ROE and 300 basis points. Sixty percent of the Subtracted Amount would earn a return at the Board's deemed cost of long-term debt, determined annually;

- **cost overages:** for each year that the EWTL is in service, the ROE that would otherwise be earned on 40 percent of any prudently incurred cost overages would be reduced and RES Transmission would instead earn only the deemed cost of long-term debt, as determined by the OEB annually, on 100 percent of such overages; and

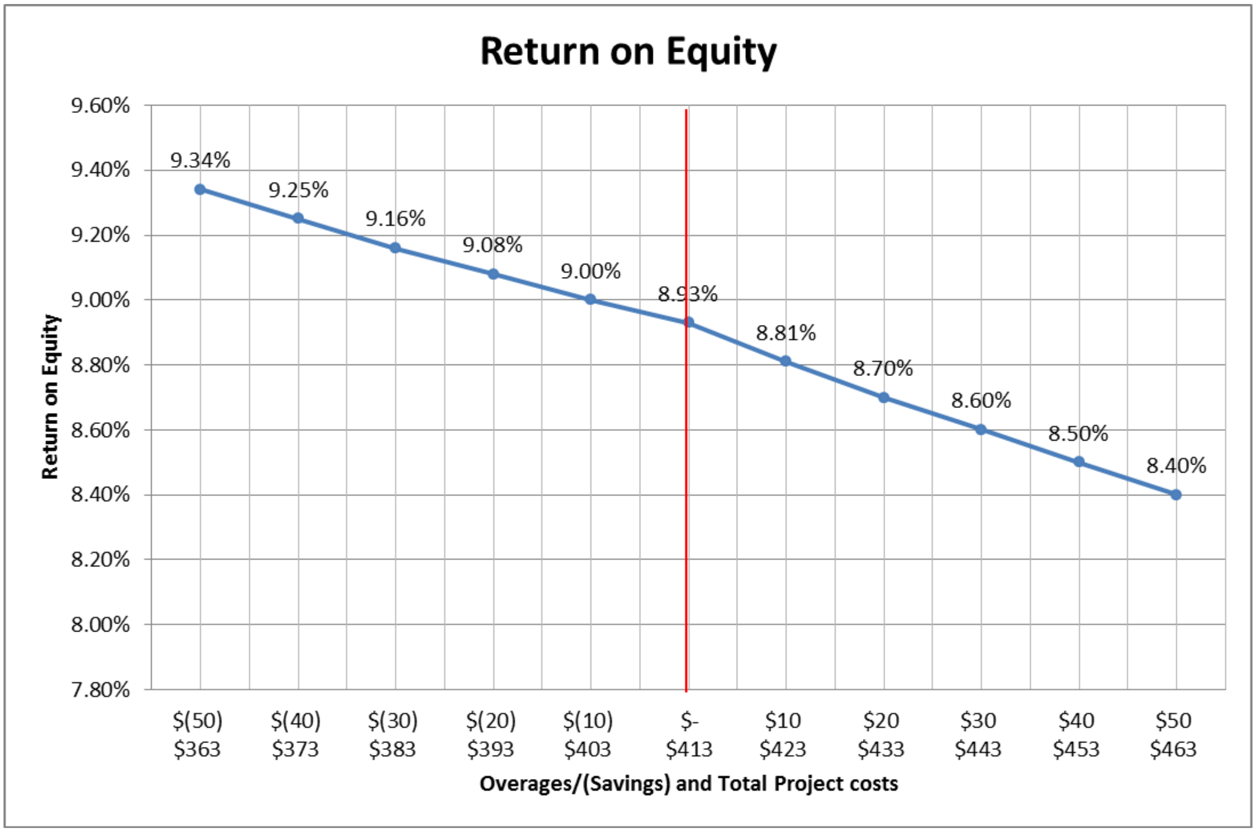
- **exceptions:** The equity portion (i.e., 40%) of the difference between the actual costs incurred in four cost categories over which the Applicant has little or no control and the estimates of such costs that are embedded in the Bid Amounts in the four categories, up to a specified limit , would earn a return at the ROE determined by the Board, annually, and would not be subject to the penalty that would be otherwise applicable to cost overages under the Applicant's proposed incentive rate methodology. The four categories are as follows: land acquisition (up to $15.5 million); First Nation and Métis participation costs and accommodation (up to $1.0 million); environmental and permitting costs (up to $2.5 million); and line costs in respect of a total line length that exceeds 410 km ($1 million for each additional km);

(iv) the utilization of US General Accounting Principles ("**USGAAP**") for regulatory accounting, reporting and rate-making purposes; and

(v) the calculation of interest for CWIP at a blended rate as follows: the ROE determined by the Board annually on 40 percent of development costs and the lesser of the actual construction facility rate (once established) or the interest during construction ("**IDC**") rate, determined by the Board annually, on 60 percent of the CWIP amount.

45. The above-described proposal – the "**Development and Construction Cost Proposal**" – is underpinned by the Applicant's rigorous schedule and cost risk assessment, the details of which are set out in the Exhibit P-5-1. Under the Development and Construction Cost Proposal, the risk that either of the Bid Amounts is exceeded would be borne, in large measure, by the Applicant. This is illustrated, in the case of Option 1, by Figure B-2 below. In sum, assuming a rate of return on equity of 8.93 percent and a $20 million overage of the Bid Amount (excluding Exceptions), the Applicant's ROE would be reduced by **0.23 percent**. Conversely, however, if the Applicant "beats" the Bid amount by $20 million, its ROE would be increased (relative to 8.93%) by just **0.15 percent**.

Figure: B-2



46. RES Transmission acknowledges that Board approval of its Development and Construction Cost Proposal for rate-making purposes, may be beyond the scope of the designation proceeding. RES Transmission is, nevertheless, prepared to commit to its Development and Construction Cost Proposal as a condition of designation by committing to prepare and submit its LTC application and its first cost-of-service application after the EWTL is placed in service, on the basis of the Proposal.

F. **Permitting**

47. It is likely that the Project will be required to complete an individual EA under Ontario's *Environmental Assessment Act* in order to obtain the necessary provincial permits and approvals. The Ontario environmental assessment

process will include Terms of Reference ("**ToR**") that will be used to complete the EA and ensure that the public, governmental agencies and First Nation and Métis communities have timely access to key Project documents to inform their participation in the EA process. The Applicant has completed an Environmental Assessment Plan to assist in developing the ToR. The Applicant's Environmental Assessment Plan is included at Exhibit L-4-1.

48. At this time, it is uncertain whether the Applicant will be required to complete a federal EA under the *Canadian Environmental Assessment Act, 2012* ("**CEAA**"). Projects that require a federal EA are listed in CEAA Regulation SOR/2012-147: *Regulations Designating Physical Activities*. It is the Applicant's current understanding that the Project would not be considered a designated physical activity under CEAA because the EWTL does not have a voltage of 345 kV or more.

49. However, since the Project may cross First Nation reserves and a National Park both Aboriginal and Northern Development Canada and Parks Canada will need to advise on whether the Project is likely to cause significant adverse environmental effects. If the federal Minister of the Environment is satisfied that the substantive requirements of CEAA can be met by the Ontario EA process, and if Ontario requests substitution, the federal Minister of the Environment must allow for the substitution of the federal EA process, by the Ontario EA process. The federal Minister of the Environment will make this determination based on the Ontario EA report. Since the substitution provisions of CEAA are new and untested, it is unknown whether the Ontario EA will fully or partially meet the requirements of the CEAA process.

50. A report entitled "Project Corridor Analysis and Critical Environmental Issues Assessment", prepared for RES Transmission by Stantec Consulting Limited, is included at Exhibit L-3-1. The Applicant's Permitting Plan is included at Exhibit L-1-1. A table that lists all of the federal, provincial and municipal permits and

approvals that will be required by the Project, as identified to-date, is included at Exhibit L-1-2. This list will evolve over time as the Project design develops and is modified based on consultation with local stakeholders, government agencies and First Nation and Métis communities. The Applicant's Environmental Assessment Plan is included in Exhibit L-4-1.

G. **Consultation**

Regulatory and Governmental

51. The Applicant understands that consultation and close coordination with governments and regulatory agencies are key to the success of the Project. If designated, RES Transmission will regularly and continuously consult with IESO, the OPA (particularly on its needs assessment and timing of the LTC application), the Ministry of Energy and other provincial and federal ministries and departments, as well as local governments with an interest in the Project.

Local Communities

52. The Applicant is committed to full and open consultations with affected stakeholders, landowners, municipalities and other local communities throughout the entire life of the Project. To achieve this, the Applicant has assembled a skilled and experienced team of Canadian personnel and advisors to help carry out its community consultation plan in a way that at all times fosters trust, communication and respect. The Applicant will reach out to all stakeholders to for meaningful input before any final decisions are made.

53. The Applicant intends to consult with anyone who owns or occupies property within the proposed construction zone or within 50 metres of the Project area. Notices will be published at key stages and letters will be sent to all landowners along the proposed routes. The Applicant intends to maintain round-the-clock access to information through a Project website, publicly posted and distributed Project documents and a Project telephone hotline.

First Nation and Métis

54. The Applicant has developed a comprehensive and inclusive consultation program to meaningfully consult with First Nation and Métis communities. Based on the Applicant's previous experience, including constructing two major electricity infrastructure projects in Ontario (the Greenwich Wind Farm and the Talbot Wind Farm), the Applicant has assembled an experienced and skilled First Nation and Métis consultation team with former Grand Council Chief John Beaucage as First Nation and Métis Special Advisor. The Applicant will consult with the 14 First Nation and four Métis communities identified by the Minister of Energy as well as any other First Nation and Métis communities that express an interest in the Project.

55. The Applicant is willing to enter into a memorandum of understanding ("**MOU**") with the Ministry of Energy to set out the respective roles and responsibilities of the Crown and the Applicant with respect to the Crown's Duty to Consult with First Nation and Métis communities. The Applicant is familiar with this approach as the RES Group has previously entered into similar MOUs with the Ministry of Energy for other significant electricity projects in Ontario. The particulars of the Bruce-Milton MOU signed between the Ministry of Energy and Hydro One may need to be revised to apply to a private sector proponent rather than a government-owned corporation such as Hydro One.

56. An overview of the Applicant's consultation plan is included at Exhibit M-1-1. The Applicant's Landowner, Municipality and Community Consultation Plan and First Nation and Métis Consultation Plan are included at Exhibit M, Tabs 2 and 3, respectively. A list of potentially affected First Nation and Métis Communities is included at Exhibit M-3-2.

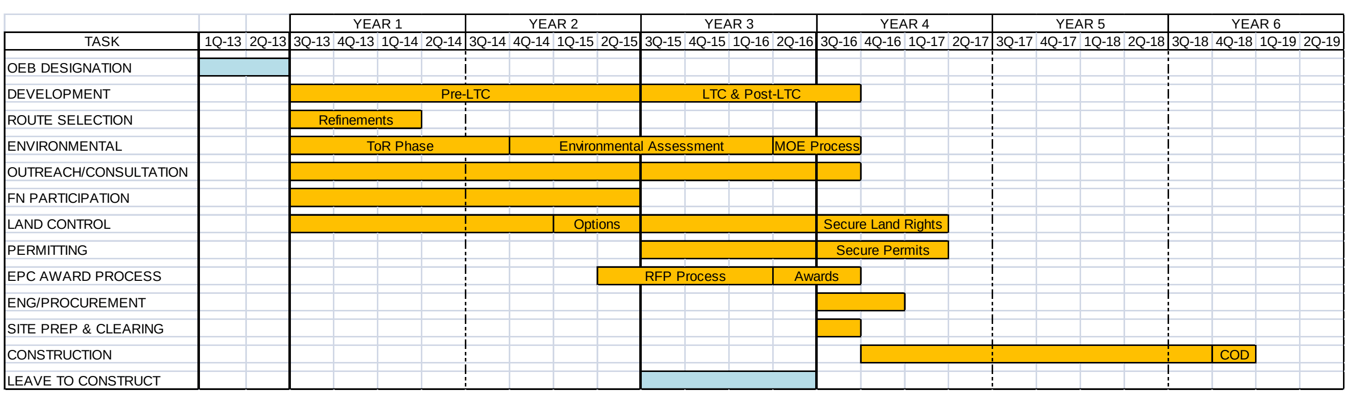
H. **Project Schedule**

57. On the basis of its preliminary development activities, the Applicant has concluded that achieving a 2017 in-service date, as stipulated in the OEB's definition of the EWTL[10], is highly unlikely, if not impossible. To achieve a 2017 in-service date would require that key development tasks be undertaken simultaneously rather than sequentially, thereby imposing significant inefficiency on the development and construction process, as well as creating the potential of problems resulting from rushed and incomplete consultation, route refinement and mitigation processes. Moreover, a 2017 in-service date would require all regulatory and permitting approvals to be obtained on an expedited basis.

58. In light of the foregoing, the Applicant proposes a development and construction schedule designed to achieve a year-end 2018 in-service date. This milestone is condition upon the receipt of timely regulatory (i.e., LTC) and permitting approvals.

59. Figure B-3, below, sets out the principal project development and construction milestones.

Figure B-3: Project Schedule



[10] OEB letter to All Electricity Transmitters Registered for the East-West Tie Line (December 20, 2011), Attachment 1, p.2.

60. Further details of the Project schedule are included in Exhibit N.

61. Notwithstanding the challenges of achieving a 2017 in-service date, the Applicant would be willing to make every reasonable effort to meet this date on the understanding that the effort involved would very likely increase total project costs by as much as 20 to 30 percent. The Applicant would, at such time, be willing to revise its cost estimates and rethink its Development and Construction Cost Proposal.

I. **Project Milestones and Reporting Requirements**

Milestones

62. The Applicant proposes 19 different Project milestones for the Development Phase of the Project and seven different Project milestones for the Construction Phase of the Project. In the event of a missed Project milestone, the Applicant will implement a planned contingency response or revise its approach and strategy in order to ensure that the Project remains on schedule for subsequent milestones.

63. Details of the milestone dates for the Development and Construction Phases of the Project are included at Exhibits N-2-2 and N-3-2. Further details of the consequences for failing to meet Project milestone dates are included in Exhibit N-1-1.

Reporting Requirements

64. The Applicant proposes providing the OEB with monthly and quarterly status reports during both the Development and the Construction Phases of the Project.

65. The Applicant's management team has a great deal of experience in delivering accurate and timely status reports to regulators in jurisdictions across North America. It will require Project contractors to provide their own status reports each month along with their invoice application. If a contractor fails to provide a

report, the invoice application will be treated as incomplete and payment will be deferred until the report is provided. This approach has proven to be an effective tool in ensuring timely reporting.

66. Details of the Applicant's proposed reporting requirements and the consequences for failing to meet prescribed reporting requirements are included at Exhibit N-4-1.

J. **Financing**

67. The Development Phase of the Project, as defined by the Board, commences with designation and concludes on the date on which the designated transmitter files a LTC application. The Applicant intends to finance activities in the Development Phase with 100 percent sponsor equity because the absence of a revenue stream during this phase of the Project would make obtaining debt financing at competitive rates difficult. Similarly, in the period after a LTC application is filed but before a LTC order is issued, the Applicant intends to finance on-going development activities through equity contributions from its sponsors.

68. During the Construction Phase, commencing on the date on which a LTC order becomes effective, activities will be financed through a combination of a construction debt facility and equity contributions from the Project's sponsors, in accordance with a 60:40 debt to equity ratio. Once the Project is placed into service, the Applicant intends to obtain long-term financing for 60 percent of the Project's value; the remaining 40 percent will continue to be financed through equity contributions from the Project's sponsors.

69. Details of the Applicant's financing plan are included at Exhibit O.

K. **Confirmations and Commitments**

70. Pursuant to subsection 1.3 of the "Filing Requirements for Designation Applications" (the "**Filing Requirements**") attached as Appendix A to the OEB's Phase 1 Decision and Order (July 12, 2011) in this proceeding (the "**Phase 1 Decision**"), RES Transmission confirms that the information that it provided in its application of July 28, 2011 for an Electricity Transmission Licence has not changed, with the following exceptions:

(i) the underlying ownership of RES Transmission has changed as a result of the acquisition, by MTC, of an equal interest in RES Transmission, as described above in paragraph 3;

(ii) the information set out in section 9 (Technical Capability and Experience of the Transmission Licencee) has been enhanced, as described above in paragraphs 5-9; and

(iii) the following individuals have been added as "key individuals" (section 10 of the Transmission Licence Application):

- Project Coordinator: Cory Blair
- Vice President, System Planning: Darrell Gerrard
- Counsel, Regulatory and Legal: Ryan Flynn
- Manager, Delivery: Todd Jensen
- Manager, Communications and Consultations: Nicholas Muszynski
- Manager, Land Control: Stephen Cookson
- Vice President, Brian Weber

71. Pursuant to subsection 1.4 of the Filing Requirements, RES Transmission confirms that it has not previously had a licence or permit revoked and is not currently under investigation by any regulatory body.

72. Pursuant to subsection 1.5 of the Filing Requirements, RES Transmission confirms and commits that, if designated as an electricity transmitter for the purpose of undertaking development work for the EWTL, it will carry out and complete such work and proceed to file an application for orders under section 92 and subsection 96(2) of the OEB Act granting RES Transmissions LTC for the EWTL and related facilities.

73. Pursuant to subsection 1.6 of the Filing Requirements, the sworn affidavit of Mr. Jerry Vaninetti, President of RES Transmission, confirming that the Application is complete and accurate to the best of his information and belief, is included at Tab 2 of this Exhibit.

74. Pursuant to subsection 1.7 of the Filing Requirements, the Applicant confirms that, subject to acceptable terms and conditions to reflect the passage of time, it is willing to be named as a runner-up designated transmitter in the event that the OEB desires to replace a designated transmitter at some point after the original designation. The Applicant is not prepared, however, to unreservedly commit to purchase or utilize work product and/or materials from the transmitter that is being replaced.

75. Pursuant to subsection 1.8 of the Filing Requirements, the Applicant confirms there has been no coordination or cooperation with other registered applicants that has contributed to this Application.

76. Pursuant to subsection 6.3 of the Filing Requirements, two sworn affidavits of Mr. Darrell Gerrard, Vice President of RES Transmission and Vice President, Transmission System Planning of MAT, confirming that the Preferred Design and

the Reference Design meet or exceed existing North American Electric Reliability Corporation ("**NERC**"), Northeast Power Coordinating Council Inc. ("**NPCC**") and IESO reliability standards as well at the OEB's Minimum Technical Requirements included at Exhibit H-3-1 and I-3-1, respectively.

77. Pursuant to subsection 6.6 of the Filing Requirements, the Applicant's confirms that it is its present intention to own and operate the EWTL, once placed in service.

L. <u>Applied-for Relief</u>

78. In the result, RES Transmission hereby applies to the Board for designation as an electricity transmitter to undertake development work in respect of the EWTL. If designated, RES Transmission requests the Board to accept its development estimate of $21.5 million as reasonable in the context of RES Transmission's overall plan of development.

79. Further, RES Transmission hereby applies to the Board for a deferral account in which budgeted development costs, incurred from the date of designation, may be recorded for future recovery in rates.

80. RES Transmission also requests that the Board approve the use of a blended rate of interest applicable to the development costs recorded in the Deferral Account, as described in paragraph 38, above.

M. <u>Conclusions</u>

81. In conclusion, the designation of RES Transmission as an electricity transmitter for the purpose of carrying out development work in respect of the EWTL is in the public interest because:

(i) Collectively, the RES Group and the MidAmerican Group have:

- proven capabilities and experience in developing, constructing, owning and operating more than 30,000 km of high-voltage transmission lines in North America;

- experience developing and constructing electricity infrastructure projects in the challenging environment of northern Ontario;

- a demonstrated ability in financing electricity infrastructure projects of the magnitude of the EWTL; and

- track records of delivering large electricity infrastructure projects on time and on budget.

(ii) RES Transmission has a robust and inclusive First Nation and Métis Participation Plan, that includes the option of as much as a $50 million investment opportunity for affected communities or the negotiation of an IBA;

(iii) both design options proposed by RES Transmission – the Reference Design and the Preferred Design – meet or exceed all applicable requirements with respect to transfer capacity, system performance and system reliability;

(iv) relative to the Reference Design, the innovative Preferred Design offers:

- superior electrical performance attributes (684 MW vs. 650 MW of total east-west transfer capacity);

- lower up-front line construction costs ($80 million);

- enhanced constructability; and

- the flexibility to stage increases in capacity transfers allowing system requirements to be met as they materialize, thereby deferring and, thus, reducing owing and operating costs to ratepayers (total savings of $62.5 million, assuming installation over eight years).

(v) RES Transmission's development and construction costs are robust because they are based on an in-depth field and desktop analysis; RES Transmission's confidence in its estimates for Options 1 and 3 is such that, in response to the requirement to propose a lower cost solution for the EWTL, it is prepared to commit to an innovative Development and Construction Cost Proposal that couples a firm cost bid with an incentive rate methodology.

82. The following are the names of RES Transmission's authorized representatives and its counsel for the purpose of serving documents on the Applicant in this proceeding:

(a) authorized representative

Jerry Vaninetti
Renewable Energy Systems America Inc.

Address for personal service and mailing address:	11101 W. 120th Avenue Suite 400 Broomfield, CO 80021
Telephone:	303-439-4636
Facsimile	303-439-4299
E-mail	jerry.vaninetti@res-americas.com

Cory Blair
Renewable Energy Systems Americas Inc.

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Telephone:	303-439-4238
Facsimile	303-439-4299
E-mail	cory.blair@res-americas.com

Darrell T. Gerrard
MidAmerican Energy Holdings Company

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Telephone:	503-813-6994
Facsimile	503-813-6893
E-mail	dgerrard@midamerican.com

Ryan Flynn
PacifiCorp

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Telephone:	503-813-5854
Facsimile	503-813-7252
E-mail	Ryan.Flynn@PacifiCorp.com

Brian Weber
MidAmerican Energy Holdings Company

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E-mail	BDWeber@midamerican.com

(b) counsel

Helen T. Newland
Fraser Milner Casgrain LLP

Address for personal service and mailing address:	77 King Street West Suite 400 Toronto-Dominion Centre Toronto, ON M5K 0A1
Telephone:	416-863-4471
Facsimile	416-863-4592
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(c) counsel

Nalin Sahni
Fraser Milner Casgrain LLP

Address for personal service and mailing address:	77 King Street West Suite 400 Toronto-Dominion Centre Toronto, ON M5K 0A1
Telephone:	416-863-4463
Facsimile	416-863-4592
E-mail	nalin.sahni@fmc-law.com

Dated January 4, 2013 at Toronto, ON

RES Canada Transmission LP

by its counsel

Fraser Milner Casgrain LLP

per: ***(signed) Helen T. Newland***

Helen T. Newland

TAB B-2-1

EB-2011-0140

ONTARIO ENERGY BOARD

IN THE MATTER OF SECTIONS 70 AND 78 OF THE *ONTARIO ENERGY BOARD ACT 1998*, S.O. 1998, c.15, (Schedule B);

AND IN THE MATTER OF A BOARD-INITIATED PROCEEDING TO DESIGNATE AN ELECTRICITY TRANSMITTER TO UNDERTAKE DEVELOPMENT WORK FOR A NEW ELECTRICITY TRANMISSION LINE BETWEEN NORTHEAST AND NORTHWEST ONTARIO: THE EAST-WEST TIE LINE

RES CANADA TRANSMISSION LP

Applicant

AFFIDAVIT OF JERRY VANINETTI

(sworn January 3rd, 2013)

I, Jerry Vaninetti, of the City of Broomfield, in the State of Colorado, MAKE OATH AND SAY:

1. I am the President of RES Canada Transmission LP ("**RES Transmission**") and, as such, have knowledge of the matters of which I hereinafter depose. To the extent that I am informed by others, I verily believe such information to be true.

2. In accordance with Section 6.3 of the "Filing Requirements for Designation Applications" (the "**Filing Requirements**"), attached as Appendix A to the Ontario Energy Board's ("**OEB**") Phase 1 Decision and Order (July 12, 2011)

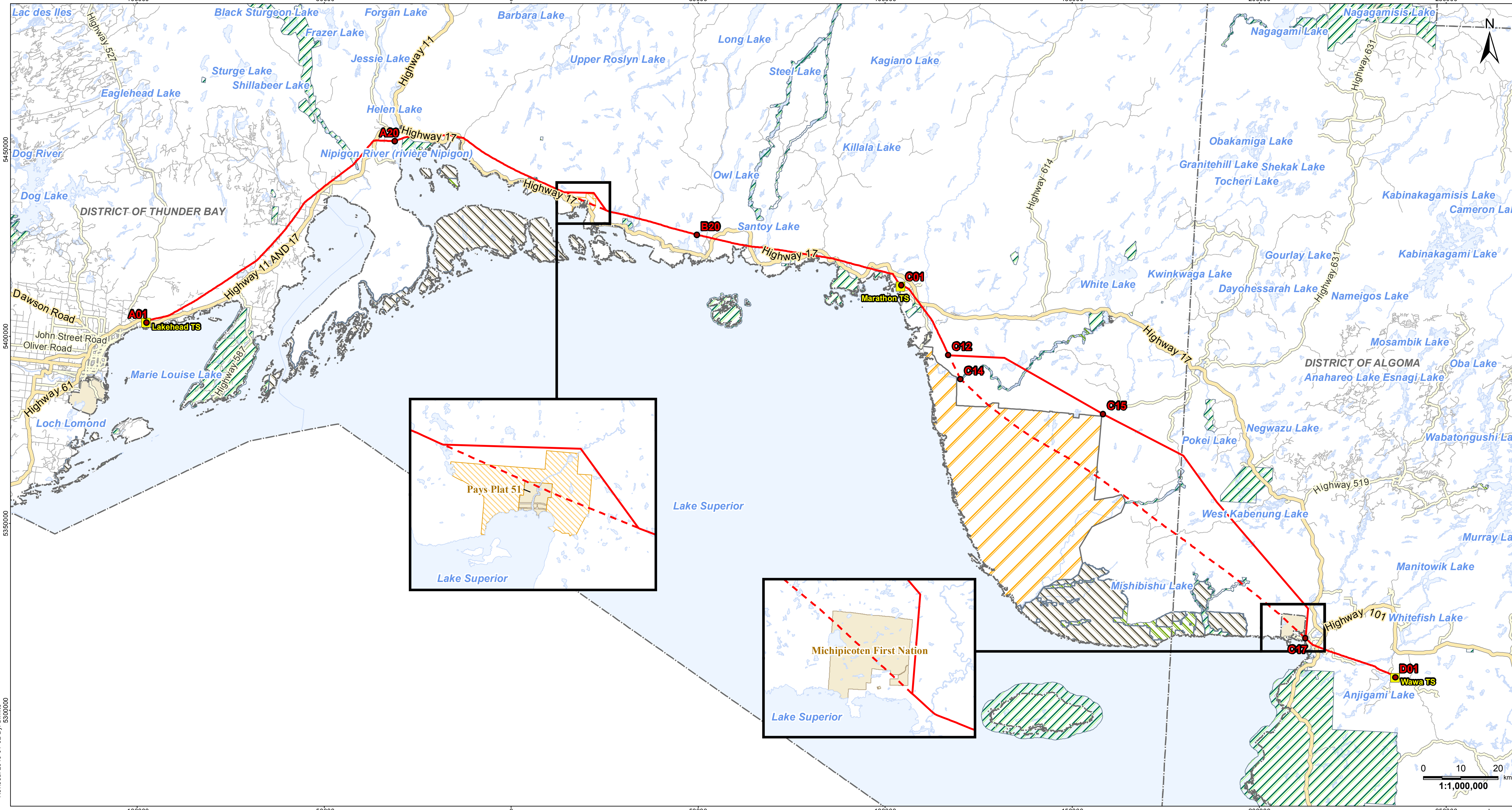
in OEB proceeding EB-2011-0140, I confirm that RES Transmission's Application for Designation is complete and accurate.

SWORN before me at the City of Broomfield this 3rd day of January, 2013	)	
Commissioner for Taking Affidavits, etc.	)	Jerry Vaninetti

SUSAN R. BRINKS
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID 20094001907
MY COMMISSION EXPIRES JANUARY 28, 2017

TAB B-3-1

Project Overview Map



Legend

- Preliminary Preferred Route**
- Reference Route
- Route Marker
- Station
- Highway
- Major Road
- Local Road
- First Nation Reserve
- First Nation Addition
- Municipal Boundary
- Conservation Reserve
- Forest Reserve
- Provincial Park
- National Park
- Waterbody

** Preliminary Preferred Route located approximately 100 m north of existing transmission line, and parallels existing transmission line corridor where feasible, except between Marathon and Wawa where the line would not adjoin the existing line.

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.

Stantec

Client/Project
RES Canada Transmission LP
East-West Tie Transmission Line

Figure No.
B-3-1

Title
Route Map

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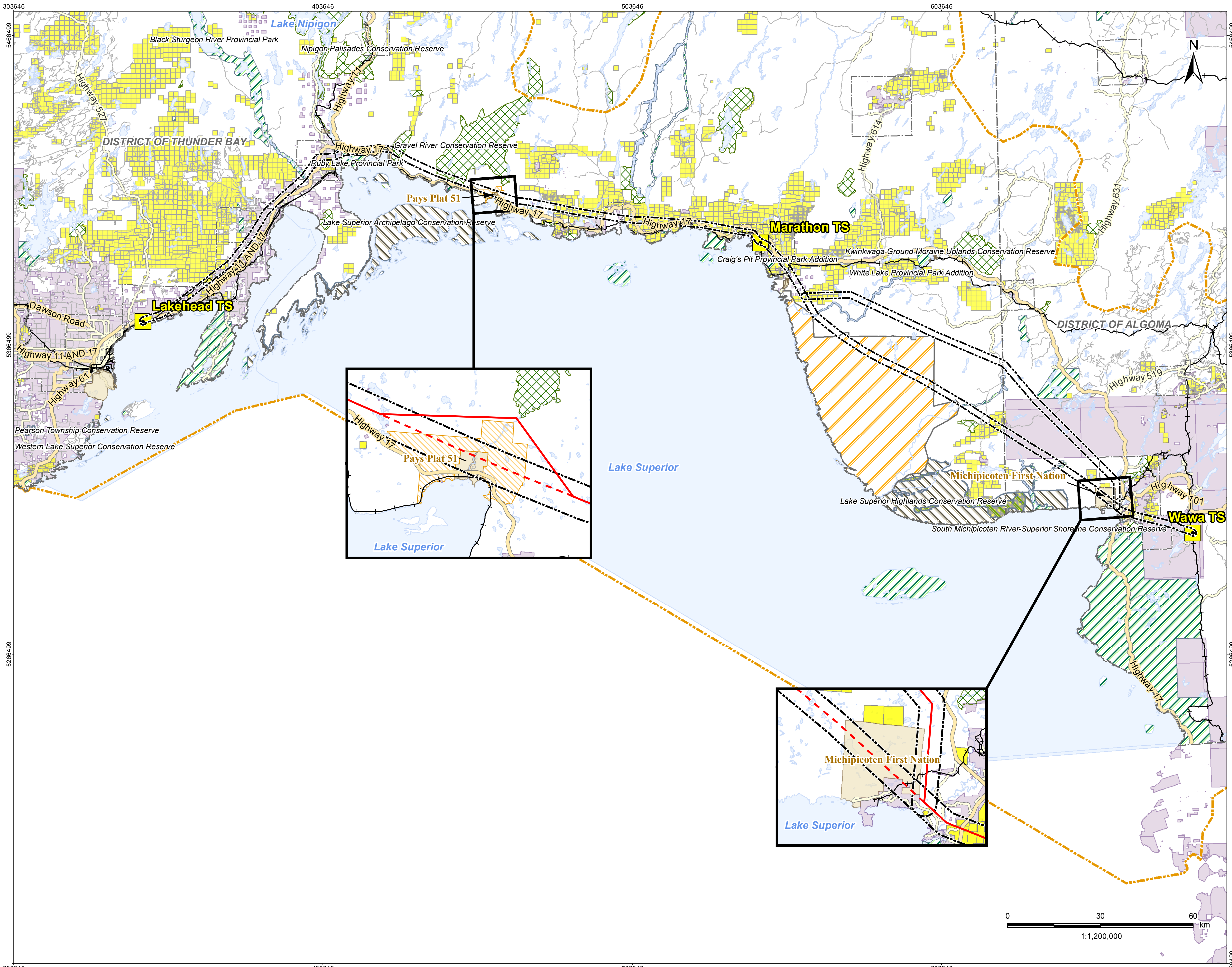
Revised: 2013-01-02 By: awhite

TAB B-3-2

Maps of Alternative Routes Showing Categories of Required Land Rights



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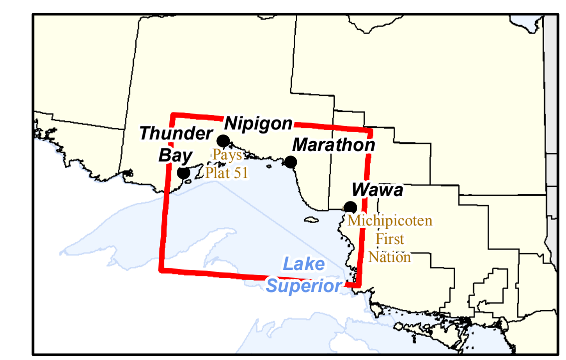
Revised: 2013-01-02 By: awhite

Legend

- Proposed Study Area Corridor*
- Preliminary Preferred Route**
- Reference Route
- Railway,
- Railway,
- Highway
- Major Road
- Local Road
- Active Mining Claim
- Conservation
- First Nation Reserve
- First Nation
- Municipal Boundary
- Conservation Reserve
- Forest Reserve
- Provincial Park
- Private Land
- National Park
- Treaty No. 60 Robinson, Superior
- Waterbody

* Preliminary Preferred Route falls within 2 km Study Area Corridor.

** Preliminary Preferred Route located approximately 100 m north of existing transmission line, and parallels existing transmission line corridor where feasible, except between Marathon and Wawa where the line would not adjoin the existing line.



Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.

Stantec

January 2013
160960725

Client/Project

RES Canada Transmission LP
East-West Tie Transmission Line

Figure No.

B-3-2

Title

Land Rights Map

TAB B-3-3

Access Road Classification Map

The Applicant, supported by PowerTel and Stantec, has conducted substantial desktop and field work to identify potential access routes and related features that could be used in the construction of the Project and has also taken into account the proposed realignment of Highway 17 between Thunder Bay and Nipigon. This information is shown in the map on the following page of this exhibit which is intended to illustrate major potential access roads. The map does not reflect the substantial additional number of roads and trails that have been identified and examined and are also under consideration for use in the construction of the Project.

The Access Road Classification Map in this exhibit has been confidentially filed.

TAB C-1-1

Corporate Organization

RES Transmission is an Ontario limited partnership formed for the purpose of pursuing opportunities in the electricity transmission sector in Ontario. A corporate organizational chart for RES Transmission is included at Exhibit C-1-2.

At the time of RES Transmission's application for an electricity transmission licence, RES Canada held a 99 percent limited partner interest in RES Transmission; the remaining 1 percent interest was held by RES Transmission's general partner, RES Canada GP. Effective October 26, 2012, however, MTC acquired a 49.5 percent interest in RES Transmission through the subscription of partnership units. As a result, RES Canada and MTC hold equal interests (49.5 percent) as limited partners in RES Transmission. RES Canada GP holds the remaining 1 percent interest as RES Transmission's general partner. Renewable Energy Systems Quebec Inc. and MEHC Canada Transmission GP Corporation each hold a 50 percent interest in RES Canada GP.

The RES Group, primarily through RES Canada and RES Americas develops renewable generation facilities and associated transmission facilities in Canada and the United States and have developed and/or constructed over 5,700 MW of renewable generation facilities and over 890 km of transmission lines to date. In Ontario, RES Canada has developed and constructed two large wind farms. Its Greenwich Wind Farm is located in northwestern Ontario and interconnects, via its 10 km, 230 kV transmission line, with Hydro One's 230 kV transmission line at a point east of Thunder Bay, Ontario. In addition, subsidiaries of RES Canada and RES Americas were selected to construct the Canadian and American portions of the Montana-Alberta Tie-Line, a 345 km**,** 230 kV electricity transmission line between Alberta and Montana. Finally, RES Canada was very recently selected by the IESO to provide regulation services. RES America's Transmission Construction brochure is included at Exhibit C-1-4.

MTC is an affiliate of MAT which is, in turn, a wholly-owned subsidiary of MEHC, a Berkshire Hathaway company.[1] MEHC and its subsidiaries (the "**MidAmerican Group**") are global leaders in the production, transportation and delivery of energy from a variety of fuel sources, including coal, natural gas, wind, hydro, nuclear, geothermal, solar and biomass. The MidAmerican Group supplies and distributes electricity and natural gas to over seven million customers in the United States and the United Kingdom. The MidAmerican Group owns more than $51 billion in total assets with a total capacity of more than 22,000 MW. The map included at Exhibit C-1-3, shows the world-wide facilities and assets comprising the MidAmerican Group.

The MidAmerican Group, through a subsidiary, PacifiCorp, owns and operates approximately 25,000 km of regulated electricity transmission lines in the United States, serving approximately 750 communities in six Western states. PacifiCorp's transmission system is interconnected with more than 80 generating plants and 15 adjacent control areas at approximately 124 interconnection points. The MidAmerican Group, through another subsidiary, MEC, owns approximately 3,500 km of transmission facilities in several Midwestern states; MEC is a transmission-owning member of the Midwest Independent Transmission System Operator, Inc.

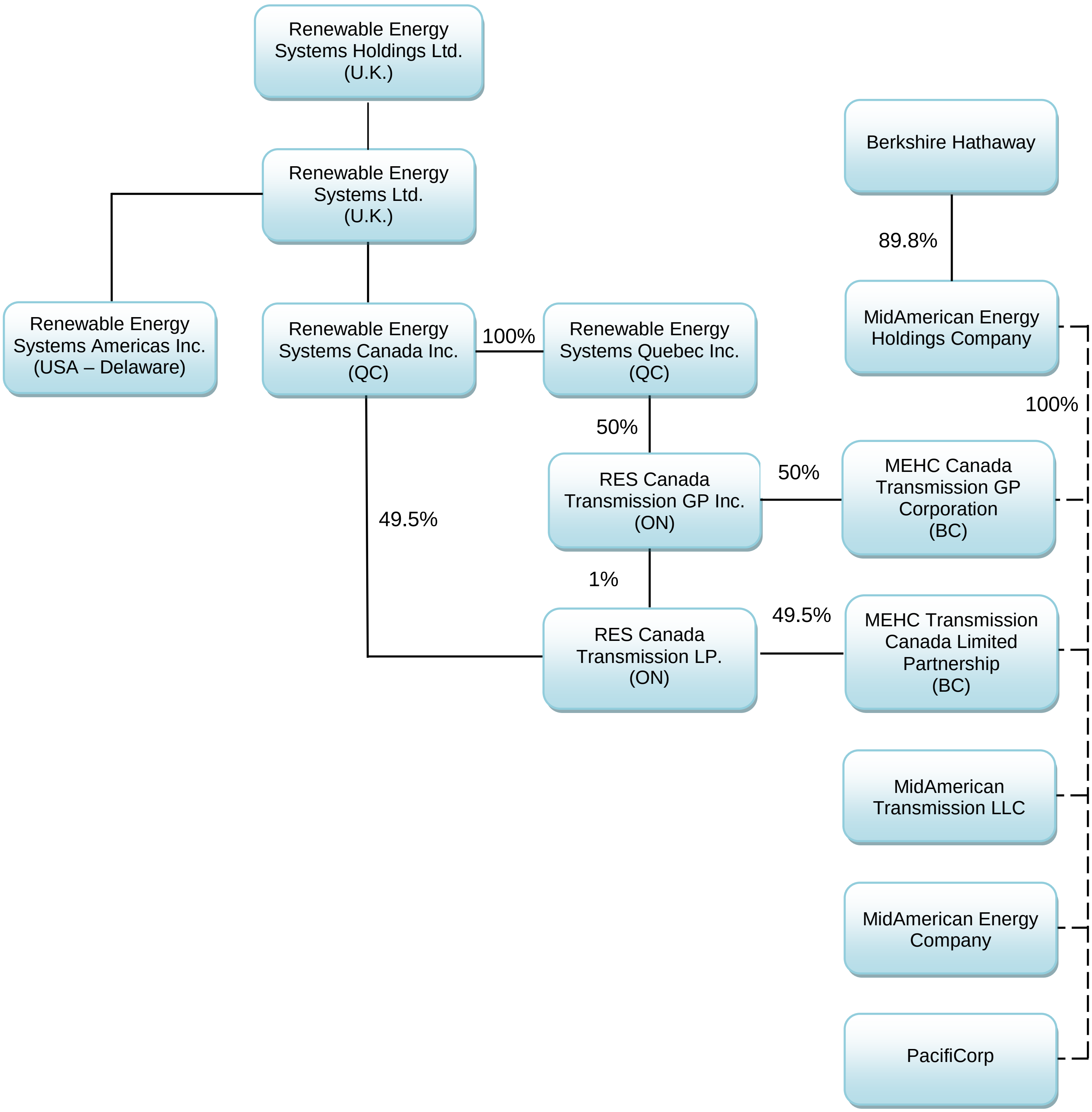
Through MAT, the MidAmerican Group is also engaged in the development of non-vertically integrated electric transmission facilities in organized and traditional markets in the United States and Canada. This includes participation in joint ventures with Prairie Wind Transmission and Electric Transmission Texas, a developer, owner and operator of independent transmission facilities in the state of Texas, including facilities that are part of the Competitive Renewable Energy Zone program connecting renewable generation with load centers.

[1] MAT provides services to MTC through an inter-company services agreement for engineering, design, project management and administrative functions.

TAB C-1-2

CORPORATE STRUCTURE

Figure C-1



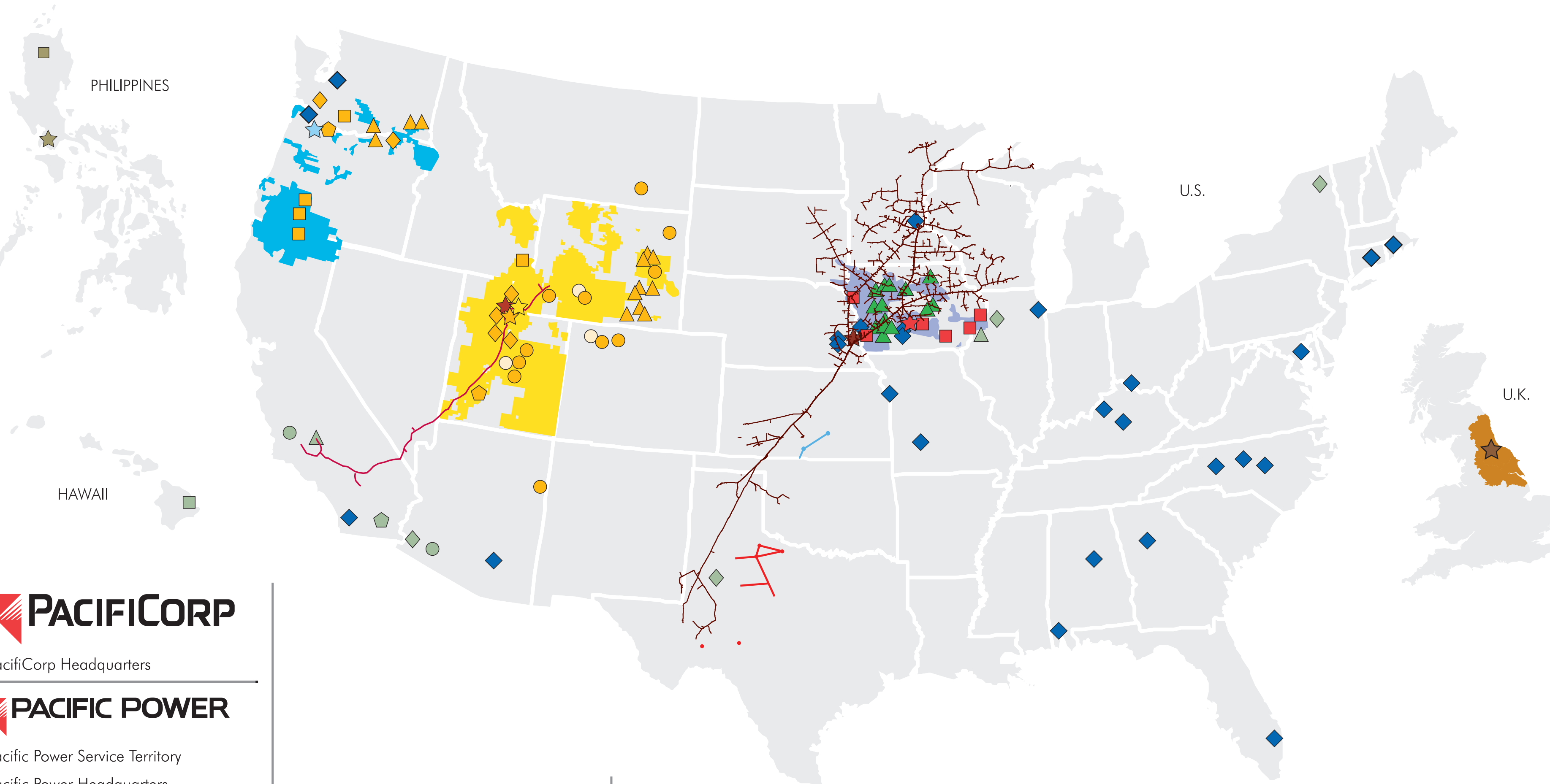
*Dashed lines denote indirect ownership through one or more wholly-owned subsidiaries.

TAB C-1-3

MidAmerican Worldwide Platform Map

MIDAMERICAN
ENERGY HOLDINGS COMPANY

MidAmerican Energy Holdings Company Headquarters



PACIFICORP

PacifiCorp Headquarters

PACIFIC POWER

Pacific Power Service Territory
Pacific Power Headquarters

ROCKY MOUNTAIN POWER

Rocky Mountain Power Service Territory
Rocky Mountain Power Headquarters

PACIFICORP ENERGY

PacifiCorp Energy Headquarters
Coal Plants
Natural Gas Plants
Geothermal and Other
Hydro Systems
Wind Plants
Coal Mines

MIDAMERICAN TRANSMISSION

Prairie Wind Transmission 345-kV Line
Electric Transmission Texas

MidAmerican ENERGY.

MidAmerican Energy Company Service Territory
MidAmerican Energy Company Headquarters
Generation Operations
Wind Projects

Northern Natural Gas

Northern Natural Gas Pipeline
Northern Natural Gas Headquarters

Kern River® GAS TRANSMISSION COMPANY

Kern River Gas Transmission Pipeline
Kern River Headquarters

NORTHERN POWERGRID

Northern Powergrid Service Territory
Northern Powergrid Headquarters

MIDAMERICAN RENEWABLES

Wind Projects
Geothermal Plants
Solar Projects
Hydro Plant
Gas Plants

CALENERGY PHILIPPINE OPERATIONS

Hydro Plant
CalEnergy Philippines Headquarters

HomeServices of America, INC.™
A Berkshire Hathaway Affiliate

Real Estate Operating Companies

TAB C-1-4

RES America's Transmission Construction Brochure

RES AMERICAS
Transmission Construction

Renewable Energy Systems Americas Inc. (RES Americas) develops and constructs transmission lines for its renewable projects as well as for external parties including utilities (as listed on back). We have constructed or have under construction more than 5,200 MW of renewable projects including including more than 300 miles of associated transmission lines. These include both single-circuit and double-circuit lines up to 345kV lines. RES Americas is expanding its transmission capabilities to serve the burgeoning market for new transmission lines to serve load, reliability, and renewables.

What We Do and How

RES Americas specializes in the development, permitting, engineering, materials procurement and construction of transmission lines and substations. We have internal development and permitting groups with extensive experience in bringing projects to construction and assisting in compliance through the construction phase. Our in house engineering team, in combination with our network of contractors and engineering consultants, provides support from the feasibility stage through cost analysis, permitting, design drawings, VAR support, harmonic study and mitigation, and construction. We have an extensive national and international network of suppliers and subcontractors, with whom we have long term relationships.

RES Americas can provide complete "one-stop-shop" service as well as construction only services. Our construction teams are highly experienced and located throughout the country working on various projects. RES Americas project management has a proven track record of bringing large projects to completion on time with no cost overruns.

res AMERICAS
powering change®

Transmission Construction Projects - Completed to date and/or under construction

Project Name, Location	Wire Size	Voltage	Miles of OHL Installed	Nameplate Capacity (MW)	Project Owner
Marengo I, WA	795 kcmil Drake	230kV	4	140.4	PacifiCorp
Marengo II, WA	795 kcmil Drake	230kV	7.3	70.2	PacifiCorp
High Plains, WY	795 kcmil Drake	230kV	10.5	99.0	PacifiCorp
Dunlap, WY	795 kcmil Drake	230kV	12	111.0	PacifiCorp
Cedar Point, CO	2x954 kcmil	230kV	42	250.2	Enbridge
Greenwich, Canada	795 kcmil Drake 556 kcmil	230kV 34.5kV	6.2 24	98.9	Enbridge
Bull Creek, TX	1,590 kcmil Lapwing	138kV	29.5	180.0	Eurus Energy
Woodward Mountain, TX	336.4 kcmil Linnet	138kV	18	159.7	FPL
King Mountain, TX	795,477, 336, 269 kcmil 477, 210 kcmil	138kV 34.5kV	19 8	278.2	FPL
Whirlwind, TX	666.6 kcmil	69kV	20.2	59.8	RES Americas
Buffalo Gap III, TX	2x963 kcmil	138kV	13	170.2	AES
Mountain Wind I, WY	795kcmil	138kV	12.3	60.9	Edison Mission Group
Wild Horse I, WA	1,272 kcmil Bittern	230 kV	9	228.6	Horizon Wind Energy
Butler Ridge, WI	795 kcmil Drake	34.5kV	9	54.0	Babcock and Brown
Sweetwater II, TX	795 kcmil Drake	138kV	8.6	91.5	Babcock and Brown
Sweetwater V, TX	2x795 kcmil 477 kcmil Hawk	345kV 34.5kV	7 1	80.5	Babcock and Brown
Hopkins Ridge I, WA	1,272 kcmil Bittern	115kV	7.3	149.4	PSE
Lone Star-Post Oak, TX	556.5kcmil Dove	138kV	6.9	200.0	Horizon Wind Energy
So. Trent Mesa, TX	556 kcmil Dove	138kV	6.5	101.2	Babcock and Brown
Hackberry, TX	2x795 kcmil	345kV	6.4	165.6	RES Americas
Talbot, Canada	795 kcmil Drake	230kV	6.2	98.9	Enbridge
Hatchet Ridge, CA	795 kcmil Drake	230kV	3.4	103.2	Pattern Energy
Sweetwater IV(B), TX	477 kcmil Hawk	34.5kV	3	105.8	Babcock and Brown
Armenia Mountain, PA	954 kcmil	115kV	2.1	100.5	AES
Crossroads, OK	795 horizontal bundled	345kV	10	227.5	Oklahoma Gas & Electric
Lower Snake River, WA	1,590 bundled	230kV	8	343.0	PSE
MATL - Montana, US/ Alberta, Canada	1,590 ACSS	230kV	214	300	Enbridge

TOTAL MILES OF OHL 534

res AMERICAS
powering change®

develops | constructs | owns | operates

Renewable Energy Systems Americas Inc.

11101 West 120th Avenue
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Broomfield, CO 80021
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F: 303.439.4299
E: info@res-americas.com
W: res-americas.com

Transmission Contact:

Andrew Fowler
303.439.4200
Andrew.Fowler@res-americas.com

For more info, scan the QR code with your smartphone. If you don't have a QR code app, it can be downloaded for free.

TAB D-1-1

Overview

Recognizing that the participation of First Nation and Métis communities will be critical to the success of the Project, the Applicant has devised a First Nation and Métis Participation Plan. The Participation Plan (which is separate from the First Nation and Métis Consultation Plan) outlines how the Applicant will work with potentially affected First Nation and Métis communities to identify, negotiate and implement a wide array of opportunities for their participation in the Project. Informed by the Applicant affiliate's experience working with First Nation and Métis communities in Ontario and supported by former Ontario Grand Chief, John Beaucage, the Participation Plan acknowledges that diverse First Nation and Métis communities will have varying needs, interests and tolerances for risk, and contemplates making available a breadth of possible opportunities, including equity participation. The Participation Plan recognizes that Ontario encourages transmission companies to enter into partnerships with interested First Nation and Métis communities where commercially feasible. Each First Nation and Métis community is expected to participate in a manner commensurate with their interest in the Project and the precise form and level of participation will be negotiated with each community. The First Nation and Métis Participation Plan Report is included at Exhibit D-2-1. The biography and resume of John Beaucage is included at Exhibit D-2-2.

Once the 18 First Nation and Métis communities with a potential interest in the Project were identified by the Minister of Energy in a letter to the Board on May 31, 2011, the Applicant notified those communities of its intention to participate in the designation process. The Applicant has attempted to involve the identified First Nation and Métis communities in the preparation of the Participation Plan and has invited them to identify the elements critical to their successful and meaningful participation in the Project. Due to the competitive nature of this proceeding as well as pre-existing commercial relationships with EWT LP and various communities potentially affected by the Project, the Applicant did not receive responses from all First Nation and Métis communities identified by the Minister of Energy. Comments provided by those communities that responded were helpful and informative and have been integrated into the Participation Plan together with additional input from the Applicant's advisor, John Beaucage. For a description and summary of the Applicant's engagement with First Nation and Métis communities to date, please refer to the Applicant's First Nation and Métis Engagement Log at Exhibit D-3-1.

Due to the diversity of the First Nation and Métis communities involved, the Participation Plan anticipates that the nature and level of participation will vary for each community. While some communities may have an appetite for direct equity contribution in the Project – and sufficient resources and tolerance of the associated risks – others may not and may prefer alternative means of participation. In the absence of detailed discussions and negotiations with each community, rather than prescribing specific forms of participation for all communities (particularly methods with significant financial implications such as direct equity investment), the Participation Plan contemplates offering a wide variety of benefits and opportunities for participation and at different levels of involvement for the consideration and selection of each community.

Financial and/or commercial participation by First Nation and Métis communities and businesses in the Project can be structured in a number of ways. Each community will have the option of choosing between two structures proposed by the Applicant: an IBA or direct equity contribution in the Project through a partnership vehicle. Defining any IBA will involve direct negotiation with the affected communities. Ultimately, it is expected that each community's participation and scope of benefits will be outlined in an IBA in a way that reflects the community's level of interest in the Project, appetite for investment and associated risk and the impact of the Project on the community's traditional lands and rights.

For those First Nation or Métis communities that may be interested in becoming a direct financial partner in the Project through an equity contribution, once the Applicant has identified interested parties through consultation and formed a team to negotiate partnership terms, the Applicant will determine the appropriate amount of equity that will be offered. This amount will be dependent upon the impact the Project will have on the communities, the extent of other forms of compensation negotiated through the IBAs, as well as the number of participants, their willingness to invest and their borrowing capacity. For example, if all eligible communities were interested in becoming equity participants, the Applicant would be prepared to offer the opportunity to invest as much as $50M in total, representing no more than a 20 percent ownership stake in the Project. Any terms offered would be consistent with conventional commercial practices and include commercial terms dependent on risk and the role of minority investors in the management of the Project as well as overall project financing requirements.

The Applicant has assembled an experienced participation implementation team that will be responsible for providing support and assistance to those First Nation and Métis communities interested in investing in the Project. Recognizing that not all communities will have the capacity, financial or otherwise, to acquire an ownership interest in the Project, the Applicant is committed to supporting those communities, such as: assisting them in forming an investment group, helping them secure loans through Ontario's Aboriginal Loan Guarantee Program or generating appropriate financing strategies. Proposed programs and methods of participation are more fully described in the First Nation and Métis Participation Plan Report included in Exhibit D-2-1.

TAB D-2-1

First Nation and Métis Participation Plan Report

First Nation and Métis Participation Plan Report

East-West Tie Transmission Project Application to the Ontario Energy Board

Prepared by RES Canada Transmission LP

December 28, 2012

OEB Application

CONTENTS

1 Context for Participation Plan

Ontario's Long Term Energy Plan (LTEP) identifies five priority transmission projects, including a new high voltage line between Thunder Bay and Wawa intended to enhance system reliability, dispatch existing generation resources more efficiently and less expensively, integrate renewable energy in the Northwest, and accommodate new mineral processing projects' electricity requirements. The LTEP explains that Ontario's electricity infrastructure must be modernized cost effectively to not only protect provincial ratepayers' interests, but also promote economic growth through competitive electricity rates. The LTEP also recognizes the First Nation and Métis communities' interests in realizing economic benefits from transmission projects that may cross their traditional territories in the future and acknowledges that the nature of this interest may vary between communities.

As suggested by the Minister of Energy in a March 29th 2011 letter to the Ontario Energy Board (the Board), the Board has initiated a proceeding (File No. EB-2011-0140) to designate an electricity transmitter to develop a new electricity transmission line between Northeast and Northwest Ontario, called the East-West Tie Line (the Project). The Board's primary objective is to select the most qualified licenced transmitter to develop, construct, own, and operate the East-West Tie Line, while also protecting Ontario consumers by ensuring cost effectiveness and reliability of supply. As the Minister's letter indicated, the Board will give significant weight to proposals that include substantial First Nation and Métis participation (Participation) in the Project or robust Participation plans. As stated by the Board, Participation can mean many things, and the Board will not restrict its consideration to any particular type of Participation.

RES Canada Transmission LP (RES Transmission) has filed an Application for Designation with the Board. Along with RES Transmission's separate First Nation and Métis Consultation plan, this Participation Plan (the Plan) describes how RES Transmission will build positive and long-lasting relationships with First Nation and Métis communities whose traditional rights may be affected by the Project. RES Transmission sees the Plan as a living, flexible document that will ensure positive participation by and relationships with all parties to meet Ontario's current and future direction and industry best practices. In designing the Plan, RES Transmission at all times kept in mind the important responsibility it would assume for negotiating and implementing full and varied opportunities for the First Nation and Métis communities to participate. As such, the Plan anticipates each community participating in ways commensurate with their interests and recognizes that Ontario encourages transmission companies to enter into partnerships with First Nation and Métis communities where commercially feasible.

2 Guiding Principles

The Plan is based on the following fundamental principles that will guide RES Transmission's discussions and negotiations with First Nation and Métis communities that may be interested in Participation.

- **Integrity and Good Faith**. Although the Province's statutory duty to consult does not mandate Participation, RES Transmission believes that Participation is crucial to discharging Crown responsibilities. RES Transmission will approach Participation openly, conducting itself with integrity and negotiating with First Nation and Métis communities and businesses in good faith at all times. RES Transmission intends to listen to and consider issues and proposed business opportunities throughout Participation.

- **Respect**. RES Transmission undertakes to negotiate and follow through Participation agreements with First Nation and Métis communities and businesses in a spirit of mutual respect and trust. To meet each community's needs and aspirations, cultural practices will be respected, business meetings will be scheduled around local events, and existing community economic development plans and priorities will be considered and reflected in proposals. All negotiation and implementation timelines will reasonably reflect the communities' capacities and needs.

- **Flexibility, Transparency, and Accountability**. Because the First Nation and Métis communities need tailored solutions, negotiating and implementation will be flexible, transparent, accountable, timely, and results-based. RES Transmission will maintain detailed notes and records of negotiations, Participation options, capacity-building initiatives, and implementation agreements and provide routine opportunities to review progress and address concerns.

- **Distinct and Continual**. The First Nation and Métis communities' successful Participation will be important to advancing the Project in the context of Ontario's LTEP. Working with individual First Nation and Métis communities and businesses, RES Transmission will promote on-going discussion of Participation issues and engage First Nation and Métis leadership in regular dialogue.

- **Communication**. RES Transmission will communicate with First Nation and Métis communities and businesses clearly, openly, and honestly at all times to ensure fruitful Participation. For instance, RES Transmission will take care to present technical information in plain language at all times and translate as appropriate.

3 Identifying Potential Participating Communities

As part of the Ontario Power Authority's Pre-Consultation efforts on the Crown's behalf, the Ministry of Energy identified the following 14 First Nations and 4 Métis communities whose interests the Project may affect.

First Nation Communities

1. Animbiigoo Zaagi'igan Anishinaabek First Nation (Lake Nipigon Ojibway)
2. Biinjitiwaabik Zaaging Anishinaabek First Nation (Rocky Bay)
3. Bingwi Neyaashi Anishinaabek (Sand Point First Nation)
4. Fort William First Nation
5. Ginoogaming First Nation
6. Long Lake No.58 First Nation
7. Michipicoten First Nation
8. Missanabie Cree First Nation
9. Ojibways of Batchewana
10. Ojibways of Garden River
11. Ojibways of Pic River (Heron Bay First Nation)
12. Pays Plat First Nation
13. Pic Mobert First Nation

14. Red Rock Indian Band

Métis Communities

1. Greenstone Métis Council
2. Superior North Shore Métis
3. Thunder Bay Métis
4. Red Sky Independent Métis Nation

Through past consultation experience in the region, RES Transmission has identified the Kiashke Zaaging Anishinaabek (Gull Bay First Nation) as another community with possible interest in the Project. This community's geographic location and status as signatory to the Robinson-Superior Treaty suggest its possible interest.

By letter, RES Transmission notified the listed First Nation communities and the Métis Nation of Ontario that it intends to participate in the East-West Tie Designation process; the letter invited those communities to work with RES Transmission to determine key elements needed for successful Participation. Because the designation process is competitive and pre-existing commercial relationships involve various communities the Project may affect, RES Transmission has not yet received responses from all identified communities despite repeated efforts. But, the comments received to date have been helpful and have been integrated into the Plan, along with input from former Ontario Grand Chief John Beaucage, Coxswain Row, and Stantec Consulting. The following table summarizes RES Transmission's communications with the identified First Nation and Métis communities and the associated outcomes. (The full Engagement Log to date is included as an exhibit to the Application.)

Table 1: First Nation and Métis Engagement Regarding Potential Participation in Project

Fort William First Nation	In exploratory meeting May 2, 2012, Fort Williams indicated that it could not discuss potential Participation because of confidentiality issues from pre-existing commercial partnership with EWT LP.
Michipicoten First Nation	Michipicoten were unwilling to meet and discuss potential Participation because of confidentiality issues from pre-existing commercial partnership with EWT LP.
Ojibways of Pic River	In exploratory meeting on May 2, 2012, where an annual impact compensation approach similar to those used in mining was raised, Ojibways of Pic River indicated inability to discuss potential Participation because of confidentiality issues from pre-existing commercial partnership with EWT LP.
Pays Plat First Nation	Pays Plat were unwilling to meet to discuss potential Participation because of confidentiality issues from pre-

	existing commercial partnership with EWT LP.
Pic Mobert First Nation	Did not respond to initial inquiries and offer to meet.
Red Rock Indian Band	Did not respond to initial inquiries and offer to meet.
Animbiigoo Zaagi'igan Anishinaabek First Nation (Lake Nipigon Ojibway)	Did not respond to initial inquiries and offer to meet.
Biinjitiwaabik Zaaging Anishinabek First Nation (Rocky Bay)	Did not respond to initial inquiries and offer to meet.
Bingwi Neyaashi Anishinaabek (Sand Point) First Nation	Bingwi Neyaashi Anishinaabek indicated verbal agreements with neighbouring communities and advised that Red Rock First Nation and Pays Plat First Nation should be approached regarding their interest in Participating in the Project.
Ginoogaming First Nation	Did not respond to initial inquiries and offer to meet.
Long Lake No. 58 First Nation	Did not respond to initial inquiries and offer to meet.
Missanabie Cree First Nation	Did not respond to initial inquiries and offer to meet.
Ojibways of Batchewana	Did not respond to initial inquiries and offer to meet.
Ojibways of Garden River	By letter, indicated interest in discussing Participation that might include resource and revenue sharing, equity sharing, First Nation procurement, employment opportunities, education and scholarship programs, and other opportunities. Garden River emphasized importance of meaningfully engaging community and citizens to ensure community has resources to evaluate Participation opportunities.
Kiashke Zaaging Anishinaabek (Gull Bay) First Nation	Did not respond to initial inquiries and offer to meet.
Métis Nation of Ontario (MNO), representing Greenstone Métis Council, Superior North Shore	In meetings, MNO expressed interest in discussing Participation opportunities only with designated

Métis, and Thunder Bay Métis	transmitter, and not with all prospective transmitters.

4 Nature of Participation

As noted above, many First Nation and Métis communities would not meet with RES Transmission to discuss Participation Plans before the Board designates a transmitter, in some cases because of pre-existing commercial relationships with EWT LP. So, in formulating its Participation Plan, RES Transmission has relied on its successful discussions with some of the communities, broad past experience with Ontario First Nation and Métis communities, advice from Former Ontario Grand Chief John Beaucage (whom RES Transmission engaged as an advisor on First Nation and Métis matters concerning the Project), input from Coxswain Row, and precedents throughout Canada. If designated, RES Transmission will refine the Plan based on further engagement with the identified communities. While some of the communities with traditional territories on the Project's periphery may have only modest interest in the Project, communities directly adjacent to or within the Project's boundaries are expected to have a specific and direct interest in the nature and benefits of Participation.

Numerous mechanisms will allow First Nation and Métis communities to participate in the Project and RES Transmission will encourage opportunities focused on capacity building, employment, and economic benefits, similar to those the LTEP targets. Among other opportunities, Participation will include:

- providing job training and upgrading skills to encourage employment during Project development and construction,
- employing First Nation and Métis people on the Project,
- enabling First Nation and Métis participation in procuring supplies and contractor services, and
- entering into financial partnerships with First Nation and Métis groups to foster economic benefit.

Each community the Project affects will bring unique interests and its own appetite – or lack thereof – for investing capital and taking on the associated risks for direct equity participation in the Project. Given the inability to discuss and negotiate with each community in advance, RES Transmission is reluctant to prescribe any specific form of Participation, especially those like direct equity investment that entail financial implications. RES Transmission will make a variety of benefits available to the communities based on each community's needs and proportionate to the Project's impact on each community's interests.

4.1 Methods of Participation

Different kinds of Participation will be available with different levels of involvement; all methods will demonstrate RES Transmission's resourcefulness and flexibility in structuring Participation. First Nation and Métis communities and businesses will have many opportunities to participate in the Project financially and commercially; the two structures generally used are Impact Benefits Agreements (IBAs) and direct equity contributions through a partnership vehicle. RES Transmission anticipates governing Participation by interested First Nation and Métis communities through IBAs and, if required, defining in the IBAs the methods and structures of potential First Nation investment.

4.1.1 Impact Benefits Agreements

An IBA is a contractual agreement between a project's proponent and an affected community; the IBA recognizes the community's interest in the project, such as traditional land use, environmental protection, and employment and business opportunities. The IBA outlines how the project's proponent and the affected community will cooperate throughout the project. In this case, IBAs between RES Transmission and various interested First Nation or Métis communities would likely outline how the First Nation or Métis community would participate in the Project and how associated issues would be addressed. As the preferred instrument to govern all other forms of Participation, the IBA will generally describe the path to direct investment in the Project, if required.

RES Transmission will negotiate directly with the affected First Nation or Métis community to define IBAs, with the final contracts including any number of different provisions that together compensate the communities for Project's impact on their traditional lands and treaty rights. Provisions could include a range of benefits for the communities, including, among others, a percentage of the Project's proceeds, fixed annual participation funding, employment, capacity funding, community infrastructure, and environmental protection measures. Because IBAs are tailored to the First Nation or Métis community's specific needs, RES Transmission expects that all identified First Nation and Métis communities will express some level of interest in negotiations. Therefore, RES Transmission has prepared the requisite budget and schedule and has an experienced Participation Implementation Team ready to engage in these negotiations, most likely community-by-community to address unique economic, environmental, and cultural issues. Because RES Transmission needs to understand each community's interest in the Project and particular needs, RES Transmission proposes early, meaningful, and ongoing consultation with the affected communities and will keep the communities informed throughout the development process to properly define community needs.

Given that discussions with individual communities have been limited so far, RES Transmission has prepared a menu of benefits to be offered and expects to later outline the Participation available to each community in an IBA to be negotiated with the First Nation and Métis leadership. Each community will have access to a combination of proposed benefits of Participation detailed later in this report. The final method of Participation and sum benefits will reflect the level of each community's interest in the Project, as well as the level of impact the Project will have on each community's traditional lands and rights.

4.1.2 Equity Contribution

RES Transmission anticipates that some First Nation or Métis communities will be interested in possibly investing equity in the Project through a partnership agreement. Generally structured through a special purpose vehicle, this kind of partnership agreement would allow for First Nation or Métis equity participation in the Project, with the structure similar to any commercial partnership between two or more parties in most respects. Under this arrangement, the First Nation or Métis communities would have a percentage equity stake in the Project. The community generally benefits from long-term revenue from the investment, through dividends; however, all investors would bear the risks inherent in the investment.

Partnership agreements for large infrastructure projects tend to be complex, with their final negotiated form crucial to the project's commercial viability and the parties' financial sustainability forming the partnership. RES Transmission expects some First Nation and Métis communities to discuss the possibility of entering into a partnership agreement that allows them to invest equity in the Project as a direct financial partner. Once the interested parties are identified through consultation and form a group to negotiate partnership terms, the Applicant will determine the appropriate amount of equity to offer; the amount will depend on the Project's impact on the group's communities, the amount of compensation negotiated through IBAs, the number of participants in the group, and the group's borrowing capacity and appetite for risk. For instance, if all eligible parties are interested equity participants, the Applicant is prepared to offer as much as $50 million investment opportunity in RES Transmission, as long as the opportunity does not exceed twenty percent (20%) of Project ownership. The terms offered to the First Nation investors will be consistent with conventional commercial practices and would include commercial terms dependent on risk and role of minority investors in the Project's management, as well as overall Project financing requirements.

RES Transmission recognizes that when compared, First Nation and Métis communities have very different financial resources and tolerances for risk. Because many of the communities may lack the capacity to acquire an ownership interest in the Project, RES Transmission commits to help those communities by assembling a Participation Implementation Team (described more fully below) responsible for supporting and helping Aboriginal communities that wish to acquire an equity ownership stake in the Project.

Experienced in helping First Nation and Métis communities, RES Transmission's Participation Implementation Team possesses broad knowledge of banking and capital markets. The team expects to employ one or a combination of the following financing methods in support of First Nation and Métis equity participation.

- **Aboriginal Loan Guarantee Program**. To increase First Nation and Métis involvement in Ontario's energy sector, the Ontario government launched the Aboriginal Loan Guarantee Program (ALGP) in 2009. Administered by the Ontario Financing Authority (OFA), the ALGP program provides a Province of Ontario loan guarantee for up to 75 percent (to a maximum of $50 million) of an Aboriginal community's equity investment in an eligible renewable energy or transmission project. On July 30, 2012, the Ontario government announced an increase in the ALGP program from $250 million to $400 million because of high demand.
- **Other Loans**. Niche lenders, such as the First Nations Finance Authority and the Business Development Bank of Canada, provide loans to First Nations to make equity investments in qualifying business ventures. Typically, these lenders impose less stringent lending requirements (for example, minimal or no loan collateral) than large chartered banks.
- **Monetization**. First Nation and Métis communities may convey certain rights or benefits to a project, which can then be monetized. For example, a First Nation may grant a right-of-way across reserve lands to place transmission towers and lines. As consideration for the granted rights, the project entity may contractually agree to make to the First Nation a series of regular payments, which could be "monetized" or converted to an upfront payment, through a financial instrument to the First Nation. The First Nation could then use the instrument to buy an equity interest in the project. Alternatively, the project entity could pay a lump sum to the First Nation as consideration for the granted rights, which the First Nation could use to fund an equity investment in the project.

RES Transmission's Participation Implementation Team will work closely with its First Nation and Métis partners to evaluate their financial capacities and risk profiles to create appropriate financing strategy and execution plans tailored to each community. The team also stands fully prepared to help these partners successfully execute the financing plans.

4.2 Benefits and Risks of Participation

The benefits listed in this section are in no way meant to be exhaustive; rather detailed benefits for each community's IBA will be structured through negotiations with the community and all commercially feasible proposals that respond to and mitigate the Project's impact on the community's interests will be considered. The listed benefits focus on capacity building, environmental protection, employment opportunities, and economic benefit.

4.2.1 Participation Capacity Support

RES Transmission understands that the relevant communities' experience, capacity, and priorities vary considerably. For instance, some First Nation and Métis communities have experience with power generation and transmission and will be able to provide long-term construction, maintenance, and other services for the Project's life-cycle. Other communities will be able to provide contractual services, such as environmental consulting, logistics, catering, transportation, lodgings, and facilities. Many other communities will have very limited capacity and need help to meaningfully participate.

Capacity support includes a range of options designed to ensure future jobs and participation in other development within communities' traditional territories. The capacity development proposed will include the list of the following items.

- **Scholarship opportunities.** Post-secondary scholarships for students wishing to undertake engineering and technical studies are contemplated; a range of potential study areas will be negotiated with the community.

- **Training opportunities**. Trade school tuition and apprenticeship enrolment will be offered for individuals wishing to increase their skill level for higher paying jobs in electrical transmission or generation fields.

- **Administrative and logistics support.** Funding will be available to ensure the right business and community representatives can be present at important meetings. Capacity support may include travel, accommodation, elder honorariums, communications support, meals, and hospitality.

- **Funding Initiatives through the Aboriginal Community Energy Plan.** Administered by the Ontario Power Authority, this program is designed to help Ontario's First Nation and Métis communities understand and plan for their electricity needs and discover options for conservation and small-scale renewable generation in their communities. RES Transmission would negotiate potentially enhancing this program, community-by-community.

- **Funding Cultural and History Projects.** Many U.S. and Canadian Aboriginal and Tribal communities are working to preserve their history and culture. Interested communities may choose to use benefit revenue to fund projects aimed at preserving language and culture for future generations.

- **Funding Art Competitions.** Given art's importance to First Nation and Métis culture, RES Transmission would sponsor regional art competitions that encourage new artists and support established artists, if identified as a need within the communities.

- **Funding Environmental Reviews.** Funding in this area could include supporting communities interested in reviewing environmental studies conducted for the Project as well as funding Traditional Ecological Knowledge Studies to evaluate existing and traditional environmental resources of traditional First Nation and Métis territory.

4.2.2 Employment Opportunities

RES Transmission will encourage First Nation and Métis communities to benefit from the employment opportunities the Project's development, construction, and operation create. These initiatives might include the following:

- **Encouraging First Nation and Métis Construction Employment.** RES Transmission would encourage employing members of First Nation and Métis communities wherever economically feasible. A liaison in each community would ensure that job and training opportunities are promoted widely.

- **Encouraging First Nation and Métis Operations Employment.** Ongoing Project operations will provide sustained, long-term employment opportunities in the relevant communities. From the Project's outset, opportunities for developing relevant skills and obtaining education will be available to ensure that operations roles can be filled locally.

- **Preferred Contractor Status.** Other elements being equal, RES Transmission will select First Nation and Métis companies for contracting opportunities. In cases where needed equipment is lacking, RES Transmission may help local contractors procure the required equipment, if appropriate.

- **Hiring First Nation and Métis Contractors for Development.** RES Transmission will make a concerted effort to hire qualified First Nation and Métis contractors during the Project's development stage.

4.3 Economic Benefits

As LTEP acknowledges, First Nation and Métis communities have an interest in realizing economic benefits from future transmission projects crossing their traditional lands. Economic benefits that extend beyond the above capacity support and employment opportunities could include the list of the following items.

- **Equity Participation.** As explained herein, the First Nation and Métis communities could be investors in the Project and partake in the long term revenues from the investment provided. As is the case with any investment, the benefit will be proportional to the size of the investment and the level of risk taken.

- **Direct Compensation.** In certain cases, RES Transmission could provide annual compensation for encroaching on traditional lands, adversely affecting treaty rights, and being physically close to a community.

- **Land Payments.** Although not anticipated on the Preliminary Preferred Route, payments would be made for using land if the Project does run through reserve lands.

- **Community Infrastructure Funding.** Some First Nation communities lack funding to improve local infrastructure; RES Transmission will negotiate infrastructure enhancement and community development as part of benefit agreements with interested communities.

- **Reserved Contracts.** RES Transmission could reserve a portion of subcontracts for the First Nation or Métis contractors in communities with particular skills sets available for the Project, where services can be rendered at competitive rates.

- **Sponsorship Opportunities.** Ontario is home to many vibrant, active communities that support cultural and sporting events. RES Transmission would provide specific funds to help communities ensure that these events have long-term economic stability.

4.4 Risks of Participation

Through discussions with First Nation and Métis communities, potential risks associated with some of the proposed forms of Participation will be outlined. Some of the proposed benefits can be realized only if the communities, or some of their members, take on the associated risks. Some of the relevant communities are fully cognizant of and able to evaluate and mitigate the risks, while others might need support from the Participation Implementation Team to fully understand the risks. The level of support required by each community will be determined through the consultation process and outlined in the IBAs. Examples of the risks include the list of the following items.

- The risk from financial commitments associated with equity participation in the Project, towards both the Project’s lenders and other financial institutions, potentially financing the First Nation and Métis equity position.

- The risks associated with any contractual agreement between RES Transmission and First Nation or Métis service providers, whether during the development, construction, or operation phase, including bonding requirements, exposure to performance guarantees, and other delivery and guarantee requirements.

- The risks associated with investing in a company, real estate, or equipment that will provide services to the Project, given that some of the proposed benefits can be realized only if the communities can contribute certain services.

5 Schedule of Participation Plan

The Pre-Consultation, Consultation, and Accommodation processes will run concurrently with Participation discussions. Given the intimate connection these discussions have, these issues will be best approached simultaneously.

During the Pre-consultation, Consultation, and Accommodation processes, engagement teams in a range of disciplines will enter into contractual arrangements with local businesses to collect, organize, map, and analyze data from field studies and other environmental and archaeological initiatives. During this time, RES Transmission will assess individual First Nation and Métis communities' unique needs and priorities. Then, IBAs will be executed with the communities the Project affects. The IBAs will outline capacity support methods that meet consultation obligations and support meaningful Participation.

RES Transmission anticipates Participation negotiations to begin as soon as possible, with actual time required for negotiating, agreeing to, and implementing Participation agreements depending on the depth of benefits involved, resources required to fulfill commitments, and Project's overall timing. The IBAs and Participation details should be finalized before RES Transmission applies to the Board for leave to construct the Project.

6 First Nation and Métis Participation Costs

As part of its Application for Designation, RES Transmission must file a summary of the total costs associated with the proposal, including cost of First Nation and Métis Participation. The table below outlines the expected quarterly costs related to implementing the Participation Plan and associated activities before implementing the participation agreements that would occur after a successful leave to construct hearing.

Table 2: Expected Budget for implementation of Participation Plan

<table>
<tr><th>Year</th><th>Quarter</th><th>Expected Cost</th><th>Expected activities</th></tr>
<tr><td rowspan="2">2013</td><td>Q3</td><td>$ 83,000</td><td>Pre-Consultation Engagement and relationship-building with identified FN's</td></tr>
<tr><td>Q4</td><td>$ 162,000</td><td rowspan="4">Negotiation of detailed IBAs with all interested communities and methods of Participation, including support for participation.</td></tr>
<tr><td rowspan="3">2014</td><td>Q1</td><td>$ 162,000</td></tr>
<tr><td>Q2</td><td>$ 157,000</td></tr>
<tr><td>Q3</td><td>$ 132,000</td></tr>
</table>

	Q4	$ 98,000	
2015	Q1	$ 98,000	
	Q2	$ 48,000	Finalization of IBAs and details of participation
	Q3	$ 20,000	Management and implementation of IBAs and methods of Participation during the leave to construct hearings
	Q4	$ 20,000	
2016	Q1	$ 20,000	
	Q2	$ 20,000	
	Q3	$ 20,000	
	Q4	$ 20,000	
Total		**$ 1,060,000**	

Although difficult to estimate before negotiations are conducted and depending on the extent to which parties avail themselves of non-investment benefits, the annual costs of implementing the IBAs can be expected to be about $400,000 annually throughout the Project once constructed and operational.

7 Participation Implementation Team

RES Transmission has assembled an experienced and skilled First Nation and Métis Participation Implementation Team that combines its extensive past internal experience with support from former Ontario Grand Chief John Beaucage, Coxswain Row Capital Corporation, and Stantec Consulting Limited. This team is prepared to work closely with First Nation and Métis communities, organizations, companies, and Crown representatives throughout the Project. The following briefly describes each team member's expertise and role.

RES Transmission

Role: Lead

Experience: RES Transmission has gained significant experience in First Nation and Métis issues through its partners – affiliates of the RES Group and the MidAmerican Group. With projects in Ontario and throughout Canada located on Crown Lands, the RES Group has engaged in substantial consultation with First Nation and Métis communities with Treaty rights on these Crown Lands. The RES Group consults with full awareness of the duty to consult enshrined in Canadian law and incorporates First Nation and Métis consultation as an integral part of the development process.

Twice the RES Group was delegated responsibility for conducting the Procedural Aspects of the Crown's Duty to Consult in Ontario. Through an agreement between Her Majesty the Queen in Right of Ontario as represented by the Ministry of Energy and Infrastructure, RES Group led the consultation process for the Greenwich and the Talbot Wind Farms, including 230 kV transmission lines associated with each. Both projects were successfully constructed in 2010-2011 with a significant support from the neighbouring First Nation and Métis communities.

The level of consultation with First Nation and Métis peoples typically depends on historical claims, treaty rights, or traditional land use. The RES Group has achieved successful outcomes on many Canadian projects, including, for instance, the Greenwich Wind Farm located on Lake Superior's northern shores in the direct vicinity of the East-West Tie Line. The RES Group also executed Aboriginal Impact Benefits Agreements that compensate for the affect the windfarm's construction and transmission line have on traditionally used lands; the IBAs additionally provided capacity funding for the relevant First Nations band members to receive educational training to prepare for wind farm services and annual funding for the First Nations to apply to renewable energy or other projects. Finally, the IBAs included an economic implementation plan for two neighbouring First Nations that provided Aboriginal construction companies preferred employment opportunities on the construction site. The plan resulted in a significant number of First Nation and Métis members working on the Greenwich construction site building roads and providing security and other services. The Greenwich project also concluded similar agreements with two Ontario Métis groups based on the north Superior shoreline, following negotiations with the Toronto-based Métis Nation of Ontario (MNO).

The RES Group is negotiating Participation Agreements with several Ontario First Nations concerning participating with RES in the FIT 2.0 process for large-scale wind energy projects. The First Nation partners would have rights to invest equity in the windfarm projects, effectively becoming an owner of the project alongside RES. IBAs would also be signed to compensate for any impact the windfarm has on the members' traditional use of the lands.

John Beaucage

Role: Special Adviser

Experience: Former Grand Council Chief of the Union of Ontario Indians and former chief of his community, John Beaucage is a prominent businessman with years of success in building consensus among First Nation and Métis communities. He was co-chair of two tables, Housing and Relationships, which lead to the First Ministers meeting in Kelowna. Current Chair of the First Nations Market Housing Fund and past advisor to the Minister of Child and Youth Services of Ontario, he served as former CEO of the Lake Huron Anishinabek Transmission Line Company and Chair of Nigig Power, a wind power company owned by the Henvey Inlet First Nation. Mr. Beaucage is uniquely positioned to advise RES Transmission to provide solutions and allow maximum and meaningful participation of First Nations in energy and transmission projects in Ontario.

Coxswain Row Capital Corporation

Role: Financial Structuring and Financing Opportunities

Experience: Founded in 1995, Coxswain Row Capital Corporation is a Toronto-based financial and management advisory firm providing services to clients in the mining, oil and gas, renewable energy, and technology sectors. Since the Green Energy Act's introduction, Coxswain Row has been actively working with First Nations communities to help facilitate their active participation in Ontario's energy sector. Coxswain Row's engagement activities with First Nations clients have included, for example, helping with feasibility studies, structuring and establishing single-purpose project development entities, completing and filing Feed-in-Tariff applications, acquiring multiple project portfolios, executing joint development and partnership agreements, securing and structuring government loan guarantees, and engaging in other project-related activities. In Q1 of 2011, Coxswain Row secured a mandate to arrange financing for a First Nation community's 50 percent ownership interest in one of Canada's largest wind projects, with an estimated capital cost of one billion dollars. Coxswain Row is also engaged with another First Nation community in evaluating, negotiating the acquisition of, and financing a portfolio of utility-scale solar projects with FIT contracts. Through these mandates and others, the company has gained unique experience in forming project finance structures and addressing other issues related to First Nations participation and partnerships.

Stantec Consulting Limited

Role: Consultation and Participation Support

Experience: Stantec's services are offered by more than 11,000 employees operating from more than 170 locations in North America, including 15 in Ontario. Its resources include experienced staff in the broad areas of permitting and compliance, program and project management, construction management, and electrical, mechanical, civil, structural, and instrumentation and controls engineers. As a multidisciplinary firm, Stantec provides strategic planning, environmental consulting, project design, project and construction management services, and civil, structural, and electrical engineering to the power industry. The company has an extensive portfolio of transmission and distribution project experience throughout the US and Canada. Stantec's Environmental Services group includes approximately 2,000 people, of which approximately 1,200 are based in Canada. Within Ontario, Stantec has 340 Environmental Services staff. With experience consulting with a number of First Nation and Métis communities across Canada, Stantec has a unique understanding of the issues surrounding First Nation and Métis consultation.

TAB D-2-2

Biography and Resume of John Beaucage

Biography John Beaucage

In October 2004, **John Beaucage** was elected as Grand Council Chief to serve the 42-member First Nations of the Anishinabek Nation. John was re-elected in 2006, by acclamation, a rare occurrence in the history of one of Canada's oldest First Nation, political organizations. Prior to his election as Grand Council Chief, Beaucage was the elected Chief of Wasauksing First Nation and served in that capacity for four consecutive terms.

Beaucage is a graduate of the University of Western Ontario with a combined degree in English and economics, and he has done post-graduate work in First Nation planning at the University of British Columbia. He also was the recipient of a Honourary Doctor of Letters from Nipissing University in the 2009 Convocation. An economist by education, Beaucage worked for the Canada Mortgage and Housing Corporation (CMHC) for over 15 years in Ottawa, Thunder Bay, Toronto, Regina and Saint John, New Brunswick. After leaving CMHC on 1989 he and his wife started a number of successful businesses in retail and in property development and management.

Grand Council Chief Beaucage played an instrumental role in the First Ministers' Meeting which took place in Kelowna, BC in November of 2005. Leading up to the First Ministers' Meeting, Beaucage served as the Co-chair for First Ministers' Working Groups for both Housing and Relationships.

In May of 2008, Beaucage was appointed Chairperson of the First Nations Market Housing Fund. The $300 million Fund was first announced in Budget 2007 and is a new and innovative way to give First Nations citizens the opportunity to own their homes on reserve.

Since leaving his position as Grand Council Chief, Beaucage now serves on a number of boards and is working on developing green energy projects with several First Nations across the country. He has also has been involved as a mediator with land disputes and was appointed as Special Advisor to the Minister of Children & Youth Services, which resulted in a much publicized report on the state of native child welfare in Ontario. He is currently a Councillor in his home community and is holder of the Health portfolio.

Eyaabay (his traditional name) is a Pipe Carrier from the Bear Clan. A citizen of Wasauksing First Nation, he was raised on the Shawanaga First Nation and has extended family in Nipissing, Curve Lake and Moose Deer Point First Nations.

John and his wife Bonnie have been married for 38 years and have four children and eight grandchildren.

CIRRICULUM VITAE

John W. Beaucage

December, 2012

John Beaucage

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Parry Sound, Ontario
P2A 2Z1

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Cell(705)746-0638
E-mail:jbeaucage@counselpa.com

Experience

1974 – 1989 Canada Mortgage & Housing Corporation

A variety of increasingly senior positions were attained in many locations across Canada starting with Graduate Trainee in Toronto Branch to National Manager of Social Housing in the CMHC National Office in Ottawa.

1989 – 1997 Beaucage & Associates

Self owned business specializing in project development and property management. Development included many single family & senior citizen projects as well as one commercial building. Properties managed were under contract with the Ministry of Housing, Ontario; at one time over 400 single-family units were under management.

1997 – 2004 Chief, Wasauksing First Nation

Elected Chief of the Wasauksing First Nation for 4 consecutive terms.

2004 – 2005 Co-chair of Housing and Relationship Tables

Co-chair of two tables during Federal-Provincial discussions and negotiations leading up to the First Ministers Meeting in Kelowna, November 2005.

2004 – 2009 Grand Council Chief, Union of Ontario Indians

Elected political leader of 42 member First Nations comprised of communities from north of Lake Superior to Sarnia, and then to the Ottawa valley.

2004 – 2009 President 7th Generation Charities

The 7th Generation Charities is a charitable organization wholly owned by the 42 member communities of the Union of Ontario Indians.

2008 – Present Chair First Nation Market Housing Fund

Chair of a board of nine Trustees for a $300M fund meant to provide ease of access for mortgage funding for on-reserve housing.

2008-2010 Board Member on Expert Panel on Climate change adaptation

Panel called together by the Premier of Ontario to make recommendations to Ontario for future legislation and policy on climate change

2009- 2011 President & CEO of the Lake Huron Anishinabek Transmission Company

The LHATC is a Ontario's newest transmission company, initiated by the Chiefs of the Huron Robinson Treaty.

2009 – Present Board Member Radiation Safety Institute of Canada

Mr. Beaucage is one of ten board members, on this national organization.

2010 – 2011 Special Advisor to the Minister Children & Youth Services

An Order-In-Council appointment

2009 – Present Mediator with York Street Dispute Resolution Group Inc.

York Street is one of the foremost ADR panels in Canada

Education, Degrees Attained

1974	**BA, English & Economics** University of Western Ontario
1992	**First Nation Planning** University of British Columbia
1995	**Justice of the Peace Training** Ministry of the Attorney General
2009	**Doctor of Letters (Honorary)** Nipissing University
2011	**ADR Certificate of Achievement** University of Windsor

TAB D-3-1

First Nation and Métis Engagement Log

First Nation and Métis Engagement Log – East West Tie Line designation process

Last Updated:
November 9th 2012

Item #	Date	Organization/ Department	Contact Name(s)	Title	Contact Information	Note
1.	May 2nd 2012	Fort Williams First Nation	Ian Bannon Edmond Colins	n/a	90 Anemki Dr., Suite 200, Thunder Bay, ON, P7C 4Z2	• RES Transmission met with Fort Williams First Nation contacts to explain RES Transmission potential involvement in upcoming EWTL designation process. • RES Transmission presented company and brief overview of planned activities for the designation and development of the EWTL.
2.	May 3rd 2012	Odjibways of Pic River	Chief Roy Michano	Chief	PO Box 193 Heron Bay ON P0T 1R0	• RES Transmission met with Pic River Chief to explain RES Transmission potential involvement in upcoming EWTL designation process. • RES Transmission presented company and brief overview of planned activities for the designation and development of the EWTL.
3.	May 3rd 2012	Michipicoten First Nation	n/a	n/a	RR1, PO Box 1, Site 8, Wawa, ON, P0S 1K0	• RES Transmission dropped in Michipicoten First Nation to provide RES Transmission company brochures and basic company information, no meeting was held with representatives as none were available.
4.	May 3rd 2012	Red Rock	n/a	n/a	PO Box 1030, 2 Main St. Lake, Helen Reserve Nipigon ON P0T 2J0	• RES Transmission dropped in Red Rock First Nation to provide RES Transmission company brochures and basic company information, no meeting was held with representatives as none were available.
5.	July 18th, 2012	Fort Williams First Nation	Chief Peter Collins	Chief	90 Anemki Dr., Suite 200, Thunder Bay, ON, P7C 4Z2	• RES Transmission invited Chief Collins to discuss potential First Nation engagement for the

						development plan for the EWTL designation process. • Due to the non-disclosure agreement in place between Bumkashwada and EWT LP the meeting was refused on grounds of non-disclosure requirements.
6.	July 18th, 2012	Michipicoten First Nation	Chief Joe Buckell	Chief	RR1, PO Box 1, Site 8, Wawa, ON, P0S 1K0	• RES Transmission invited Chief Buckell to discuss potential First Nation engagement for the development plan for the EWTL designation process. • Due to the non-disclosure agreement in place between Bumkashwada and EWT LP the meeting was refused on grounds of non-disclosure requirements.
7.	July 18th, 2012	Pays Plat First Nation	Chief Xavier Thompson	Chief	10 Central Place Pays Plat ON P0T 3C0	• RES Transmission invited Chief Thompson to discuss potential First Nation engagement for the development plan for the EWTL designation process. • Due to the non-disclosure agreement in place between Bumkashwada and EWT LP the meeting was refused on grounds of non-disclosure requirements.
8.	August 9th 2012	Fort Williams First Nation	Chief Peter Collins	Chief	90 Anemki Dr., Suite 200 Thunder Bay ON P7C 4Z2	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
9.	August 9th 2012	Michipicoten First Nation	Chief Joe Buckell	Chief	RR1, PO Box 1, Site 8 Wawa ON P0S 1K0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the

						OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
10.	August 9th 2012	Odjibways of Pic River	Chief Roy Michano	Chief	PO Box 193 Heron Bay ON P0T 1R0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
11.	August 9th 2012	Pays Plat First Nation	Chief Xavier Thompson	Chief	10 Central Place Pays Plat ON P0T 3C0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
12.	August 9th 2012	Pic Mobert First Nation	Chief Johanna Desmoulin	Chief	PO Box 717 Mobert ON P0M 2J0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies

						• Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
13.	August 9th 2012	Red Rock Indian Band	Chief Arlene Wawia	Chief	PO Box 1030, 2 Main St. Lake, Helen Reserve Nipigon ON P0T 2J0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
14.	September 10th 2012	Métis Nation of Ontario (MNO)	Jason Taylor Maden (legal) and Cameron Burgess	Legal and Chair of Consultation Committee		• Meeting was held at Jason Taylor Maden Law office in Toronto between MNO representatives and RES Transmission • Lunch followed
15.	September 13th 2012	Métis Nation of Ontario (MNO)	Jason Taylor Madden (legal) and Cameron Burgess	Legal and Chair of Consultation Committee		• Follow up e-mail was sent requesting one-pager to initiate consultation framework discussions
16.	September 27th 2012	Animbiigoo Zaagi'igan Anishinaabek First Nation (Lake Nipigon Ojibway)	Chief Yvette Metansinine	Chief	PO Box 120, Beardmore, ON, P0T 1G0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
17.	September 27th 2012	Biinjitiwabik Zaaging Anishnabek First Nation (Rocky Bay)	Chief Velda Lesperance	Chief	General Delivery, Macdiarmid, ON, P0T 2B0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns

						including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
18.	September 27th 2012	Bingwi Neyaashi Anishinaabek (Sand Point) First Nation	Chief Paul Gladu	Chief	146 Court Street South, Thunder Bay, ON, P7B 2X6	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
19.	September 27th 2012	Ginoogaming First Nation	Chief Ceila Echum	Chief	PO Box 89, Long Lac, ON, P0T 2A0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
20.	September 27th 2012	Long Lake No. 58 First Nation	Chief Allen Towegishig	Chief	PO Box 609, Long Lac, ON, P0T 2A0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
21.	September	Missanabie Cree First	Chief Kim Rainville	Chief	174B highway 17 East, Bells	• RES Transmission sent out letter, by

	27th 2012	Nation			Point, Garden River, ON, P6A6Z1	e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
22.	September 27th 2012	Ojibways of Batchewana	Chief Dean Sayers	Chief	236 Frontenac Street, Sault Ste Marie, ON, P6A 5K9	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
23.	September 27th 2012	Ojibways of Garden River	Chief Lyle Sayers	Chief	RR4, 7 Shingwauk Street, Graden River, ON, P6A 6Z8	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
24.	September 27th 2012	Kiashke Zaaging Anishinaabek (Gull Bay First Nation)	Chief Miles Nowegejick	Chief	188 General Delivery, Gull Bay, ON, P0T 1P0	• RES Transmission sent out letter, by e-mail and regular mail, informing First Nation of participation in the OEB designation process for the EWTL. • Request was made to meet in order to discuss potential concerns

						including treaty rights, potential impacts and mitigation strategies • Follow up meetings were offered in forum deemed most appropriate to First Nation peoples.
25.	October 3rd 2012	Bingwi Neyaashi Anishinaabek (Sand Point) First Nation	Jordan Hatton	Director of Lands and Resources	jhatton@shawbiz.ca Phone: 807-623-2724 Fax: 807-623-2764 Cell: 807-472-9619	• Received e-mail from the Bingwi Neyaashi Anishinaabek (Sand Point) First Nation indicating support for the Project. • E-mail indicated that verbal agreements between the Bingwi Neyaashi Anishinaabek (Sand Point) First Nation and Red Rock Indian Band and Pays Plat First Nation indicate that Red Rock Indian Band and Pays Plat First Nation should be approached.
26.	October 11th 2012	Métis Nation of Ontario (MNO)	Jason Taylor Madden (legal) and Cameron Burgess	Legal and Chair of Consultation Committee	Jason@jtmlaw.ca cameronb@metisnation.org	• Follow up e-mail requesting follow up call or meeting from September meeting.
27.	October 22nd 2012	Ojibways of Garden River	Chief Lyle Sayers	Chief	RR4, 7 Shingwauk Street, Graden River, ON, P6A 6Z8	• Received letter from Ojibways of Garden River in response to September introduction letter • Ojibways of Garden River expressed support for the project and appreciates RES Transmission outreach. • Indicated interest in partnering in the economic development in the area.

TAB E-1-1

Overview

This Exhibit E sets out the Applicant's capability to develop, construct, own, operate and maintain the EWTL. This is demonstrated by each of the RES Group's and the MidAmerican Group's prior experience in the electricity transmission and generation industry in Canada and the US, in the following critical areas:

- financing of greenfield and brownfield projects (Tab 2);
- design and construction (Tab 3);
- land acquisition and site control (Tab 4);
- environmental compliance, permitting and regulatory compliance (Tab 5);
- First Nation and Metis consultation (Tab 6); and
- stakeholder consultation (Tab 7).

The Applicant will demonstrate that by virtue of prior experience and its relevance to the development, construction, operation and maintenance of the EWTL, it satisfies the Board's criteria for the required technical and financial capacity for designation. The collective transmission experience of the RES Group and the MidAmerican Group in North America can be summarized as:

- overall more than 30,000 km of high-voltage transmission lines owned and/or operated by the MidAmerican Group in the US under the jurisdiction of 11 state public regulatory commissions, FERC, ERCOT and NERC. This includes 115 kV, 138 kV, 230 kV, 345 kV, and 500 kV lines owned and/or operated by the following members of the MidAmerican Group:
    - PacifiCorp: 6 US States (http://www.pacificorp.com/tran.html);

  - MEC: 4 US States (http://www.midamericanenergy.com/elecOverview.aspx);
  - MAT: 2 US States;

- 890 km of high-voltage transmission lines developed and/or constructed by the RES Group throughout North America since 1998 which includes 27 generation tie lines and the recent construction of the Montana Alberta Tie Line (345 km 230 kV line). This includes 138 kV, 230 kV, and 345 kV lines including two 230 kV generation tie lines in Ontario, one of which is connected to the existing Hydro One East-West Tie Line between Thunder Bay and Nipigon (see http://www.res-americas.com/en/what-we-do/competencies/transmission.aspx);

- 3,300 km PacifiCorp Energy Gateway Project: US $6.0 billion of new 230 kV, 345 kV, and 500 kV lines currently under development or construction in parts of several Northwest and Rocky Mountain States (http://www.pacificorp.com/tran/tp/eg.html);

- 400 km MEC MISO Projects: Four of MISO's "Multi-Value Projects" in Iowa (https://efs.iowa.gov/efiling/groups/external/documents/docket/121060.pdf);

- 188 km MAT SPP Joint-Venture Project[1]: One of the "SPP Priority Projects" in Kansas (http://prairiewindtransmission.com/faq.aspx);

- 666 km MAT ERCOT Joint-Venture Projects1: Several 345 kV "ERCOT CREZ Projects" in Texas (http://www.ettexas.com/projects/consortium.asp); and

- the MidAmerican Group has constructed and owns, operates and maintains its extensive transmission system in the US in a wide area, under a multitude of climatic conditions. These conditions are indicative to electric transmission assets located at elevations from sea level, to high desert regions, to mountain terrains above 2438 metres. The system is located in dense urban areas,

[1] In partnership with American Electric Power and other utilities

sparsely populated, remote lands and mountains regions of all types. This past year MEHC operating units Rocky Mountain Power, and Pacific Power each celebrated 100 years of successful operation and customer service in their respective areas. This speaks to the Applicant's long term commitment and success in constructing, operating and maintaining bulk electric transmission systems for customers, similar to the project being presented via this Application.

TAB E-2-1

Financial Capability

The long-term investment in infrastructure projects is a key focus of the MidAmerican Group and it is understood that long-term investments require long-term development horizons. The MidAmerican Group was established to develop and own transmission assets for the life of those assets.

The MidAmerican Group owns electric and gas assets totalling $47.7 billion, as of December 31, 2011, has undertaken $2.6 billion in capital expenditures in 2011, and supports $2.5 billion in ongoing operating expenditures and has ample access to debt and equity capital in support of its project development activities. Since 2004, the MidAmerican Group has invested or committed to invest $6 billion in owned and operated wind power generation. As part of a recent expansion into ownership of independent power projects, the MidAmerican Group has financed, through standalone joint ventures, approximately $336 million of transmission capital expenditures to date and is committed to another $103 million through 2014. This includes the Competitive Renewable Energy Zone infrastructure build out in Texas and the Prairie Wind Transmission Project in Kansas.

The RES Group also has considerable experience financing electricity infrastructure projects. The RES Group has directly financed in excess of 600 MW of renewable electricity generation projects (spanning more than 30 different wind/solar facilities) representing over $1 billion in total investment. The RES Group has been involved in over 6 GW of renewable energy transactions and has been at the forefront of financing projects globally for the last 20 years. This provides the RES Group with unrivalled experience and expertise in financing projects. The RES Group has the in-house skills and close links with banks, finance house, investors, insurers, manufacturers, consultants and legal specialists necessary to all the RES Group to assemble the best financing arrangements for a particular project. When combined with its technical, engineering and environmental expertise, the RES Group consistently adds extra value to all its projects.

Financial Capability

The MidAmerican Group had operating revenues of $11.1 billion in 2011 and retained earnings of $14.1 billion as of December 31, 2011 on its audited consolidated financial statements, which can be reviewed in Exhibit O-1-2. The RES Group had revenues for fiscal year 2011 of approximately $1.2 billion and total capital and reserves of approximately $267 million as of October 31, 2011. Financial Statements for the RES Group can be reviewed in Exhibit O-1-2. The RES Group has net interest in projects valued at approximately $470 million to the end of 2011.

The MidAmerican Group through its parent entity, MEHC exhibits strong investment grad rating with Moody’s, Standard & Poor’s, and Fitch Rating of Baa1, BBB+ and BBB+, respectively, and such rating allow MEHC to maximize pricing benefits in the debt capital markets. MEHC is also 90 percent owned by Berkshire Hathaway (which maintains a credit rating of Aa2/AA+/A+), thereby providing MEHC with significant equity capital and flexibility to construct large electricity infrastructure projects across the globe. As such, this provides the MidAmerican Group with significant financial capability and experience in financing large scale electricity infrastructure projects and this experience and reputation with bond investors offers pricing advantages that other potential sponsors may not possess. Financial statements for the MidAmerican Group can be reviewed in Exhibit O-1-3.

MidAmerican Group subsidiaries and/or joint venture partners have, from time to time, issued debt either in the capital markets or the private placement markets based on prevailing market conditions. Debt has been issued with maturities ranging from 5 to 30 years. Regulated entities within the MidAmerican Group have complied with varying regulatory requirements across the jurisdictions they are operating in, regarding debt/equity splits. Under the Texas jurisdiction, the MidAmerican Group and its joint venture partner have followed a capitalization structure of 60 percent debt and 40 percent equity.

The parent entity in the RES Group, Renewable Energy Systems Holdings Ltd., is a privately held company with very little corporate level debt. It therefore does not have a rating with the major rating agencies. Please see attached at Exhibit E-2-3 a Dunn and Bradstreet review for a third party assessment of Renewable Energy Systems Holdings Ltd., which is owned by shareholders of the Sir Robert McCalpine Group formed in 1872. The Sir Robert McCalpine Group has significant experience in major construction projects, ranging from nuclear power generating facilities to the recently built London Olympic stadium through this cumulative financial strength and experience, the RES Group has considerable access to capital, both through its shareholders and through third party financings.

MidAmerican Group Experience

Below is an indicative list of electricity infrastructure financing experience of the MidAmerican Group.

Topaz Solar

The MidAmerican Group financed the first tranche of $850 million debt in February 2012 at 5.75 percent; a second tranche is expected to be financed in 2013 with the MidAmerican Group foreseeing no problems to obtain the necessary financing. This $2.4 billion solar photovoltaic plant will be one of the largest in the world upon completion in 2015. In addition, a $345 million project-level five-year letter of credit facility was also established for use to (a) provide security under the power purchase agreement and large generator interconnection agreements, (b) fund the debt service reserve requirement and the operation and maintenance debt service reserve requirement, (c) provide security for remediation and mitigation liabilities, and (d) provide security in respect of conditional use permit sales tax obligations.

Pinyon Pines I and II

Bank term-loan financing for $437 million is in place for this 168-MW Alta VII and 132-MW IX located in Kern County, CA.

Bishop Hill II

Long-term fixed-rate project financing of $120 million is in place for this 81 MW project located in Henry County, approximately 20 miles southeast of Rock Island, Illinois.

RES Group Experience

Below is an indicative list of electricity infrastructure financing experience of the RES Group.

Hackberry Wind

In 2008, the RES Group closed financing for the 160 MW Hackberry wind project, including a long-term debt facility of $167 million, tax equity investment of $135 million and RES Group equity of $45.6 million. The RES Group was able to close this transaction, despite the 2008 financial crisis, demonstrating a unique ability to close financings even in the toughest market environments.

Whirlwind Energy

In 2008, the RES Group also closed financing on the 60 MW Whirlwind Wind Farm including a long-term debt facility of $49.4 million, tax equity investment of $56.4 million and RES Group equity of $16.7 million.

Astraeus

In 2005, the RES Group raised €225 million to finance over 200 MW of renewable electricity generation projects in the UK, France and Ireland. This portfolio of projects, known as Astraeus, is still successfully operating and involves over 15 different banks with the lead arrangers being Bank of Tokyo-Mitsubishi, BNP Paribas and Royal Bank of Canada. Several projects have been added to the portfolio in the following years such that the generation portfolio now totals 250 MW. The intricacies of this portfolio, with different tariff regimes, legislative jurisdictions, turbine manufactures and banks, demonstrates the RES Group's ability to successfully manage complex financial transactions.

Boreas

In 2008, the RES Group, together with Nord/LB, reached financial close to provide non-recourse debt for a portfolio, named Boreas, of up 300 MW of electricity generation projects. The first project to be financed was the 25 MW Gruig wind farm in Northern Ireland. This initial financing was for £31 million. Gruig benefits from a long term merchant style PPA with Energia under the Irish Single Electricity Market.

Hill of Towie / EIB intermediated UK Onshore Wind

In March 2010 the RES Group established another portfolio facility with Lloyds Banking Group and BNP Paribas to develop and own a pipeline of up to 300 MW of electricity generation projects in the UK and France. The first project to be added was Hill of Towie wind farm (48.3 MW). The long term project finance facilities for Hill of Towie were £76 million, with a debt tenor of 17 years. This financing is particularly significant since it was one of the first project finance transactions after the banking crisis of 2008, and it was the first large scale project to benefit from the EIB Intermediated UK Onshore Wind Scheme. The portfolio has subsequently grown and now houses over 100 MW of generation projects.

Please refer to Exhibit E-2-2 for further information on the transmission line and electricity generation financing experience of the RES Group and the MidAmerican Group in North America.

TAB E-2-2

Representative List of Projects Financed

The following is a list of representative projects financed by either equity or debt or a combination of both, whether issued specifically for the project or as general corporate debt.

Table E-1

RES Group Power Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Marengo I, WA	230 kV	6.40 km
Marengo II, WA	230 kV	11.70 km
High Palins, WY	230 kV	16.80 km
Dunlap, WY	230 kV	19.20 km
Cedar Point, CO	230 kV	67.20 km
*Greenwich, Canada	230 kV; 34.5 kV	9.90 km; 38.40 km
Bull Creek, TX	138 kV	47.20 km
Woodward Mountain, TX	138 kV	28.80 km
King Mountain, TX	138 kV; 34.5 kV	30.40 km; 12.80 km
Whirlwind, TX	69 kV	32.30 km
Buffalo Gap III, TX	138 kV	20.80 km
Mountain Wind I, WY	138 kV	19.70 km
Wild Horse 1, WA	230 kV	14.40 km
Butler Ridge, WI	34.5 kV	14.40 km
Sweetwater II, TX	138 kV	13.76 km
Sweetwater V, TX	345 kV; 34.5 kV	11.20 km; 1.60 km
Hopkins Ridge I, WA	115 kV	11.70 km
Lone Star-Post Oak, TX	138 kV	11.00 km
So. Trent Mesa, TX	138 kV	10.40 km
Hackberry, TX	345 kV	10.20 km

*Talbot, Canada	230 kV	9.90 km
Hatchet Ridge, CA	230 kV	5.40 km
Sweetwater IV(B), TX	34.5 kV	4.80 km
Armenia Mountain, PA	115 kV	3.40 km
Crossroads, OK	345 kV	16.00 km
Lower Snake River, WA	230 kV	12.80 km
*Montana Alberta Tie Line – Montana, U.S./Alberta, Canada	230 kV	342.40 km
MidAmerican Group Power Recent Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Populus to Terminal,UT, 10	345 kV	216 km
Mona Oquirrh, UT	345 kV; 500 kV	160 km
Siqurd to Red Butte, UT	345 kV	272 km
Gateway West, WY, ID	250 kV; 345 kV; 500 kV	1,600 km
Gateway South WY, UT	500 kV	680 km
St. George Transmission Station, UT	345 kv line 138 kV and static var compensator; (SVC)	32 km
Red Butte Transmission Station, UT	345 kV static var compensator (SVC)	N/A
Camp Williams to 90th South, UT	345 kV	18 km
California Oregon Intertie Transfer Capability OR	500 kV Shunt and Series Cap Banks	N/A
DJ to Casper 230kV No 1 & 2 Line Rebuild Wy	230 kV	97 km
Meridian Lonepine 230kV Ln #1 Reconductor OR	230 kV	4 km
Meridian Sub - Install 230 kV Capacitor Bank OR	230 kV	N/A
Pinto Substation 345kV Series Capacitor UT	345 kV	N/A

St George-Red Butte Central Dbl Ckt 345kV Ln UT	345 kV	28 km
Prairie Wind Transmission KS	345 kV	172 km
Vantage-Pomona Heights 230kV Line WA	230 kV	63 km
Competitive Renewable Energy Zone projects TX	345 kV and higher	1740 km
RES Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Ainsworth Wind Farm, NE	59 MW	Wind
Armenia Mountain Wind, PA	101 MW	Wind
Blue Canyon Wind Farm, OK	99 MW	Wind
*Brooke-Alvinston Wind Energy Project, ON	10 MW	Wind
Buffalo Gap III Wind Farm, TX	170 MW	Wind
Bull Creek Wind Farm, TX	180 MW	Wind
Butler Ridge, WI	54 MW	Wind
Cameron Ridge, CA	60 MW	Wind
Cedar Point Wind Energy Project, CO	250.2 MW	Wind
Central Plains Wind Farm, KS	99 MW	Wind
Crossroads Wind Energy Project, OK	227.5 MW	Wind
Dunlap Wind Energy Project, WY	111 MW	Wind
Flat Water Wind Farm, NE & KS	60 MW	Wind
*Greenwich Wind Energy Project, ON	99 MW	Wind
Gulf Wind Wind Farm, TX	283 MW	Wind
Hackberry Wind Farm, TX	166 MW	Wind
Harbor Wind Project, TX	9 MW	Wind
Harvest Wind, WA	99 MW	Wind

Hatchet Ridge Wind Farm, CA	101.2 MW	Wind
High Plains, WY	99 MW	Wind
Hopkins Ridge II Wind Farm, WA	7 MW	Wind
Hopkins Ridge Wind Farm, WA	149 MW	Wind
King Mountain Wind Ranch, TX	278 MW	Wind
Llano Estacado, NM	1 MW	Wind
Lone Star (Mequite and Post Oak) Wind Farm, TX	400 MW	Wind
Lower Snake River Wind Project, WA	343 MW	Wind
Marengo Wind Farm II, WA	71 MW	Wind
Marengo Wind Farm Phase I, WA	140 MW	Wind
McFadden Ridge I, WY	29 MW	Wind
Mountain Wind I Wind Farm, WY	29 MW	Wind
Mountain Wind II Wind Farm, WY	61 MW	Wind
Nine Canyon Wind Farm Phase I, WA	48 MW	Wind
Nine Canyon Wind Farm Phase II, WA	16 MW	Wind
Nine Canyon Wind Farm Phase III, WA	32 MW	Wind
NREL, CO	3.8 MW	Wind
NREL II, CO	2.0 MW	Wind
Pacific Crest, CA	47 MW	Wind
*Site Nordique Experimental en éolien Cours (SNEEC), QC	4.1 MW	Wind
South Trent Mesa, TX	101 MW	Wind
Sweetwater Wind Farm Phase II,TX	92 MW	Wind
Sweetwater Wind Farm Phase IV(B),TX	106 MW	Wind

Sweetwater Wind Farm Phase V, TX	81 MW	Wind
*Talbot Wind Energy Project, ON	99 MW	Wind
Whirlwind Energy Center, TX	60 MW	Wind
White Creek Wind Farm, WA	205 MW	Wind
Wigton Wind Farm, Jamaica	21 MW	Wind
Wild Horse Expansion Wind Project, WA	44 MW	Wind
Wild Horse Wind Farm, WA	229 MW	Wind
Wildcat Wind Project, NM	27.3 MW	Wind
Woodward Mountain Wind Ranch, TX	160 MW	Wind
Gaines Cavern Wind Project, TX	2.0 MW	Wind
*Halkirk 1 Wind Project, AB	149.4 MW	Wind
Mehoopany Wind Farm, PA	140.8 MW	Wind
Twin Ridges Wind Farm, PA	139.4 MW	Wind
*Rutley Solar Project, ON	10 MW	Solar
Webberville Solar, TX	30 MW	Solar
MidAmerican Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Bishop Hill II, IL	81 MW	Wind
Pinyon Pines Wind I CA	168 MW	Wind
Pinyon Pines Wind II CA	132 MW	Wind
AC Topaz, CA	550 MW	Solar
AC Agua Caliente, AZ	290 MW	Solar
Wailuku, HI	5 MW	Hydro
Chehalis, WA	520 MW	Natural Gas
Lake Side, UT	558 MW	Natural Gas
Currant Creek, UT	548 MW	Natural Gas
Hermiston, OR	237 MW	Natural Gas

Gadsby single-cycle, UT	120 MW	Natural Gas
Little Mountain, UT	14 MW	Natural Gas
Blundell Plant, UT	34 MW	Natural Gas Geothermal
Carbon Plant, UT	172 MW	Coal
Chehalis Generating Facility, WA	520 MW	Natural Gas
Currant Creek Plant, UT	550 MW	Natural Gas
Dave Johnston Plant, WY	762 MW	Coal
Gadsby Generation Facility, UT	353 MW	Natural Gas
Hunter Plant, UT	1,147 MW	Coal
Huntington Plant, UT	909 MW	Coal
Jim Bridger Plant, WY	1,412 MW	Coal
Lake Side Plant, UT	558 MW	Natural Gas
Naughton Plant, WY	700 MW	Coal
Wyodak Plant, WY	268 MW	Natural Gas, Coal
Cholla Plant, AZ	395 MW	Natural Gas, Coal
Colstrip Plant, MT	148 MW	Natural Gas, Coal
Craig Plant, CO	166 MW	Natural Gas, Coal
Hayden Plant, CO	78 MW	Natural Gas, Coal
Bear river, ID/UT	105 MW	Hydro, (decommissioned)
Condit, WA	137 MW	Hydro
Klamath, OR/CA	170 MW	Hydro
Lewis River, WA	578 MW	Hydro
North Umpqua, OR	204 MW	Hydro
Rogue river, OR	52 MW	Hydro
Wallowa Falls, OR	1.1 MW	Hydro
Blundell, UT	34 MW	Natural Gas
Dunlap Ranch 1, WY	111 MW	Wind
Foote Creek 1, WY	32.6 MW	Wind

Glenrock, WY	99 MW	Wind
Glenrock III, WY	39 MW	Wind
Goodnoe Hills, WA	94 MW	Wind
High Plains, WY	99 MW	Wind
Leaning Juniper 1, OR	100.5 MW	Wind
Marengo, WA	140.4 MW	Wind
Marengo II, WA	70.2 MW	Wind
McFadden Ridge 1, WY	28.5 MW	Wind
Rolling Hills, WY	99 MW	Wind
Seven Mile Hill, WY	99 MW	Wind
Seven Mile Hill II, WY	19.5 MW	Wind
Imperial Valley, CA	327 MW	Natural Gas
Cordova, IL	537 MW	Natural Gas
Power Resources, TX	212 MW	Natural Gas
Saranac, NY	240 MW	Natural Gas
Yuma, AZ	50 MW	Natural Gas
Casecnan, Philippines	150 MW	Hydro

***Denotes projects in Canada**

TAB E-2-3

Dunn & Bradstreet Review

Decide with Confidence

Comprehensive Report

Report viewed	10 Dec 2012
Subscriber Number	965-326483
Your Reference	RR Nov-12

▶ Collapse All ▶ Expand All

Identification & Summary

Click on the Section Headings to Collapse/Expand each section

HELP TOP

RENEWABLE ENERGY SYSTEMS HOLDINGS LTD

Risk Evaluation

D&B Rating	5A 1
D&B Risk Indicator	1
D&B Failure Score	100
D&B Delinquency Score	43
D&B Maximum Credit	£10,000,000

Legal Events

Number of Court Judgments	0
Value of all Court Judgments	0
Number of Mortgages and Charges	0

Associations

Parent Company	No
Number of Principals	9

Financial Summary

Latest Accounts Date	31 Oct 2011
Tangible Net Worth	£157,171,000
Turnover	£ 748,908,000

Identification

Main Trading Address	Beaufort Court Egg Farm Lane KINGS LANGLEY HERTFORDSHIRE WD4 8LR UNITED KINGDOM
Telephone Number	01923 299 200
Fax Number	01923 299 299
D-U-N-S® Number	73-653-6090
Registered Number	4913497
Web Address	www.res-group.com
Registered Address	Beaufort Ct, Egg Farm Lane Off Station Rd, Kings Langley, WD4 UNITED KINGDOM
Line of Business (SIC)	HOLDING COMPANY (6711)

D&B Risk Assessment

HELP TOP

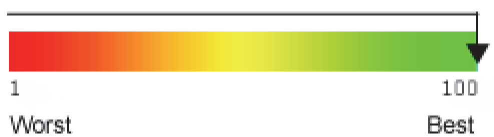
RISK OF BUSINESS FAILURE: MINIMUM

D&B Rating	**5A 1**	
Financial Strength	5A	(based on tangible net worth) £ 157,171,000
Risk Indicator	1	Represents a minimum risk of business failure.

D&B Maximum Credit **£ 10,000,000**

Maximum amount on monthly open credit terms.

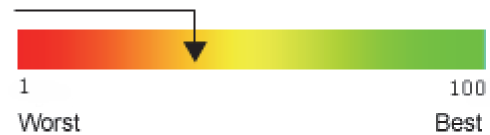
D&B Failure Score **100 out of 100** Help on scores



0% of UK businesses have a lower risk of failure.

Incidence of failure **0.03%** (3 per 10,000)

D&B Delinquency Score **43 out of 100** Help on scores



57% of UK businesses have a lower risk of paying significantly late.

Incidence of delinquency **10.94%** (1,094 per 10,000)

- The Failure and Delinquency Scores are both relative measures of risk allowing the ranking of all businesses in the UK database. This means that the scores show where a business ranks compared to all other businesses in the D&B UK database.
- The D&B Delinquency Score predicts the likelihood that a business will pay its obligations late within the next 12 months

Main Influencing Factors for Risk Evaluation

- There are few or no negative lead up events associated with the principals of this business.
- There are a large number of principals associated with this business.
- The cash figure for this business is strong.
- The liabilities to net worth ratio is satisfactory.
- We do not have trade data on this business.
- There are no outstanding CCJs or Scottish Decrees for this business or they are not material to the risk assessment.

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My e-Portfolio Data

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Today's Data (10.12.2012)		
Risk Indicator	1	
Failure Score	100	
Days Beyond Terms	Not avail.	
Credit Limit	GBP 10,000,000	

Initial Data (09.03.2006)	
Risk Indicator	1
Failure Score	98
Days Beyond Terms	Not avail.
Credit Limit	GBP 1,250,000

My Credit Limit	Not avail.	My Account Number	Not avail.
Notes to Account	Not avail.	My Reference	RR Nov-12

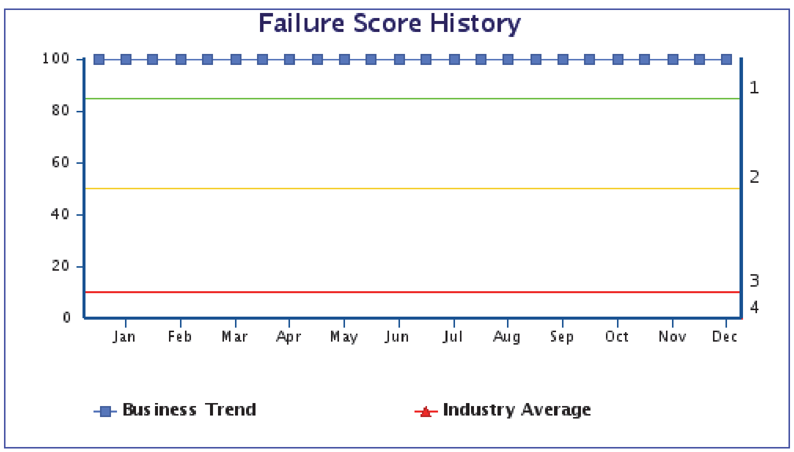
Click here to add / amend details

D&B Rating & Score - Industry Sector Comparison

HELP TOP

History and Industry Comparison of D&B Failure Score

The graph below shows the history of the D&B Failure Score for RENEWABLE ENERGY SYSTEMS HOLDINGS LTD over the last 12 months compared to the average for its industry group.



Commentary

Payment Industry Comparison

HELP TOP

Shown below is an industry comparison based on the 10,331 other businesses in same industry group as RENEWABLE ENERGY SYSTEMS HOLDINGS LTD where D&B has payment experiences.

Industry Payment Behaviour		
Upper quartile (top 25%)	pays within terms	Paydex of 80
Median (middle 50%)	pays 9 days beyond terms	Paydex of 74
Lower quartile (bottom 25%)	pays 20 days beyond terms	Paydex of 63

Public Notice Information

HELP TOP

Public Notice information is added to the D&B Database and, if present, will appear in this section. This section was last updated from public sources on 10 Dec 2012.

Judgments

Year	Total Judgments	Total Value	Closed Judgments	Value (Closed)
2012	0	0	0	0
2011	0	0	0	0
2010	0	0	0	0
2009	0	0	0	0
2008	0	0	0	0
Total	**0**	**0**	**0**	**0**

Mortgages and Charges

Number of registered charges: 0

Legal Filing Summary

Registered Number	4913497
Accounting Reference Date	3110
Latest Annual Return Date	26 Sep 2012
Latest Accounts Filed	31 Oct 2011

All public notice information has been obtained in good faith from the appropriate public sources.

Download documents on this business filed at Companies House

Special Events

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Critical legal notice information filed is investigated by D&B Analysts,and where relevant, comment is presented in this section.

- Shareholders amended

Current Principals

HELP TOP

There are currently **9** principals. There have been **0** appointments in the last 12 months.

To gain additional insight into the principal(s) of this business, **conduct a consumer credit search.**

Mr Cullum Mcalpine:

Position	Director
Date Appointed	04 Nov 2003
Address	40 Bernard Street , London , WC1N 1LG
Date of Birth	31 Jan 1947
Nationality	British
Occupation	Civil Engineering And Building

Other Current Associations

Company Name	Date Appointed
KNOTT PARK ONE LLP	17 Nov 2011
KNOTT PARK LTD	14 Nov 2011
DERYN PROPERTIES (INVESTMENT) LLP	25 Aug 2009
DERYN PROPERTIES LTD ⚠	12 Jun 2009
WHITE ROCK BUSINESS PARK LTD	03 Dec 2008
Partnership Accumulation Ltd	24 May 1999
BALCO (MARINE) LTD ⚠	03 May 1995
CHERRYMAIN LTD	20 Apr 1994
Sir Robert McAlpine (Holdings) Ltd	18 Jan 1994
DAILYFREE COMPANY LTD ⚠	11 Nov 1993
NEWARTHILL LTD	01 Oct 1993
SIR ROBERT MCALPINE LTD	06 Jun 1992
MCALPINE,SIR ROBERT,(CONSTRUCTION) LTD ⚠	07 May 1992
MCALPINE,SIR ROBERT,(WESTERN) LTD ⚠	20 Sep 1991
VERTICAL AXIS WIND TURBINES LTD ⚠	05 Sep 1991

This principal has other associations

Previous Associations

Company Name	Date Appointed	Date Resigned
CAFEFIRST LTD	10 Aug 2005	30 Jan 2008

SMV INVESTMENTS	30 Jan 2004	02 Jun 2006
RES-GEN LTD	05 Nov 2003	01 Jul 2008
Mitie Group PLC	01 Apr 2003	31 Jul 2008
Deanminster Ltd	12 Apr 2002	01 Apr 2004
Renewable Energy Systems Ltd	04 Sep 1998	25 Feb 2009
EDEN PROJECT LTD	02 Feb 1998	24 May 2010
MCAULAY DEVELOPMENTS LTD	20 Apr 1994	01 Apr 2008
WINNER DEVELOPMENTS LTD	14 Jun 1991	01 Dec 2004
GLENDURHAM LTD	06 Jun 1991	22 Jul 2010

Susan Mary Reilly:

Position	Director
Date Appointed	27 Jan 2010
Address	Beaufort Court Egg Farm Lane, Off Station Road , Kings Langley , Hertfordshire , WD4 8LR
Date of Birth	26 Apr 1961
Nationality	British
Occupation	Deputy Chief Executive Officer

Other Current Associations

Company Name	Date Appointed
HELIOS SOCIAL ENTERPRISE	23 Nov 2009

Previous Associations

Company Name	Date Appointed	Date Resigned
Scottish Power UK PLC	29 Aug 2006	30 Jun 2008
Scottishpower Investments Ltd	29 Aug 2006	30 Jun 2008
Scottish Power UK Holdings Ltd	29 Aug 2006	30 Jun 2008
SCOTTISH POWER UK GROUP LTD	29 Aug 2006	30 Jun 2008
COLDHAM WINDFARM LTD	29 Sep 2004	23 Jun 2005
SCOTTISHPOWER (DCL) LTD	01 Jun 2004	11 Jun 2004
SCOTTISHPOWER (DCOL) LTD	01 Jun 2004	11 Jun 2004
Sterling Collections Ltd	28 May 2004	23 Jun 2005
HOLFORD GAS STORAGE LTD	14 Aug 2003	23 Jun 2005
MANWEB GENERATION HOLDINGS LTD	01 Apr 2003	23 Jun 2005
SCOTTISHPOWER RENEWABLES (UK) LTD	01 Apr 2003	23 Jun 2005

BEAUFORT ENERGY LTD ⚠	01 Apr 2003	23 Jun 2005
RENEWABLES NORTHWEST LTD ⚠	17 Dec 2002	26 Apr 2006
CELTPOWER LTD	19 Feb 2002	31 Mar 2003
SCOTTISHPOWER ENERGY MANAGEMENT (AGENCY) LTD	09 Oct 2001	23 Jun 2005

David Stannard Jenkins:

Position	Director
Date Appointed	13 Jun 2006
Address	Beaufort Court Egg Farm Lane , Kings Langley , Hertfordshire , WD4 8LR
Date of Birth	13 Apr 1944
Nationality	British
Occupation	Chartered Accountant

No other current associations

Previous Associations

Company Name	Date Appointed	Date Resigned
DOWNE HOUSE SCHOOL	07 Jan 2003	16 Nov 2011

Miles Colin Shelley: Aca

Position	Director
Date Appointed	04 Nov 2003
Address	20 Tuffnells Way , Harpenden , Hertfordshire , AL5 3HQ
Date of Birth	13 May 1961
Nationality	British
Occupation	Chartered Accountant

Other Current Associations

Company Name	Date Appointed
MCALPINE OFFSHORE LTD	19 Apr 2011
BRITISH CONTRACTS CO LTD	19 Apr 2011
CARDIFF GATE LTD ⚠	22 Jul 2010
GLENDURHAM LTD ⚠	22 Jul 2010
IMBERFIELD LTD ⚠	22 Jul 2010
BANKSIDE ELECTRICAL CONTRACTORS LTD	05 May 2005

DERBY JOINERY LTD	05 May 2005
Brickworth Development Ltd	30 Jun 2004
HERBRAND LTD	30 Jun 2004
SIR ROBERT MCALPINE LTD	30 Jun 2004
Sir Robert McAlpine (Holdings) Ltd	30 Jun 2004
ST. BLAISE (1998) LTD	30 Jun 2004
R M P A SERVICES PLC	27 Oct 2003
RMPA NOMINEES LTD	24 Oct 2003
RMPA HOLDINGS LTD	24 Oct 2003

This principal has other associations

Previous Associations

Company Name	Date Appointed	Date Resigned
RINGMOORS PROPERTIES LTD	30 Jun 2004	19 Jul 2004
MAJORPARK LTD	30 Jun 2004	19 Jul 2004
NORTHERNMICRO DEVELOPMENTS LTD	30 Jun 2004	20 Apr 2012
MARCHMONT PROPERTIES LTD	30 Jun 2004	19 Jul 2004
RES-GEN LTD	05 Nov 2003	01 Jul 2008
ALTAHULLION WIND FARM LTD	22 Oct 2002	26 Aug 2003
LENDRUM'S BRIDGE WIND FARM NO.2 LTD	30 Apr 2002	20 Jun 2003
Autolink Holdings (A19) Ltd	19 Jul 2000	30 Jun 2004
AUTOLINK CONCESSIONAIRES (A19) LTD	19 Jul 2000	30 Jun 2004
Summit Holdings (Wishaw) Ltd	12 Oct 1998	17 Mar 2004
Summit Healthcare (Wishaw) Ltd	12 Oct 1998	16 Mar 2004
SUMMIT FINANCE (WISHAW) PLC	12 Oct 1998	16 Mar 2004
AUTOLINK CONCESSIONAIRES (M6) PLC	16 Apr 1997	16 Apr 2012
AUTOLINK HOLDINGS (M6) LTD	16 Apr 1997	16 Apr 2012

Gavin Malcolm Mcalpine:

Position	Director
Date Appointed	06 Apr 2004
Address	40 Bernard Street , London , WC1N 1LG
Date of Birth	17 May 1976

Nationality	British
Occupation	Company Director

Other Current Associations

Company Name	Date Appointed
SOLAR SLATE LTD	17 Sep 2009
RES NORTHERN EUROPE LTD ⚠	17 Aug 2009
RES ENTERPRISES LTD	27 May 2009
Renewable Energy Systems Ltd	20 May 2005

Previous Associations

Company Name	Date Appointed	Date Resigned
RES On-Site Ltd	11 May 2007	24 Dec 2009
RES-GEN LTD	20 May 2005	01 Jul 2008

David Stannard Jenkins:

Position	Director
Date Appointed	13 Jun 2006
Address	40 Bernard Street , London , WC1N 1LG
Date of Birth	13 Apr 1944
Nationality	British
Occupation	Chartered Accountant

No other current associations

Dr Ian David Mays: Mbe

Position	Director
Date Appointed	04 Nov 2003
Address	The Shires, Chapel Croft , Chipperfield , Hertfordshire , WD4 9DR
Date of Birth	28 Aug 1953
Nationality	British
Occupation	Engineer

Other Current Associations

Company Name	Date Appointed
RES ENTERPRISES LTD	26 May 2009
TEMERAIRE HEIGHTS LTD	07 Sep 2008

RES NORTHERN EUROPE LTD ⚠	05 Nov 2003
RENEWABLE ENERGY GROUP LTD	05 Nov 2003
RENEWABLE ENERGY SYSTEMS CONSTRUCTION LTD	31 Oct 2003
RENEWABLE ENERGY SYSTEMS ASIA PACIFIC LTD ⚠	31 Oct 2003
WESTERN WIND FARMS LTD ⚠	06 Jan 1997
Wind Energy Systems Ltd	19 Nov 1996
RENEWABLE ENERGY CENTRE LTD	08 Dec 1995
Renewable Energy Systems Ltd	07 May 1992

Previous Associations

Company Name	Date Appointed	Date Resigned
RES HEAT & POWER LTD	14 Oct 2008	27 Jan 2011
FUTURE HEATING LTD	08 May 2008	08 Oct 2008
RES FUELS LTD	03 Sep 2007	13 Oct 2008
PASSIVHAUS (UK) LTD	08 Aug 2007	16 Oct 2008
RES INBUILT LTD	08 Aug 2007	16 Oct 2008
GB-SOL LTD	14 May 2007	30 Sep 2008
PV SYSTEMS LTD	14 May 2007	30 Sep 2008
RES SOLAR LTD	14 May 2007	30 Sep 2008
RES ESCO LTD	11 May 2007	13 Oct 2008
RES On-Site Ltd	11 May 2007	24 Dec 2009
EARTHENERGY UTILITY LTD ⚠	26 Mar 2007	09 Oct 2008
EARTHENERGY LTD ⚠	26 Mar 2007	09 Oct 2008
WOOD ENERGY LTD	16 Nov 2006	23 Sep 2008
WOOD ENERGY ESCO LTD.	16 Nov 2006	23 Sep 2008
RENEWABLES EAST	01 Jun 2005	22 Sep 2010

Donald Crawford Joyce:

Position	Director
Date Appointed	07 Dec 2010
Address	Beaufort Court Egg Farm Lane , Kings Langley , Herts , WD4 8LR
Date of Birth	11 Nov 1973
Nationality	British
Occupation	Chief Financial Officer

Other Current Associations

Company Name	Date Appointed
RES NORTHERN EUROPE LTD ⚠	07 Dec 2010
RENEWABLE ENERGY SYSTEMS ASIA PACIFIC LTD ⚠	07 Dec 2010
Renewable Energy Systems Ltd	07 Dec 2010

Dominic James Hearth:

Position	Company Secretary
Date Appointed	01 Jul 2008
Address	20 Ashchurch Grove , London , W12 9BT
Date of Birth	04 Feb 1966
Nationality	British

Other Current Associations

Company Name	Date Appointed
GREEN HILL ENERGY LIMITED	06 Jul 2009
HILL OF TOWIE LTD	06 Jul 2009
WIND TURBINE DEVELOPMENTS LTD	01 Jul 2008
WRYDE CROFT WIND FARM LTD	12 Jan 2005
Renewable Energy Systems Ltd	10 May 2004
FOUR BURROWS LTD	10 May 2004
FORSS WIND FARM LTD.	10 May 2004
DYFFRYN BRODYN LTD	10 May 2004
RES DEVELOPMENTS LTD	10 May 2004
RES HEAT & POWER LTD	10 May 2004
RES NORTHERN EUROPE LTD ⚠	10 May 2004
RES UK & IRELAND LTD	10 May 2004
RENEWABLE ENERGY GROUP LTD	10 May 2004
RES Wind Farm Holdings Ltd	10 May 2004
Wind Energy Systems Ltd	10 May 2004

This principal has other associations

Previous Associations

Company Name	Date Appointed	Date Resigned

GLENS OF FOUDLAND WIND FARM LTD	10 May 2004	08 Oct 2004
146 Elgin Avenue Ltd	22 Apr 2003	04 Nov 2006

favourable out of business

unfavourable out of business

Previous Principals

HELP TOP

Michael Robert O'Neill Ba Hons Aca (Appointed 04 Nov 2003, Resigned 01 Jul 2008)

Address	Langley Vale , 134 Chipperfield Road , Kings Langley , Hertfordshire , WD4 9JD
Date of Birth	17 Jan 1968
Nationality	British
Date Appointed	04 Nov 2003

Other Current Associations

Company Name	Date Appointed
TULLYMURDOCH LTD	12 Jun 2012
BNRG SOUTH PETHERWIN LTD	03 Feb 2011
BNRG WHIMPLE LTD	03 Feb 2011
BNRG CURRY RIVEL LTD	03 Feb 2011
BNRG CHEVITHORNE LTD	03 Feb 2011
BNRG ST. CLETHER LTD	03 Feb 2011
BNRG TREGULLAND LTD	03 Feb 2011
BNRG ALTARNUN LTD	03 Feb 2011
BNRG NORTH PETHERWIN LTD	03 Feb 2011
BNRG PURITON NO. 2 LTD	20 Dec 2010
RDS ELEMENT POWER LTD	17 Dec 2010
BNRG ELEMENT POWER LTD	10 Dec 2010
Element Power Northern Europe Developments Ltd	19 Nov 2010
ELEMENT POWER LTD	13 Oct 2008

Previous Associations

Company Name	Date Appointed	Date Resigned
BRIDGEWATER SOLAR LTD	20 Dec 2010	27 Feb 2012
PURITON SOLAR LTD	20 Dec 2010	27 Feb 2012
RENEWABLE ENERGY SYSTEMS (NORTHERN IRELAND) LTD	19 May 2006	01 Jul 2008
WOLF BOG WIND FARM LTD ⚠	16 Nov 2005	23 Mar 2007
Lough Hill Wind Farm Ltd	17 Jun 2005	28 Jan 2008
WIND FARM DEVELOPMENTS LTD	23 Mar 2005	01 Jul 2008
LENDRUM'S BRIDGE WIND FARM LTD	10 Mar 2005	28 Jan 2008
LENDRUM'S BRIDGE (HOLDINGS) LTD	10 Mar 2005	22 Jan 2008
WRYDE CROFT WIND FARM LTD	12 Jan 2005	01 Jul 2008
	08 Sep 2004	31 Oct 2005

CALLAGHEEN WIND FARM LTD ⚠		
PRYSAN WINDFARM LTD	22 Jan 2004	01 Jul 2008
CORSTON WINDFARM LTD	22 Jan 2004	01 Jul 2008
MYNYDD CLOGAU WINDFARM LTD	22 Jan 2004	25 Feb 2005
CEFN CROES WINDFARM LTD	22 Jan 2004	01 Jul 2008
RES HEAT & POWER LTD	05 Nov 2003	10 May 2004

Patrick Hugh Walker Taylor (Appointed 25 Nov 2003, Resigned 08 Mar 2005)

Address	15 Upper Hill Rise , Rickmansworth , Hertfordshire , WD3 7NU
Date of Birth	19 Sep 1946
Nationality	British
Occupation	Group Financial Director
Date Appointed	25 Nov 2003

Other Current Associations

Company Name	Date Appointed
TWO PARKS DEVELOPMENTS LTD ⚠	22 Jul 1996
RIVER ROAD INVESTMENTS LTD ⚠	22 Jul 1996
MARCHMONT ESTATES LTD ⚠	22 Jul 1996
OXFORD COURT (MANCHESTER) LTD ⚠	11 Apr 1996
COLGUY HOLDINGS LTD ⚠	25 Mar 1996
LAKEFOREST INVESTMENTS LTD ⚠	25 Mar 1996
NINEGRADE LTD ⚠	25 Mar 1996
GLOSSWALL HOUSE INVESTMENTS LTD ⚠	15 Mar 1996
MCALPINE,SIR ROBERT,SERVICES LTD ⚠	15 Mar 1996

Previous Associations

Company Name	Date Appointed	Date Resigned
IMMUPHARMA UK LTD ⚠	15 Feb 2006	13 Jun 2007
IMMUPHARMA PLC	15 Feb 2006	13 Jun 2007
REDDIFORD SCHOOL TRUSTEE	04 Jul 2004	10 Oct 2006

ST. BLAISE (1998) LTD	09 Mar 2004	30 Jun 2004
MC ALPINE ENTERPRISES LTD	06 Aug 2003	25 Nov 2004
DERBY JOINERY LTD	11 Mar 2002	01 Mar 2005
AQUAE SULIS LTD	30 Apr 1999	30 Jun 2004
NORTHERNMICRO DEVELOPMENTS LTD	04 Oct 1996	30 Jun 2004
RINGMOORS PROPERTIES LTD	22 Jul 1996	30 Jun 2004
Brickworth Development Ltd	22 Jul 1996	30 Jun 2004
HERBRAND LTD	22 Jul 1996	30 Jun 2004
SIR ROBERT MCALPINE PROPERTIES LTD	22 Jul 1996	30 Jun 2004
Sir Robert McAlpine Capital Ventures Ltd	22 Jul 1996	30 Jun 2004
MARCHMONT PROPERTIES LTD	22 Jul 1996	30 Jun 2004
BRITISH CONTRACTS CO LTD	22 Jul 1996	30 Jun 2004

Bondlaw Directors Limited (Appointed 26 Sep 2003, Resigned 04 Nov 2003)

Address	39-49 Commercial Road , Southampton , Hampshire , SO15 1GA
Nationality	British
Occupation	Corporate Body
Date Appointed	26 Sep 2003

Other Current Associations

Company Name	Date Appointed
BONDCO 880 LTD	12 Jun 2003
BONDCO 964 LTD	19 Dec 2002
BONDCO 962 LTD	19 Dec 2002
BONDCO 790 LTD	21 Feb 2000
BONDCO 763 LTD	07 Dec 1999
Capitol Energy Supplies Ltd	14 Aug 1998
European College of Aviation Training Ltd	07 Jul 1998
Air Bravo Ltd	24 Feb 1997

AIR SHANNON LTD	24 Feb 1997
AIR BELFAST LTD	24 Feb 1997
Plymouth Recycling 2000 Ltd	12 Aug 1996
Carmarthen Waste Management Ltd	14 Feb 1996
PORTLAND TRANSPORT LTD	10 Sep 1992
BARRY-LINE BUS CO LTD	05 Feb 1992

Previous Associations

Company Name	Date Appointed	Date Resigned
EAGLE LAND 002 LTD	09 Jan 2008	13 Mar 2008
KNARVEL LTD	26 Mar 2007	07 Jun 2007
CONTOURGLOBAL EUROPE LTD	26 Mar 2007	05 Jun 2007
GRAPHIC SUPPLIES LTD	20 Dec 2005	10 Jan 2006
TRIDENT UNDERWRITING LTD	15 Dec 2005	20 Mar 2006
OAKS GATE (TENTERDEN) MANAGEMENT CO LTD	16 Sep 2005	31 May 2006
ENGINEERING EMPLOYERS' FEDERATION CYMRU WALES LTD	29 Sep 2003	30 Sep 2003
RENEWABLE ENERGY GROUP LTD	26 Sep 2003	05 Nov 2003
YORK HOUSE (CHEAM) MANAGEMENT CO LTD	09 May 2003	29 Jul 2004
R3solve Ltd	22 Jan 2003	15 Sep 2010
MORANDE EUROPE LTD	19 Dec 2002	04 Mar 2003
LONE EAGLE INVESTMENTS LTD	19 Dec 2002	21 Feb 2003
PARKINS GROUP LTD	19 Dec 2002	02 Apr 2003
Fairfield12 Ltd	19 Dec 2002	11 Aug 2003
Pro Resolve Software Ltd	24 Oct 2002	16 Jan 2003

Bondlaw Secretaries Limited (Appointed 26 Sep 2003, Resigned 04 Nov 2003)

Address	Oceana House , 39-49 Commercial Road , Southampton , Hampshire , SO15 1GA
Nationality	British
Date Appointed	26 Sep 2003

Other Current Associations

Company Name	Date Appointed
Bondco 1101 Ltd ⚠	06 Nov 2006
ARJO WIGGINS NORTH AMERICA INVESTMENTS	24 Jan 2005
ARJO WIGGINS US HOLDINGS	24 Jan 2005
ARJO WIGGINS APPLETON HOLDINGS	24 Jan 2005
WIGGINS TEAPE PENSIONS LTD	24 Jan 2005
AWA FINANCE ⚠	24 Jan 2005
FASTNET ESTATES LTD	09 May 2004
CARTUS RELOCATION LTD	25 Mar 2004
Duval Surface Cleaning System Co Ltd ⚠	18 Aug 2003
BONDCO 880 LTD ⚠	12 Jun 2003
MY6 LTD	07 Jun 2003
LAMOR CORPORATION UK LTD	29 May 2003
PENINSULA MILK PRODUCERS LTD ⚠	17 Mar 2003
AGRICAPITAL EUROPE LIMITED ⚠	29 Jan 2003
R3solve Ltd	22 Jan 2003

This principal has other associations

Previous Associations

Company Name	Date Appointed	Date Resigned
THE CORNWALL FOUNDATION OF PROMISE LTD	06 Mar 2006	28 Apr 2008
ANTALIS SA HOLDINGS LTD	24 Jan 2005	30 Jan 2008
Antalis Europe Holdings ⚠	24 Jan 2005	28 May 2007
Antalis Holdings Ltd	24 Jan 2005	30 Jan 2008
Antalis Group	24 Jan 2005	30 Jan 2008
Windward Prospects Ltd	24 Jan 2005	18 May 2009
ANTALIS OVERSEAS HOLDINGS LTD	24 Jan 2005	30 Jan 2008
Antalis Group Holdings Ltd	24 Jan 2005	30 Jan 2008
VISUAL CLARITY LTD ⚠	16 Sep 2004	18 Dec 2006
Terran Systems Ltd	30 Jul 2004	13 Jul 2005
R.M.B. TRADING LTD	13 May 2004	02 Aug 2004
CARBONLESS PAPERS LTD ⚠	31 Mar 2004	22 Jul 2005

ARJO WIGGINS CARBONLESS PAPERS INTERNATIONAL LTD	31 Mar 2004	22 Jul 2005
IDEM LTD	31 Mar 2004	22 Jul 2005
ARJO WIGGINS CARBONLESS PAPERS LTD	31 Mar 2004	22 Jul 2005

favourable out of business

unfavourable out of business

Subsidiaries

HELP TOP

Company Name	Operates As	Year Started	% Shares owned
RES ENTERPRISES LTD	Holding companies, NEC	-	-
RENEWABLE ENERGY SYSTEMS LTD	ELECTRIC SERVICES	1988	-
RES MEDITERRANEE	REAL ESTATE AGENTS AND MANAGERS	1900	-

Click here to see the Global Family Tree for this business

Click here for Global Family Tree with Minority Holdings

Branches

HELP TOP

RENEWABLE ENERGY SYSTEMS HOLDINGS LTD has **1** branch(es) or division(s)

Address
Renewable Energy Systems Holdings Ltd, Unit 7000, Gower Street, Glasgow, G51 1PR, LANARKSHIRE

Legal Structure

HELP TOP

Legal Form	Private Limited Liability Company
Date Started	2003
Date of Registration	26 Sep 2003
Registered Number	4913497
Registered office	Beaufort Ct, Egg Farm Lane Off Station Rd, Kings Langley, WD4
Summary Issued Capital	60,000,000 divided into 60,000,000 Ordinary shares of 1 each,

Operations

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Operating as	SIC Code	NACE Code	UK SIC Code
HOLDING COMPANY	6711	74.15	74.151

Holding company for renewable energy

Other Operating Details

Employees 624

Financial Summary

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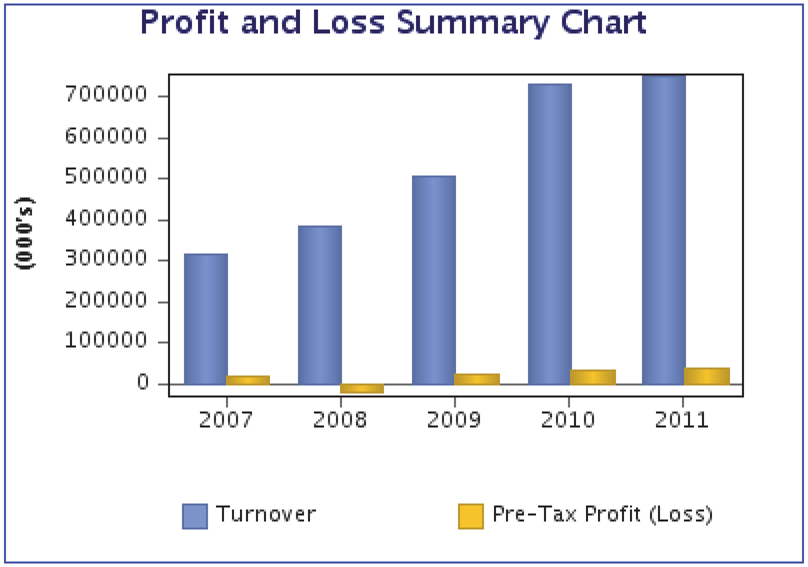
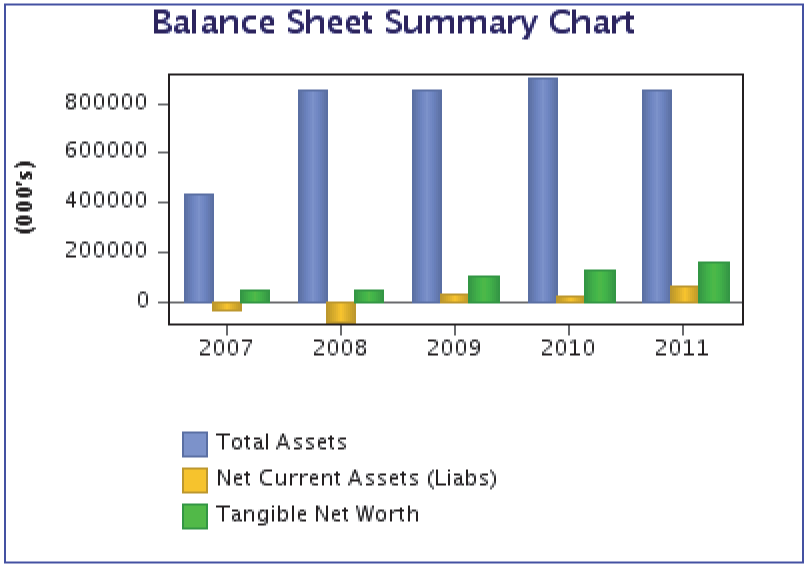
	Fiscal Consolidated GBP 31 Oct 2011 (000's)	Fiscal Consolidated GBP 31 Oct 2010 (000's)	Fiscal Consolidated GBP 31 Oct 2009 (000's)	Fiscal Consolidated GBP 31 Oct 2008 (000's)	Fiscal Consolidated GBP 31 Oct 2007 (000's)
Sales Turnover	748,908	729,467	506,043	383,534	318,067
Exports	672,602	670,477	394,223	315,962	287,372
Profit / (Loss) Before Taxes	37,561	31,828	21,626	(21,273)	20,549
Equity Shareholders Funds	168,895	138,253	120,031	62,904	65,025
Tangible Net Worth	157,171	124,019	103,835	45,084	48,341
Total Fixed Assets	579,362	590,403	574,549	545,259	271,568
Total Assets	867,668	919,957	866,135	868,767	454,261
Total Current Assets	288,306	329,554	291,586	323,508	182,693
Total Current Liabilities	223,905	306,307	262,062	407,965	215,927
Net Current Assets (Liabilities)	64,401	23,247	29,524	(84,457)	(33,234)
Long Term Debt	474,868	475,397	484,042	397,898	173,309
Employees**	990	781	624	461	315

(** not in 000's)





Profit And Loss Accounts

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	Fiscal Consolidated GBP 31 Oct 2011 (000's)	Fiscal Consolidated GBP 31 Oct 2010 (000's)	Fiscal Consolidated GBP 31 Oct 2009 (000's)	Fiscal Consolidated GBP 31 Oct 2008 (000's)	Fiscal Consolidated GBP 31 Oct 2007 (000's)
Net Sales	**748,908**	**729,467**	**506,043**	**383,534**	**318,067**
Including Exports of	672,602	670,477	394,223	315,962	287,372
Cost of sales	622,759	624,042	411,635	346,290	268,429
Gross Profit / (loss)	**126,149**	**105,425**	**94,408**	**37,244**	**49,638**
General Expenses	48,466	45,840	51,516	35,751	20,497
Other Operating Income	-	3,271	-	-	-
Other Operating charges	1,002	149	951	1,394	331
Net Operating Income	**76,681**	**62,707**	**41,941**	**99**	**28,810**
Interest receivable / non group interest	512	-	11,679	2,145	2,713
Group related financial income	1,079	1,915	41	72	176
Other financial income	1,120	4	-	1,241	1,434
Total Financial Income	**2,711**	**1,919**	**11,720**	**3,458**	**4,323**
Interest Payable	23,794	-	24,646	20,598	10,958
Other Group Financial Expenses	18,037	32,798	7,389	4,232	1,626
Total Financial Expenses	**41,831**	**32,798**	**32,035**	**24,830**	**12,584**
Profit / (Loss) Before Taxes	**37,561**	**31,828**	**21,626**	**(21,273)**	**20,549**
Corporation Tax	1,433	(3,602)	2,514	(3,618)	(495)
Prior Adjustment of corporation tax	2,897	(2,530)	(1,682)	(770)	-
Total Corporation Tax	4,330	(6,132)	(32,320)	(4,388)	(495)
Deferred Taxation	(6,330)	11,500	10,755	7,329	(3,595)
Prior year adjustments	-	-	-	-	(915)
Total Other Tax	1,948	20,813	12,656	(7,693)	9,777
Profit / (Loss) After Taxes	**31,283**	**17,147**	**41,290**	**(9,192)**	**11,267**
Exceptional Items	-	429	(250)	(197)	(206)
Net Income	**31,283**	**16,718**	**41,540**	**-**	**11,473**
Dividends	0	0	0	0	0
Retained Profit for the year	**31,283**	**16,718**	**41,540**	**(8,995)**	**11,473**
Reconciliation					
Retained Earnings at start of year	70,557	53,839	12,299	21,294	9,821

	Retained Profit for the year	31,283	16,718	41,540	(8,995)	11,473
	Retained Earnings at end of year	101,840	70,557	53,839	12,299	21,294
NOTES						
	Payroll	69,782	62,090	58,732	32,557	27,024
	Depreciation	35,246	35,927	36,294	18,356	12,820
	Directors Remuneration **	1,658,000	1,100,000	1,569,000	1,316,000	1,337,000
	Audit Fee **	654,000	716,000	622,000	585,000	345,000
	Non Audit Fee **	240,000	159,000	100,000	179,000	94,000
	Number of Employees **	990	781	624	461	315
	Auditors Remuneration **	894,000	875,000	722,000	764,000	439,000

(** not in 000's)

Balance Sheet

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		Fiscal Consolidated GBP 31 Oct 2011 (000's)	Fiscal Consolidated GBP 31 Oct 2010 (000's)	Fiscal Consolidated GBP 31 Oct 2009 (000's)	Fiscal Consolidated GBP 31 Oct 2008 (000's)	Fiscal Consolidated GBP 31 Oct 2007 (000's)
FIXED ASSETS						
	Other Intangibles	11,724	14,234	16,196	17,820	16,684
	Total Intangible Assets	**11,724**	**14,234**	**16,196**	**17,820**	**16,684**
	Land & Buildings	92,480	60,668	15,840	249,016	63,913
	Fixtures & Equipment	455,524	491,091	540,089	274,370	186,290
	TANGIBLE FIXED ASSETS	**548,004**	**551,759**	**555,929**	**523,386**	**250,203**
	Long Term Investments	19,634	24,410	2,424	4,053	4,037
	Other long term assets	-	-	-	-	644
	Total Fixed Assets	**579,362**	**590,403**	**574,549**	**545,259**	**271,568**
CURRENT ASSETS						
	Work in progress	36,516	32,687	23,127	12,313	3,618
	Other	379	120	827	51,397	0
	Stock & work in progress	**36,895**	**32,807**	**23,954**	**63,710**	**3,618**
	Cash at bank / in hand	113,270	115,746	138,985	63,806	97,947
	Trade Debtors	75,581	102,089	75,621	120,055	49,513
	Other receivables	3,691	4,299	1,971	205	867
	Prepayments	20,942	33,132	26,279	30,440	21,408
	Tax recoverable	26,693	31,329	21,492	41,709	6,605
	Amounts owed by group companies	11,234	10,152	3,284	3,583	2,735
	Total Current Assets	**288,306**	**329,554**	**291,586**	**323,508**	**182,693**
CURRENT LIABILITIES						
	Trade Creditors	35,555	57,895	35,896	34,502	41,180
	Accruals / Deferred Income	85,885	104,155	59,424	91,610	56,016
	Bank loans & overdrafts	39,498	47,786	54,710	90,714	60,385
	Tax & Social Security	18,824	15,426	11,493	3,220	7,578
	Amounts due to group companies	127	65	77	71,997	23,653
	Other Current Liabilities	44,016	80,980	100,462	115,922	27,115
	Total Current Liabilities	**223,905**	**306,307**	**262,062**	**407,965**	**215,927**

	Net Current Assets (Liabilities)	**64,401**	**23,247**	**29,524**	**(84,457)**	**(33,234)**
	Total Assets less Current Liabilities	**643,763**	**613,650**	**604,073**	**460,802**	**238,334**
LONG-TERM LIABILITIES						
	Amounts due to group companies	36,000	43,000	49,204	-	-
	Deferred Taxation	19,746	29,393	-	16,189	4,965
	Other Borrowing/Mortgages & Loans	410,400	393,996	403,951	368,523	154,624
	Minority Interests	-	630	-	-	-
	Other long term liabilities	8,722	8,378	30,887	13,186	13,720
	Total Long Term Liabilities	**474,868**	**475,397**	**484,042**	**397,898**	**173,309**
	Net Assets	**168,895**	**138,253**	**120,031**	**62,904**	**65,025**
Net Worth / Shareholders Funds						
	Issued Share Capital	60,000	60,000	60,000	37,000	37,000
	Reserves	7,055	7,696	6,192	13,605	6,731
	Retained Earnings / Profit & Loss Account	101,840	70,557	53,839	12,299	21,294
	Equity Shareholders Funds	**168,895**	**138,253**	**120,031**	**62,904**	**65,025**
	Tangible Net Worth	**157,171**	**124,019**	**103,835**	**45,084**	**48,341**
Notes to the Balance Sheet						
	Highest Paid Director **	785,000	738,000	899,000	878,000	1,337,000
	Guarantees given to pay off indebtedness	No	No	No	No	No
	Operating Lease Commitments Plant & Machinery (or other)	448	822	447	196	-
	Operating Lease Commitments Land & Building	4,956	14,697	3,806	2,295	1,391
	Total Operating Lease Commitments	**5,404**	**15,519**	**4,253**	**2,491**	**1,391**

(** not in 000's)

AUDITORS/REGISTRARS:

AUDITORS
Deloitte LLP, London

Cash Flow Statement

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	31 Oct 2011 (000's)	31 Oct 2010 (000's)	31 Oct 2009 (000's)	31 Oct 2008 (000's)	31 Oct 2007 (000's)
Cash Inflow from Operating Activities	61,514	102,052	173,869	-	-
Returns on investment & servicing of finance	(24,886)	(29,010)	(29,723)	-	-
Taxation	(2,264)	2,379	(4,680)	-	-
Capital Expenditure & Financial Investment	(40,546)	(81,556)	(45,434)	-	-
Acquisitions & disposals	-	(883)	(3,407)	-	-
Cash Inflow (outflow) before use of liquid assets & financing	**(6,182)**	**(7,018)**	**90,625**	**-**	**-**
Financing	3,522	(25,395)	(13,669)	-	-
Increase (Decrease) in cash in the year	**(2,660)**	**(32,413)**	**76,956**	**-**	**-**

Key Financial Ratios

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	31 Oct 2011	31 Oct 2010	31 Oct 2009	31 Oct 2008	31 Oct 2007
Profitability					
Profit Margin (%)	5	4.4	4.3	(5.5)	6.5
Shareholders' Return (%)	23.9	25.7	20.8	(47.2)	42.5
Return On Capital (%)	5.8	5.2	3.6	(4.6)	8.6
Return On Assets (%)	4.3	3.5	2.5	(2.4)	4.5
Financial Status					
Acid Test (x)	0.8	0.7	0.8	0.5	0.7
Current Ratio (x)	1.3	1.1	1.1	0.8	0.8
Solvency Ratio (%)	444.6	630.3	718.5	1,787.5	805.2
Fixed Assets/Net Worth (%)	348.7	444.9	535.4	1,160.9	517.6
Current Liabilities/Net Worth (%)	142.5	247	252.4	904.9	446.7
Current Liabilities/Stocks (%)	606.9	933.7	1,094	640.3	5,968.1
Asset Utility					
Stock Turnover Rate	20.3	22.2	21.1	6	87.9
Collection Period (days)	36.8	51.1	54.5	114.3	56.8
Asset Turnover (%)	86.3	79.3	58.4	44.1	70
Sales / Net Working Capital (x)	11.6	31.4	17.1	(4.5)	(9.6)
Assets / Sales (%)	115.9	126.1	171.2	226.5	142.8
Creditors / Sales (days)	17.3	29	25.9	32.8	47.3
Employee					
Capital / Employee*	650.3	785.7	968.1	999.6	756.6
Sales / Employee*	756.5	934	811	832	1,009.7
Profit / Employee*	37.9	40.8	34.7	(46.1)	65.2
Employee Average Wage*	70.5	79.5	94.1	70.6	85.8

(* in 000's)

Download accounts and annual returns on this business filed at Companies House

Growth Rates

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	2011 vs 2010	2011 vs 2009	2011 vs 2008	2011 vs 2007
Turnover	2.67	47.99	95.27	135.46
Gross Profit	19.66	33.62	238.71	154.14
Net Operating Profit	22.28	82.83	77,355.56	166.16
Profit Before Tax	18.01	73.68	276.57	82.79
Profit After Tax	82.44	(24.24)	440.33	177.65
Net Profit for the year	82.44	(24.24)	440.33	177.65
Number of Employees	26.76	58.65	114.75	214.29
Profit / Employee	(7.11)	9.22	182.21	(41.87)
Total Intangible Assets	(17.63)	(27.61)	(34.21)	(29.73)
Current Assets	(12.52)	(1.12)	(10.88)	57.81
Total Assets	(5.5)	0.71	0.59	95.61
Current Liabilities	(26.9)	(14.56)	(45.12)	3.69
Net Current Assets (Liabilities)	177.03	118.13	176.25	293.78
Total Assets less Current Liabilities	4.91	6.57	39.7	170.11
Long Term Liabilities	(0.11)	(1.9)	19.34	174
Net Assets	22.16	40.71	168.5	159.74

Financial Notes / Opinions

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Year	Unfavourable	Financial Notes / Opinions
31 Oct 2011	No	-
31 Oct 2010	No	-
31 Oct 2009	No	NOTES 1. TO THE ACCOUNT STATE :- Going Concern :- The Group's business activities, together with the factors likely to affect its future development, performance & position are set out in the Directors Report. The financial position of the Group is set out in the Consolidated Balance Sheet & the accompanying notes to the financial statements. The Group's Cash & borrowings positions are set out in the Directors Report & notes 17, 18, 19 & 24 to the financial statements. a description of the Group's financial risks are also set out in the Directors report. At the year end Group had cash of pound 139.0 million (2008 pound 63.8 million) In order to maintain liquidity to ensure that sufficient funds are available for ongoing operations & future developments the Group uses a mixture of long-term limited recourse borrowings & a long-term working capital loan provided by a related party.
31 Oct 2008	No	NOTE 1 TO THE ACCOUNT STATE: GOING CONCERN: The group''s business activities, together with the factors likely to affect its future development, performance and position are set out in the directors report. The financial position of the group is set out in the consolidated balance sheet and the accompanying notes to the financial statements. The group''s cash and borrowing positions are set out in the director report and note 18 and 26 to the financial statements. A description of the group''s financial risks are also set out in the directors report. The group has cash of 63.8 million and carries no significant debt other than not-resource and future developments the group uses a misture of long term project finance and medium- term working capital finance provided by its parent company. As a consequence, the directors believe that the group will be able to manage its business risks successfully despite the current uncertain economic outlook.
31 Oct 2007	No	-

Customer Service and Support

HELP TOP

Contact Information

Online Assistant Service	**http://www.dnb.co.uk/customerservices/**
Telephone Number	+44(0) 845 145 1700

Please quote your subscriber number **965-326483** for any query or support.

D&B Worldwide Network

Decide with Confidence

TAB E-3-1

Design and Construction Capability

The RES Group and the MidAmerican Group have each developed and constructed electricity generation projects and transmission lines as part of their respective businesses. The RES Group has provided both turnkey and construction only services in respect of over 5,700 MW of renewable power generation projects in North America, including the successful development and construction of associated single and double circuit transmission lines. Additionally, the RES Group has provided third-party construction services for 345 km of stand-alone, integrated transmission projects in the United States and Canada. The MidAmerican Group has over 100 years of experience in the planning, designing, engineering, permitting, constructing, and operating of high voltage transmission lines as a public utility throughout the western and midwestern United States. The development and delivery of these projects are subject to regulation, primarily by FERC and also ERCOT. FERC regulations result in the development, operation and maintenance of a safe, adequate, and reliable transmission system in a cost effective manner for customers. These regulations are enforced by NERC and its subsidiary organizations including Western Electric Coordinating Council ("**WECC**"), Midwest Reliability Organization ("**MRO**"), and Electric Reliability Council of Texas ("**ERCOT**"). The MidAmerican Group complies with all the regulations of these agencies for the design and construction of projects in a manner that provides long term safe, adequate, and reliable energy.

The MidAmerican Group through an engineering, procurement and construction delivery model has successfully developed and constructed over 30,000 km of single and double circuit high voltage transmission lines in North America. This includes managing projects through the development of the best alternative with regards to customer's needs, costs, environmental impact, permitting constraints and engineering for safe long-term operation and maintenance of the lines.

The MidAmerican Group is the number one owner of wind powered electricity generation projects in the US among rate regulated utilities, with 2,909 MW of owned capacity and 407 MW under construction. The MidAmerican Group is also a leader in geothermal power generation, with interests in 10 geothermal plants in the US and a solar powered electricity generation portfolio owned and under development of 840 MW.

RES Group Experience

The RES Group is part of the Sir Robert McAlpine group of companies with over 100 years of experience in construction and engineering in the UK and worldwide and more specifically has acquired extensive development, construction and ownership expertise in the renewable energy industry worldwide since 1982 and in North America since 1997. The RES Group and has developed, constructed or has under construction, more than 5,700 MW of renewable energy generation projects and more than 890 km of transmission lines (which includes 27 generation transmission ties) in North America. A map showing the electricity generation project portfolio of the RES Group is contained in Exhibit E-3-3. The following is a representative selection of transmission projects which the RES Group has designed and/or constructed in North America.

Montana Alberta Tie Line

The RES Group is currently providing construction services to Montana Alberta Tie Ltd. in respect of the Montana Alberta Tie Line. The Montana Alberta Tie Line is a 230 kV transmission line that will stretch 345 km from Lethbridge in Alberta to Great Falls, Montana.

Cedar Point, Colorado

The RES Group has provided construction services in respect of a 68 km, 230 kV transmission line including two 34.5/230 kV project substations that connects the Cedar Point Wind Farm to its transmission connection point on Public Service Company of Colorado's existing 230 kV transmission system (the "**Cedar Point Wind Farm**"). The transmission line traverses three Colorado counties on land owned by both private landowners and the State of Colorado. Cedar Point was developed and constructed in its entirety by the RES Group, and although it is currently owned by Enbridge, RES Group continues to have an operational role with respect to both the wind farm and its associated transmission line.

Greenwich, Ontario

The RES Group developed and constructed the 99 MW Greenwich Wind Farm, located on 4,000 hectares of Crown land, northeast of Thunder Bay (the "**Greenwich Wind Farm**"). The RES Group designed, developed and constructed the transmission facilities to connect the Greenwich Wind Farm to the IESO-controlled transmission grid. Such transmission facilities comprised an approximately 10 km 230 kV double circuit overhead transmission line (as well as over 38 km of 34.5 kV distribution line) which the RES Group continues to operate. These facilities involved a successful application to the Board for LTC pursuant to Section 96(1) of the OEB Act. This experience of the RES Group is particularly significant given the location of the development and construction which is in the same region as the proposed route for the EWTL.

Talbot, Ontario

The RES Group developed and constructed the 99 MW Talbot Wind Farm, located on 4000 hectares of private land in South Western Ontario (the "**Talbot Wind Farm**"). The RES Group designed, developed and constructed the transmission facilities to connect the Talbot Wind Farm to the IESO-controlled transmission grid. Such transmission facilities comprised a 10.3 km 230 kV transmission line, substation and switching station which the RES Group continues to operate. These facilities involved a successful application to the Board for LTC pursuant to Section 96(1) of the OEB Act.

Whirlwind, Texas

The RES Group developed, constructed and owns the 59.8 MW Whirlwind Energy Center, including its associated 34 km, 69 kV transmission line (the "**Whirlwind Wind**

Farm"). The RES Group designed, developed and constructed the transmission facilities to connect the Whirlwind Wind Farm to its transmission connection point with American Electric Power's existing transmission system. Development and construction of the transmission line involved consultation with numerous private landowners as well as the Texas Department of Transportation.

Further information on the transmission line and electricity generation project portfolio of the RES Group is contained in Exhibit E-3-2.

MidAmerican Group

The MidAmerican Group has successfully designed, developed and constructed large, complex, transmission projects with an aggregate length of over 30,000 km. Its delivery method has been hugely successful for projects similar in size and scope of the ETWL and even larger and more complex ones as will be described below. The MidAmerican Group uses its own staff for lead development roles in: project management, permitting and siting, engineering, project scheduling and controls, testing and turn up. The following is a representative selection of recent transmission projects which the MidAmerican Group has designed and/or constructed, owns and operates in North America.

Populus to Terminal Project

The MidAmerican Group completed its 216 km Populus to Terminal double circuit 345 kV transmission project in 2009. The transmission line was built using steel monopoles and required a completely new 500 kV/ 34 kV transmission stations. Two existing 345 kV substations also required extensive expansions and modifications as well as several other intermediate transmission stations were required. The project comprised over 900 steel monopoles and foundations constructed in a variety of geological conditions from soft, highly corrosive soils along the shoreline area of the Great Salt Lake to rocky mountainous conditions in Northern Utah and Southern Idaho.

Access roads were constructed to each structure location of the transmission line which traverses through several different topography including steep and rugged terrain, agricultural land, wetlands, and metropolitan Salt Lake City areas. The project was completed on schedule and under budget.

Number of Permits and certificates and approvals: 7 conditional use permits, state of Utah Certificate of Public Convenience and Necessity.

Federal Environmental Assessment (NEPA:) Not Required.

Original Budget: $885 million.

Final Cost: $835 million completed.

In-service ahead of schedule: 43 days.

Stakeholder meetings: Over 20 stakeholder meetings.

Mona Oquirrh Project

The Mona Oquirrh Project is on schedule to be completed in early 2013 and was the outcome of an extensive development process lasting over 4 years, conducted successfully by the MidAmerican Group. The Mona Oquirrh Project comprises the construction, operation, and maintenance of a new 160 km transmission line that consists of double-circuit 345 kV and single circuit 500 kV transmission lines from a newly constructed 345/138 kV substation in central Utah to an existing 345 kV substation in the Salt Lake City area. The project faces challenging terrain, with steep and rugged terrain up to 2,600 metres in elevation in addition to wetlands and a 5.6 km area in which helicopter assisted construction was required. All foundations are cast in place and such foundations will range from 1.2 metres to 4.3 metres in diameter. Foundation depths range from 6 metres to 18 metres. The 160 km of transmission line will be energized at 345 kV and has been designed to accommodate future 500 kV service into the area. The Mona Oquirrh Project will require the construction of 192 monopoles, which is proving particularly challenging while building through 16 km of steep and rugged terrain. The Mona Oquirrh Project utilized over 14,000 tons of steel and over 23,000 cubic metres of concrete. The project will be completed ahead of schedule and under its original budget.

Number of Permits and certificates and approvals: Record of Decision from the U.S. Department of Interior's Bureau of Land Management 4 conditional use permits, state of Utah Certificate of Public Convenience and Necessity.

Federal Environmental Assessment (NEPA:) Yes, 4 years to obtain.

Original Budget: $402 million.

Estimated Cost when completed: $378 million completion date May 2013.

In-service ahead of schedule: estimated 14 days.

Stakeholder meetings or mailings: 71 meetings, 3 mailings with over 5,000 newsletters distributed.

Sigurd to Red Butte Project

The 272 km Sigurd to Red Butte 345 kV transmission project has been developed by the MidAmerican Group and is under contract for construction which is scheduled to be completed in 2015, following an extensive period of over 3 years of development. The transmission line circuit typically will be supported by single-circuit, steel-pole H-frame structures at tangent locations. Both the H-frame tangent structures and lattice structure angle/dead-end structures will typically be 24 metres to 43 metres in height above ground. Spacing between structures, typically, will be between 244 metres and 366 metres. Structures will typically be installed by direct imbed or when necessary, drilled pier foundations and will include both conventional and helicopter construction methods. The project is expected to be completed in early 2015, below its original budget.

Number of Permits and certificates and approvals: 5 conditional use permits, 2 Records of Decision (U.S. Department of Interior's Bureau of Land Management and US Forest Service), state of Utah Certificate of Public Convenience and Necessity.

Federal Environmental Assessment (NEPA:) Yes, 3.5 years to obtain.

Original Budget: $420 million.

Estimated Cost when completed: $390 million construction begins early 2013, target under budget.

In-service estimate ahead of schedule: 30 Days.

Stakeholder meetings or mailings: 147 stakeholder meetings, 2 mailing with over 6,000 newsletters distributed.

Gateway West Project

The Gateway West Project has been developed by the MidAmerican Group further to a complex development and permitted process that commenced in 2007. The Gateway West Project will consist of approximately 1600 km of 230 kV, 345 kV and 500 kV transmission line, beginning at the Windstar Substation near Glenrock, Wyoming and terminating at Hemingway Substation southwest of Boise, Idaho. For the 256 km of 230 kV transmission line, which includes both new construction and rebuilt lines and the 8 km of 345 kV transmission line, support structures will consists of tubular steel H-frame fabricated in either dulled galvanized or self weathering steel. The remaining 500 kV segments of the transmission line will be constructed using self supported steel lattice towers, fabricated in dulled, galvanized steel.

Typical foundations will be composed of steel-reinforced concrete drilled piers with a diameter of 1.2 metres and a depth of approximately 6.7 metres. Depending on underlying soil and rock conditions, the 345 kV H-frames may be supported by steel-reinforced concrete drilled piers while the 230 kV support structures will be directly embedded. Additionally, all 345 kV angle structures will be self-supporting (i.e. no guys) such that they will require concrete drilled pier foundations.

Primary communications for relaying and control will be provided via the optical ground wire that will be installed on the transmission lines. For the 500 kV transmission lines, a secondary communications path will be provided by an existing microwave system. A secondary communication path may also be developed using a powerline carrier. Updated microwave equipment may be installed at existing sites and at the substations.

To accommodate the new 500 kV transmission line segment of the Gateway West Project, the upgrade of ten existing substations as well as the construction of four new substations at 230 kV, 345 kV and 500 kV will be required. Major equipment will include 19 550 kV transformers, two 345 kV 750 MVA phase shifters, two 550 kV series capacitors, 17 shunt capacitors, 33 550 kV reactors and one 245 kV static var compensator.

Number of Permits and certificates and approvals: Record of Decision from the U.S. Department of Interior’s Bureau of Land Management, 13 conditional use permits, Wyoming Industrial Siting Permit.

Federal Environmental Assessment (NEPA:) Yes, estimated 6 years to obtain, permit expected mid 2013

Original Budget: $ 1.5 billion.

Estimated Cost: Construction start 2014, target under budget.

In-service ahead of schedule: Construction start 2014, target ahead of schedule days.

Stakeholder meetings or mailings: Over 240 public meetings and two mailings with over 10,000 newsletters distributed.

Gateway South Project

The Gateway South Project is being developed by the MidAmerican Group and targeted for a December 2020 completion. The Gateway South Project consists of approximately 680 km of single-circuit 500 kV transmission line from the future Aeolus Substation, near Medicine Bow, Wyoming to the new Clover Substation, near Mona, Utah. Additional 500 kV circuit breaker bays will be constructed at both of these locations to accommodate the project. Two proposed, series compensation stations located at approximately the one-third and two-third points of the line, are also part of specifications for the Gateway South Project. The Gateway South Project will be built using self supporting lattice towers fabricated from dulled galvanized steel. The primary foundation type will be steel-reinforced concrete drilled piers with steel grillage as a possible alternate.

Number of Permits and certificates and approvals: NEPA with 2 Record of Decisions (U.S. Department of Interior's Bureau of Land Management and US Forest Service), state of Utah Certificate of Public Convenience and Necessity, Wyoming Industrial Siting Permit.

Federal Environmental Assessment (NEPA:) Yes, estimated 6 years to obtain, permit expected 2014.

Original Budget: $1.3 billion.

Estimated Cost when completed: Project targeting to be under budget.

In-service ahead of schedule: Estimated 30 days.

Stakeholder meetings or mailings: Over 50 public meetings and two mailings distributed to over 25,000 mailings.

St. George Transmission Station 138kV Static Var Compensator

The St. George Substation is a facility jointly owned by the Utah Associated Municipal Power Systems and the MidAmerican Group in Southern Utah. This project included some major re-arrangement of existing substation bays as well as the addition of a new 138 kV static var compensator to the substation. There were a total of thirteen breakers affected with five of those relocated from existing positions. A 32 km 138 kV single circuit transmission line was rebuilt as a double circuit 345kV line from the Red Butte Substation to St. George Substation as part of this project. Only one circuit has been energized at 138 kV at this time on that line. Construction will allow for the future conversion of this line to 345 kV. The role of the MidAmerican Group was to provide station design and the development of the engineering, procurement and construction package and contract.

Number of Permits and certificates and approvals : 2 conditional use permits, 2 grant via the U.S. Department of Interior's Bureau of Land Management, cooperative agent with U.S, Fish and Wildlife Agencies.

Federal Environmental Assessment (NEPA:) Yes.

Oringial Budget: $65 million.

Estimated Cost or Final if completed: $63 million completed.

In service ahead of schedule: 2 days.

stakeholder meetings or mailings: more than 20.

Red Butte Transmission Station Project

The Red Butte Transmission Station Project involved the installation by the MidAmerican Group of a new static var compensator at the Red Butte Substation. The function of the static var compensator is to control the transmission system's dynamic performance and prevent voltage collapse following system disturbances. The static var compensator also provides supplementary steady-state voltage regulation, while preserving sufficient dynamic vars for system disturbances. The addition of these reactive components requires very fast switching to stabilize the system which is accomplished by switching in reactors or capacitors very quickly through a thyristor valve.

The existing substation was increased in size by nearly double to accommodate the static var compensator and the future the Sigurd to Red Butte 345 kV no. 2 line. A new 345 kV line bay was added including two new breakers and five new air-break switches tying to the new static var compensator. Three new 345 kV, 150 MVAR capacitor banks with three new breakers were also installed as part of this project. The addition of this equipment required the installation of a new control house, station service additions and improvements and a new building to store the spare static var compensator equipment.

Number of Permits and certificates and approvals: 1 conditional use permit, Special Use Authorization Amendment U.S. Forest Service, 1 Finding of Impact with U. S. Forest Service, environmental assessment from U.S. Department of Interior's Bureau of Land Management.

Federal Environmental Assessment (NEPA:) Yes, 2 years to conduct environmental assessment.

Original Budget: $48 million.

Estimated Cost or Final if completed: $45 million completed.

In service ahead of schedule: 2 days.

stakeholder meetings or mailings: More than 10, more than 5000 newsletters distributed

Camp Williams to 90th South Transmission Project (the "Camp Williams Project")

The Camp Williams to 90th South Transmission Project was developed by the MidAmerican Group and consisted of the construction of a new double-circuit 345 kV transmission line that extends approximately 18km through the western portion of Salt Lake City Valley, primarily within existing rights-of-way and within two existing substations. The transmission line was built on 113 monopole TSP structures supported by drilled concrete piers.

Number of Permits and certificates and approvals: 7 conditional use permits.

Federal Environmental Assessment (NEPA:) Not required.

Original Budget: $47 million.

Final Cost: $46 million.

In-service ahead of schedule: 5 days.

Stakeholder meetings: over 5 stakeholder meetings.

Further information on transmission line and electricity generation portfolio of the MidAmerican Group is contained in Exhibit E-3-2.

TAB E-3-2

Representative List of Projects Designed and Constructed

Table E-2

RES Group Power Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Marengo I, WA	230 kV	6.40 km
Marengo II, WA	230 kV	11.70 km
High Palins, WY	230 kV	16.80 km
Dunlap, WY	230 kV	19.20 km
Cedar Point, CO	230 kV	67.20 km
*Greenwich, Canada	230 kV; 34.5 kV	9.90 km; 38.40 km
Bull Creek, TX	138 kV	47.20 km
Woodward Mountain, TX	138 kV	28.80 km
King Mountain, TX	138 kV; 34.5 kV	30.40 km; 12.80 km
Whirlwind, TX	69 kV	32.30 km
Buffalo Gap III, TX	138 kV	20.80 km
Mountain Wind I, WY	138 kV	19.70 km
Wild Horse 1, WA	230 kV	14.40 km
Butler Ridge, WI	34.5 kV	14.40 km
Sweetwater II, TX	138 kV	13.76 km
Sweetwater V, TX	345 kV; 34.5 kV	11.20 km; 1.60 km
Hopkins Ridge I, WA	115 kV	11.70 km
Lone Star-Post Oak, TX	138 kV	11.00 km
So. Trent Mesa, TX	138 kV	10.40 km
Hackberry, TX	345 kV	10.20 km
*Talbot, Canada	230 kV	9.90 km
Hatchet Ridge, CA	230 kV	5.40 km
Sweetwater IV(B), TX	34.5 kV	4.80 km
Armenia Mountain, PA	115 kV	3.40 km

Crossroads, OK	345 kV	16.00 km
Lower Snake River, WA	230 kV	12.80 km
*Montana Alberta Tie Line – Montana, US/Alberta, Canada	230 kV	342.40 km
MidAmerican Group Power Recent Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Populus to Terminal,UT, 10	345 kV	216 km
Mona Oquirrh, UT	345 kV; 500 kV	160 km
Siqurd to Red Butte, UT	345 kV	272 km
Gateway West, WY, ID	250 kV; 345 kV; 500 kV	1,600 km
Gateway South WY, UT	500 kV	680 km
St. George Transmission Station, UT	345 kV line 138 kV static var compensator; (SVC)	32 km
Red Butte Transmission Station, UT	345kV static var compensator	N/A
Camp Williams to 90th South, UT	345 kV	18 km
California Oregon Intertie Transfer Capability I OR	500 KV Shunt and Series Cap Banks	N/A
DJ to Casper 230kV No 1 & 2 Line Rebuild Wy	230 kV	97 km
Meridian Lonepine 230kV Ln #1 Reconductor OR	230 kV	4 km
Meridian Sub - Install 230 kV Capacitor Bank OR	230 kV	N/A
Pinto Substation 345kV Series Capacitor UT	345 kV	N/A
St George-Red Butte Central Dbl Ckt 345kV Ln UT	345 kV	28 km
Vantage-Pomona Heights 230kV Line WA	230 kV	63 km
Prairie Wind Transmission KS	345 kV	172 km

Competitive Renewable Energy Zone projects TX	345 kV and higher	1740 km
RES Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Ainsworth Wind Farm, NE	59 MW	Wind
Armenia Mountain Wind, PA	101 MW	Wind
Blue Canyon Wind Farm, OK	99 MW	Wind
*Brooke-Alvinston Wind Energy Project, ON	10 MW	Wind
Buffalo Gap III Wind Farm, TX	170 MW	Wind
Bull Creek Wind Farm, TX	180 MW	Wind
Butler Ridge, WI	54 MW	Wind
Cameron Ridge, CA	60 MW	Wind
Cedar Point Wind Energy Project, CO	250.2 MW	Wind
Central Plains Wind Farm, KS	99 MW	Wind
Crossroads Wind Energy Project, OK	227.5 MW	Wind
Dunlap Wind Energy Project, WY	111 MW	Wind
Flat Water Wind Farm, NE & KS	60 MW	Wind
*Greenwich Wind Energy Project, ON	99 MW	Wind
Gulf Wind Wind Farm, TX	283 MW	Wind
Hackberry Wind Farm, TX	166 MW	Wind
Harbor Wind Project, TX	9 MW	Wind
Harvest Wind, WA	99 MW	Wind
Hatchet Ridge Wind Farm, CA	101.2 MW	Wind
High Plains, WY	99 MW	Wind
Hopkins Ridge II Wind Farm, WA	7 MW	Wind
Hopkins Ridge Wind Farm, WA	149 MW	Wind
King Mountain Wind Ranch, TX	278 MW	Wind
Llano Estacado, NM	1 MW	Wind

Lone Star (Mequite and Post Oak) Wind Farm, TX	400 MW	Wind
Lower Snake River Wind Project, WA	343 MW	Wind
Marengo Wind Farm II, WA	71 MW	Wind
Marengo Wind Farm Phase I, WA	140 MW	Wind
McFadden Ridge I, WY	29 MW	Wind
Mountain Wind I Wind Farm, WY	29 MW	Wind
Mountain Wind II Wind Farm, WY	61 MW	Wind
Nine Canyon Wind Farm Phase I, WA	48 MW	Wind
Nine Canyon Wind Farm Phase II, WA	16 MW	Wind
Nine Canyon Wind Farm Phase III, WA	32 MW	Wind
NREL, CO	3.8 MW	Wind
NREL II, CO	2.0 MW	Wind
Pacific Crest, CA	47 MW	Wind
*Site Nordique Experimental en éolien Cours (SNEEC), QC	4.1 MW	Wind
South Trent Mesa, TX	101 MW	Wind
Sweetwater Wind Farm Phase II,TX	92 MW	Wind
Sweetwater Wind Farm Phase IV(B),TX	106 MW	Wind
Sweetwater Wind Farm Phase V, TX	81 MW	Wind
*Talbot Wind Energy Project, ON	99 MW	Wind
Whirlwind Energy Center, TX	60 MW	Wind
White Creek Wind Farm, WA	205 MW	Wind
Wigton Wind Farm, Jamaica	21 MW	Wind
Wild Horse Expansion Wind Project, WA	44 MW	Wind
Wild Horse Wind Farm, WA	229 MW	Wind
Wildcat Wind Project, NM	27.3 MW	Wind

Woodward Mountain Wind Ranch, TX	160 MW	Wind
Gaines Cavern Wind Project, TX	2.0 MW	Wind
*Halkirk 1 Wind Project, AB	149.4 MW	Wind
Mehoopany Wind Farm, PA	140.8 MW	Wind
Twin Ridges Wind Farm, PA	139.4 MW	Wind
*Rutley Solar Project, ON	10 MW	Solar
Webberville Solar, TX	30 MW	Solar
MidAmerican Group Recent Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Lake Side, UT	558 MW	Natural Gas
Currant Creek, UT	548 MW	Natural Gas
Gadsby single-cycle, UT	129 MW	Natural Gas
Currant Creek Plant, UT	550 MW	Natural Gas
Lake Side Plant, UT	558 MW	Natural Gas
Black Cap, OR	2 MW	Solar
Dunlap 1, WY	111 MW	Wind
Glenrock, WY	99 MW	Wind
Glenrock III, WY	39 MW	Wind
Goodnoe Hills, WA	94 MW	Wind
High Plains, WY	99 MW	Wind
Rolling Hills, WY	99 MW	Wind
Seven Mile Hill, WY	99 MW	Wind
Seven Mile Hill II, WY	19.5 MW	Wind

***Denotes projects in Canada**

TAB E-3-3

RES Group Electricity Generation and Transmission Project Portfolio

Figure E-1

RES PROJECTS

Projects under construction, constructed, and/or operating.

5,745 MW

Wyoming–380 MW
- Mountain Wind I, Uinta County–61
- Mountain Wind II, Uinta County–80
- High Plains, Carbon & Albany Counties–99
- McFadden Ridge I–Carbon & Albany Counties–29
- Dunlap –Carbon County–111

Oklahoma- 326.5
- Crossroads, Dewey County–227.5
- Blue Canyon VI, Caddo County–99

Washington–1,383 MW
- Nine Canyon I, Benton County–48
- Nine Canyon II, Benton County–16
- Nine Canyon III, Benton County–32
- Hopkins Ridge I, Columbia County–149
- Hopkins Ridge II, Columbia County–7
- Marengo I, Columbia County–140
- Marengo II, Columbia County–71
- Wild Horse, Kittitas County–229
- White Creek, Klickitat County–205
- Harvest Wind, Klickitat County–99
- Wild Horse II, Kittitas County–44
- Lower Snake River, Garfield County–343

California–208.2 MW
- Cameron Ridge, Kern County–60
- Pacific Crest, Kern County–47
- Hatchet Ridge, Shasta County–101.2

Colorado–256 MW
- NREL, Superior–3.8
- Cedar Point, Lincoln, Elbert & Arapahoe Counties–250.2
- NREL II, Superior–2

New Mexico–28.3 MW
- Llano Estacado, Curry County–1
- Wildcat, Lea County–27.3

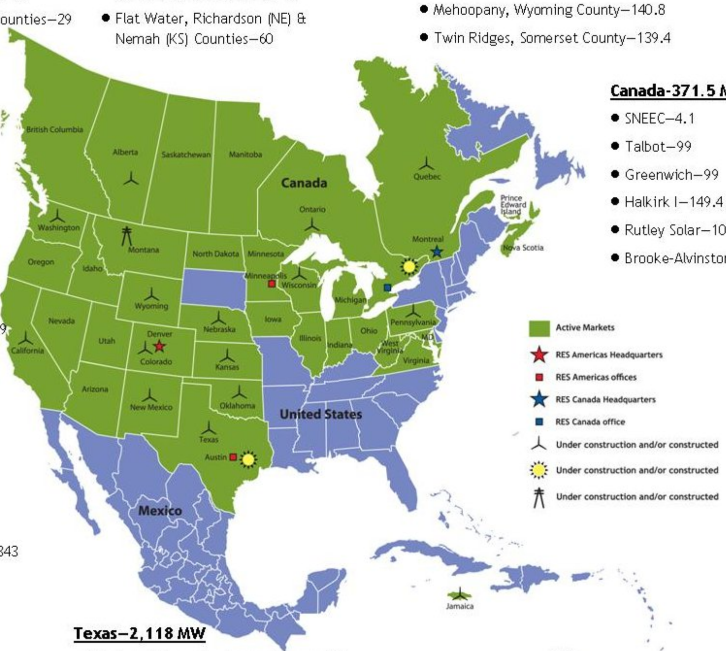
Kansas–99 MW
- Central Plains, Wichita County–99

Nebraska–119 MW
- Ainsworth, Brown County–59
- Flat Water, Richardson (NE) & Nemah (KS) Counties–60

Wisconsin–54 MW
- Butler Ridge, Dodge County–54

Pennsylvania–381.2 MW
- Armenia Mountain, Tioga & Bradford Counties–101
- Mehoopany, Wyoming County–140.8
- Twin Ridges, Somerset County–139.4

Canada-371.5 MW
- SNEEC–4.1
- Talbot–99
- Greenwich–99
- Halkirk I–149.4
- Rutley Solar–10
- Brooke-Alvinston–10



Texas–2,118 MW
- Woodward Mountain, Pecos County–160
- King Mountain, Upton County–278
- Sweetwater II, Nolan County–92
- Sweetwater IV, Nolan County–106
- Sweetwater V, Nolan County–81
- Whirlwind, Floyd County–60
- Lone Star, Shackelford & Callahan Counties–400
- Hackberry, Shackelford County–166
- South Trent Mesa, Nolan & Taylor Counties–101
- Buffalo Gap III, Nolan & Taylor Counties–170
- Bull Creek, Nolan County–180
- Gulf Wind, Kenedy County–283
- Webberville Solar, Travis County–30
- Harbor Wind, Nueces County–9
- Gaines Cavern, Gaines County–2

Montana – 214 miles OHL
- MATL–214 miles

Jamaica–21 MW
- Wigton–21

Measurements in megawatts (MW)

Figure E-2: RES Gen-ties

Project Name, Location	Wire Size	Voltage	Miles of OHL Installed	Nameplate Capacity (MW)	Project Owner
Marengo I, WA	795 kcmil Drake	230kV	4	140.4	PacifiCorp
Marengo II, WA	795 kcmil Drake	230kV	7.3	70.2	PacifiCorp
High Plains, WY	795 kcmil Drake	230kV	10.5	99.0	PacifiCorp
Dunlap, WY	795 kcmil Drake	230kV	12	111.0	PacifiCorp
Cedar Point, CO	2x954 kcmil	230kV	42	250.2	Enbridge
Greenwich, Canada	795 kcmil Drake 556 kcmil	230kV 34.5kV	6.2 24	98.9	Enbridge
Bull Creek, TX	1590 kcmil Lapwing	138kV	29.5	180.0	Eurus Energy
Woodward Mountain, TX	336.4 kcmil Linnet	138kV	18	159.7	FPL
King Mountain, TX	795,477,336,269 kcmil 477, 210 kcmil	138kV 34.5kV	19 8	278.2	FPL
Whirlwind, TX	666.6 kcmil	69kV	20.2	59.8	RES Americas
Buffalo Gap III, TX	2x963 kcmil	138kV	13	170.2	AES
Mountain Wind I, WY	795kcmil	138kV	12.3	60.9	Edison Mission Group
Wild Horse I, WA	1272 kcmil Bittern	230 kV	9	228.6	Horizon Wind Energy
Butler Ridge, WI	795 kcmil Drake	34.5kV	9	54.0	Babcock and Brown
Sweetwater II, TX	795 kcmil Drake	138kV	8.6	91.5	Babcock and Brown
Sweetwater V, TX	2x795 kcmil 477 kcmil Hawk	345kV 34.5kV	7 1	80.5	Babcock and Brown
Hopkins Ridge I, WA	1272 kcmil Bittern	115kV	7.3	149.4	PSE
Lone Star-Post Oak, TX	556.5kcmil Dove	138kV	6.9	200.0	Horizon Wind Energy
So. Trent Mesa, TX	556 kcmil Dove	138kV	6.5	101.2	Babcock and Brown
Hackberry, TX	2x795 kcmil	345kV	6.4	165.6	RES Americas
Talbot, Canada	795 kcmil Drake	230kV	6.2	98.9	Enbridge
Hatchet Ridge, CA	795 kcmil Drake	230kV	3.4	103.2	Pattern Energy
Sweetwater IV(B), TX	477 kcmil Hawk	34.5kV	3	105.8	Babcock and Brown
Armenia Mountain, PA	954 kcmil	115kV	2.1	100.5	AES

TOTAL MILES OF OHL 302.4

TAB E-4-1

Land Acquisition Capability

General

Each of the RES Group and MidAmerican Group has acquired extensive experience in the acquisition and/or compliance with land rights for over 30,000 km of existing transmission lines throughout the United States and Canada. This experience not only includes obtaining rights of way through private, provincial, state, Crown and federal lands but, also lands subject to other regulatory governances such as environmental conservation easements, lands subject to bankruptcy, mining claims, First Nation rights and railway usage. Although the RES Group and the MidAmerican Group have been extremely successful in obtaining these rights of way, it can be challenging and time consuming without adequate planning and preparation. Both the RES Group and the MidAmerican Group value the merits of establishing a good working relationship with all landowners and stakeholders while providing the best alternative for their respective developments with regards to cost, environmental impact, constructability, reliability and other important aspects in determining the final alignment of a transmission line.

In those areas where the MidAmerican Group has been unsuccessful in obtaining the rights of way from landowners, it, as a last resort, has relied on condemnation or expropriation rights provided by federal, state, and local legal systems to obtain rights of way for fair market value in timely manner, so as to not impact project schedule. It is the MidAmerican Group's goal to minimize the use of expropriation rights and to that end, has exercised these rights fewer than 50 times in the last 5 years. This is made possible by cooperative and proactive engagements with stakeholders and regulators.

Through their combined experience in obtaining land rights and acquisition of site control for the development of electricity infrastructure generally, the RES Group and the MidAmerican Group have a clear understanding how critical it is to project schedule. Each has a proven approach to managing projects with respect to construction schedule and releasing rights of way in a manner that allows construction to begin while remnant parcels are still in the process of being obtained. This is one possible approach that could be implemented in connection with the EWTL to ensure that project schedules are met.

The MidAmerican Group has implemented a risk mitigation strategy in respect of land assembly to determine areas where substantial lengths of continuous rights of way are likely to be obtained prior to construction commencing. The MidAmerican Group has successfully executed construction contracts that release these rights of way at time of contract execution. However, the contract also allows for the release of the remnant parcels by a later date. This allows the contractor to structure the project schedule during the competitive bidding process according to release dates of rights of way, keeping the costs competitive and allowing the project to be constructed on schedule, minimizing overall project risk.

Both the RES Group and the MidAmerican Group have also proven success in situations where it is necessary to begin negotiations with land owners and purchase rights of way as early as possible in order to meet schedule requirements. These rights of way are considered purchased at risk due to outstanding permits and/or approvals being obtained. However, in these areas, the rights of way are considered a low risk because 1) there is a good relationship in place and high potential of reaching an agreement with the landowner or other local agencies, and 2) there are no other viable solutions for a line route and it appears all permitting demonstrates the route as acceptable. The RES Group and the MidAmerican Group have demonstrated on various projects that this effort assists in getting rights of way as early as possible at a low risk to the project and increases the likelihood of rights way being obtained in a manner supportive of the construction schedule.

The following section sets out some specific examples of the variety of land acquisition techniques employed by the RES Group and the MidAmerican Group in connection with their respective electricity transmission and power generation portfolios.

RES Group Representative Experience

The RES Group has a unique approach to land acquisition and has developed a number of innovative ways of compensating landowners for the use of the land while maximizing benefits to the host community and the project. Using an option to lease or option for easements has been an effective tool to lock up large contiguous tracks of land. A majority of the RES Group's land acquisition activities are done in house in order to insure that landowners concerns and requests are integrated into the stakeholder consultation process and taken into account through to construction. In the case where land agents are used they are closely managed and use internal RES Protocols and receive RES Group training before approaching landowners. The RES Group prides itself on its honest approach to all stakeholders, especially its landowners.

The RES Group has acquired the land rights for over 5,000 MW of renewable energy projects and their related transmission and collector system corridors. The RES Group's professional land specialists manage over 4,000 land agreements across the U.S. and Canada as well as additional land agreements across the rest of the world. The private land currently under control of the RES Group for infrastructure development in North America represents over 800,000 acres. Through the development of proprietary mapping and database management software, the RES Group is able to manage the acquisition process in great detail. The RES Group's experience and the tools it has developed allow for close tracking of key acquisition activities such as payment schedules, communication logs, contact management and land control mapping. This integration with the development team also allows key integration with the stakeholder consultation process through the environmental assessment. Throughout the acquisition process the legal team is on hand to support land agreement negotiations allowing tailoring the approach to individual landowners and reducing overall acquisition costs by responding to specific issues with non-monetary solutions. Through its internal tools and process the RES Group's legal team is able to run basic title searches as land is being acquired.

The internal legal support of RES Group have crafted and negotiated financeable land agreements for every Province in Canada and all major jurisdictions in North America. Select representative examples of projects in which the RES Group has acquired land rights follows below.

Greenwich, Ontario

In connection with the Greenwich Wind Farm, the RES Group was exclusively responsible for securing the land rights for the 48 km transmission/distribution corridor necessary to connect the project to the existing Hydro One East-West Transmission line. The wind farm itself was developed exclusively by RES and required the acquisition of applicant of record status from the MNR followed by a 25 year Crown lease in accordance with the MNR's procedure for "Windpower Site Release and Development". Part of the Greenwich Wind Farm's transmission line was not located on Crown land and crossed two private properties, over which the RES Group obtained options during the development phase of the Greenwich Wind Farm, which were later converted into transmission facilities easements for the transmission line corridor. The site targeted for the lease had multiple active mining claims and required consents for the disposition of surface rights prior to obtaining the MNR leases. These matters were reviewed by the Board in connection with the RES Group's application for LTC pursuant to Sections 92 and 96(2) of the OEB Act, which was assigned file number EB-2009-0315. The RES Group also successfully addressed the challenging issue of managing overlapping transmission corridor rights over its transmission corridor for the Greenwich Wind Farm which existed pursuant to Hydro One transmission easements for the existing Hydro One East-West Transmission line.

Talbot, Ontario

The RES Group was also exclusively responsible for securing land rights for a single circuit 230 kV transmission line of 10.3 km in length and the 70 km distribution corridor in connection with the Talbot Wind Farm, located in south-western Ontario. The Talbot

Wind Farm itself is located on 4,000 hectares of private land over which the RES Group acquired the requisite rights, over the development phase of the project. The corridor for the 10.3 km transmission line and associated substation and switching station was secured by the RES Group from:

- five private landowners by way of lease;
- private landowners through easement;
- Hydro One by way of an easement/right of entry;
- CSX Transportation Inc. by way of an easement/right of entry;
- the Municipality of Chatham Kent for municipal rights of way by way of a road use agreement;
- the Ontario Ministry of Transportation for a right of way over Highway 401 as well as an encroachment permit for the Ontario Ministry of Transportation corridor; and
- Pre-existing oil and gas leases that required non-disturbance and subordination agreements.

These matters were reviewed by the Board in connection with RES Group's application for LTC pursuant to Sections 92 and 96(2) of the OEB Act, which was assigned file number EB-2009-0290.

Cedar Point, Colorado

In connection with the Cedar Point Wind Farm, the RES Group was exclusively responsible for securing the land rights for the 67.2 km transmission corridor necessary to connect the project to the existing Public Service Company of Colorado transmission system. The 67.2 km transmission corridor consisted of 10 private landowners as well as a tract of land owned by the State of Colorado. The Cedar Point Wind Farm itself is located on 9,000 hectares of private land consisting of 16 landowners over which the RES Group acquired the requisite rights, over the development phase of the project. The corridor for the 67.2 km transmission line and two associated project collector substations was secured by the RES Group from:

- five private landowners by way of lease;
- eleven private landowners through easement;
- the State of Colorado through right of way contract; and
- Lincoln County, Elbert County, Arapahoe County, Colorado Department of Transportation and numerous oil and gas pipeline companies and electric transmission and distribution companies through crossing agreements.

Further information on the transmission line and electricity generation project portfolio of the RES Group, where it has carried out land acquisition activities, is contained in Exhibit E-4-2.

MidAmerican Group Representative Experience

The MidAmerican Group has demonstrated success utilizing rights of way contracting firms for the acquisition of rights of way on its larger more complex projects. Once a final survey has been completed and easement exhibits have been created, the contractor follows a defined scope including the following in order to acquire the necessary right for a transmission line project.

Due Diligence: Begins with research of the land title per parcel, which includes analyzing and resolving exceptions to title that affect transmission line easements. Preliminary title reports will be provided per parcel, including copies of the vesting deed(s) and all documents noted as exceptions to title. All issues or exceptions will be reported to the MidAmerican Group per the title analysis report. The title analysis report shall include a recommendation as to whether the MidAmerican Group should obtain subordination, seek condemnation of potentially conflicting title exceptions or obtain releases, re-conveyances or other means to resolve identified conflicts.

Valuation and appraisals: The right of way contractor will obtain from a pre-approved, qualified Member Appraisal Institute/MAI appraiser a market analysis “blanket appraisal” of land values by zoning and/or land use within the defined corridor. The contractor will obtain property specific appraisals from a pre-approved, qualified Member Appraisal Institute/MAI appraiser. Appraisals must be suitable for condemnation litigation and, as needed by the MidAmerican Group, appraiser will provide testimony as an expert witness concerning the appraisal in legal proceedings.

Negotiations: The contractor will review and track legal descriptions and exhibits for accuracy in addition to preparing offer letters, maintain a complete written record of each landowner contact, and ensure all forms meet state statute requirements. The contractor will make personal contact in accordance with project schedule with all landowners in order to begin the negotiation of the acquisition of the right of way and will continue through the settlement process. The contractor will submit properly executed and notarized right of way documents to the appropriate county recorder’s office for recording within two business days. The MidAmerican Group has also found success having the contractor negotiate with the landowner and prepare construction restrictions or stipulations list prior to construction who will then act as a construction liaison during construction between the landowner and the construction contractor for the duration of the project. The contractor will then settle any damage claims and obtain damage releases for those properties not negotiated by the engineer procure construct contractor.

Populus to Terminal Project

The MidAmerican Group’s Populus to Terminal Project was proximate to an urbanized setting and as a result was subject to several local communities who showed intense opposition to the project. The Populus to Terminal Project transmission corridor consisted of 505 private land owner parcels (over 122 km) and 5 km of state lands. The balance of the line was constructed across easements already owned by the MidAmerican Group. Through the MidAmerican Group's experience in developing the best alternative, developing effective relationships with landowners, and understanding the legal processes that are in place, it was successful in obtaining rights of way across all parcels within an 18 month period which did not impact the project schedule.

Mona Oquirrh Project

In May 2011, construction began on the Mona Oquirrh Project which consists of 112 km of single circuit 500 kV construction and 48 km of double-circuit 345 kV construction. Due to the location of the selected transmission corridor, the Mona Oquirrh Project required completion of an environmental impact statement and required a record of decision issued by the U.S. Department of Interior's Bureau of Land Management in February 2011. The transmission corridor for the Mona Oquirrh included 204 private land parcels, 19.2 km of state lands, and 56 km of federal lands. All rights of way were obtained within a 14 month period in a manner to not impact the project schedule. The project also crossed approximately 3.2 km of an abandoned hazardous waste site and the MidAmerican Group obtained, through strong stakeholdering (with the Environmental Protection Agency, the Utah State Department of Environmental Quality and Tooele County Health Department), an easement across the property which was considered by most, locally, to be impossible. This involved procuring an amendment to a conservation easement allowing the transmission line to pass through the property.

The Mona Oquirrh Project also traversed a steep, rugged mountain range to an elevation of 8,400 feet and through Kennecott Utah Copper's active mining operation. This active mining operation includes the largest man made excavation on earth and is the second largest copper producer in the United States. In order to site the transmission line to minimize risk to the MidAmerican Group, customers and to Kennecott Copper's current and future mining operations, the transmission line alignment and access road plan was modified and an agreement was developed that minimized risk to both parties and allowed the project to move forward on schedule. This agreement was crucial to obtaining rights of way that allowed for the safe and cost effective construction of the Mona Oquirrh Project and minimized the impacts to Kennecott's current and future operations and ultimately be the lowest risk to the MidAmerican Group and its customers.

The Mona Oquirrh Project also traversed through 19.2 km of Utah State Institutional Trust Administration lands. These lands are managed by the state in an effort to provide funding to the state of Utah education system. The MidAmerican Group was successful in obtaining rights of way through all such parcels in manner that protected the project schedule.

Sigurd to Red Butte Project

The MidAmerican Group's Sigurd to Red Butte Project, which comprises 272 km of single circuit 345 kV transmission line, has presented especially complex siting challenges that the MidAmerican Group has successfully navigated. The transmission corridor for the project consists of approximately 179.2 km of federal lands and 80 km of private lands. Rights of way across 166 private parcels are required and are scheduled to be complete by December 2012 and will have been completed in a 13 month period. In coordination with the U.S. Department of Interior Bureau of Land Management, the U.S. Forest Service, tribal parties, stakeholders, and individual landowners, the MidAmerican Group continuously refined the initial route alternatives to address stakeholder concerns, minimize resource impacts, and resolve siting conflicts. For example, significant re-routes were made to minimize impacts to a proposed wind farm and minimize potential visual impacts to the Mountain Meadow National Landmark. After months of diligent work and close collaboration with a multitude of stakeholders, the MidAmerican Group is on schedule to obtain all rights of way on schedule by December 2012.

Gateway West Project

The Gateway West Project comprises approximately 1,600 km of transmission line. The sheer scale of the transmission corridor required for the Gateway West Project has required engagement of a very large interdisciplinary team of regulators from multiple agencies that have needed to reach agreement on numerous complex siting issues and concerns. It has also been necessary to address the interests of several important landowners, tribes, and stakeholders that required changing the project design, route alignments, and overall system configuration. In addition to these conditions and several others, the Gateway West Project has also become a test case for Wyoming's Greater Sage Grouse core area strategy as well as the U.S. Department of Interior's Bureau of Land's national Greater Sage Grouse guidance. Nevertheless the MidAmerican Group has been able to keep the project moving forward. The MidAmerican Group anticipates that a final environmental impact statement will be issued in early 2013 and a record of decision in early 2013 after which the process to secure local and state permits will begin.

Gateway South Project

The Gateway South Project comprises 680 km of single circuit 500 kV transmission line. The line route crosses approximately 352 km of federal property, 56 km of state property of 272 km of private lands. The project is currently going through the National Environmental Policy Act environmental impact statement process which currently includes over 4,200 km of alternative routing. There are currently over 6,000 potential landowners with as many mailers sent to date. The number of alternative routing is a result of several challenges including sage grouse, tribal lands, forest, wind farms, etc.

Camp Williams Project

The Camp Williams Projects comprises a new, 18 km 345 kV transmission line that goes through the western portion of Salt Lake City Valley in Utah. The line was constructed primarily within an existing right of way although the MidAmerican Group also obtained 22 private land easements across 6.6 km.

Further information on the transmission line and electricity generation project portfolio of the MidAmerican Group, where it has carried out land acquisition activities, is contained in Exhibit E-4-2.

TAB E-4-2

Land Acquisition – Representative List of Experience

Table E-3

RES Group Power Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Marengo I, WA	230 kV	6.40 km
Marengo II, WA	230 kV	11.70 km
Cedar Point, CO	230 kV	67.20 km
*Greenwich, ON Canada	230 kV; 34.5 kV	9.90 km; 38.40 km
Woodward Mountain, TX	138 kV	28.80 km
King Mountain, TX	138 kV; 34.5 kV	30.40 km; 12.80 km
Whirlwind, TX	69 kV	32.30 km
Hopkins Ridge I, WA	115 kV	11.70 km
Lone Star-Post Oak, TX	138 kV	11.00 km
Hackberry, TX	345 kV	10.20 km
*Talbot, ON Canada	230 kV	9.90 km
Hatchet Ridge, CA	230 kV	5.40 km
Crossroads, OK	345 kV	16.00 km
Lower Snake River, WA	230 kV	12.80 km
MidAmerican Group Power Recent Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Populus to Terminal,UT, 10	345 kV	216 km
Mona Oquirrh, UT	345 kV; 500 kV	160 km
Siqurd to Red Butte, UT	345 kV	272 km
Gateway West, WY, ID	250 kV; 345 kV; 500 kV	1,600 km
Gateway South WY, UT	500 kV	680 km

St. George Transmission Station, UT	345 kV line and138 kV static var compensator; (SVC)	32 km
Red Butte Transmission Station, UT	345 kV static var compensator	N/A
Camp Williams to 90th South, UT	345 kV	18 km
California Oregon Intertie Transfer Capability I OR	500 KV Shunt and Series Cap Banks	N/A
DJ to Casper 230kV No 1 & 2 Line Rebuild Wy	230 kV	97 km
Meridian Lonepine 230kV Ln #1 Reconductor OR	230 kV	4 km
Meridian Sub - Install 230 kV Capacitor Bank OR	230 kV	N/A
Pinto Substation 345kV Series Capacitor UT	345 kV	N/A
St George-Red Butte Central Dbl Ckt 345kV Ln UT	345 kV	28 km
Vantage-Pomona Heights 230kV Line WA	230 kV	63 km
RES Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Cameron Ridge, CA	60 MW	Wind
Cedar Point Wind Energy Project, CO	250.2 MW	Wind
Central Plains Wind Farm, KS	99 MW	Wind
Crossroads Wind Energy Project, OK	227.5 MW	Wind
*Greenwich Wind Energy Project, ON	99 MW	Wind
Hackberry Wind Farm, TX	166 MW	Wind
Hatchet Ridge Wind Farm, CA	101.2 MW	Wind
High Plains, WY	99 MW	Wind
King Mountain Wind Ranch, TX	278 MW	Wind

Lone Star (Mequite and Post Oak) Wind Farm, TX	400 MW	Wind
Lower Snake River Wind Project, WA	343 MW	Wind
Marengo Wind Farm II, WA	71 MW	Wind
Marengo Wind Farm Phase I, WA	140 MW	Wind
NREL, CO	3.8 MW	Wind
*Site Nordique Experimental en éolien Cours (SNEEC), QC	4.1 MW	Wind
*Talbot Wind Energy Project, ON	99 MW	Wind
Whirlwind Energy Center, TX	60 MW	Wind
Wigton Wind Farm, Jamaica	21 MW	Wind
Woodward Mountain Wind Ranch, TX	160 MW	Wind
Gaines Cavern Wind Project, TX	2.0 MW	Wind
MidAmerican Group Recent Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Lake Side, UT	558 MW	Natural Gas
Currant Creek, UT	548 MW	Natural Gas
Currant Creek Plant, UT	550 MW	Natural Gas
Lake Side Plant, UT	558 MW	Natural Gas
Dunlap 1, WY	111 MW	Wind
Glenrock, WY	99 MW	Wind
Glenrock III, WY	39 MW	Wind
Goodnoe Hills, WA	94 MW	Wind
High Plains, WY	99 MW	Wind
Rolling Hills, WY	99 MW	Wind
Seven Mile Hill, WY	99 MW	Wind
Seven Mile Hill II, WY	19.5 MW	Wind

***Denotes projects in Canada**

TAB E-5-1

Environmental, Permitting and Regulatory Capability

Both the RES Group and the MidAmerican Group have extensive experience obtaining necessary permits, environmental approvals and regulatory approvals for electricity infrastructure projects in the United States and Canada, as will be demonstrated further below. The collective experience of the RES Group and the MidAmerican Group and the processes that both have consistently implemented to ensure permitting, environmental and regulatory compliance will serve to facilitate the Applicant's successful permitting of the EWTL.

Each of the RES Group and the MidAmerican Group follows a step-by-step process to evaluate environmental impacts of a project from initial project conceptualization through construction. Early in the project development process, it is typical for meetings with key planning and regulatory entities to be held, to brief them on project concepts, benefits, and typical environmental issues to circumvent inaccurate information, allay fears, and garner opinions regarding what issues need prioritization as the project development process proceeds. Communication throughout the planning and permitting process to provide strategic information and reduce the risk of new issues being raised beyond the early project development stages is a key strategy. The RES Group and the MidAmerican Group have found that this open dialogue is crucial in keeping the planning and permitting process on schedule and helps address issues early and effectively.

As transmission projects are complex to permit, environmental impact assessments – including full evaluation of potential ecological, cultural resource, and socioeconomic effects – are routinely needed to document issues and how project planning, design, construction, operation, and de-commissioning are to be completed in a manner that avoids, minimizes, and if necessary mitigates for unavoidable negative effects of project implementation. The RES Group and the MidAmerican Group have extensive experience in managing environmental impact assessments addressing transmission line routing, siting, and permitting. Permitting staff also have extensive experience developing permitting strategies and applications, providing expert hearing testimony, and implemented numerous environmental compliance monitoring programs.

RES Group Representative Experience

The RES Group has an in-house permitting department with three dedicated full-time staff. The staff manages the critical process of obtaining all necessary permitting and zoning approvals on all development and construction projects to ensure compliance with all applicable environmental and development laws and regulations. The RES Group also has an internal staff of legal counsel to also provide guidance and interpretation of laws, regulations, and ordinances. The RES Group also routinely augments its in-house staff resources with third party consultants to ensure that the team includes members with the best available local knowledge of how to achieve successful permitting, zoning, and public involvement for any given project. These consultants perform technical resource assessments and studies, support permit applications and provide expertise on environmental issues and local administrative processes. In addition, the RES Group's permitting department and third party consultants plan and execute public outreach and public involvement activities designed to account for local environmental, socioeconomic, and regulatory issues in a comprehensive and inclusive manner, in order to expedite planning and regulatory review and approval to the extent possible. Select representative examples of projects in which the RES Group has obtained permits, environmental and regulatory approvals are below.

Greenwich Wind Farm

In connection with the Greenwich Wind Farm in Ontario, the RES Group was exclusively responsible for securing all permits, environmental approvals and regulatory approvals required to successfully develop that project. The RES Group consulted with 13 federal government agencies, 16 provincial government agencies and the Townships of Dorian and Shuniah. The Greenwich Wind Farm required and was successfully granted an environmental approval pursuant to an environmental screening report/environmental impact statement. The RES Group also consulted several agencies with respect to possible interference with communications towers. The Greenwich Wind Farm was successfully permitted and the Board granted the RES Group LTC transmission facilities pursuant to Board file number EB-2009-0315.

Talbot Wind Farm

The RES Group also successfully conducted its permitting, environmental approval and regulatory approval process in connection with the Talbot Wind Farm in Ontario. In the case of the Talbot Wind Farm, the RES Group consulted with 5 federal agencies, 13 provincial government agencies, as well as the Municipality of Chatham Kent and agencies within the County of Chatham. The RES Group also consulted several agencies with respect to possible interference with communications towers. The RES Group successfully obtained a statement of completion in respect of its environmental review report/environmental impact statement. Due to an application for federal ecoEnergy funding for the Talbot Wind Farm, the environmental review report/environmental impact statement was also prepared to comply and satisfy the requirements of the CEAA. The Talbot Wind Farm was successfully permitted and the Board granted the RES Group LTC transmission facilities pursuant to Board file number EB-2009-0290.

Cedar Point Wind Farm

In connection with the Cedar Point Wind Project, the RES Group was exclusively responsible for securing all permits, environmental approvals and regulatory approvals required to successfully develop and construct the project. The RES Group consulted with 5 federal government agencies, 3 state government agencies and 5 local agencies in the U.S. The Cedar Point Wind Project required and was successfully granted use by special review permits and building permits from the Lincoln County Board of Commissioners, the Elbert County Board of Commissioners and the Arapahoe County Board of Commissioners. Additionally RES Group negotiated a compatible development agreement with a large mineral estate owner within the project area to establish and outline the terms of compatible development by of both the surface and mineral estates.

Further information on the transmission line and electricity generation projects, where the RES Group has conducted permitting, environmental assessment and regulatory compliance, is contained in Exhibit E-5-2.

MidAmerican Group Representative Experience

As part of its regional scale Energy Gateway Transmission Expansion Program (3200 km across the western U.S.) which consists of the Populus to Terminal Project, the Mona Oquirrh Project, the Sigurd to Red Butte Project, the Gateway West Project, and the Gateway South Project, the MidAmerican Group's success has relied heavily upon key staff whose principal responsibility is working with local communities and clients to site, permit, and construct new transmission and substation facilities. These experts have dozens of years of experience siting and permitting substation and transmission line facilities and are well-versed in the principles of engaging stakeholders as well as the nuances and complexities associated with stakeholder engagement in local, state, and federal permitting processes. It is through this knowledge that the MidAmerican Group has gained an appreciation of the merits of proactive yet practical engagement of stakeholders in the siting and ultimate development of energy projects.

Each project within the Energy Gateway Transmission Expansion Program has needed to interact closely with local authorities and conduct extensive community outreach. For example, the MidAmerican Group has participated in over 150 meetings in addition to the required public scoping meetings for the Gateway West Project to gather substantive input from stakeholders and generate solutions. When needed, the MidAmerican Group has also engaged professional facilitators to assist with the process and provide stakeholders with an open, transparent mechanism to address and work out their concerns. These projects have also had to address the interests of several important landowners, tribes, and stakeholders that required changing the project design, route alignments, and overall system configuration in response to concerns voiced and included:

- demonstrated success in obtaining approvals from federal, state, and local authorities in a timely manner to maintain project schedules;
- federal agencies consist of, but are not limited to, the U.S. Department of Interior's Bureau of Land Management, the U.S. Department of Agriculture's Forest Service, the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Federal Aviation Administration, the Department of Energy, and FERC;
- state agencies including the Utah and Wyoming Public Service Commissions, Oregon, Idaho, and California Public Utilities Commissions, California Energy Council, Wyoming Infrastructure Authority and Industrial Siting Council, Utah Facilities Review Board, Oregon Energy Facility Siting Council, numerous state land agencies, natural resource departments, wildlife agencies, state historic preservation offices, and other state agencies with some level of jurisdiction;
- local authorities including many counties and cities that required conditional use permits or other local permitting approvals. Local authorities include many counties and cities that required conditional use permits or other local permitting approvals; and
- in those areas operating as a public utility, the MidAmerican Group through PacifiCorp has sought and obtained Certificates of Public Convenience and Necessity ("**CPCN**") or equivalent from State level authorities (such as a Public Service Commissions or Public Utilities Commissions) prior to construction. The CPCN approves the need for the project, whether it be for the overall stability of the existing bulk transmission system with regards to reliability, to increase the

capacity of the system to meet both short and long term customer demands for energy, or combination of both of these needs.

Since 2007, the MidAmerican Group has obtained federal approvals under the *United States National Environmental Policy Act* (the "**NEPA**") for over 560 km of transmission lines and is expecting further approvals on an additional 2400 km between 2013 and 2014. Select representative examples of projects in which the MidAmerican Group has obtained permits, environmental and regulatory approvals are below.

Populus to Terminal Project

The Populus to Terminal Project needed to obtain several local conditional use permits and overcome localized opposition who used its planning process in an attempt to delay the project and attach unfavorable conditions as part of its permit approval. This project required an environmental assessment from the Utah Department of Wildlife Resources due to the route of the line across land owned by the latter and permits were also obtained from the U.S. Army Corps of Engineers and the Environmental Protection Agency regarding Section 404 for wetland protection. While the MidAmerican Group's alignment of where the project was sited, was based on safety, reliability and cost effectiveness, it was also heavily determined by preferences of the local jurisdictions and/or communities. The project also required and obtained a state approved CPCN.

Mona Oquirrh

In May 2011, construction began on the Mona Oquirrh Project. This project required four local conditional use permits, an environmental impact statement under NEPA and a state of Utah approved CPCN. The MidAmerican Group successfully addressed local municipality concerns and resistance based upon its perceived visual impacts and conviction that a better route existed. By hosting several conflict resolution meetings, working with individual landowners, and thoroughly demonstrating that the preferred route chosen by the U.S. Department of Interior's Bureau of Land Management in the environmental impact statement was founded on objective analyses (the Mona Oquirrh

Project did require an environmental impact statement), a favourable decision was obtained from the Utah Facilities Siting Review Board. Following completion of all federal, state and local permitting, the project is on schedule to be placed into service in early 2013; the permitting phase lasted 4 years on this project

Sigurd to Red Butte.

Using lessons learned on earlier projects, the Sigurd to Red Butte Project was successful in acquiring 5 conditional use permits with outspoken community support for the project. The transmission corridor for the project is abundant in sensitive resource areas, including rich cultural resources, listed and candidate endangered species, incompatible land uses, a newly created national landmark and U.S. Forest Service "Inventoried Roadless Areas". This success was based on the MidAmerican Group's approach in creating opportunities and forums for the local community to provide substantive input through local community working groups and landowner meetings throughout the U.S Department of Interior's Bureau of Land Management environmental impact statement process. The environmental impact statement was obtained under the NEPA. As issues were raised, the MidAmerican Group addressed them individually until resolved to the satisfaction of all parties. In coordination with all governmental agencies, First Nation and Métis parties, stakeholders, and individual landowners, the MidAmerican Group continuously refined the initial route alternatives to address stakeholder concerns, minimize resource impacts, and resolve siting conflicts. For example, significant re-routes were made to minimize potential visual impacts to the Mountain Meadow National Landmark and avoid constraining a proposed wind farm whose developer was an established asset to the local community's economy. After more than 3 years of diligent work and close collaboration with a multitude of stakeholders, the MidAmerican Group is on schedule to obtain all necessary approvals with construction scheduled to begin in early 2013. The project also required and obtained a state approved CPCN.

Gateway West Project

The project team successfully navigated and completed the complex permitting, approval, and consultation requirements for the construction and operations of the Gateway West Project and it is currently in the final stages of the NEPA, environmental impact statement approval process. The Gateway West project has also included permitting activities at state level in both Wyoming and Idaho: Section 106 consultation (*National Historic Preservation Act, 1966*); Section 10 and Section 404 (U.S.ACE permitting); Section 7 consultation (*Endangered Species Act*); Section 401 (Water Quality Certification); Section 402 (NPDES); U.S.FS Special Use permit; BLM right-of-way grant; Wyoming Industrial Siting Permit; Conditional Use Permits; and several other local and state permits/approvals.

This permitting phase for the Gateway West Project commenced in 2007 and the project will be delivered through an Engineer Procure Construct ("**EPC**") contract methodology and targeted for completion by December 2018.

Gateway South Project

The Gateway South Project is in the early stages of the U.S. National Environmental Policy Act, environmental impact statement approval process involving up to 13 separate U.S. Department of Interior's Bureau of Land Management jurisdictions and three national forests. The MidAmerican Group is actively working with regulators and stakeholders to address siting concerns and yet another set of unique challenges. The project is currently analyzing over 4,100 km of alternative routing through Wyoming, Colorado, and Utah and also includes additional permitting with regards to Section 106 consultation (*National Historic Preservation Act, 1966*); Section 10 and Section 404 (U.S.ACE permitting); Section 7 consultation (*Endangered Species Act*); Section 401 (Water Quality Certification); Section 402 (National Pollutant Discharge Elimination System); United States Forest Service Special Use permit; Bureau of Land Management right-of-way grant; Wyoming Industrial Siting Permit; Conditional Use

Permits; and several other local and state permits/approvals. Project permitting commenced in 2008 with a record of decision expected in early 2015.

Camp Williams Project

The Camp Williams Project was constructed adjacent to an existing MidAmerican Group 345 kV transmission corridor on private lands. Although the project did not require a U.S. National Environmental Policy Act, environmental impact statement, the project still required obtaining permitting from eight different cities and counties. Environmental compliance oversight was also performed throughout construction of the project to ensure applicable environmental laws and regulations and environmental mitigation measures were pursued. In coordination with federal, state and local agencies, the project prepared wetland delineation studies, threatened and endangered species assessments, received one stream alteration permit and five conditional use permits.

The MidAmerican Group's Energy Gateway Program in addition to other public regulated service areas is required to maintain compliance with mandated FERC and NERC bulk electricity system reliability and performance standards administered by WECC. These standards dictate the minimum levels of transmission system reliability, redundancy and performance required to interconnect to the larger transmission grid system. In addition, the MidAmerican Group is regulated by state level regulatory agencies, such as the Public Service Commission of the state of Utah. Each project is required to obtain a notice of approval from the state regulatory agency prior to construction. In Utah, for example, a CPCN is to be granted by the Public Service Commission approving the purpose and need for the project. Similar regulatory approvals are required in other jurisdictions served by the MidAmerican Group.

Further information on the transmission line and electricity generation projects where the MidAmerican Group has conducted permitting, environmental assessment and regulatory compliance is contained in Exhibit E-5-2.

TAB E-5-2

<u>Environmental, Permitting and Regulatory – Representative List of Experience</u>

Table E-4

RES Group Power Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Marengo I, WA	230 kV	6.40 km
Marengo II, WA	230 kV	11.70 km
Cedar Point, CO	230 kV	67.20 km
*Greenwich, Canada	230 kV; 34.5 kV	9.90 km; 38.40 km
Woodward Mountain, TX	138 kV	28.80 km
King Mountain, TX	138 kV; 34.5 kV	30.40 km; 12.80 km
Whirlwind, TX	69 kV	32.30 km
Hopkins Ridge I, WA	115 kV	11.70 km
Lone Star-Post Oak, TX	138 kV	11.00 km
So. Trent Mesa, TX	138 kV	10.40 km
Hackberry, TX	345 kV	10.20 km
*Talbot, ON Canada	230 kV	9.90 km
Hatchet Ridge, CA	230 kV	5.40 km
Crossroads, OK	345 kV	16.00 km
Lower Snake River, WA	230 kV	12.80 km
MidAmerican Group Power Recent Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Populus to Terminal,UT, 10	345 kV	216 km
Mona Oquirrh, UT	345 kV; 500 kV	160 km
Siqurd to Red Butte, UT	345 kV	272 km
Gateway West, WY, ID	250 kV; 345 kV; 500 kV	1,600 km
Gateway South WY, UT	500 kV	680 km

St. George Transmission Station, UT	345 kV line and 138 kV static var compensator; (SVC)	32 km
Red Butte Transmission Station, UT	345 kV static var compensator	N/A
Camp Williams to 90th South, UT	345 kV	18 km
California Oregon Intertie Transfer Capability I OR	500 kV Shunt and Series Cap Banks	N/A
DJ to Casper 230kV No 1 & 2 Line Rebuild Wy	230 kV	97 km
Meridian Lonepine 230kV Ln #1 Reconductor OR	230 kV	4 km
Meridian Sub - Install 230 kV Capacitor Bank OR	230 kV	N/A
Pinto Substation 345kV Series Capacitor UT	345 kV	N/A
St George-Red Butte Central Dbl Ckt 345kV Ln UT	345 kV	28 km
Vantage-Pomona Heights 230kV Line WA	230 kV	63 km
Prairie Wind Transmission KS	345 kV	172 km
Competitive Renewable Energy Zone projects TX	345 kV and higher	1740 km
RES Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Buffalo Gap III Wind Farm, TX	170 MW	Wind
Bull Creek Wind Farm, TX	180 MW	Wind
Cameron Ridge, CA	60 MW	Wind
Cedar Point Wind Energy Project, CO	250.2 MW	Wind
Central Plains Wind Farm, KS	99 MW	Wind
Crossroads Wind Energy Project, OK	227.5 MW	Wind

*Greenwich Wind Energy Project, ON	99 MW	Wind
Hackberry Wind Farm, TX	166 MW	Wind
Hatchet Ridge Wind Farm, CA	101.2 MW	Wind
Hopkins Ridge Wind Farm, WA	149 MW	Wind
King Mountain Wind Ranch, TX	278 MW	Wind
Lone Star (Mequite and Post Oak) Wind Farm, TX	400 MW	Wind
Lower Snake River Wind Project, WA	343 MW	Wind
Marengo Wind Farm II, WA	71 MW	Wind
Marengo Wind Farm Phase I, WA	140 MW	Wind
*Site Nordique Experimental en éolien Cours (SNEEC), QC	4.1 MW	Wind
*Talbot Wind Energy Project, ON	99 MW	Wind
Whirlwind Energy Center, TX	60 MW	Wind
Wigton Wind Farm, Jamaica	21 MW	Wind
Woodward Mountain Wind Ranch, TX	160 MW	Wind
Gaines Cavern Wind Project, TX	2.0 MW	Wind
MidAmerican Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Lake Side, UT	558 MW	Natural Gas
Currant Creek, UT	548 MW	Natural Gas
Gadsby single-cycle, UT	129 MW	Natural Gas
Currant Creek Plant, UT	550 MW	Natural Gas
Lake Side Plant, UT	558 MW	Natural Gas
Lewis River, WA	510 MW	Hydro
North Umpqua, OR	194 MW	Hydro
Dunlap 1, WY	111 MW	Wind

Glenrock, WY	99 MW	Wind
Glenrock III, WY	39 MW	Wind
Goodnoe Hills, WA	94 MW	Wind
High Plains, WY	99 MW	Wind
Rolling Hills, WY	99 MW	Wind
Seven Mile Hill, WY	99 MW	Wind
Seven Mile Hill II, WY	19.5 MW	Wind

***Denotes projects in Canada**

TAB E-6-1

First Nation and Métis Consultation – Overview

The RES Group and the MidAmerican Group, through their extensive development activities have gained significant experience in First Nation and Métis consultation. While consultation generally is a key element of a successful project, the RES Group and the MidAmerican Group share a deep respect for First Nation and Métis people and the need to understand and accommodate Treaty and First Nation and Métis rights that encompass the customs, practices and traditions of these distinctive cultures.

Many of the RES Group's projects in Ontario and throughout Canada are located on Crown Lands. As such, the RES Group has engaged in a high level of consultation with First Nation and Métis communities with Treaty rights on these Crown Lands. The RES Group has undertaken consultation in full awareness of the 'duty to consult' enshrined in Canadian law, and incorporates First Nation and Métis consultation as an integral part of the development process.

On two occasions, the RES Group was delegated the responsibility to carry out the procedural aspects of the Crown's Duty to Consult in Ontario. Through the execution of an agreement between Her Majesty the Queen in Right of Ontario as represented by the MOI and the RES Group, the consultation process for the Greenwich Wind Farm and the Talbot Wind Farm, including the associated 230 kV transmission lines, was led by the RES Group. Both projects were successfully completed with a high level of support within affected communities.

The specific level of consultation with First Nation and Métis peoples is typically done in accordance with historical claims, treaty rights or traditional use of the lands. In this regard, many outcomes have been obtained by the RES Group on a range of Canadian projects. For example, on the Greenwich Wind Farm the RES Group executed an ABA, whereby construction impacts upon traditionally used lands were financially compensated for. Alongside the ABA, the RES Group also negotiated First Nation and

Métis Economic Implementation Plans ("**EIP**") for the two neighbouring First Nation to the Greenwich Wind Farm transmission tie line, whereby First Nation and Métis construction companies were provided with preferred employment opportunities on the construction site.

On another occasion in Quebec, the RES Group concluded an economic investment plan for a First Nation adjacent to the project, whereby the First Nation had a right to become a minority investor in the project.

All of the RES Group's electricity infrastructure projects in Canada have included some level of First Nation consultation that has been tailored as a function of the impact each individual project has had on historical claim, Treaty rights or traditional use of the project's lands.

The MidAmerican Group has demonstrated a high level of success in tribal consultation, as First Nation and Métis consultation is referred to in the US, through both permitting and operation and maintenance of its facilities. This has been accomplished by supplementing internal staff with highly qualified environmental firms providing access to a large stable of PhD anthropologists who have spent their careers coordinating and facilitating relationships among governments, sovereign nations, and project applicants, helping all of these entities navigate a complex environment of treaty rights, regulations, and good faith relationships to achieve desired outcomes and compromises. In this process, MidAmerican Group scientists also conduct research and ethnography to increase understanding of the human and cultural environment, and thus create new options for balancing the needs of many parties. While the MidAmerican Group's work has primarily been U.S. and U.S. territorially focused, it has worked with Pacific and Rocky Mountain/Plains peoples who traditionally span the Canadian border, and which retain Canadian ties. The MidAmerican Group similarly works with Native Alaskans and far northern culture groups. MidAmerican Group staff work inside communities with tribal members, elders, and officials, to identify and model resources, issues, and values important or sacred in relation to development and government-regulated projects. For these engagements anthropologists, ethnographers, and ‘contact period’ historians and archaeologists and a staff of experts, as well as facilitators are used.

The MidAmerican Group has employed these approaches to working with tribal communities on interstate pipeline projects; in the Powder River gas fields where the massive Pumpkin Buttes sacred site presented unique challenges, and on interstate power and gas lines where numerous tribal entities had overlapping concerns and interests.

In these contexts, the MidAmerican Group often collaborates with federal agencies such as the U.S. Department of Interior’s Bureau of Land Management on successful strategies for consultation and negotiation. In addition, several MidAmerican Group staff members have worked directly for tribal governments, providing environmental services and training programs for tribal monitors. This has included employing and working alongside Native American monitors during construction projects and archaeological excavations to ensure that Native American cultural resources are treated appropriately.

Further information on the transmission line and electricity generation project portfolio of the RES Group where First Nation and Métis consultation has been conducted is included in Exhibit E-6-2.

TAB E-6-2

First Nation and Metis Consultation – Representative List of Experience

Table E-5

RES Group Power Transmission Projects		
Project Name, Location	**Voltage**	**Length**
Greenwich, ON Canada	230 kV; 34.5 kV	9.90 km; 38.40 km
Talbot, ON Canada	230 kV	9.90 km
Montana Alberta Tie Line – Montana, US/Alberta, Canada	230 kV	342.40 km
RES Group Power Generation Projects		
Project Name, Location	**Capacity**	**Technology**
Brooke-Alvinston Wind Energy Project, ON	10 MW	Wind
Greenwich Wind Energy Project, ON	99 MW	Wind
Amethyst Wind Energy Project, ON	100 MW	Wind
Athelstane Wind Energy Project, ON	100 MW	Wind
Talbot Wind Energy Project, ON	99 MW	Wind

TAB E-7-1

Other Stakeholder Consultation

The RES Group and the MidAmerican Group understand the critical importance of adequate stakeholder consultation with affected groups and individuals and the effect that failure to give due regard to the same can have on project schedule and overall project risk.

Both the RES Group and the MidAmerican Group have experience in multiple consultation strategies, whether through the conduct of multiple open houses, public information centres and working group meetings or the publication of newsletters and fact sheets. In connection with Greenwich Wind Farm and the Talbot Wind Farm, the RES Group held 2 and 3 public information centres, respectively. At such public information centres, information panels were set up, question and answer sessions conducted and attendees invited to complete questionnaires about the project.

In connection with the Sigurd to Red Butte Project, the MidAmerican Group has invited public participation in working group meetings and sends newsletters periodically to landowners and other interested parties. An example can be reviewed in Exhibit E-7-2. The MidAmerican Group has adopted a similar approach to its other projects, including the Gateway West Project which is currently undergoing an extensive stakeholdering process.

The measures for stakeholder consultation developed by each of the RES Group and the MidAmerican Group are in addition to the minimum expected consultation requirements through the various environmental assessment processes that apply in the jurisdictions where they conduct their respective operations. On their projects, each of the RES Group and the MidAmerican Group continue stakeholder consultation and communications through project construction and implementation phases as well as through the operations phase. Additional stakeholder consultation and communications tools and activities that have been used on past projects include:

- the formation of a community benefit fund, which donates funds annually to environmental projects in nearby communities;
- the appointment of an operations manager to process real-time project information and help address community concerns during all project stages;
- in lead up to and during construction, weekly ads in local newspapers and radio stations on project progress;
- web site development and maintenance with frequent updates on project progress (see for example, www.greenwichwindfarm.com, www.talbotwindfarm.com and www.pacificorp.com/tran/tp/eg/gc.html);
- toll-free telephone numbers to receive messages during development and construction, with prompt relaying of information to appropriate personnel;
- the appointment of a construction community liaison officer who directly addresses issues raised by the community during the construction phase of the project;
- project update bulletins mailed or hand delivered to keep area residents apprised of the progress of construction, dates and timing of any traffic disruptions connected with the project and any other matters that may affect or be of interest to area residents and other project stakeholders;
- newspaper notices regarding traffic disruptions and construction timings of interest;
- personal consultations as requested or if warranted;
- regular meetings with affected municipalities regarding project implementation;
- ongoing discussions with provincial government agencies as required;

- ongoing consultation and meetings with project landowners; and
- formation of a project advisory committee composed of members that represent the various interests in the project: landowners, councillors, environmental groups, etc. Project advisory committees meet on regular basis to discuss project issues and concerns prior to and during the project construction.

TAB E-7-2

Example of Stakeholder Newsletter

Figure E-3

January 2010
Vol. 1 • Issue 1

transmission lines

Important news about Rocky Mountain Power's **Sigurd to Red Butte** transmission project

Landowner meeting dates

February 2
Best Western Abbey Inn
1129 S. Bluff St.
St. George

February 3
Enterprise High School
565 S. 200 E.
Enterprise

February 4
Crystal Inn
1575 W. 200 N.
Cedar City

February 9
Oak Tree Inn
777 W. Highway 21
Milford

February 10
Sevier Valley Center
800 W. 200 S.
Richfield

The agenda for all meetings is as follows:
5:30 p.m. Open house
6:30 p.m. Presentation
7:00 p.m. Questions & Answers
8:00 p.m. Adjourn

Project timeline

- Public scoping – first quarter 2010
- Environmental Impact Statement – Dec. 2008- to be determined
- Informational meetings – 2009-project completion
- Permitting and obtaining rights of way – 2011-2012
- Construction – 2012-2014
- Estimated line in service for customers – Summer 2014

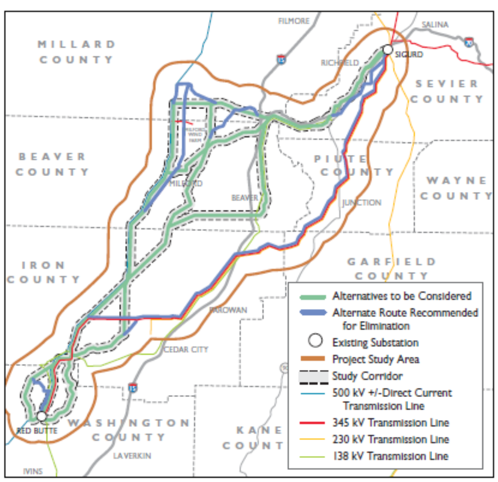
New transmission project to help meet area's growing need for electricity

Utah grows – Rocky Mountain Power invests to keep pace

Rocky Mountain Power is always working to provide safe, reliable electrical service to meet the growing needs of its customers. Utah has been one of the fastest growing states in the nation for more than a decade and both new and existing customers have greater needs for energy than ever before – especially electricity. The recent economic recession has caused a slowing of this growth and the company has adjusted appropriately for customer needs. Still, demand for electricity is growing despite the economic conditions. Typical residential consumers today are using 26 percent more electricity than they did 20 years ago.

In 2007, Rocky Mountain Power committed to expanding its transmission network to ensure sufficient capacity will be available to meet the needs of its new and existing customers. This project will add an additional high-voltage transmission line carrying electricity from the existing Sigurd substation near Richfield to an expanded Red Butte substation near Central in Washington County. In addition to serving Rocky Mountain Power customers, this line will increase capacity and reliability for new and existing customers of the various municipal and rural electric systems in the state.

This new transmission line will benefit customers by improving system reliability now and provide increased supply and flexibility to meet customer needs in the future. To meet expected demand, this project is planned to be completed and in service to customers in 2014.



To view this map online, visit the Sigurd to Red Butte project Web site at **rockymountainpower.net/transmission.**

Project description

The exact placement of the transmission line has not yet been determined. The proposed project will consist of a new, single-circuit 345,000-volt (345 kV) transmission line connecting the Sigurd substation, located approximately six miles northeast of Richfield in Sevier County, Utah, to the Red Butte substation, located southwest of the town of Central in Washington County, Utah. The line would be approximately 160 miles long. The structures, made of steel with self-weathering or dull galvanized finish, will vary in type depending on the location (see illustrations on reverse).

ROCKY MOUNTAIN POWER
Let's turn the answers on.

Route selection process

During the past year Rocky Mountain Power has been working with local officials, gathering data, and conducting in-depth studies. Several community working groups have been formed, consisting of local leaders, to advise the company regarding local features, community issues and land use. To further ensure decisions regarding the final location are fully informed, Rocky Mountain Power will be hosting a number of meetings throughout the course of the project to provide details and collect comments from customers, landowners and other interested parties. The first series of meetings will be held February 2-10, 2010. Please see the schedule on the reverse for a meeting near you.

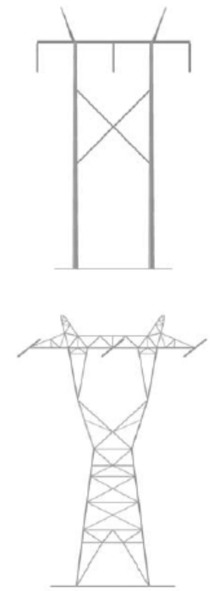
Many locations are being considered for the transmission line. The potential locations will be evaluated to ensure additional capacity and improved reliability is sufficient to meet the current and future needs of electric customers.

Criteria used in the selection process include: reliability, safety, eventual cost to customers, accessibility, area to be served, other electric facility locations, technical feasibility, land use, etc.

Environmental review & permitting process

Because portions of the project will be built on federal lands, the Bureau of Land Management (BLM) will develop the Environmental Impact Statement (EIS) regarding this project as part of the National Environmental Policy Act (NEPA). The NEPA process requires the BLM, working with Rocky Mountain Power, to develop an Environmental Impact Statement detailing an analysis of potential environmental impacts of a proposed range of reasonable alternatives for this project. The BLM is the lead agency for the NEPA process. Public participation is encouraged throughout the NEPA process and dates and locations of public meetings will be published in local newspapers, mailed to project-specific mailing lists and posted on company and BLM Web sites. At the conclusion of this process the BLM and U.S. Forest Service will issue a right-of-way grant to build the proposed transmission line on federal property. The company will also apply for all necessary permits and approvals from other federal and state agencies and local jurisdictions.

Typical structure types



Important news about Rocky Mountain Power's **Sigurd to Red Butte** transmission project

For more information, please contact us:

E-mail:
ConstructionProjects
@pacificorp.com

Phone:
801-220-4221

Web:
rockymountainpower.net/
transmission

To submit official comments on the Sigurd to Red Butte project, please submit them directly to the Bureau of Land Management, Cedar City Field Office, Attn: Rob Wilson, 176 East DL. Sargent Drive, Cedar City, UT 84721 or E-mail at utsrbproj@blm.gov or visit http://www.blm.gov/ut/st/en/fo/cedar_city/planning/sigurd_to_red_butte.html.

Comments submitted directly to Rocky Mountain Power are not considered part of the official BLM record.

transmission lines

ROCKY MOUNTAIN POWER
201 South Main, Suite 2300
Salt Lake City, UT 84111

TAB E-8-1

Adherence to Good Utility Practices

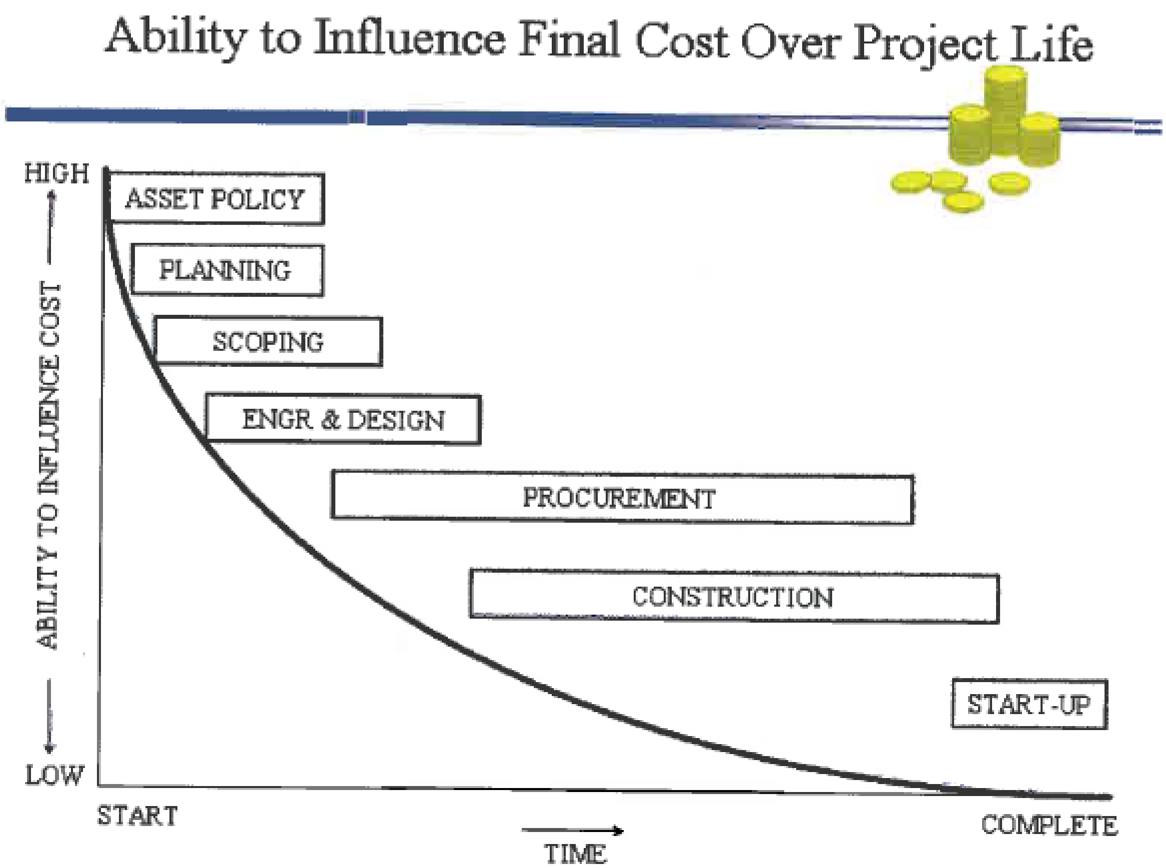
Each of the RES Group and the MidAmerican Group will ensure that the Applicant's corporate governance, organization plan, project management plan and the implementation of the same are consistent with their own good utility practices. This is a key part of the corporate governance of each of the RES Group and the MidAmerican Group, to ensure subsidiaries follow the business practices of their parent.

MidAmerican Group

As described in this Exhibit E, the MidAmerican Group employs an engineering, procurement and construction delivery model for large, complex, electricity transmission infrastructure projects. This delivery method has been hugely successful for projects similar in size and scope of the EWTL and even larger and more complex projects. MidAmerican Group's projects were planned designed and constructed (when placed in service) in accordance with prudent utility practice and in accordance with national and industry standards and criteria.

Concepts, tools, methodologies and proven practices for project management of the MidAmerican Group are consistent with the Project Management Institute, an independent professional organization that specializes and is a resource to U.S. companies regarding the practices used in the management and delivery of large infrastructure projects including, but not limited to, bulk electric power systems ("**Project Management Institute**"). See Figure E-4 below.

Figure E-4



Consistent with Project Management Institute guidelines, the MidAmerican Group employs industry accepted practices in its process of scoping, development, design, procurement and construction of large power transmission projects.

500 kV Lattice Tower Development $10M

The MidAmerican Group has developed through its typical course of business a family of both single and double circuit lattice towers for its Energy Gateway Program. The MidAmerican Group is committed to providing high quality, reliable, and cost efficient solutions on their projects and developing a new family of towers demonstrates a prudent utility approach in obtaining these objectives. Both tower families consists of a tangent, long span, small running angle, 45 degree dead-end and a 90 degree deadend towers. Since the single circuit will see much greater use additional towers were developed to improve economy and now include a light tangent and (2) larger running angle towers. To demonstrate a high level of commitment and prudency, the majority of towers were full load tested to prove design capacity of each configuration while the remainders were prototyped fit tested providing additional certainty that the towers be able to be efficiently assembled and erected.

Design Performance Standards Followed In The Industry

Additionally, the MidAmerican Group uses the following industry standards for the design and construction of various MidAmerican Group projects. Materials and equipment procured for projects are required to be in conformance with these and other standards including but not limited to the following.

Table E-6

Reference Abbreviation	Name
AA	Aluminum Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISE	Association of Iron and Steel Engineers
ANSI	American National Standards Institute
API	American Petroleum Institute
AREMA	American Railway Engineering and Maintenance Association
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Nondestructive Testing
ASTM	American Society for Testing and Materials
AWS	American Welding Society
CMAA	Crane Manufacturer Association of America
CRSI	Concrete Reinforcing Steel Institute
EIA	Electronic Industries Alliance
EPA	Environmental Protection Agency
HMI	Hoist Manufacturer's Institute

Reference Abbreviation	Name
IBC	International Building Code
ICEA	Insulated Cable Engineers Association
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISA	Instrument Society of America
ISO	The International Organization for Standardization
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEMA	National Electrical Manufacturers Association
NERC	North American Electric Reliability Corporation
NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
SAE	Society of Automotive Engineers
SDI	Steel Deck Institute
SSPC	Structural Steel Painting Council
TIA	Telecommunications Industry Association
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc

The MidAmerican Group has also proven it is successful in planning, budgeting and timely delivery, including regulatory process execution, of major infrastructure projects in accordance with good utility practices (see Exhibit E-5-1). This is evidenced by the success of the many projects described in this Exhibit E. The MidAmerican Group is extensively challenged throughout project delivery with the many regulatory processes listed below. It must continually demonstrate good utility practices related to alternatives analysis, technical solutions, project performance viability, safety, lowest overall cost solutions, customer impacts, risk and reliability versus cost, cost recovery and operations and maintenance or risk failure to meet requirements for permitting its projects.

National Environmental Policy Act Permitting Process: For any project proposed on federal land, the proponent must submit an application to the land management agency for a right-of-way grant to cross federal land. This process invokes the *National Environmental Policy Act* process which requires federal agencies to undertake an assessment of the environmental effects of their proposed actions prior to making a decision as to whether or not they should issue the grant. Two key focuses of the *National Environmental Policy Act* process are analyzing and disclosing the impacts of a project on the environment and consulting with the public. Federal land management agencies could include but are not limited to the Bureau of Land Management, the Forest Service, and the National Park Service.

Conditional Use Permits: Local land use authority is the jurisdiction of cities, towns, and counties. The purpose of conditional use permits is to provide for the regulation of certain uses to ensure compatibility with existing land uses. An application must be submitted to the local jurisdiction and often requires the proponent appear before the planning commission and/or governing body for public hearing.

Certificate of Public Convenience and Necessity: Before a regulated utility can construct major capital projects, the utility is required to a prudency determination that this project is in the customers' interest and is necessary to provide safe, reliable, adequate, and efficient service.

Utah Utility Facilities Siting Review Board: The Facility Review Board is designed to resolve disputes between local governments and utilities over facility siting in the State of Utah. The Review Board may hear disputes over cost and some siting matters and cannot preempt local authority, but may require the local government to alter its conditions or requirements, or pay incremental costs of requiring alternative routes.

Wyoming Industrial Siting Permit: Transmission lines in the State of Wyoming over 161 kV and projects with estimated construction cost exceeding $96,000,000 are subject to the jurisdiction of the Wyoming Industrial Siting Division, part of the Wyoming Department of Environmental Quality. The Wyoming Industrial Siting Council reviews the socio-economic and environmental impacts of the proposed industrial facilities before issuing a permit for construction.

School and Institutional Trust Land Administration Permitting Process: State owned lands in Utah are administered by this process. Prior to entering or crossing these lands, an applicant must submit an application to the School and Institutional Trust Land Administration for approval.

Section 106 Consultation: Section 106 of the *National Historic Preservation Act* requires that federal agencies take into account the effects of their undertakings on historic and archaeological resources eligible for or listed on the National Register of Historic Places. This often means that cultural resource surveys are conducted to identify these resources. Consultation with the State Historic Preservation Office and other consulting parties is also required to seek the State Historic Preservation Office's concurrence on findings and determinations.

TAB E-9-1

Relevance of Representative Experience to the EWTL

As previously described in this Exhibit E, the RES Group and the MidAmerican Group have successful experience in developing, permitting, designing, constructing, owning, and/or operating more than 30,000 km of transmission lines under local, regional and federal regulatory oversight. Past development and construction of transmission lines by the RES Group and the MidAmerican Group has been conducted within a wide range of climates, topography, ground conditions, weather conditions, vegetation management regimes, construction and operating conditions, stakeholder and First Nation and Métis concerns, which makes their cumulative experience directly applicable to the Project.

The RES Group and the MidAmerican Group's prior experience in the following areas will be particularly relevant to the development and construction of EWTL:

- extreme topographic and weather conditions in the Rocky Mountains and Northwestern Ontario – the region of Northern Ontario in which the EWTL will be located is subject to severe weather and the ability to manage construction and construction timetables in such conditions will require reliance on appropriate prior experience;
- ground conditions in the Northwest and Rocky Mountains and the Canadian Shield – as will be demonstrated in Exhibit J, the proposed route for the EWTL will involve traversing variable ground conditions including muskeg and rocky soils;
- long spans and river crossings in the US Pacific Northwest and Midwest, including long spans over the Mississippi and Columbia Rivers and their tributaries – as will be demonstrated in Exhibit J, the proposed route for the EWTL will require sensitive management of watercourses and water bodies that are within or proximate to the proposed route for the EWTL;

- extensive vegetation management regimes in the Pacific Northwest, Rocky Mountain states and Midwest – the proposed route for the EWTL may involve the passage through a National Park and in any event, the EWTL will traverse parts of Northern Ontario that are ecologically sensitive, such as Provincial Parks and conservations areas;

- First Nation experience in Ontario and tribal experience in Nevada, Arizona and Utah, including past consultation with many of the First Nation and Métis identified as potentially affected by the EWTL and successful benefits agreements reached with two of the First Nation within the footprint of the EWTL (Fort William and Red Rock) – as the Board has identified, First Nation and Métis consultation, accommodation and participation are of critical importance. Familiarity with the First Nation and Métis interests, traditional rights and practices will provide the Applicant with a solid base to conduct First Nation and Métis engagement and consultation;

- the MidAmerican Group has demonstrated a high level of success in tribal consultation, as First Nation and Métis consultation is referred to in the US, through both permitting and operation and maintenance of its facilities. This has been accomplished by supplementing internal staff with highly qualified environmental firms providing access to a large stable of PhD anthropologists who have spent their careers coordinating and facilitating relationships among governments, sovereign nations, and project applicants, helping all of these entities navigate a complex environment of treaty rights, regulations, and good faith relationships to achieve desired outcomes and compromises. In this process, MidAmerican Group scientists also conduct research and ethnography to increase understanding of the human and cultural environment, and thus create new options for balancing the needs of many parties. While the MidAmerican Group's work has primarily been U.S. and U.S. territorially focused, it has worked with Pacific and Rocky Mountain/Plains peoples who traditionally span the Canadian border, and which retain Canadian ties. The MidAmerican Group similarly works with Native Alaskans and far northern culture groups. MidAmerican Group staff work inside communities with tribal members, elders, and officials, to identify and model resources, issues, and values important or sacred in relation to development and government-regulated projects. For these engagements anthropologists, ethnographers, and 'contact period' historians and archaeologists and a staff of experts, as well as facilitators are used;

- the MidAmerican Group has employed these approaches to working with tribal communities on interstate pipeline projects; in the Powder River gas fields where the massive Pumpkin Buttes sacred site presented unique challenges, and on interstate power and gas lines where numerous tribal entities had overlapping concerns and interests;

- the MidAmerican Group often collaborates with federal agencies such as the U.S. Department of Interior's Bureau of Land Management on successful strategies for consultation and negotiation. In addition, several MidAmerican Group staff members have worked directly for tribal governments, providing environmental services and training programs for tribal monitors. This has included employing and working alongside Native American monitors during construction projects and archaeological excavations to ensure that Native American cultural resources are treated appropriately;

- compliance with local, regional, and national environmental and permitting requirements, including environmental assessments and environmental impact statements without adversely affecting project schedules – as will be demonstrated in Exhibit L, the extent of the permits and approvals required in connection with the EWTL will required a coordinated, proactive and methodical approach to permitting approval. It has been shown that the RES Group and the

MidAmerican Group have, time and again, completed permitting activities without creating delays to project schedules (see Exhibit E-3-7 and Exhibit E-5-1);

- extensive regulatory proceedings for transmission approvals including LTC and comparable processes (including demonstration of need) in Ontario and multiple US jurisdictions and before multiple regulatory bodies – it is well understood that successful designation of the Applicant is a critical but only an initial step in the development of the EWTL; the experience of the RES Group and the MidAmerican Group in obtaining successful LTC for multiple projects will be bought to the EWTL LTC process, including engagement with the OPA for the demonstration of need;

- active participation in several regional reliability and transmission planning organizations including Midwest Independent System Operator ("**MISO**"), Southwest Power Pool, ERCOT, WECC and regional transmission organizations similar to IESO as well as engagement with the IESO itself, the OPA, the Electrical Safety Authority and Hydro One – participation experience will be key to engaging with two key stakeholders of the EWTL, the IESO and Hydro One and, previous experience will both inform the Applicant's approach and ability to understand positions and tailor responses with these parties;

- extensive stakeholder outreach to finalize routes, mitigate impacts and secure public support of transmission lines, including outreach to First Nation and Métis communities, local government and communities, non-governmental organizations, and advocacy groups – these are engaged and important stakeholders and the development of the EWTL cannot be a success without sensitive and effective stakeholder management;

- experience in developing sound structure grounding solutions in areas of very high resistive soils to meet our structure grounding plan of reaching a maximum ground resistance of 20 ohms wherever possible. The Applicant plans to employ multiple spar grounding at each structure with as many as ten spars on h-frame structures and twelve on lattice structures. Structures that do not reach the 20 ohm level will be analyzed and additional measures (such as counterpoise) employed to achieve the best grounding level possible. Each grounding lead from structure is copper welded to avoid theft; and

- consistent experience in developing projects on time and within budget – the RES Group and the MidAmerican Group understand it is paramount that the interest of Ontario's ratepayers are safeguarded throughout the development, construction and operation of the EWTL and the starting point is maintaining project schedule and budgeted cost.

The table below highlights the key elements associated with the EWTL and the application of those within the projects referenced in this Exhibit.

Table E-7

		Projects									
		Populus Terminal	Gateway West	Gateway South	Mona Oquirrh	Sigurd Red Butte	Camp Williams - 90th	St George SVC	Red Butte SVC	Greenwich Ward Farm	Talbot Wind Farm
Project Elements	Regulatory Controlled Project	X	X	X	X	X	X	X	X		
	Transmission Line greater than 230kV	X	X	X	X	X	X				
	Distance over 200 KM	X	X	X		X					
	Separate Transmission & Substation Projects		X	X	X	X				X	X
	Federal Environmental Permitting Process		X	X	X	X				X	X
	Environmental Compliance	X	X	X	X	X	X	X	X	X	X
	Seasonal Environmental & Cultural Constraints	X	X	X	X	X				X	X
	Seasonal Weather Constraints	X	X	X	X	X	X			X	
	Federal Property		X	X	X	X					
	State/Crown Property	X	X	X	X	X				X	X
	Private Property	X	X	X	X	X	X	X	X	X	X
	Gravel/ Mining/ Energy Operations	X	X	X	X	X				X	

		Projects									
		Populus Terminal	Gateway West	Gateway South	Mona Oquirrh	Sigurd Red Butte	Camp Williams - 90th	St George SVC	Red Butte SVC	Greenwich Ward Farm	Talbot Wind Farm
	in ROW										
	Poor Quality/Soft soils	X					X				X
	Rocky soils	X	X	X	X	X				X	
	Varied Terrain	X	X	X	X	X					
	Remote Access		X	X	X	X				X	

TAB F-1-1

Project Management Plan – Overview

The Applicant will, through the combined resources of the RES Group and the MidAmerican Group that will be made available to it for the Project, be able to assemble a wealth of resources and experience dedicated to all phases of the Project's development and construction. These resources will include design, construction, land acquisition, technical, permitting, environmental, regulatory, financial and First Nation and Métis consultation subject matter experts.

The RES Group and the MidAmerican Group will ensure that the consistent, efficient and effective approaches that have been proven on previous projects, including those examined in Exhibit E, will be utilized on the Project. A senior project management team leader will be appointed to the Applicant's project management team. It is presently expected that Jerry Vaninetti will perform the role of project management team leader. Mr. Vaninetti has 40 years of management experience in the electricity industry, including 10 years with a utility, 13 years in project development (mainly transmission), 9 years as a management consultant and 8 years in energy transportation. Recently, he has managed two major transmission projects in the western U.S. Rocky Mountains, the Wyoming-Colorado Intertie Project (300 km of 345 kV transmission line) and the High Plains Express Project (3500 km of 500 kV transmission line. Mr. Vaninetti is currently the Senior Vice President Transmission with RES Americas and President of the Applicant.

Mr. Vaninetti will be supported by the following individuals (or in the case of changing roles in the future, individuals with commensurate experience) and together they will comprise the Applicant's project management team (the "**Project Management Team**"):

- Project Coordinator, Cory Blair: 6 years of transmission experience in the utility and renewable energy industries in the western U.S., including transmission planning, project management, transmission public policy, and stakeholder outreach. Current position: Transmission Development Manager, RES Americas, part of the RES Group;

- Manger, Planning, Darrell Gerrard: 35 years of working experience in the electric utility and energy supply business in the U.S. and abroad. Experience in a broad range of responsibilities required for successful operation of a large electric utility company including transmission, distribution and generation engineering and technical support, system planning, asset management, technology application, operations, construction, maintenance, safety, dispatching and grid operations, budgeting, business planning, customer service, safety and regulation. Utility system experience with companies in the U.S., Australia, UK, Canada; participant in due diligence teams seeking potential transmission and development asset acquisitions in the U.S., Turkey, Brazil, Australia. Current position: Vice President Transmission System Planning, PacifiCorp, part of the MidAmerican Group;

- Manager, Delivery, Todd Jensen**:** 22 years of experience in engineering and project management, with eight years specifically in the electric utility industry in the western U.S., including 5 years as Director of Main Grid Transmission. Experience in a broad range of electric utility applications, including transmission line, distribution line and substation projects. Most notable experience includes directing the Energy Gateway program which is comprised of projects in three states totalling over $5 billion. Vast experience in facility siting, permitting, right of way acquisition, contract negotiations, construction and commissioning, as well as cost controls, risk management and regulation;

- Manager, Land & Permitting, Ryan Henning: 20 years of experience in environmental, routing, and permitting for energy projects including transmission lines. Current position: Senior Permitting Specialist, RES Americas, part of the RES Group;

- Manager, Regulatory & Legal, Ryan Flynn: 10 years of experience in commercial negotiations, legislative, litigation and regulatory proceedings relating to among other things, PacifiCorp's long-term transmission strategy and policy, Current position: Vice President and General Counsel, Pacific Power , part of the MidAmerican Group;

- Manager, Communications & Consultations, Nicolas Muszynski: over 10 years experience in siting, permitting and financing renewable energy projects and related transmission infrastructure across Ontario and other Canadian jurisdictions. He has led the consultation process for multiple projects in Ontario two of which required a leave to construct application before the Board. Current position: Senior Development Manager, Renewable Energy Systems Canada Inc., part of the RES Group;

- Manager, Commercial & Finance, Venkata Bujimalla: 20 years of experience in banking, corporate financial planning, M&A analysis, tax and regulatory research Current position: Manager, Transmission Business Development, MAT, part of the MidAmerican Group.

Resumes for the Project Management Team can be found in Exhibit F-1-2.

The Project Management Team, under the leadership of Mr. Vaninetti will develop, promptly following the designation of the Applicant, a detailed project management plan (the "**Project Management Plan**") which will break down project delivery into the following structure:

- planning and delivery – this project task will include development of engineering and design, cost analysis, construction plans and project construction controls, overall cost benefit analysis, operation and maintenance planning and project scheduling;

- environmental and permitting – this project task will include route selection, environmental assessment and permitting;
- regulatory and legal – this project task will include OEB and Ontario ministry interaction, as well as conducting preparatory legal and regulatory work in connection with the Applicant's LTC for the EWTL;
- communications and consultation – this project task will include development and execution of communication and consultation with First Nation and Métis groups, municipalities, local communities and other stakeholders;
- commercial and finance – this project task will include project finance planning, accounting and First Nation participation and accommodation; and
- land control – this project task will include activities critical to securing site control over private, Crown lands and other lands and rights of way.

The Project Management Team structure is further shown in Exhibit F-1-3.

The Project Management Plan will address and be prepared, consistent with the Applicant's Project schedule (see Exhibit N for the Applicant's current proposed Project schedule) and establish a baseline timetable to monitor progress, so that the Project Management Team is able to update the Project schedule with the latest information, promptly, in accordance with good utility practices.

The Project Management Plan will further address change control management and communication protocols to ensure communication methods and reporting approaches are consistent across the Project.

In addition to the Project Management Team, a supplemental project team will be deployed in the EWTL region for on-the-ground representation and real-time oversight. The Applicant will also augment the efforts for all design review by utilizing a qualified "owner's engineer" with staff capable of performing thorough and detailed design review in a timely manner.

The "owner's engineer" is one example of the way in which the Applicant will manage the development of the Project with a combination of internal personnel and external resources. Please see Exhibit F-4-1 for further information on the Applicant's plan for use of external, third party resources.

The Applicant's Project Management Plan involves the commitment of significant human resources to manage, conduct, and administer all aspects of the Project's development and construction, operation and maintenance. It has been organized by specific management task for the development and leave to construct hearing phases of the Project and generalized during the construction phase as quantified and illustrated in Exhibit F-1-4. The Applicant has budgeted for (i) between approximately 5.1 and 6.5 full-time employee equivalents ("**FTEs**") during the development phase through the application to the Board for leave to construct, (ii) approximately 6.6 to 8.0 FTEs during the leave to construct hearing phase, and (ii) a gradual decline from approximately 6.1 to 3.5 FTEs during the construction phase of the Project. These latter estimates will be revised and subdivided into more categories in the Applicant's application to the Board for leave to construct. Approximately 20 percent of the development budget through the application to the Board for LTC of the EWTL ($4.3M) is dedicated to the time charges applicable to Applicant's project management of the Project, including expenses.

TAB F-1-2

Project Management Team Resume

Jerry Vaninetti, Senior Vice President, Transmission

Mr. Vaninetti is responsible for RES' North American transmission business including transmission project development and transmission solutions for the company's renewable energy projects. He has specialized in transmission and generation development since 1999 with responsibilities for business development, project management, project due diligence, and associated commercial, technical, and public policy issues. He is a frequent speaker at transmission and renewable conferences and participant in regulatory venues.

Prior to joining RES Americas in September of 2010, Mr. Vaninetti provided Transmission Development services to Trans-Elect, NextEra, and LS Power in varying contract and employment capacities. He was a member of the senior management team and partner in Trans-Elect, the nation's first independent transmission company. In recent years, he served as project manager for the proposed Wyoming-Colorado Intertie and the High Plains Express transmission projects – both of which involved partnerships with utilities (see below).

Prior to joining Trans-Elect in 2005, his transmission development experience was gained as President of Great Northern Power Development and as Interim Executive Director of the Wyoming Infrastructure Authority. Prior to then, he specialized in fuel supply and transportation issues for Resource Data International (RDI), where he was Principal in its Consulting Practice, and before that in management roles with Savage Industries and Utah Power & Light Company.

Transmission Project Management Experience

Wyoming-Colorado Intertie (WCI): Project Manager for a proposed 180 mile long 345 kV merchant transmission line to deliver Wyoming wind to Colorado. The development team included the Wyoming Infrastructure Authority, Western Area Power Administration, LS Power, and Trans-Elect. WCI successfully conducted a FERC-compliant Open Season process. Websites: www.wcintertie.com

High Plains Express (HPX): Project co-manager and chair of the Commercial Committee for a collaboration of seven utilities[1], three state transmission authorities (WY, NM, and CO), and two independent transmission developers (LS Power and NextEra). HPX is a proposed $5 billion 500 kV AC project planned to enable renewables and improve the transmission connections between the footprint utilities in the states of Wyoming, Colorado, New Mexico, and Arizona. Website: www.highplainsexpress.com

[1] Xcel Energy, SRP, Tri-State, Black Hills, PNM, WAPA and Colorado Springs Utilities

Other Transmission Accomplishments & Activities

- Co-chair of the WREZ Generation & Transmission Work Group
- Formed and managed strategic alliances, advisory service agreements, and joint ventures with renewable energy developers and state transmission authorities
- Managed outreach to renewable advocacy and transmission public policy groups
- Initial organization and management of the Wyoming Infrastructure Authority
- Successfully completed a FERC-compliant transmission open season process
- Active participation in state regulatory proceedings and dockets
- Co-founder of the Upper Great Plains Transmission Coalition
- Transmission interconnection and service filings for multiple projects
- Co-chair of Transmission Committee for the Colorado Independent Energy Association and Transmission Board Member for the Interwest Energy Alliance

Employment History

- **1972-1981:** Director of Exploration and Fuel Quality Control, Utah Power & Light Company, Salt Lake City, Utah; identification and evaluation of fuel resources.
- **1981-1985**: Manager of Fuel Supply Services, Norwest Mine Services, Salt Lake City, Utah; advisory services to the minerals industry and market analyses.
- **1985-1993**: Vice President of Business Development, Savage Industries, Salt Lake City, Utah and Lexington, Kentucky; materials handling & transportation business.
- **1993-1999**: Principal, Consulting Practice, Resource Data International, Boulder, Colorado; expert witness and railroad merger, fuel supply, and market analyses.
- **1999-2004**: President, Great Northern Power Development/Great Northern Properties, Denver, Colorado; mineral leasing and joint venture power project/transmission development on lignite/wind projects in Montana and North Dakota in partnership with Peter Kiewit & Sons.
- **2004-2006**: Management Consultant, Denver, Colorado. Trans-Elect Development Company, NRG, Wyoming Infrastructure Authority, Coalition Energy, Midwest Generation, American Association of Railroads, and Heron Lake Bio-Energy.
- **2006-2010**: Vice President & Partner, Trans-Elect Development Company, Denver, Colorado; transmission project management, business development, due diligence, public policy, and outreach to the renewable industry.
- **2010**: Western Transmission Development, NextEra Energy Resources, Denver, Colorado; identification and management of Western transmission projects.
- **2011**-Present: Senior Vice President Transmission, RES Americas, Broomfield, Colorado; management of RES' transmission business throughout North America.

Cory Blair, Transmission Development Manager

Professional Profile

As an electrical transmission project manager for an independent development company, I work with cross-functional teams to provide development services for independent transmission projects, including origination and prospecting, licensing and permitting, outreach and commercial partnerships, as well as advocacy for transmission policy and regulation throughout North America. A fundamental component of these development efforts is scheduling and coordinating projects of different sizes, complexity, and location.

Professional Accomplishments

Transmission Development Project Management

- Perform up-front prospecting and project feasibility analysis for numerous regulated transmission projects and transmission partnership opportunities throughout North America
- Ongoing development project management, including coordination of internal resources as well as management of third-party consultants, counsel, etc. for the development lifespan of a project
- Active in political and regulatory arenas advocating for competition and inclusion of independent transmission in regulated environments

Transmission Interconnection Analysis and Strategy

- Have provided transmission power flow analysis in support of over 2,000 MW of wind generation projects in various stages of development
- Proficient in Power Flow Software, including PowerWorld, Siemens PTI PSS/E, and GE PSLF
- Managed third-party consultants to provide detailed studies beyond in-house capabilities
- Provided transmission support for competitive RFP bids and ensuing PPA negotiations

Generator Interconnection Process Management

- Managed FERC-approved Large Generator Interconnection Processes (LGIP) for nearly 1500 MW of generation projects throughout the WECC region, in multiple Balancing Areas and utility footprints
- Liaised between utilities and internal construction/operations departments to ensure regulatory compliance

Regulatory and Legislative Administration

- Participate in and provide comments in various regulatory arenas, including FERC, WECC, and various state Public Utilities Commissions
- Follow legislative activities relating to renewable energy and transmission development, including testifying before legislative committees in support of various bills
- Active board member/participant in various trade organizations, including AWEA, Interwest Energy Alliance, Renewable Northwest Project (RNP), and Coloardo Independent Energy Association (CIEA), and co-chair/serve on various transmission, regulatory, and legislative committees

Project Details

- Assisted in commercial partnership discussions for regulated transmission development opportunities in multiple jurisdictions
- Managed project-level participation in competitive transmission development opportunities throughout North America
- Was responsible for all transmission-related aspects of over 2,000 MW of generation projects under development, totaling nearly $5 Billion in potential capital expenditures
- Testified in support of two renewable energy related bills in the Colorado Legislature, relating to taxation of generation tie-lines and streamlining of transmission planning processes. Both bills were signed into law
- Created Legislative/Regulatory Guidebooks and whitepapers on the myths of wind power for internal/external distribution
- Intervened in and provided comments for multiple regulatory dockets involving utility rate cases, energy resource plans, renewable portfolio standards, transmission planning rules, and transmission expansion projects

Work History

Transmission Development Manager	Renewable Energy Systems Americas Inc.	Denver, CO	April 2011 - Present
Transmission Manager	E.ON Climate & Renewables N.A.	Denver, CO	July 2008 – April 2011
Transmission Planning Engineer	Xcel Energy Services Inc.	Denver, CO	Sept. 2007 – July 2008
Transmission Design Engineer	Arizona Public Service Company	Phoenix, AZ	Jan. 2007 – Sept. 2007
Asset Management Intern	Arizona Public Service Company	Phoenix, AZ	June 2006 – Jan. 2007

Education

BS Electrical Engineering **Power Systems Emphasis**	Arizona State University	Tempe, AZ	December 2006

Darrell T. Gerrard
Vice President Transmission System Planning

Expertise

- **Transmission, Distribution and Generation –**
  - **Business Planning**
  - **System Planning**
  - **Engineering**
  - **Construction**
  - **Operations and Maintenance**
  - **Technical Support**
  - **Asset Management**
  - **Regulation**

Formal Education

- **Certificate of Completion – Electricity, Utah Technical College, 1976**
- **B.S. Electrical Engineering – Power Systems, University of Utah, 1980**
- **Utility Executive Education Program, Darden School of Business, University of Virginia, 1997**
- **Advanced Management Program, Wharton Business School, University of Pennsylvania, 2003**

Career Training/ Education

- **Business Leadership Program, Scottish Power**
- **Leadership-in-Action Series, PacifiCorp**
- **Administrative Management, PacifiCorp**
- **Effective Negotiations, Karrass**
- **Strategic Decision Making, Strategic Design Group Inc**

Mr. Gerrard is Vice President for Transmission System Planning for MidAmerican Transmission. He has devoted 35 years of working experience to the electric utility and energy supply business in the United States and abroad. He is experienced in a broad range of responsibilities required for the successful operation of a large electric utility company, including Transmission, Distribution and Generation engineering and technical support, system planning, asset management, technology application, operations, construction, maintenance, safety and regulation. He has utility system experience with companies in the United States, the United Kingdom, Australia and Canada. Additionally, he has served on due diligence teams seeking potential Transmission and Distribution asset acquisitions in the United States, Brazil, Australia and Turkey.

<u>*Representative Experience*</u>*:*

Vice President –Transmission Systems, PacifiCorp, 2006-Present
Officer responsibility for technical planning, architecting, obtaining WECC approvals and delivery support for PacifiCorp's Energy Gateway Transmission Expansion Plan. The Plan includes eight segments of 500kV, 345kV and 230kV transmission lines stretching nearly 2,000 miles, and requiring an investment of $5.4 Billion. Responsibilities include:

- Conceptual planning and project reliability and performance
- NERC Standards compliance
- WECC project review, ratings and operations approvals
- Technical planning and systems engineering
- Professional witness for regulatory proceedings for siting, permitting and cost recovery
- Vice-Chairman of Northern Tier Transmission Group Planning Committee
- FERC Order 1000 compliance support for Transmission Planning and Cost Allocation

Vice President–Transmission, PacifiCorp, 2000-2006
Officer responsibility for PacifiCorp's Transmission Business Unit, formed in 1998. PacifiCorp has one of the largest transmission grids serving the western United States, operating assets in 10 western states with over 150 interconnections to other electric supply companies and generators integrated into WECC. Responsibilities included:

- Management of nearly $1.2 Billion of Main Grid Transmission assets located in 10 western states in the United States.

Career Training/ Education, cont.

- **Leadership Styles, PacifiCorp**
- **Management of Media Relations, PacifiCorp**
- **Performance Planning for Success, PacifiCorp**
- **Front-Line Leadership Series, Zenger-Miller Co.**
- **Engineer as Manager, Battelle Co.**

Organizations/ Affiliations

Present:

- **WECC Planning Coordination Committee**
- **WECC Reliability Policy and Issues Committee**
- **NAESB Executive Committee**
- **NASEB Triage Committee**
- **Member IEEE Power Engineering Society**
- **Western Energy Institute (WEI) Planning Committee**

Past:

- **Member Project Management Institute**
- **Electric Utilities Service Requirements Committee**
- **Chairman and VP NELPA T&D Planning Committee**
- **Member Northwest Electric Light & Power Assoc. – Standards and Guidelines Committee**
- **Past Chairman PacifiCorp United Way Campaign**

- Transmission system planning and expansion, Grid Operations and Dispatching, Control Area operations and security.
- Compliance with WSCC, NERC, RMS, NWPP operating criteria and reliability standards, codes and safety and work rules.
- Business planning, development of operating plans, budgets and performance reporting, billing and revenue capture, O&M and Capital budget development and execution.
- Transmission Business Unit Investment Strategy and Policy development and execution to maximize returns and identify and manage risks.
- Development of NERC Compliance Office, necessary for implementation of mandatory NERC reliability, standards and guidelines implementation.
- Providing non-discriminatory transmission services to system users and generation interconnections; FERC regulatory compliance to Federal Orders 888, 889, 2000; tariff administration; development and filing of services contracts and federal rate case assessment, recovery and development.
- Executive responsibility for Serious Incident Inquiries related to safety and operations.
- Industry shaping and influence via EEI, FERC, WECC, NERC, NWPP, NAESB, etc.
- Current Participation:
  - Power Delivery Board
  - Investment Committee Power Delivery (ICPC)
  - Transmission Investment Committee (TIC)
  - Power Delivery Technology Steering Committee
  - Power Delivery Safety Steering Committee
  - RTO Steering Committee
  - IRP Steering Committee
  - WECC Reliability Policy Issues Committee
  - North American Electric Standards Board (NASEB) Executive Committee
  - EEI Transmission Policy Task Force

Assistant Vice President–Corporate Engineering, PacifiCorp, 1995-2000

Responsibilities included:

- Centralized engineering, design, standards and technical support services for all T&D business units of PacifiCorp, located in 7 western states.

Organizations/ Affiliations, cont.

Past cont.:

- **Member American Wood Preservers Association, Wood Pole Committee**
- **Leader Western Utilities Personal Protective Grounding Taskforce**
- **Junior Achievement Loaned Executive**
- **Westside Soccer Youth Association**
- **Raleigh Hill Little League Association**

Total Years Experience

- **35**

- Management of 365 employees (union and non-union) located in Portland, Salt Lake City and field operating locations across PacifiCorp.
- Project Management, Major Projects Delivery, Project Controls, Engineering for Distribution Systems, Substations, Transmission Lines, T&D System Planning and Civil Engineering.
- Lead responsibility for development of annual T&D capital budget ($475 Million typical) and 5-year construction budgets. Risk assessment and prioritization of investments submitted to Corporate.
- Leader of special taskforce to develop and implement Corporate Capital Utilization Guidelines and capital controls for improved utilization of capital resources available to PacifiCorp.
- Leader in technology assessment and deployment for T&D systems. Sponsor of distribution System 2000 Project developed for integrated T&D system planning, design, mapping, operation and asset management. Developed plans for deployment of CADOPS, CADPAD, FEEDERALL, FORESITE, GIS, SCADA and Substation Automation Pilots.
- Leader of international team assignment at PowerCor Australia (Melbourne) to develop design and construction standards, estimating tools, material and equipment specifications, planning standards and vendor lists for newly privatized PowerCor. Assisted in development of PacifiCorp's first international assignee compensation and benefits package for employee deployment in Australia.

Director T&D Engineering–Pacific Division, PacifiCorp, 1992-1995

Directed all activities required to support engineering and technical support for PacifiCorp's Retail, Wholesale, Power supply (Hydro) and corporate offices. Responsibilities included:

- Under sponsorship of Senior Vice President reestablished core competency engineering and project management as a new function and new department within PacifiCorp. Consolidated decentralized functions related to engineering and design, major investment construction, technical support and planning. (Engineering and project management had been outsourced exclusively in the late 1980s and PacifiCorp had become too dependent on outside engineering services and contractors to support day-to-day system operations.)

- Established Operability Reliability Guidelines Team (ORG), charged with consolidation of design, operating and construction standards for Utah Power and Pacific Power Divisions. Merger savings gained via common materials, equipment specifications and vendor selections during procurement.

T&D Engineering and Technical Support Manager, Pacific Power and Light, 1990-1992
Responsible for field operations engineering in Oregon, California and Washington, as well as System Planning, construction support and code compliance. Responsible for T&D system inspection and maintenance program development and regulatory approvals. Provided Facilities Management for service centers, fleet management and general plant. Responsibilities also included:

- Vegetation management and contract administration. Commissioned vegetation best practice review with external consultant and submitted to OPUC to support maintenance program. Responsible for submittal of annual T&D Inspection and Maintenance Program Compliance Report in Oregon.
- Budget preparation and execution. Asset management of all T&D assets in three western states. Liaison with regulatory agencies and interconnected utilities.
- Interface and liaison with major customers on technical matters and system performance.

Manager Transmission and Distribution System Standards, Pacific Power and Light, 1984-1990
Responsibilities included:

- Development, maintenance, approval and publishing of T&D system design and construction standards and reliability/operability guidelines. Code compliance with National Electric Safety Code, National Electric Code, California GO95, California GO128, Washington State Administrative Code (WAC), OSHA safety work rules, construction equipment applications, cost effective and efficient designs, material specifications and vendor qualification and selection. Liaison with electrical contractors, state and local inspectors and other utilities. Development and administration of seven state requirements for customer interconnection standards applications.
- Line extension policy development. RCMS estimating system maintenance and updating. Customer Service Requirements Manual design. Customer Interconnection Standards and Applicant Built Lines requirement.
- Transition Team Member for Utah Power – Pacific Power merger.

Oregon Area Field Engineer, Pacific Power and Light, 1980-1984
Responsibilities included:

- Distribution system design, inspection and operations support.
- Oregon and California Troubleshooter and liaison for customer service on technical issues and reliability.
- Load growth and reliability project development and budget formation for area.

MIDAMERICAN TRANSMISSION

Todd Jensen
Director, Main Grid Transmission Delivery

Expertise

- **Project Management**
- **Program Direction**
- **Power Design**
- **Communications**

Education

- **BSEE, University of Utah, 1989**

Total Years of Experience

- **22**

Mr. Jensen is the Director of Main Grid Transmission Delivery for MidAmerican Transmission. He is responsible for full and complete project oversight, and manages all project disciplines in the Project Management Office which includes Transmission and Substation project planning, route and site selection, right of way acquisition, permitting, construction, commissioning and closeout. He manages all aspects of contract and contractor oversight, including sensitive contract negotiations, management of risk, procurement, conflict resolution and escalations. He is directly responsible for the prudent management of budgetary and cost control functions. From its inception, Mr. Jensen has been the Program Director for the $5.4 billion Energy Gateway Program.

Representative Project List:

Populus to Terminal 345kV Project – Commissioned in 2010, this $864 million project consisted of approximately 135 miles of double circuit, 345kV Transmission Line on steel monopole structures. In addition, one new 345kV Substation and two expanded Substations were constructed as part of the project. Physical challenges included soft and highly corrosive soils along the shoreline area of the Great Salt Lake and high incidence of Artesian water flow conditions. Additionally, significant challenges were encountered with regard to permitting. Mr. Jensen was instrumental in working with his team to overcome extreme negative perceptions on the part of residents and municipal leaders in order to obtain needed conditional use permits. The project was completed on time and under budget.

90th South to Camp Williams 345kV Project – This $46.4 million project consisted of constructing a new double-circuit 345kV Transmission Line that extends 11 miles through the western portion of the Salt Lake Valley. The Transmission Line was built using TSP monopole structures supported by drilled concrete piers. The line was built within existing rights of way through commercial and residential portions of the valley. The primary challenge was the spotting of towers and maintaining blowout in a suburban area where new commercial development had encroached up to and, in some instances, into the right of way. The project came in on time and on budget.

Mona to Oquirrh 345kV Project - The $402 million Mona to Oquirrh project consists of approximately 70 miles of new Transmission Line utilizing single circuit 500kV lattice towers, as well as 30 miles of new Transmission Line utilizing double circuit 345kV TSP monopoles. The line begins at the new 500/345kV Clover Substation, routes through the Tooele Valley continuing over the Oquirrh Mountains and terminating at the existing Oquirrh Substation in West Jordan, Utah. A short segment of rebuilt double circuit 345kV Transmission Line connects the existing Mona Substation to the new Clover Substation. Physical challenges included design and construction in helicopter only segments of the Long Ridge Mountains, as well as the rugged terrain of the Oquirrh Mountains, reaching approximately 8,400 feet in elevation. Additional challenges included contentious perceptions by residents and communities, as well as a rigorous process to complete a full NEPA environmental impact statement and to receive a Record of Decision from the BLM. These challenges were met and overcome by the project team, with Mr. Jensen's direction playing a prominent role. The project is near completion with the in service date targeted for May 2013. All indications are that the project will be commissioned on time and under budget.

Terminal 138kV Substation Project **–** This $48.6 million project's purpose was to replace two existing 345/138kV 450 MVA transformers with new 345/138kV 700 MVA transformers, and to relocate the decommissioned transformers for use in other company assets. Terminal Substation is an existing station and serves a large portion of the Salt Lake Valley as well as Davis County, Utah. Terminal is also the oldest major station in Salt Lake City and is therefore constricted by adjacent property and buildings. Without the option of expansion, phased construction with limited outages was necessary. The project is near completion and will be in service summer of 2013, on time and on budget.

Oquirrh to Terminal 345kV Project – This $30.3 million project consists of a double circuit 345kV Transmission Line on tubular steel pole structures approximately 14 miles in length that will connect the existing Oquirrh Substation in West Jordan, Utah to the existing Terminal Substation in Salt Lake City, Utah. In doing so, the line will traverse the heavily congested Salt Lake City metropolitan area. Significant right of way challenges have been encountered as the project has coordinated carefully with the Utah Department of Transportation (UDOT) to exchange PacifiCorp's existing project right of way, and to reroute the project, to accommodate UDOT's extensive Mountain View Corridor highway project. Arrangements have been made to relocate existing 138kV and 345kV Transmission Lines to allow the Oquirrh to Terminal Transmission Line Project to be constructed in an alignment that will not conflict with the highway project. The scheduled in service date for the project is summer 2016.

Sigurd to Red Butte 345kV Project – This $380 million project consists of a single circuit 345kV Transmission Line approximately 170 miles in length, beginning at the Sigurd Substation near Richfield, Utah, and terminating at the Red Butte Substation near the town of Central, Utah. The line will consist of tubular steel pole H-frame for tangent structures and self supported lattice steel deadend towers. Work will include expansion of both Substations for the new line, as well as two distribution Substations fed through Red Butte Substation. This project will route through federal and state lands with historical and cultural significance and will be governed under the regulations of the NEPA permitting process. Preliminary designs for both Transmission Lines and Substations are complete, the right of way is nearing 100%

completion, the Record of Decision has been granted and EPC contractors are in place to begin work in 2013.

Energy Gateway West 500kV Project – The $1.6 billion Gateway West Project consists of approximately 1,000 miles of 230kV, 345kV and 500kV AC Transmission, beginning at Windstar Substation near Glenrock, Wyoming and terminating at Hemingway Substation southwest of Boise, Idaho. The proposed Transmission Line circuits will be supported by three types of structures. For the 160 miles of 230kV (which includes both new construction and rebuilt lines), as well as five miles of 345kV, structures will consists of tubular steel H-frame. The remaining 500kV segments will be constructed using self supported steel lattice towers. The project will include modifications or expansions of 10 existing stations and the construction of four new Substations. Major equipment will include (19) 550kV Transformers, (2) 345kV 750MVA Phase Shifters, (2) 550kV Series Capacitors, (17) Shunt Capacitors, (33) 550kV Reactors and (1) 245kV SVC. Preliminary engineering is complete and development of the EPC RFP package is underway (targeted for release summer 2013). The NEPA permitting process is underway, with the final environmental impact statement due for publication early 2013, and significant state permitting negotiations are in play as well. The first segment of the phased project is scheduled to be in service in 2018.

Energy Gateway South Project – The $1.3 billion Gateway South project, targeted for December 2020 completion, consists of approximately 425 miles of single circuit 500kV Transmission Line from the future Aeolus Substation, near Medicine Bow, Wyoming to the new Clover Substation, near Mona, Utah. Two proposed series compensation stations will be located at approximately the one-third and two-thirds points along the route. This line will be built using self supporting lattice towers. Project delivery will be via EPC contract methodology, and preliminary route and draft environmental impact studies are currently underway.

Prior to his assignment as Program Director of the Energy Gateway Program, Mr. Jensen worked for four years in project management capacities on a large variety of distribution line, transmission line and substation projects for PacifiCorp. Before joining PacifiCorp in 2005 he worked for XO Communications as the Director of National Repair. His responsibilities included oversight in repairing telecommunications services for the company customer base. In addition, Mr. Jensen was a Telecommunications Design Engineer for 10 years, designing fiber optic links and microwave communications systems.

RESUME

NAME: Ryan W. Henning

NATIONALITY: US Permanent Resident

EMPLOYER: Renewable Energy Systems Americas, Inc.
11101 W. 120th Avenue, Suite 400
Broomfield, CO 80021
Tel: (303) 439-4200
Fax: (303) 439-4299
Web: www.res-americas.com

CURRENT POSITION: Senior Permitting Specialist

EDUCATION:

- Bachelor of Science – Biological Sciences; University of North Dakota; Grand Forks, North Dakota, 1994
- Master of Science – Conservation Biology; California State University, Sacramento; Sacramento, California, 2007

PROFESSIONAL EXPERIENCE:

Highlights

- Extensive transmission line permitting experience: Colorado-New Mexico 345kV Intertie; Desert Southwest 500kV; Sacramento Voltage Support 230kV; Central Wisconsin 345kV; Cranberry-Conover-Plains 230kV; Venus-Metonga 230kV; Sunrise Powerlink 500kV; Far Northwest 230kV; Rifle-Shoshone 230kV; & Chisago-Dairyland 345kV.
- Vast working knowledge of the ESA, CWA, SMCRA, NEPA, and routing and siting procedures for lineal energy projects.
- Prepared numerous Section 7 biological assessments and threatened & endangered species consultations.
- Prepared and managed numerous feasibility and environmental permit applications for electrical generation and transmission line projects in Utah, Texas, Arizona, California, Wisconsin, Washington, Colorado, Wyoming, and Oregon.
- Successfully developed permitting strategies and applications, provided expert hearing testimony, and implemented environmental compliance monitoring programs for over 50 major industrial projects across 13 western states.

2010 - Present Renewable Energy Systems Americas, Inc.
Sr. Permitting Specialist
Responsible for providing permitting strategy, implementation, and compliance on 12,500 megawatt pipeline of solar, biomass, and wind energy facilities. Current territory includes the Western U.S., Rocky Mountain, Canada, and Caribbean Regions.

2006 - 2010 CH2M HILL Inc., Denver, CO
Sr. Project Manager/Client Service Manager
Sr. Project Manager and Client Service Manager for industrial clients associated with a $6+ billion international engineering consulting company. Also responsible for managing contracts with strategic clients and establishing relationship and rapport with both existing and new clients to expand core business market areas. Additional responsibilities included providing permitting strategies and implementation on industrial and energy infrastructure projects; expert permitting testimony; client service management relations; and extensive public outreach to local, State, and Federal government agencies, opposition groups, and the general public.

1996 - 2010 ARCADIS (formerly Greystone Consultants, Inc.), Denver, CO & Sacramento, CA
Certified Project Manager
Certified Project Manager for industrial clients associated with a $1 billion international engineering consulting company. Provided impact assessment and permitting support on over 50 major projects to both private sector and federal agencies including the Bureau of Land Management, U.S. Fish and Wildlife Service, U.S. Forest Service, Federal Energy Regulatory Commission, Office of Surface Mining, U.S. Army Corps of Engineers, and various State and local agencies.

1988 - 1994 Bellaire Corporation (subsidiary of North American Coal Corp) – Indian Head Mine, Beulah, ND
Environmental Scientist III
Environmental scientist for a leading North American lignite coal mining company. Responsible for mine permitting and revisions, environmental compliance, and reclamation implementation at a 4,750-acre surface lignite coal mine. Additional responsibilities included assisting in daily operational mine management activities and supervision of reclamation workforce (eight employees).

LANGUAGES:
- English

PROFESSIONAL AFFILIATIONS/LICENSES:
- The Wildlife Society
- USACE Wetlands Delineation Survey Techniques
- Northern Goshawk USFS Protocol Survey Techniques
- Black-footed Ferret USFWS Protocol Survey Techniques
- Southwestern Willow Flycatcher USFWS Protocol Survey Techniques
- Preble's Meadow Jumping Mouse USFWS Protocol Survey Techniques

- Utes Ladies' Tresses Orchid USFWS Protocol Survey Techniques
- FERC Environmental Inspection Training

MIDAMERICAN TRANSMISSION

Ryan L. Flynn
Regulatory Counsel

Expertise

- **Strategic Transmission Policy Development**
- **Litigation**
- **Commercial Negotiations**
- **State and Federal Transmission Legislation**
- **Regulatory Proceedings**

Education

- **B.S. Politics, Willamette University, Salem, OR, 1997**
- **Juris Doctor Degree, The George Washington University Law School, Washington, D.C., 2002**

Organizations/ Certifications

- **Oregon State Bar, Member**
- **District of Columbia Bar, Member**
- **Washington State Bar, Member**

Total Years of Experience

- **11**

Mr. Flynn serves as Regulatory Counsel at MidAmerican Transmission. He advises the Company in commercial negotiations and regulatory proceedings, particularly on Transmission matters.

Ryan also supports the company in the development of overall strategic transmission policy, including participation in various regional initiatives. He is tasked with managing the Company's regulatory and litigation strategy with respect to transmission development.

Representative Experience:

- ***Vice President and General Counsel–Pacific Power, Portland, Oregon, September 2012–Present***
- ***Senior Counsel–Pacific Power, Portland, Oregon, July 2009–August 2012***
- ***Legal Counsel–Pacific Power, Portland, Oregon, December 2006–June 2009***

Responsibilities have included:

- Represent company in commercial contract negotiations, including joint ownership, operation and maintenance agreements, joint development agreements and asset purchase and sale agreements.
- Development of state and federal legislation and provision of general support to Government Affairs business unit.
- Management of company's litigation strategy with respect to the Transmission business unit, including proceedings before the Ninth Circuit Court of Appeals regarding Bonneville Power Administration Residential Exchange Program.
- Support company in the development of overall strategic transmission policy, including participation in various regional initiatives.
- Represent company in various state and federal rulemaking and contested case proceedings before the Oregon Public Utility Commission and Federal Energy Regulatory Commission (FERC).

Associate–Davis Wright Tremaine LLP, Seattle, Washington, September 2004–November 2006

Responsibilities included:

- Represented clients in FERC hydropower relicensing proceedings and comprehensive settlement negotiations involving federal and state agencies, tribes and municipalities, among other stakeholders.
- Represented clients in administrative land use hearings,

including application of the Shoreline Management Act and related regulations.
- Represented client in the financing of a 205 megawatt wind power project in Klickitat County, Washington.

- ***Associate–Troutman Sanders LLP, Washington, D.C., September 2002–July 2004***
- ***Summer Associate–Troutman Sanders LLP, Washington, D.C., May2001–August2001***

Responsibilities included:
- Assisted in the preparation and filing of a market and transmission tariff for a Regional Transmission Organization (RTO), including legal analysis and advice, preparing testimony and drafting tariff language.
- Regularly monitored and advocated on behalf of a major utility for legislation amending the Clean Air Act before the United States Congress.
- Drafted regulatory filings before FERC on behalf of major utilities, state commissions and RTOs.

Legislative Assistant–Committee on Agriculture, U.S. House of Representatives, Washington, D.C., serving Chairman Robert F. "Bob" Smith (OR) (1998–1999)and Chairman Larry Combest (TX) (1999–2001)

Responsibilities included:
- Compiled, prepared and evaluated legislation for consideration by the Subcommittee on Department Operations, Oversight, Nutrition, and Forestry.
- Investigated and conducted oversight of the U.S. Department of Agriculture and the Environmental Protection Agency with a focus on e-commerce, forestry and appropriation issues.
- Drafted questions and hearing presentations for Members of Congress and Committee witnesses; authored Committee report language; coordinated and participated in meetings with industry officials.

RESUME

NAME:	Nicolas Muszynski
NATIONALITY:	Canadian
EMPLOYER:	Renewable Energy Systems Canada Inc. (RES Canada) 300 Léo Pariseau Suite 2516 Montreal, Quebec H2X 4B3 Tel: (514) 525-2113 Fax: (514) 524-9669 Web: www.res-group.com
CURRENT POSITION:	Senior Development Manager, RES Canada
EDUCATION:	1998- 2003 École Polytechnique de Montréal – Engineering Physics. 2005 École Polytechnique de Montréal – Graduate Level courses in Energy Engineering.
PROFESSIONAL QUALIFICATIONS:	Member of the Ordre des Ingénieurs du Québec (OIQ)

PROFESSIONAL EXPERIENCE:

2008 – Present **Renewable Energy Systems Canada Inc. –** Senior Development Manager
Responsible for the development of Ontario and Quebec assets including managing development budgets. Activities include securing land, permitting, budgeting, financial analysis and building strong relationships with all project stakeholders.

2006 – 2008 **Airtricity-E.ON Climate and Renewables –** Development Manager (Québec - Ontario)
Development of a pipeline of greenfield projects of over 500MW across Quebec and Ontario. A total of over 300MW were winning projects on the Hydro-Quebec Distribution 2005 Call for Tenders. Development of solid partnerships with all project stakeholders and negotiation of EPC contracts for construction and turbine supply. Running financial models and analyzing financial and technical risks.

2006 **AWS Truewind –** Project Analyst

- Responsible for various consultancy contracts to clients in the North American wind industry. Including due diligence work, risk and uncertainty analysis and site prospecting.

2001 – 2004 **Hélimax Energy –** Wind Energy Project Engineer jr.

Responsible for various consultancy contracts to clients in the North American and African wind industry. Including data treatment, wind resource assessment and project management. Participation in projects currently under operation of over 500MW.

Venkata Bujimalla
Manager, Transmission Business Development

Expertise

- **Financial Planning and Analysis**
- **Business Development**
- **Regulatory Research and Strategic Planning**
- **Regulatory Proceedings**
- **Federal and State Transmission Policy Analysis**
- **Project Management**

Education

- **Bachelor of Technology, National Institute of Technology, Warangal, India**

- **Bachelor of Law, Gujarat University, Ahmedabad, India**

- **Master of Public Policy, Ohio State University, Columbus, OH, USA**

- **Master of Business Administration, Ohio State University, Columbus, OH, USA**

Total Years of Experience

- **20**

Mr. Bujimalla serves as Manager of Transmission Business Development at MidAmerican Transmission. He supports the Company in business development, financial planning and analysis, mergers and acquisitions, due diligence, joint venture activity, asset purchase and sale valuations, and commercial agreement negotiations.

Venkata supports the company's transmission business development by participating in various industry forums and regional regulatory processes that have a strategic impact on transmission business growth.

<u>Representative Experience</u>:

Financial Planning and Analysis

- Led budgeting, financial planning and analysis functions, including regulatory analysis and strategic planning for achieving allowed returns for MidAmerican Energy Company.

- Worked with treasury to develop and update financing strategies to meet corporate goals and to develop financial plans that met rating agency requirements to keep the credit ratings stable.

- Provided leadership for financial valuation support and due diligence needed for various acquisition proposals and joint venture business development activities considered by MidAmerican Transmission.

Regulatory Experience

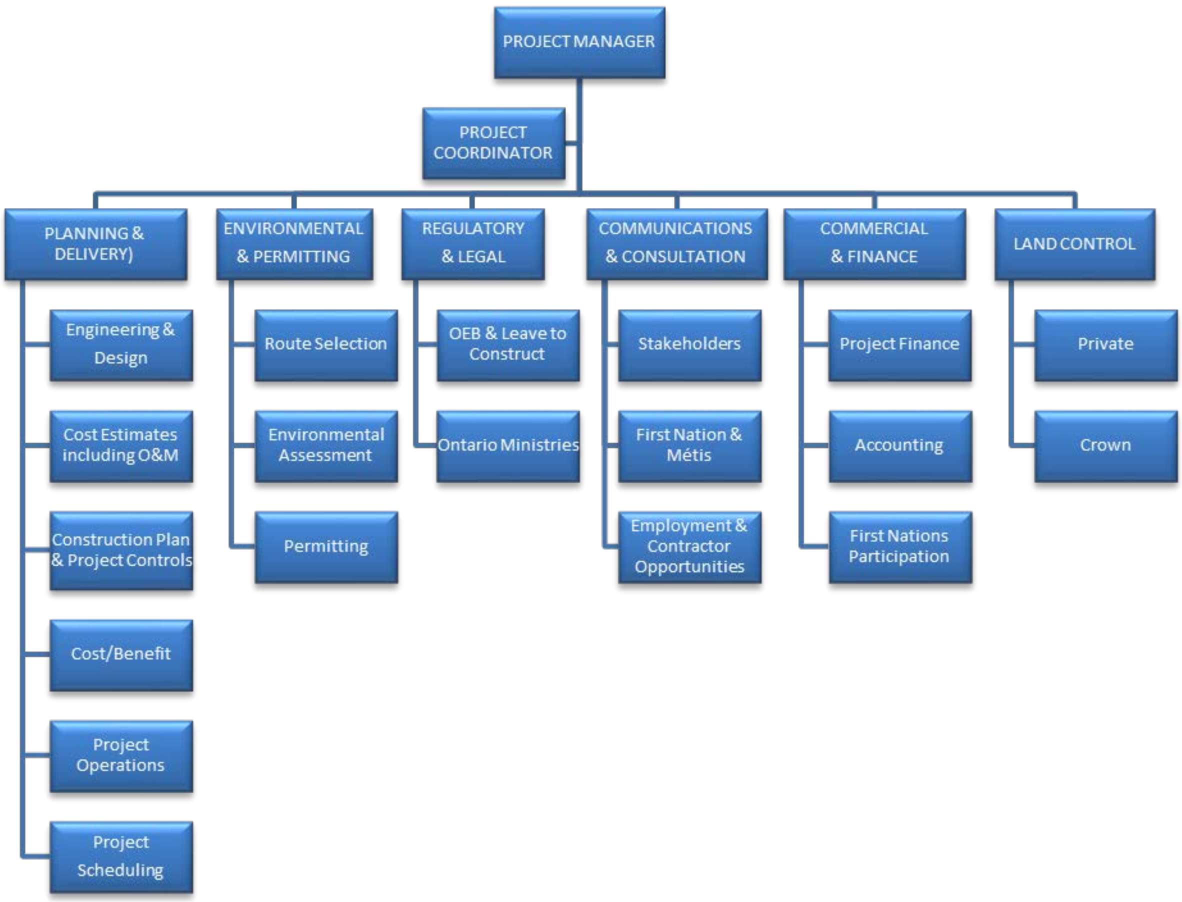
- Collected and analyzed data on US electric and natural gas utility markets and published reports on impact of regulatory policy on utility markets, investments and industry structure, while working at the National Regulatory Research Institute, a research arm of the National Association of Regulatory Utility Commissioners.

  Some published reports are:
  - *Review of Electric Standard Offer Services* published by Harvard Electricity Policy Group.
  - *Consumer Perceptions of Electric and Natural Gas Prices* (Co-author).
  - *Features and Regulatory Oversight of Natural Gas Choice Programs* (Co-author).
  - *Performance Review of Electric Power Markets* (Co-author), which was a review conducted for the Virginia State Commission Corporation.

TAB F-1-3

Project Management Team

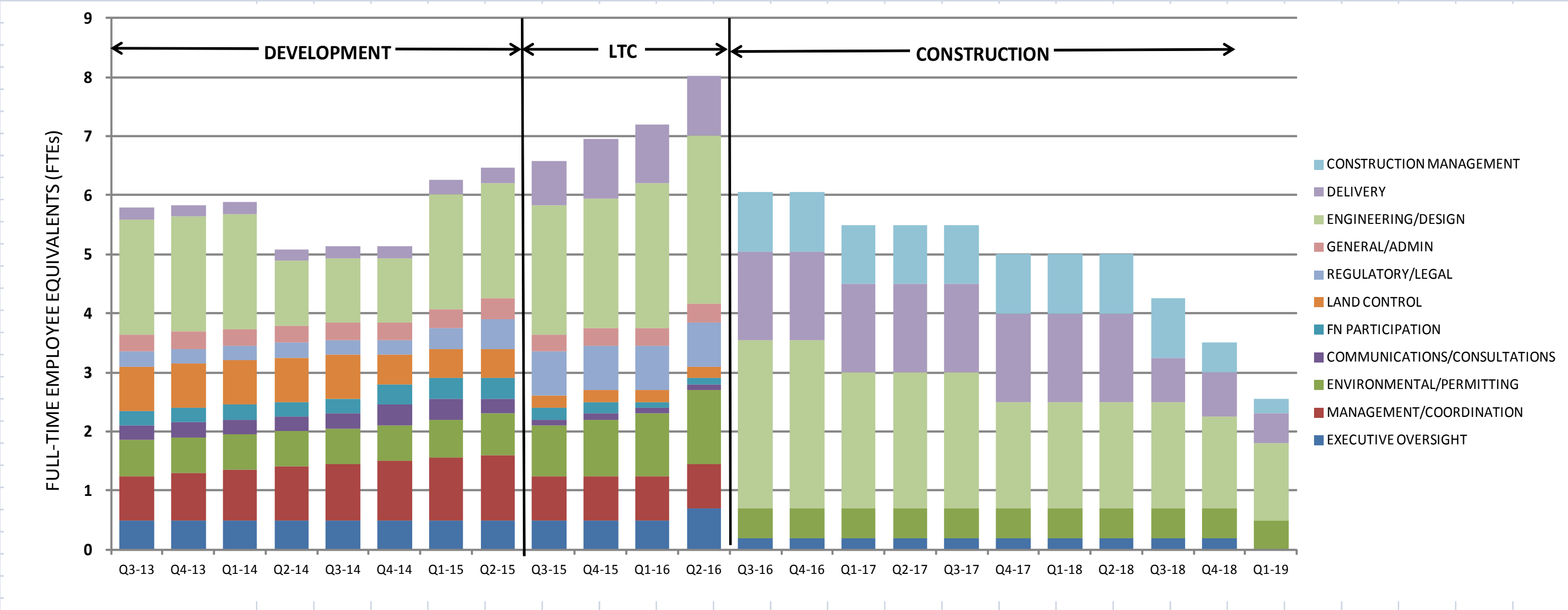
Figure F-1



TAB F-1-4

Full Time Employee Equivalents

Figure F-2



	DEVELOPMENT								LTC HEARING				CONSTRUCTION										
	Q3-13	Q4-13	Q1-14	Q2-14	Q3-14	Q4-14	Q1-15	Q2-15	Q3-15	Q4-15	Q1-16	Q2-16	Q3-16	Q4-16	Q1-17	Q2-17	Q3-17	Q4-17	Q1-18	Q2-18	Q3-18	Q4-18	Q1-19
EXECUTIVE OVERSIGHT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0
MANAGEMENT/COORDINATION	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.1	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENVIRONMENTAL/PERMITTING	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.9	1.0	1.1	1.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
COMMUNICATIONS/CONSULTATIONS	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.3	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
FN PARTICIPATION	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
LAND CONTROL	0.8	0.8	0.8	0.8	0.8	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
REGULATORY/LEGAL	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.8	0.8	0.8	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
GENERAL/ADMIN	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ENGINEERING/DESIGN	2.0	2.0	2.0	1.1	1.1	1.1	2.0	2.0	2.2	2.2	2.5	2.9	2.9	2.9	2.3	2.3	2.3	1.8	1.8	1.8	1.8	1.6	1.3
DELIVERY	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.8	1.0	1.0	1.0	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	0.8	0.8	0.5
CONSTRUCTION MANAGEMENT	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.3
TOTALS	5.8	5.8	5.9	5.1	5.1	5.1	6.3	6.5	6.6	7.0	7.2	8.0	6.1	6.1	5.5	5.5	5.5	5.0	5.0	5.0	4.3	3.5	2.6

TAB F-2-1

Key Individuals

The key individuals who are critical to the development and construction of the Project are listed below and the Applicant will use its reasonable efforts to ensure that such persons remain involved with the Project:

- Project Management Team Leader, Jerry Vaninetti: 40 years of management experience in the electricity industry, including 10 years with a utility, 13 years in project development (mainly transmission), 9 years as a management consultant and 8 years in energy transportation. Recently, he has managed two major transmission projects in the western US Rocky Mountains, the Wyoming-Colorado Intertie Project (300 km of 345 kV transmission line) and the High Plains Express Project (3500 km of 500 kV transmission line) – both currently in development;

- Project Coordinator, Cory Blair: 6 years of transmission experience in the utility and renewable energy industries in the western US, including transmission planning, project management, transmission public policy, and stakeholder outreach; experience includes employments in transmission planning with two utilities: Xcel Energy and Arizona Public Service;

- Vice President, System Planning, Darrell Gerrard: 35 years of working experience in the electric utility and energy supply business in the US and abroad. Experience in a broad range of responsibilities required for successful operation of a large electric utility company including transmission, distribution and generation engineering and technical support, system planning, asset management, technology application, operations, construction, maintenance, safety, dispatching and grid operations, budgeting, business planning, customer service, safety and regulation. Utility system experience with companies in the US, Australia, UK, Canada; participant in due diligence teams seeking potential transmission and development asset acquisitions in the US, Turkey, Brazil, Australia. current experience in development and planning of PacifiCorp's Energy Gateway Transmission Expansion Project at PacifiCorp as discussed in Exhibit E;

- Manager, Delivery, Todd Jensen**:** 22 years of experience in engineering and project management, with eight years specifically in the electric utility industry in the western US, including 5 years as Director of Main Grid Transmission. Experience in a broad range of electric utility applications, including transmission line, distribution line and substation projects. Most notable experience includes directing the Energy Gateway program which is comprised of projects in three states totalling over $5 billion. Vast experience in facility siting, permitting, right of way acquisition, contract negotiations, construction and commissioning, as well as cost controls, risk management and regulation;

- Manager, Land & Permitting, Ryan Henning: 20 years of experience in environmental, routing, and permitting for energy projects including transmission lines, including extensive experience in the procedural and compliance requirements of various local, state, and federal policies and acts and various other government policies relating to routing and siting procedures for energy infrastructure projects. Prepared numerous feasibility studies for water resource, pipeline, electrical transmission and energy projects throughout the western US. Prepared and managed numerous environmental permit applications for a variety of electrical generation and transmission projects, including permitting approximately 1,600 km of electrical transmission throughout the US;

- Counsel Regulatory & Legal, Ryan Flynn: 10 years of experience in commercial negotiations, legislative, litigation and regulatory proceedings relating to, among other things, PacifiCorp's long-term transmission strategy and policy.

- Manager, Communications & Consultations, Nicolas Muszynski: over 10 years experience in siting, permitting and financing renewable energy projects and related transmission infrastructure across Ontario and other Canadian jurisdictions. He has led the consultation process for multiple projects in Ontario two of which required a leave to construct application before the Board;

- Manager, Land Control, Stephen Cookson: over 10 years experience as an energy and infrastructure project developer with a focus on the management of environmental assessment processes, land acquisition, permitting, budgeting, planning, and stakeholder relationships. Successfully brought to close over 250 MW of utility-scale renewable generation projects in Ontario and Quebec, including the Greenwich Wind Farm, which connects via a 230 kV transmission line developed and constructed by the RES Group to the existing Hydro One East-West Tie Line near Nipigon; and

- Vice President, Commercial & Finance, Brian Weber: more than 10 years of experience in business development, corporate finance, budgeting, mergers and acquisition diligence and analysis, regulation, strategy, project management and transmission line design.

The key individuals listed above are in addition to the key individuals of the Applicant listed in its Application for Electricity Transmission Licence dated July 28, 2011.

TAB F-3-1

Design, Development and Construction Team

The Applicant's development and construction team will include the Project Management Team and members of the RES Group and MidAmerican Group's technical staff, with additional team members added when necessary. Applicant's technical team is comprised of the following individuals (full resumes can be found in Exhibit F-3-2):

- Director of Engineering, Paul Ng: 32 years of engineering experience including 11 years in the electric utility industry and 20 years in structural engineering consulting capacities. In recent years he has directed the engineering team responsible for PacifiCorp's Energy Gateway transmission expansion program presently under construction, which encompasses a total linear distance of nearly 3,226 km. He was instrumental in overseeing the development, testing and commissioning of a complete new family of transmission structures for use in the program expansion;

- Principal Transmission Engineer, Joe Hallman: 34 years of engineering experience in the electric utility industry. His responsibilities include providing engineering specifications and design and technical support as projects mature from scoping through permitting, design, contracting and construction. In recent years he has been the Principal Transmission Engineer for the engineering team responsible for PacifiCorp's Energy Gateway transmission expansion program presently under construction in the Rocky Mountains, which encompasses a total linear distance of nearly 3,226 km. He was instrumental in helping develop, test and commission a complete new family of transmission structures for use in the program expansion;

- Senior Civil Engineer, James D. Higgins: 19 years of civil engineering experience including four years in the electric utility industry and 15 years working for a multidiscipline engineering firm focused on civil geotechnical and structural engineering, as well as construction materials testing, civil inspection and surveying, in support of land development and power delivery projects. In recent years he has served as the Civil Engineering discipline lead for all transmission and substation projects for PacifiCorp's Energy Gateway transmission expansion program presently under construction, which encompasses a total linear distance of nearly 3,226 km. Additionally, he has coordinated with in-house Construction Management and Civil Inspectors to ensure the constructed projects meet project and contractual specifications;

- Director of Transmission Planning, Thomas N. Tjoelker: 32 years of engineering experience in the electric utility industry including 12 years performing detailed electrical transmission studies, and 10 years as a manager with responsibilities liaising Engineering with Operations and Transmission Business Unit functions, as well as managing asset maintenance policies and an Area Planning Engineering group. In recent years he has served as Director of Main Grid Transmission Planning where he has developed transmission expansion plans and has managed a Main Grid Transmission Planning Group for a major electric utility company. In this position he has also been responsible for compliance and monitoring several NERC mandatory reliability standards;

- Principal Transmission System Planner, Ravikanth Varanasi: 13 years of transmission planning experience including four years in the electric utility industry. Additionally, he has spent nine years directly involved in power systems energy consulting, where he conducted power flow studies, as well as voltage stability, power import/export, and reactive compensation studies, to develop short and long-term transmission system requirements and reinforcements for various utilities, ISO/RTO's and IPP's across the United States and Canada. Recently he has conducted numerous system assessments, as well as transmission planning and operating studies needed to maintain transmission system capacities for a major electric utility;

- Senior Transmission Planning Engineer, Ravi Bantu: 12 years of transmission planning experience both in support of the development of utility-scale renewable generation, as well as in a third-party consulting role performing system impact and transient stability studies, power and short circuit analyses, transmission expansion studies, ground grid analyses, and AC interference analyses. Involved in the determination of optimum transmission interconnection strategies based on system impact assessments and market delivery options;

- Electrical Design Engineering Manager, Gopal Padmanabhan: Over 20 years of experience in the U.S. and Canada in electrical power system design and engineering, with a focus on high voltage transmission and substation development. Responsible for system design, cost estimation, procurement, testing, and commissioning in close coordination with system operators, supply and construction contractors for protection/control schemes and operating procedures.

TAB F-3-2

Resumes of Design, Development and Construction Team

Paul Ng, S.E.
Director of Engineering

Expertise

- **Transmission Engineering**
- **Substation Engineering**
- **Structural Engineering**

Education

- **B.S. Civil Engineering, University of Utah, 1981**

Organizations

- **Structural Engineers Association of Utah**

Registration

- **SE 170653-2203**

Total Years of Experience

- **31**

Mr. Ng is a structural engineer with over 31 years of experience and serves as the Director of Engineering for MidAmerican Transmission. He is responsible for project technical oversight and manages all engineering disciplines in the Project Management Office which includes Transmission, Substation, Protection & Controls and Civil and Communication functions. Upon joining PacifiCorp Mr. Ng has been responsible for providing support for all Energy Gateway projects which includes the following:

Representative Project List:

Populus to Terminal 345kV Project – Commissioned in 2010, this project consisted of approximately 135 miles of double circuit, double bundle 1272 ACSR Bittern conductor 345kV Transmission Line on steel monopole structures. Foundations were all steel reinforced drilled concrete piers. In addition, one new 345kV Substation and two expanded Substations were constructed as part of the project. Additional work included communications, redundant path microwave system and upgrades to special protection schemes. The line runs perpendicular to the multiple canyons along the Wasatch Mountain range and is subject to wind gusts of up to 130 miles per hour. Challenges included designing transmission structures and foundations to withstand high wind forces, as well as constructing drilled concrete piers in soft and highly corrosive soils along the shoreline area of the Great Salt Lake.

90th South to Camp Williams 345kV Project – This project consisted of constructing a new double-circuit 345kV Transmission Line that extends 11 miles through the western portion of the Salt Lake City Valley. The Transmission Line was built using TSP monopole structures supported by drilled concrete piers. V-string polymer insulators were used to support a double bundled 1275 Bitten TW conductor. The line was built within existing rights-of-way through commercial and residential portions of the valley. The primary challenge was the spotting of towers and maintaining blowout in a suburban area where new commercial development had encroached up to and, in some instances, upon our right-of-way.

Mona to Oquirrh 345kV Project - The Mona to Oquirrh project consists of approximately 70 miles of new Transmission Line utilizing single circuit 500kV lattice towers, as well as 30 miles of new Transmission Line utilizing double circuit 345kV TSP monopoles. The line will begin at the new 500/345kV Clover Substation, and will route through the Tooele Valley continuing over the Oquirrh Mountains and terminate at the existing Oquirrh Substation in West Jordan, Utah. A short segment of rebuilt double circuit 345kV Transmission Line will connect the existing Mona Substation to the new Clover Substation. Challenges included design and construction in helicopter only segments of the Long Ridge Mountains, as well as the rugged terrain of the Oquirrh Mountains, reaching approximately 8,400 feet in elevation. The project is near completion with the in service date targeted for May 2013.

Terminal 138kV Substation Project **–** The project's purpose was to replace two existing 345/138kV 450 MVA transformers with new 345/138kV 700 MVA transformers. In order to support the additional load, the existing 138kV bays built with 2,000 amp wire bus had to be replaced with 5-inch aluminum bus capable of supporting 3,000 amps. Terminal Substation is an existing station and serves a large portion of the Salt Lake Valley as well as Davis County, Utah. Terminal is also the oldest major station in Salt Lake City and is therefore constricted by adjacent property and buildings. Without the option for expansion, the major challenge of this project was constructing new bays and demolishing existing bays while maintaining service to customers. The solution was phased construction with limited outages and temporary shoofly feeds. The project is near completion and will be in service summer of 2013.

Sigurd to Red Butte 345kV Project – This project consists of a single circuit 345kV Transmission Line approximately 170 miles in length, beginning at the Sigurd Substation near Richfield, Utah, and terminating at the Red Butte Substation near the town of Central, Utah. The line will consist of tubular steel pole H-frame for tangent structures and self supported lattice steel deadend towers. Work will include expansion of both Substations for the new line as well as two distribution Substations fed through Red Butte Substation. This project will route through federal and state lands with historical and cultural significance and will be governed under the regulations of the NEPA permitting process. Preliminary designs for both Transmission Lines and Substations are complete and EPC contractors are in place to begin work in 2013.

Energy Gateway West 500kV Project – The Gateway West Project consists of approximately 1,000 miles of 230kV, 345kV and 500kV AC Transmission beginning at Windstar Substation near Glenrock, Wyoming and terminating at Hemingway Substation southwest of Boise, Idaho. The proposed Transmission Line circuits will be supported by three types of structures. For the 160 miles of 230kV (which includes both new construction and rebuilt lines), as well as five miles of 345kV, structures will consists of tubular steel H-frame fabricated in either dulled galvanized or self weathering steel. The remaining 500kV segments will be constructed using self supported steel lattice towers fabricated in dulled galvanized steel. The proposed conductor for the 500 kV lines will be triple bundle 1,949.6 kcmil ACSR Athabaska. The conductor for the 345kV lines will be triple bundle 1,272 kcmil ACSR Bittern. Similar to the 345kV lines, the conductor for the new 230kV line will be bundled 1,272 kcmil ACSR Bittern. The project will include modifications or expansions of 10 existing stations and the construction of four new Substations. Major equipment will include (19) 550kV Transformers, (2) 345kV 750MVA Phase Shifters, (2) 550kV Series Capacitors, (17) Shunt Capacitors, (33) 550kV Reactors and (1) 245kV SVC. Preliminary engineering is complete and development of the EPC RFP package is underway (targeted for release by summer 2013).

Energy Gateway South Project – The Gateway South project, targeted for December 2020 completion, consists of approximately 425 miles of single-circuit 500kV Transmission Line from the future Aeolus Substation, near Medicine Bow, Wyoming to the new Clover Substation, near Mona, Utah. Two proposed series compensation stations will be located at approximately the one-third and two-thirds points along the route. This line will be built using self supporting lattice towers fabricated from dulled galvanized steel to support a triple bundle 1,949.6 kcmil ACSR Athabaska conductor. Project delivery will be via EPC contract methodology, and preliminary route and draft environmental impact studies are currently underway.

500kV Lattice Tower Development – MidAmerican Transmission/PacifiCorp has developed both families of single and double circuit lattice towers for the Energy Gateway Program. Both families consist of a tangent, long span, small running angle, 45 degree deadend and 90 degree deadend towers. Since the single circuit will see much greater use, additional towers were developed to improve economy. These include a light tangent and (2) larger running angle towers. The majority of towers were full load tested to prove design capacity of each configuration while the remainders were prototype fit tested.

Prior to joining MidAmerican Transmission/PacifiCorp, Mr. Ng worked for over two decades in consulting engineering primarily at Ford, Bacon and Davis which has been acquired by FL Smidth. He served in the capacity of Project Engineer/Lead Structural Engineer on various industrial manufacturing and mining projects. Projects include an Industrial Waste Incineration Facility in Alberta Canada, a Secondary Crusher Plant for Newmont Gold at Carlin, Nevada, Petroleum Refinery Facilities for CHS at Laurel, Montana and a 600 ton Load-out Station for CC&V in Cripple Creek, Colorado.

Joe Hallman, P.E.
Principal Transmission Engineer

Expertise

- **Transmission Line Design, Distribution Through 500kV**

Education

- **B.S. Mechanical Engineering, University of Utah, 1983**

Organizations

- **ASCE, Member**
- **Member IEEE, Overhead Lines Working Group**
- **Member ASCE Task Committee on MOP 74**

Registration

- **Registered Professional Engineer, UT**

Honors and Activities

- **Recently presented a lattice tower development paper at ACSE SEI Conference**
- **Chi Epsilon, Civil Engineering Honor Society, Member**

Total Years of Experience

- **34**

Mr. Hallman is a Principal Engineer in the Transmission Delivery Project Management Office for MidAmerican Transmission. He is responsible for engineering aspects of major overhead transmission line projects. His responsibilities include providing engineering specifications and design and technical support as projects mature from scoping through permitting, design, contracting and construction. Projects are delivered by the Transmission Delivery Project Management Office primarily through Engineer Procure and Construct (EPC) contracting methodology. Mr. Hallman works with consulting engineering firms responsible for pre- and post- EPC contract Owner's Engineering as well as those responsible for engineering from the EPC contractor. Mr. Hallman also works with company and contract inspectors to verify that construction of lines meets company and industry specifications.

Representative Project List:

Mona-Limber – Approximately 70 miles of lattice tower supported single circuit 500 kV Transmission Line from a new Substation named Clover in Mona, Utah to the future site of a new Substation called Limber, in Tooele County, Utah. Engineering lead for development of 15 single and double circuit lattice towers to be used in this project as well as throughout PacifiCorp's extensive 500kV transmission build-out. Transmission engineering lead for development of many applicable material standards to be used with the new lattice tower family. Provided many transmission line engineering specifications for design, materials and procedures. Participated in permitting processes by providing project transmission requirements and through involvement in public meetings. Challenges included construction of tubular pole structures and lattice towers in difficult terrain and according to environmental limitations. Similar challenges occurred during stringing of wires.

Populus to Terminal – Approximately 135 mile double circuit 345kV steel monopole Transmission Line from Downey, Idaho to Salt Lake City, Utah. Responsibilities included providing engineering specifications; reviewing line design, structure, and material submittals from contractor; participating in progress meetings, field reviews and final inspections of construction, as well as providing owner's involvement in resolving many design and construction issues. Challenges included establishing a line route acceptable to many local communities and regulatory agencies, construction of structures in difficult terrain, and achieving appropriate grounding in rocky soil.

90th South to Camp Williams – Approximately 11 miles of double circuit 345kV Transmission Line on tubular poles between two Substations within Salt Lake County, Utah. Served as Transmission Engineering lead for the project. Provided transmission line engineering specifications for design, materials and procedures. Responsible for review of engineering submittals and final transmission line construction review prior to energization. Challenges included construction of structures and stringing of wires in a congested urban setting adjacent to an existing 345kV double circuit line.

***Clover Substation* –** A new 345/138 kV Substation located in Mona, Utah with both 138 and 345kV tie lines. Served as Transmission Engineering lead for lines associated with the project. Provided design specifications for transmission lines, reviewed design and material submittals from contractor, reviewed construction. Challenges included construction of 138kV line while keeping existing line energized, significant material issues with large steel deadend poles, and scheduling work within environmentally sensitive areas.

Camp Williams to Mona – Approximately 60 miles of 345 V construction on H-frame and lattice structures. Project Manager for the project. Reviewed engineering documents and provided much direction to design and material issues, oversaw project budget and schedule, and dealt with contract change orders from construction contractor. Challenges included construction of new structures, replacing existing structures, while making multiple line shoo-flies to keep line energized, and evaluation of in-place lattice structures with respect to proposed line mechanical loading.

Limber-Oquirrh – Approximately 30 miles of tubular steel structure supported double circuit 345kV Transmission Line from the future site of a new Substation called Limber, in Tooele County, Utah, to an existing Substation named Oquirrh in West Jordan, Utah. Engineering discipline lead for all transmission and transmission related elements of the project. Pre-EPC aspects included development of transmission items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of transmission items in EPC bids. Post-EPC duties included management of Owner's Engineer transmission team and review of EPC submittals for compliance with company standards and Contract. Managed inspections of transmission line work and provided construction engineering support and discrepancy resolution review. Challenges included steep terrain and rugged, rock covered landscape, open mine pit proximity and NEPA permitting restrictions.

Limber to Terminal – Approximately 45 miles of double circuit 345kV Transmission Line from the future site of a new Substation called Limber, in Tooele County, Utah, to an existing Substation called Terminal in Salt Lake City, Utah. Mr. Hallman is the engineering discipline lead for all transmission aspects of the project. Coordinated with Owner's Engineer on development of preliminary engineering in support of NEPA permitting for the project. Challenges included soft soils adjacent to the Great Salt Lake and pinch points between Interstate 80 and Kennecott's tailings pond located in Magna, Utah.

Oquirrh-Terminal – Approximately 15 miles of new tubular steel supported double circuit 345kV Transmission Line from an existing Substation called Oquirrh in West Jordan, Utah, to an existing Substation called Terminal in Salt Lake City, Utah. Additionally, portions of an existing lattice steel supported double circuit 138kV Transmission Line is being relocated in support of the Mountain View Corridor (MVC) road construction project for the Utah Department of Transportation (UDOT). Coordination with the Owner's Engineer on development of the engineering documents for relocations required for the phased construction of the MVC. Relocation includes approximately 300 feet of underground transmission line. Challenges included coordination with the department of transportation, phasing of the relocations and coordination with the larger future Oquirrh to Terminal 345kV project.

Terminal Substation – This project included replacement of two existing 345-138 kV transformers and construction of a new six bay breaker and a half 138kV Substation yard as well as replacement of five 138kV, and installation of two 345kV circuit breakers. Engineering discipline lead for all transmission portions of the project. Pre-EPC aspects included development of transmission items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of transmission items in EPC bids. Post-EPC duties included management of Owner's Engineer transmission team and review of EPC submittals for compliance with company standards and Contract. Managed inspections of transmission line work and provided construction engineering support and discrepancy resolution review. Challenges included brown-field site, high ground water conditions, soft soils, phased construction and storm water management around transmission assets.

Sigurd to Red Butte – Approximately 170 miles of tubular steel H-frame tangent with lattice steel angle and deadend structure supported single circuit 345kV Transmission Line between an existing Substation named Sigurd near Richfield, Utah, and an expansion of an existing Substation named Red Butte near the town of Central in Washington County, Utah. Engineering discipline lead for all transmission aspects of the project. Pre-EPC aspects included development of transmission items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of transmission items in EPC bids. Challenges included difficult soils, construction planning, line routing and NEPA permitting.

Energy Gateway West – Ten transmission line segments totaling approximately 1,00 miles at 500kV and 230kV from an expansion of a Substation named Windstar near Glenrock, Wyoming to an existing Substation named Hemingway southwest of Boise, Idaho. The project is broken down into the following segments: Segment 1 will be approximately 60 miles of new double circuit 230kV Transmission Line from Windstar to a new Substation named Aeolus to be located near Medicine Bow, Wyoming. Segment 2 will be approximately 100 miles of double circuit Transmission Line (230kV on one side and 500kV on the other) from Aeolus to a new Substation named Heward southwest of Aeolus. The 230kV line will loop in and out of the new Heward Substation. Segment 3 is a continuation, approximately 63 miles in length, of the double circuit 500/230kV Transmission Line from the new Heward Substation to an expansion of an existing Substation named Jim Bridger. Segment 4 will be approximately 191 miles of lattice steel structure supported single circuit 500kV Transmission Line from Jim Bridger Substation to an expansion of a Substation named Populus near Downey, Idaho. Segment 5 will be approximately 53 miles of lattice steel structure supported single circuit 500kV Transmission Line from Populus Substation near Downey, Idaho to an expansion of an existing Substation named Borah near American Falls, Idaho. Segment 6 will be approximately 78 miles of lattice steel structure supported single circuit 500kV Transmission Line from Borah Substation to an existing Substation named Midpoint near Shoshone, Idaho. Segment 7 will be approximately 126 miles of lattice steel structure supported single circuit 500kV Transmission Line from Populus Substation near Downey, Idaho to a new Substation named Cedar Hill to be located southeast of Twin Falls, Idaho. Segment 8 will be approximately 150 miles of lattice steel structure supported single circuit 500kV Transmission Line from Midpoint Substation to a new Substation named Hemingway to be located in Idaho southwest of Boise. Segment 9 will be approximately 153 miles of lattice steel structure supported single circuit 500kV Transmission Line from the new Cedar Hill Substation to the new Hemingway Substation. Segment 10 will be approximately 34 miles of lattice steel structure supported single circuit 500kV Transmission Line from an existing Substation named Midpoint to the new Cedar Hill Substation. Pre-EPC aspects included development of transmission items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer. Challenges include NEPA permitting, environmental restrictions, construction planning and line routing.

Energy Gateway South – Approximately 400 miles of lattice steel supported single-circuit 500kV Transmission Line from a future Substation named Aeolus, near Medicine Bow, Wyoming to an expansion of an existing Substation named Clover, near Mona, Utah. Two proposed series compensation stations located at approximately the one-third and two-third points of the line. This line crosses federal, state, tribal and private lands. Pre-EPC aspects include development of transmission items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and review of the transmission information prepared for the project. Challenges expected are difficult soils, construction planning, line routing and NEPA permitting.

MIDAMERICAN TRANSMISSION

James D. Higgins, P.E.
Senior Civil Engineer

Expertise

- **Civil Engineering**
- **Geotechnical Engineering**
- **Deep Foundations**
- **Access Roads**

Education

- **BSCE, University of Utah, 2006**
- **MSCE, Kansas State University, In progress 2012**

Organizations

- **ASCE, Member**
- **IEEE, Member**
- **ISSMGE, Member**

Certifications/Affiliations

- **NHI, Drilled Shaft Inspections**

Registration

- **Professional Engineer, CA**

Honors and Activities

- **ISSMGE, Technical Committee 212, Deep Foundations**
- **Chi Epsilon, Civil Engineering Honor Society, Member**

Total Years of Experience

- **19**

Mr. Higgins is a Senior Civil Engineer in the Transmission Delivery Project Management Office for MidAmerican Transmission. He is the Civil Engineering discipline lead for all transmission and substation projects. His responsibilities include provision of technical support for all facets of projects from inception, development of the scope of work, preliminary engineering and permitting through construction, inspection and commissioning. Projects are delivered by the Transmission Delivery Project Management Office primarily through Engineer Procure and Construct (EPC) contracting methodology. Mr. Higgins coordinates with Civil Engineers from consulting engineering firms responsible for pre- and post- EPC contract Owner's Engineering as well as those responsible for engineering from the EPC contractor. Additionally, Mr. Higgins coordinates with in-house Construction Management and Civil Inspectors to ensure the constructed project meets project and contractual specifications.

Representative Project List:

Populus to Ben Lomond – Approximately 90 miles of double circuit 345 kV Transmission Line, supported on steel monopoles from a new 345 kV Substation named Populus in Downey, Idaho, to an expansion of an existing 345 kV substation named Ben Lomond in Willard, Utah. Engineering discipline lead for all civil and geotechnical aspects of the transmission and substation portions of the project. Aspects included drilled shaft foundations for substation and transmission structures, substation site grading and drainage, substation steel structures, transmission line access roads and structure pads, as well as monitoring of developed springs and wells near the construction. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included large drilled shaft foundations in soils ranging from competent bedrock to weak lake sediments.

Ben Lomond to Terminal – Approximately 46 miles of double circuit 345 kV Transmission Line supported on steel monopoles from an expansion of an existing 345 kV Substation named Ben Lomond in Willard, Utah, to an expansion of a 46/138/345 kV Substation named Terminal in Salt Lake City, Utah. Engineering discipline lead for all civil and geotechnical aspects of the transmission and substation portions of the project. Aspects included drilled shaft foundations for substation and transmission structures, substation site grading and drainage, substation steel structures, transmission line access roads and structure pads. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included large drilled shaft foundations in wetlands adjacent to the Great Salt Lake. Soils consisted of very weak lake sediments.

90th South to Camp Williams – Approximately 11 miles of tubular steel structure supported double circuit 345 kV transmission line from an expansion of an existing 345/138 kV Substation named 90th South to a new bay constructed at a substation named Camp Williams, in Salt Lake City, Utah. Engineering discipline lead for all civil and geotechnical aspects of the transmission and substation portions of the project. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of civil items in EPC bids. Post-EPC aspects included drilled shaft foundations for substation and transmission structures, substation site grading and drainage, substation steel structures, transmission line access roads and structure pads, as well as monitoring of developed springs and wells near the construction. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included large drilled shaft foundations adjacent to existing infrastructure and poor soil conditions.

Clover Substation – A new 345/138 kV Substation located in Mona, Utah. Engineering discipline lead for all civil and geotechnical aspects of the project. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of civil items in EPC bids. Post-EPC aspects included drilled shaft foundations for substation and transmission structures, substation site grading and drainage, substation steel structures, transmission line access roads and structure pads, as well as monitoring of developed springs and wells near the construction. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included large green-field site grading, cut/fill balance of stepped substation, offsite drainage and compliance with IEEE Std. 693-2005.

Oquirrh Substation – Addition of a 345 kV bay to an existing Substation located in West Jordan, Utah. Engineering discipline lead for all civil and geotechnical aspects of the project. Development of civil items of Scope of Work and Request for Proposal, review of civil engineering submittals including drilled shaft foundations for substation structures, substation site grading and drainage modifications, and substation steel structures. Ensured compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included construction within an existing substation site and compliance with IEEE Std 693-2005.

Mona-Limber – Approximately 70 miles of lattice tower supported single circuit 500 kV Transmission Line from a new Substation named Clover in Mona, Utah to the future site of a new Substation called Limber, in Tooele County, Utah. Engineering discipline lead for all civil and geotechnical aspects of the transmission project. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of civil items in EPC bids. Post-EPC aspects included drilled shaft foundations for transmission structures, transmission line access roads and structure pads. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included wet soil conditions, compliance with NEPA permitting for construction on public lands and approximately 6 miles of helicopter assisted construction where ground disturbing activity was restricted.

Limber-Oquirrh – Approximately 30 miles of tubular steel structure supported double circuit 345 kV Transmission Line from a the future site of a new Substation called Limber, in Tooele County, Utah to an existing Substation named Oquirrh in West Jordan, Utah. Engineering discipline lead for all civil and geotechnical aspects of the transmission and substation portions of the project. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of civil items in EPC bids. Post-EPC aspects included drilled shaft foundations for substation and transmission structures, substation site grading and drainage, substation steel structures, transmission line access roads and structure pads, as well as monitoring of developed springs and wells near the construction. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included steep terrain, excavation in rock, open mine pit proximity and NEPA permitting restrictions.

Limber to Terminal – Approximately 45 miles of double circuit 345 kV transmission line from the future site of a new Substation called Limber, in Tooele County, Utah to an existing Substation called Terminal in Salt Lake City, Utah. Mr. Higgins is the engineering discipline lead for all civil and geotechnical aspects of the transmission project. Coordinated with Owner's Engineer on development of preliminary engineering in support of NEPA permitting for the project. Challenges included soft soils adjacent to the Great Salt Lake and pinch points between Interstate 80 and Kennecott's tailings pond located in Magna, Utah.

Oquirrh-Terminal – Approximately 15 miles of new tubular steel supported double circuit 345kV transmission line from an existing Substation in West Jordan, Utah to an existing Substation called Terminal in Salt Lake City, Utah. Additionally, portions of an existing lattice steel supported double circuit 138 kV Transmission Line is being relocated in support of the Mountain View Corridor (MVC) road construction project for the Utah Department of Transportation. Coordination with the Owner's Engineer on development of the engineering documents for relocations required for the phased construction of the MVC. Relocation includes approximately 300 feet of underground transmission line. Foundation design review, geotechnical engineering and civil inspection coordination for construction of the project. Challenges included coordination with the department of transportation, phasing of the relocations and coordination with the larger future Oquirrh to Terminal 345kV project.

Terminal Substation – This project included replacement two existing 345/138 kV transformers and construction of a new six bay breaker and a half 138kV substation yard as well as replacement of five 138kV and installation of two 345kV circuit breakers. Engineering discipline lead for all civil and geotechnical aspects of the transmission and substation portions of the project. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of civil items in EPC bids. Post-EPC aspects included drilled shaft foundations for substation and transmission structures, substation site grading and drainage, substation steel structures, transmission line access roads and structure pads, as well as monitoring of developed springs and wells near the construction. Duties included management of Owner's Engineer civil team and review of EPC submittals for compliance with company standards and Contract. Managed Civil Inspections and provided construction engineering support and discrepancy resolution review. Challenges included brown-field site, high ground water conditions, soft soils, phased construction and storm water management.

Sigurd to Red Butte – Approximately 170 miles of tubular steel H-frame tangent with lattice steel angle and deadend structure supported single circuit 345kV Transmission Line between an existing Substation named Sigurd near Richfield, Utah, and an expansion of an existing Substation named Red Butte near the town of Central in Washington County, Utah. Engineering discipline lead for all civil and geotechnical aspects of the transmission and substation portions of the project. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and evaluation of civil items in EPC bids. Challenges included difficult soils, construction planning, line routing and NEPA permitting.

Energy Gateway West – Ten transmission line segments totaling 1008 miles at 500 kV or 230 kV from an expansion of a Substation named Windstar near Glenrock, Wyoming to an existing Substation named Hemingway southwest of Boise, Idaho. The project is broken down into the following segments: Segment 1 will be approximately 60 miles of new double circuit 230kV Transmission Line from Windstar to a new Substation named Aeolus to be located near Medicine Bow, Wyoming. Segment 2 will be approximately 100 miles of double circuit Transmission Line (230kV on one side and 500kV on the other) from Aeolus to a new Substation named Heward southwest of Aeolus. The 230kV line will loop in and out of the new Heward substation. Segment 3 is a continuation, approximately 63 miles in length, of the double circuit 500/230kV Transmission Line from the new Heward substation to an expansion of an existing Substation named Jim Bridger. Segment 4 will be approximately 191 miles of lattice steel structure supported single circuit 500kV Transmission Line from Jim Bridger Substation to an expansion of a Substation named Populus near Downey, Idaho. Segment 5 approximately 53 miles of lattice steel structure supported single circuit 500kV Transmission Line from Populus Substation near Downey, Idaho to an expansion of an existing Substation named Borah near American Falls, Idaho. Segment 6 will be approximately 78 miles of lattice steel structure supported single circuit 500kV Transmission Line from Borah Substation to an existing Substation named Midpoint near Shoshone, Idaho. Segment 7 will be approximately 126 miles of lattice steel structure supported single circuit 500kV Transmission Line from Populus Substation near Downey, Idaho to a new Substation named Cedar Hill to be located in Idaho, southeast of Twin Falls. Segment 8 will be approximately 150 miles of lattice steel structure supported single circuit 500kV Transmission Line from Midpoint Substation to a new Substation named Hemingway to be located in Idaho southwest of Boise. Segment 9 will be approximately 153 miles of lattice steel structure supported single circuit 500kV Transmission Line from the new Cedar Hill Substation to the new Hemingway Substation. Segment 10 will be approximately 34 miles of lattice steel structure supported single circuit 500kV Transmission Line from an existing Substation named Midpoint to the new Cedar Hill Substation. Pre-EPC aspects included development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer. Challenges included NEPA permitting, environmental restrictions, construction planning, line routing, and phased geotechnical exploration.

Energy Gateway South – Approximately 400 miles of lattice steel supported single-circuit 500kV Transmission Line from a future Substation named Aeolus, near Medicine Bow, Wyoming to an expansion of an existing Substation named Clover near Mona, Utah, as well as two proposed series compensation stations located at approximately the one-third and two-third points of the line. This line crosses federal, state, tribal, and private lands. Pre-EPC aspects include development of civil items of EPC Scope of Work and Request for Proposal, development and review of the preliminary engineering in coordination with the Owner's Engineer and review of the geotechnical information prepared for the project. Challenges expected are difficult soils, construction planning, line routing and NEPA permitting.

Prior to starting with MidAmerican Transmission, Mr. Higgins worked for 15 years for a multidiscipline engineering firm focused on civil geotechnical and structural engineering as well as construction materials testing, civil inspection and surveying, in support of land development and power delivery projects. He gained experience in aspects of each of these engineering disciplines and design as related to development of residential, commercial, light industrial and power delivery projects.

Thomas N. Tjoelker
Director, Transmission Planning

Expertise

- **Transmission Expansion Planning**
- **Power System Studies**
- **System Design**
- **Project Management**
- **Maintenance Policy**

Education

- **B.S. Electrical Engineering, Washington State University, 1980**

Total Years Experience

- **32**

Tom Tjoelker is Director of Transmission Planning with MidAmerican Transmission, LLC. He is currently exploring transmission projects in various markets in North America and also assisting PacifiCorp transmission planning activities. Mr. Tjoelker joined PacifiCorp in 1980 after graduating from Washington State University. In his current capacity he directs staff engineers who perform planning studies for high voltage transmission systems, both external to PacifiCorp's transmission system as well as within PacifiCorp's system. He has 32 years of experience in Transmission Planning, Project Management, and Maintenance Policy.

Representative Experience:

PacifiCorp, Portland, OR – 1980-2012

- ***Director/Manager, Main Grid Transmission Planning, 2007-Present***

First as Manager and then as Director Mr. Tjoelker has been responsible for the day to day management of PacifiCorp's Pacific Power Main Grid Transmission Planning Group, which focuses on the transmission system above 200 kV. Responsibilities have included developing transmission expansion plans for PacifiCorp's system, as well as providing support to the operations group responsible for the day to day operations of the system. In this position he has also been responsible for several NERC reliability standards.

- ***Manager, Area Transmission Planning, 2003-2007***

In this capacity Mr. Tjoelker was responsible for the day to day management of the Area Planning Engineering group, which focuses on the transmission system under 200 kV.

- ***Manager, Maintenance Policy, 2000-2003***

In this capacity Tom was responsible for the development, implementation and enforcement of asset maintenance policies for the asset base assigned to PacifiCorp's Distribution and Transmission Organizations. He was also responsible for the management of the Joint Use of Facilities Group.

- ***Manager, Engineering Services, 1997-2000***

The Engineering Services Manager is responsible for the management of PacifiCorp's Project Managers, and acts as the main point of contact, as well as the liaison between the Engineering Department and the Pacific Region Operations and the Transmission Business Unit organizations.

- ***Transmission Planning Engineer, 1985-1997***

In this position Mr. Tjoelker performed detailed electrical transmission system studies for a specified geographic area, and he devised plans for additions and modifications to the system necessary to assure proper system operation. This required the preparation of detailed system studies and the preparation of the necessary budget item proposals for the electrical system expansion called for in these studies. The specifying of equipment (transformers, regulators and circuit breakers) and the application of this equipment was a major part of the study/budget process in which Tom was involved.

- ***Staff Engineer, 1980-1985***

Mr. Tjoelker worked as a staff engineer, supporting project cost estimating, generation plant engineering and power resources engineering.

Ravikanth Varanasi, P.E
Principal Transmission Planner

Expertise

- **Transmission Expansion Planning**
- **Power System Studies**
- **System Design**
- **Project Management**

Education

- **B.S. Electrical and Electronics Engineering, REC-Surathkal, India, 1999**
- **M.S. Electric Power Engineering, Rensselaer Polytechnic Institute, 2003**

Registration

- **P.E, Electrical, Washington State**

Total Years of Experience

- **13**

Ravi Kanth Varanasi is a Principal transmission planner with MidAmerican Transmission, LLC. He is currently exploring transmission projects in various markets in North America and also assisting PacifiCorp transmission planning activities. Mr. Varanasi joined PacifiCorp in 2008 after working for Energy Consulting at GE (Schenectady, NY) and ABB Electric Systems Consulting (Raleigh, NC). In his current capacity, he performs planning studies for high voltage transmission systems at PacifiCorp, along with various other studies to meet PacifiCorp compliance requirements. He has 13 years of experience in transmission planning, economic studies and power-flow and stability studies.

Representative Experience:

PacifiCorp, Portland, OR – 2009-Present
Mr. Varanasi is an expert user of the PSS/E power system analysis tool, with significant experience with the GE PSLF program, as well. He has conducted numerous system assessments, as well as transmission planning and operating studies needed to maintain the transmission system capacities for the existing system. He has represented the company on many sub-regional and WECC committees. He has also given expert opinion on many NERC and WECC compliance activities related to transmission planning, operating procedures, system protection, transmission services and generation.

GE Energy, Schenectady, NY – 2007-2008
Prior to joining PacifiCorp, Mr. Varanasi was a Senior Engineer in the Economics group for the GE MAPS (Multi-area Production Simulation) program in GE Power Systems Energy Consulting. In this position, he was responsible for developing and implementing marketing and sales plans, acquiring new customers and conducting customer training. He developed a GE-MAPS market simulation model for WECC and ERCOT markets. Some of these studies analyzed profitability under different market conditions and transmission related studies related to congestion management using FTRs and TCCs, and system level studies that analyzed the impact of FERC's SMD (Standard Market Design) and ISO/RTO formations on market participants. He has extensively analyzed GE power generation design alternatives to support new product introduction teams by providing feedback on efficiency valuation.

ABB Inc., Raleigh, NC – 2004-2007
Mr. Varanasi was a Consulting Engineer at ABB where he

conducted power flow studies, as well as voltage stability, power import/export, and reactive compensation studies, to develop short and long-term transmission system requirements and reinforcements for various utilities, ISO/RTO's and IPP's across the United States and Canada (e.g. NYISO, NEISO, SPP, MISO, and AESO). He has also performed industrial studies to evaluate short-circuit load flow, harmonics (design of filters), power flow and power factor correction. He has extensively used EMTP to perform many transient analyses for insulation coordination, line switching, evaluation of breaker capabilities, capacitor switching, series compensation design, Ferro-resonance studies, etc.

Tata Consultancy Services – GE, Schenectady, NY / Chennai, India – 1999-2003
Mr. Varanasi was also a contract employee at GE and has managed engineers' onsite and offshore coordinated activities in the requisition engineering and controls group to meet GE delivery requirements. He has conducted detailed gas turbine and generator control fulfillment engineering projects. He has approved and audited turbine control software for GE Mark V/VI and performed many control modifications and upgrade projects. He has implemented six sigma quality and process optimization in fulfillment engineering, meeting all business objectives and goals.

RAVI BANTU, P.E.

1211 S Quebec Way; Apt# 7-108	Cell: (913)-219-9225
Denver, CO 80231	Email: ravibantu@gmail.com

Broad and well-rounded background including strengths in organizing assignments, problem solving and technical leadership. Mature and quality oriented with high standards for achievement.

EDUCATION & REGISTRATIONS

Professional Engineer, State of Ohio
MBA, University of Colorado Denver, Denver, 2012
M.S.E.E, University of Missouri-Rolla, Rolla, MO, 2001
B.S. Electrical Engineering, Nagarjuna University, India, 1999

PROFESSIONAL EXPERIENCE

RES Americas Development Inc, Broomfield , CO **November 2008- Present**

Sr. Transmission Strategist
Responsibilities include supporting the development of utility-scale renewable energy projects (Wind and Solar) in USA, Canada and in Chile from the "prospecting" phase of a project through generation interconnection process and address transmission congesion, deliverability issues and participate in several committees and trade organizations to advocate renewables in the respective regions of the electricity markets.

- Worked with several Transmission Owners in the South West region of WECC, Pacific NW region of WECC, CAISO, MISO, PJM & eastern provinces of Canada.
- Provide technical support for evaluating transmission prospects for transmission development.
- Determines optimum strategy for interconnecting the project output to the electric grid based on system impact assessments and market delivery options. Use analytical tools and methods to determine optimum plan for interconnection.
- Assesses actual grid capacity in a region by reviewing and verifying technical studies performed by transmission providers and communicate and negotiate with regional transmission providers to develop the most efficient and cost-effective plan for integrating the project into the electric power grid.
- Submit to transmission service providers in the respective regions for generation and transmission services and for evaluations of technical studies.
- Offer technical expertise when negotiating LGIA and PPA for several projects.
- Participate in several committees including technical and policy based to advocate for and influence the decesions which are favorable for renewable energy projects.

Black & Veatch, Overland Park, KS **September 2001- October 2008**
System Studies Engineer:
Responsible for performing system impact studies, transient stability studies, short circuit analyses, transmission expansion studies, ground grid analyses, AC interference analyses, relay setting & coordination, power quality study, develop software for internal purposes, Substation design, and training. Present findings of the analyses verbally and in writing to both external and internal clients.

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- Performed transient stability studies for UI for Trumbull substation. The purpose of this study is to analyze the Trumbull Substation Project and assure that it poses no significant adverse impact on the reliability and operating characteristics of the interconnected bulk power transmission system in accordance with the Independent System Operator New England (ISO-NE).The studies were conducted using Dynamic Module of Power Technology's (PTI) PSS/E software.
- Supervised and performed transient stability studies for SPP as part of generation interconnection studies for several wind farms (GE, Acciona , Mitubishi, Vestas Etc.,) and coal plants. The studies were conducted using Dynamic Module of Power Technology's (PTI) PSS/E software. The objective of the study was to determine the impact of the wind farm on the BPS.
- Performed steady state study for PPM (Pinascal wind project) to determine the reactive needs for the project. The study involves complete modeling of the wind farm from the high voltage down to the generator voltage. The studies were conducted using Steady State module of Power Technology's (PTI) PSS/E software.
- Performed transient stability studies for American Transmission Company as part of generation interconnection studies. The studies were conducted using Power Technology's (PTI) PSS/E software. The objective of the study was to determine the critical clearing times under various contingencies such as faults, outages, breaker failure, etc.
- Performed several system impact studies for SPP which included power flow analysis, short circuit analysis and stability analysis.
- Supervised and also performed transmission assessment and impact study due to generation addition at various locations in the States of Kansas and Oklahoma. Load flow studies were conducted for various contingencies to identify overloaded elements. The recommendations included cost estimates for the necessary upgrades.
- Performed transient stability studies for SPP as part of generation interconnection studies. The studies were conducted using Power Technology's (PTI) PSS/E software. The objective of the study was to determine the critical clearing times under various contingencies such as faults, outages, breaker failure, etc.
- Modeled systems under study using ISIM, PSS/E and PSLF software to perform transient stability analysis. Subsequently an adequate protection scheme was proposed.
- Studied systems for impact and facility using PSS/E, MUST and PSLF. Analysis considering FCITC and TDF was done. Available transmission system capability was computed and recommendations for future changes were given.
- Short Circuit analyses were performed. Relay co-ordination and Protection relaying scheme was designed for Ngrid using ASPEN.
- Developed internal software for finding errors in the data which is used as an input to PSS/E. A software in Xcel is formulated to determine the reactive power pricing for a power plant. Importance was given for determining the operational costs rather than the capital costs.
- A basic course was taught in fundamentals of power systems and using PSS/E and MUST for professions in Special Projects Division within B&V.
- Performed retrofit substation design projects for AEP such as replacing existing relays with new SEL relays and performing relay settings. The majority of work included generating AC, DC schematics, wiring drawing and physical layouts.
- Several bus design projects were done for UI.

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- A review of previous ground grid designs of the power plants was done and the upgrades were recommended. MALZ, MALT,RESAP and FCDIST modules of CDEGS were used for this purpose. Cost estimate of the upgrades was recommended. Designed and analyzed several substation ground grids and power plant ground grids for UI,AEP,WES,PG&E,Connectiv etc.,
- Performed AC interference studies on the pipelines in the corridor of the 138kV, 260kV transmission lines. The studies were done to evaluate the affect of moving the transmission structures or a change in the configuration of the pipelines. Right of Way (ROW) module of CDEGS was used as tool to do the analysis.

PUBLICATIONS

Improvement of power quality in VSI drives, IEEE Conference, 2002.

SOFTWARE SKILLS

POWER WORLD, PSS/E, PSLF, MUST, DAPPER, CAPTOR, ISIM, CAPE, ASPEN, ETAP, CDEGS,WINIGS.

RESUME

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NATIONALITY:	Canadian
EMPLOYER:	11101 W. 120th Avenue Suite 400 Broomfield, CO 80021 Tel: (303) 439-4200 Fax: (303) 439-4299 Web: www.res-americas.com
CURRENT POSITION:	Elect Eng Manager
EDUCATION:	**MS (Electrical)**
PROFESSIONAL QUALIFICATIONS:	**PE in few States in US and PEng in two provinces in Canada**

PROFESSIONAL EXPERIENCE:

2008- to date **RES Americas, Inc. –**
As Design Manger, support the design team in developing performance specifications, review of design, develop prelim cost estimates and site visits during construction, tesinga nd commissioning.
Projects: High Plains, WY, Armenia Mountain, PA, Wild Horse Expansion, WA, Harvest Wind ,WA

2002 – 2008 **Samuel Engineering**, Greenwood Village, CO.
As Chief/Lead electrical / Project engineer, I have executed large industrial projects involving HV (up to 230kV) substations. Responsibilities include main substation layout and distribution system design, pole-mounted reclosers, specify and procure capital intense and long lead equipment. Establish and negotiate with contractors for supply and construction. Also responsible for detail engineering, system studies, substation structures, live and dead tank circuit breakers, PLC equipment, protection and control schematics, procurement, construction co-ordination and commissioning. Use of ETAP software for system analayis. Field support during testing/commissioning; additionally develop installation and operating procedures; evaluate operational and safety improvements at existing electrical substations.

2000 – 2002 **NEPCO (a subsidiary of ENRON),** Englewood, CO

As lead electrical engineer, responsible for the complete electrical design, power system studies, develop specifications and procure major equipment electrical equipment including 500kV transformers, GCBs, ISO-phase bus ducts, MV auto transfer systems, substation steel structures, DC systems, work closely with a team of designers and engineers, develop protection and control schematics, cable tray and underground systems, liaison with Independent System Operator (ISO) for physical tie-ins, coordinate protection and control, testing and commissioning..
Projects – Coyote Springs , Boardman OR, 330MW Combined cycle palant.

1998 –2000 **Brown and Caldwell,** Denver , CO
As lead electrical engineer, responsible for the complete electrical system design, major equipment procurement like transformers and HV/MV switchgear, large VFDs for lift stations; work closely with team of designers and engineers, sizing and integration of cogeneration power using digester gas, automatic transfer schemes, coordinate protection and control with local Utility, testing and commissioning.
Projects – Waste Water Treatment Plant (WWTP) in Denver, Englewood, and Ely, MN.

1997-1998 **Lead electrical engineer, H A Simons Inc**., Phoenix, AZ.
As lead electrical engineer, responsible for the complete electrical design, major equipment procurement, coordinate protection and control, testing and commissioning for a large copper mine site in Morenci, AZ. Major equipment include transformers, Electro winning system, harmonic filters, HV/MV and LV switchgear and all aspects of system control.
Projects – Morenci Copper project in Morenci, Morenci, AZ.

1989-1996 **Sr./Lead electrical engineer, Kilborn Engineering,** Vancouver, Canada
As Sr./Lead electrical engineer, responsible for the complete electrical design, major equipment procurement, design of cable tray, underground duct banks, lighting, lightning protection, coordinate protection and control, testing and commissioning for various hydroelectric generating stations. Use of PSS/E software for system analysis. Major equipment includes transformers, governors, protection and control cabinets, HV/MV and LV switchgear and all aspects of system control.
Projects – BC Hydro's various Hydro and one thermal generating stations and many substations.

TAB F-4-1

External Service Providers

The Applicant will identify, qualify, and select contractors, advisors and professional services providers at the appropriate time in the development, construction, operation and maintenance of the Project. As appropriate, a competitive bidding process will be utilized in which Ontario-based parties will have preference, provided that they have the requisite qualifications and are competitive and recognizing that First Nation and Métis contractors will be utilized where appropriate and consistent with the Applicant's commitments to First Nation and Métis participation and accommodation. The Applicant's selection of contractors, advisors and professional services providers will generally occur in three major phases, as follows:

- Applicant designation preparation phase: selection of parties that will provide services during the development phase and support the preparation of Applicant's designation application. This has been largely completed and is discussed below;
- development phase: selection of Project's owners' engineer within six months of designation via a competitive bidding process, as discussed below;
- construction phase: selection of an EPC contractor via a competitive bidding process that occurs during the Board's LTC proceedings and the simultaneous selection of site preparation contractors which are likely to include First Nation and Métis entities. Maintenance contractors will be selected during the latter stages of construction which are also likely to include First Nation and Métis entities.

The Applicant will contract with a substantial number of external parties to provide services in the development of the Project and the preparation of a LTC application. Approximately 80 percent of the Project development budget is for such purposes. The Applicant intends to contract primarily with qualified Canadian contractors, advisors and professional services providers particularly Ontario-based parties and qualified parties with significant Ontario experience.

The Applicant has identified and interviewed potential contractors and advisors to ascertain their qualifications and availability to support the Applicant in the event that it is designated to develop the Project. On the basis of these activities, it has selected a core group of Ontario-based parties that have been used to support its efforts in preparing this Application for designation to the OEB, that may continue to be utilized in the event that the Applicant is designated to develop the Project, as follows:

- legal: Fraser Milner Casgrain LLP (Toronto, ON);
- environmental & technical consultant: Stantec Consulting Limited (Toronto & Vancouver);
- rate regulation; JT Brown Consulting (Toronto, ON);
- construction advisors: PowerTel Utilities Contractors Limited (Whitefish, ON);
- First Nation and Métis advisor: John Beaucage, former Ontario Grand Chief (Parry Sound, ON);
- communications: Campbell Strategies Inc. (Toronto, ON);
- project development support: Juan Anderson (Thunder Bay, ON);
- First Nation and Métis financing: Coxswain Row Capital Corporation (Toronto, ON);
- cost/benefit analysis: Energy and Environmental Economics (E3) or Brattle Group (US); and
- financial matters: Deloitte (various US and Canadian offices).

The Applicant has identified additional parties that will be considered in the event of its designation, but at this juncture it is premature to consider and select such parties until an applicant has been designated. Additional contractors and advisors that will be considered in the event of the Applicant's designation will include select First Nation and Métis contractors, technical and engineering consultants, contractors within affected communities and possibly Hydro One, who may be considered for certain operating and maintenance responsibilities. Parties listed by the IESO as "Connection Assessment Support Consultants" would be considered, and in many cases are qualified and certified for engineering and design purposes beyond IESO-approved connection assessments. These entities are listed in Exhibit F-4-2.

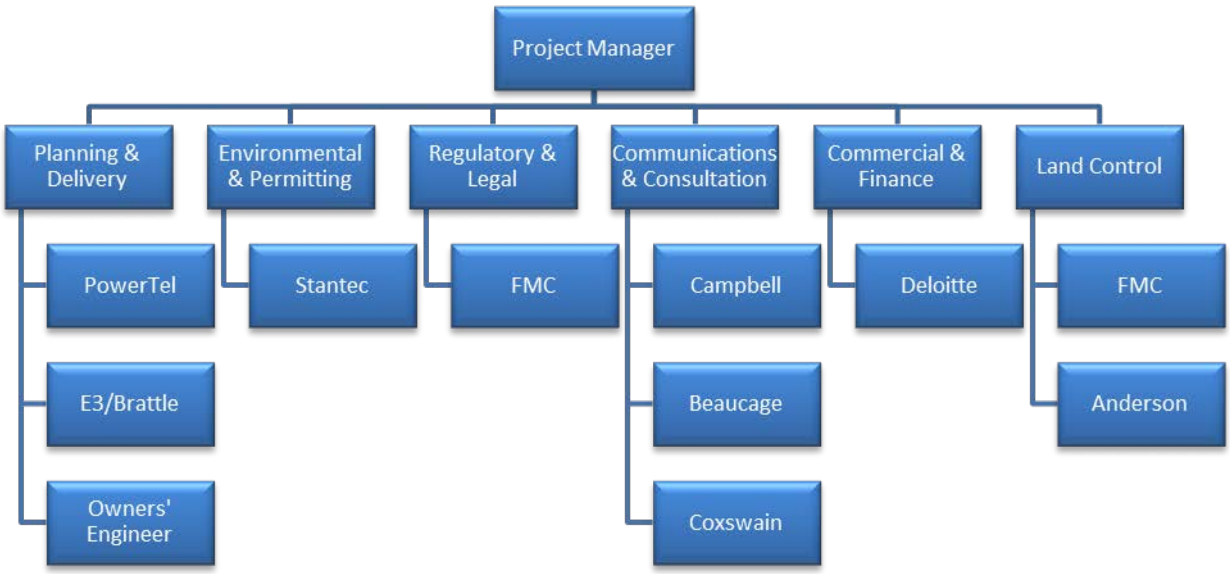
Foremost among the parties with which the Applicant will contract in the event of its designation is an owners' engineer. The Applicant will conduct a qualification and competitive bidding process in the first 6 months after being designated, with the selected party initiating work about 6 months after designation. The parties that would be considered as owners' engineer are likely to include but are not limited to the following entities:

- Canadian: AMEC, Black & MacDonald, Genivar, Teshmont, SNC-Lavalin, and Stantec; and

- North American: Black & Veatch, Burns & McDonnell, HDR, Power Engineers, RW Beck, Sargent & Lundy, and Shaw Group.

The Applicant's contractors and advisors will be managed by a combination of the Project Management Team and the managers of each of the six major areas of responsibility identified in Exhibit F-1-3. For instance, the Manger of Planning and Delivery will manage PowerTel, the owners' engineer, the cost/benefit consultant, and additional consultants and advisors as required within the range of that manager's responsibilities.

Figure F-3: Primary Project Consultants & Advisors Organizational Chart (Development Phase)



Finally, the qualification and selection of an EPC contractor will entail significant effort on the part of the Applicant and its consultants and advisors during the LTC proceedings, particularly the owners' engineer who will be charged with developing bid specifications for inclusion in a bidders' package that would be provided to qualified potential EPC contractors. The work of the owners' engineer would be supplemented by the expertise of the RES Group and the MidAmerican Group, both of whom have considerable experience in qualifying, selecting, and managing EPC contractors for large and complex projects (evidenced in Exhibit E) located in remote regions comparable to the Project.

TAB F-4-2

1 **IESO Connection Assessment Support Consultants**

The consultants in the following list have indicated an interest in providing connection support services to connection applicants. The IESO does not give any assurances regarding the performance of consultants, nor does it assume any liability for poor performance.

Connection applicants may wish to verify that the consultant whom they select is capable of performing the following types of studies using PTI or PTI-compatible software:

– Calculation of short circuit current at specific locations for selected contingencies.
– Verification of generator and dynamic control system models and assessment of their performance against market rule requirements.
– Loadflow and transient stability analysis to identify unacceptable equipment loadings, pre- and post-contingency voltage performance and dynamic response based on limiting system conditions and critical contingencies.

HATCH

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2

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Teshmont Consultants LP

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SNC-Lavalin Engineers and Constructors

Sherry Ahmad, P. Eng
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Stone & Webster Canada

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TAB F-5-1

Operation and Maintenance Plan

A definitive operation and maintenance plan ("**O&M Plan**") has not been established for the Project at this time. The specific operation and maintenance activities and actions deemed necessary for the Project will be prepared during the development phase of the Project as more specific Project details, specifications and line centerline location are established. The MidAmerican Group and the RES Group have significant experience in operating and maintaining large scale high voltage (230 kV, 345 kV and 500 kV) transmission systems in a multitude of geographies and climates as discussed in Exhibit E, which will assist with preparation of an O&M Plan.

The O&M Plan will be prepared based on CSA, IESO standards and requirements and other applicable standards and requirements including but not limited to:

- IESO Reliability Compliance Program for Vegetation (Form IMO-FORM-1526 V0.7 or latest version; and
- Ontario Energy Board Transmission System Code SECTION 10 (July 14, 2000) or latest version.

The RES Group and MidAmerican Group's experience would dictate the use of a general O&M outline in the initial formation of a comprehensive O&M Plan for the Project. The outline below is for illustrative purposes and would be modified as necessary to prepare an O&M Plan for the Project to ensure safety, reliability, performance and sustaining the life of the Project assets.

General Operation & Maintenance (O&M) Requirements and Check List for Transmission Lines

Land Rights

Easements.

Rights of way owned in fee simple.

Special Permits (crossings, usage limits, access).

Roads, bridges and gates.

Annual Testing and Inspection

Mandated standards, guidelines and criteria.

Aerial patrols.

Ground patrols.

Climbing inspections.

Video and infrared scan.

Grounding.

Anchor testing.

Prioritize conditions found and follow up.

Vegetation Management

Trimming practices and cycle(s).

Clearing and brushing.

Use of herbicides.

Tree clearing (danger trees, preventable and non-preventable).

Roads and access.

System Operations & Communications

SCADA monitoring.

SCADA control and indication.

Electronic communications systems.

Protection and control systems.

Protocols for outages and clearances.

Outage procedures.

Compliance and Reporting

Mandatory agency requirements.

Utility/Owner requirements.

Audits.

Spare Equipment and Materials

Quantity, type and location.

Transport.

Security.

Specialty Tools (Energized work if required).

Safety equipment, tools and devices.

Emergency Repairs and Restoration

Emergency action plans.

Contact list.

Initial response.

Communications protocol.

Mutual assistance agreements.

NERC Compliance (or other Regulatory Agency Compliance)

IESO Compliance

Record Keeping and Reporting, Data Storage and Retention

Communications and Notifications

TAB G-1-1

Two Design Options

The Applicant proposes two options for the design and construction of the EWTL between Wawa and Thunder Bay: the **Reference Design** option and the **Preferred Design** option. The Reference Design comprises a double-circuit transmission line, as described by the OPA in its June 30, 2011 report on the long-term electricity outlook for the Northwest[1]. The Preferred Design proposed by the Applicant comprises an innovative single-circuit transmission line.

While both the Reference Design and the Preferred Design meet or exceed all applicable requirements with respect to transfer capacity, system performance and system reliability[2], the Preferred Design is a superior option for the following four overarching reasons:

(i) it has superior electrical performance attributes, including a total east-west transfer capacity of 684 MW compared to the 650 MW in the OPA's reference option and the Applicant's Reference Design;[3,4]

(ii) its upfront, overall cost of construction for the transmission line portion of the Project is $80 million less than for the Reference Design;[5]

(iii) it can be constructed and put into service more quickly than can the Reference Design;[6] and

[1] Ontario Power Authority, "Long Term Electricity Outlook for the Northwest and Context for the East-West Tie Expansion" (June 30, 2011); the OPA assumes that the expanded East-West Transmission Line would comprise a new double-circuit 230 kV overhead transmission line.
[2] These requirements include the Board's minimum technical requirements and minimum design criteria for the reference option in attachments 1 and 2 of the Board's letter to Registered Electricity Transmitters, dated December 20, 2011; and the reliability and other standards of the IESO, the NERC and the NPCC.
[3] Details of the transfer capacity of the two design options are provided in Exhibits G, H and I.
[4] Further detail of the Preferred Design's superior electrical performance attributes are available in the Preferred Design IESO Feasibility Study included at Exhibit H-2-3.
[5] Details of the cost of constructing the two design options are included in Exhibit P.
[6] Details of the constructability of the Preferred Design are included at Exhibits G and H.

(iv) it allows for increments of transfer capacity to be installed in five discrete stages, in the form of station upgrades, in order to meet system requirements as they materialize, thereby deferring and, thus, reducing costs to ratepayers; assuming that the five stages are installed over an eight year period, commencing in 2018, the total savings in owning and operation costs would be approximately $62.5 million.

Both the Preferred Design and the Reference Design can be installed in either of the two potential transmission line routes that have been identified by the Applicant and described in Exhibit J.

The key features of the Preferred Design and the Reference Design are summarized below in this Exhibit. A diagram that illustrates the differences between the Preferred Design and the Reference Design is included at Exhibit G-2-1. Schematics that compare the station upgrades required under both design options are included at Exhibit G-3-1, G-3-2 and G-3-3. A diagram that shows the staging of capacity additions, under the Preferred Design, is included at Exhibit G-4-1. A graph that compares the cost of the Preferred Design and the Reference Design is included at Exhibit G-5-1. A summary of the Applicant’s technological innovations for the Project is included at Exhibit G-6-1.The Applicant’s plan for addressing challenges during the development and construction phases of the Project is included at Exhibit G-7-1. A summary of the benefits to local communities from the Applicant’s two design options is included at Exhibit G-8-1.

Detailed design and other technical information about the Preferred Design and the Reference Design are included at Exhibits H and I, respectively. This information includes the Feasibility Studies that were prepared by the IESO in respect of the Preferred Design and the Reference Design (at Exhibit H-2-3 and Exhibit I-2-2, respectively).

Key Features of Design Options

Conductors

The single circuit Preferred Design uses an innovative single 1557-ACSS trapezoidal conductor along the entire length of the line, from Wawa to Thunder Bay. The double circuit Reference Design uses two single 1192.5 kcmil ACSR conductors along the entire length of the line. The Preferred Design's single-circuit option also uses a higher current carrying capability conductor which has the effect of reducing the total weight of the conductor to 70 percent of that in the Reference Design. Moreover, since the Preferred Design uses only one set of three conductors compared to two sets of six conductors in the Reference Design (one conductor for each of the three phases of electric power), the Preferred Design will experience 40 percent less stress due to ice and wind loadings. This means that smaller towers can be used to support the conductors which, in turn, translates into savings in construction and material costs. The proposed 1557 ACSS trapezoidal conductor also possesses superior technical capabilities relative to 1192.5 ACSR conductors. These superior capabilities include: a larger capacity to transfer current (i.e., higher ampacity); reduced line sag during situations of emergency electrical loads; an ability to operate at higher temperatures; and excellent self-damping vibration properties.

Required System Upgrades

While additional transformer station system upgrades are required to support both the Preferred Design and the Reference Design, the type of required station upgrades is different for each option. Table G-1, below, summarizes the substation and other upgrades that are required under each design option. Further description of the Preferred Design and the Reference Design can be found in Exhibits H-1-1 and I-1-1 respectively.

Table G-1: Required System Upgrades

Equipment	Preferred Design	Reference Design
1. Static VAr Compensators		
a. Marathon TS	Yes	Yes
b. Wawa TS	No	No
c. Lakehead TS	No	No
2. Series Compensators		
a. Between Wawa TS and Marathon TS	Yes	No
b. Between Marathon TS and Lakehead TS	Yes	No
3. 40 MVAr Shunt Reactors		
a. Marathon TS[7]	Yes	Yes
b. Wawa TS	No	No
c. Lakehead TS	No	No
4. Shunt Capacitor Banks		
a. Marathon TS	Yes	No
b. Wawa TS	No	No
c. Lakehead TS	Yes	Yes
5. Protection and Control		
a. Marathon TS	Yes	Yes
b. Wawa TS	Yes	Yes
c. Lakehead TS	Yes	Yes

[7] Three shunt reactors are required to be installed at Marathon TS.

Towers and Foundations

The Preferred Design uses a combination of single-circuit tubular steel H-frame structures and single-circuit steel lattice structures to optimize the line for local conditions. The Reference Design uses much larger, double-circuit lattice towers because the double-circuit Reference Design towers will need to support more and heavier wire and higher ice and wind stress than the Preferred Design towers. The choice of tower structure under the Preferred Design (H-frame vs. lattice) will depend on the suitability of each tower to particular line crossings, the ease of constructing foundations in local conditions, the types of foundations that are required at each site and the availability of local materials.

The smaller lattice towers used in the Preferred Design require less material (i.e. steel), less installation-related labour and smaller foundations (i.e. concrete, gravel and rebar steel). In the result, the Preferred Design is less expensive to construct, relative to the Reference Design. This cost advantage is discussed in Exhibit P. Over the approximately 400 km length of the Project, the smaller towers used in the Preferred Design will lead to substantial savings in construction and material costs. Where the Preferred Design uses single-circuit H-frame structures, there would be further cost savings from constructing, two rather than four, foundations for each tower, even after accounting for the closer spacing of the single-circuit H-frame structures. Finally, the smaller towers used in the Preferred Design are expected to have less of a visual impact than the larger towers used in the Reference Design. A comparison of the towers and foundations used in the Preferred Design and the Reference Design is included in Table G-2 below.

Table G-2: Towers and Foundations

	Preferred Design	Reference Design
1. **Towers**		
a. Single circuit H frame towers	Yes (first choice)	No
b. Single circuit lattice towers	Yes (where local conditions require)	No
c. Double circuit lattice towers	No	Yes
2. **Foundations**		
a. For single circuit H frame towers	2 foundations/tower	
b. For single circuit lattice towers	4 foundations/tower	
c. For double circuit lattice towers		4 foundations/tower

Station Interconnections

Since the Preferred Design requires only one set of three conductors to interconnect with each transformer station (as opposed to the two sets, six conductors, required by the Reference Design), significantly fewer circuit breakers are required to be installed at each of Wawa, Marathon and Lakehead TSs. This translates into significant cost savings (see Exhibit P for details on the cost of each design option).

Schematics that compare the station interconnections and circuit breakers required under the Preferred Design and under the Reference Design, for each of Wawa, Marathon and Lakehead TSs, are included at Exhibits G-3-1, G-3-2 and G-3-3, respectively.

Staging of Capacity Additions

The Reference Design requires that all facilities be constructed in the same time frame, making the full 650 MW transfer capacity available as soon as the EWTL is placed into service. Under the Preferred Design, the full transfer capacity (684 MW) could be installed at once or, alternatively, in stages, as system requirements materialize. The electricity demand scenarios that are included in the OPA's 2011 long-term electricity outlook for the Northwest indicate that the full 650 MW of transfer capacity that is stipulated in the OEB's definition of the EWTL, is unlikely to be required by the initial EWTL in-service date. It is far more likely that the need for this transfer capacity will develop over time. In these circumstances, it makes economic sense to construct only those facilities that will be required in the foreseeable future and defer the construction – and cost – of additional capacity to future periods. Table G-3, below, describes the staged approach that is possible under the Preferred Design.

Table G-3: Staged Capacity Additions

Stage	Facilities Added	Total Installed Transfer Capacity (MW)	Incremental Transfer Capacity Added (MW)
1	transmission line constructed from Wawa TS to Lakehead TS with an interconnection at Marathon TS	387	
2	series compensation added between Wawa TS and Marathon TS	436	49
3	series compensation added between Marathon TS and Lakehead TD	484	48
4	shunt capacitors added at Lakehead TS and Marathon TS, static VAr compensator added at Marathon TS (without series compensation between Marathon TS and Lakehead TS as described in Stage 3)	614	130
5	stage 4 plus series compensation added between Marathon TS and Lakehead TS	684	70

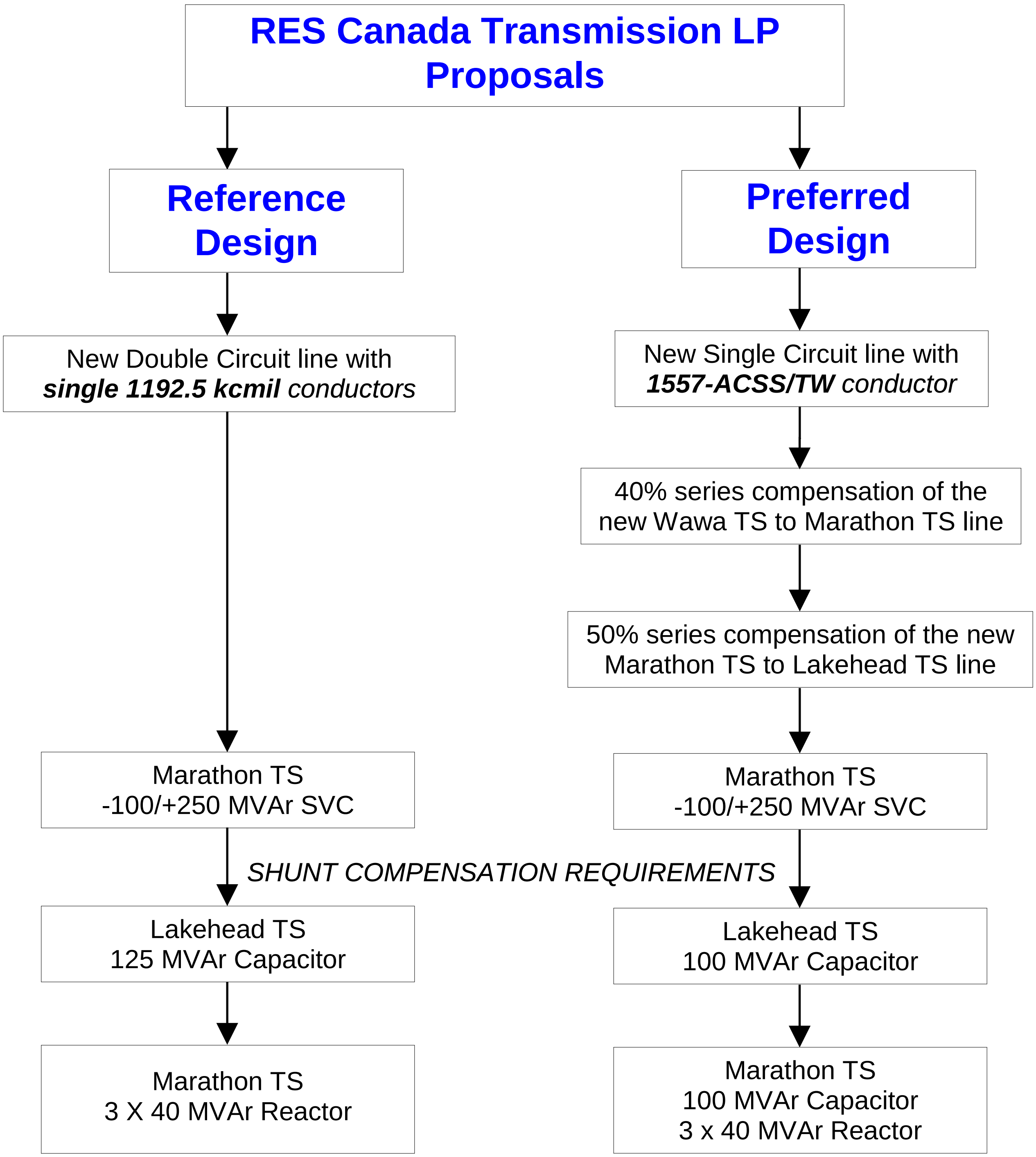
The completion of Stage 1 would increase the total transfer capacity of the existing transmission corridor to 387 MW and improve system reliability, facilitating more efficient and cost-effective dispatch of existing generation resources. The completion of stages 2 through 5 involve the construction of transformer station and other upgrades.

The stages could be constructed by Hydro One if and when system demand materializes. Each stage would take approximately two years to construct and more than one stage could be constructed in the same time frame, if necessary. A diagram showing the upgrades that would be added at each stage is included at Exhibit G-4-1.

Adding transfer capacity in stages and only if and when required by system demand, as proposed in the Preferred Design, would defer or avoid altogether, the expenditure of the significant capital costs of stages 2 through 5. This would translate into substantial savings for Ontario ratepayers. A graph that compares the OPA's estimate of the cost of constructing the Reference Design with the Applicant's estimate of the cost of constructing its Preferred Design is included in Exhibit G-5-1.

TAB G-2-1

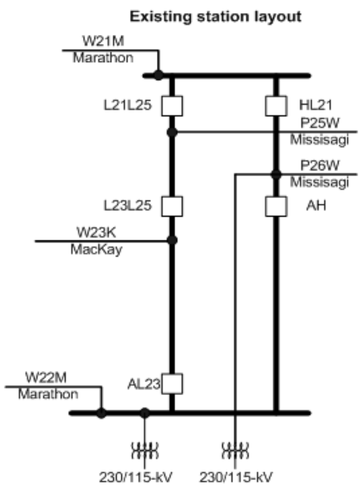
Preferred Design vs. Reference Design Diagram



TAB G-3-1

Comparison Schematic of Wawa TS Upgrades for Preferred Design vs. Reference Design

Wawa 230-kV

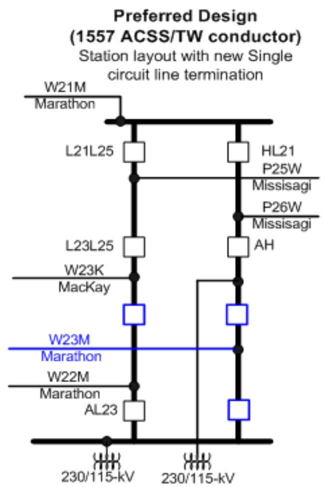


Scope of Work

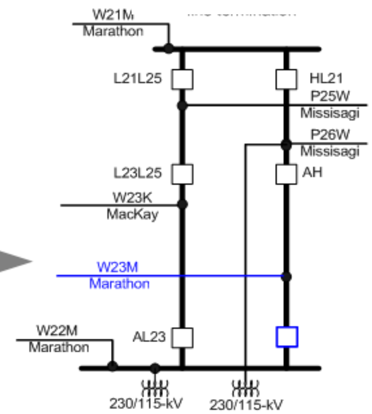
- 3 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 1 X 230-kV line disconnect switch
- 3 X 230-kV CCVT's
- 3 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.

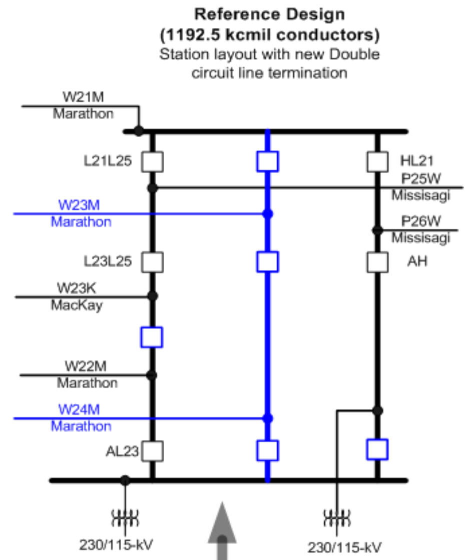
Scope of Work

- 1 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 1 X 230-kV line disconnect switch
- 3 X 230-kV CCVT's
- 3 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.



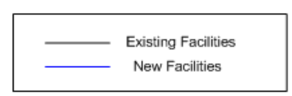
OR





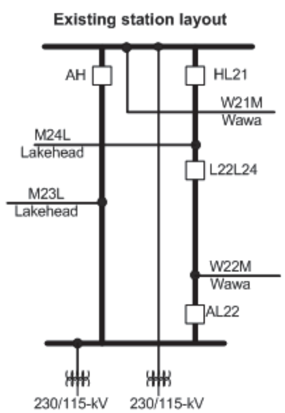
Scope of Work

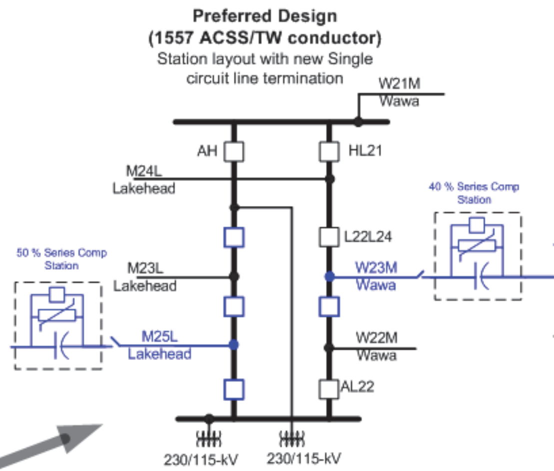
- 5 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 2 X 230-kV line disconnect switches
- 6 X 230-kV CCVT's
- 6 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.



TAB G-3-2

Comparison Schematic of Marathon TS
Upgrades for Preferred Design vs. Reference Design

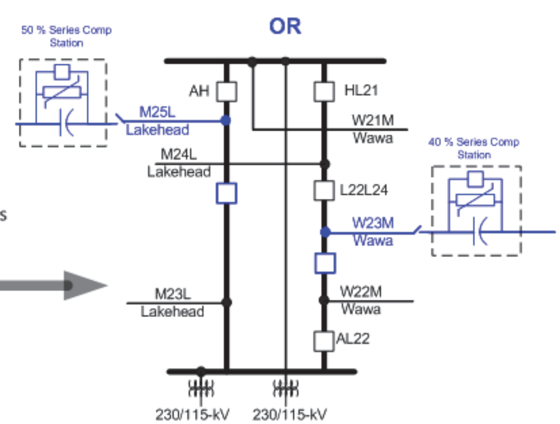




Scope of Work

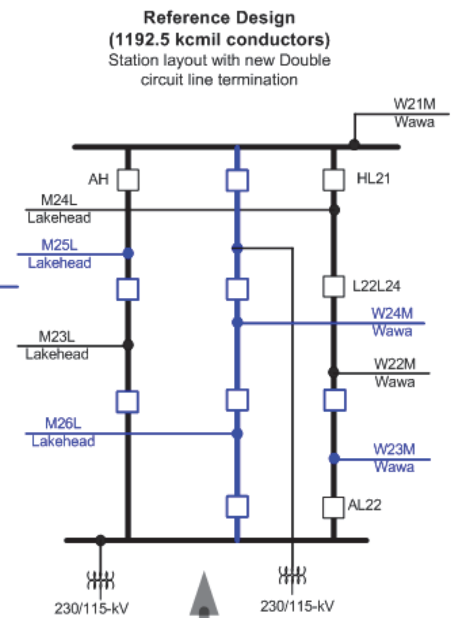
- 4 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 2 X 230-kV line disconnect switch
- 6 X 230-kV CCVT's
- 6 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.

OR



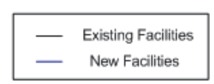
Scope of Work

- 2 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 2 X 230-kV line disconnect switch
- 6 X 230-kV CCVT's
- 6 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.



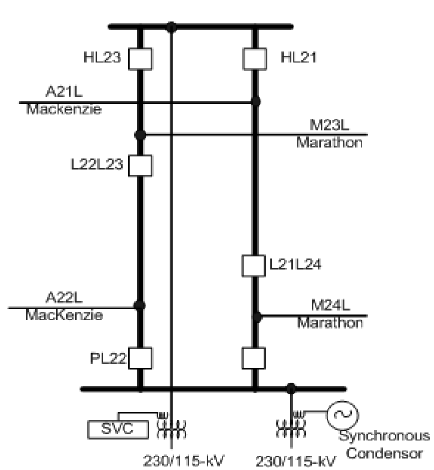
Scope of Work

- 7 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 4 X 230-kV line disconnect switch
- 12 X 230-kV CCVT's
- 12 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.



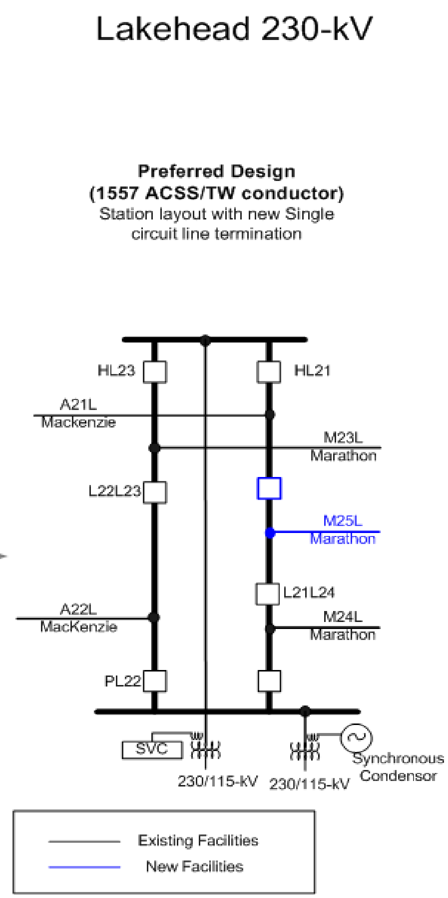
TAB G-3-3

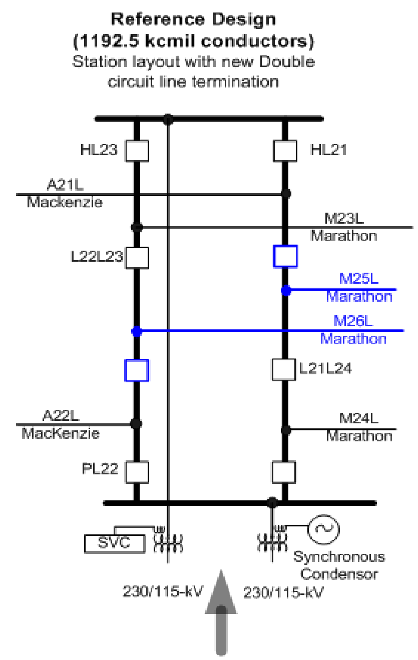
Comparison Schematic of Lakehead TS Upgrades for Preferred Design vs. Reference Design



Scope of Work

- 1 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 1 X 230-kV line disconnect switch
- 3 X 230-kV CCVT's
- 3 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.



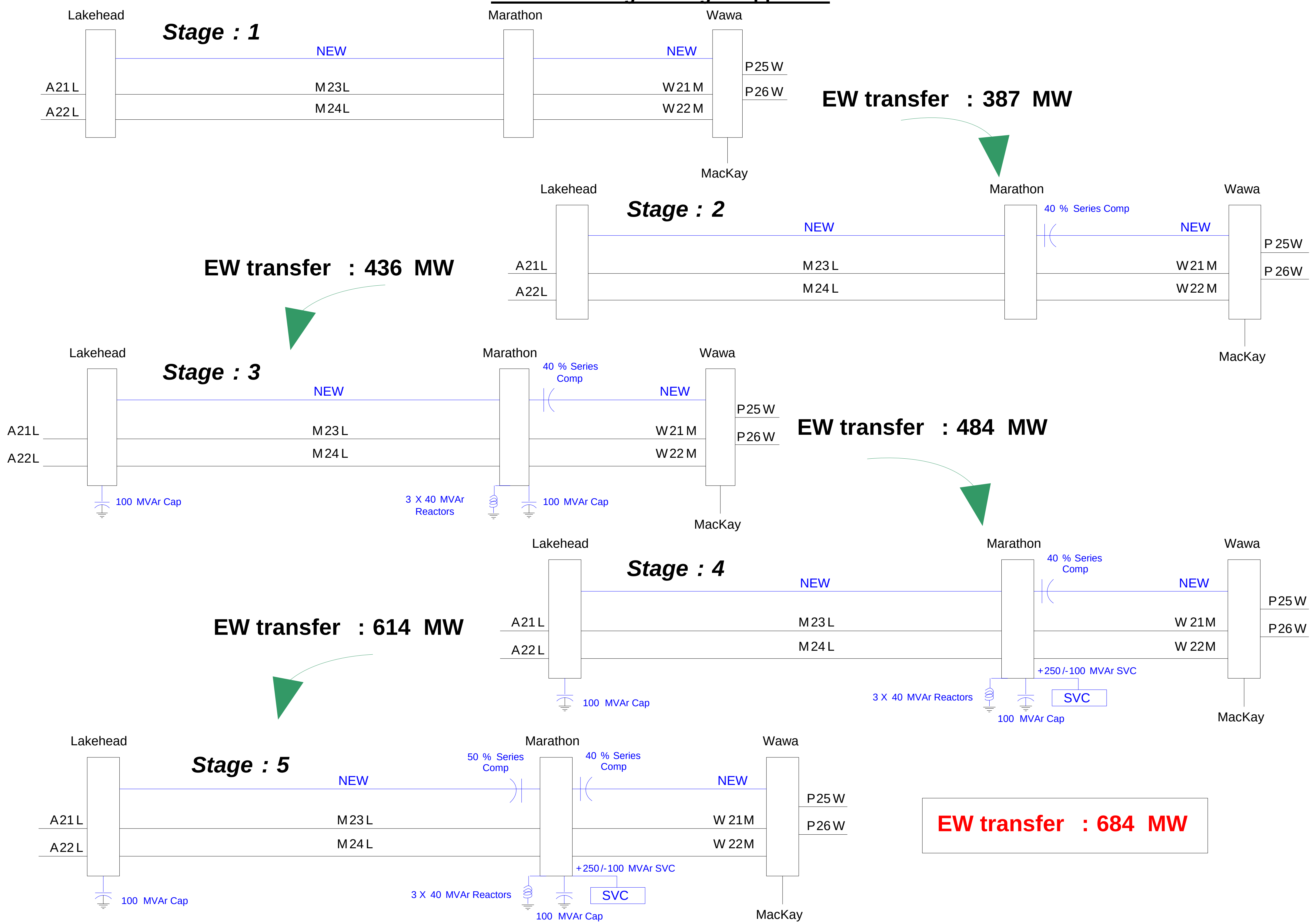


Scope of Work

- 2 X 230-kV 3000 Amps circuit breakers with 2 associated disconnect switches
- 2 X 230-kV line disconnect switches
- 6 X 230-kV CCVT's
- 6 x 230-kV surge arrestors
- Additional Bus work and structures, Control panel work, modifications to existing P&C.

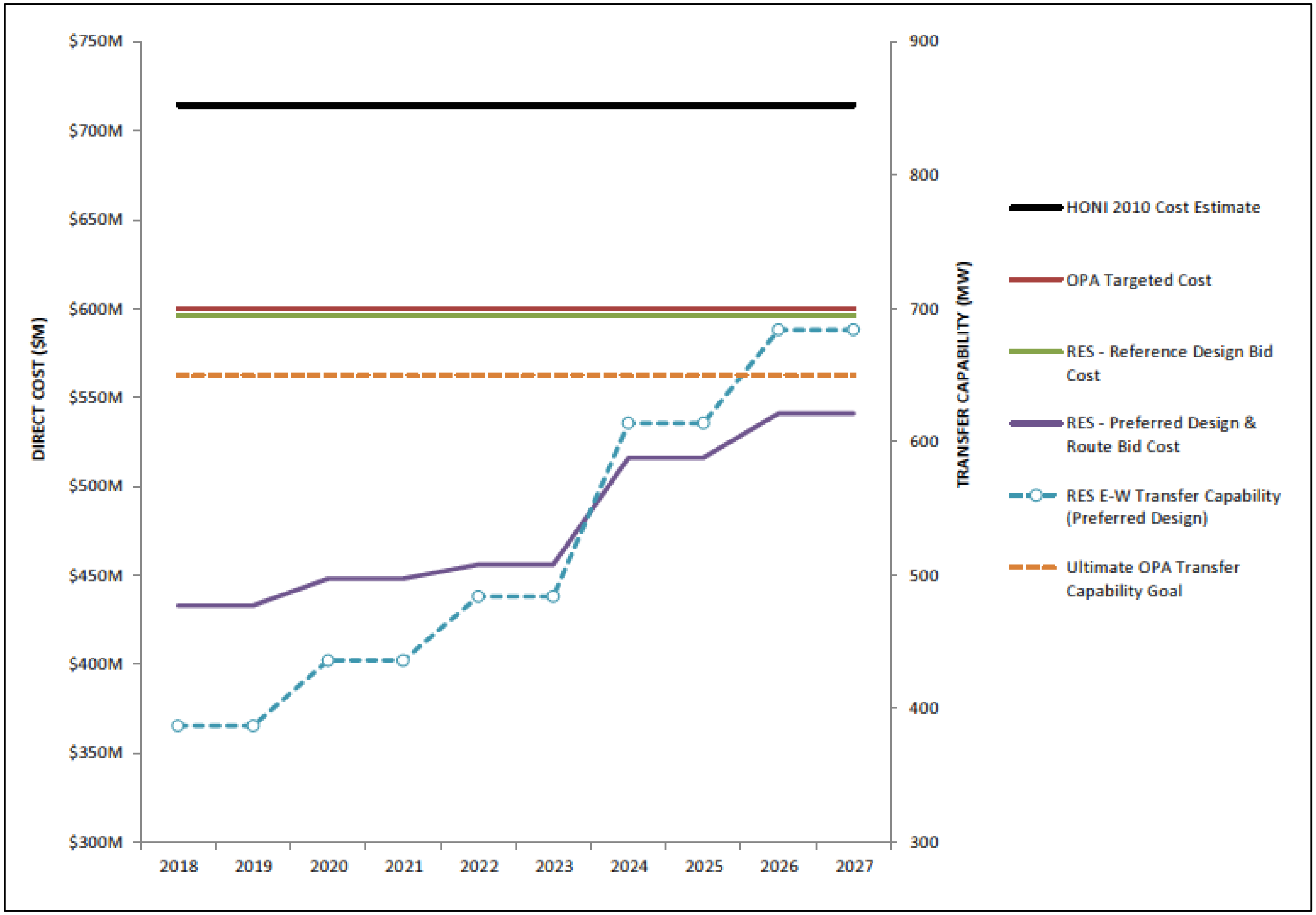
TAB G-4-1

Preferred Design – Staged Approach



TAB G-5-1

1 **Project Line, Station and Interconnection Cost**



2

TAB G-6-1

Technological Innovations

The Applicant is proposing an innovative Preferred Design with a single-circuit from Wawa to Thunder Bay. The conductor being proposed is a 1557 ACSS trapezoidal conductor that has superior electrical and mechanical qualities compared to the 1192.5 kcmil conductor being proposed as a part of the Reference Design option. MAT has more than 4,800 km of different types of trapezoidal wire conductors currently installed and operating on its existing transmission systems; an additional 1,600 km of trapezoidal conductor will be installed by June 2015.

Conductor Description

The 1557 ACSS trapezoidal conductor is designed for overhead distribution and transmission lines. It is designed to operate continuously at elevated temperatures up to 250°C without loss of strength; it sags less under emergency electrical loadings than ACSR/TW; it has excellent self-damping (vibration and galloping) properties; and, its final sags are not affected by long-term creep of other aluminum, which are known to stretch in length over service life.

The 1557 ACSS trapezoidal conductor is available in equal area and equal diameter design. The equal area design allows equal electrical ampacity in a smaller diameter conductor when compared with a standard ACSS conductor. The equal diameter design allows more ampacity in an equal diameter conductor when compared with a standard ACSS conductor. The 1557 ACSS trapezoidal conductor also provides many design opportunities for new line construction including: reduced tower cost, decreased sag, increased self-damping properties, increased operating temperature and improved corrosion resistance.

The 1557 ACSS trapezoidal conductor is a composite, concentric-lay-stranded conductor. Steel strands form the central core of the conductor with one or more layers of 63 percent minimum average conductivity aluminum 1350-0 wire stranded around it.

The steel core carries most or all of the mechanical load of the conductor due to the "0" (fully annealed or soft) temper aluminum. Steel core conductors are protected from corrosion by Galfan®, zinc-5 percent aluminum-mischmetal alloy coating. High strength steel core, aluminized and aluminum clad steel core is also available.

Series Capacitor

The Preferred Design option includes the use of 230 kV series capacitors. Series compensation is a well-established technology that is primarily used to reduce transfer reactances, most notably in bulk transmission corridors. The result is a significant increase in the transient and voltage stability in transmission systems. Series compensation is self-regulating in the sense that its reactive power output follows the variations in transmission line current, a fact that makes the series compensation concept extremely straightforward and cost-effective. MAT employs extensive use of series capacitors on its current transmission systems, which are in operation at 230 kV, 345 kV and 500 kV.

Series compensation has long been the preferred solution for optimizing performance in very large bulk transmission corridors. Installing a capacitive reactance in series in a long (typically more than 200 km) transmission line reduces both the angular deviation and the voltage drop, which increases the load capacity and electrical stability of the line. Since the current through the transmission line directly "drives" the MVAr output from the capacitor, the compensation concept is "self-regulating” in voltage. This straightforward principle ensures that series compensation is an extremely cost effective solution under a wide range of line electrical loading conditions.

Series compensation provides increased transient (angular) stability of a power corridor and increased voltage stability of the grid. It also improves the voltage profile along the power corridor and optimizes power sharing between parallel circuits. If requested, the Applicant would call upon MAT’s experience in working with series compensation to assist Hydro One.

Static VAr compensator ("SVC")

An SVC is an innovative, flexible alternating current ("**AC**") transmission system device that can provide instantaneous voltage support by absorbing or providing reactive power based on voltages. An SVC can improve power system transmission and distribution performance in a number of ways. An SVC increases transfer capacity and reduces losses while maintaining a smooth voltage profile under different network conditions. The dynamic stability of the grid can also be improved, and active power oscillations can be damped and mitigated. MAT extensively employs SVCs at 345 kV and 500 kV on its transmission systems in operation today.

The benefits of SVC to power transmission include the following:

- stabilized voltages in weak systems;
- reduced transmission losses;
- increased transmission capacity, to reduce, defer the need for new lines;
- higher transient stability limit;
- increased damping of minor disturbances;
- greater voltage control and stability; and
- power oscillation damping.

Boosting Transmission Capacity

The SVC will help to ensure that the system voltage does not sag, even when the power flow is heavy. This means that more power can be transmitted through the system under stable conditions over existing lines. If requested, the Applicant would call upon MAT's experience in working with the SVCs to assist Hydro One.

TAB G-7-1

Applicant's Plan for Addressing Project's Challenges

The Project will likely confront challenges because of the remote location, local weather conditions, and the land's natural features, composition and extreme elevation shifts. The Applicant has completed more than 50 man-days in the field inspecting, gathering data and assessing the Reference Route and the Preliminary Preferred Route. In addition, the Applicant has made extensive use of aerial fly-over video media provided by Hydro One to assess Project challenges. The Applicant's design confronts and resolves those challenges as follows.

Transmission Line Solutions

Remote Location

Although the Project covers land in remote locations, with difficult access to many sections of the line, the Project must reach all parts of the sited lands in order to install the foundation, build structures, install the wires, remove and control vegetation and maintain the lines and structures afterwards. To ensure ready and continuous access, the Applicant plans to utilize existing access roads. where feasible. and will also create and maintain new access roads, either on or near the transmission line's right-of-way, as necessary. The Applicant recognizes that even with the new access roads, some areas may still require the use of a helicopter, barge, or tracked or small off-road vehicles for access. The Applicant plans to tailor its construction, delivery and staging of materials to specific staging locations along the line, based on the available level of access. It also plans to schedule work during seasons when access is optimal.

Maps showing locations for the delivery and staging of materials are included in Exhibit H-6-4. A map that shows the road classification for both the Reference Route and the Preliminary Preferred Route is included at Exhibit H-6-3.

Natural Terrain

Northern Ontario's many lakes, rivers, and cliffs will make continuous line construction challenging. The Applicant's design resolves these challenges by erecting long-span structures – including structure islands if needed – and installing much of the "sock lines" necessary for pulling in conductors by helicopter. Where practical, helicopter support will also be used for foundation and tower installation. Extreme undulations in the land's elevation pose another challenge, one that requires proper structures to be located in the proper spot to avoid problems. The Applicant's plan calls for speciality structures able to bear significant vertical load and similar hold-down structures in valleys and other low lands to overcome this challenge. The Applicant will also design structure heights to minimize the effects of changing elevation, to the extent possible, while complying with all wire clearance requirements. To achieve proper wire sags and tensions and clearances above obstacles, the Applicant intends to strictly follow best practices for conductor stringing. In addition, the Applicant intends to use offset clipping throughout the inclined terrain in order to obtain proper sag-tension and keep insulators plumb.

The dense vegetation, trees, and bushes covering much of the land will be cleared from the Project's right-of-way to allow the line to be constructed and operated. The Applicant plans to cut near the ground line and use or remove deadfall to ease mobility, and will clear the right-of-way to bare ground to build the access road. Following construction, vegetation will be continually monitored and cleared to maintain access and proper line clearance. Long stretches of steep terrain along the line route will require adjustments to the Applicant's usual conductor stringing plan that uses wire pulls approximately 5 km long and assumes two conductor reel lengths are pulled at a time (called "double sock"). If areas that require "triple sock" pulls between accessible pulling locations are encountered (i.e., where three reels of wire are pulled at one time), the Applicant will evaluate the process and apply it only if required by limited access.

Weather and Forces of Nature

The Applicant's primary consideration in constructing transmission lines is protection from lightning strikes. To ensure quality line performance when lightning strikes, the Applicant's structure grounding plan intends to reach a maximum ground resistance of 20 ohms wherever possible. Because the high resistive soil in the area makes meeting this structure ground resistance level extremely difficult, the Applicant plans to use multiple spar grounding at each structure, with up to ten spars on H-frame structures and twelve on lattice structures. Structures not reaching 20 ohms will be analyzed with further measures (such as counterpoise) added to achieve the best possible grounding level. To prevent theft, every grounding lead from the structure will be copper weld.

In addition to lightning, extreme weather is anticipated during parts of the Project. The Applicant's plan stages construction to match appropriate work to expected conditions. For example, muskeg must be avoided when soft and wet; accordingly, these areas will be scheduled for winter work when that land is flatter and more easily traversed. Steep and rocky terrain that is easy to access in warm weather, will be scheduled for milder months. Multiple phases of timber harvest have occurred along portions of the proposed routes but significant fuel remains. Heavily forested and remote locations create a real risk of fast-spreading forest fires. The Applicant's plan includes precautions to prevent fires from starting. The Applicant commits to maintaining, at each active construction site, fire boxes equipped with fire extinguishing tools and supplies.

Foundation Design Solutions

A project of this nature can expect to face numerous challenges in constructing foundations for the structures. The Applicant's plan accounts for these in several ways, not the least of which is by choosing foundations from an array of foundation types, including: concrete pier, pad and pedestal, rock anchor, helical pier, grillage, and direct embeds. Through comprehensive geotechnical exploration and testing, soil will be characterized and a model for applying the discovered soil and rock design-strength parameters will be formulated. Based on the soil conditions and load demand, the Applicant will choose the optimal type and design for the foundations. The Applicant's access plan and construction personnel will identify any constraints on available materials, delivery, and equipment requirements and, if any are constrained, will select a foundation permitting limited excavation and concrete. Design assumptions made during excavation will be verified by a qualified Geotechnical Engineer, authorized to alter the design as appropriate for any unanticipated conditions.

Construction Design Solutions

The safety of the Applicant's crew is a primary concern. Since cold weather provides the best access to muskeg and other wetlands, the Applicant contemplates substantial construction during winter months when frozen lands are easily traversed and ground disturbance is limited. However, snow, wind, and heavy rain require augmented safety measures and the Applicant plans to implement procedures and supply appropriate equipment to ensure that all work is performed in a safe manner. At a minimum, crews will be outfitted with harsh weather gear and equipment and will perform construction within specified limits.

If temperatures fall too low, hydraulic equipment can shut down and bring most construction activities to a halt. Although temperatures in Ontario rarely fall below crew and equipment thresholds, Ontario has experienced below -30°C weather and the Applicant's construction schedule allows for shut downs accordingly.

Similarly, heavy snowfalls can impede construction. To address this, equipment will be staged during winter months to remove snow from access roads and work areas in order that construction can continue. To keep from disturbing the soil, however, snow plows and graders will be kept at least two inches above the ground. Cleared snow will be pushed to and stored in permitted areas and best efforts will be made to keep melting snow from flooding or eroding the land. Along with snow, high winds are inevitable in northern Ontario. Strong winds can not only inhibit crane and helicopter operation, but also prevent work crews from climbing. The Applicant will monitor wind speeds closely and the Applicant's plan allows for times when work will be shut down because wind safety thresholds are exceeded.

In warm weather, the Applicant anticipates the need for wooden mats (where permitted) to allow access to soft or wetland areas and limit ground disturbance. To preserve the root ball of vegetation and ensure re-establishment, any mats used would be placed directly on vegetation and removed as soon as construction ends.

Access Solutions

Construction across Lake Superior's northern section will require very careful planning for both staging materials and construction. The Applicant has developed two approaches to ensure access to the project.

Conventional Ground-Based Construction

The Applicant expects to use existing public and private roads to access the transmission line right-of-way. Based on existing construction trails (two track roads), line patrol video and field reconnaissance, the Applicant believes that most of the route is accessible to conventional construction vehicles equipped with rubber tires or tracks. Existing roads will be upgraded, if necessary, to make them passable and construction trails will be graded using tracked excavators. From the existing construction road, new stub roads will provide access to the proposed transmission line. Where the transmission centerline deviates from the existing line, new roads will be built along the right-of-way and between structures; where natural terrain or highway construction creates obstacles along the right-of-way, access in and out of these areas will be one-way, if possible. The Applicant also plans to take full advantage of frozen ground conditions during colder months to access areas of soft soils or muskeg, but in warm weather, will use wooden mats to allow access and distribute the weight of construction vehicles.

Non-Conventional Access

Recognizing that conventional ground-based construction may not be possible along every section of the line, particularly in the Terrance Bay to Marathon section, the Applicant anticipates using helicopters to deliver crews, equipment and materials to otherwise inaccessible locations, for the purpose of building the foundation and structures. In turn, the design and construction of the foundation and structures, themselves, will take into account the use of helicopters. For instance, structures will be framed at nearby fly yards and delivered to the site in assemblies, within the lift capacity of the helicopters, and crews on site will use jigs to help assemble the structures. The Applicant also plans to use helicopters to fly sock line between pulling and tensioning yards, where conventional stringing equipment and conductor reels will be staged and deployed.

In addition to using helicopters where the terrain or limitations on construction restrict ground access, the Applicant may use barges to deliver construction equipment to areas surrounding lakes. For example, barges might be used between the railway crossing at McKellar Harbor and equipment barged from Neys Bay.

TAB G-8-1

Local Benefits

The economic benefits of the Project will be extensive. At all stages of the Project's life cycle – planning, development, construction, operation and maintenance – numerous stakeholders, from local residents and businesses to the Province of Ontario, will share in the significant and varied benefits that the Project will generate.

A project as significant as the EWTL will first and foremost provide local and regional businesses with the direct benefit of participation in the Project through the provision of goods and services. As part of its contracting policy, the Applicant intends, wherever possible, to give preference to qualified Ontario-based or Canadian businesses with significant local experience, through a competitive bidding process.

Contractors, suppliers, advisors and other goods and service providers will be needed at all phases of the Project. During the development stage, the Applicant expects to spend at least 80 percent of its development budget in the local region or the province, representing an investment of $16 million in the Ontario economy. To date, the Applicant has spent nearly $1.5 million on its designation application and other development activities, most of which has been for the services of Ontario-based providers, including professional advisors and local contractors.

During the construction phase alone, the Applicant estimates that approximately $330 million will be spent on the purchase of materials and supplies, contracting and consulting services and other expenditures necessary for construction, representing approximately 98 percent of all construction costs. More than $70 million of this amount is expected to be spent locally and directly for services and construction contracts in the region of northwestern Ontario. To the extent that major equipment and supplies can be sourced locally, that figure – and the benefit to local businesses – would increase. After the Project is placed in service, it will continue to require goods and services, thereby providing a long-term and direct economic benefit to local and Ontario providers.

Another significant and direct economic benefit of the Project will be the employment and sub-contracting opportunities it generates, particularly in the immediate vicinity of the Project. Over the course of the Project's 24-month construction period, the Applicant estimates that an average of 158 workers will be employed with an estimated 221 workers employed during peak periods. Some of the specialized contractors and other labourers, for instance, are expected to come from the Sault Ste. Marie area, as well as from western Ontario near Dryden and Kenora. To maximize equal opportunity for local sub-contractors, opportunities for sub-contracting would be posted on the Project website with advertisements in local communities, such as in newspapers or by posting on community billboards.

In addition to providing individuals and businesses with an opportunity to participate directly in the Project at its various stages, the Project also represents a source of revenue for local businesses, municipalities and Ontario. For instance, lodging and housing, particularly during the development and construction phases, will be necessary, and local restaurants and food industry businesses will have opportunities for additional revenue. Municipalities will benefit from the Project's investment in local and regional businesses and the tax revenue it generates, and the province will benefit directly from private land payments and revenue for the use of Crown land, as well as from the payment of provincial taxes. At over 400 km in length, the EWTL will have a long reach across Northwestern Ontario, providing benefits to the many important communities along its route, such as Thunder Bay, Shunia, Dorion, Red Rock, Nipigon, Terrace Bay, Marathon, White River and Wawa.

One particular benefit of the Project will be that provided to First Nation and Métis communities through contracting services, employment and opportunities for capacity building. The selection of contractors, advisors and other service providers will, in most cases, be made through a competitive bidding process, and consistent with its commitment to First Nation and Métis participation and accommodation, the Applicant intends to give preference whenever possible and appropriate to qualified and competitive First Nation and Métis service providers.

Finally, certain parties, in particular, may benefit from the Project. Hydro One, for instance, may be considered for certain operating and maintenance responsibilities for the Project. Since technical and engineering consultants will be necessary for the Project, parties listed by the IESO as “Connection Assessment Support Consultants” (see Exhibit F-4-2) – who in many cases are qualified and certified for engineering and design purposes beyond IESO-approved connection assessments – may also be considered.

TAB H-1-1

Overview – Preferred Design

As described in Exhibit G-1-1, the Preferred Design comprises a single-circuit 230-kV line between Wawa TS and Lakehead TS, divided into Segment #1 (between Wawa TS and Marathon TS) and Segment #2 (between Marathon TS and Lakehead TS). The Preferred Design meets or exceeds all transfer capacity, reliability and system performance requirements specified in the OEB's Minimum Technical Requirements and Minimum Design Criteria as well as the reliability standards of the IESO, NERC and NPCC. Details of how the Preferred Design meets all of the requirements of the OEB, IESO, NERC and NPCC are included in Exhibit H-2-1. An affidavit of a RES Transmission officer attesting that the Preferred Design meets these requirements is included in Exhibit H-3-1.

The Preferred Design comprises the following six components:

(i) conductors;

(ii) transformer substation upgrades;

(iii) transformer station interconnections;

(iv) tower and foundation design;

(v) access road design; and

(vi) phased-in construction.

Each of these six components is described, in detail, below.

Conductors

The Preferred Design will comprise approximately 1,200 kms of single-circuit line with a single 1557 ACSS trapezoidal conductor (i.e., 400 km X 3 wires). Details of the 1557 ACSS trapezoidal conductor ratings are included at Exhibit H-4-1. A schematic diagram showing the interconnection of the new line at each of the Wawa TS, Marathon TS and Lakehead TS, is included at Exhibit H-4-2.

Transformer Station Upgrades

To meet the required 650 MW transfer capacity, equipment upgrades would be required at both Marathon TS and at Lakehead TS as part of the Preferred Design.

At Marathon TS, the following five components need to be added to achieve the required 650 MW transfer capacity and meet other system performance requirements:

(i) one +250/-100 MVAr Static VAr Compensator;

(ii) three 40 MVAr shunt reactors rated at 230-kV;

(iii) approximately 100 MVAr shunt capacitor bank rated at 230-kV;

(iv) a series capacitor bank of approximately 36 ohms to provide compensation of 40 percent of the line impedance for Segment #1 (Wawa TS to Marathon TS); and

(v) a series capacitor bank of approximately 62 ohms to provide compensation of 50 percent of the line impedance for Segment #2 (Marathon TS to Lakehead TS).

A detailed study to establish the precise design and protection specifications of the series capacitors described in items 4 and 5 above would be conducted at a later stage.

At Lakehead TS, approximately 100 MVAr shunt capacitor bank rated at 230 kV would be added to meet system performance requirements and achieve the 650 MW transfer capacity across the EWTL.

The Applicant understands that the transformer station upgrades described above would be constructed by Hydro One.[1]

Transformer Station Interconnections

Wawa TS: The schematic of the Wawa transformer station is included in Exhibit H-4-3. The existing station layout has a common mode outage that results in the loss of a line and transformer for fault on the existing line or the transformer.

Configuration 1 describes terminating the new line with three breakers to eliminate the common mode outage condition. Configuration 2 describes terminating the new line with one breaker without eliminating the common mode outage. Configuration 1 has been included in RES Transmission’s proposal.

Marathon TS: The schematic of the Marathon transformer station is included in Exhibit H-4-4. The existing station layout has a common mode outage that results in the loss of a line and transformer for a fault on the existing line or the transformer.

Configuration 1 describes terminating the new line with four breakers to eliminate the common mode outage condition. Configuration 2 describes terminating the new line with two breakers without eliminating the common mode outage condition. Configuration 1 has been included in RES Transmission’s proposal.

Lakehead TS: The schematic of the Lakehead transformer station is included in Exhibit H-4-5. The proposed station layout describes terminating the new line with one breaker. This configuration has been included in RES Transmission’s proposal.

It is RES Transmission’s understanding that the choice of the number of breakers and manner in which the line is terminated will be determined by the OEB and Hydro One. The line termination information provided above at each of the interconnecting station is for informational purposes only. It is also the Applicant’s understanding that the all

[1] Ontario Energy Board, “Transmission Infrastructure: East-West Line: Project Scope (EB-2011-0140)”, January 10, 2012 at p. 4.

substation design and construction work, including all system protection and controls, would be conducted by Hydro One.

Tower and Foundation Design

The Preferred Design would use both single-circuit H-frame structures and single-circuit lattice structures along the length of the line, as necessary, to optimize the design and construction in local conditions. Details of the spacing of the two types of towers on the Reference Route and the Preliminary Preferred Route are provided in Table H-1 below.

Table H-1: Tower Spacing

Tower Type	Spacing between Towers	ROW on Reference Route	ROW where Preliminary Preferred Route Differs	Number of Towers on Reference Route	Number of Towers on Preliminary Preferred Route
H-frame Tangent	335 m	53 m	46 m	1200	1230
Lattice Tower Horizontal Tangent	410 m	46 m	46 m	1000	1020

The single-circuit H-frame towers will be constructed using tubular steel poles (“**TSP**”) and either dulled galvanized or weathering steel finish. The single-circuit lattice structures will have steel components with a dulled galvanized steel finish. The choice of tower structure under the Preferred Design (H-frame vs. lattice) will depend on the suitability of each tower to particular line crossings, the ease of constructing foundations in local conditions, the types of foundations that are required at each site and the availability of local materials.

Along both the Preliminary Preferred Route and the Reference Route, 60 percent of structure locations have bedrock at or near the ground surface; 25 percent of structure locations have glacial till and 15 percent of structure locations have muskeg, soft or organic soil. Groundwater is estimated to be present at the ground surface in approximately 20 percent of structure locations. This will be confirmed during the detailed line and foundation design phases. Given the subsurface conditions, foundation construction is expected to be difficult for three reasons: excavation; access for equipment and access for concrete delivery vehicles.

The use of TSP single-circuit H-frame structure is a superior alternative for foundation construction. Single-circuit H-frame structures require only two foundations, as opposed to four foundations for lattice structures, and would be used where ever practical to reduce construction and material costs. However, since the span of the single-circuit H-frame structures is only 335 m, compared to 410 m for the lattice structure, approximately 200 additional single-circuit H-frame structures would be required for both Segment #1 and Segment #2 together. Design assumptions for subsurface conditions and subsurface properties are included at Exhibit H-5-1. Tower design assumptions and strength specifications are provided at Exhibit H-5-2. A schematic of the single-line H-frame towers to be used in the Preferred Design are included at Exhibit H-5-3. A schematic of the single-line lattice towers to be used in the Preferred Design are included at Exhibit H-5-4.

Access Road Design

In order to determine the necessary access roads for the Reference Route and the Preliminary Preferred Route, the Applicant reviewed aerial flyover access video provided by Hydro One; existing maps; and mining claims pertaining to the lands in question; and also prepared a detailed roads inventory report and conducted on-the-ground field observations. Specifically, the Applicant reviewed the Reference Route and the Preliminary Preferred Route in six sections:

(i) Thunder Bay to Nipigon River;

(ii) Nipigon River to Terrace Bay;

(iii) Terrace Bay to Marathon;

(iv) Marathon to Magpie River (Preliminary Preferred Route);

(v) Marathon to Magpie River (Reference Route); and

(vi) Magpie River to Wawa TS.

Design assumptions for the construction of access roads for the Preferred Design are included at Exhibit H-6-1. An inventory report classifying and detailing the condition of the roads in one to ten km segments in included at Exhibit H-6-2. A map that shows the road classification for both the Reference Route and the Preliminary Preferred Route is included at Exhibit H-6-3. Maps showing locations for the delivery and staging of materials are included at Exhibit H-6-4.

Staging of Capacity Additions[2]

The Reference Design requires that all facilities be constructed in the same time frame, making the full 650 MW transfer capacity available as soon as the EWTL is placed into service. Under the Preferred Design, the full transfer capacity (684 MW) could be installed at once or, alternatively, in stages, as system requirements materialize. The electricity demand scenarios that are included in the OPA's 2011 long-term electricity outlook for the Northwest indicate that the full 650 MW of transfer capacity that is stipulated in the OEB's definition of the EWTL, is unlikely to be required by the initial EWTL in-service date. It is far more likely that the need for this transfer capacity will develop over time. In these circumstances, it makes economic sense to construct only those facilities that will be required in the foreseeable future and defer the construction –

[2] The discussion of Staging of Capacity Addition is identical to that in Exhibit G-1-1.

and cost – of additional capacity to future periods. Table H-2, below, describes the staged approach that is possible under the Preferred Design.

Table H-2: Staged Capacity Additions

Stage	Facilities Added	Total Installed Transfer Capacity (MW)	Incremental Transfer Capacity Added (MW)
1	transmission line constructed from Wawa TS to Lakehead TS with an interconnection at Marathon TS	387	
2	series compensation added between Wawa TS and Marathon TS	436	49
3	series compensation added between Marathon TS and Lakehead TD	484	48
4	shunt capacitors added at Lakehead TS and Marathon TS, static VAr compensator added at Marathon TS (without series compensation between Marathon TS and Lakehead TS as described in Stage 3)	614	130
5	stage 4 plus series compensation added between Marathon TS and Lakehead TS	684	70

The completion of Stage 1 would increase the total transfer capacity of the existing transmission corridor to 387 MW and improve system reliability, facilitating more efficient and cost-effective dispatch of existing generation resources. The completion of stages 2 through 5 involve the construction of transformer station and other upgrades as described above. The stages could be constructed by Hydro One if and when system demand materializes. Each stage would take approximately two years to construct and more than one stage could be constructed in the same time frame, if necessary. A diagram showing the upgrades that would be added at each stage is included at Exhibit G-4-1.

Adding transfer capacity in stages and only if and when required by system demand, as proposed in the Preferred Design, would defer or avoid altogether, the expenditure of the significant capital costs of stages 2 through 5. This would translate into substantial savings for Ontario ratepayers. A graph that compares the OPA's estimate of the cost of constructing the Reference Design with the Applicant's estimate of the cost of constructing its Preferred Design is included in Exhibit G-5-1.

TAB H-2-1

Compliance with Specified Requirements

As described in the technical specifications provided in this Exhibit, the Applicant's Preferred Design for the EWTL will meet or exceed all of the design and construction requirements of the OEB and the IESO.

OEB Requirements

The Preferred Design meets each of following OEB requirements:

(i) Minimum Technical Requirements for the Reference Option of the E-W Tie Line, November 9, 2011;

(ii) Appendix A, Minimum Design Criteria for the Reference Option of the E-W Tie Line (230kV) Wawa to Thunder Bay Transmission Line), November 9, 2011;

(iii) Phase 1 Decision and Order Filing Requirements for East-West Tie Designation Applications, July 12, 2012 (the "**Filing Requirements**"), Section 6 of the Filing Requirements.

For items # 1 and 2 above, a full list of the relevant codes, standards, regulations and procedures that will be followed by the Applicant in the design and construction of the Preferred Design for the EWTL is included at Exhibit H-2-2.

For item #3 above, table H-3 below confirms how each of the requirements of s. 6.1 of Filing Requirements will be met.

Table H-3: Filing Requirements

Description of Requirement	**Preferred Design**
Length of the transmission line	Reference Route: 401.5 km Preliminary Preferred Route: 409.2 km
Number of circuits	1
Voltage class	230 kV
Load carrying capacity – summer continuous rating at 93°C conductor temperature and 30°C ambient temperature	1545 amperes Approximately 642 MVA at 240 kV
Load carrying capacity – summer emergency rating at 127°C conductor temperature and 30°C ambient temperature	1891 amperes Approximately 768 MVA at 240 kV
Resulting total transfer capacity of the EWTL	684 MW
Anticipated lifetime of the line	50 years for the transmission line 30 years for the transformer station equipment

Description of Requirement	**Preferred Design**
Number and average spacing of towers	Approximately 1,200 single-circuit H-frame towers spaced 335 m apart for the Reference Route (approximately 1,230 towers for the Preliminary Preferred Route) Approximately 1,000 single-circuit lattice towers spaced 410 m apart for the Reference Route (approximately 1,020 towers for the Preliminary Preferred Route)
Tower structure type and composition	Single-circuit steel lattice towers with dulled galvanized steel finish Single-circuit H-frame towers made with TSP and either dulled galvanized or weathering steel finish
Conductor size and type	1557 ACSS trapezoidal wire conductor

Description of Requirement	Preferred Design
Protection against cascading failure and conductor galloping	**Cascading Tower Failures** will be protected against through a robust line design. The Applicant intends to install full deadend structures at no more than twelve mile increments with a strain type structure or another full deadend about halfway between these. This is a significant improvement over the cascading design of the existing line where there may be no deadend for easily twice the distance the Applicant intends to maintain. **Conductor galloping** is an infrequent occurrence and is a function of steady wind on wire that typically has an asymmetric coating of ice creating a partial airfoil or wing. The amplitude of any galloping that may occur is a function of the wire size, its tension and the span length. We protect against damage and flashover by limiting the span lengths, and by increasing the dimensional spacing between phases. The H-frame structures will be wider than the lattice steel due to the lattice tower's delta phasing, and will have shorter span lengths to keep galloping ellipses small enough to avoid conflict.

Description of Requirement	Preferred Design
Design assumptions	Design assumptions for subsurface conditions and subsurface properties are included at Exhibit H-5-1 Design assumptions for the two different types of towers are included at Exhibit H-5-2 Design and alignment assumptions for the construction of access roads are included at Exhibit H-6-1
Interconnection with existing transformer station	Confirmed
Line switched at Marathon TS	Confirmed

IESO Requirements

The Preferred Design also meets each of the following IESO requirements:

(i) NERC Criteria;

(ii) NPCC Directory No. 1; and

(iii) Ontario Resource and Transmission Assessment Criteria.

The three IESO requirements listed above are the same requirements used by the IESO in conducting their feasibility study for the Preferred Design. The IESO's Feasibility Study for the Preferred Design that confirms, in detail, the total transfer capacity of the Preferred Design is included at Exhibit H-2-3.

The Preferred Design meets all NERC TPL Standards related to Transmission System Planning Performance requirements as well as the NPCC Directory No. 1 requirements for both Transmission Design Criteria and Stability Assessment.

The portion of the bulk power system in each Planning Coordinator Area and in each Transmission Planning Area shall be designed with sufficient transmission capability to serve forecasted demand under the conditions noted in ss. 5.4.1 and 5.4.2. These criteria will also apply after any critical generator, transmission circuit, transformer, series or shunt compensating device or high voltage direct current ("**HVdc**") pole has already been lost, assuming that the Planning Coordinator Area generation and power flows are adjusted between outages by the use of the ten-minute 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. For each of the contingencies stated below that involves a fault, stability shall be maintained when the simulation is based on fault clearing initiated by the "system A" protection group, and also shall be maintained when the simulation is based on fault clearing initiated by the "system B" protection group.

(i) A permanent three-phase fault on any generator, transmission circuit, transformer or bus section, with normal fault clearing.

(ii) Simultaneous permanent phase to ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit tower, with normal fault clearing.

The Preferred Design meets the Ontario Resource and Transmission Assessment 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.

A signed affidavit from an officer of the licenced transmitter RES Transmission, that the Preferred Design meets all of the above OEB and IESO technical requirements is included at Exhibit H-3-1.

TAB H-2-2

Table of Applicable Codes, Standards, Regulations and Procedures

CSA C22.3 No. 1, “Overhead Systems”
CSA C22.3 No. 3, “Electrical Coordination”
CSA C22.3 No. 6, “Principles and Practices of Electrical Coordination Between Pipelines and Electric Supply Lines”
CSA C22.3 No. 60286, “Design Criteria of Overhead Transmission Lines”
CSA O15-90, “Wood Utility Poles and Reinforcing Stubs”
CSA O80 SERIES-08 – “Wood Preservation”
CSA C108.3.1, “Limits and Measurement Methods of Electromagnetic Noise from AC Power Systems, 0.15-30 MHz”
CAN/CSA-C411.1-10 – “AC Suspension Insulators”
CSA C411.4-10, “Composite Suspension Insulators for Overhead Lines > 75 kV”
CSA C57-98 (R2006), “Electric Power Connectors for Use in Overhead Line Conductors”
CSA C83-96 (R2005), “Communication and Power Line Hardware”
CAN/CSA-C61089:03, “Round Wire Concentric Lay Overhead Electrical Stranded Conductors”
CAN/CSA-C60888:03, “Zinc-coated Steel Wires for Stranded Conductors”
CAN/CSA-C60889:03, “Hard Drawn Aluminum Wire for Overhead Line Conductors”
CSA G12, “Zinc-Coated Steel Wire Strand”
CSA-C49.2-10, “Compact Round Aluminum Conductors Steel Reinforced (ACSR)”
CSA-G164, “Hot Dip Galvanizing of Irregularly Shaped Articles”
G40.20-04/G40.21-04 (R2009) – “General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel”

ASME-BPVC-SEC 2C-2010 - Section 2 - Materials - Part C – “Specifications for Welding Rods, Electrodes, and Filler Metals”
ASCE 10-97, “ Design of Latticed Steel Transmission Structures”
ASCE 48-05, “Design of Steel Transmission Pole Structures”
ASCE 74, “Guidelines for Electrical Transmission Line Structural Loading”
ASTM A394, “Standard Specification for Steel Transmission Tower Bolts, Zinc-Coated and Bare”
ASTM A572, “Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel”
IEEE 751, “Trial Use Design Guide for Wood Transmission Structures”
IEC 61897, “Requirements and Tests for Stockbridge Type Aeolian Vibration Dampers”

TAB H-2-3

IESO Feasibility Study

CONFIDENTIAL **REP-2**

Feasibility Study

An assessment of the westward transfer capability of various proposals to reinforce the East-West Tie

1.0

RES Canada Transmission LP

A study to determine the effect of certain proposals on the westward transfer capability of the East-West Tie

CAA ID No 2012-469 *FINAL VERSION* *29th December 2012*

RES CANADA TRANSMISSION LP: FEASIBILITY STUDY

i. PURPOSE

To assess the westward transfer capability of the East-West Tie with the following reinforcement proposals:

- *Option 2A - with new single circuit 230 kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS*
- *Option 2B - Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus 50% series compensation on the new circuit between Marathon TS and Lakehead TS.*
- *Option 2C - Option 2A plus 40% series compensation between Wawa TS and Marathon TS on the new circuit.*
- *Option 2E - Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus a 100 Mvar capacitor at both Lakehead TS and Marathon TS plus a +250/-100 Mvar SVC at Marathon TS*
- *Option 2F - Option 2E plus 50% series compensation from Marathon TS to Lakehead TS*

ii. EXECUTIVE SUMMARY

East-West Tie Transfer West is the westward flow of active power on the 230 kV transmission system, measured at Wawa TS.

The OPA, in their report on the Long-Term Electricity Outlook for the North-West, "finds that the expansion of the E-W Tie is the preferred alternative based on economic, flexibility, technical, operational and other considerations" to accommodate future load growth in the North-West region of Ontario.

"The OPA has assumed that the proposed expanded East-West Tie would be a new double-circuit 230kV overhead transmission line. The new line is to connect both Wawa TS and Lakehead TS....and is to be switched at Marathon TS."

"The new line, in conjunction with the existing tie, is to provide total eastbound and westbound capabilities of the order of **650MW**, while respecting all NERC, NPCC and IESO reliability standards."

An interim maximum transfer requirement across the East-West Tie of approximately **400MW** during the initial period of operation following its reinforcement has been identified in the IESO Reference Study of Various Options for Reinforcing the East-West Tie.

Assessments were performed on a series of proposals that could be staged to reach an ultimate transfer capability of **650MW.** For this assessment of the transfer capability of the *RES Canada Transmission LP* proposals, the same criteria were used as those defined in the *IESO Reference Study*.

All anticipated NERC, NPCC and IESO reliability criteria would be satisfied at the East-West Tie transfers levels reported for each option.

As in the *IESO Reference Study*, it has been assumed that any material adverse effects from breaker failure contingencies would be eliminated by good station design. Station layouts that would avoid material adverse effects from breaker failure contingencies have been included in this assessment.

iii. Transfer Capability of the RES Canada Proposals

The present maximum westward transfer capability across the East-Ties respecting anticipated NERC, NPCC and IESO reliability criteria is **175 MW**.

With automatic post-contingency switching of the tertiary-connected reactors at Marathon TS, the maximum transfers that could be achieved across the East-West Tie while satisfying the reliability criteria would be as follows, for each of the proposals:

- *Option 2A - new single circuit 230 kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS*

  The maximum westward transfer capability that could be achieved across the East-West Tie would be **387MW**.

- *Option 2B - Option 2A* **plus** *40% series compensation from Wawa TS to Marathon TS* **plus** *50% series compensation on the new circuit between Marathon TS and Lakehead TS*

  The maximum westward transfer capability that could be achieved across the East-West Tie would be **484MW**.

- *Option 2C - Option 2A* **plus** *40% series compensation between Wawa TS and Marathon TS on the new circuit*

  The maximum westward transfer capability that could be achieved across the East-West Tie would be **436MW**.

- *Option 2E - Option 2A* **plus** *40% series compensation from Wawa TS to Marathon TS* **plus** *100 Mvar capacitor at both Lakehead TS and Marathon TS* **plus** *+250/-100 Mvar SVC at Marathon TS*

  The maximum westward transfer capability that could be achieved across the East-West Tie would be **614MW**.

- *Option 2F - Option 2E* **plus** *50% series compensation from Marathon TS to Lakehead TS*

  The maximum westward transfer capability that could be achieved across the East-West Tie would be **684MW**.

Only Option 2F would meet the required transfer capability of **650MW**. Since all of the other proposals are sub-sets of the enhancements identified for *Option 2F,* they could therefore be implemented as stages of a program to reach the required westward transfer capability of the East-West Tie of **650MW**.

All of the other proposals (i.e. *Option 2A*, *Option 2B*, *Option 2C* & *Option 2E*) would provide an interim increase in the East-West Tie transfer capability ranging from approximately **400 MW** to **614MW**. Implementing any of these proposals would alleviate the bottle neck presented by the existing East-West Tie until other transmission enhancements to expand the transfer capability are placed in-service.

For *Option 2E* there would also be a requirement to increase the limited-time rating of some of the 115kV circuits to a slightly higher level than was identified in the *IESO Reference Study* for the single-circuit alternatives.

FEASIBILITY STUDY:

To assess the westward transfer capability of the East-West Tie for the following proposals between Wawa TS & Lakehead TS:

- *Option 2A - with new single circuit 230 kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS*
- *Option 2B - Option 2A plus 40% series compensation on the new circuit from Wawa TS to Marathon TS plus 50% series compensation on the new circuit between Marathon TS and Lakehead TS*
- *Option 2C - Option 2A plus 40% series compensation on the new circuit between Wawa TS and Marathon TS*
- *Option 2E - Option 2A plus 40% series compensation on the new circuit from Wawa TS to Marathon TS plus 100 Mvar capacitor at both Lakehead TS and Marathon TS plus +250/-100 Mvar SVC at Marathon TS*
- *Option 2F - Option 2E plus 50% series compensation from Marathon TS to Lakehead TS*

STUDY REPORT

FEASIBILITY STUDY FOR RES CANADA TRANSMISSION LP

STUDY REPORT

This report summarises the results of the analysis performed to determine the westward transfer capability of the East-West Tie following its reinforcement between Wawa TS and Lakehead TS with the following proposals:

- *Option 2A - with new single circuit 230 kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS*
- *Option 2B - Option 2A plus 40% series compensation on the new circuit from Wawa TS to Marathon TS plus 50% series compensation on the new circuit between Marathon TS and Lakehead TS*
- *Option 2C - Option 2A plus 40% series compensation on the new circuit between Wawa TS and Marathon TS*
- *Option 2E - Option 2A plus 40% series compensation on the new circuit from Wawa TS to Marathon TS plus 100 Mvar capacitor at both Lakehead TS and Marathon TS plus +250/-100 Mvar SVC at Marathon TS*
- *Option 2F - Option 2E plus 50% series compensation from Marathon TS to Lakehead TS*

1. New 230kV Circuits

The following positive sequence circuit parameters were used in the assessments. These parameters are consistent with 1557 kcmil ACSS/TW conductors in a horizontal arrangement with the outer conductors 7.92m (26 feet) from the central conductor. Other conductor arrangements that yield comparable electrical performance would also be acceptable.

New Circuit Positive Sequence Parameters	*On a 220 kV, 100 MVA base*			
Line Section	km	R1(pu)	X1 (pu)	B1 (pu)
Wawa x Marathon	168.3	0.014523	0.17148	0.275369
Marathon x Lakehead	229.4	0.019518	0.232046	0.376419

The anticipated thermal ratings for the conductors of the new circuits are listed below. It should be noted that some vendors quote a very high continuous operating temperature (250^{o}C) for this ACSS/TW conductor. Ratings at the 93^{o}C/127^{o}C temperatures were used to enable a fair comparison with the minimum technical requirements identified in OEB's Line Minimum Design Criteria. This conductor will meet the IESO ampacity requirements to achieve a 650MW westward transfer capability on the East-West Tie.

Thermal Ratings for the new circuits				
For an ambient condition of 25°C & at a wind speed of 2ft/s	Continuous at 93^{o}C		Long-term Emergency at 127^{o}C	
		At 240kV		At 240kV
Proposed 1557 kcmil 36/7 conductors	1545A	642MVA	1891A	786MVA

For the section of the East-West Tie between Wawa TS and Marathon TS, the loss of the existing double-circuit line would leave only the new line to carry the East-West transfer. While most of the pre-contingency transfer would appear on the new single-circuit line, a limited amount would remain on the Manitoba & Minnesota Interconnections following tap-changer action of the phase-shifters on these Interconnections.

2. New 230kV Capacitors at Marathon TS and Lakehead TS

In each assessment shunt capacitors have been assumed at Marathon TS and Lakehead TS that would produce about 125Mvar at 246kV (i.e. 100 Mvar at 220kV).

3. New Static Var Compensators

For those Options that included an SVC at Marathon TS, the SVC was assumed to be continuously adjustable throughout the range +250Mvar (capacitive) to -100Mvar (inductive), with the reactive power measured at the Marathon 230kV bus. The SVC was modelled as controlling the 230 kV busbar voltage, with zero droop assumed for the steady state assessments. For the transient analysis, the dynamic model shown in Diagram A-1 was used to represent the Marathon SVC.

There has been no attempt to optimize the dynamic performance of the Marathon SVC. The performance predicted by this model has been shown to be consistent with the measured performance of an existing installation in Ontario.

As in the *IESO Reference Study*, it was assumed that the existing synchronous condenser would have been replaced with an SVC, with the same rating as the existing unit (+ 60MVAr/ - 40MVAr) and with the same dynamic performance characteristics, by the time any of these proposals would be placed in-service.

4. New Circuit Series Compensation

For the steady state analysis, the series compensation was assumed to be located at the terminal stations of each line section, with the amount of compensation distributed equally between the two terminals. Installing series compensation at other locations would be acceptable provided the same total amount of compensation is installed.

For those RES Options that included series compensation, the following levels of compensation were assumed:

- Wawa TS to Marathon TS section approximately **40%** *For Options 2B, 2C, 2E & 2F*
- Marathon TS to Lakehead TS section approximately **50%** *For Option 2F*

Hydro One has indicated that any proponent’s circuit on which series compensation has been installed would need to be equipped with independent switching facilities at each terminal to ensure that isolation of the entire facility, should it experience a fault, would remain the responsibility of the proponent.

Since it will be the proponent’s responsibility to establish the switchyards at each terminal of the new line in which to locate the breakers required by Hydro One, these could also be used as locations for series capacitors. This would avoid the need to establish a third switchyard, solely for the series capacitors.

The proposed arrangement, with approximately half the series compensation installed at each terminal, is shown in **Diagram 1**.

5. Station Layouts

The transfer capabilities that have been quoted for each of the *RES Canada* proposals are based on the limitations imposed by double-circuit (adjacent circuits on a common structure) contingencies. To ensure that breaker-failure conditions would not be more limiting whenever all transmission elements are in-service, it has been assumed that the reconfiguration of the circuit terminations as shown in the following Diagrams for Wawa TS, Marathon TS and Lakehead TS would be completed as part of the Reinforcement Project.

Diagram 2 shows a station layout for Wawa TS to mitigate adverse effects from breaker-failure conditions.

Diagram 3 shows a station layout for Marathon TS to mitigate adverse effects from breaker-failure conditions.

Diagram 4 shows a station layout for Lakehead TS to mitigate adverse effects from breaker-failure conditions.

All three diagrams illustrate arrangements that would mitigate restrictions during transmission element outages by providing at least three diameters at each station. Circuits from opposite directions (i.e. one from the east and the other from the west) were also selected for termination into the adjacent positions on each diameter, to mitigate the effects of breaker failure conditions.

6. Criteria

The same criteria have been used to assess these *RES Canada* proposals as was used in IESO Reference Study of Various Options for Reinforcing the East-West Tie. For easy reference, the more relevant reliability criteria to this assessment are summarized below.

Voltage Stability criteria restrict the corresponding pre-contingency transfer to the lesser of the following:

- 10% lower than the instability point of the pre-contingency P-V curve, or
- 5% lower than the instability point of any post-contingency P-V curve.

The IESO uses a constant MVA load model in its planning assessments for voltage stability

Scheduled active power transfer into Ontario from Manitoba and Minnesota has been assumed to be zero. Manitoba and Minnesota phase shifter operation has been modelled as described in the *IESO Reference Study*. Voltage assessments have capped post-contingency support from Manitoba and Minnesota at the "four-taps-and-lock" level.

To respect Transient Stability criteria, stability must be preserved while the critical transfer is increased by at least 10%. Stability therefore has to be maintained with the East-West transfer increased by 10% above its stated transfer capability.

The IESO uses voltage dependent load models in its planning assessments of transient stability. Unless better information is available, the IESO employs a load model with different voltage dependencies for active power (i.e. $P \propto V^{1.5}$) and reactive power (i.e. $Q \propto V^{2.0}$). The default dynamic load models have been used in this study.

Steady state stability criteria require the damping factor for oscillation modes to be above 3% in a pre-contingency state and above 1% in a post-contingency state following all automatic actions.

Loading criteria require equipment to be within continuous ratings with all elements in-service and to be within long-term emergency ratings with any one element out of service. For transmission circuits, the long-term emergency rating is the continuous rating that can be accommodated for up to 50 hours per year.

Although the original assessment of the proposed reinforcement of the East-West Tie with a new 230kV double-circuit line between Wawa TS and Lakehead TS did not include automatic post-contingency switching of the tertiary-connected reactors at either Wawa TS or Marathon TS, switching of the Marathon reactors was found to be necessary for each the RES proposals to limit the rating of the SVC required at Marathon TS to a maximum of 250MVAr.

7. Voltage Stability Analysis

In each of the studies that examined the effect of contingencies involving either the Wawa x Marathon or the Marathon x Lakehead double-circuit line, automatic post-contingency switching of the tertiary-connected reactors at Marathon TS was assumed to occur.

7.1 Study Results for Option 2A - new single circuit 230kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS

The results have been summarised in **Table 1** for all of the contingency conditions that were assessed. With the proposed revisions to the termination arrangements, the critical contingency would involve the existing double-circuit line between Wawa TS and Marathon TS. This contingency would limit the pre-contingency transfer across the East-West Tie to approximately **383MW westwards**.

TABLE 1	*Summary of Transfer Capabilities with Option 2A*			***Equivalent Pre-contingency Transfer Limit***
Diagram 5	Pre-contingency	East-West Transfer West:	***381MW***	
		Sudbury Flow West:	***351MW***	
		NW Load assumed	*705MW*	
Diagram 6	PV-analysis	Voltage Stability Limit: 0.9 x 462MW	***415MW***	**415MW**
Diagram 7	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Wawa TS to Marathon TS Marathon reactors cross-tripped.		
		EW Tie Transfer:	***373MW***	
Diagram 8	PV-analysis	Voltage Stability Limit: 0.95 x 399MW	***379MW***	**387MW**
		*(Limit would **exceed** the post-cont. transfer by*	*6MW)*	(381MW + 6MW)*
Diagram 9	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Marathon TS to Lakehead TS Only Marathon reactors cross-tripped.		
		EW Tie Transfer:	***383MW***	
Diagram 10	PV-analysis	Voltage Stability Limit: 0.95 x 414MW	***392MW***	**390MW**
		*(Limit would **exceed** the post-cont. transfer by*	*9MW)*	(381MW + 9MW)*

* To derive the equivalent pre-contingency limiting flow, the incremental post-contingency flow in excess of the required 5% margin has been added to the initial pre-contingency flow to obtain the effective voltage stability limit.

To minimise any errors associated with this approximation, the transfers selected for each pre-contingency case were adjusted so that they would be close to the final post-contingency stability limit.

(i.e. *For Option 2A* Pre-contingency Transfer: 381MW Post-contingency Voltage Stability Limit: 387MW)

Approximate Load Meeting Capability of Option 2A: ***711MW*** NW Load: **705MW** + 6MW 'extra voltage stability margin' for the limiting contingency above

7.2 Study Results for Option 2B – Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus 50% series compensation on the new circuit between Marathon TS and Lakehead

The results have been summarised in **Table 2** for all of the contingency conditions that were assessed. With the proposed revisions to the termination arrangements, the critical contingency would involve the existing double-circuit line between Wawa TS and Marathon TS. This contingency would limit the pre-contingency transfer across the East-West Tie to approximately **482MW westwards**.

TABLE 2	*Summary of Transfer Capabilities for Option 2B*			***Equivalent Pre-Contingency Transfer Limit***
Diagram 11	Pre-contingency	East-West Transfer West: Sudbury Flow West: *NW Load assumed*	***482MW*** ***350MW*** *795MW*	
Diagram 12	PV-analysis	Voltage Stability Limit: 0.9 x 54MW	***493MW***	**493MW**
Diagram 13	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Wawa TS to Marathon TS Marathon reactors cross-tripped.		
		EW Tie Transfer:	***493MW***	
Diagram 14	PV-analysis	Voltage Stability Limit: 0.95 x 521MW *(Limit would **exceed** post-cont. transfer by*	***495MW*** *2MW)*	**484MW** (482MW + 2MW)
Diagram 15	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Marathon TS to Lakehead TS Only Marathon reactors cross-tripped.		
		EW Tie Transfer:	***496MW***	
Diagram 16	PV-analysis	Voltage Stability Limit: 0.95 x 530MW *(Limit would **exceed** the post-cont. transfer by*	***503MW*** *7MW)*	**489MW** (482MW + 7MW)

Approximate Load Meeting Capability of Option 2B: ***797MW*** NW Load: **795MW** + 2MW 'extra voltage stability margin' for the limiting contingency above

7.3 Study Results for Option 2C –Option 2A plus 40% series compensation between Wawa TS and Marathon TS on the new circuit

The results have been summarised in **Table 3** for all of the contingency conditions that were assessed. With the proposed revisions to the termination arrangements, the critical contingency would involve the existing double-circuit line between Marathon TS and Lakehead TS. This contingency would limit the pre-contingency transfer across the East-West Tie to approximately **436MW westwards**.

TABLE 3	*Summary of Transfer Capabilities for Option 2C*			***Equivalent Pre-Contingency Transfer Limit***
Diagram 17	Pre-contingency	East-West Transfer West: Sudbury Flow West: *NW Load assumed*	***431MW*** ***349MW*** *751MW*	
Diagram 18	PV-analysis	Voltage Stability Limit: 0.9 x 513MW	***462MW***	**462MW**
Diagram 19	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Wawa TS to Marathon TS Marathon reactors cross-tripped.		
		EW Tie Transfer:	***440MW***	
Diagram 20	PV-analysis	Voltage Stability Limit: 0.95 x 491MW *(Limit would **exceed** post-cont. transfer by*	***466MW*** *26MW)*	**457MW** **(**431MW + 26MW)
Diagram 21	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Marathon TS to Lakehead TS Only Marathon reactors cross-tripped.		
		EW Tie Transfer:	***429MW***	
Diagram 22	PV-analysis	Voltage Stability Limit: 0.95 x 457MW *(Limit would **exceed** post-cont. transfer by*	***434MW*** *5MW)*	**436MW** **(**431MW + 5MW)

Approximate Load Meeting Capability of Option 2C:

NW Load: **751MW** + 5MW 'extra voltage stability margin' for the limiting contingency above ***756MW***

7.4 Study Results for Option 2E – Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus a 100 Mvar capacitor at both Lakehead TS and Marathon TS plus a +250/-100 Mvar SVC at Marathon TS

The results have been summarised in **Table 4** for all of the contingency conditions that were assessed. With the proposed revisions to the termination arrangements, the critical contingency would involve the existing double-circuit line between Marathon TS and Lakehead TS. This contingency would limit the pre-contingency transfer across the East-West Tie to approximately **614MW westwards**.

TABLE 4	*Summary of Transfer Capabilities for Proposal 2E*			***Equivalent Pre-Contingency Transfer Limit***
Diagram 23	Pre-contingency	East-West Transfer West:	***616MW***	
		Sudbury Flow West:	***348MW***	
		NW Load assumed	*908MW*	
Diagram 24	PV-analysis	Voltage Stability Limit: 0.9 x 791MW	***712MW***	**712MW**
Diagram 25	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Wawa TS to Marathon TS Wawa & Marathon reactors cross-tripped.		
		EW Tie Transfer:	***620MW***	
Diagram 26	PV-analysis	Voltage Stability Limit: 0.95 x 710MW	***674MW***	**670MW**
		*(Limit would **exceed** the post-cont. transfer by*	*54MW)*	(616MW + 54MW)
Diagram 27	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Marathon TS to Lakehead TS Only Marathon reactors cross-tripped.		
		EW Tie Transfer:	***597MW***	
Diagram 28	PV-analysis	Voltage Stability Limit: 0.95 x 627MW	***595MW***	**614MW**
		*(Limit would **be less than** the post-cont. transfer by*	*2MW)*	(616MW - 2MW)

Approximate Load Meeting Capability of Option 2E:

906MW

NW Load: **908MW** - 2MW 'lower voltage stability margin' for the limiting contingency above

7.5 Study Results for Option 2F: Option 2E plus 50% series compensation from Marathon TS to Lakehead TS

The results have been summarised in **Table 5** for all of the contingency conditions that were assessed. With the proposed revisions to the termination arrangements, the critical contingency would involve the existing double-circuit line between Wawa TS and Marathon TS. This contingency would limit the pre-contingency transfer across the East-West Tie to approximately **684MW westwards**.

TABLE 5	*Summary of Transfer Capabilities for Option 2F*			***Equivalent Pre-Contingency Transfer Limit***
Diagram 29	Pre-contingency	East-West Transfer West: Sudbury Flow West: *NW Load assumed*	***663MW*** ***346MW*** *950MW*	
Diagram 30	PV-analysis	Voltage Stability Limit: 0.9 x 822MW	***740MW***	**740MW**
Diagram 31	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Wawa TS to Marathon TS Wawa & Marathon reactors cross-tripped.		
		EW Tie Transfer:	***664MW***	
Diagram 32	PV-analysis	Voltage Stability Limit: 0.95 x 721MW *(Limit would **exceed** the post-cont. transfer by*	***685MW*** *21MW)*	**684MW** (663MW + 21MW)
Diagram 33	Post-contingency	*Contingency:* Existing 230kV double-circuit line - Marathon TS to Lakehead TS Marathon reactors cross-tripped.		
		EW Tie Transfer:	***682MW***	
Diagram 34	PV-analysis	Voltage Stability Limit: 0.95 x 757MW *(Limit would **exceed** the post-cont. transfer by*	***719MW*** *37MW)*	**700MW** (663MW + 37MW)

Approximate Load Meeting Capability of Option 2F:

NW Load: **950MW** + 21MW 'extra voltage stability margin' for the limiting contingency above ***971MW***

8. *Transient Stability Analysis*

The results of the transient stability analysis have been summarised in **Table 6**. The analysis shows that transient stability will be *less* restrictive than voltage stability.

<table>
<tr><th>Table 6</th><th>Transient Stability Analysis</th><th colspan="3">East-West Tie Transfer</th><th rowspan="2">Contingencies Examined</th></tr>
<tr><th colspan="2">Proposal</th><th>Last Tested Stable Point</th><th>With a 10% margin</th><th>Voltage Stability Limit</th></tr>
<tr><td>Option 2A -</td><td>new single circuit 230 kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS</td><td>553MW</td><td>502MW</td><td>387MW</td><td rowspan="5">LLG faults at:
• Wawa TS
• Marathon TS
• Lakehead TS

Simulations used a local terminal fault clearing time of 83ms and a remote terminal clearing time 33ms later.

These are standard fault clearing times for 3-cycle breakers (like those at Wawa, Marathon and Lakehead) with PLC communication between the terminal stations.</td></tr>
<tr><td>Option 2B -</td><td>Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus 50% series compensation on the new circuit between Marathon TS and Lakehead TS</td><td>553MW</td><td>502MW</td><td>484MW</td></tr>
<tr><td>Option 2C -</td><td>Option 2A plus 40% series compensation between Wawa TS and Marathon TS on the new circuit</td><td>553MW</td><td>502MW</td><td>436MW</td></tr>
<tr><td>Option 2E -</td><td>Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus 100 Mvar capacitor at both Lakehead TS and Marathon TS plus +250/-100 Mvar SVC at Marathon TS</td><td>699MW</td><td>635MW</td><td>614MW</td></tr>
<tr><td>Option 2F -</td><td>Option 2E plus 50% series compensation from Marathon TS to Lakehead TS</td><td>761MW</td><td>692MW</td><td>684MW</td></tr>
</table>

Since *Option 2F* would be the only one that would satisfy the 650MW EW Tie transfer requirement, representative transient responses for have been included for only this Option to illustrate that its performance would meet criteria.

The responses for each of the other proposals were similar.

Response to the W21M and W22M Double-Circuit Contingency

Diagram 35 shows the voltage response at key buses (Wawa, Marathon, Lakehead, Kenora, and Mississagi) and the reactive response of the SVCs at Marathon and Lakehead for the Wawa TS to Marathon TS double-circuit contingency.

The voltage response at these buses demonstrates system performance will meet the IESO criteria that voltage not dip to less than 70% or stay under 80% for longer than 250ms following fault clearing.

The reactive power response of the SVCs at Marathon and Lakehead demonstrates the IESO post-contingency damping criteria are satisfied. The large post-contingency increase in reactive power at the Marathon SVC demonstrates its performance will be critical to maintaining reliability at high westward East-West Tie transfer levels.

Diagram 36 shows the rotor angle response for generating units in the North-West region and units that are electrically relatively near to Wawa TS. The angle response demonstrates all units are transiently stable and the damping criteria are satisfied.

Since the fault in this example is applied at Marathon, units closer to Marathon will accelerate more before fault clearing than units further than Marathon. This can be seen by comparing the rotor angle response at Scott GS with the rotor angle response at Silver Falls GS.

Response to the M23L and M24L Double-Circuit Contingency

Diagram 37 shows the voltage response at key buses (Wawa, Marathon, Lakehead, Kenora, and Mississagi) and the reactive response of the SVCs at Marathon and Lakehead for the Marathon TS to Lakehead TS double-circuit contingency.

The voltage response at these buses demonstrates system performance will meet the IESO criteria that voltage should not dip less than 70% or stay under 80% for longer than 250ms following fault clearing.

The reactive power response of the SVCs at Marathon and Lakehead demonstrates the IESO post-contingency damping criteria are satisfied. The active response of the Marathon SVC demonstrates its performance will be critical to maintaining reliability at high westward East-West Tie transfer levels.

Diagram 38 shows the rotor angle response for generating units in the North-West region and units that are electrically relatively near to Wawa TS. The angle response demonstrates all units are transiently stable and the damping criteria are satisfied.

9. Equipment Loading Analysis

Equipment loading issues for the single-circuit alternatives identified in the IESO Reference Study of Various Options for Reinforcing the East-West Tie are also applicable to these RES Canada proposals. The *IESO Reference Study* found that the maximum continuous operating temperature for the circuits T1M, A1B & A5A would need to be increased to at least 105°C to provide a long-term emergency rating of approximately 690A should a single-circuit line be installed to reinforce the East-West Tie.

115kV Circuits T1M, A1B & A5A between Marathon TS and Alexander TS

Following a double-circuit contingency involving the existing line between Marathon TS and Lakehead TS, the higher effective impedance of the new single-circuit line that would remain in-service over this section would result in higher transfers over the parallel 115kV connection than were recorded for the *IESO Reference Study*.

For *Option 2A*, the E-W transfers are not high enough to cause thermal overloading of the 115kV parallel path. **Diagram 9** shows the relevant post-contingency flows.

For *Option 2C*, the higher level of E-W transfer would push the post-contingency on circuit T1M to marginally above its present long-term emergency rating. **Diagram 15** shows the relevant post-contingency flows.

For *Option 2B*, with a higher E-W transfer than that assumed in *Option 2C,* the 50% series compensation would reduce the post-contingency flow on the parallel 115 kV circuits. **Diagram 21** shows the relevant post-contingency flows.

For *Option 2E*, the combination of the higher transfer level on the E-W Tie and the absence of series compensation on the Marathon TS to Lakehead TS circuit would push the post-contingency loading on circuit T1M to well above its *present* long-term emergency rating. The post-contingency loading on circuits A1B and A5A would be at, or slightly above, their long-term emergency ratings. **Diagram 27** shows the post-contingency flow on circuit T1M would just exceed the enhanced **690A** rating that was recommended in the *IESO Reference Study*

For *Option 2F*, the higher transfer on the E-W Tie, even with series compensation on the Marathon TS to Lakehead TS circuit would push the post-contingency loading on circuit T1M to marginally above its *present* long-term emergency rating. **Diagram 33** shows the relevant post-contingency flows.

115kV Circuit B6M between Lakehead TS & Mackenzie TS

To avoid overloading circuit B6M, which provides a parallel 115kV connection from Birch TS to Moose Lake TS, it has been assumed that this circuit would be cross-tripped immediately following a double-circuit contingency involving circuits A21L & A22L between Lakehead TS and Mackenzie TS.

With the 230kV circuits A21L & A22L out-of-service, and with the 115kV circuit B6M cross-tripped, all of the load to the west of Mackenzie TS would then be isolated on to the Manitoba and Minnesota Interconnections.
To accommodate the immediate post-contingency reductions in both the transfers on the East-West Tie and in the associated reactive losses, while also maintaining voltages within acceptable limits, a reactive absorption capability of at least 100MVAr would be required at Marathon TS. This would be in addition to the reactive absorption capability already assumed to be available from the two SVCs at Lakehead TS.

10. Summary

The analysis performed to assess the transfer capability of the East-West Tie, with automatic post-contingency switching of the tertiary-connected reactors at Marathon TS, determined the following transfer capabilities for each of the five proposals examined:

- *Option 2A - with new single circuit 230 kV lines from Wawa TS to Marathon TS and from Marathon TS to Lakehead TS:* ***387MW***
- *Option 2B - Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus 50% series compensation on the new circuit between Marathon TS and Lakehead TS* ***484MW***
- *Option 2C - Option 2A plus 40% series compensation between Wawa TS and Marathon TS on the new circuit* ***436MW***
- *Option 2E - Option 2A plus 40% series compensation from Wawa TS to Marathon TS plus a 100 Mvar capacitor at both Lakehead TS & Marathon TS plus +250/-100 Mvar SVC at Marathon TS* ***614MW***
- *Option 2F - Option 2E plus 50% series compensation from Marathon TS to Lakehead TS* ***684MW***

Only *Option 2F* would yield the required transfer capability (i.e. ~ **650MW**) on the East-West Tie to serve the required load level (i.e. **950MW**) in the North-West region.

Diagram 5 in the IESO Reference Study of Various Options for Reinforcing the East-West Tie shows an East-West Tie transfer **of 652 MW** will serve **950 MW** of load in the North-West region. At 652 MW of East-West transfer westward, North-West generation is **390 MW**, North-West losses are **83MW** and North-West imports are **6MW**.

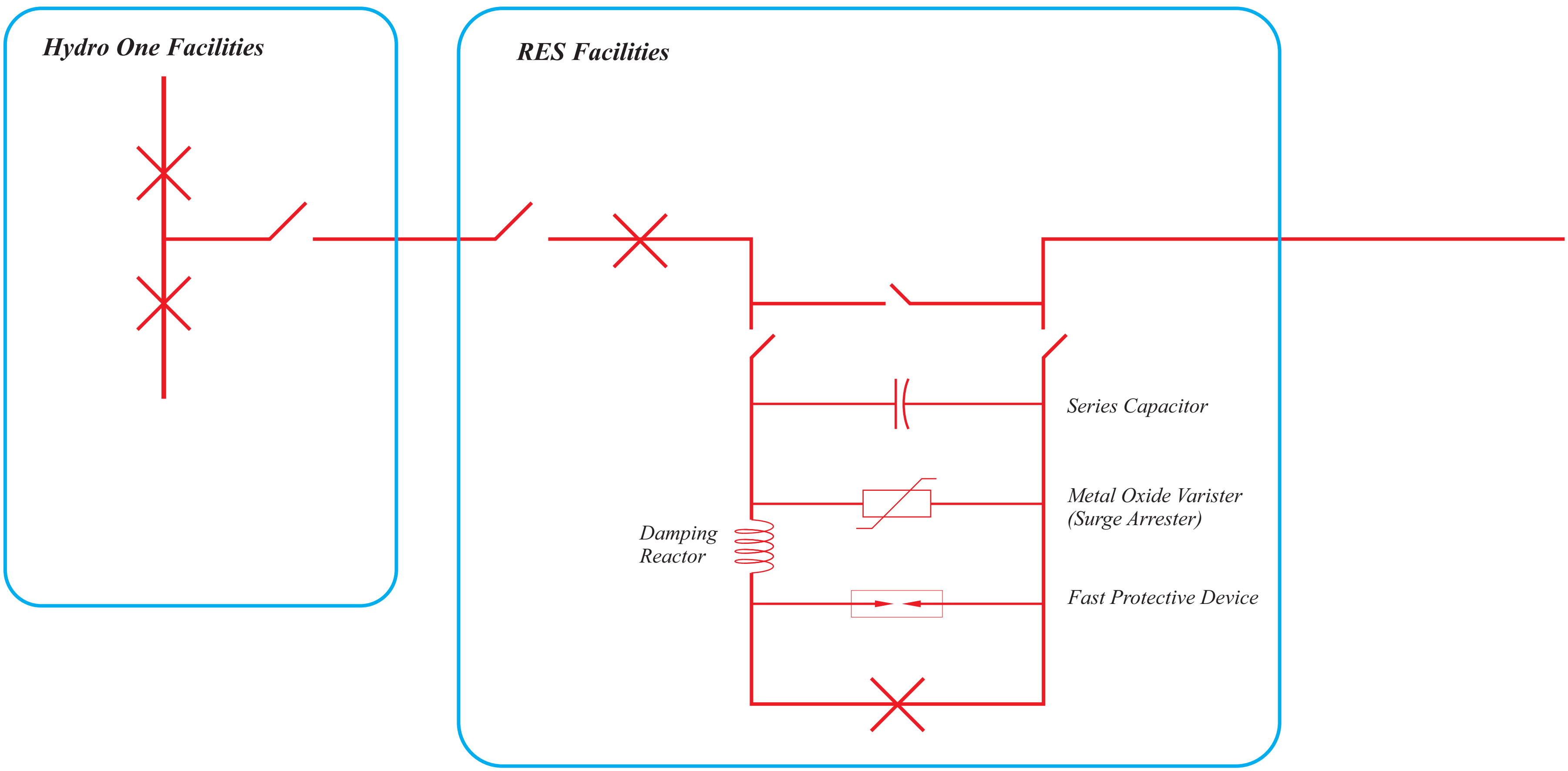
Table 7 presents a summary of North-West load meeting capability for the condition with the combined output from the generation in the North-West, which is predominately hydroelectric, set at a 'dry year' value of 390MW.

Summary of North-West Load Meeting Capabilities

TABLE 7	*EAST-WEST TIE REINFORCEMENT: SUMMARY OF EW TIE TRANSFERS & NW LOAD MEETING CAPABILITIES*		
Reinforcement Options	*Facilities*	*NW Load Meeting Capability*	*EW Tie Transfer Limit*
Existing EW Tie	Existing 230kV double-circuit line with no additional reactive compensation, either series or shunt	*~ 500MW* 390MW (gen) + 175MW (EW transfer W) - NW losses (65MW est.) - imports (0MW)	175MW
EW Tie Reinforcement Reference Case Diagram 5 of the IESO's EW Tie Report of 14th August 2011	New 230kV double circuit lines - 1192kcmil conductors: Wawa to Marathon & Marathon to Lakehead - uncompensated +200/-100MVAr SVC at Marathon	***950MW***	652MW
RES REINFORCEMENT OPTIONS	*With automatic post-contingency switching of the tertiary-connected reactors at Marathon TS assumed for each case*		
RES Option 2A Diagram 5	New 230kV single-circuit line - 1557kcmil conductors: Wawa to Marathon - no series compensation Marathon to Lakehead - no series compensation	*711MW*	387MW
RES Option 2C Diagram 17	*New 230kV single-circuit line -* 1557kcmil conductors: *Wawa to Marathon - 40% series compensation* *Marathon to Lakehead - no series compensation*	*756MW* *Δ from Option 2A: +45MW*	436MW
RES Option 2B Diagram 11	New 230kV single-circuit line - 1557kcmil conductors: Wawa to Marathon - 40% series compensation Marathon to Lakehead - 50% series compensation	*797MW* *Δ from Option 2C: +41MW*	484MW
RES Option 2E Diagram 23	New 230kV single-circuit line - 1557kcmil conductors: Wawa to Marathon - 40% series compensation Marathon to Lakehead - no series compensation +250/-100MVAr SVC at Marathon and 100Mvar cap at M&L	*906MW* *Δ from Option 2B: +109MW*	614MW
RES Option 2F Diagram 29	New 230kV single-circuit line - 1557kcmil conductors: Wawa to Marathon - 40% series compensation Marathon to Lakehead - 50% series compensation +250/-100MVAr SVC at Marathon and 100 Mvar cap at M&L	***971MW*** *Δ from Option 2E: +65MW*	684MW

DIAGRAMS

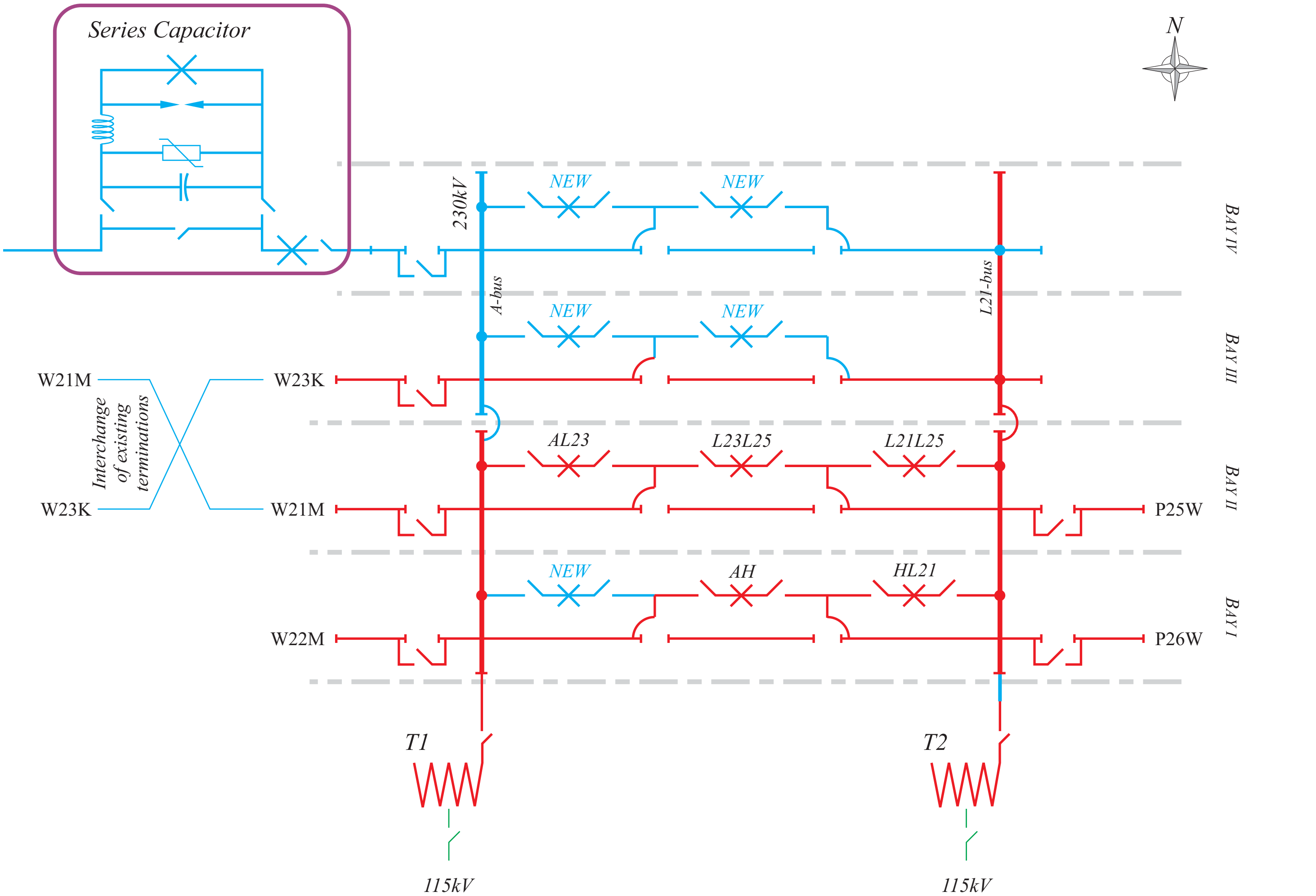
WAWA TS, MARATHON TS OR LAKEHEAD TS



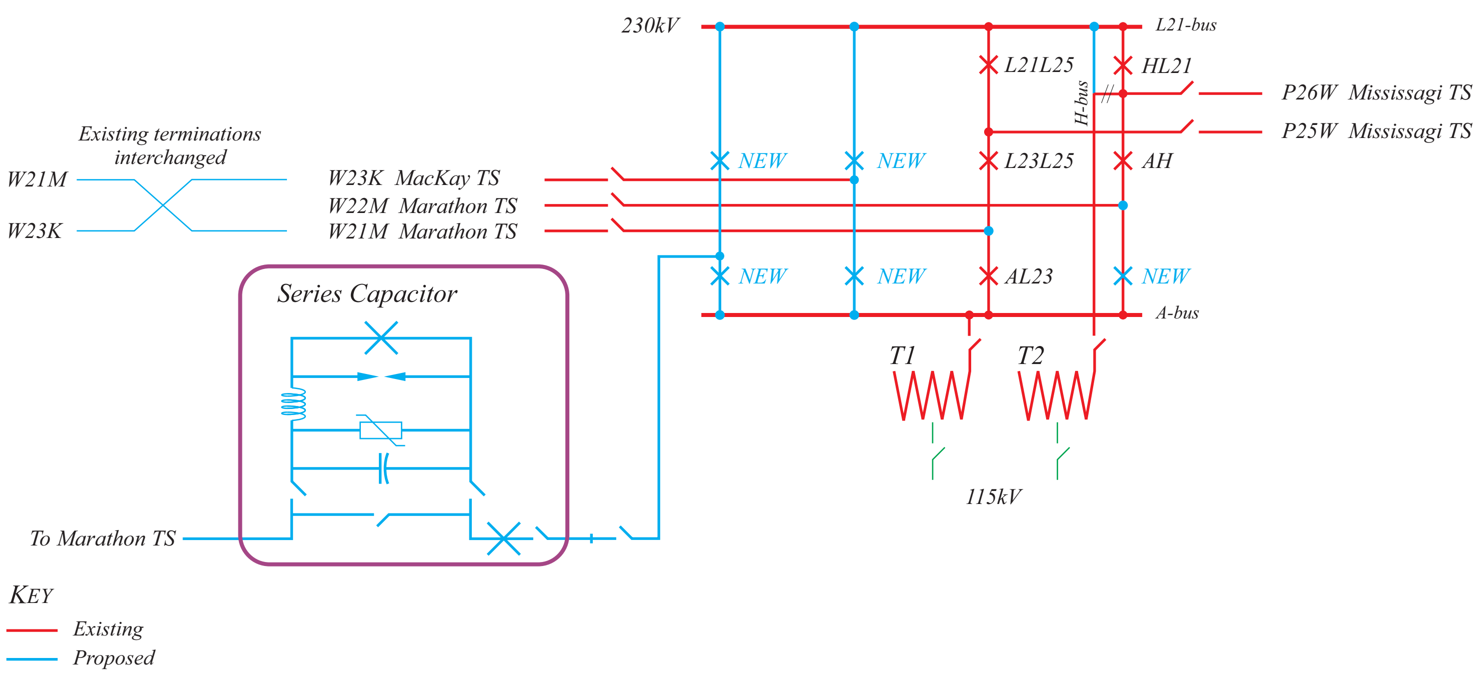
Proposed Termination Arrangement of the Series-Compensated Lines at Wawa TS, Marathon TS and Lakehead TS

DIAGRAM 1

21st December 2012



SINGLE-LINE DIAGRAM

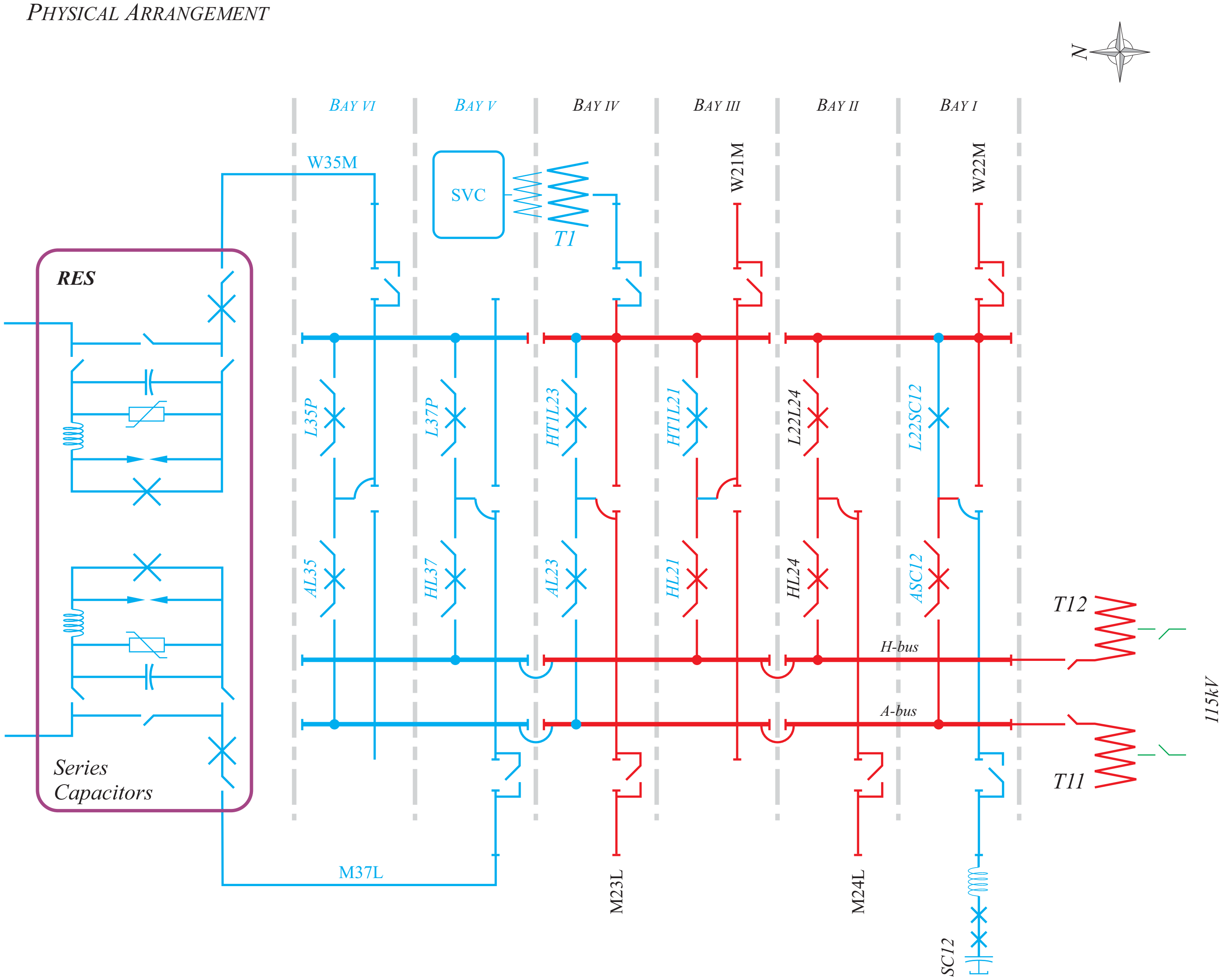


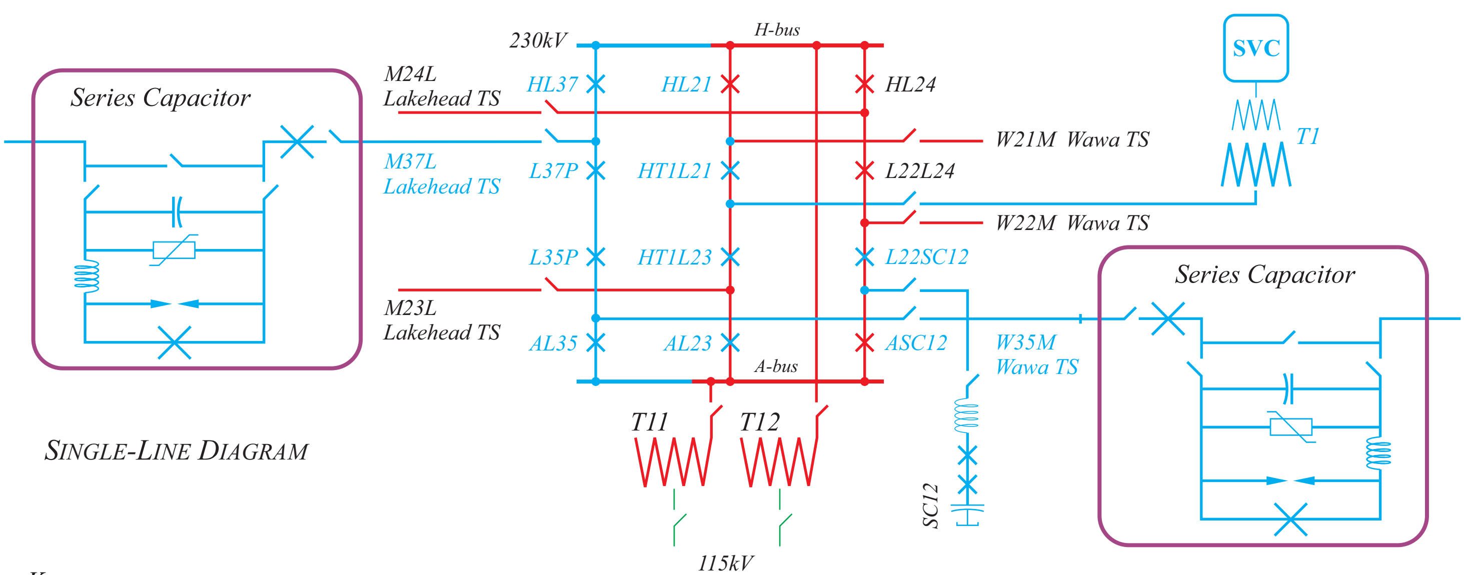
WAWA TS: Termination of the new single-circuit line

DIAGRAM 2

7th November 2012

Physical Arrangement





Single-Line Diagram

Key

Existing

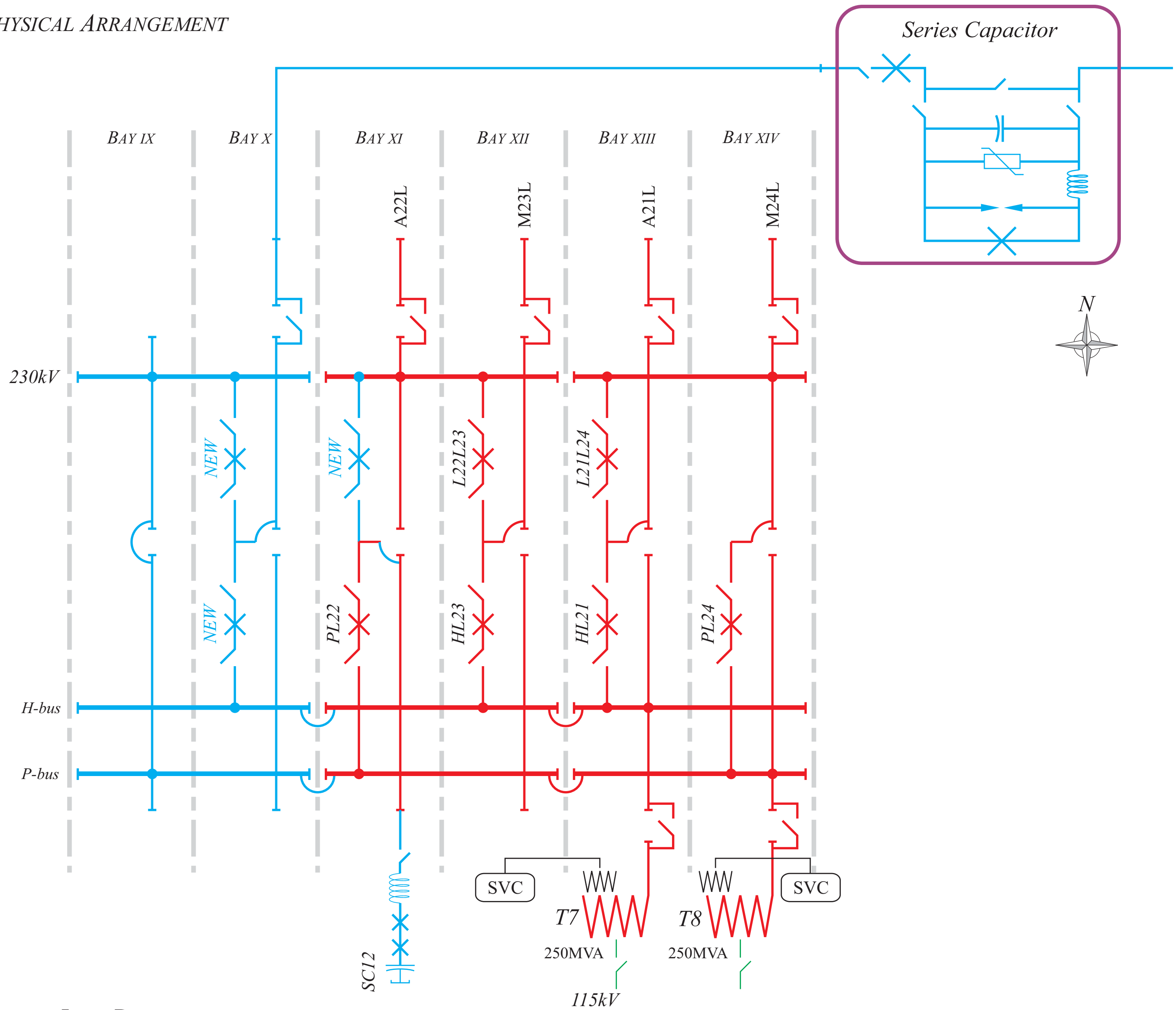
Proposed

MARATHON TS: With two new single-circuit lines

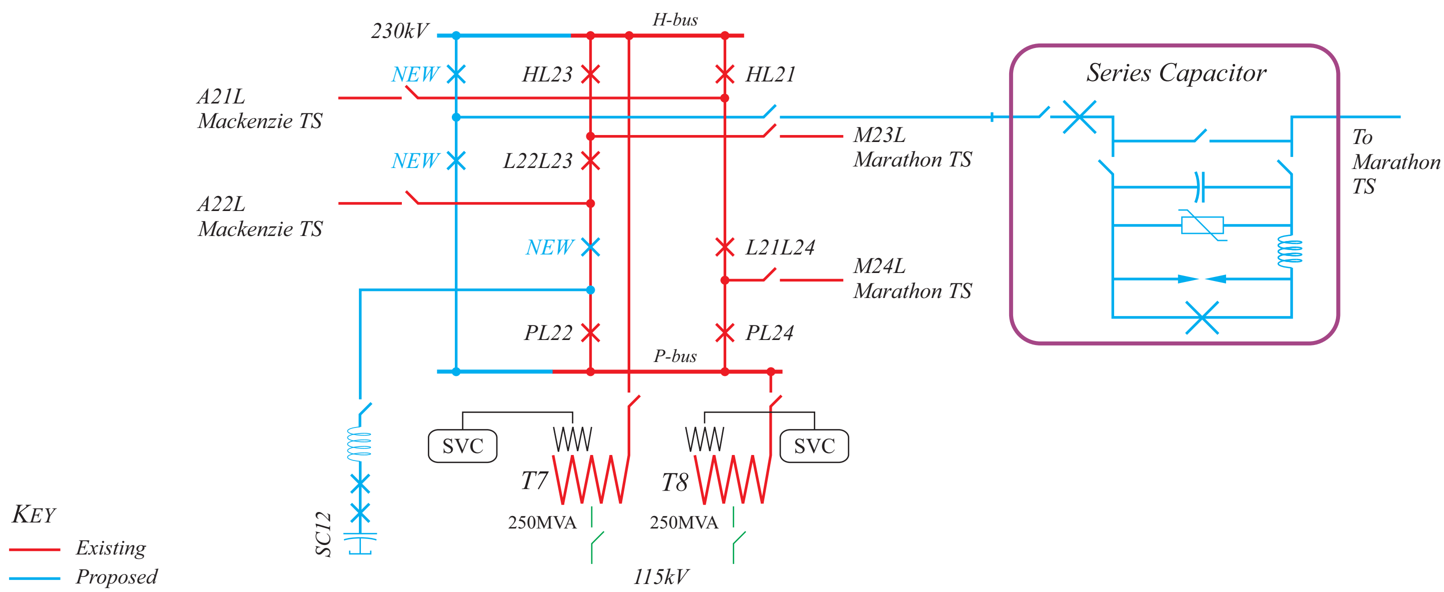
DIAGRAM 3

21st December 2012

Physical Arrangement



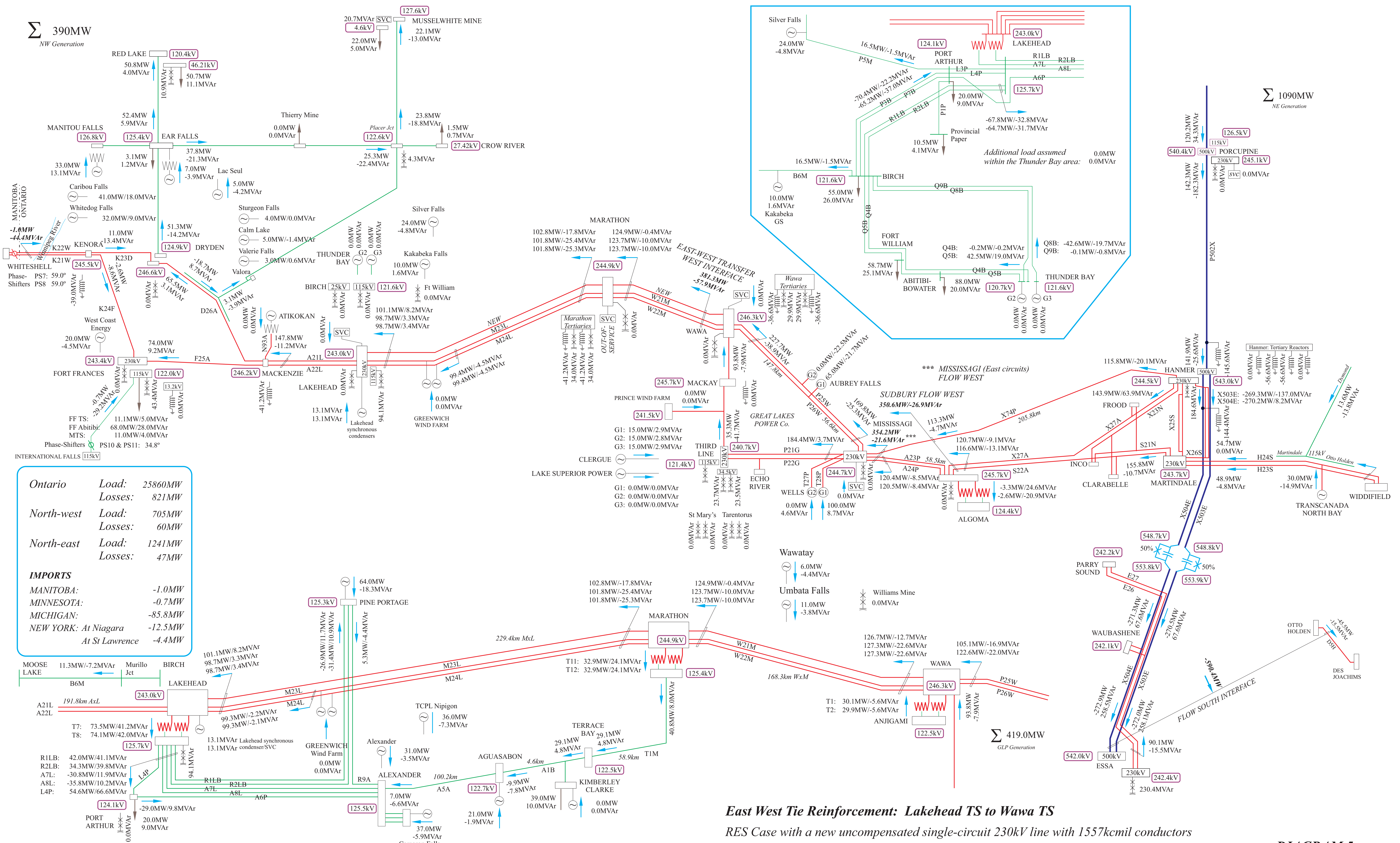
Single-Line Diagram



LAKEHEAD TS: Termination of the new single-circuit line

DIAGRAM 4

7th November 2012

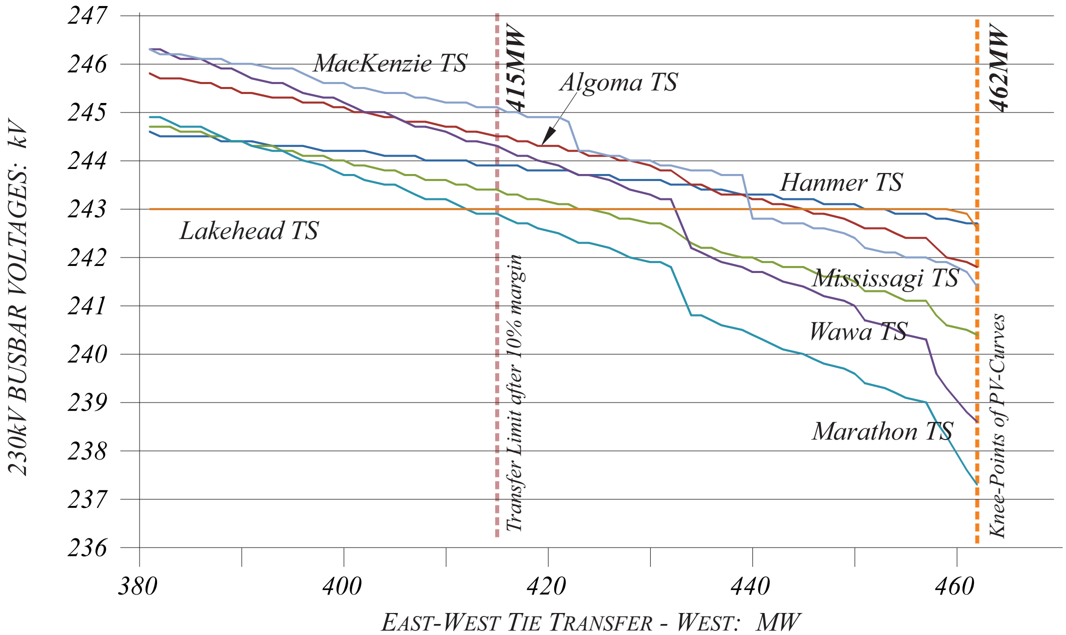


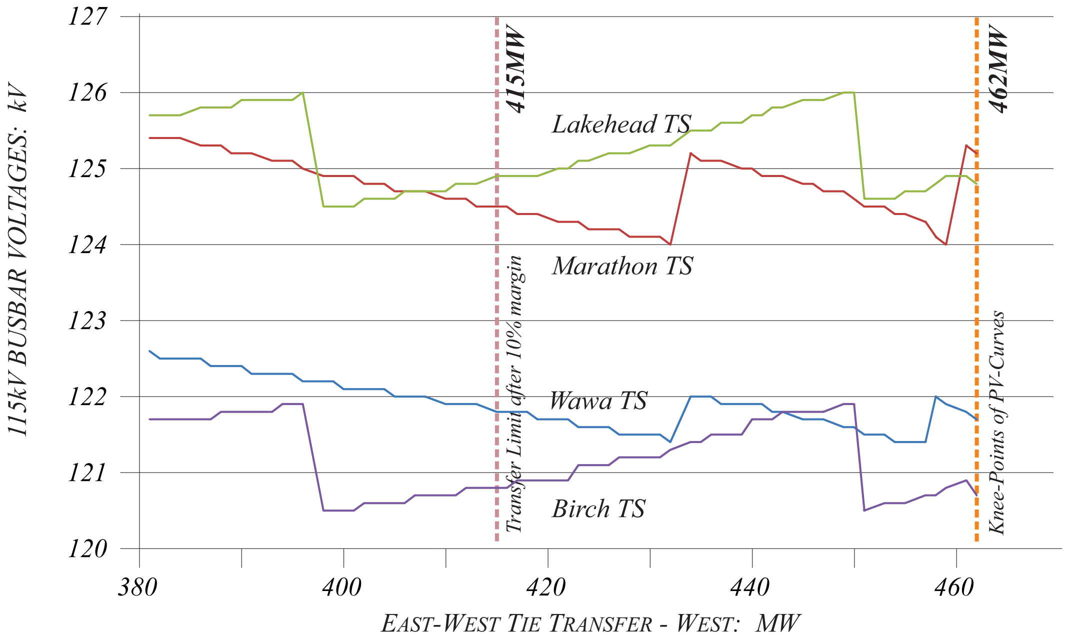
East West Tie Reinforcement: Lakehead TS to Wawa TS

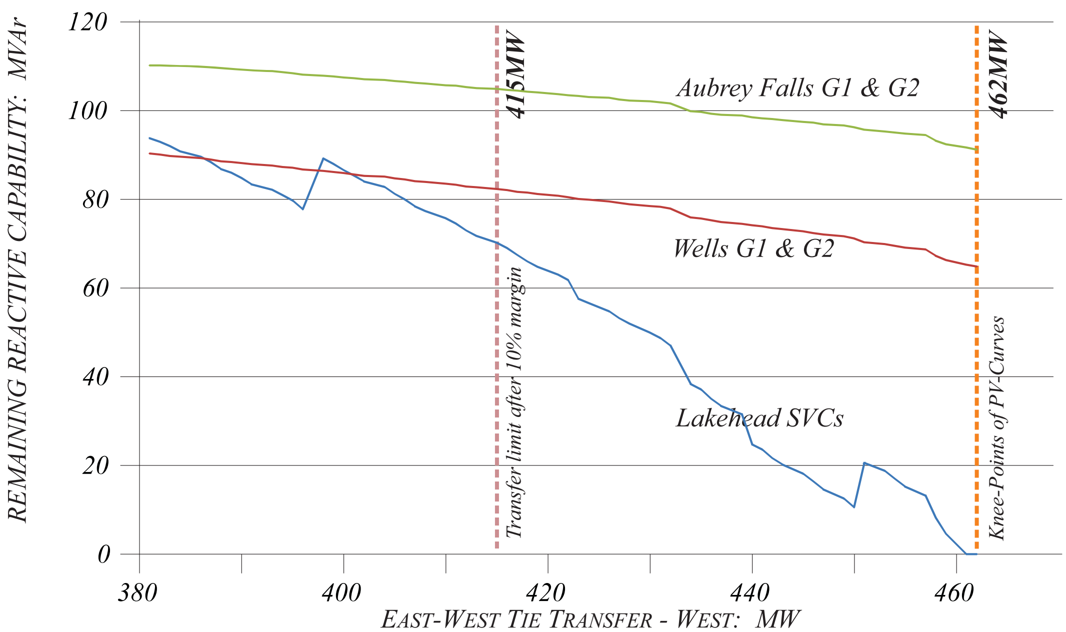
RES Case with a new uncompensated single-circuit 230kV line with 1557kcmil conductors

DIAGRAM 5

22nd December 2012







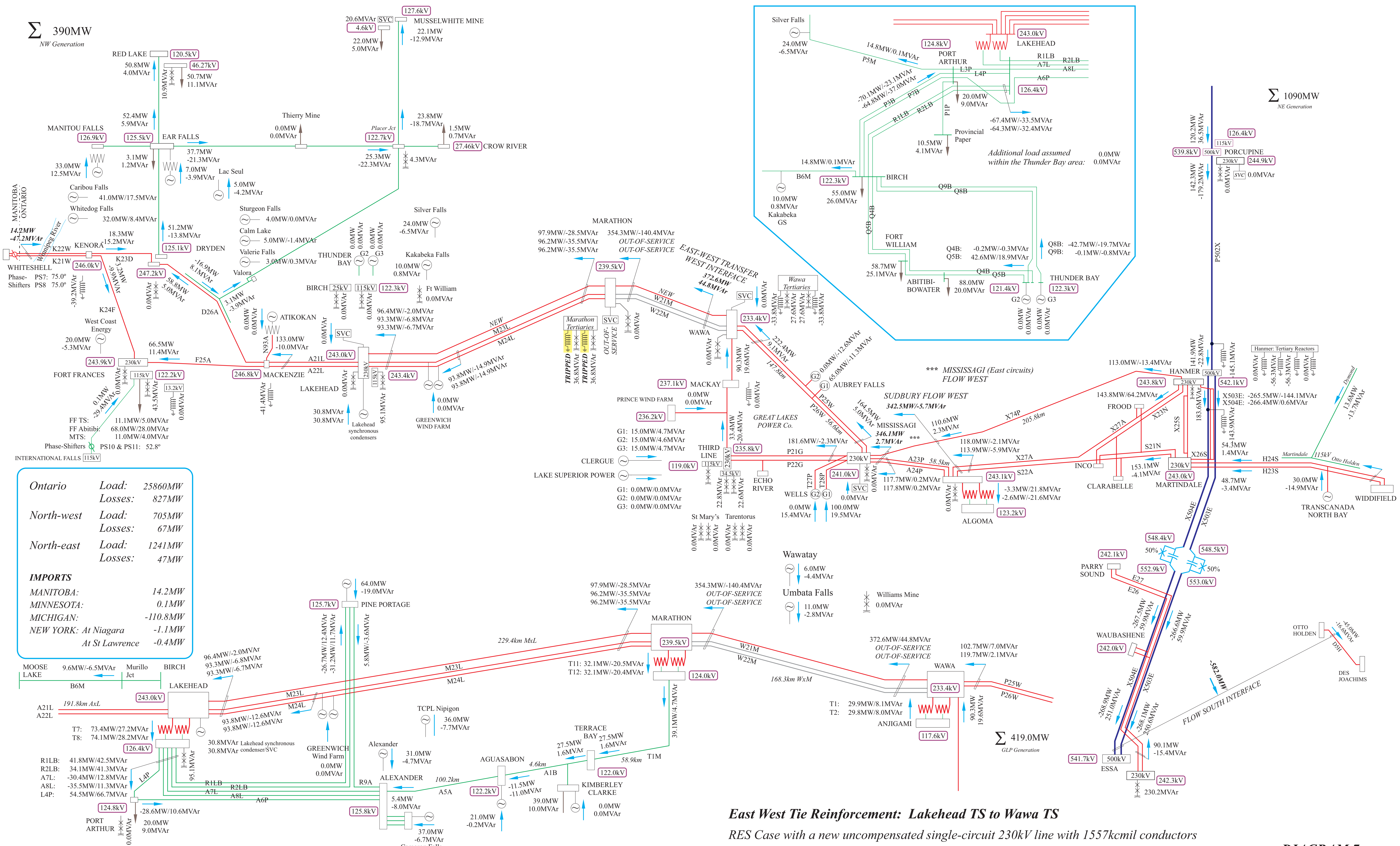
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With no series compensation
With no SVC at Marathon TS
Pre-Contingency

PV-analysis

Pre-Contingency

DIAGRAM 6

22nd December 2012



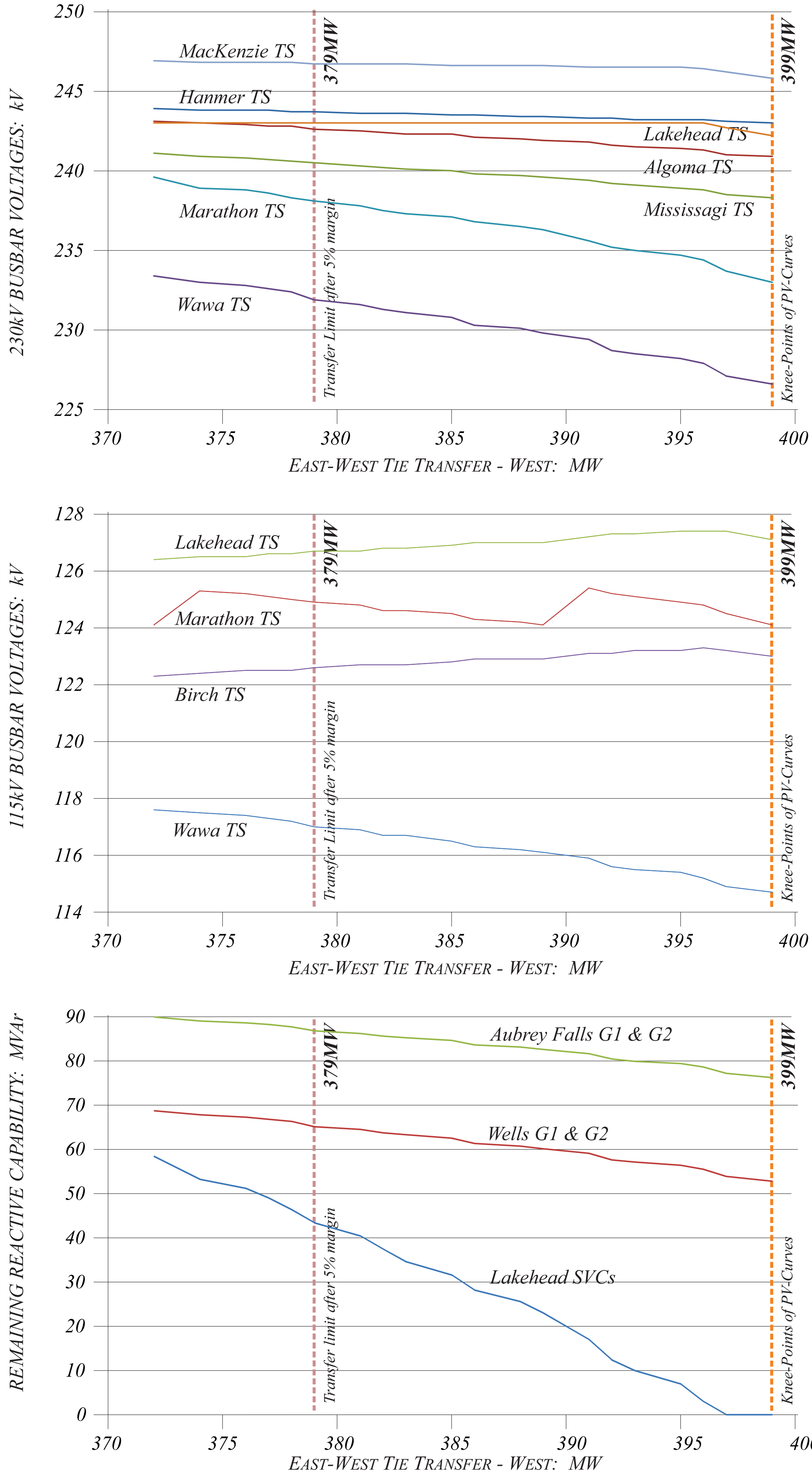
East West Tie Reinforcement: Lakehead TS to Wawa TS

RES Case with a new uncompensated single-circuit 230kV line with 1557kcmil conductors

Contingency: *Existing 230kV double-circuit line - Wawa x Marathon (W21M + W22M)*
Marathon reactors tripped immediately post-contingency

DIAGRAM 7

22nd December 2012



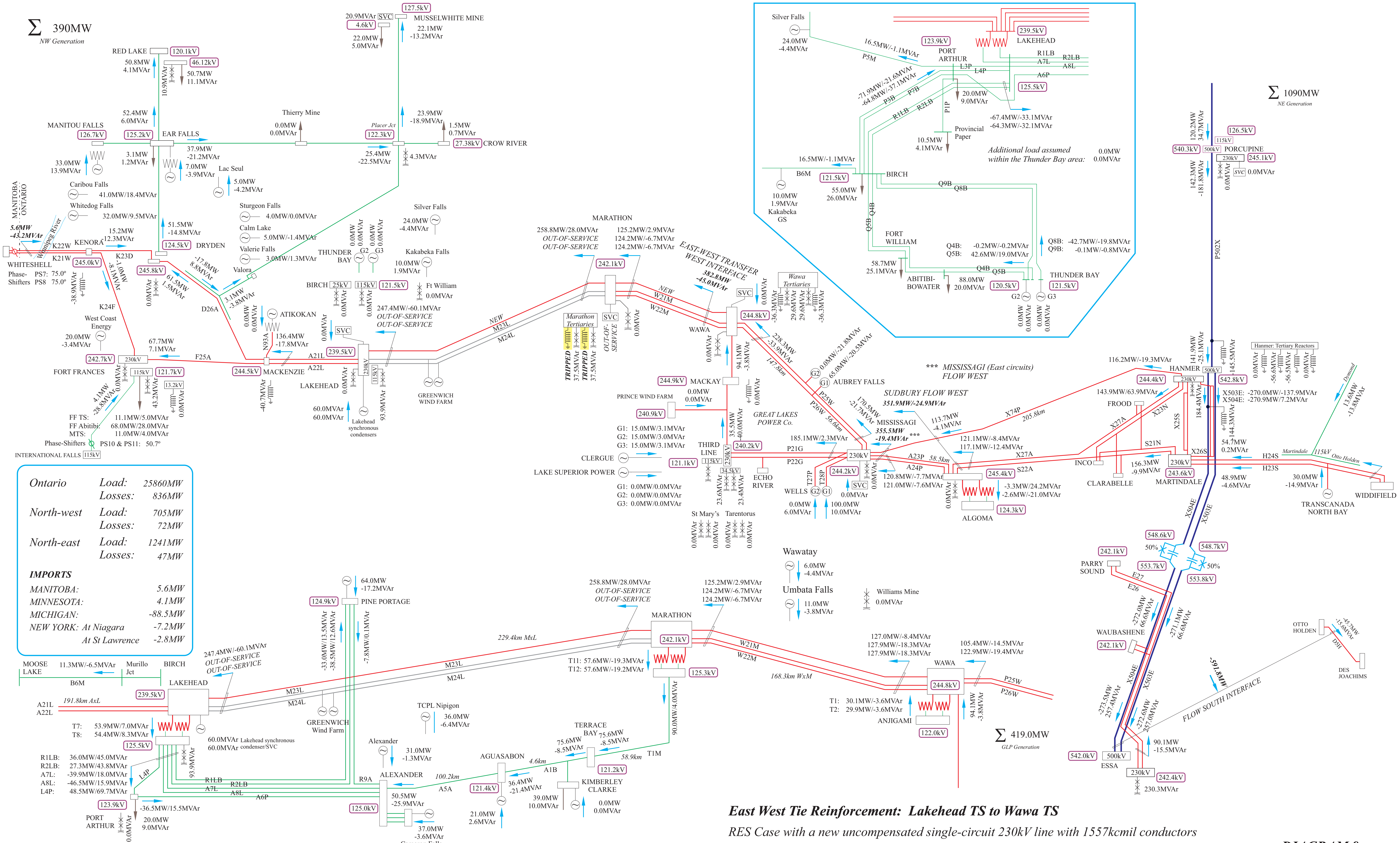
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With no series compensationon
With no SVC at Marathon TS
Contingency: *Double-circuit contingency between Wawa TS & Marathon TS*
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 8

22nd December 2012



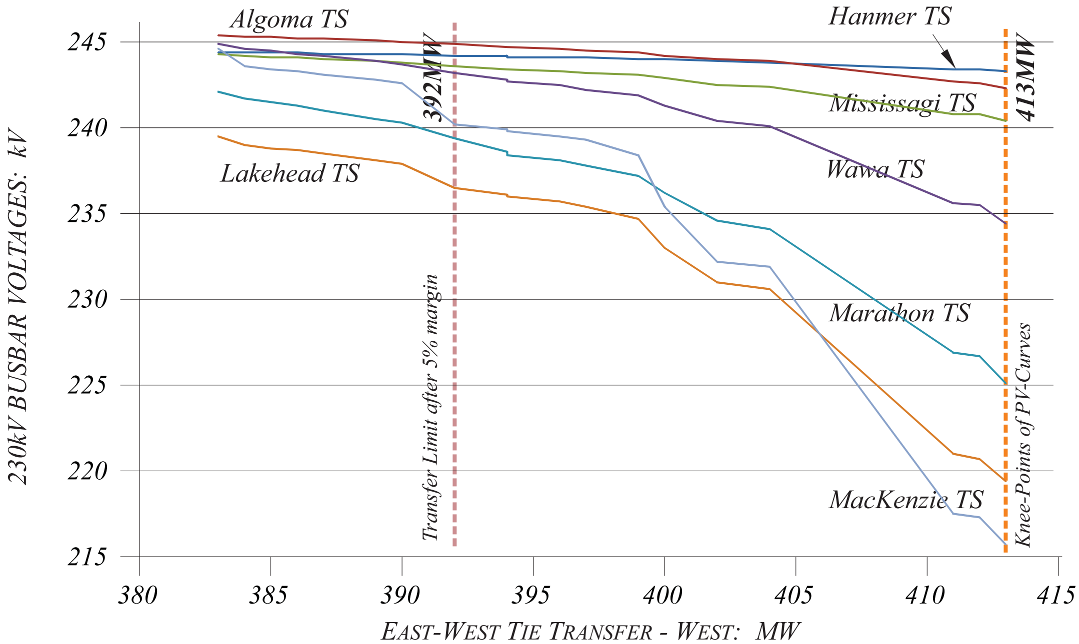
East West Tie Reinforcement: Lakehead TS to Wawa TS

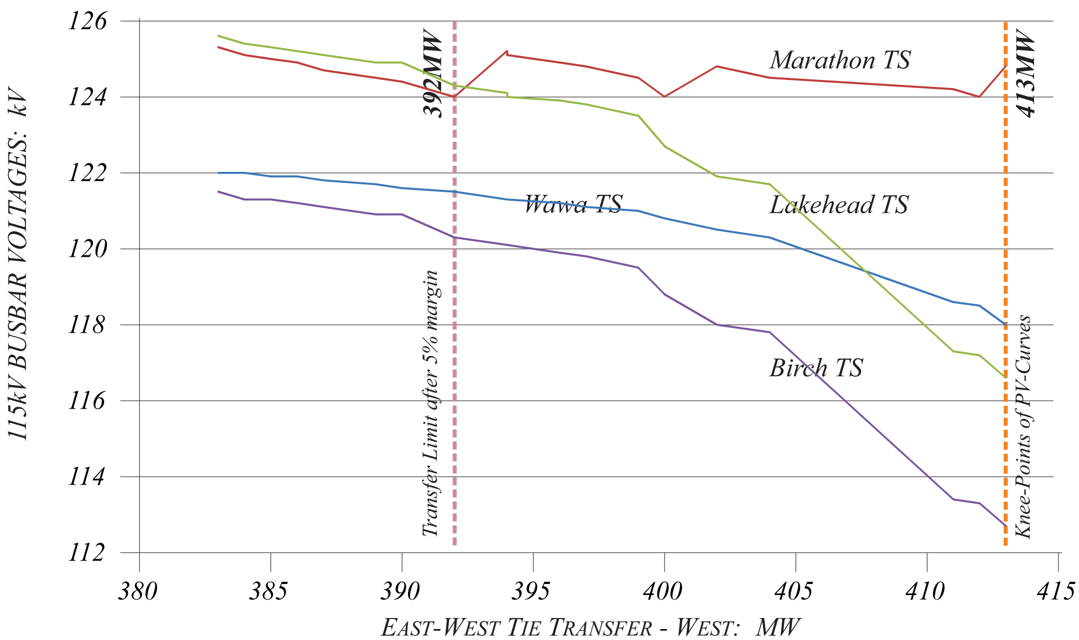
RES Case with a new uncompensated single-circuit 230kV line with 1557kcmil conductors

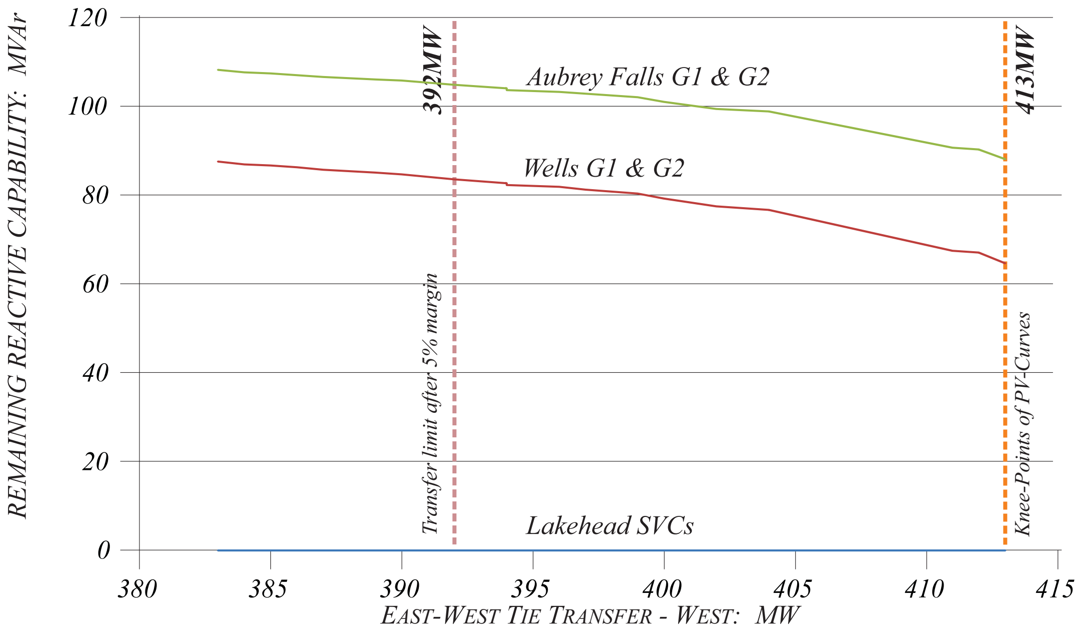
Contingency: *Existing 230kV double-circuit line - Marathon x Lakehead (M23L + M24L)*
Marathon reactors tripped immediately post-contingency

DIAGRAM 9

27th December 2012







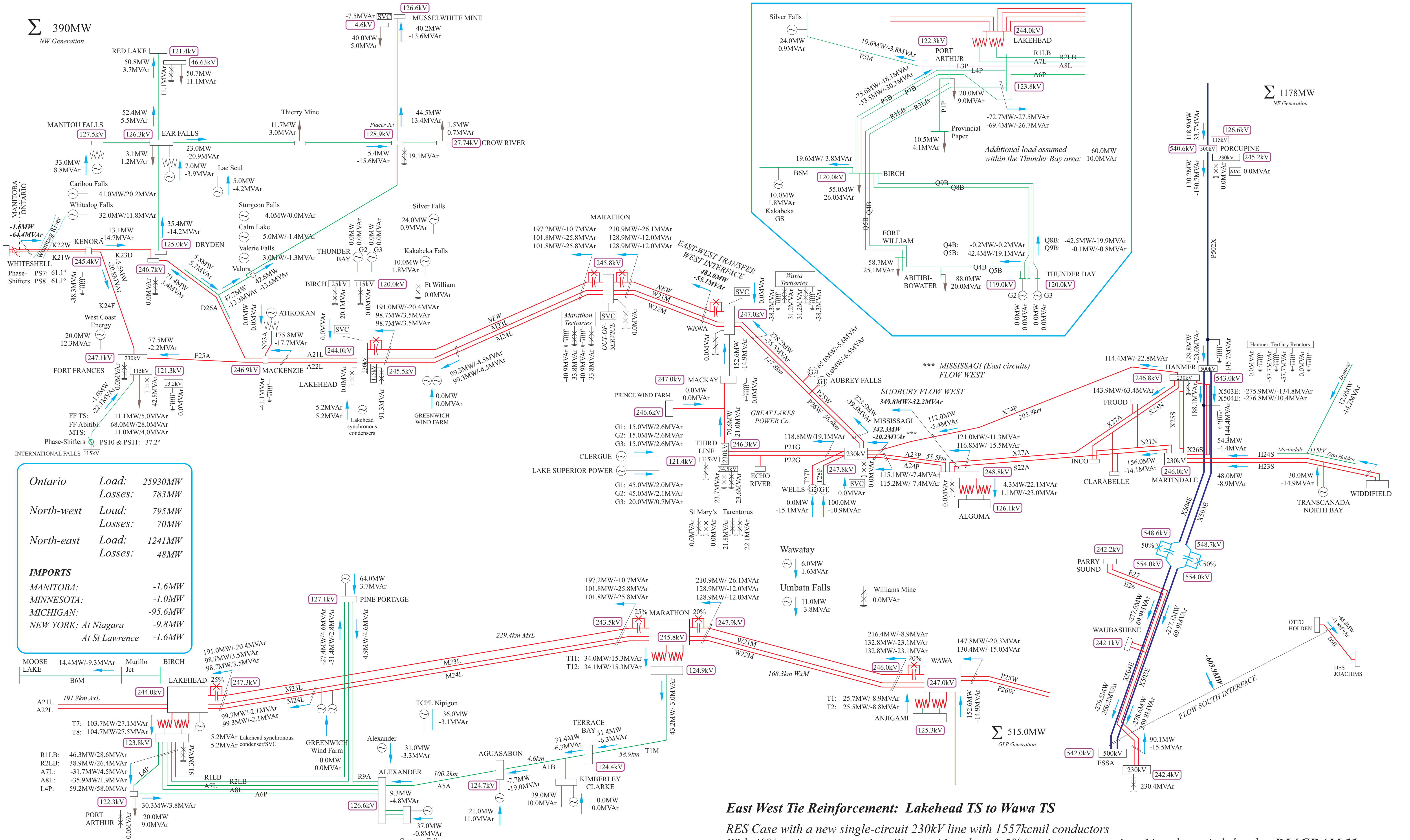
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With no series compensation
With no SVC at Marathon TS
Contingency: Double-circuit contingency between Marathon TS & Lakehead TS
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 10

27th December 2012

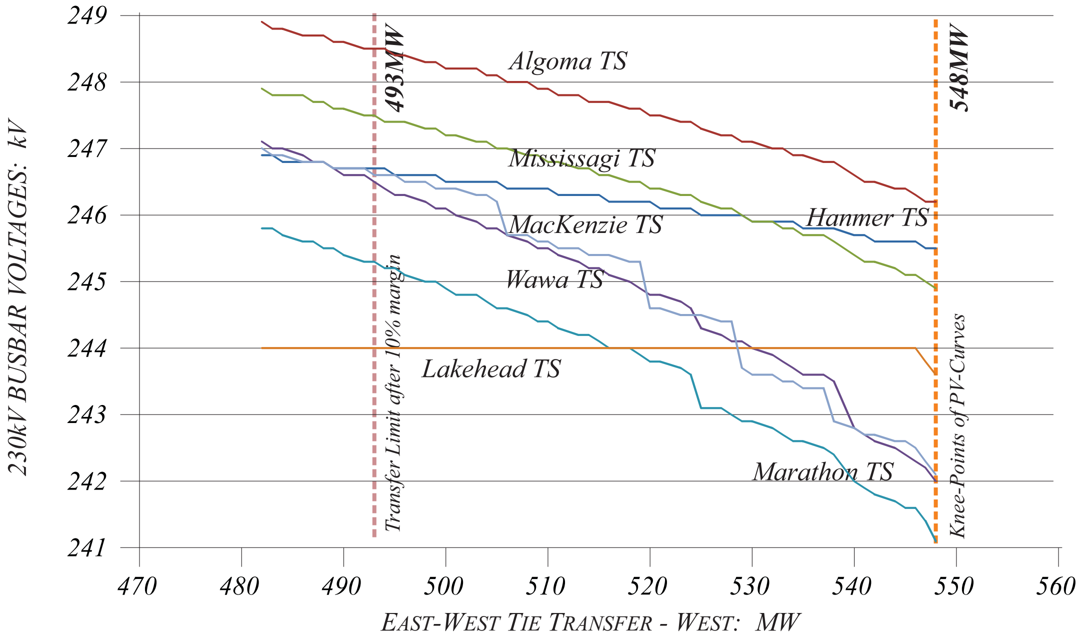


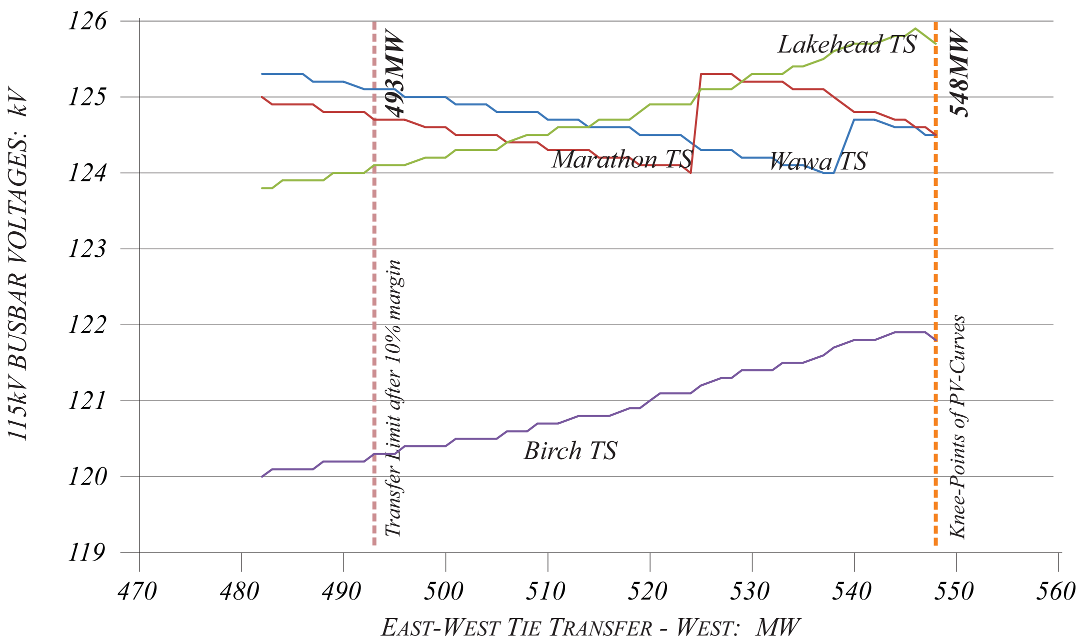
East West Tie Reinforcement: Lakehead TS to Wawa TS

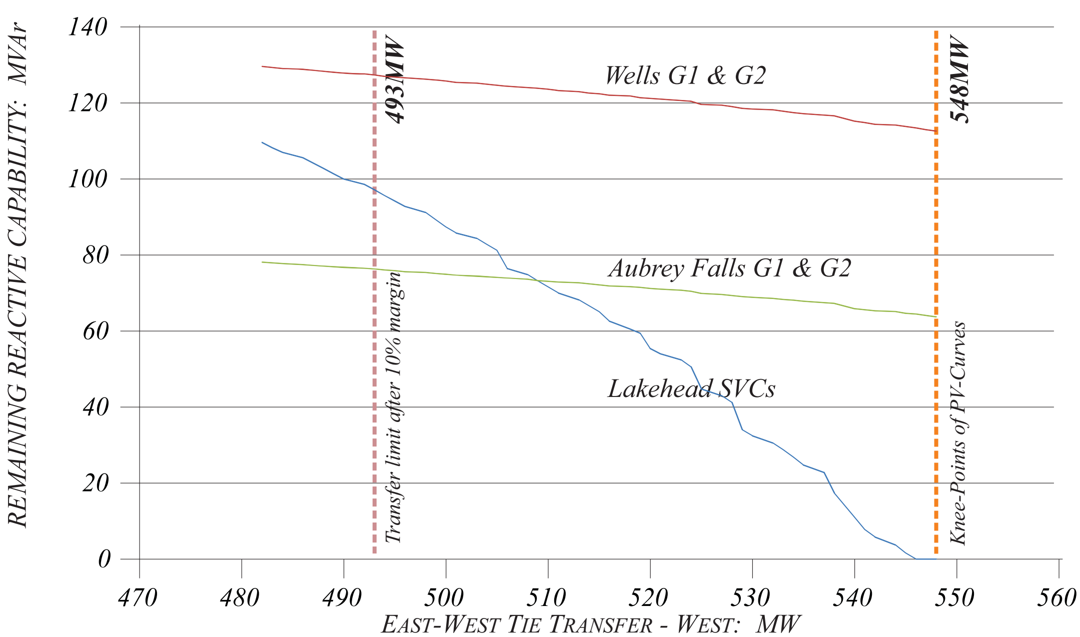
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation: Wawa x Marathon & 50% series compensation: Marathon x Lakehead
With no SVC at Marathon TS
East-West Tie transfer: 482MW

DIAGRAM 11

23rd December2012







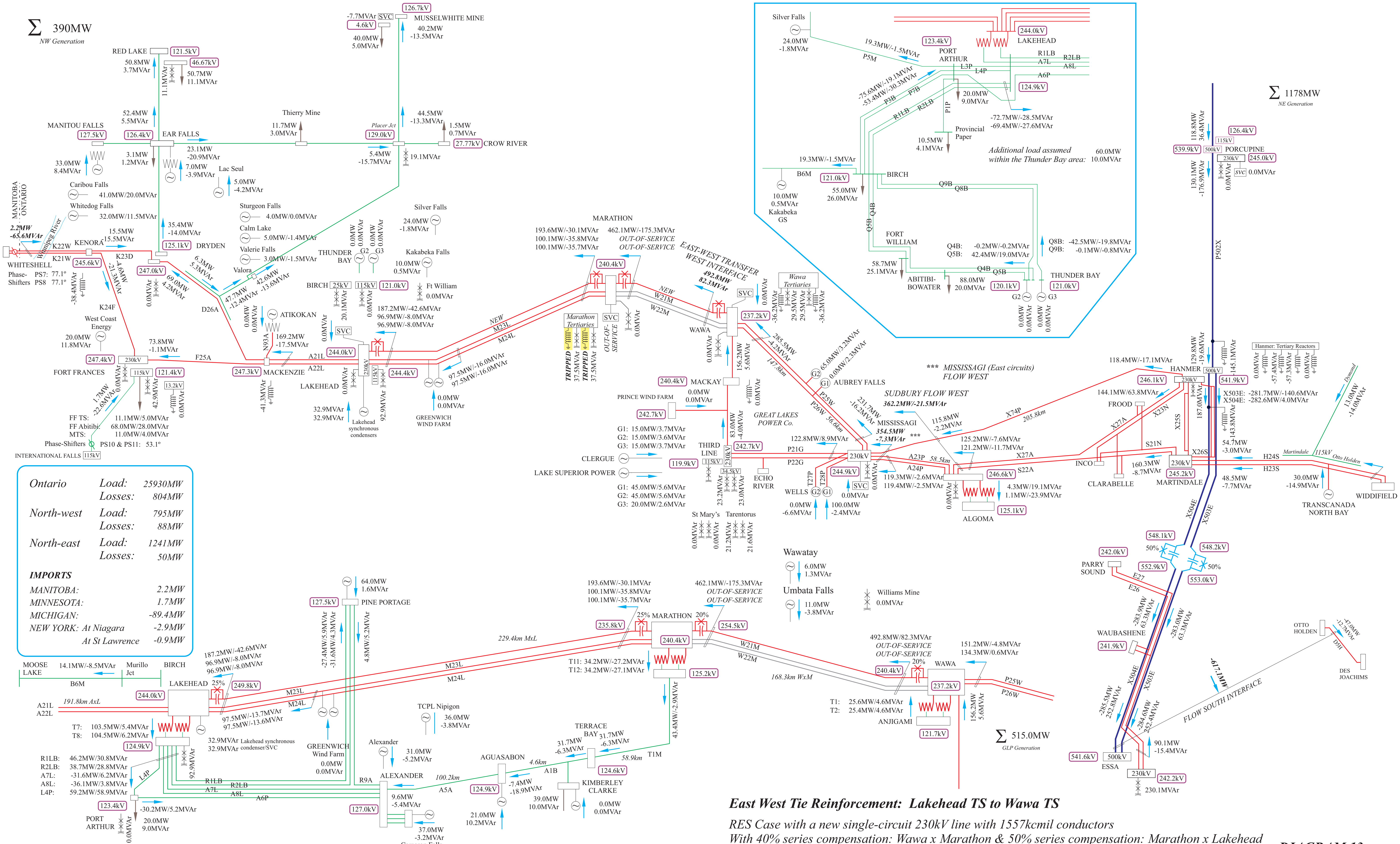
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With series compensation: 40% Wawa x Marathon & 50% Marathon x Lakehead
With no SVC at Marathon TS
Pre-Contingency

PV-analysis

Pre-Contingency

DIAGRAM 12

23rd December 2012



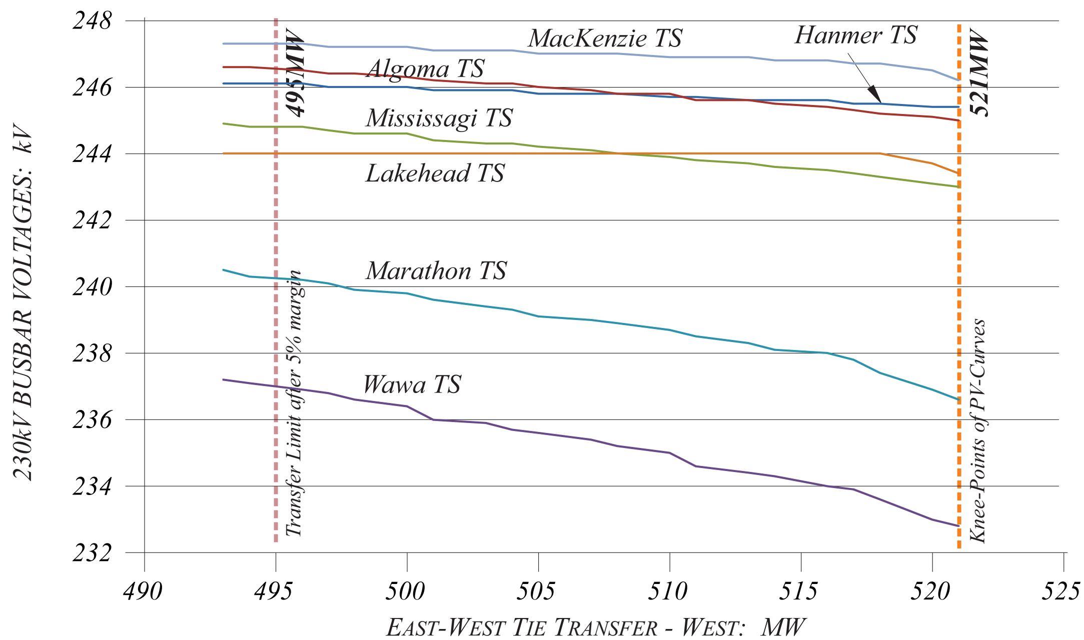
East West Tie Reinforcement: Lakehead TS to Wawa TS

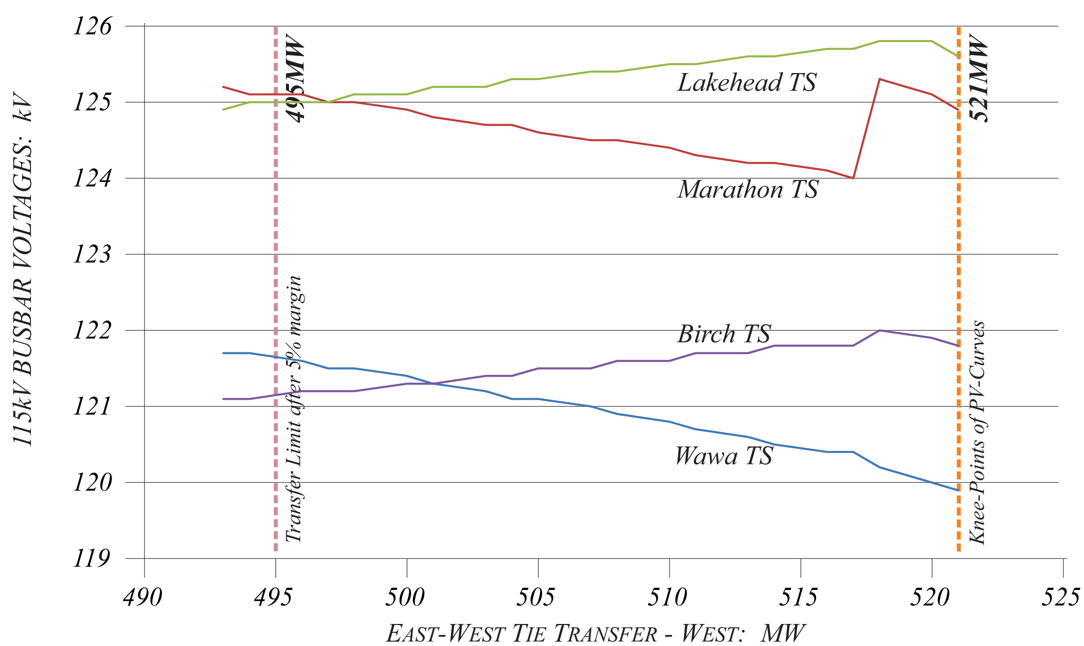
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation: Wawa x Marathon & 50% series compensation: Marathon x Lakehead
With no SVC at Marathon TS

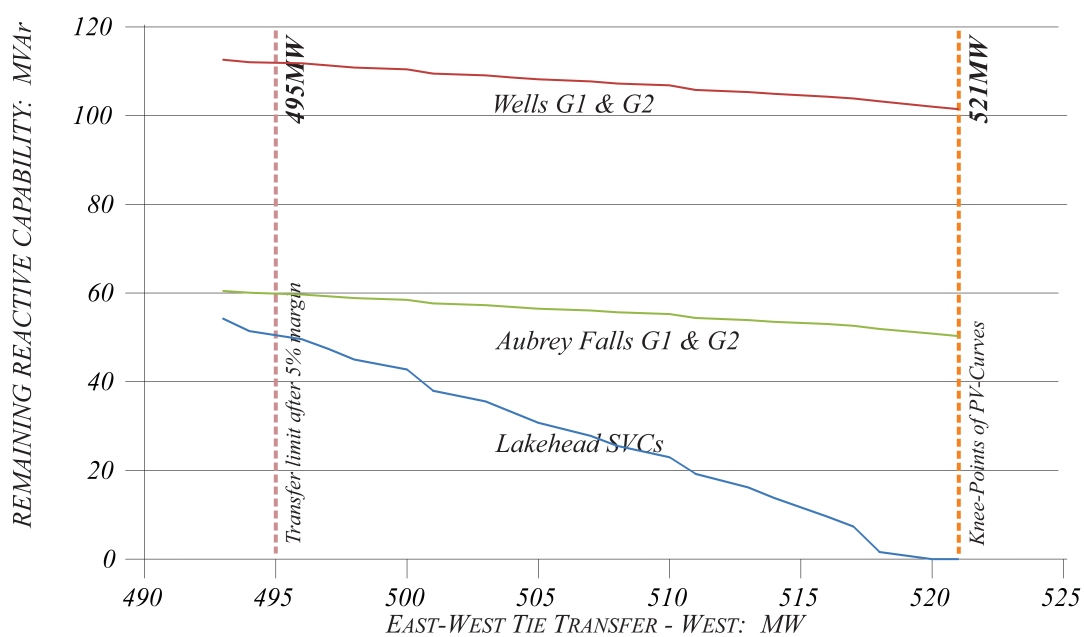
Contingency: *Existing double-circuit line between Wawa TS & Marathon TS (W21M + W22M)*
Marathon reactors tripped

DIAGRAM 13

23rd December 2012







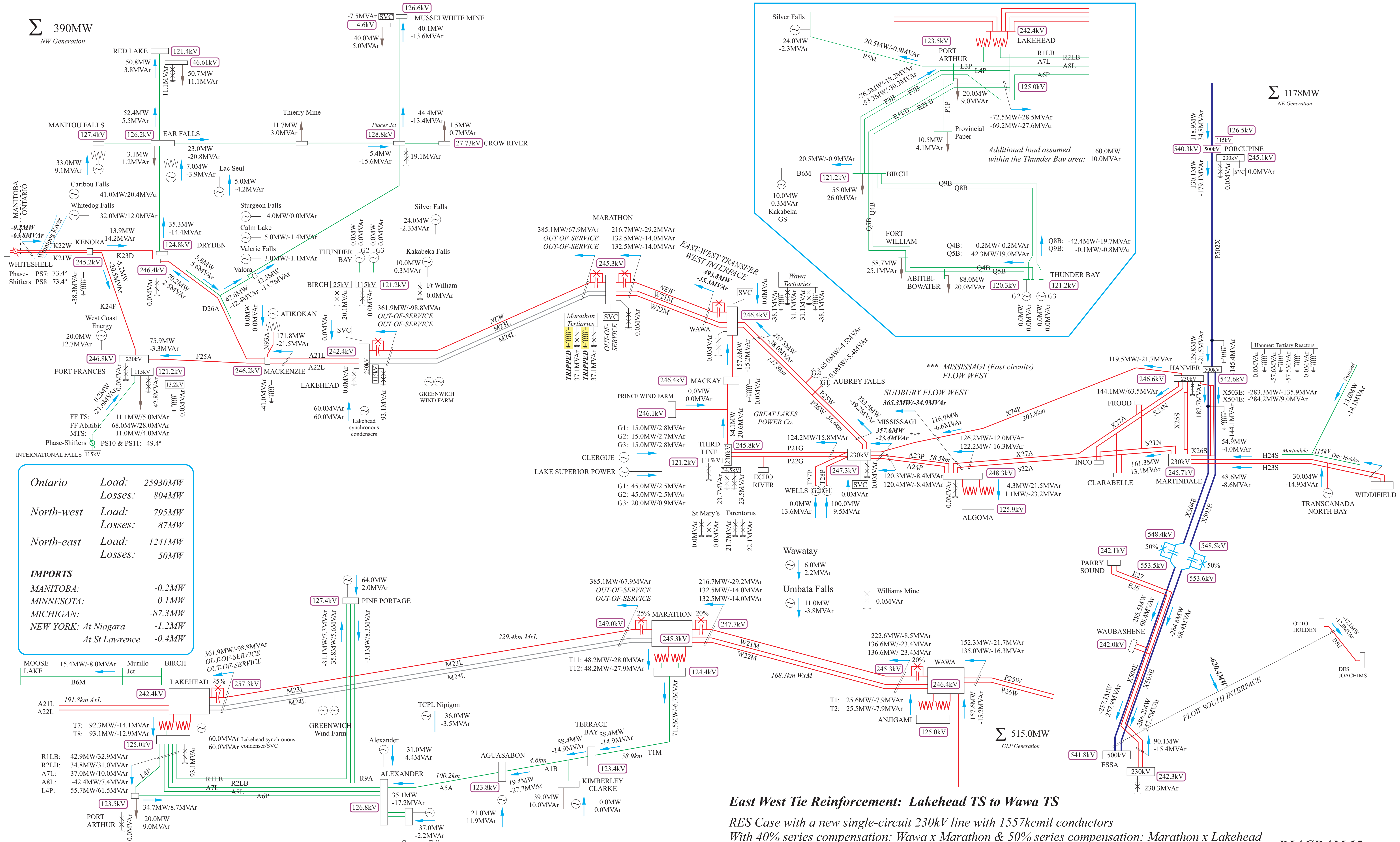
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With series compensation: 40% Wawa x Marathon & 50% Marathon x Lakehead
With no SVC at Marathon TS
Contingency: Double-circuit contingency between Wawa TS & Marathon TS
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 14

23rd December 2012



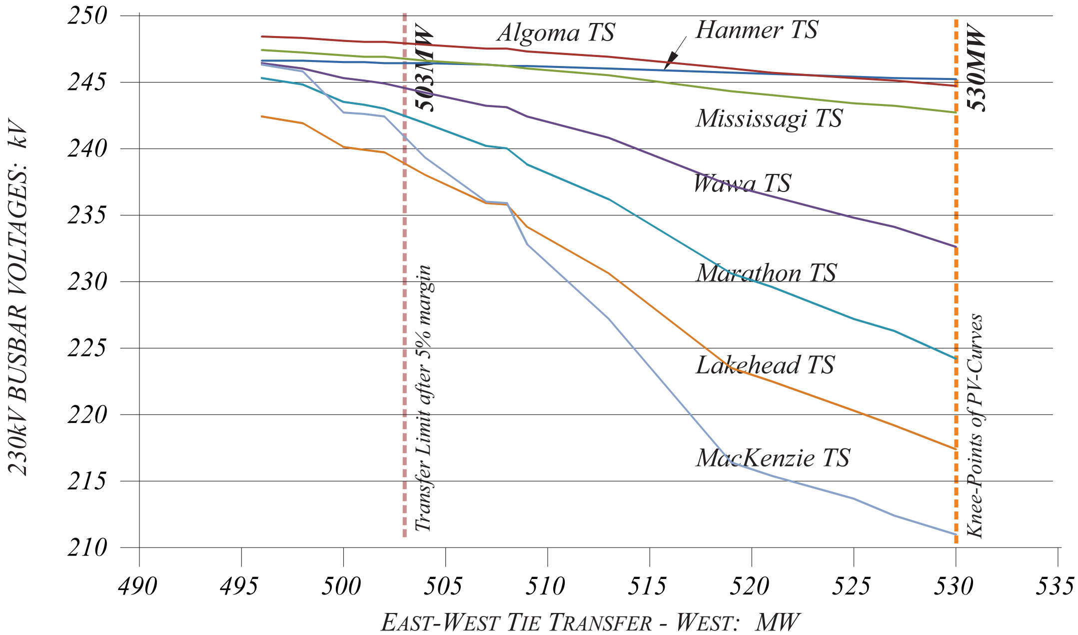
East West Tie Reinforcement: Lakehead TS to Wawa TS

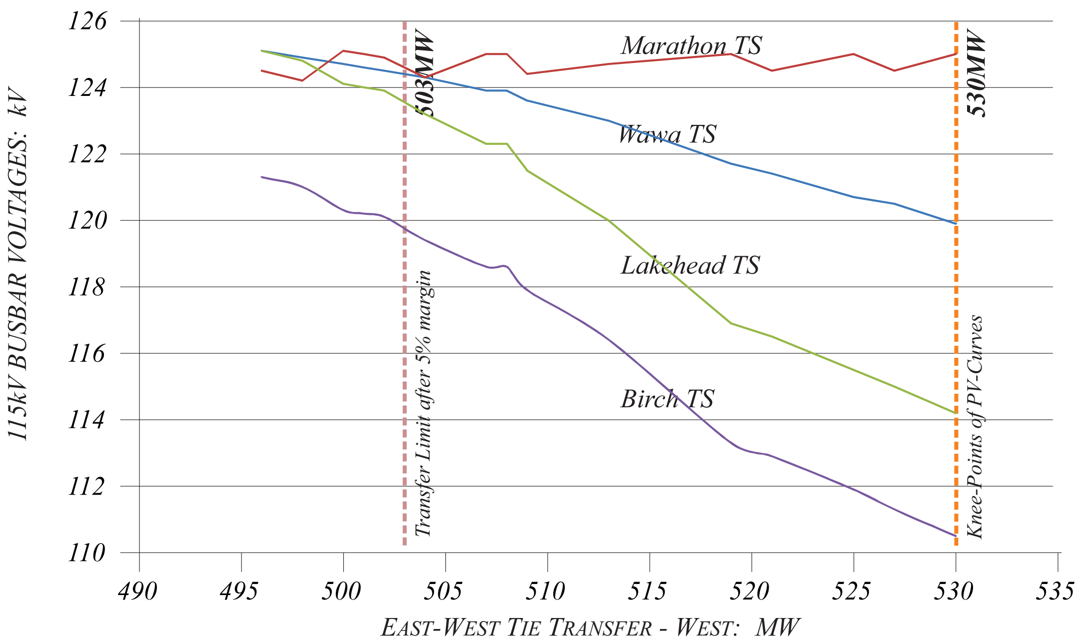
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation: Wawa x Marathon & 50% series compensation: Marathon x Lakehead
With no SVC at Marathon TS

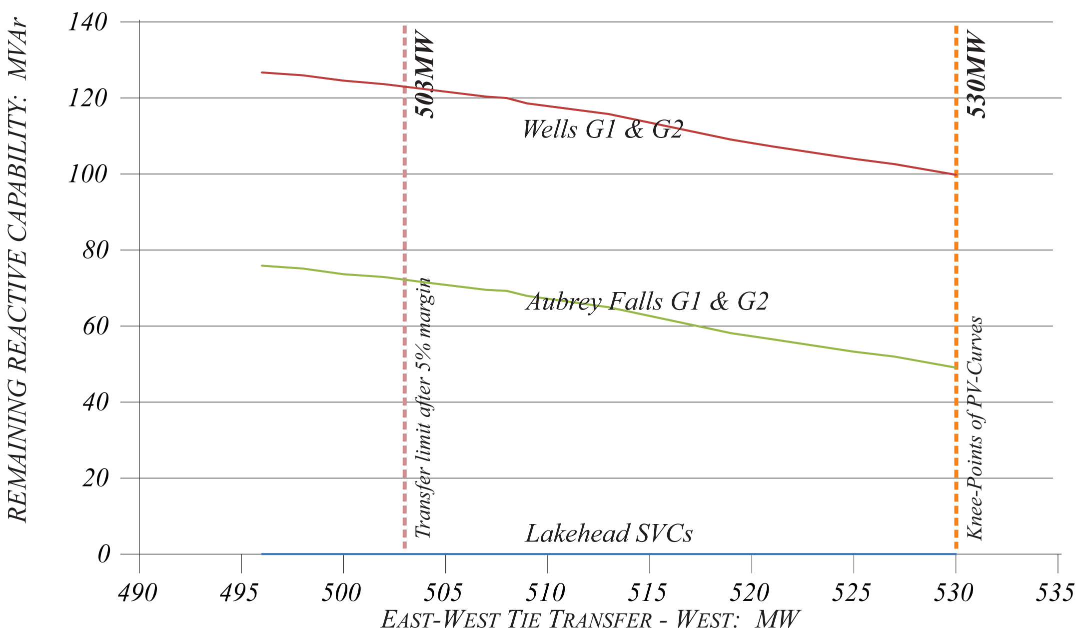
Contingency: *Existing double-circuit line between Marathon TS & Lakehead (M23L + M24L)*
Marathon reactors tripped

DIAGRAM 15

23rd December 2012







East-West Tie Reinforcement:

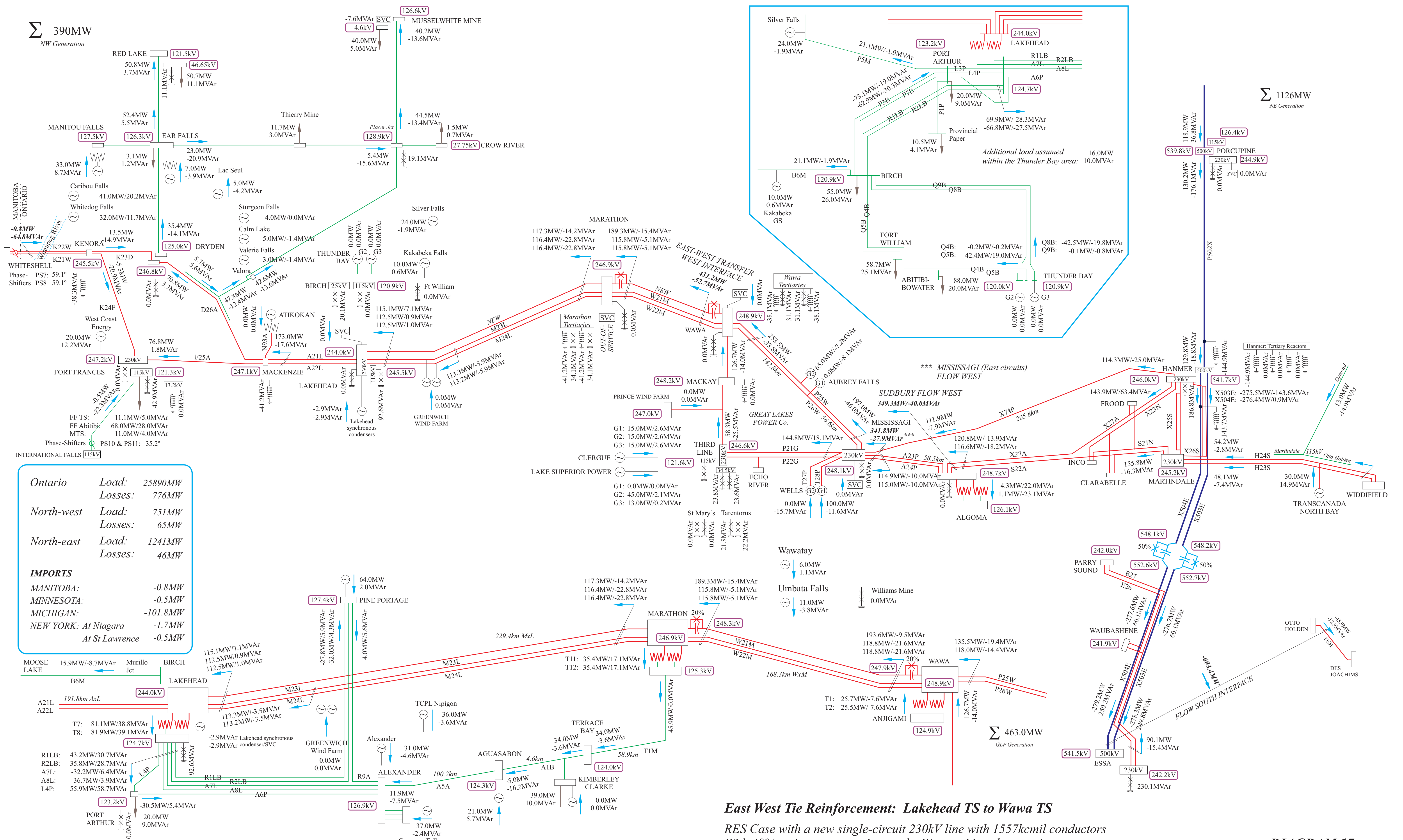
Case with a new single-circuit 230kV line with 1557kcmil conductors
With series compensation: 40% Wawa x Marathon & 50% Marathon x Lakehead
With no SVC at Marathon TS
Contingency: Double-circuit contingency between Marathon TS & Lakehead TS
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 16

23rd December 2012

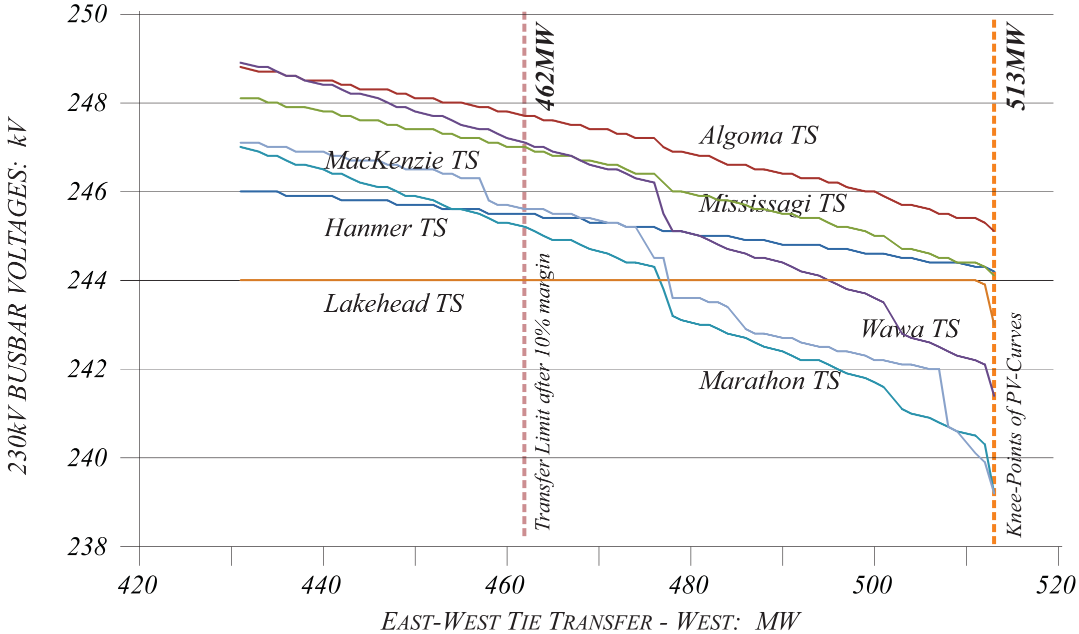


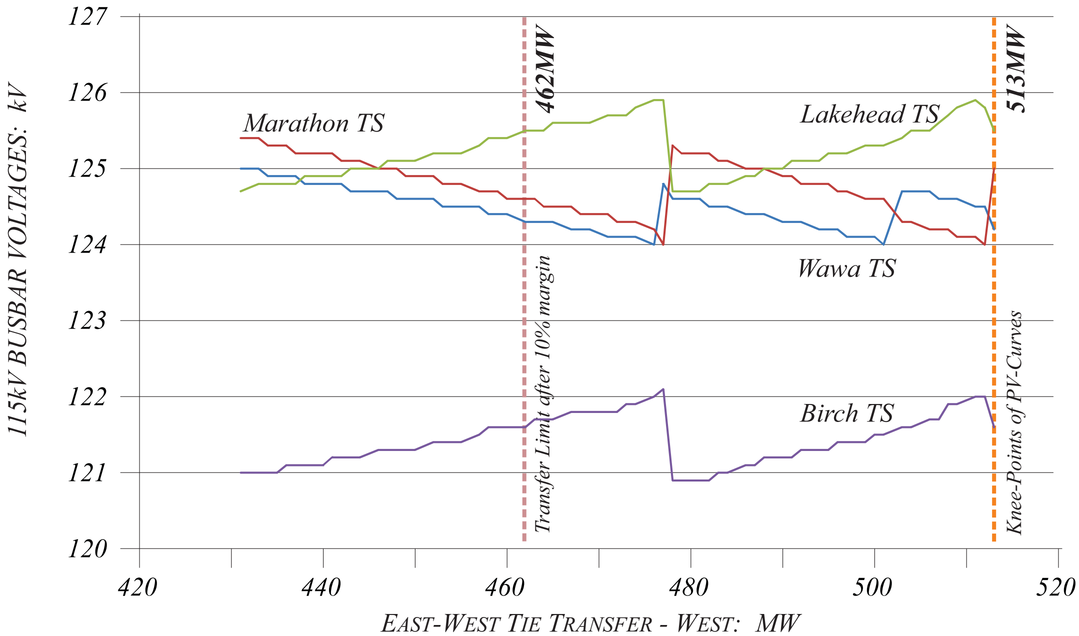
East West Tie Reinforcement: Lakehead TS to Wawa TS

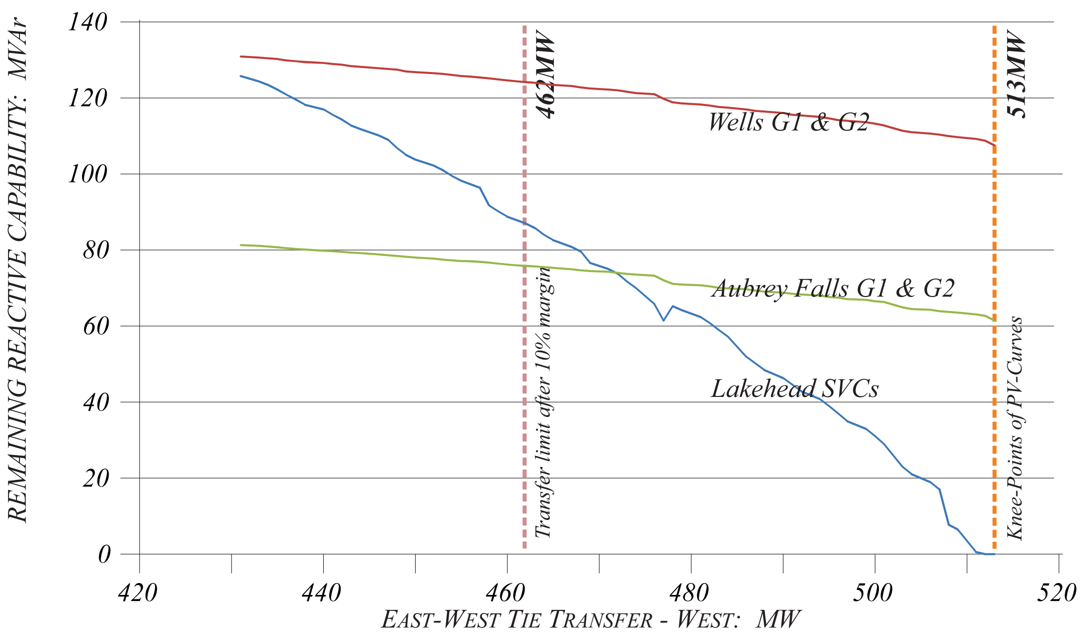
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation on the Wawa x Marathon section
With no SVC at Marathon TS
East-West Tie transfer: 431MW

DIAGRAM 17

23rd December 2012







East-West Tie Reinforcement:

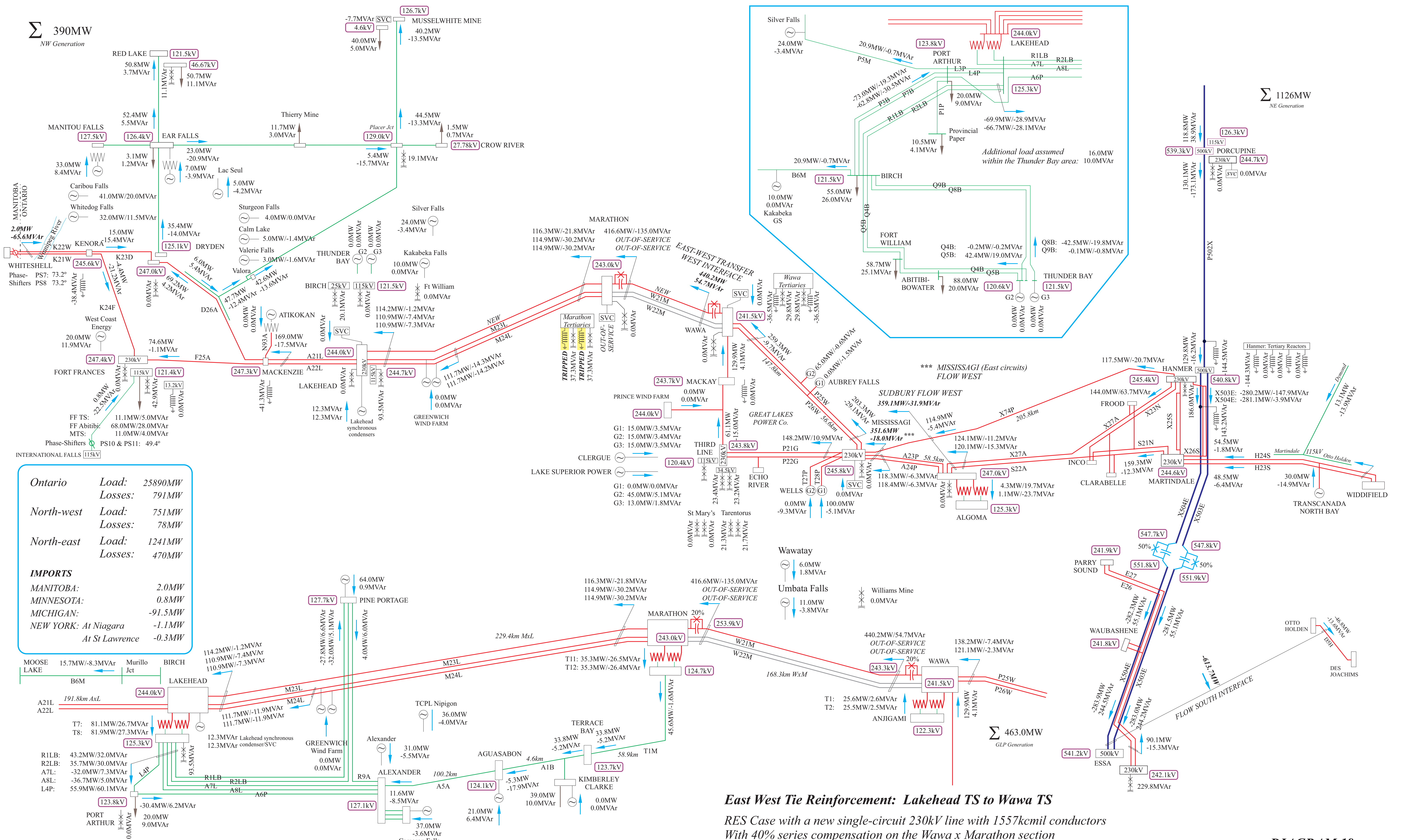
Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation on the Wawa x Marathon section
With no SVC at Marathon TS
Pre-Contingency

PV-analysis

Pre-Contingency

DIAGRAM 18

23rd December 2012



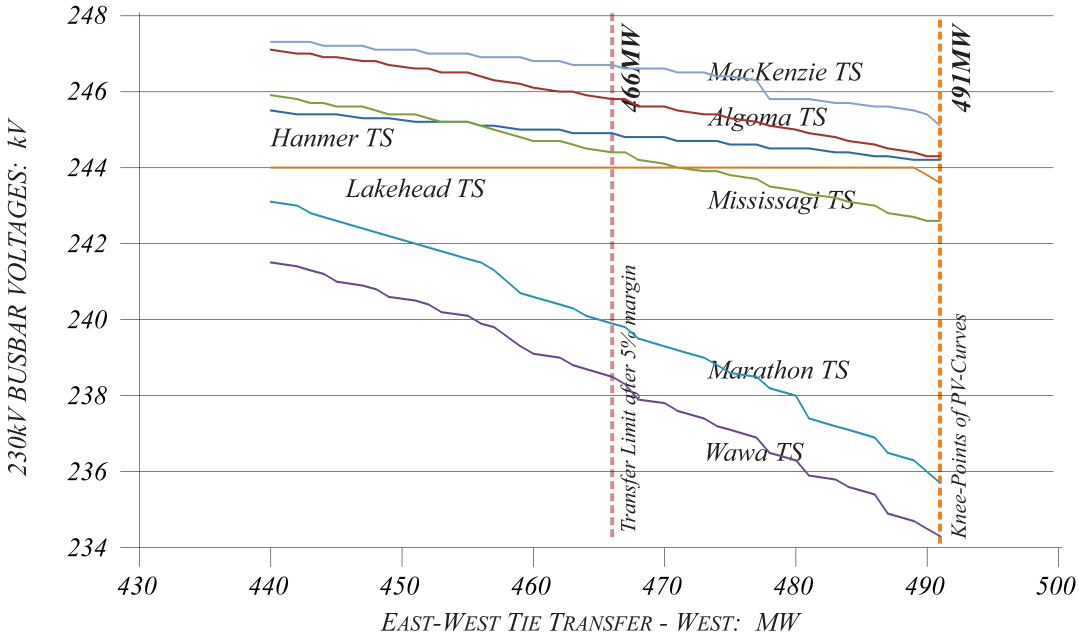
East West Tie Reinforcement: Lakehead TS to Wawa TS

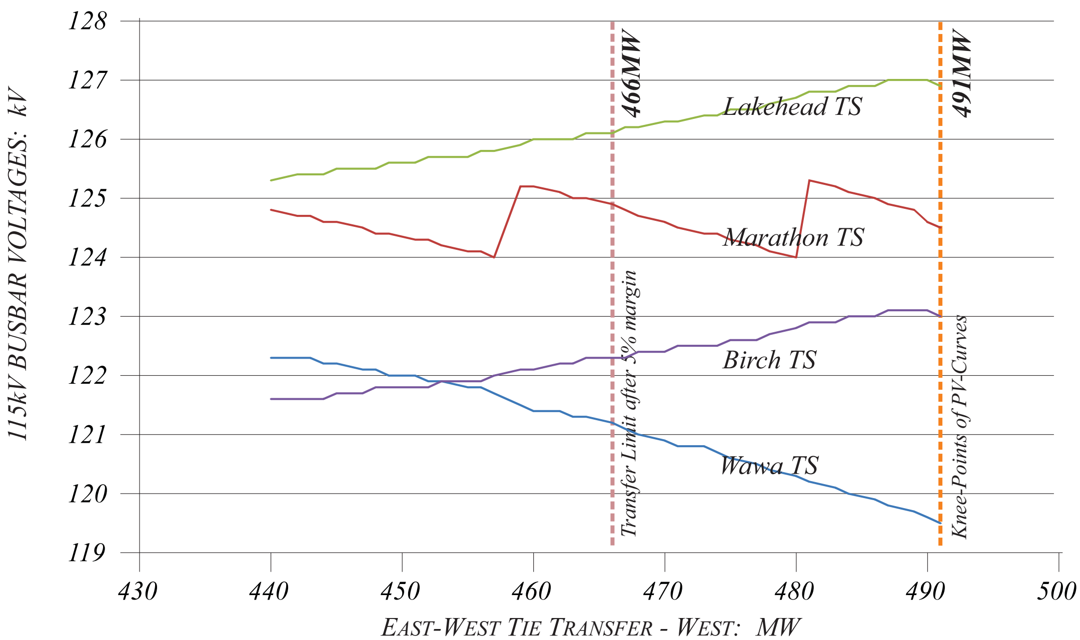
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation on the Wawa x Marathon section
With no SVC at Marathon TS

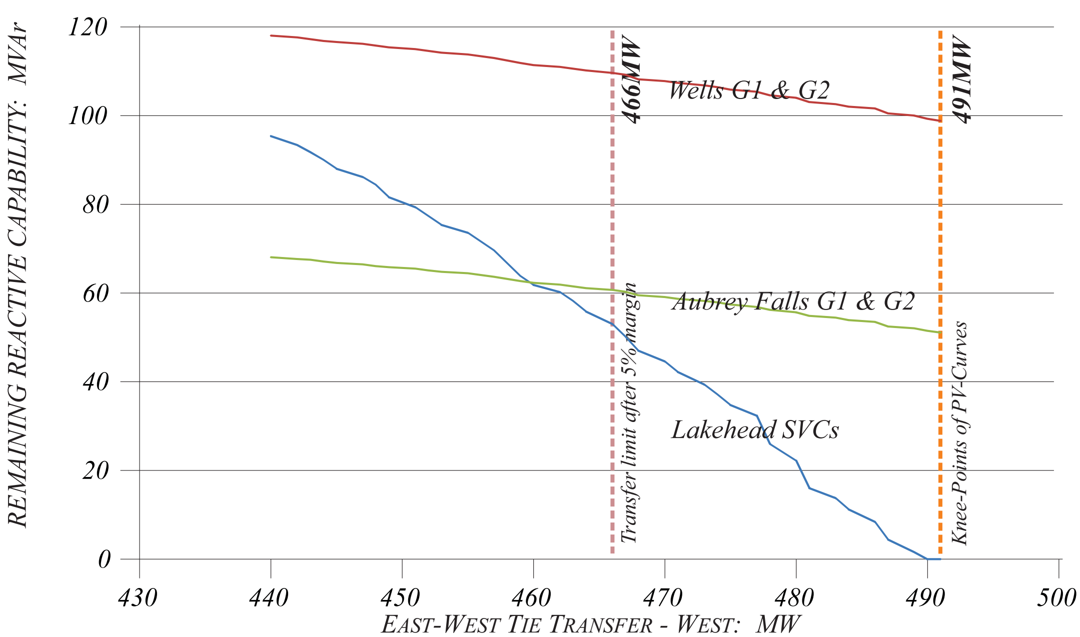
Contingency: *Existing double-circuit line between Wawa TS & Marathon TS (W21M + W22M)*
Marathon reactors tripped

DIAGRAM 19

23rd December 2012







East-West Tie Reinforcement:

Case with a new single-circuit 230kV line with 1557kcmil conductors

With 40% series compensation on the Wawa x Marathon section

With no SVC at Marathon TS

Contingency: Double-circuit contingency between Wawa TS & Marathon TS

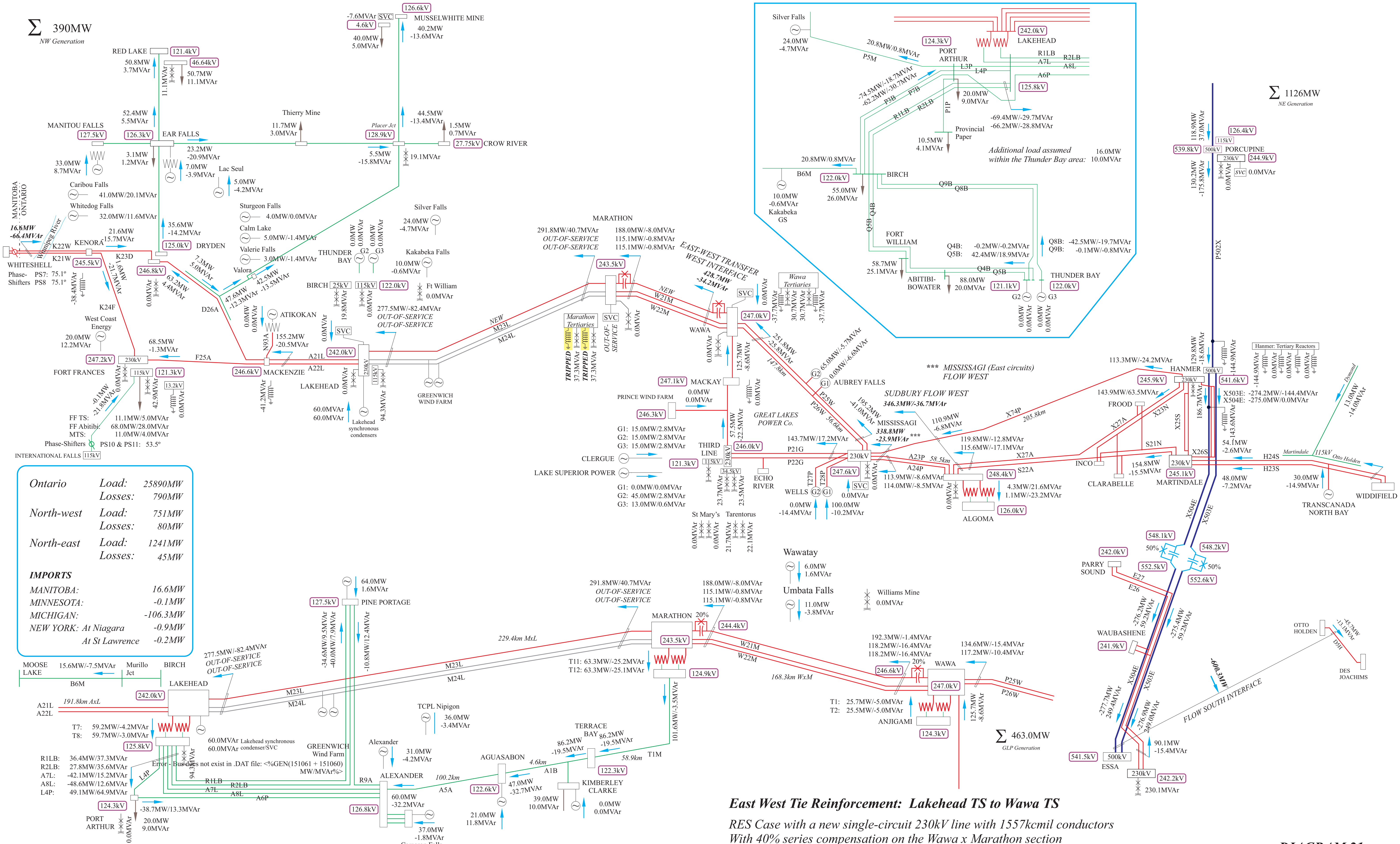
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 20

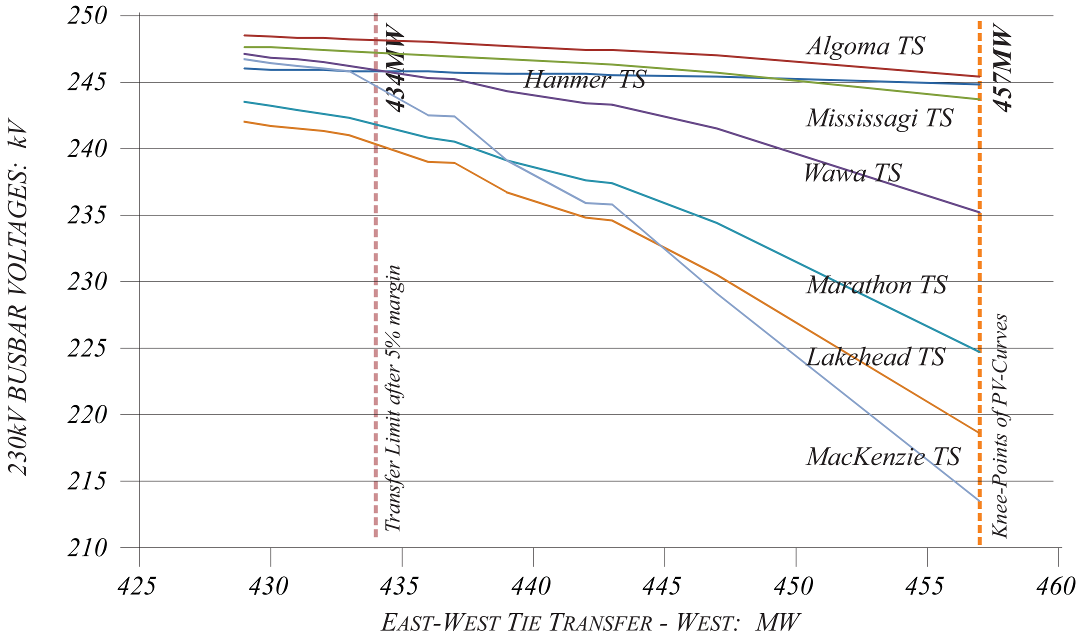
23rd December 2012

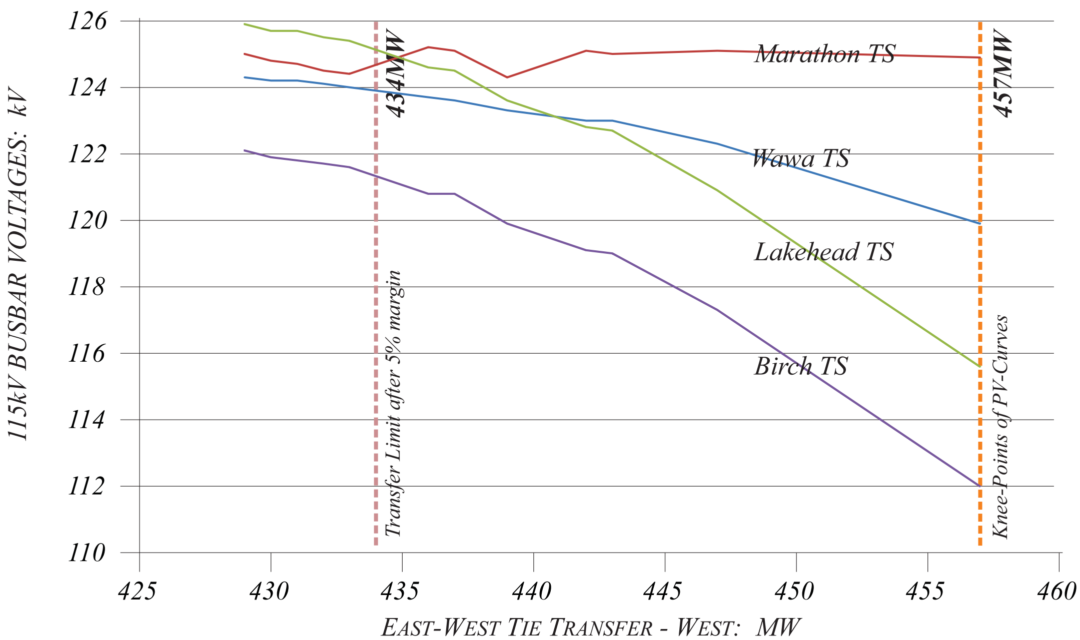


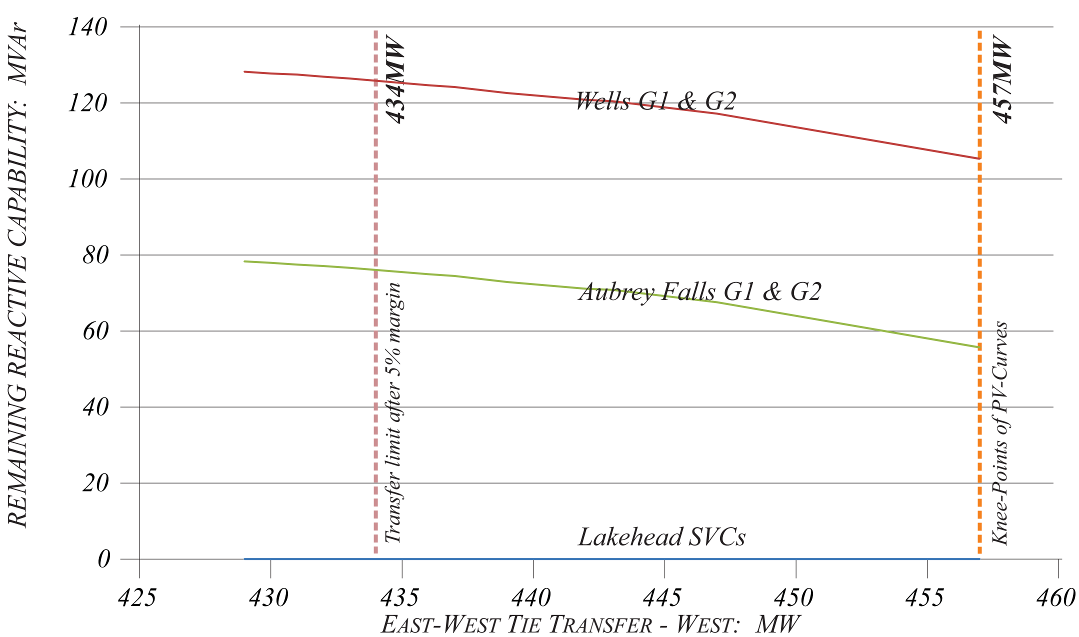
East West Tie Reinforcement: Lakehead TS to Wawa TS

RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation on the Wawa x Marathon section
With no SVC at Marathon TS

Contingency: *Existing double-circuit line between Marathon TS & Lakehead TS (M23L + M24L)*
Marathon reactors tripped







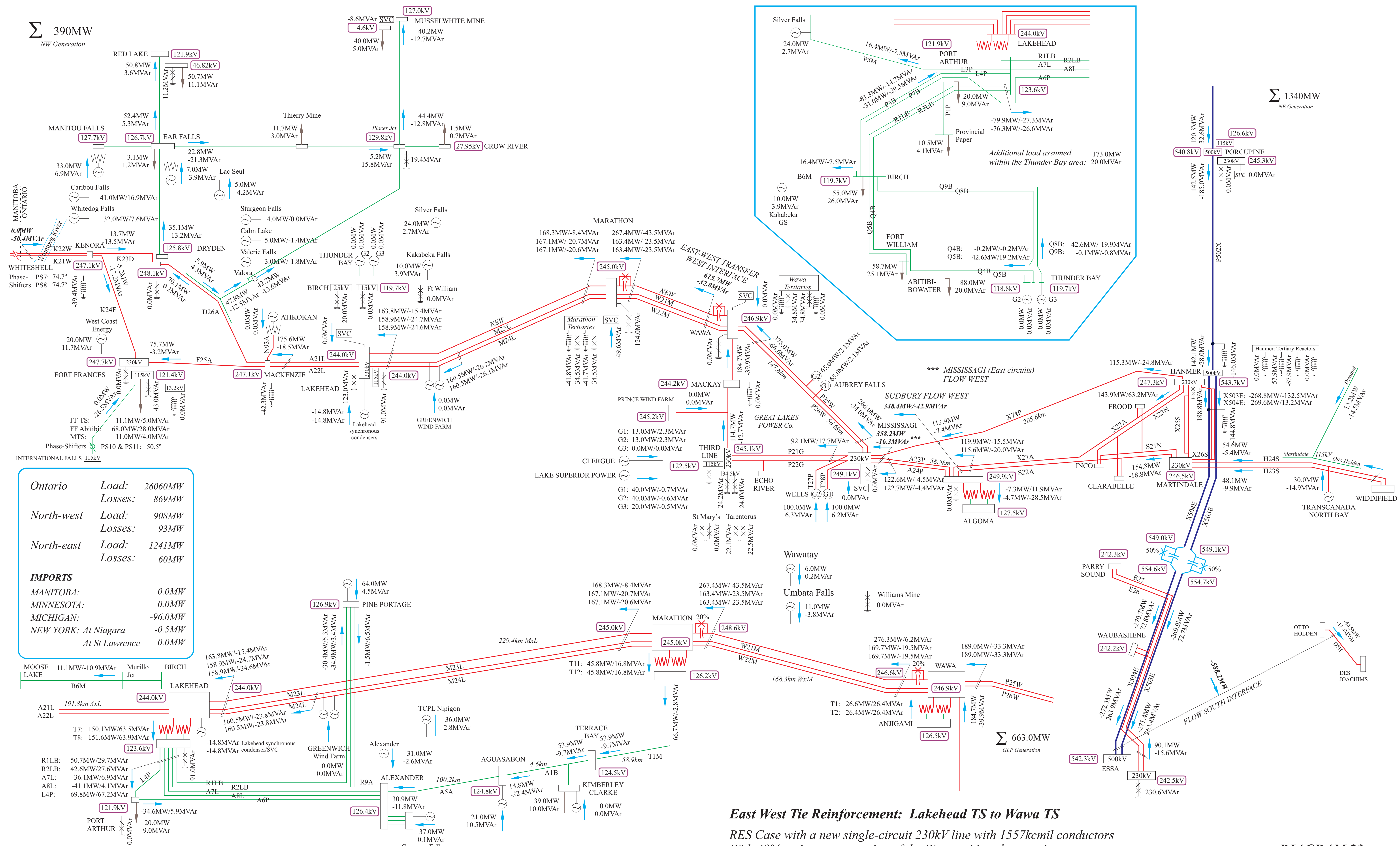
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation on the Wawa x Marathon section
With no SVC at Marathon TS
Contingency: Double-circuit contingency between Marathon TS & Lakehead TS
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 22

23rd December 2012

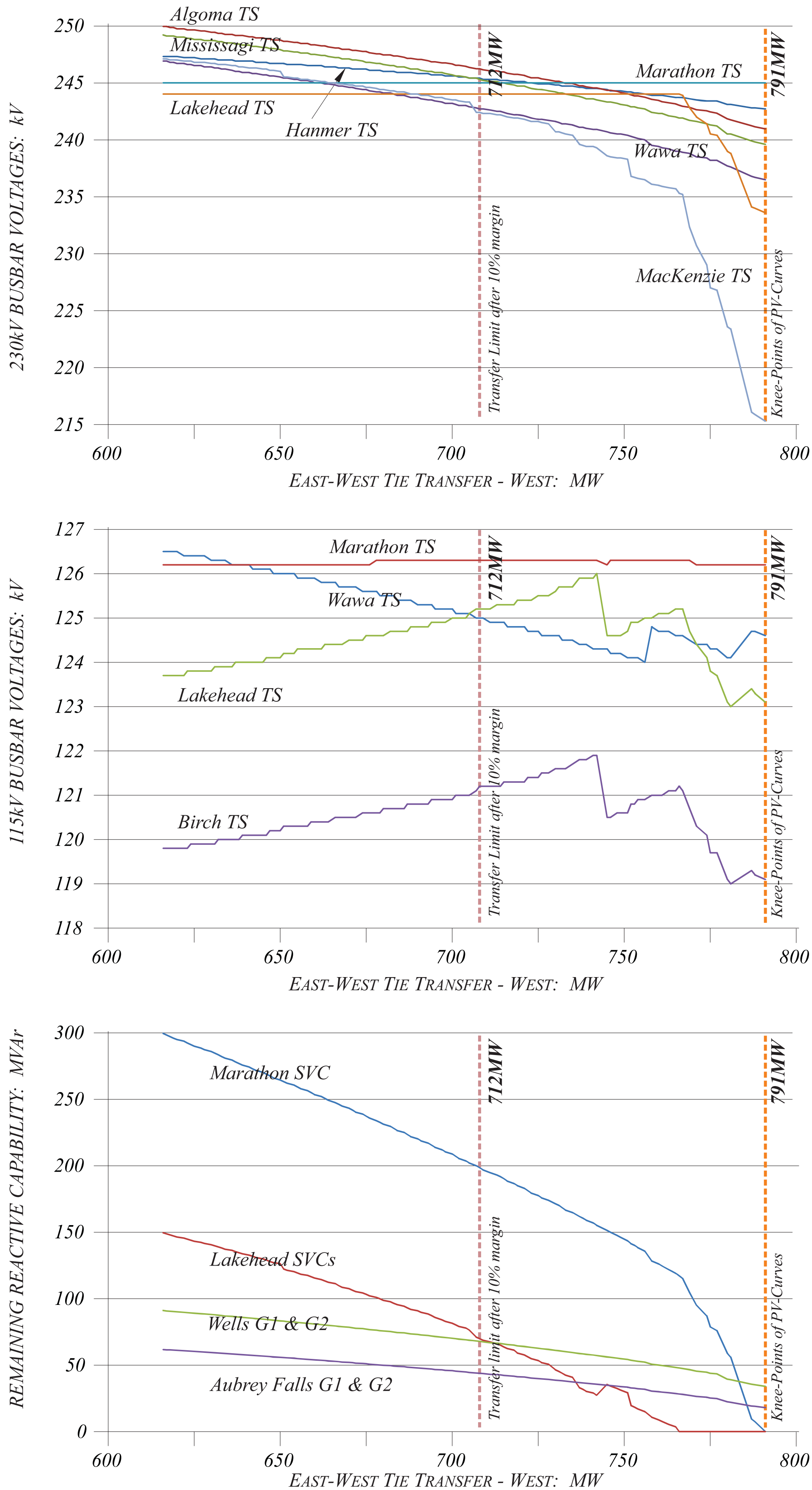


East West Tie Reinforcement: Lakehead TS to Wawa TS

RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation of the Wawa x Marathon section
With a 250/-100MVAr SVC at Marathon TS
East-West Tie transfer: 615MW

DIAGRAM 23

22nd December 2012



East-West Tie Reinforcement:

Case with a new single-circuit 230kV line with 1557kcmil conductors

With 40% series compensationon the Wawa x Marathon section

With a +250/-100MVAr SVC at Marathon TS

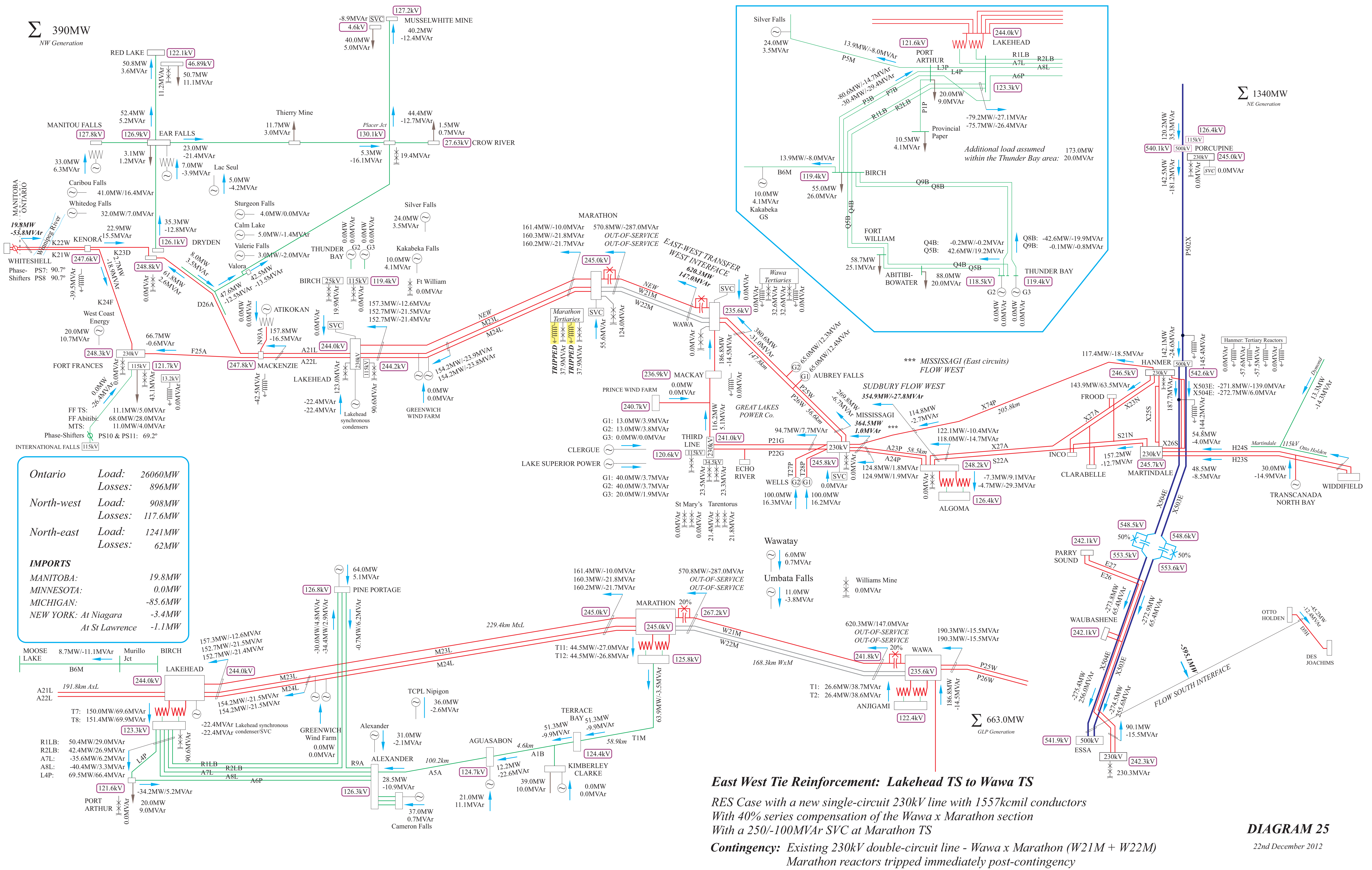
Pre-Contingency

PV-analysis

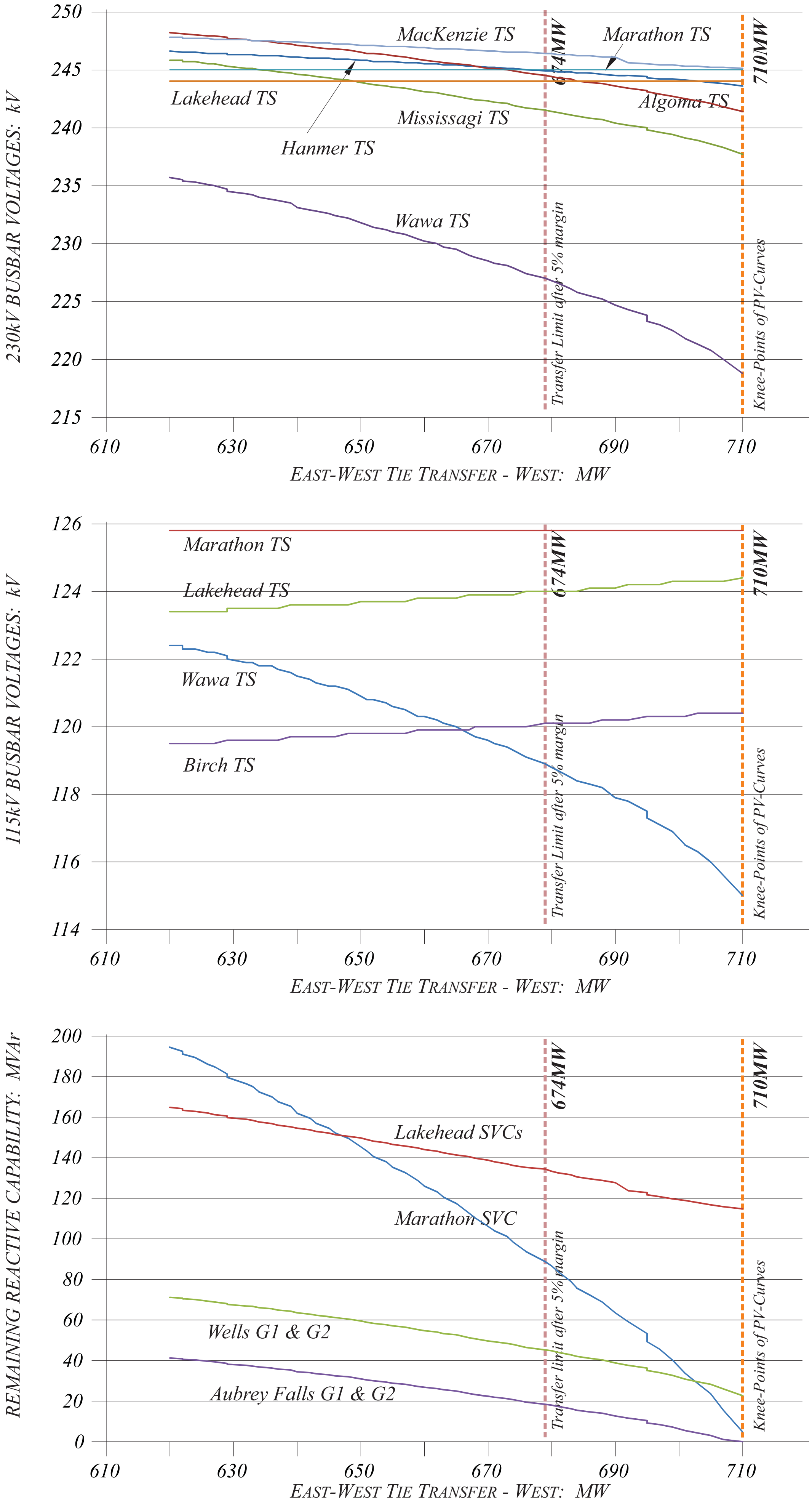
Pre-Contingency

DIAGRAM 24

22nd December 2012



Σ 390MW
NW Generation
Σ 1340MW
NE Generation
Σ 663.0MW
GLP Generation
Ontario Load: 26060MW
Losses: 896MW
North-west Load: 908MW
Losses: 117.6MW
North-east Load: 1241MW
Losses: 62MW
IMPORTS
MANITOBA: 19.8MW
MINNESOTA: 0.0MW
MICHIGAN: -85.6MW
NEW YORK: At Niagara -3.4MW
At St Lawrence -1.1MW
EAST-WEST TRANSFER
WEST INTERFACE
620.3MW
147.0MVAr
SUDBURY FLOW WEST
354.9MW/-27.8MVAr
*** MISSISSAGI (East circuits) FLOW WEST
FLOW SOUTH INTERFACE
-595.1MW
Additional load assumed within the Thunder Bay area: 173.0MW 20.0MVAr
RED LAKE
EAR FALLS
MANITOU FALLS
DRYDEN
KENORA
WHITESHELL
FORT FRANCES
MACKENZIE
LAKEHEAD
MARATHON
WAWA
MACKAY
MISSISSAGI
ALGOMA
HANMER
PORCUPINE
MARTINDALE
ESSA
PARRY SOUND
WAUBASHENE
TRANSCANADA NORTH BAY
WIDDIFIELD
PORT ARTHUR
BIRCH
THUNDER BAY
ALEXANDER
AGUASABON
TERRACE BAY
KIMBERLEY CLARKE
ANJIGAMI
PINE PORTAGE
East West Tie Reinforcement: Lakehead TS to Wawa TS
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation of the Wawa x Marathon section
With a 250/-100MVAr SVC at Marathon TS
Contingency: Existing 230kV double-circuit line - Wawa x Marathon (W21M + W22M)
Marathon reactors tripped immediately post-contingency
DIAGRAM 25
22nd December 2012



East-West Tie Reinforcement:

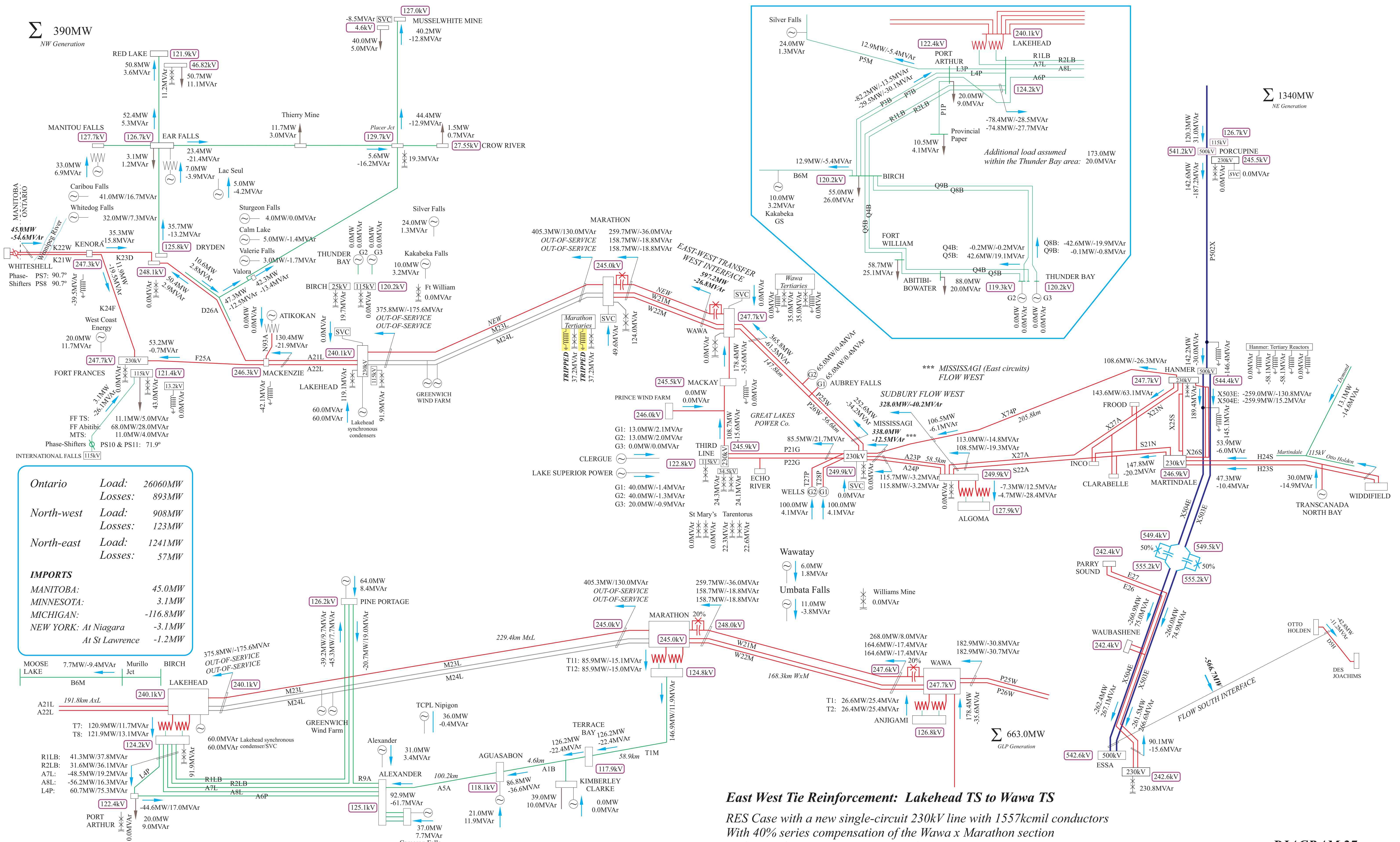
Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation on the Wawa x Marathon section
With a +250/-100MVAr SVC at Marathon TS
Contingency: Double-circuit contingency between Wawa TS & Marathon TS
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 26

22nd December 2012



Ontario	*Load:*	*26060MW*
	Losses:	*893MW*
North-west	*Load:*	*908MW*
	Losses:	*123MW*
North-east	*Load:*	*1241MW*
	Losses:	*57MW*

IMPORTS

MANITOBA:		*45.0MW*
MINNESOTA:		*3.1MW*
MICHIGAN:		*-116.8MW*
NEW YORK:	*At Niagara*	*-3.1MW*
	At St Lawrence	*-1.2MW*

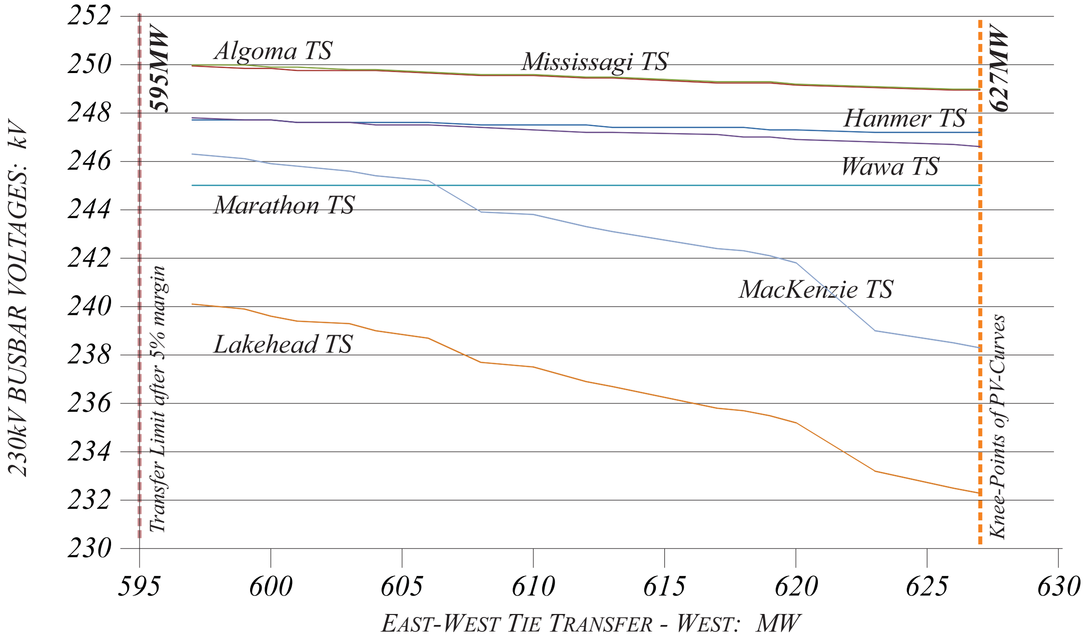
East West Tie Reinforcement: Lakehead TS to Wawa TS

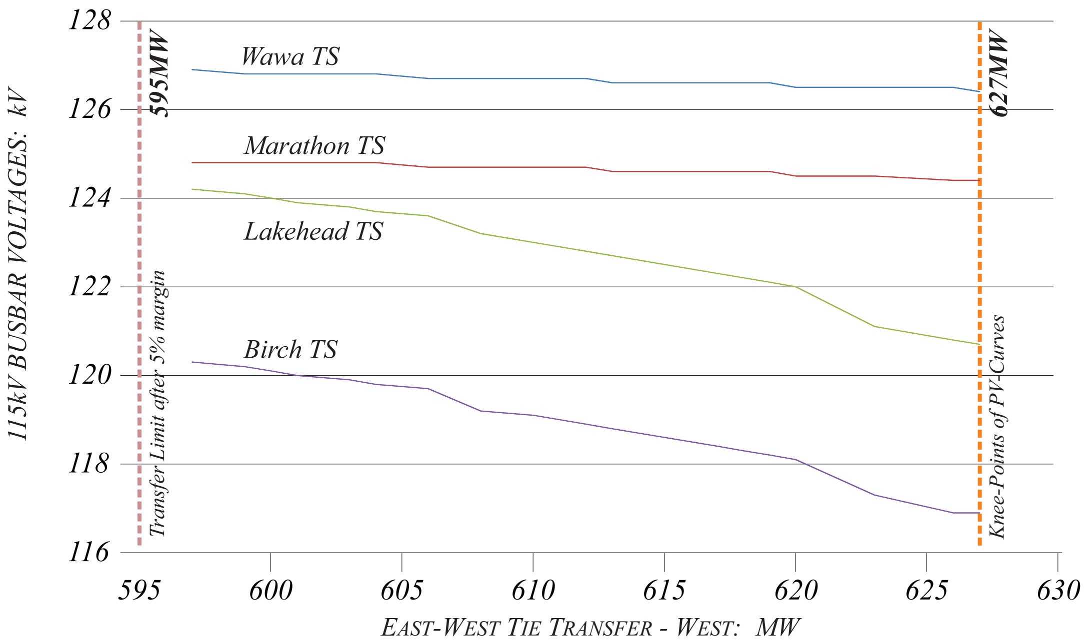
RES Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation of the Wawa x Marathon section
With a 250/-100MVAr SVC at Marathon TS

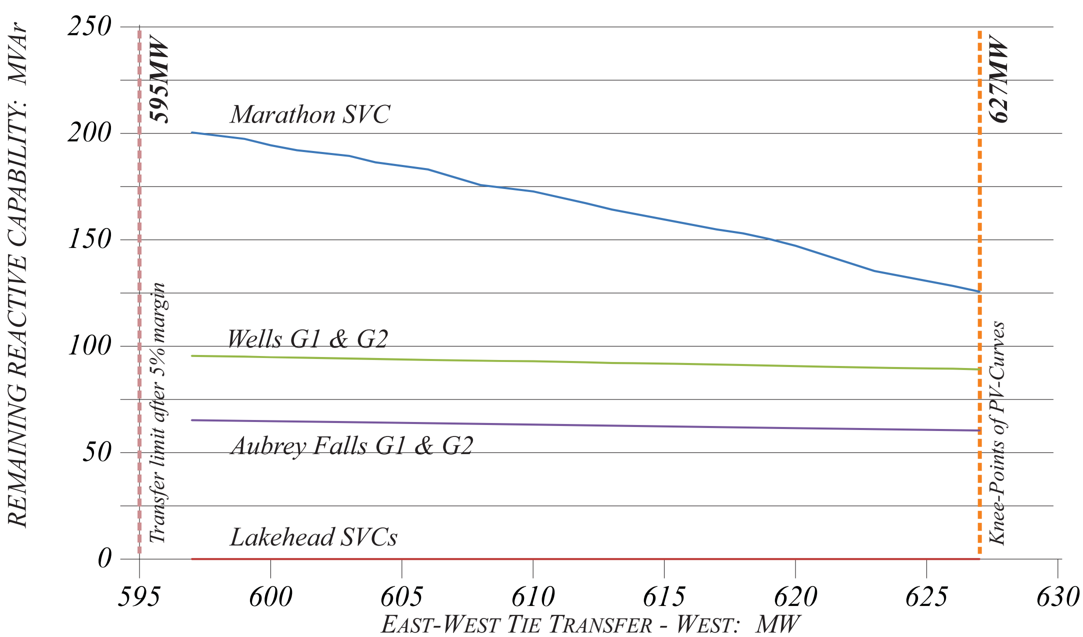
Contingency: *Existing 230kV double-circuit line - Marathon x Lakehead (M23L + M24L)*
Marathon reactors tripped immediately post-contingency

DIAGRAM 27

22nd December 2012







East-West Tie Reinforcement:

Case with a new single-circuit 230kV line with 1557kcmil conductors

With 40% series compensation on the Wawa x Marathon section

With a +250/-100MVAr SVC at Marathon TS

Contingency: Double-circuit contingency between Marathon TS & Lakehead TS

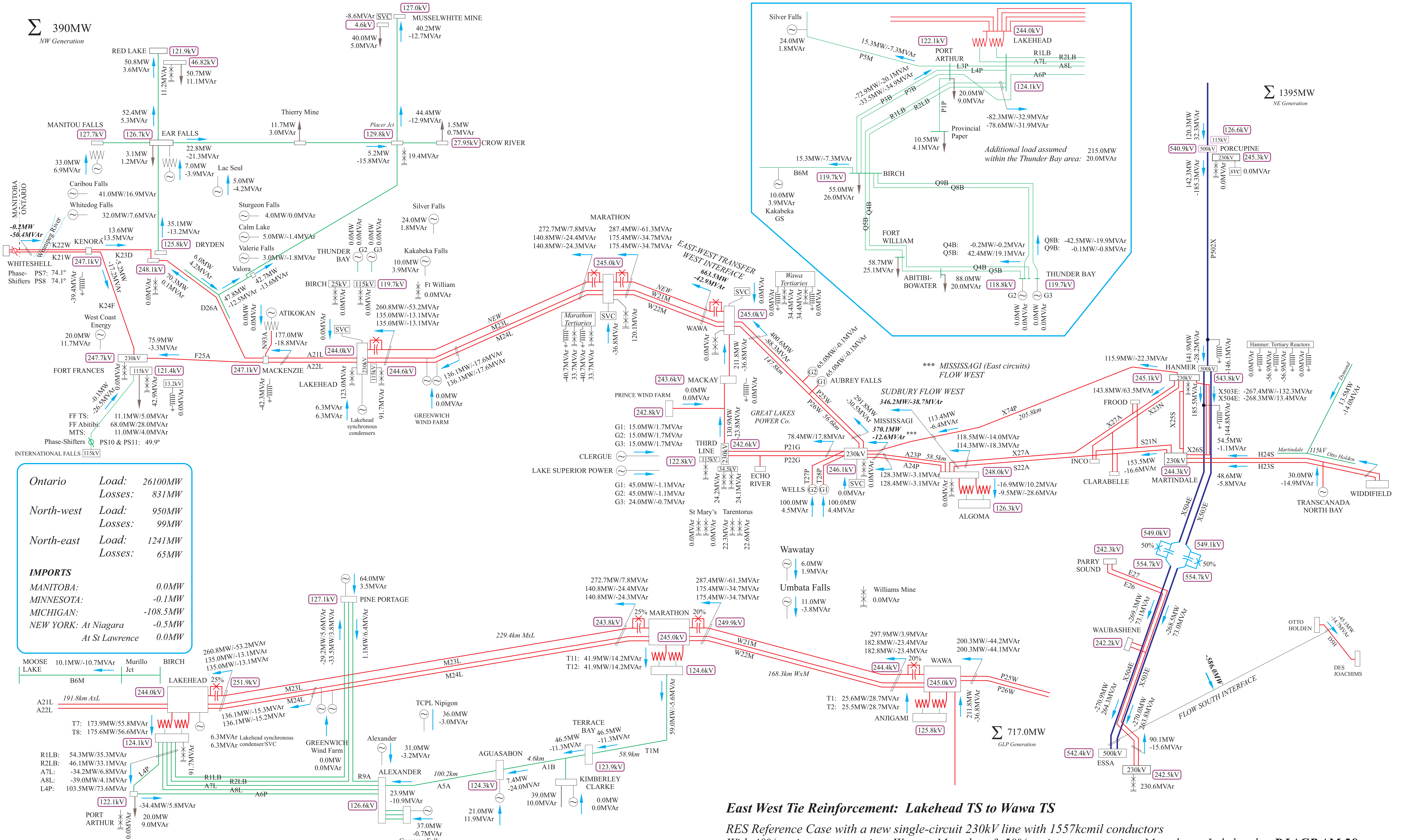
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 28

22nd December 2012



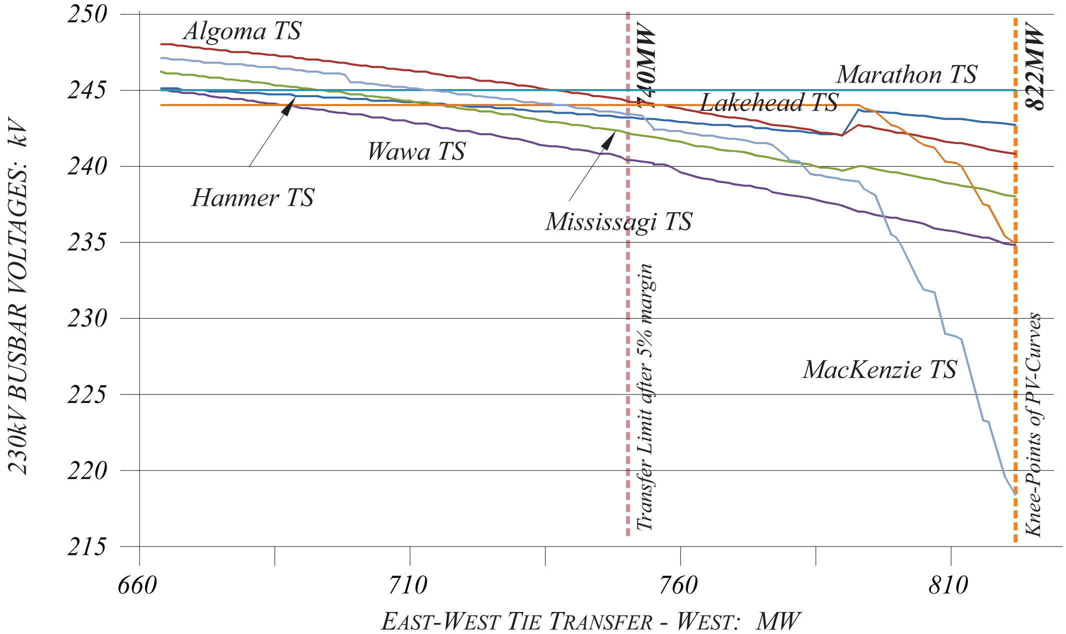
East West Tie Reinforcement: Lakehead TS to Wawa TS

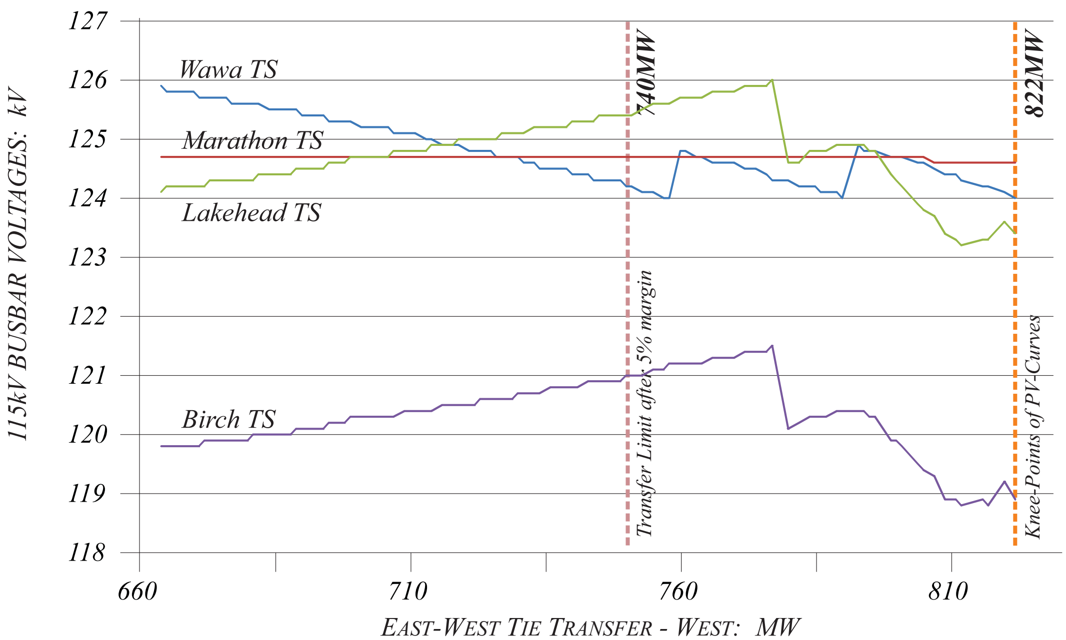
RES Reference Case with a new single-circuit 230kV line with 1557kcmil conductors

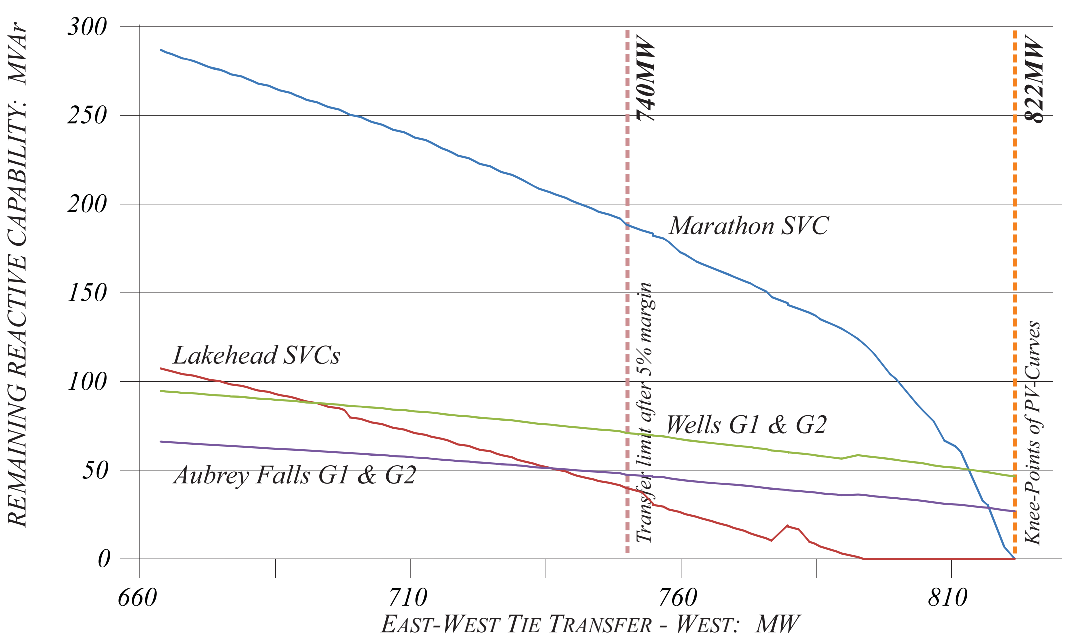
With 40% series compensation: Wawa x Marathon & 50% series compensation: Marathon x Lakehead

DIAGRAM 29

20th December 2012







East-West Tie Reinforcement:

Case with a new single-circuit 230kV line with 1557kcmil conductors

With series compensation: 40% Wawa x Marathon & 50% Marathon x Lakehead

With a +250/-100MVAr SVC at Marathon TS

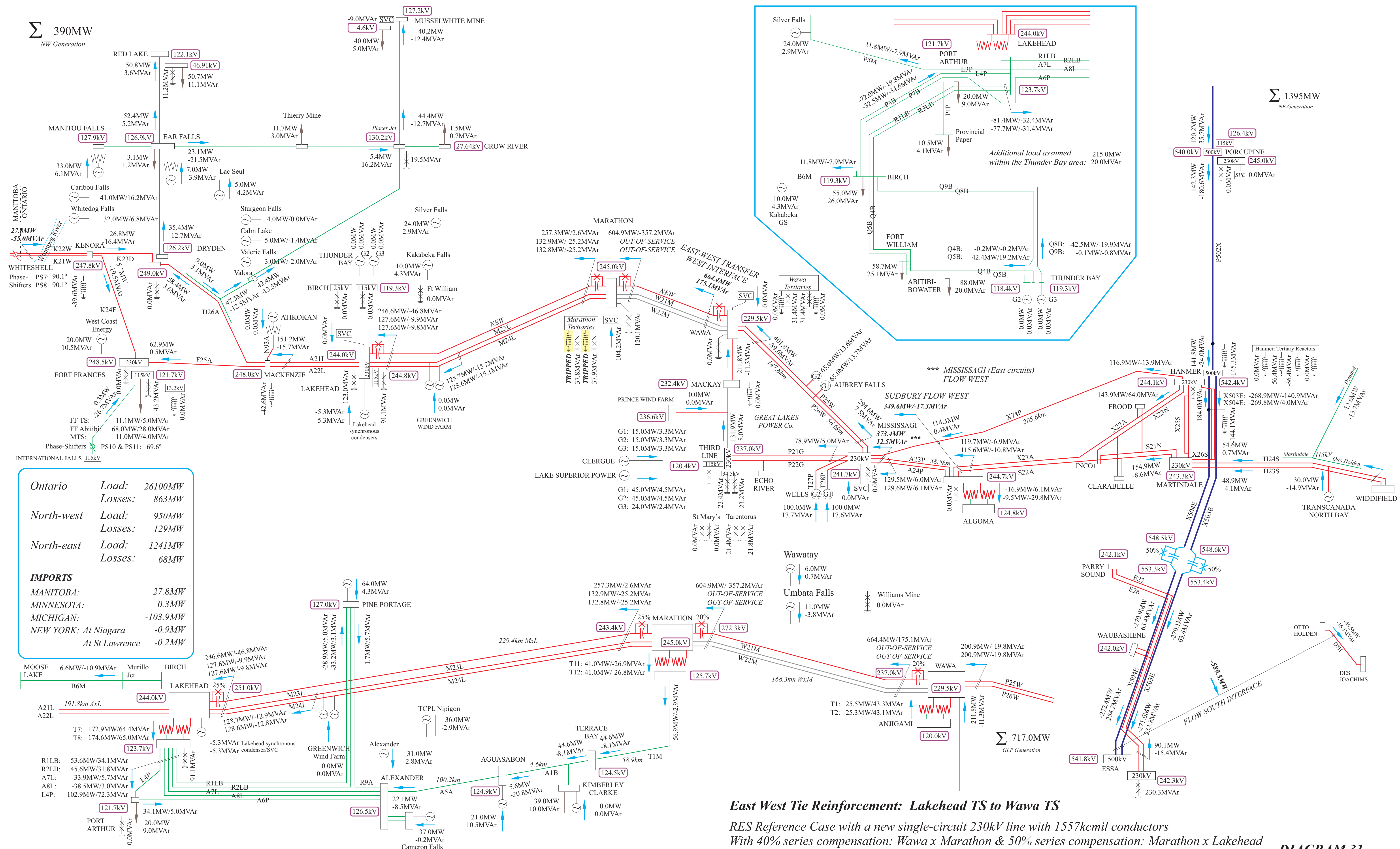
Pre-Contingency

PV-analysis

Pre-Contingency

DIAGRAM 30

20th December 2012



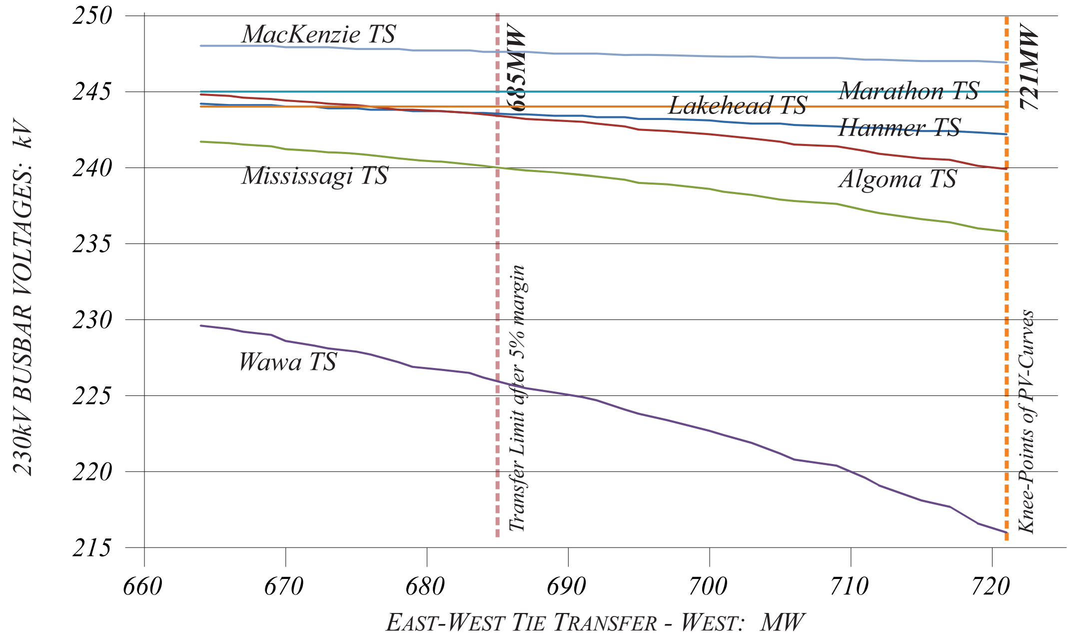
East West Tie Reinforcement: Lakehead TS to Wawa TS

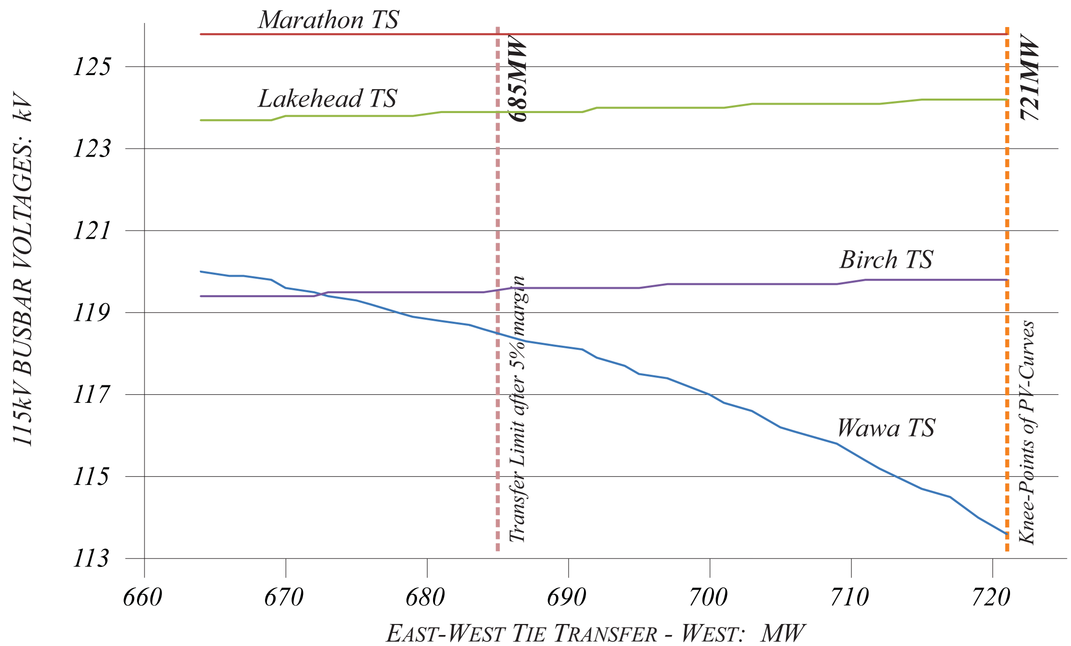
RES Reference Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation: Wawa x Marathon & 50% series compensation: Marathon x Lakehead

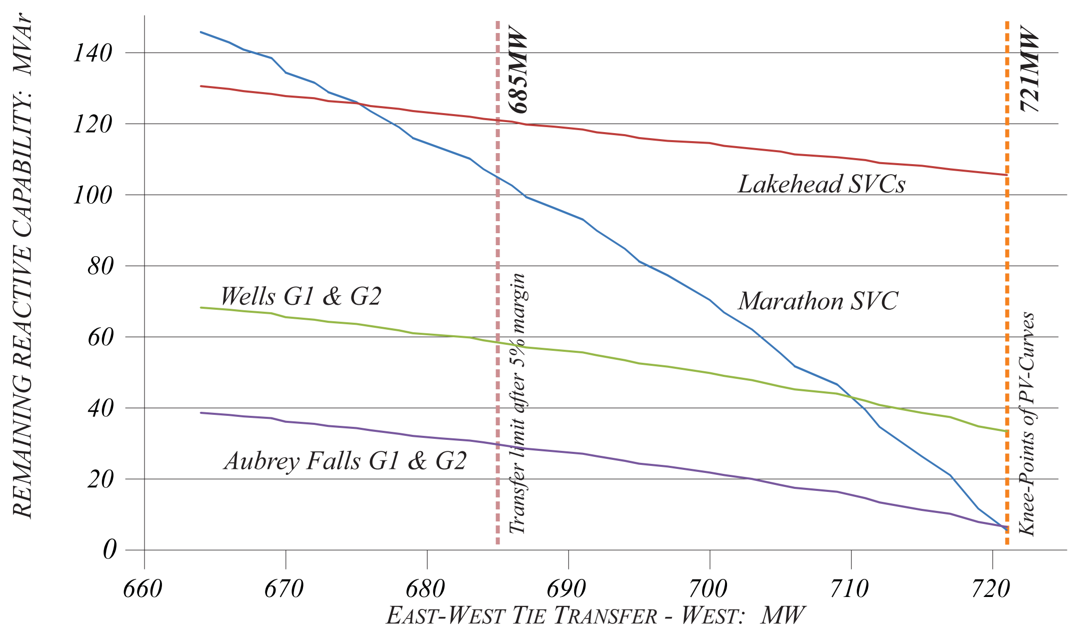
Contingency: Existing 230kV double-circuit line - Wawa x Marathon (W21M + W22M)
Marathon reactors tripped immediately post-contingency

DIAGRAM 31

20th December 2012







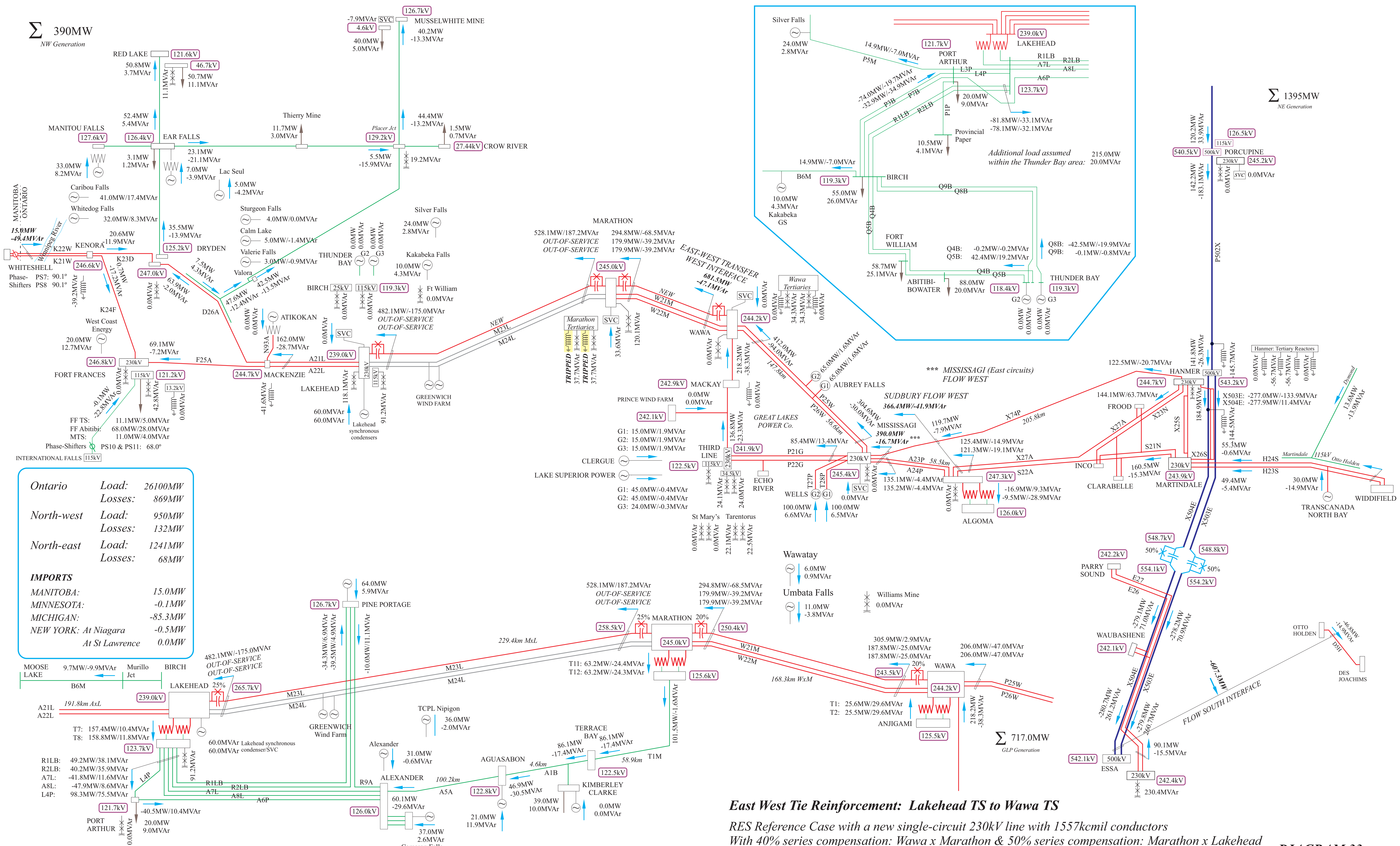
East-West Tie Reinforcement:
Case with a new single-circuit 230kV line with 1557kcmil conductors
With series compensation: 40% Wawa x Marathon & 50% Marathon x Lakehead
With a +250/-100MVAr SVC at Marathon TS
Contingency: Double-circuit contingency between Wawa TS & Marathon TS
Marathon reactors tripped

PV-analysis

Post-Contingency

DIAGRAM 32

20th December 2012



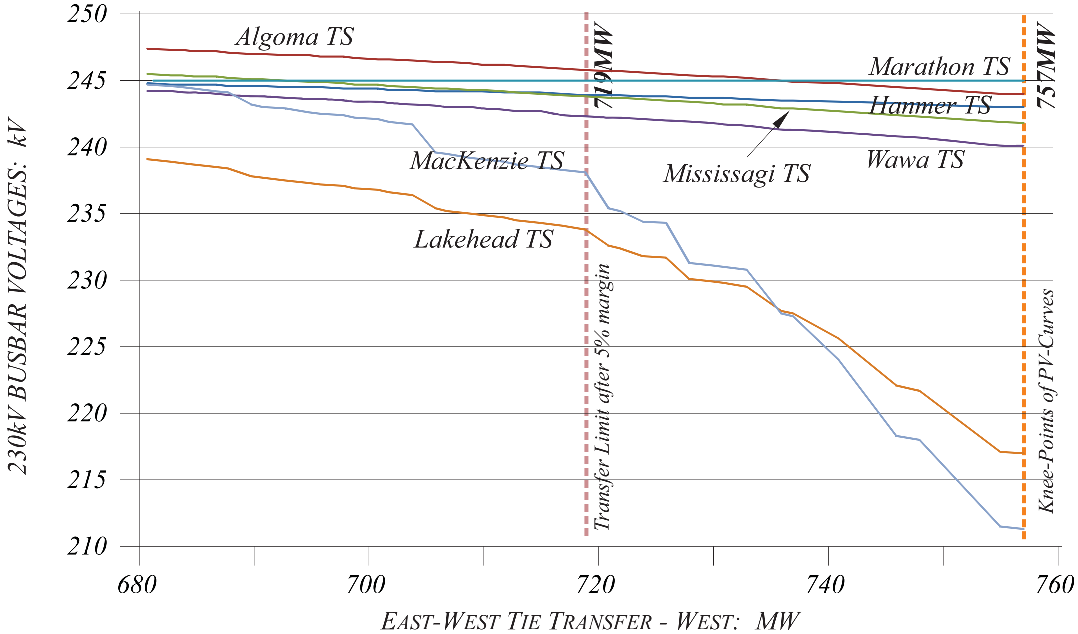
East West Tie Reinforcement: Lakehead TS to Wawa TS

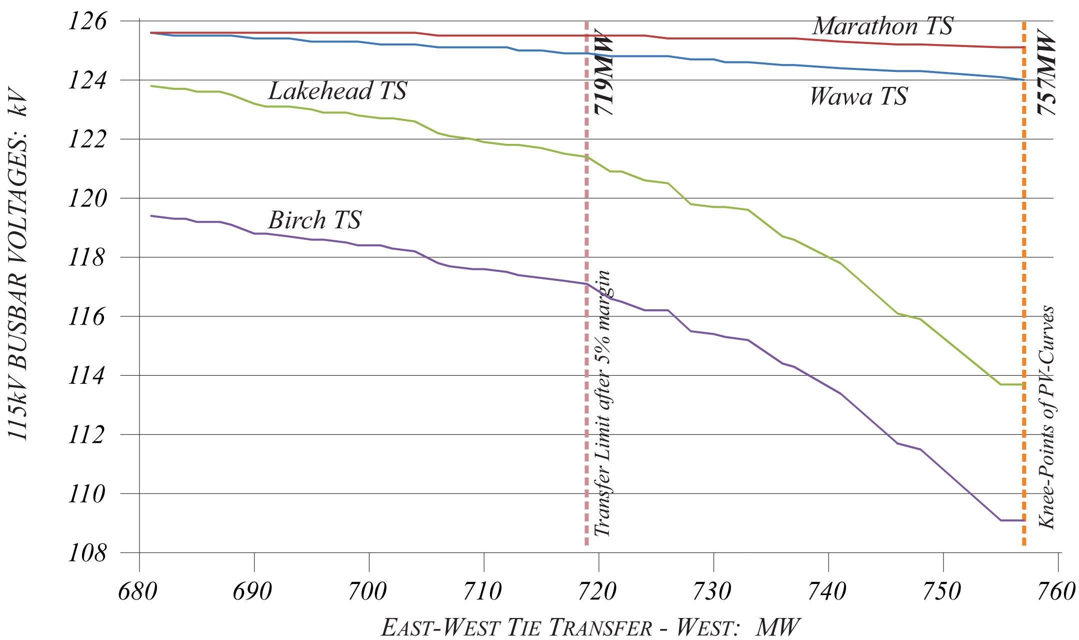
RES Reference Case with a new single-circuit 230kV line with 1557kcmil conductors
With 40% series compensation: Wawa x Marathon & 50% series compensation: Marathon x Lakehead

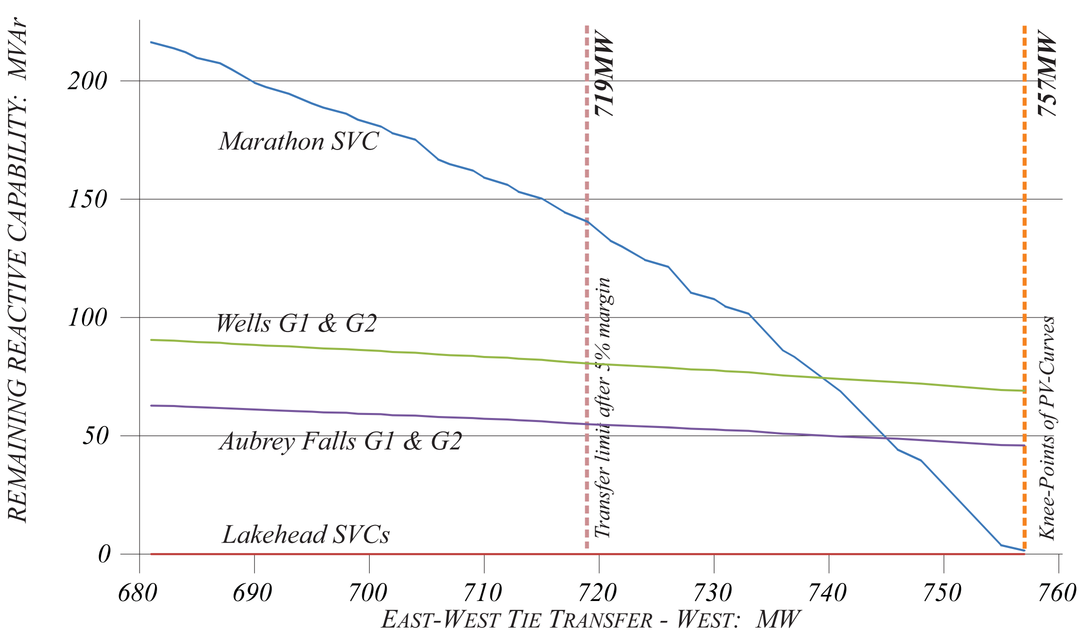
Contingency: *Existing 230kV double-circuit line - Marathon x Lakehead (M23L + M24L)*
Marathon reactors tripped immediately post-contingency

DIAGRAM 33

20th December 2012







East-West Tie Reinforcement:

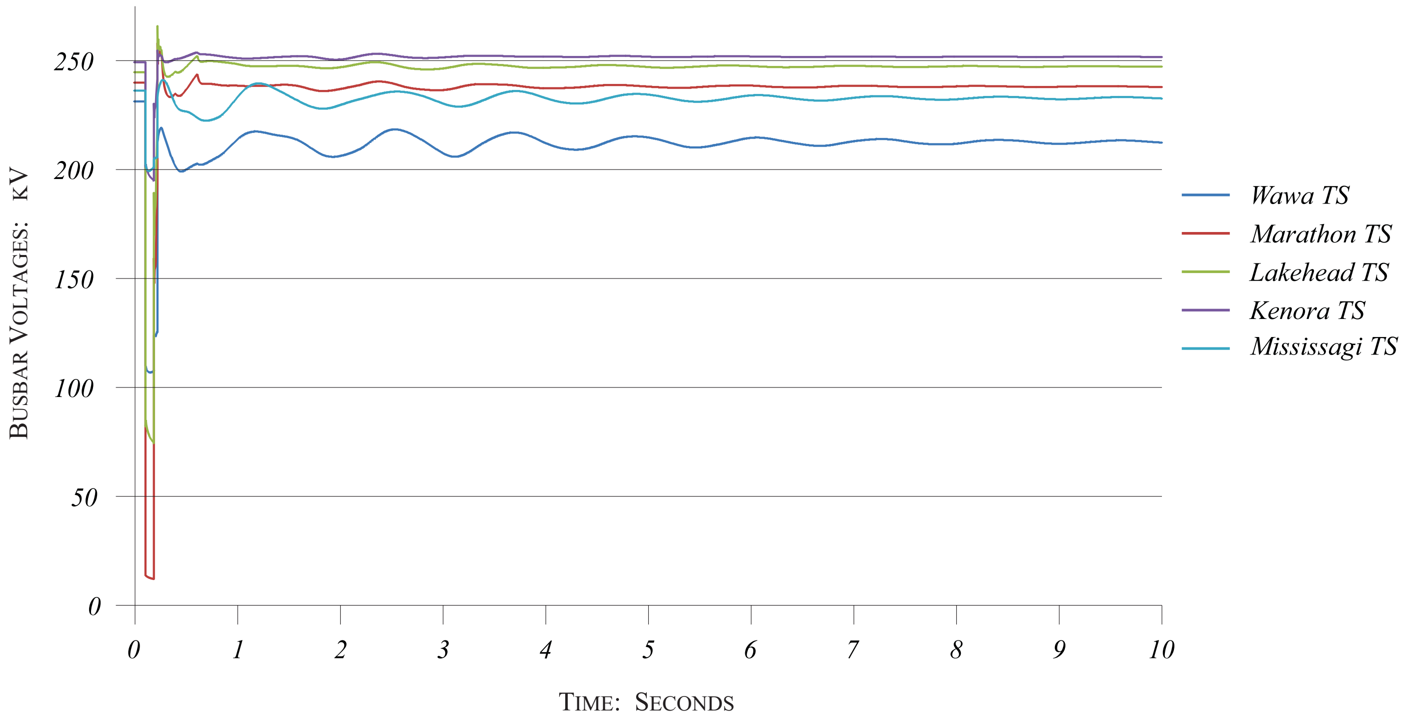
Case with a new single-circuit 230kV line with 1557kcmil conductors
With series compensation: 40% Wawa x Marathon & 50% Marathon x Lakehead
With a +250/-100MVAr SVC at Marathon TS
Contingency: Double-circuit contingency between Marathon TS & Lakehead TS
Marathon reactors tripped

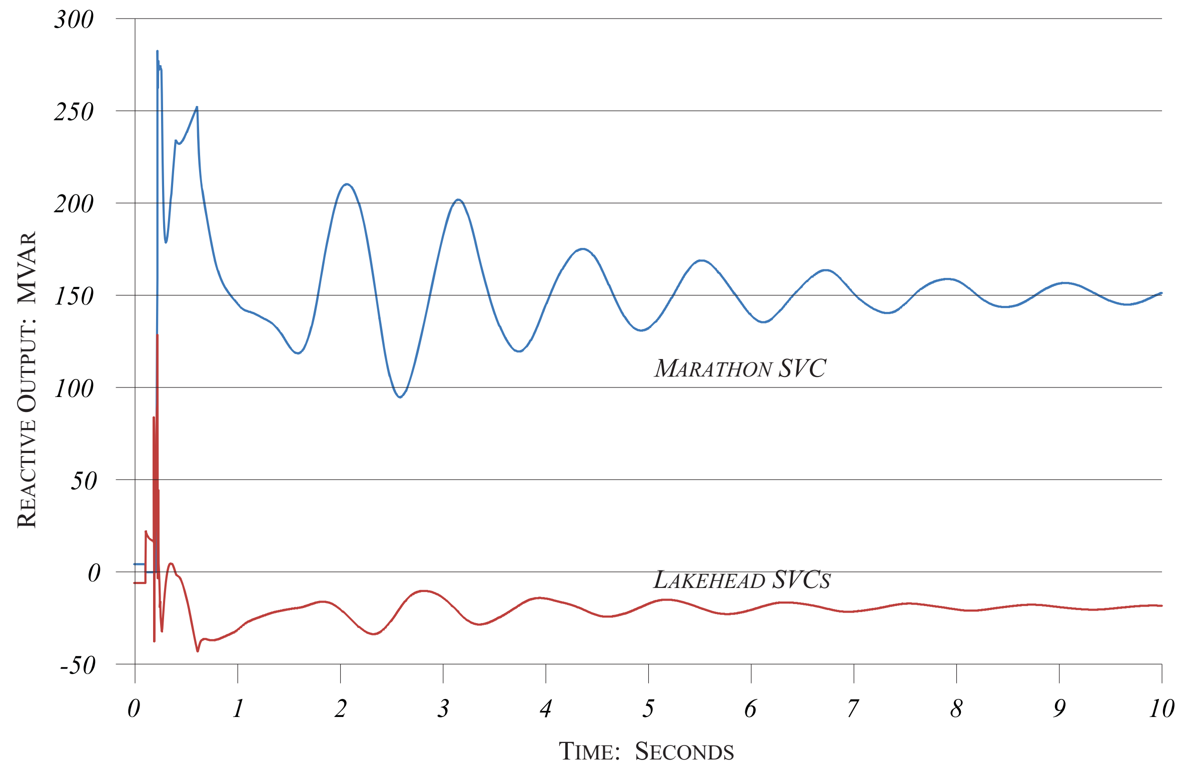
PV-analysis

Post-Contingency

DIAGRAM 34

20th December 2012





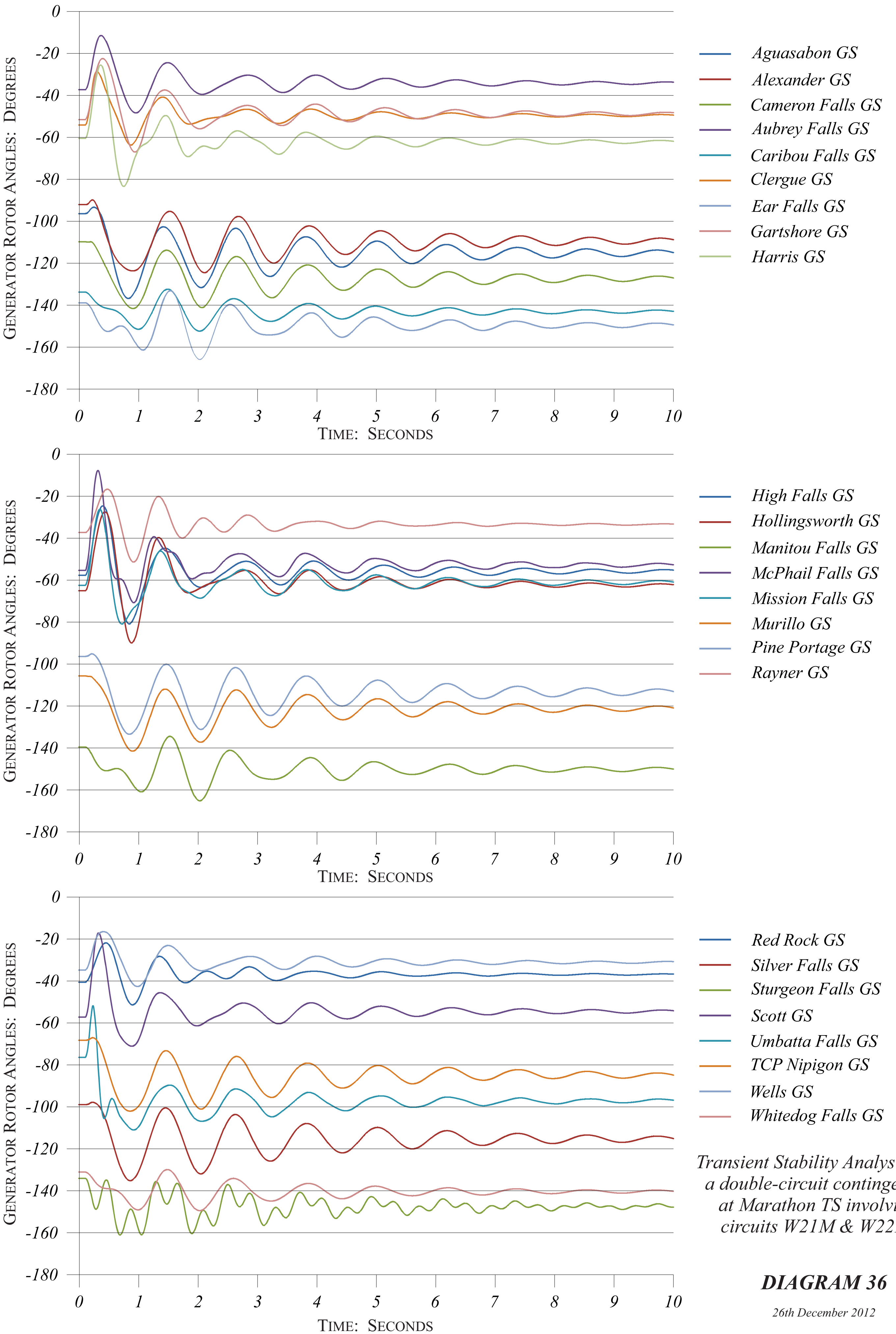
East-West Tie transfer increased to 760MW to provide
a margin of 10% on a projected maximum transfer of 690MW

Fault applied at 0.1 sec.
Fault cleared at Marathon terminal at 0.183 sec (Δ +83ms).
Fault cleared at Wawa terminal: 0.216 sec (Δ + 33ms)

Transient Stability Analysis for a double-circuit contingency at Marathon TS involving circuits W21M & W22M

DIAGRAM 35

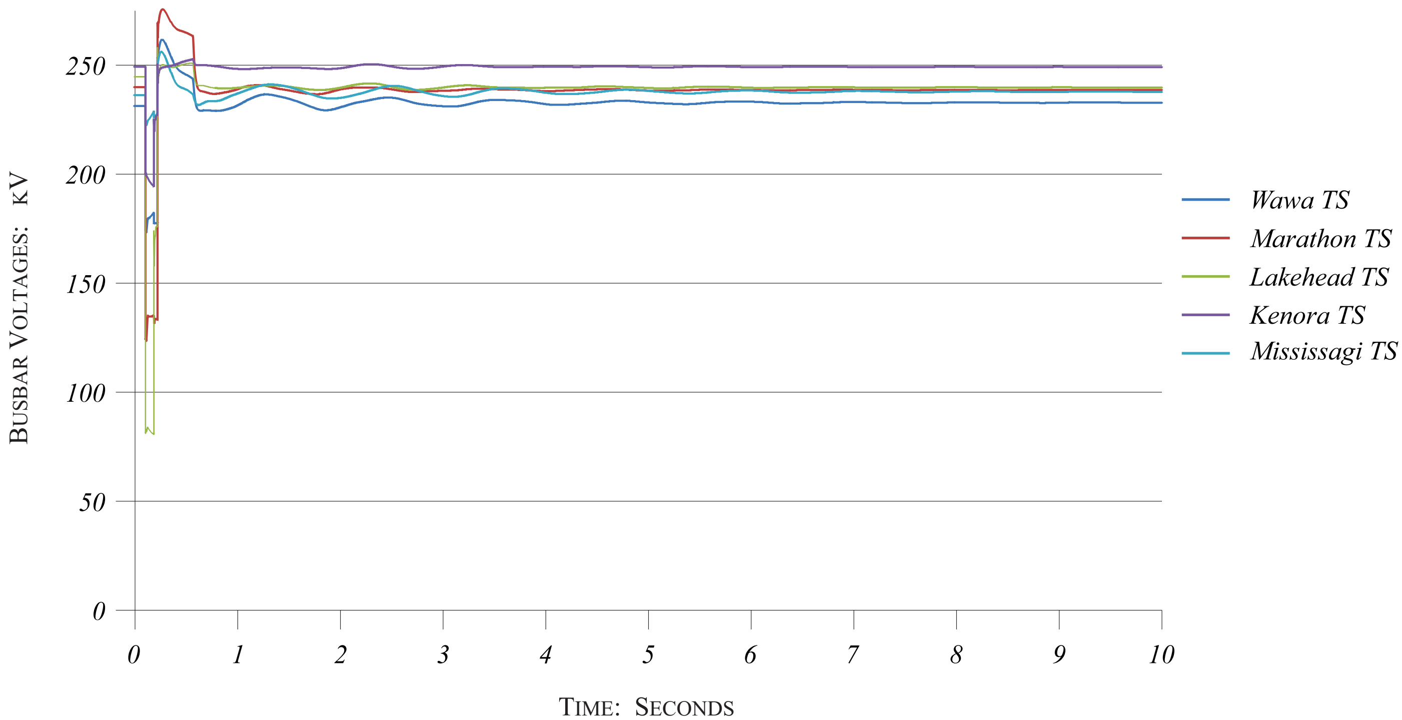
29th December 2012

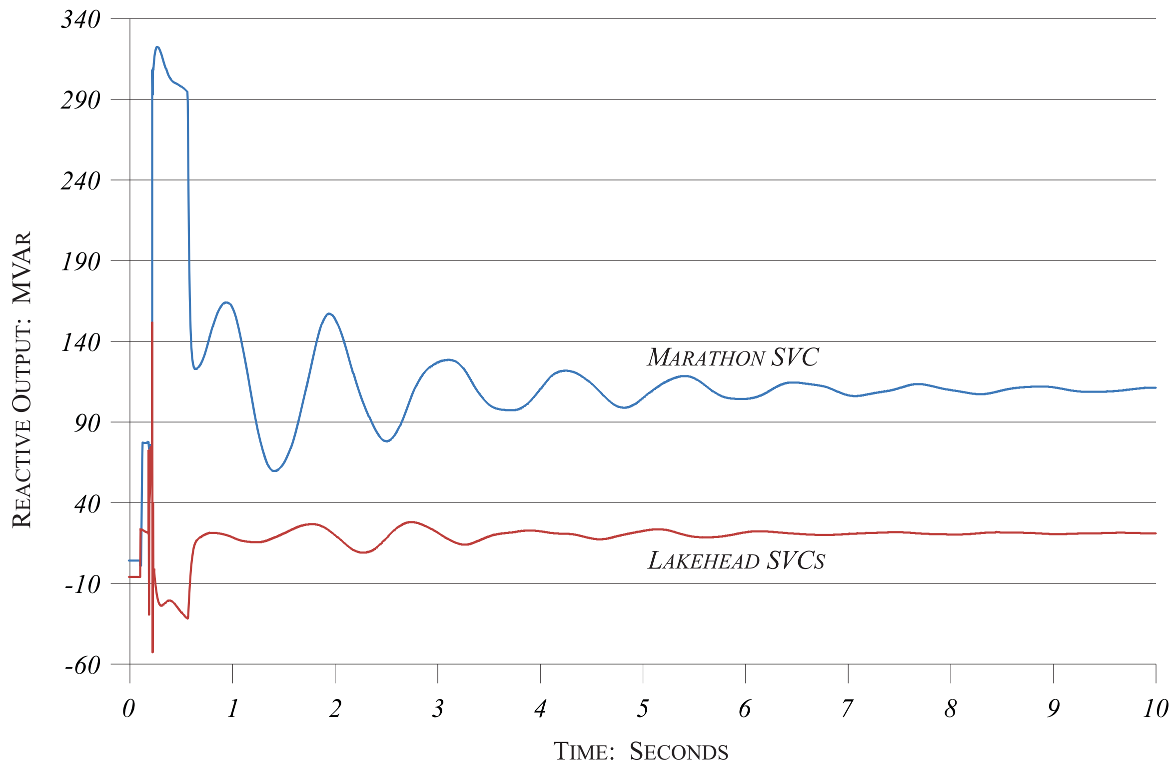


Transient Stability Analysis for a double-circuit contingency at Marathon TS involving circuits W21M & W22M

DIAGRAM 36

26th December 2012





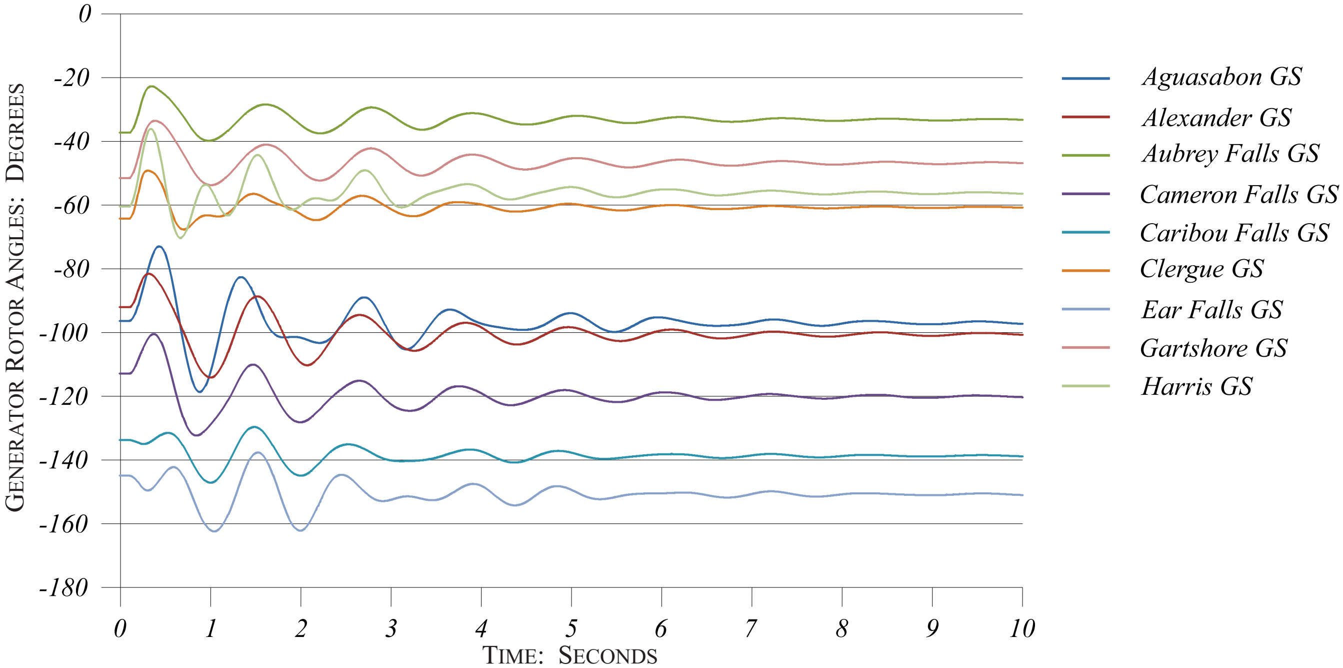
East-West Tie transfer increased to 760MW to provide
a margin of 10% on a projected maximum transfer of 690MW

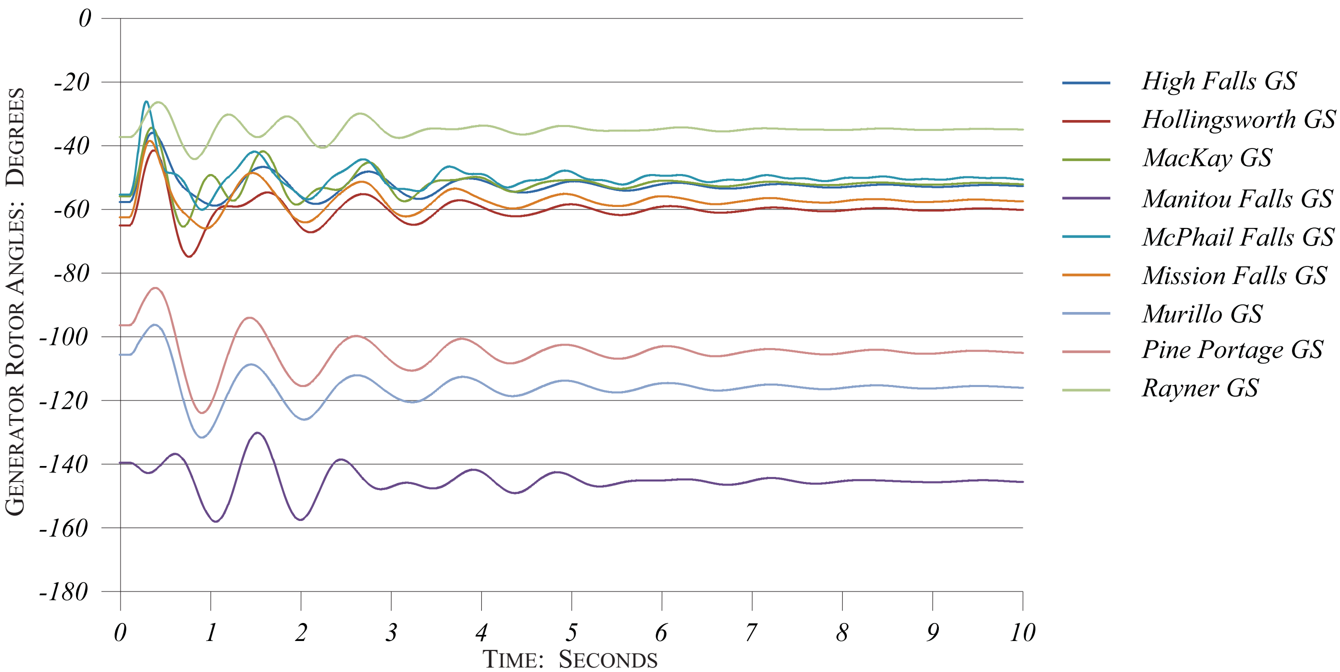
Fault applied at 0.1 sec.
Fault cleared at Greenwich terminal at 0.183 sec (Δ +83ms).
Fault cleared at the Marathon & Lakehead terminals: 0.216 sec (Δ + 33ms)

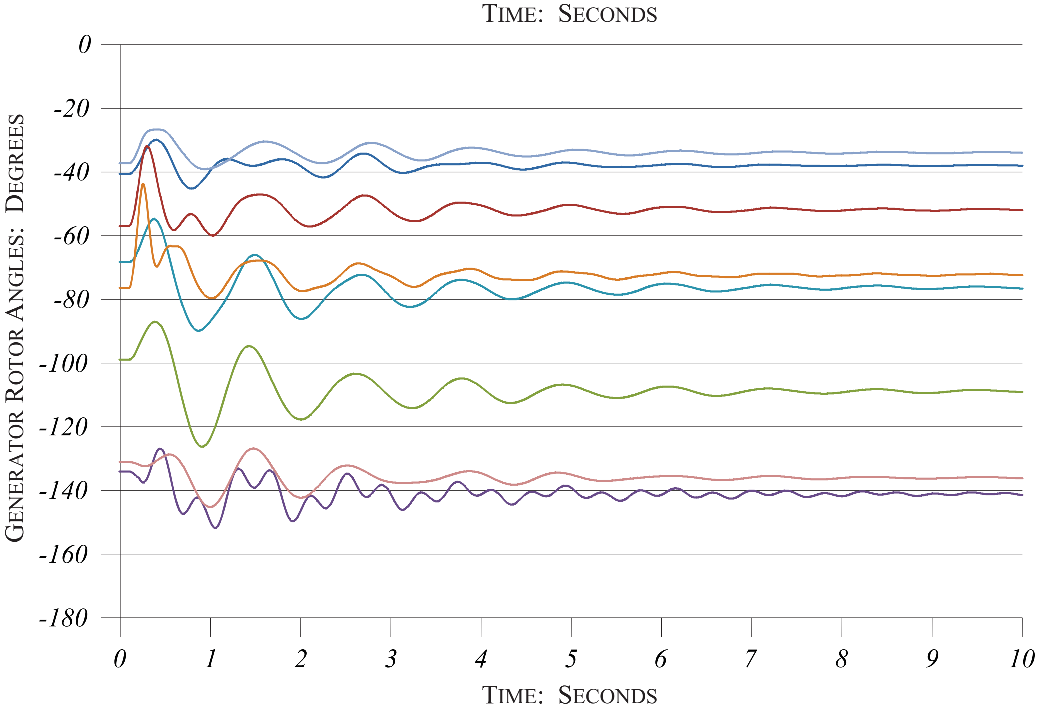
Transient Stability Analysis for a double-circuit contingency at the tap to the Greenwich Wind Farm off circuits M23L & M24L

DIAGRAM 37

29th December 2012





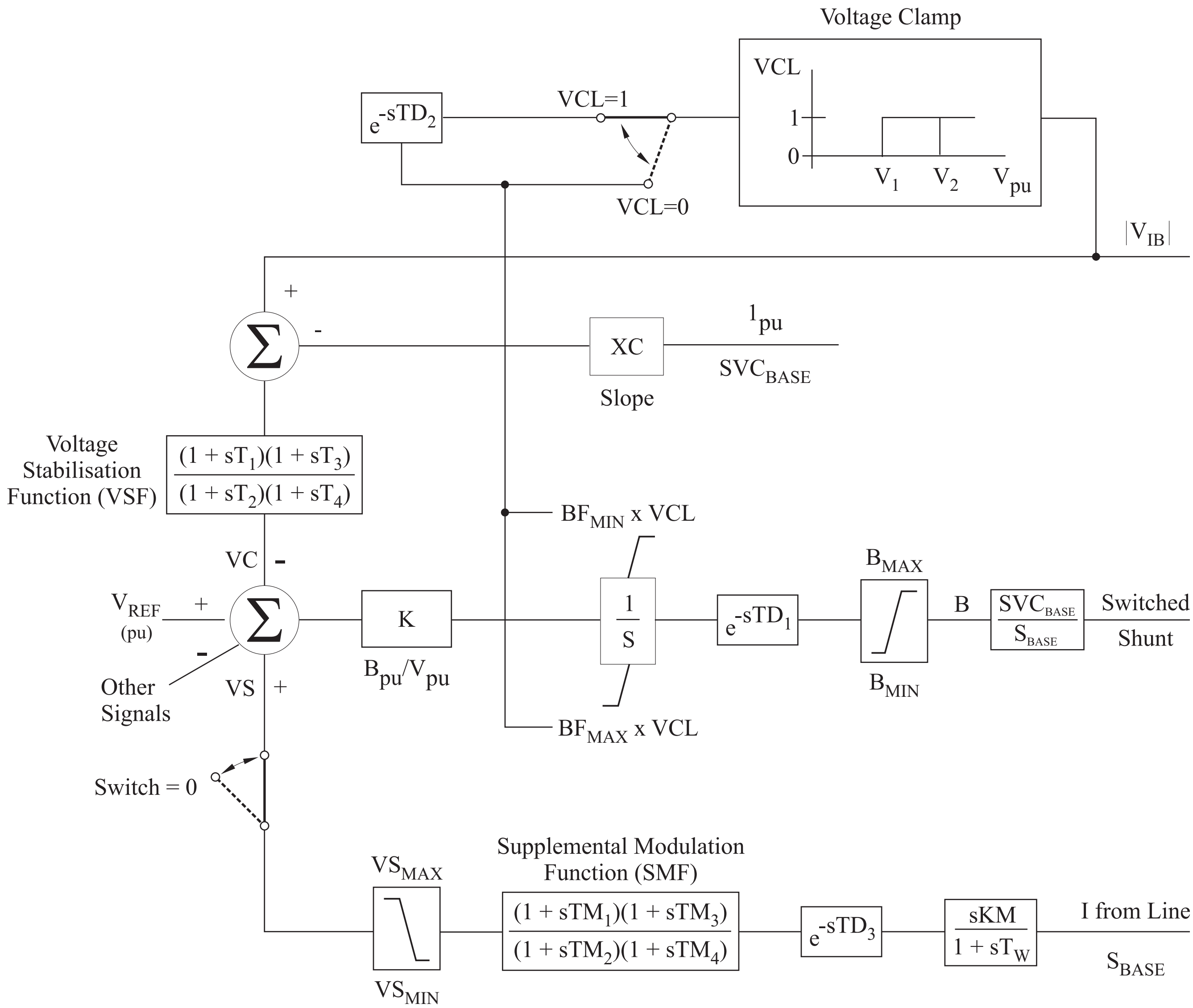


Transient Stability Analysis for a double-circuit contingency at the tap to the Greenwich Wind Farm off circuits M23L & M24L

DIAGRAM 38

29th December 2012

APPENDIX A



SVC set to control the voltage of the 230kV busbar at Marathon TS

BF_{MAX}	999	T_1	0
BF_{MIN}	-999	T_2	0.005
B_{MAX}	0	T_3	0
B_{MIN}	0	T_4	0
VS_{MAX}	0.1	T_W	1
VS_{MIN}	-0.1	TD_1	0.004
K	30	TD_2	0.01
KM	1	TD_3	1
V_1	0.5	TM_1	0.4
V_2	0.58	TM_2	0.07
XC	-0.0167	TM_3	0.00
		TM_4	0.03

SVC_{BASE} = Σ Capacitors - Σ Reactors

IF BF_{MAX} = 0.0, BF_{MAX} = Σ Capacitors/SVC_{BASE}

IF BF_{MIN} = 0.0, BF_{MIN} = Σ Reactors/SVC_{BASE}

IF B_{MAX} = 0.0, B_{MAX} = Σ Capacitors/SVC_{BASE}

IF B_{MIN} = 0.0, B_{MIN} = Σ Reactors/SVC_{BASE}

IF IB = 0, $|V_{IB}| = |V_{IBUS}|$

PTI CHSVCT Model Used to Represent the Marathon SVC

DIAGRAM A-1

18th November 2012

TAB H-3-1

EB-2011-0140

ONTARIO ENERGY BOARD

IN THE MATTER OF SECTIONS 70 AND 78 OF THE *ONTARIO ENERGY BOARD ACT 1998*, S.O. 1998, c.15, (Schedule B);

AND IN THE MATTER OF A BOARD-INITIATED PROCEEDING TO DESIGNATE AN ELECTRICITY TRANSMITTER TO UNDERTAKE DEVELOPMENT WORK FOR A NEW ELECTRICITY TRANMISSION LINE BETWEEN NORTHEAST AND NORTHWEST ONTARIO: THE EAST-WEST TIE LINE

RES CANADA TRANSMISSION LP

Applicant

AFFIDAVIT OF DARRELL GERRARD

(sworn January 3rd, 2013)

I, Darrell Gerrard, of the City of Portland, in the State of Oregon, MAKE OATH AND SAY:

1. I am Vice President, System Planning of RES Canada Transmission LP and, as such, have knowledge of the matters of which I hereinafter depose. To the extent that I am informed by others, I verily believe such information to be true.

2. In accordance with Section 6.3 of the "Filing Requirements for Designation Applications" (the "**Filing Requirements**"), attached as Appendix A to the Ontario Energy Board's ("**OEB**") Phase 1 Decision and Order (July 12, 2011)

in OEB proceeding EB-2011-0140, I confirm that the, single-circuit design option for the East-West Tie line (the "**Preferred Design**"), as described in the RES Canada Transmission LP Application for Designation, will be designed to meet or exceed all applicable technical, reliability and other standards including the standards of the North American Electric Reliability Corporation (the "**NERC**"), the Northeast Power Coordinating Council Inc. (the "**NPCC**") and the Independent Electricity System Operator (the "**IESO**").

3. A feasibility study to determine the effect of certain proposals on the westward transfer capability of the East-West Tie for RES Canada Transmission LP, dated December 29, 2012 (the "**IESO Feasibility Study**") concluded that the Preferred Design satisfied all anticipated NERC, NPCC, and IESO reliability criteria at the specified East-West Tie line transfer levels. The IESO Feasibility Study for the Preferred Design is included at Exhibit H-2-3 of RES Canada Transmission LP's Application for Designation.

4. In accordance with Section 6.3 of the Filing Requirements, I confirm that the Preferred Design will be designed to meet or exceed the OEB's "Minimum Technical Requirements for the Reference Option for the E-W Tie Line (November 9, 2011)."

SWORN before me at Salt Lake City, Utah this 3 day of January, 2013	)))))	
Commissioner for Taking Affidavits, etc.		Darrell Gerrard

Notary Public
KATHY GIATRAS
Commission #611841
My Commission Expires
Aug. 1, 2015
State of Utah

TAB H-4-1

Preferred Design – Conductor Ratings

The Preferred Design is a single-circuit line with a single 1557 ACSS trapezoidal conductor and has an approximate rating of 1891 amperes or 786 MVA at 240 kV measured at a conductor temperature of 127^{O} C and 25^{O} C ambient.

The thermal rating of the 1557 ACSS trapezoidal conductor is much higher than the 768 MVA at 127^{O} C. The 1557 ACSS conductor is designed for continuous operation at 200^{O} C – more than sufficient to operate the EWTL at 650 MW. The conductor and shield wire specifications are provided in Table H-4 below.

Table H-4: Conductor and Shield Wire Specifications

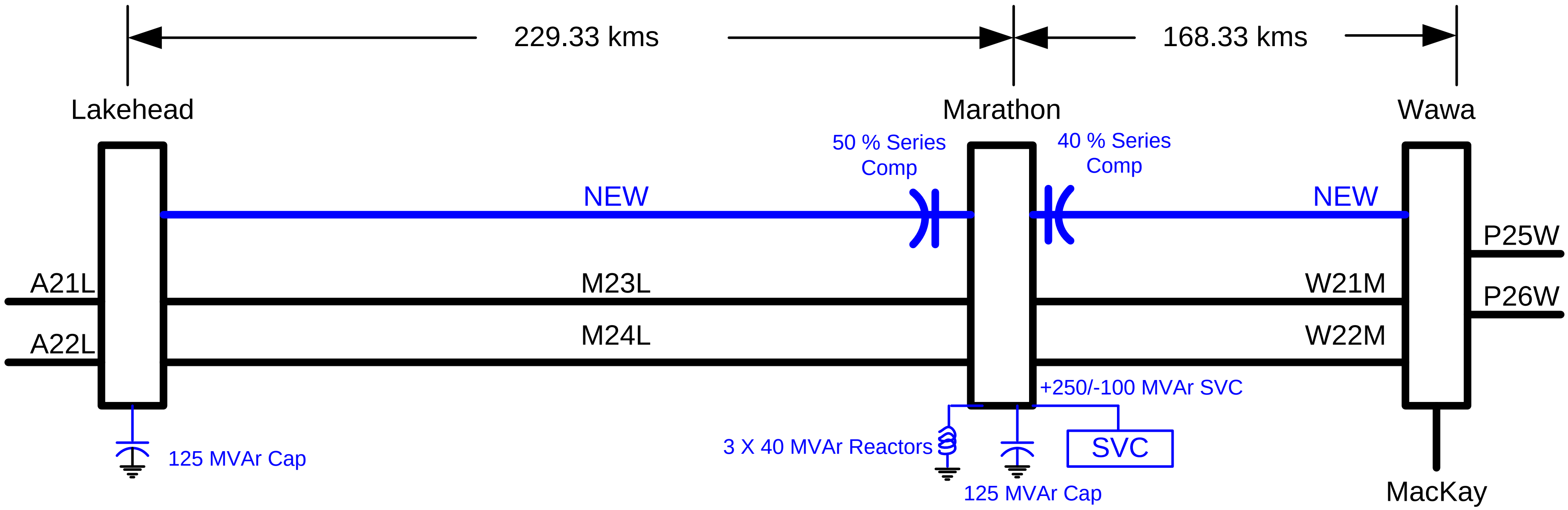
Conductor Type and Size of the Preferred Design	Stranding	Diameter (mm)	Weight (kg/km)	Rated Breaking Strength (kN)
Potomac 1557.4 trapezoidal wire	36/7	34.16	2611	129
1/2 in Extra High Strength Overhead Shield Wire	7	12.57	893	66.5
1/2 in Optical Ground Wire 48 fiber	10	12	431	66.5

Insulator assemblies will use toughened glass insulators with 14-ANSI[1] Class 52-5 units in suspension and 16-ANSI Class 52-11 units in deadend applications. Suspension units carry a 60 kN mechanical and electrical (working) rating while the deadend units carry a 110 kN mechanical and electrical (working) rating. Hardware, suspension clamps, deadend bodies and splices (compression or implosive type) will be rated to match insulator strengths.

[1] American National Standards Institute (http://www.ansi.org/).

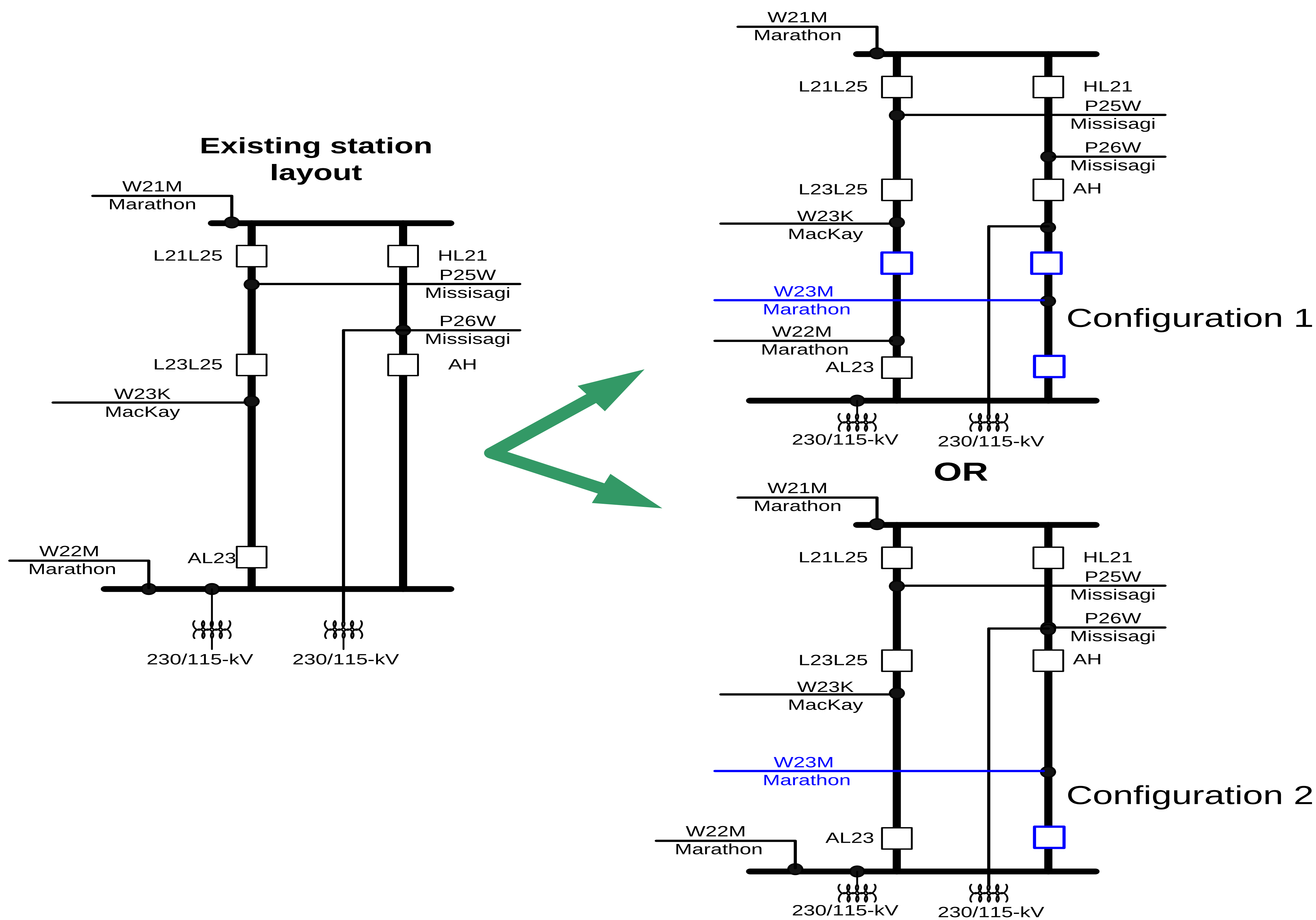
TAB H-4-2

Preferred Design – Conductor Interconnections



TAB H-4-3

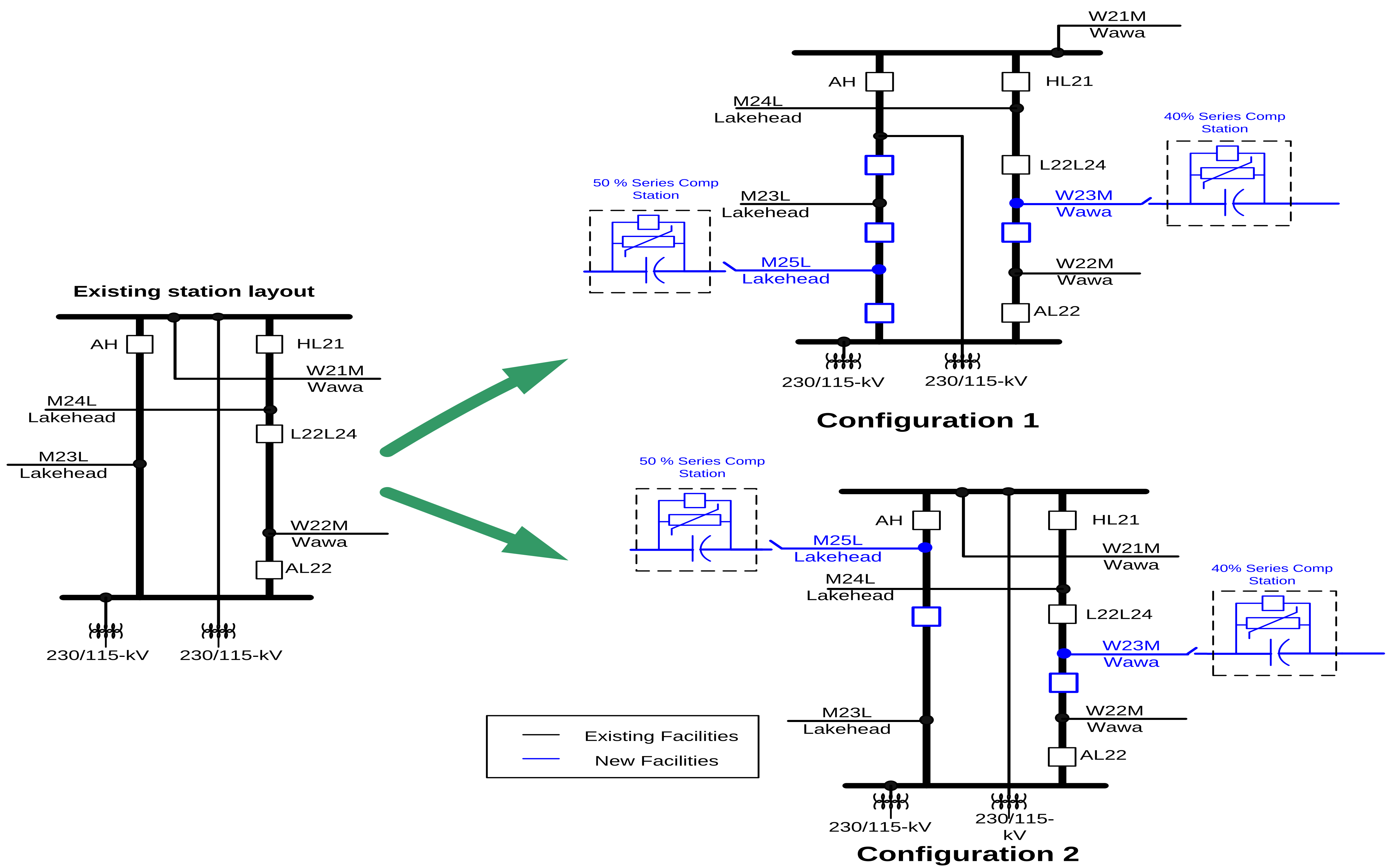
1 **Preferred Design – Wawa TS Interconnection Schematic**



2

TAB H-4-4

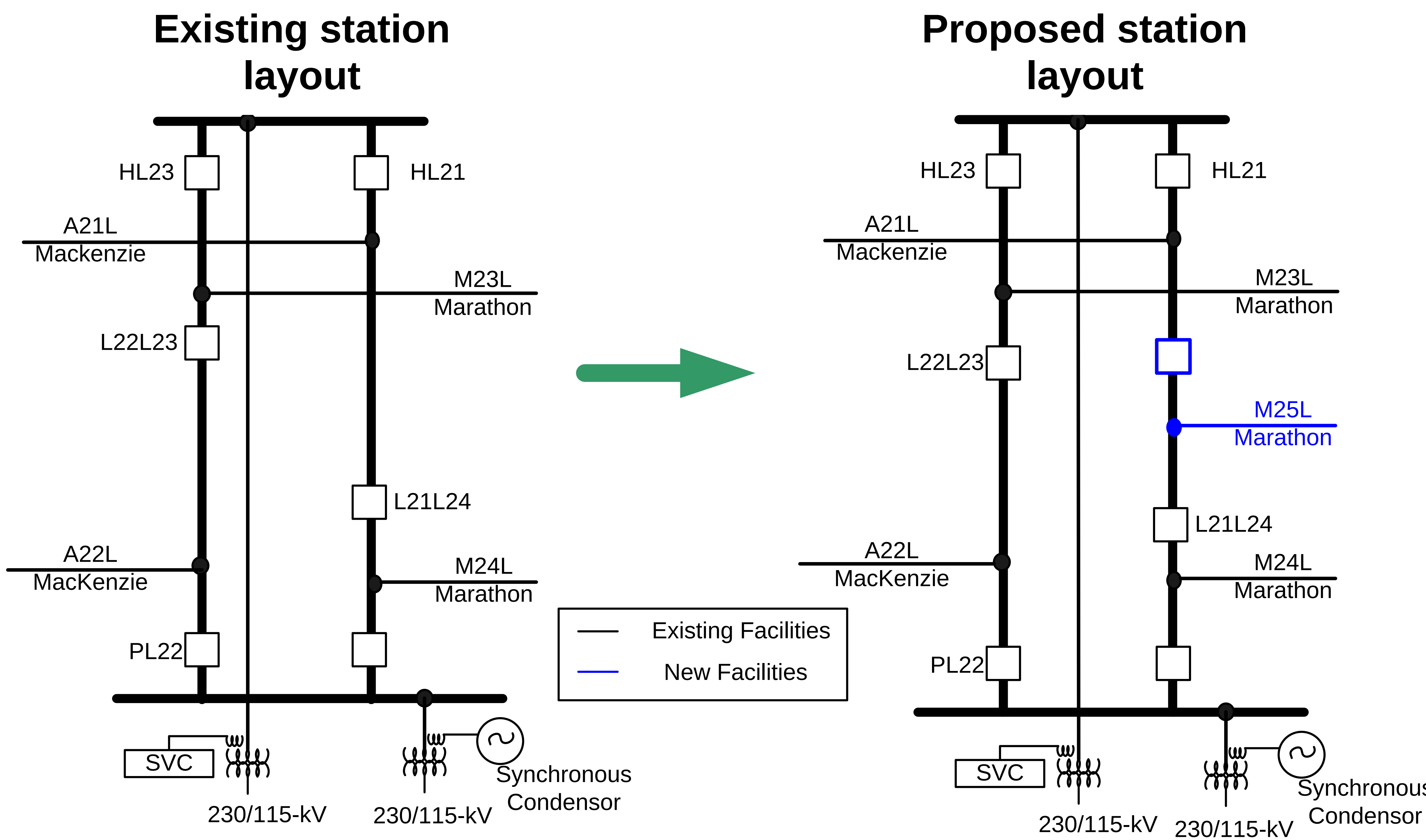
1 **Preferred Design – Marathon TS Interconnection Schematic**



2
3 *Note: Additional station upgrades to add shunt compensation not shown.*

TAB H-4-5

1 **Preferred Design – Lakehead TS Interconnection Schematic**



2
3 *Note: Additional station upgrade to add shunt compensation not shown.*

TAB H-5-1

Design Assumptions for Subsurface Conditions and Subsurface Properties

Subsurface conditions and subsurface properties are assumed to be consistent for both the Preliminary Preferred Route and the Reference Route and also for the Preferred Design and the Reference Design.

Subsurface Condition Design Assumptions

(i) Bedrock at ground surface or near-surface (within 1 metre):

- 60 percent of structure locations.

(ii) Glacial till (continuous) sandy, gravelly silt and clay, over-consolidated:

- 25 percent of structure locations.

(iii) Soft/organic/muskeg soil over bedrock (maximum 3 metre depth):

- 15 percent of structure locations.

(iv) Groundwater at ground surface:

- <20 percent of structure locations.

The four design subsurface condition design assumptions above are based on the Hydro One East-West Tie Expansion SNC Lavalin Transmission & Distribution Study Estimates document**,** as confirmed where possible, by on-the-ground site and aerial observations.

Subsurface Properties

Bedrock Property Assumptions

(i) Hard granite/basalt igneous rock minimum 120 KPa unconfined compressive strength;

(ii) Minimum 12 KPa ultimate bond stress between rock and anchor grout;

(iii) FS (**"Factor of Safety"**) applied to rock anchor loading = 2; and

(iv) Competent (high Rock Quality Designation, etc.) within top 0.3 to 0.6 metres (relatively thin weak, weathered zone).

Very Stiff Glacial Till:

(i) Soil class/type; Clay (U.S. Federal Highway Administration specifications) for SHAFT engineering software evaluation;

(ii) Straight shaft pier foundations (no bells);

(iii) Total unit weight of 1,600 kg/m^3;

(iv) Cohesion = 120 KPa in top 6 metres; 144 KPa below 6 metres;

(v) Depth of water table = 0 metres;

(vi) Length of upper exclusion zone without skin friction = 1.6 metres;

(vii) FS applied to the ultimate side friction = 2;

(viii) FS applied to the ultimate base capacity = 3;

(ix) Soil class / type; Stiff Clay with Free Water (Reese) for LPILE engineering software evaluation; and

(x) p-y modification factors; p = 0 for top 1.5 metres of soil.

Muskeg / Soft / Organic Soil

(i) Allowable soil bearing pressure = 120 KPa (presumptive value; however, foundations would likely be set on underlying bedrock);

(ii) Cohesion = 12 KPa;

(iii) Granular backfill submerged soil density = 960 kg/m^3; and

(iv) Maximum depth to competent bedrock = 4.5 metres.

All values were conservatively assumed based upon experience and published values. Subsurface geotechnical exploration and testing was not performed. A comprehensive geotechnical exploration and testing program will be planned and completed. Soils will be characterized and a model for applying the discovered soil and rock design-strength parameters will be formulated.

TAB H-5-2

Tower Design Assumptions and Strength Specifications

Single-Circuit H-frame Towers

The single-circuit H-frame towers will be constructed using TSPs and can be fabricated using either dulled galvanized or weathering steel finish. TSPs are shop fabricated from long flat plates that are bent into tapered shapes and continuously seam welded to form a twelve-sided hollow pole structure. Flange plates are welded at the ends to facilitate field bolting of pole segments into a complete tower leg using high strength bolts. Two sets of X-bracing fabricated from pipe are field connected between the TSP legs to provide lateral stability. Horizontal cross-arm and shield wire arms, all made from TSPs, are bolted to the top of the TSP legs to complete the H-frame structure. The single-circuit H-frame structures used in the Preferred Design will range from approximately 25-54 m tall.

The single-circuit H-frame towers are based on PLS modelling[1] maximum factored loads x 1.1 and are assumed to be structure design loadings for the structure across the project. Strength specifications for the single-circuit H-frame towers are provided in Table H-5 below.

Table H-5: Strength Specifications for Single-Circuit H-frame Towers

Structure/Class	Compression (kN)	Uplift (kN)	Ground-line Moment (kN-m)	Shear (kN)
0-1 deg Tangent	98	-214	212	36
1-5 deg Heavy Tangent	133	-271	263	44
Deadend	-	-76	2,998	98

[1] Power Line Systems - Computer Aided Design and Drafting.

Single-Circuit Lattice Towers

Free standing lattice towers are constructed from hot rolled equal leg angles and are typically fabricated in a dulled galvanized steel finish. The angles are shop cut to predetermined lengths and then drilled for field bolting. Angles are seldom connected directly to one another but rather through gusset or connection plates. All materials are bundled, marked, crated and shipped to the on-site material yards. The lattice towers are then bolted in discreet sections at an assembly yard prior to delivery either by truck or helicopter to the tower pad for final assembly of the complete tower. The single-circuit lattice towers used in the Preferred Design will be approximately 25-54 m tall.

The single-circuit lattice structures are based on similar 230 kV structure designs and are assumed to have the same load factors across the project. Uplift is the primary item of concern in the design of the single-circuit lattice structure foundations. Strength specifications for the single-circuit lattice towers are provided in Table H-6 below.

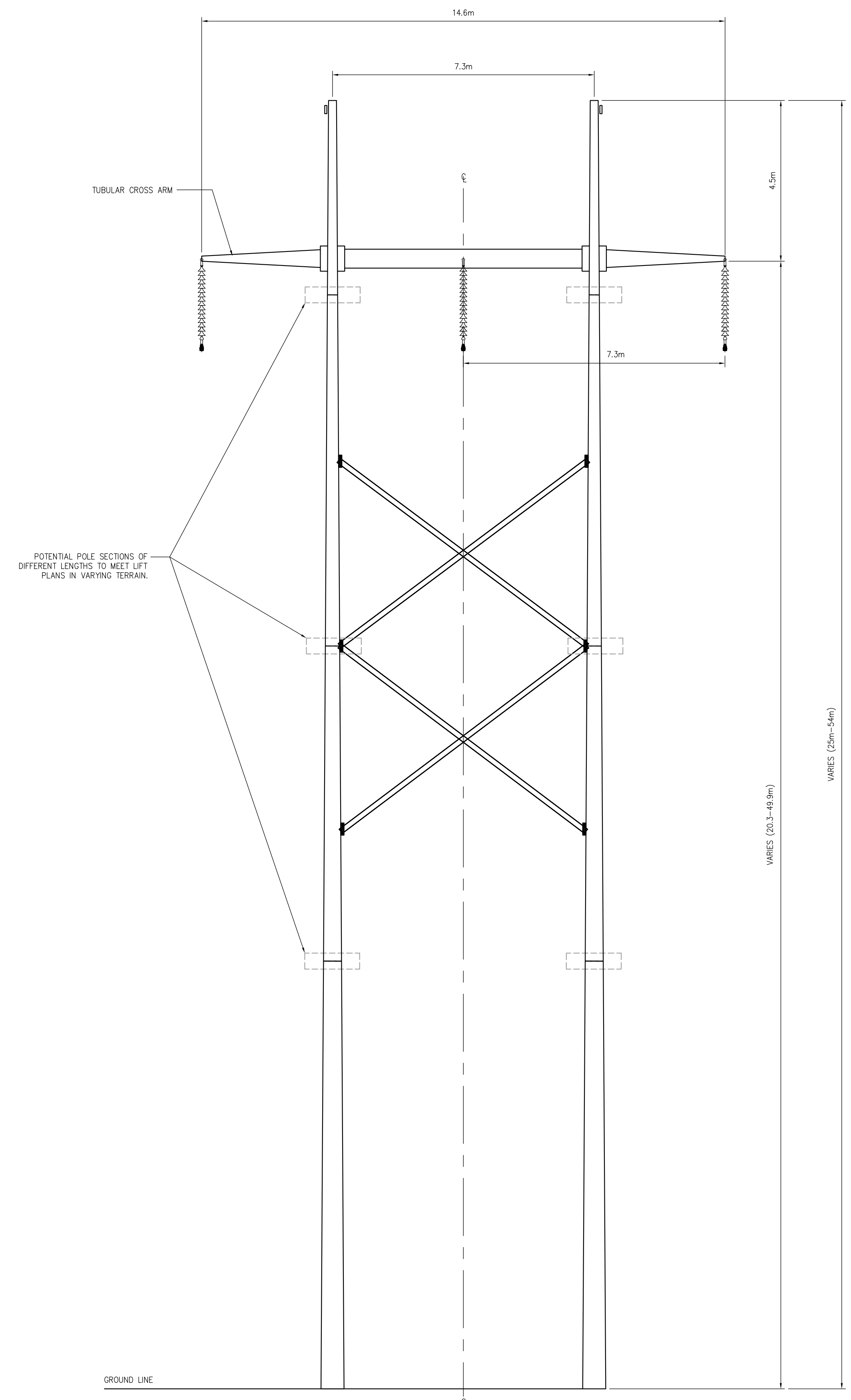
Table H-6: Strength Specifications for Single-Circuit H-frame Towers

Structure/Class	Compression (kN)	Uplift (kN)	Ground-line Moment (kN-m)	Shear (kN)
0-1 deg Tangent	343	-285	0	58
Heavy Tangent	516	-427	0	85
Deadend	1370	-1134	0	111

TAB H-5-3

Single-Circuit H-frame Tower Schematic

PLOT SCALE 1:2



ELEVATION VIEW
SINGLE CIRCUIT H-FRAME
POTOMAC ACSS TW (1557) – SHIELDED W/ OPGW AND SHIELD WIRE

NOTES:

1. PROVIDED IS A REPRESENTATIVE STRUCTURE BASED ON RFP REQUIREMENTS. THE DIMENSIONS MAY CHANGE.

NO.	DATE	REVISIONS	ENGINEER	DES./ DR.	CHECKED	APPROVED

N.T.S.

PROJ/ER#	PL#	DISCIPLINE ENG.
DATE: 11/21/2012	LINE CODE:	
ENG. A. CALDWELL/SAIC	DES.	PROJECT ENG. A. CALDWELL/SAIC
DR. K. WHEELER/SAIC	CH. A. CALDWELL/SAIC	
SCALE: N.T.S.		APPROVAL ENG. D. BODDY/SAIC

OEB
230kV TRANSMISSION
SINGLE CIRCUIT H-FRAME

SHEET 1 OF 1

N/A

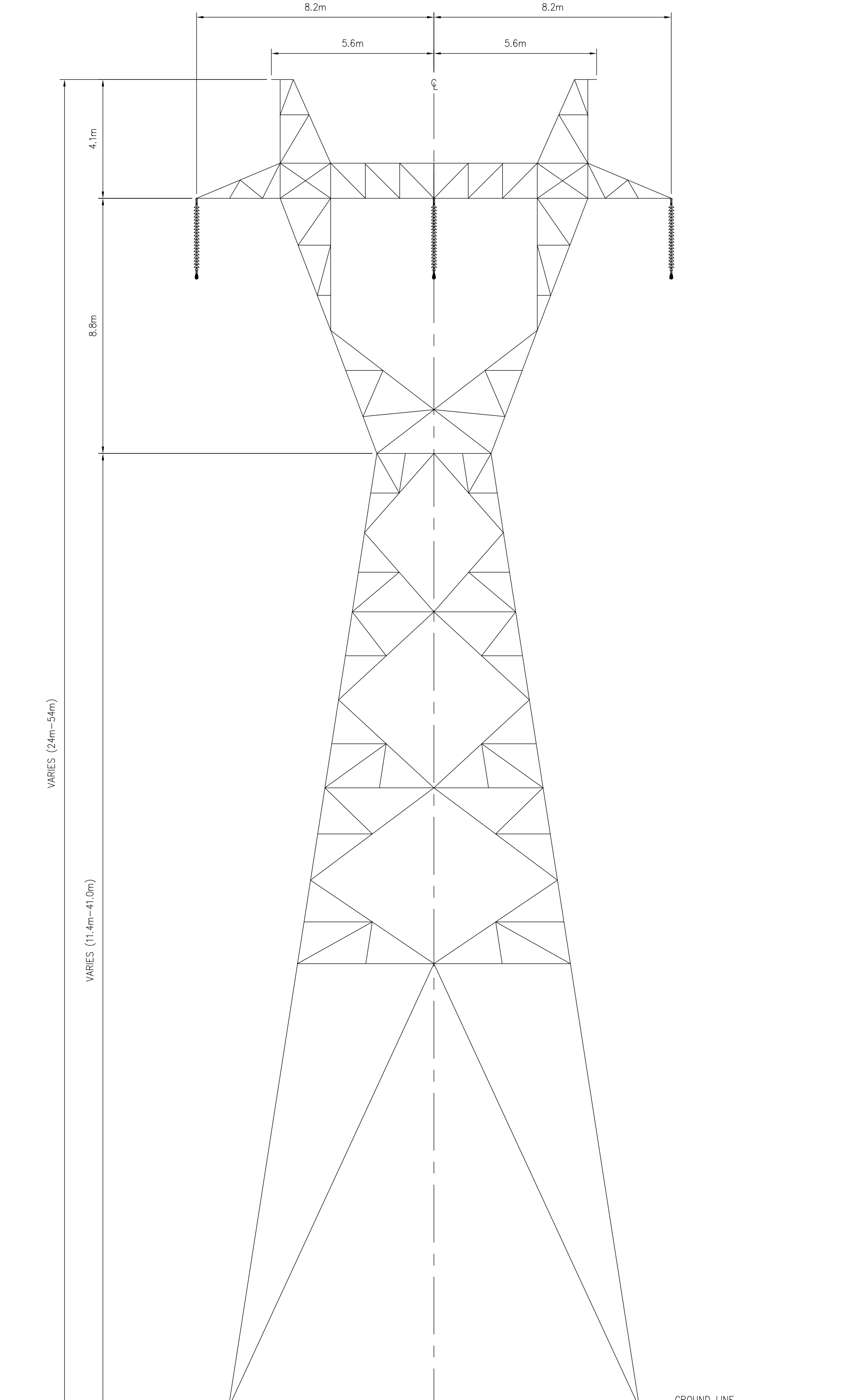
REVISION 0A

FILE LOCATION: O:\2071-Salt Lake City\OEB\Drawings\OEB-230kV_SINGLE_CIRCUIT_STEEL_H-FRAME ACCESSED BY: THOMPSON, LAURIE L. SAVED BY: (HICKSLL) 11/21/2012 10:29:38 AM

TAB H-5-4

Single-Circuit Lattice Tower Schematic

PLOT SCALE 1:2



ELEVATION VIEW
SINGLE CIRCUIT LATTICE TOWER
POTOMAC ACSS TW (1557) - SHIELDED W/ OPGW AND SHIELD WIRE

NOTES:

1. PROVIDED IS A REPRESENTATIVE STRUCTURE BASED ON RFP REQUIREMENTS. THE DIMENSIONS MAY CHANGE.

NO.	DATE	REVISIONS	ENGINEER	DES./DR.	CHECKED	APPROVED

TRANSMISSION

PROJ/ER# | PL#
DATE: 11/21/2012 | LINE CODE:
ENG. A. CALDWELL/SAIC | DES.
DR. K. WHEELER/SAIC | CH. A. CALDWELL/SAIC
DISCIPLINE ENG.
PROJECT ENG. A. CALDWELL/SAIC
APPROVAL ENG. D. BOODY/SAIC
SCALE: N.T.S.

OEB
230kV TRANSMISSION
SINGLE CIRCUIT TANGENT LATTICE

SHEET 1 OF 1

N/A

REVISION 0A

TAB H-6-1

Access Road Design Assumptions

Preliminary Preferred Route Access Road Design Assumptions

1. The entire Preliminary Preferred Route, approximately 409 km, will have a new, continuous access road within the Right-of-Way (“**ROW**”).

   (a) 85 percent of new access road will be clearing and cutting only, no grading.

   (b) 15 percent of new access road will be clearing and cutting with limited grading (primarily blading/smoothing only).

   (c) 10 percent of new access road will require use of matting (supplemental allowance for soft, saturated conditions).

   (d) A 1.15 factor increase is assumed for grade change (e.g. rolling topography) and centerline change (rerouting, curves, etc.) applied to linear access road distances.

2. An additional 80 km of public road/existing access roads outside of proposed ROW will require minor improvement.

   (a) 50 percent of this length will require widening the road to accommodate construction access.

   (b) 50 percent of this length will require widening the road and smoothing/repairing existing road surface.

3. There will be one access point improvement / entrance per 8 km of transmission line alignment.

4. One 64.5 m x 226 m pulling / tensioning site for every two reel lengths plus 25 percent for additional angles and deadends that do not correspond with reel lengths.

5. Average 81 km access stub road from ROW to access pulling/tensioning site.

6. One 8 hectare laydown yard to be smooth graded (blading and compacting) per 56.5 km of transmission alignment.

7. One 32 m x 4.5 m cleared and smoothed pullout area along the new ROW access road every 0.8 km.

Reference Route Access Road Design Assumptions

1. Entire 402 km length of existing transmission line ROW can be utilized for new line construction.

   (a) 50 percent of the existing transmission ROW access route will be overland travel with no significant cutting or grading.

   (b) 30 percent of existing transmission line ROW access route will require shrub/tree cutting and clearing only, no grading.

   (c) 20 percent of existing transmission line ROW access route will include clearing and cutting and limited grading/blading cut and fill operations.

   (d) 5 percent of existing transmission line ROW access route will require use of matting with a supplemental allowance for soft, saturated conditions.

2. A 1.15 factor increase is assumed for grade change (e.g. rolling topography) and centerline change (rerouting, curves, etc.), applied to linear access road distances. Average 81 m distance of proposed transmission line to existing transmission line ROW (average structure spur road length assumed for access to each new structure).

(a) 85 percent of new access roads will be clearing and cutting only, no grading.

(b) 15 percent of new access roads will be clearing and cutting with limited grading (primarily blading only).

(c) 10 percent of new access roads will require use of matting (supplemental allowance for soft, saturated conditions).

(d) A 1.15 factor increase is assumed for grade change (e.g. rolling topography) and centerline change (rerouting, curves, etc.); applied to linear access road distances.

3. 56.5 km of public road/existing access roads (outside of proposed ROW and existing transmission line ROW) will require minor improvement.

(a) 50 percent of this length will require widening to accommodate construction access.

(b) 50 percent of this length will require widening and smoothing/repairing existing road surface.

4. One access point improvement/entrance per 8 km of transmission line alignment.

5. One 64.5 m x 226 m pulling/tensioning site for every two reel lengths plus 25 percent for additional angles and deadends that do not correspond with reel lengths.

6. Average 81 m access stub road from ROW to access pulling/tensioning site

7. One 8 hectare laydown yard to be smooth graded (blading and compacting) per 56.5 km of transmission line alignment.

8. One 32 m x 4.5 m cleared, smoothed pullout area within the existing ROW access every 0.8 km.

TAB H-6-2

Access Road Inventory Report

The Access Road Inventory Report on the next page of this exhibit has been produced by PowerTel after conducting field work and a substantial desktop review.

The Access Road Inventory Report has been confidentially filed.

TAB H-6-3

Access Road Classification Map

The Applicant, supported by PowerTel and Stantec, has conducted substantial desktop and field work to identify potential access routes and related features that could be used in the construction of the Project and has also taken into account the proposed realignment of Highway 17 between Thunder Bay and Nipigon. This information is shown in the map on the following page of this exhibit which is intended to illustrate major potential access roads. The map does not reflect the substantial additional number of roads and trails that have been identified and examined and are also under consideration for use in the construction of the Project.

The Access Road Classification Map in this exhibit has been confidentially filed.

TAB H-6-4

Staging Locations Map

Confidentially Filed.

TAB I-1-1

Overview – Reference Option

As described in Exhibit G-1-1, the Reference Design comprises a double-circuit 230 kV line between Wawa TS and Lakehead TS, divided into Segment #1 (between Wawa TS and Marathon TS) and Segment #2 (between Marathon TS and Lakehead TS). The Reference Design meets or exceeds all transfer capacity, reliability and system performance requirements specified in the OEB's Minimum Technical Requirements and Minimum Design Criteria as well as the reliability standards of the IESO, the NERC and the NPCC. Details of how the Reference Design meets all of the requirements of the OEB, IESO, NERC and NPCC are included at Exhibit I-2-1. An affidavit of a RES Transmission officer attesting that the Reference Design meets these requirements is included at Exhibit I-3-1.

The Reference Design comprises the following five components:

(i) conductors;

(ii) transformer substation upgrades;

(iii) transformer station interconnections;

(iv) tower and foundation design; and

(v) access road design.

Each of these 5 components is described, in detail, below.

Conductors

The Reference Design will comprise approximately 2,400 kms of single 1192.5 kcmil conductor (i.e., 400 km X 6 wires). Details of the 1192.5 kcmil conductor ratings are included at Exhibit I-4-1. A schematic diagram showing the interconnection of the new lines at each of the Wawa TS, Marathon TS and Lakehead TS, is included at Exhibit I-4-2.

Transformer Station Upgrades

To meet the required 650 MW transfer capacity, equipment upgrades would be required at both Marathon TS and at Lakehead TS as part of the Reference Design.

At Marathon TS, the following two components need to be added to facilitate the required 650 MW transfer capacity and meet other system performance requirements:

(i) one +200/-100 MVAr Static VAr Compensator and

(ii) three 40 MVAr shunt reactors rated at 230-kV.

At Lakehead TS, a 125 MVAr shunt capacitor bank rated at 250-kV[1] would be added to meet system performance requirements and achieve the 650 MW transfer capacity across the EWTL.

The Applicants understand that the transformer station upgrades described above would be constructed by Hydro One.[2]

Transformer Station Interconnections

Wawa TS: The schematic of the Wawa TS is included in Exhibit I-4-3. The existing station layout has a common mode outage that results in the loss of a line and transformer for fault on the line or the transformer.

Configuration 1 describes terminating the new double circuit line with five breakers to eliminate the common mode outage condition. Configuration 2 describes terminating the new double circuit line with two breakers without eliminating the common mode outage. Configuration 1 has been included in RES Transmission's proposal.

[1] Independent Electricity System Operator, "Feasibility Study: An assessment of the westward transfer capacity of various options for reinforcing the East-West Tie", August 18, 2011 at s. 2.1, p. 4.
[2] Ontario Energy Board, "Transmission Infrastructure: East-West Line: Project Scope (EB-2011-0140)", January 10, 2012 at p. 4.

Marathon TS: The schematic of the Marathon transformer station is included in Exhibit I-4-4. The existing station layout has a common mode outage that results in the loss of a line and transformer for fault on the line or the transformer.

Configuration 1 describes terminating the new double circuit line with seven breakers to eliminate the common mode outage condition. Configuration 2 describes terminating the new double circuit line with four breakers without eliminating the common mode outage condition. Configuration 1 has been included in RES Transmission's proposal.

Lakehead TS: The schematic of the Lakehead transformer station is included in Exhibit I-4-5. The proposed station layout describes terminating the new line with one breaker. This configuration has been included in RES Transmission's proposal.

It is RES Transmission's understanding that the choice of the number of breakers and the manner in which the line is terminated will be determined by the OEB and Hydro One. The line termination information provided above at each of the interconnecting stations is for informational purposes only. It is also the Applicant's understanding that all substation design and construction work, including system protection and controls, would be conducted by Hydro One.

Tower and Foundation Design

The Reference Design would employ the use double-circuit lattice structures along the length of the line. On the Reference Route parallel to the existing ROW, the double-circuit lattice towers would have an average span of approximately 410 m with a ROW of 46 m. Approximately 1,000 towers are expected to be used along the Reference Route.

On the Preliminary Preferred Route, the double-circuit lattice towers would have the same average span and ROW, but the slightly longer distances would result in approximately 1,020 towers being used. The double-circuit lattice structures will have steel components with a dulled galvanized steel finish.

Along both the Preliminary Preferred Route and the Reference Route, 60 percent of structure locations have bedrock at or near the ground surface; 25 percent of structure locations have glacial till and 15 percent of structure locations have muskeg, soft or organic soil. Groundwater is estimated to be present at the ground surface in approximately 20 percent of structure locations. Given the subsurface conditions, foundation construction is expected to be difficult for three reasons: excavation; access for equipment and access for concrete delivery vehicles.

Design assumptions for subsurface conditions and subsurface properties for the Reference Design are identical to the assumptions for the Preferred Design and are included at Exhibit H-5-1. Tower design assumptions and strength specifications for the Reference Design are included at Exhibit I-5-1. A schematic of the double-circuit lattice towers to be used in the Reference Design are included at Exhibit I-5-2.

Access Road Design

In order to determine the necessary access roads for the Reference Route and the Preliminary Preferred Route, the Applicant reviewed aerial flyover access video provided by Hydro One; existing maps; and mining claims pertaining to the lands in question; and also prepared a detailed roads inventory report and conducted on-the-ground field observations. Specifically, the Applicant reviewed the Reference Route and the Preliminary Preferred Route in six sections:

(i) Thunder Bay to Nipigon River;

(ii) Nipigon River to Terrace Bay;

(iii) Terrace Bay to Marathon;

(iv) Marathon to Magpie River (Preliminary Preferred Route);

(v) Marathon to Magpie River (Reference Route); and

(vi) Magpie River to Wawa TS.

The access road design assumptions for the Reference Design are identical to the assumptions for the Preliminary Preferred Design and are included at Exhibit H-6-1. An inventory report classifying and detailing the condition of the roads in one to ten km segments for both the Reference Design and the Preferred Design is included at Exhibit H-6-2. A map that shows the road classification for both the Reference Route and the Preliminary Preferred Route is included at Exhibit H-6-3.

TAB I-2-1

Compliance with Specified Requirements

As described in the technical specifications provided in this exhibit, the Applicant's Reference Design for the EWTL will meet or exceed all of the design and construction requirements of the OEB and the IESO.

OEB Requirements

The Reference Design meets each of following OEB requirements:

(i) Minimum Technical Requirements for the Reference Option of the E-W Tie Line, November 9, 2011;

(ii) Appendix A, Minimum Design Criteria for the Reference Option of the E-W Tie Line (230 kV) Wawa to Thunder Bay Transmission Line), November 9, 2011; and

(iii) Phase 1 Decision and Order Filing Requirements for East-West Tie Designation Applications, July 12, 2012 (the "**Filing Requirements**"), Section 6.1 of the Filing Requirements.

For items # 1 and 2 above, a full list of the relevant codes, standards, regulations and procedures that will be followed by the Applicant in the design and construction of the Reference Design and the Preferred Design for the EWTL is included at Exhibit H-2-2.

For item #3 above, table I-1 below confirms how each of the requirements of s. 6 of Filing Requirements will be met.

Table I-1: Filing Requirements

Description of Requirement	**Reference Design**
Length of the transmission line	Reference Route: 401.5 km Preliminary Preferred Route: 409.2 km
Number of circuits	2
Voltage class	230 kV
Load carrying capacity – summer continuous rating at 93°C conductor temperature and 30°C ambient temperature	1120 amperes 466 MVA at 240 kV
Load carrying capacity – summer emergency rating at 127°C conductor temperature and 30°C ambient temperature	1440 amperes 599 MVA at 240 kV
Resulting total transfer capacity of the EWTL	652 MW
Anticipated lifetime of the line	50 years for the transmission line 30 years for the transformer station equipment.

Description of Requirement	**Reference Design**
Number and average spacing of towers	Approximately 1,000 double-circuit lattice towers spaced 410 m apart for the Reference R (approximately 1,020 for the Preliminary Preferred Route)
Tower structure type and composition	Double-circuit steel lattice towers with dulled galvanized steel finish
Conductor size and type	1192.5 kcmil; 54/19 conductors
Protection against cascading failure and conductor galloping	**Cascading Tower Failures** will be protected against through a robust line design. The Applicant intends to install full deadend structures at no more than twelve mile increments with a strain type structure or another full deadend about halfway between these. This is a significant improvement over the cascading design of the existing line where there may be no deadend for easily twice the distance the Applicant intends to maintain. **Conductor galloping** is an infrequent occurrence and is a function of steady wind on wire that typically has an asymmetric coating of ice creating a partial airfoil or wing. The amplitude of any galloping that may occur is a function of

Description of Requirement	**Reference Design**
	the wire size, its tension and the span length. We protect against damage and flashover by limiting the span lengths, and by increasing the dimensional spacing between phases.
Design assumptions	Design assumptions for subsurface conditions and subsurface properties are included at Exhibit H-5-1 Design assumptions for the double-circuit lattice towers are included at Exhibit I-5-1 Design and alignment assumptions for the construction of access roads are included at Exhibit H-6-1
Interconnection with existing transformer station	Confirmed
Line switched at Marathon TS	Confirmed

IESO Requirements

The Reference Design also meets each of the following IESO requirements:[1]

(i) NERC Criteria;

(ii) NPCC Directory No. 1; and

(iii) Ontario Resource and Transmission Assessment Criteria.

[1] Independent Electricity System Operator, “Feasibility Study: An assessment of the westward transfer capacity of various options for reinforcing the East-West Tie”, August 18, 2011 at s. 9, p. 13.

The three IESO requirements listed above are the same requirements used by the IESO in conducting their feasibility study for the Reference Design. The IESO's Feasibility Study for the Reference Design is included at Exhibit I-2-2.

The Reference Design meets NERC Standard TPL-001-2 Transmission System Planning Performance requirements as well as the NPCC Directory No. 1 requirements for both Transmission Design Criteria and Stability Assessment.

The portion of the bulk power system in each Planning Coordinator Area and in each Transmission Planning Area shall be designed with sufficient transmission capability to serve forecasted demand under the conditions noted in ss. 5.4.1 and 5.4.2. 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 the Planning Coordinator Area generation and power flows are adjusted between outages by the use of the ten-minute 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. For each of the contingencies stated below that involves a fault, stability shall be maintained when the simulation is based on fault clearing initiated by the "system A" protection group, and shall also be maintained when the simulation is based on fault clearing initiated by the "system B" protection group.

1. A permanent three-phase fault on any generator, transmission circuit, transformer or bus section, with normal fault clearing.

2. Simultaneous permanent phase to ground faults on different phases of each of two adjacent transmission circuits on a multiple circuit tower, with normal fault clearing.

The Reference Design meets the Ontario Resource and Transmission Assessment 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.

A signed affidavit from an officer of the licenced transmitter RES Transmission, that the Reference Design meets all of the above OEB and IESO technical requirements is included at Exhibit I-3-1.

TAB I-2-2

IESO Feasibility Study

PUBLIC

IESO_REP_0748

Power to Ontario.
On Demand.

Feasibility Study

An assessment of the westward transfer capability of various options for reinforcing the East-West Tie

1.0

A study to review the requirements for reinforcing the East-West Tie to provide a westward transfer capability of approximately 650MW

FINAL VERSION *18th August 2011*

FEASIBILITY STUDY:

TO ASSESS THE TRANSFER CAPABILITY OF VARIOUS OPTIONS FOR REINFORCING THE EAST-WEST TIE

EXECUTIVE SUMMARY

Feasibility Study: To assess the transfer capability of various options for reinforcing the East-West Tie

Executive Summary

1. Introduction

The OPA, in their report on the *Long-Term Electricity Outlook for the North-West*, has identified scope for additional load growth in the North-West and, from their assessment of the long-term supply needs for the area, *"finds that expansion of the E-W tie is the preferred alternative based on economic, flexibility, technical, operational and other considerations."*

"The OPA has assumed that the proposed expanded East-West Tie would be a new double-circuit 230kV overhead transmission line. The new line is to connect both Wawa TS and Lakehead TS.....and is to be switched at Marathon TS."

"The new line in conjunction with the existing tie is to provide total eastbound and westbound capabilities of the order of 650MW, while respecting all NERC, NPCC and IESO reliability standards."

Following the issue of FERC Order No. 743 on 18th November 2010, directing NERC to revise the definition of the Bulk Electric System (BES), it is expected that the 230kV transmission facilities west of Sudbury will be designated as BES.

This will require the East-West Tie to be designed to meet:

- the *Transmission System Planning Performance Requirements* specified in *NERC Standard TPL-001-2, &*
- the requirements for the *Design & Operation of the Bulk Power System* specified in *NPCC Directory No. 1*

This will mean that double-circuit contingencies will need to be respected at all times, rather than during high-risk periods when electrical storms are in the area, as is currently the practice.

It should be noted that although the standards specify other contingency conditions that must also be examined, including single-circuit contingencies with either a failure of their relay protection, or the failure of one of the breakers to operate, these conditions have been assumed to be less onerous for the system than double-circuit contingencies. However, to limit the adverse effects of breaker failure conditions, good station design will be critical.

Feasibility Study

This report summarises the results of analysis performed on two options for reinforcing the East-West Tie to achieve a transfer capability of approximately **650MW** westwards, measured at Wawa TS, while respecting double-circuit contingencies at all times:

Option 1 With a new 230kV double-circuit line installed between Wawa TS and Lakehead TS, as proposed by the OPA, and

Option 2 With a new 230kV high-capacity, single-circuit line installed between the same terminal stations.

East-West Tie

The present 'storm limit' on the East-West Tie, between Wawa TS and Mackenzie TS, under which double-circuit contingencies are respected, restricts transfers to approximately 175MW. As noted by the OPA in their report, should it become necessary to apply this limit at all times, it would severely affect the ability to supply the forecast load in the North-West, especially during periods of low rainfall when the output of the 780MW of hydroelectric facilities in the area would be restricted.

Sudbury Flow West Interface

The requirement to respect the loss of *'any two adjacent (vertically or horizontally) circuits on a common structure'* (NERC Standard TPL-001-2) would similarly have a significant effect on the transfer capability of the Sudbury Flow West Interface (SFW).
Following the loss of the 230kV double-circuit line between Algoma TS and Mississagi TS, all of the transfer across the SFW Interface would then appear on the 206km single-circuit 230kV line between Hanmer TS and Mississagi TS. The subsequent increase in the reactive losses would severely depress the voltages at Mississagi TS and Wawa TS; effectively limiting the maximum transfer across this Interface to approximately **350MW**.

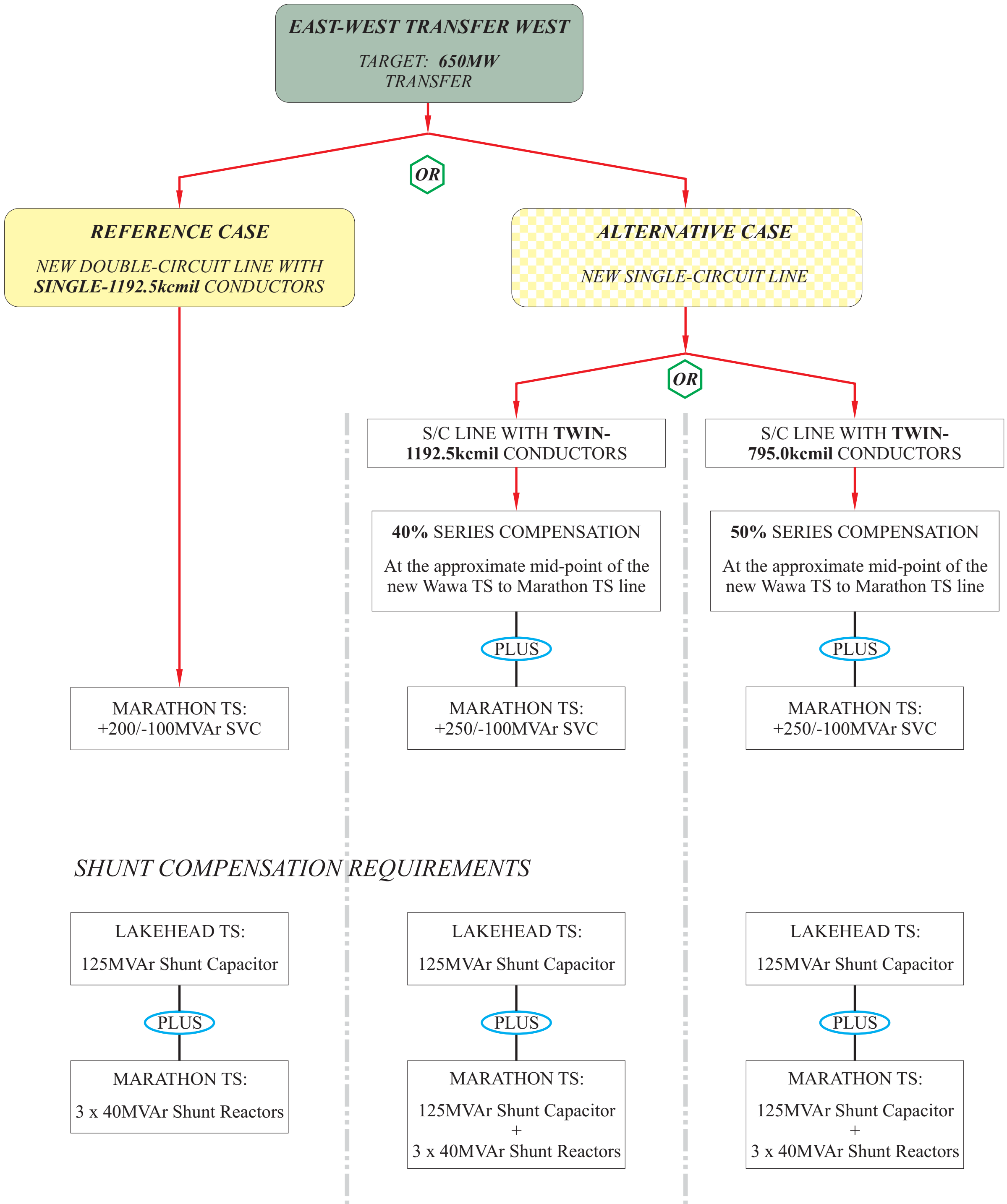
Transmission System between Mississagi TS & Wawa TS

The transmission system between Mississagi TS & Wawa TS consists of the facilities shown in the following Table:

Hydro One			*Circuits*	*Generation Connected*
Mississagi TS	to Wawa TS	230kV double-circuit line:	P25W & P26W	Aubrey Falls G1 & G2
Great Lakes Power				
Mississagi TS	to Third Line TS	Two 230kV circuits that occupy common structures for 11 spans	P21G & P22G	Wells G1 & G2
Third Line TS	to MacKay TS	230kV single-circuit line	K24G	-
MacKay TS	to Wawa TS	230kV single-circuit line	W23K	-

With the East-West Tie reinforced with a new double-circuit line between Wawa TS and Lakehead TS, double-circuit contingencies involving either the existing Hydro One owned line between Mississagi TS and Wawa TS, or the GLP owned line between Mississagi TS and Third Line, would restrict westward transfers across the East-West Tie Interface to a maximum of approximately **500MW**.

In their assessment, the OPA has identified a maximum transfer requirement across the East-West Tie of approximately *400MW* during the initial period of operation following its reinforcement. The 500MW E-W Tie Transfer West limit, for contingencies on that portion of the system between Mississagi TS and Wawa TS, would therefore be more than adequate for the expected transfers during this period.



SUMMARY OF THE REINFORCEMENT OPTIONS ***FIGURE 1***

SVC Static VAr Compensator

Reference Case for the Feasibility Study

The *Reference Case* that was used for this study assumed the construction of a new 230kV double-circuit line between Wawa TS and Lakehead TS, as proposed by the OPA, with intermediate terminations into Marathon TS. To minimise transmission losses, the new line was assumed to be equipped with single-1192.5kcmil conductors.

The following interface transfers were also assumed for the *Reference Case*, and these were achieved through adjustments to the load and generation patterns that were modelled:

- approximately **650MW** westwards, across the East-West Tie Interface, and
- approximately **350MW** across the Sudbury Flow West Interface

This report summarises the results of the analysis performed on the *Reference Case* and it also provides an assessment of an *Alternative Case* for reinforcing the East-West Tie based on the construction of a high-capacity, single-circuit 230kV line.

2. Conclusions

Figure 1 provides a summary of those facilities, identified through the analysis, which would be required to achieve the target transfer of **650MW** westwards across the East-West Tie, measured at Wawa TS, for both the *Reference Case* and the *Alternative Case,* with a coincident transfer of **350MW** across the Sudbury Flow West Interface.

2.1 Requirements for the Reference Case: With reinforcement consisting of a new 230kV double-circuit line equipped with single-1192.5kcmil conductors

For the *Reference Case*, an additional shunt capacitor bank with a nominal rating of 125MVAr (at 250kV) would be required at Lakehead TS to limit the pre-contingency reactive output from the two SVCs (Static VAr Compensators) at Lakehead TS.

Following a double-circuit contingency involving the new 230kV double-circuit line between Wawa TS and Marathon TS, all of the transfer on the East-West Tie would appear on the existing double-circuit line. To supply the immediate increase in the post-contingency reactive losses, a fast-acting source of reactive compensation would be required at Marathon TS. Further dynamic reactive compensation would also be needed to ensure that the IESO's criterion for voltage stability could be satisfied. This criterion requires the planned post-contingency transfer across the critical transmission Interface to have a margin of at least 5% from the transfer at which voltage instability is detected.

To supply both the increased post-contingency reactive losses and achieve a voltage stability limit that could accommodate a transfer of 650MW westwards across the East-West Tie, an SVC, or an equivalent source of dynamic reactive compensation, with a rating of **200MVAr,** would be required at Marathon TS.

The analysis also showed that the installation of the 200MVAr SVC, or its equivalent, at Marathon TS would be sufficient to respond to contingencies involving the new double-circuit line on the adjacent section of the East-West Tie between Marathon TS and Lakehead TS.

115kV Circuits T1M, A1B & A5A between Marathon TS and Alexander TS

Following a double-circuit contingency involving either the existing 230kV line between Marathon TS and Lakehead TS or the proposed new line, overloading of the parallel 115kV single-circuit connection between Marathon TS and Alexander TS would occur. To accommodate these increased transfers, the maximum continuous operating temperature for circuits T1M, A1B & A5A, that together form the parallel connection, would need to be increased to at least 93°C to provide a continuous rating of approximately 620A.

Double-circuit Contingencies involving the section of the EW Tie between Lakehead TS & Mackenzie TS

To avoid overloading circuit B6M, which provides a parallel 115kV connection from Birch TS to Moose Lake TS, it was assumed that this circuit would be cross-tripped immediately following a double-circuit contingency involving circuits A21L & A22L between Lakehead TS and Mackenzie TS.

With the 230kV circuits A21L & A22L out-of-service, and with the 115kV circuit B6M cross-tripped, all of the load to the west of Mackenzie TS would then be isolated on to the Manitoba and Minnesota Interconnections.

To accommodate the immediate post-contingency reductions in both the transfers on the East-West Tie and in the associated reactive losses, while also maintaining voltages within acceptable limits, a reactive absorption capability of at least 100MVAr would be required at Marathon TS. This would be in addition to the absorption capability already assumed to be available from the two SVCs at Lakehead TS.

Reactive Compensation requirement for the lightly-loaded case

To maintain the pre-contingency voltages within the 250kV threshold and to limit the 'continuous' reactive absorption by the SVC at Marathon TS to a maximum of approximately 50MVAr , three 40MVAr shunt reactors would need to be installed at Marathon TS to augment the absorption capabilities of the SVCs at Lakehead TS and Marathon TS:

- Lakehead TS — a total of -80MVAr from both the existing SVC and the SVC that has been proposed to replace the existing synchronous condenser
- Marathon TS — -100MVAr as proposed to limit the post-contingency 'transient' voltages following the separation of the system west of Mackenzie TS in response to a contingency involving the 230kV line between Lakehead TS and Mackenzie TS

Restricting the maximum 'continuous' absorption by the SVC at Marathon TS to around 50MVAr was found necessary to ensure that the local voltages could be maintained below the 250kV threshold in the event of a contingency involving the SVC.

2.2 Requirements for the Alternative Case: With reinforcement consisting of a new 230kV single-circuit line

For the *Alternative Case*, the higher impedance of the new 230kV single-circuit line would result in an unbalanced flow distribution between the two lines, resulting in increased reactive losses. To compensate for these increased pre-contingency losses, a 125MVAr capacitor bank would be required at both Lakehead TS and Marathon TS.

For this Case, the loss of the existing double-circuit line would represent the more-critical contingency since all of the post-contingency transfer would then appear on the new single-circuit line.

With only the single-circuit line remaining in-service post-contingency, the reactive losses would be substantially higher than those arising from the *Reference Case*. To compensate for these increased post-contingency losses, the amount of dynamic reactive compensation available at Marathon TS would also need to increase.

For the version of the *Alternative Case* with twin-1192.5kcmil conductors, 'dynamic' compensation rated at 350MVAr would be required at Marathon TS to address the immediate post-contingency reactive requirements for a transfer of 650MW westwards across the East-West Tie.

However, a 350MVAr SVC would not be sufficient to provide a voltage stability limit that would satisfy the 5% margin required under the IESO's criteria. Since the voltage decline at Wawa TS would be the critical factor, further increases in the rating of the Marathon SVC would be far less effective than installing a second SVC at Wawa TS. Rather than pursuing this, the study concentrated on the benefits of installing series compensation on the new line.

Series Compensation on the new single-circuit line

The analysis for the *Reference Case* showed that a 200MVAr SVC would be required at Marathon TS to support the post-contingency flows through the existing double-circuit line following a contingency involving the new double-circuit line. For the *Alternative Case*, since a contingency involving the new single-circuit line would also leave only the existing double-circuit line in-service over the faulted section, an SVC rated at 200MVAr was considered to represent the *minimum* reactive requirement for achieving a transfer capability of 650MW with the *Alternative Case*.

The effect of installing different levels of series compensation on the section of the new single-circuit line between **Wawa TS and Marathon TS**, with the object of limiting the size of the SVC that would be required at Marathon TS to approximately **200MVAr**, was examined.

With the new single-circuit line equipped with either:

- ***twin-1192.5kcmil** conductors & with **40%** series compensation installed on the Wawa to Marathon section OR*
- ***twin-795.0kcmil** conductors & with **50%** series compensation installed on the Wawa to Marathon section*

For both versions of the *Alternative Case,* a **200MVAr** SVC at Marathon TS would be sufficient to provide a voltage stability limit with the necessary 5% margin to accommodate the post-contingency transfers following the loss of the existing double-circuit line between Wawa TS and Marathon TS.

For the loss of the existing double-circuit line on the adjacent section of the East-West Tie between Marathon TS and Lakehead TS, the SVCs at Lakehead TS would reach their maximum output, leaving insufficient reactive support available to allow for margin. To ensure that the requirement for a 5% margin could be satisfied, the rating of the SVC at Marathon TS would need to be increased to **250MVAr**.

115kV Circuits T1M, A1B & A5A between Marathon TS and Alexander TS

Following a double-circuit contingency involving the existing line between Marathon TS and Lakehead TS, the higher impedance of the new high-capacity, single-circuit line that would remain in-service over this section would result in higher transfers over the parallel 115kV connection than were recorded for the *Reference Case*. To accommodate this higher flow, the maximum continuous operating temperature for the circuits T1M, A1B & A5A that form this parallel connection would need to be increased to at least 105^{o}C to provide a long-term emergency rating of approximately 690A.

Double-circuit Contingencies involving the section of the East-West Tie between Lakehead TS and Mackenzie TS

For the Alternative Case, separation of that part of the system west of Mackenzie TS on to the Manitoba and Minnesota Interconnections and the subsequent reductions in the transfers on the East-West Tie, would require not only the full reactive absorption capability of the SVCs at Marathon TS and Lakehead TS, but also the cross-tripping of the new shunt capacitor bank at Marathon TS to ensure that voltages remained below the 250kV threshold.

Relative Merits of a new High-Capacity Single-Circuit line versus a new Double-Circuit line

One-plus-One Contingency

The NERC, NPCC & IESO criteria all refer to a requirement to respect a second single-element contingency after experiencing an initial single-element contingency or outage, with control actions being taken between the two events to adjust the flows.

With the East-West Tie reinforced with a new single-circuit line, it would therefore be necessary, immediately following a contingency or outage involving this new line, to re-prepare the system for the loss of one of the circuits on the remaining double-circuit line.

Since the loss of the new single-circuit line would leave only the existing double-circuit in-service over the affected section, the transfer capability of the East-West Tie would therefore be reduced to the present limit for a *single-circuit contingency* of 350MW.
Since the targeted transfer capability of the reinforced East-West Tie is 650MW, a reduction to 350MW following the loss of the new single-circuit line would therefore require either additional generating resources totalling at least 300MW to be dispatched, or if there were the capability to arm load rejection of up to 150MW in response to the second contingency, then this would allow a corresponding lesser amount of generation to be dispatched.

Increasing the transfers via the Interconnections with Manitoba and Minnesota would also allow the amount of generation capacity that would need to be dispatched to be reduced.

All of these control actions would comply with the IESO's criteria.

Reinforcing the East-West Tie with a new double-circuit line would require no similar actions following the loss of either of the double-circuit lines (a simultaneous One-plus-One contingency) or the loss of one circuit of one of the lines followed by the loss of one of the circuits of the companion line.

For the One-plus-One contingency condition, the installation of a new double-circuit line to reinforce the East-West Tie would therefore represent the superior option.

2.3 Transmission System Losses: For the two reinforcement options

The transmission losses recorded for each of the reinforcement options that were assessed have been summarised in the following Table:

Summary of Transmission Losses on the East-West Tie									
Diagram	*East-West Transfer West*	*Marathon to Wawa Section*			*Lakehead to Marathon Section*			*Total Losses for both Sections*
			Circuit losses	*Total Losses*		*Circuit losses*	*Total Losses*	
Reference Case: With double-circuit lines equipped with single-1192.5kcmil conductors								
5.	652.0MW	New line	8.6MW	20.6MW	New line	8.4MW	19.8MW	*40.4MW*
		Existing:	12.0MW		Existing:	11.4MW		
Alternative Case with: New single-circuit lines equipped with twin-1192.5kcmil conductors								
14.	664.2MW	New line	6.0MW	23.6MW	New line	5.6MW	21.4MW	*45.0MW*
		Existing:	17.6MW		Existing:	15.8MW		
Alternative Case with: New single-circuit lines equipped with twin-1192.5kcmil conductors & with 40% series compensation of the new Wawa x Marathon line								
18.	662.0MW	New line	10.0MW	20.8MW	New line	5.7MW	21.5MW	*42.3MW*
		Existing:	10.8MW		Existing:	15.8MW		
Alternative Case with: New single-circuit lines equipped with twin-795.0kcmil conductors & with 50% series compensation of the new Wawa x Marathon line								
28.	670.6MW	New line	17.9MW	27.5MW	New line	8.4MW	24.8MW	*52.3MW*
		Existing:	9.6MW		Existing:	16.4MW		

These results show the following:

- For the Reference Case (Diagram 5), the installation of the 1192.5kcmil conductors on the new double-circuit line would reduce the losses by approximately 6.4MW. (A reduction of approximately 27%)

  [3.4MW on the Wawa to Marathon section plus 3.0MW on the Marathon to Lakehead section.]

- For the Alternative Case with no series compensation installed on the new line (Diagram 14), the unbalanced flow distribution would increase the losses on the existing line by 10.0MW (~ 43%). The results also show that because of the much lower losses on the new line there would be little benefit from equipping it with a larger conductor.

- Installing series compensation on the new line of the Alternative Case would improve the flow distribution between the two lines, reducing the losses on the existing line.

  In Diagram 18, with 40% series compensation installed on the new line equipped with 1192.5kcmil conductors, the total losses for the two lines on the *Wawa to Marathon section* would be similar to those for the Reference Case.

  In Diagram 28, with 50% series compensation installed on the new line equipped with 795.0kcmil conductors, the total losses for the two lines on the *Wawa to Marathon section* would be approximately 7MW higher than those for the Reference Case. Although the higher level of compensation would contribute to these increased losses, the primary cause would be the smaller conductor size.

Series Compensation and Conductor Size: Effect on Transmission Losses

Although the primary objective of installing series compensation on the new single-circuit line for the *Alternative Case* was to achieve a reduction in the post-contingency reactive losses on the new line and to reduce the size of the SVC required at Marathon TS, the improved flow distribution that would occur between the two lines would be an added benefit.

Since the proportion of the East-West Tie transfer that would appear on the new line will depend on the level of compensation installed, this would present an opportunity to minimise the transmission losses through the selection of an appropriate conductor size in conjunction with the preferred level of series compensation.

3. Replacement SVC at Lakehead TS: Recommendation

In this study it was assumed that the replacement SVC for the existing synchronous condenser at Lakehead TS would be rated the same as the existing SVC; namely +60/-40MVAr.

The analysis has indicated that should the East-West Tie be reinforced and its transfer capability increased, that the Lakehead area would benefit from a higher rated unit.

It is therefore recommended that when a decision is made to replace the existing synchronous condenser that consideration should be given to acquiring an SVC with rating of at least ± 100MVAr.

4. Station Layout Diagrams

A second report detailing the proposed connection arrangements for the new facilities at Mississagi TS, Wawa TS, Marathon TS and Lakehead TS, paying particular attention to reducing any adverse effects from breaker-failure conditions, will be issued by end-September 2011.

FEASIBILITY STUDY:

TO ASSESS THE TRANSFER CAPABILITY OF VARIOUS OPTIONS FOR REINFORCING THE EAST-WEST TIE

STUDY REPORT

Feasibility Study: To assess the transfer capability of various options for reinforcing the East-West Tie

STUDY REPORT

This report summarises the results of analysis performed on different options for reinforcing the East-West Tie to achieve a transfer capability of approximately **650MW** westwards, measured at Wawa TS.

5. *Reinforcement Options that were examined*

i. The *Reference Case*, with the East-West Tie reinforced with a new 230kV double-circuit line, equipped with 1192.5kcmil conductors, installed between Wawa TS and Lakehead TS, with terminations into Marathon TS

ii. An *Alternative Case* with the reinforcement of the East-West Tie provided through the installation of a new single-circuit 230kV line between Wawa TS and Lakehead TS, with terminations into Marathon TS.

   Two options were considered for the conductors to be installed on the proposed single-circuit line:

   - Twin-795.0kcmil 26/7 conductors (two conductors per phase, separated by spacers), to give thermal ratings approximately the same as those provided by the existing double-circuit line.
   - Twin-1192.5kcmil 54/19 conductors to provide similar thermal ratings to those proposed for the new double-circuit line.

Each of these cases will require different amounts of post-contingency reactive support to satisfy the IESO's voltage-stability requirements. Additional studies were also conducted to identify facilities that would permit the IESO's criteria to be met while minimising or eliminating the need for additional reactive compensation.

Assumed thermal ratings for the new line

<table>
<tr><td colspan="3">Thermal Ratings for the new line (assumed sheltered)</td><td colspan="4">(MVA ratings at 240kV)</td></tr>
<tr><td colspan="3">For an ambient temperature of 30°C & a wind speed of 0-4km/hr</td><td colspan="2">Continuous at 93°C</td><td colspan="2">Long-term Emergency at 127°C</td></tr>
<tr><td>1.</td><td>Reference Case
For each circuit of the new double-circuit line</td><td>equipped with single- 1192.5kcmil 54/19 conductors</td><td>1120A</td><td>466MVA</td><td>1440A</td><td>599MVA</td></tr>
<tr><td>2.</td><td rowspan="2">Alternative Case
For the new circuit of the single-circuit line</td><td>equipped with twin- 795.0kcmil 26/7 conductors</td><td>1750A</td><td>727MVA</td><td>2240A</td><td>931MVA</td></tr>
<tr><td>3.</td><td>equipped with twin- 1192.5kcmil 54/19 conductors</td><td>2230A</td><td>927MVA</td><td>2880A</td><td>1197MVA</td></tr>
</table>

6. *Generation Assumptions*

North-West

For this study, the output from the existing hydroelectric facilities was set at 334MW, which would represent approximately 43% of the peak output of 780MW from these facilities. This would be similar to the expected output from the hydroelectric facilities during a dry year.

A further contribution of 56MW was also assumed to be available from the existing gas-fired facilities in the area, giving a total output of **390MW** from the generation facilities in the North-West.
The Atikokan and Thunder Bay facilities were assumed to be out-of-service, and the output from the wind-turbine facilities was assumed to be zero.

North-east

The output from the hydroelectric facilities owned by Great Lakes Power (GLP), within the area between Algoma TS and Wawa TS, was set at 560MW. This would represent approximately 70% of their peak output of 804MW.

The existing thermal generation in the area was assumed to contribute a further 142MW, primarily from the Lake Superior Power and the Algoma Steel facilities.

The total generation assumed for the GLP area was therefore **702MW**. For the entire north-east, of which the GLP area is part, the total generation output was assumed to be **1372MW**.

7. Load Assumptions

For this study, a peak load of 950MW was assumed for the North-West, which would give a peak demand of approximately1040MW once the transmission losses of approximately 90MW have been factored in. This demand would therefore correspond reasonably closely with the demand forecast contained in the OPA's report of 30th June 2011 entitled:

Long Term Electricity Outlook for the Northwest and Context for the East-West Tie Expansion

The base load for the North-West that had been modelled in the load flow case used for this study totalled approximately 675MW. To achieve the required load of 950MW, 215MW of new load was added in the Thunder Bay area, with a further 60MW of new load distributed throughout the Red Lake/Crow River/Musselwhite area.

To avoid possible overloading of the existing 115kV transmission facilities from Dryden TS as a result of adding the new loads in the Red Lake/Crow River/Musselwhite area, a new 115kV connection was assumed to be available between Valora Junction and Musselwhite SS.

8. Target Transfers on the East-West Tie and on the Sudbury Flow West Interface

With the output from the local generation facilities in the North-West set at 390MW, and with the total load in this area adjusted to 950MW, then after accounting for the estimated 90MW of transmission losses on the system west of Wawa TS, this would result in the targeted transfer of approximately **650MW** being required across the East-West Tie Interface.

For the area between Algoma TS and Wawa TS, the loads included in the model totalled approximately 370MW, while the transmission losses over this part of the system were shown to total approximately 30MW.

Analysis had also shown that the existing transmission facilities between Sudbury (Hanmer TS and Martindale TS) and Mississagi TS would be capable of supporting a maximum transfer of approximately **350MW**, following a double-circuit contingency involving the existing line between Algoma TS and Mississagi TS.

With a maximum transfer of **350MW** across the Sudbury Flow West Interface and with a total demand of approximately 400MW in the area between Algoma TS and Wawa TS, the output from the generating facilities in this area, all of it owned by GLP, had to be set at approximately 700MW to achieve the targeted transfer of **650MW** across the East-West Tie**.**

9. Planning Criteria

On 18th November 2010 FERC issued Order 743 and directed NERC to revise the definition of Bulk Electric System so that the definition encompasses all Elements and Facilities necessary for the reliable operation and planning of the interconnected bulk power system.

In response, NERC initiated Project 2010-17 SDT and proposed the following continent-wide definition of the Bulk Electric System:

Bulk Electric System:

All Transmission and Generation Elements and Facilities operated at voltages of 100kV or higher necessary to support bulk power system reliability. Elements and Facilities operated at voltages of 100kV or higher, including Radial Transmission systems, may be excluded and Elements and Facilities operated at voltages less than 100kV may be included if approved through the BES definition exemption process.

Should those 230kV transmission facilities west of Sudbury be designated as part of the Bulk Electric System, then the Standards that would need to be respected would be the following:

i. NERC Standard TPL-001-2 **Transmission System Planning Performance Requirements**

[This Standard scheduled to be submitted for regulatory approval during Q3 of 2011]

Extract from Table 1. Transmission System Standards - Normal and Emergency Conditions

Category	*Initial Condition*	*Event*	*Fault Type*	*Interruption of firm transmission service allowed*	*Non-consequential load loss*
P6 Multiple Contingency (Two overlapping singles)	Loss of one of the following followed by System adjustments: 1. Transmission Circuit 2. Transformer 3. Shunt Device	Loss of one of the following: 1. Transmission Circuit 2. Transformer 3. Shunt Device	3Ø	Yes	Yes
P7 Multiple Contingency (Common Structure)	Normal System	The loss of: Any two adjacent (vertically or horizontally) circuits on a common structure	SLG	Yes	Yes

ii. NPCC Directory No. 1 dated 15th December 2009, which states:

5.4 Transmission Design Criteria

The portion of the **bulk power system** in each Planning Coordinator Area and in each Transmission Planning Area shall be designed with sufficient transmission capability to serve forecasted demand under the conditions noted in Sections 5.4.1 and 5.4.2. 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 the Planning Coordinator Area generation and **power** flows are adjusted between outages by the use of the **ten-minute reserve** and where available, phase angle regulator control and HVdc control.

5.4.1 Stability Assessment

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.** For each of the **contingencies** stated below that involves a fault, **stability** shall be maintained when the simulation is based on **fault clearing** initiated by the **"system A" protection group**, and also shall be maintained when the simulation is based on **fault clearing** initiated by the **"system B" protection group**.

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 transmission circuits on a multiple circuit tower, with **normal fault clearing**.

iii. The IESO's Ontario Resource and Transmission Assessment Criteria (ORTAC)

From Section 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.

The analysis covered by this report therefore concentrated on the effects of double-circuit contingencies involving the following line sections:

i.	between Algoma TS and Mississagi TS	Circuits A23P & A24P	
ii.	between Wawa TS and Marathon TS	Circuits W21M & W22M,	or the new double-circuit line
iii.	between Marathon TS and Lakehead TS	Circuits M23L & M24L,	or the new double-circuit line
iv.	between Lakehead TS and Mackenzie TS.	Circuits A21L & A22L	

Analysis also examined the effect of double-circuit contingencies involving the line section between Mississagi TS and Wawa TS (circuits P25W & P26W) and the section of circuits P21G & P22G near GLP's Third Line Substation that uses double-circuit line construction, to provide an indication of the transfer capability of this portion of the system.

Both of these contingency conditions would result in the loss of generation capacity; for a P25W + P26W contingency - the loss of both Aubrey Falls units; and for a P21G + P22G contingency - the loss of both Wells units.

From Section 4.5.1 ***Power - Voltage (P-V) Curves***

With the loads modelled as constant MVA loads, the transfer across the critical interface is to be increased in small increments (usually 1% of the interface transfer), recording the power flow and busbar voltages until the knee-point of the P-V Curve is reached or the case does not solve.

For voltage stability, the interface transfer corresponding to the knee-point when multiplied by 0.95 (representing the required 5% margin) must be greater than the interface transfer recorded in the post-contingency study.

10. Transfers to Manitoba & Minnesota

For this study, pre-contingency transfers of approximately 0MW were assumed on the Interconnections with both Manitoba and Minnesota.

Operation of the Phase-Shifters

The current modes of operation for the phase-shifters on the Manitoba and Minnesota Interconnections are described below. For the purpose of this study it has been assumed that, following the reinforcement of the East-West Tie, the present modes of operation will continue.

Phase-shifters on the Manitoba Interconnections

Once a difference of more than 25.6MW from the scheduled transfer is detected across this Interconnection, the operation of the phase-shifters is initiated. Tap-changer operation will then continue until either the difference between the actual and the scheduled transfer is reduced below the 25.6MW threshold or until four tap-changer operations have been completed. Once four tap-changer operations have occurred within a two minute period, the controller is automatically switched to the manual mode.

Phase-shifters on the Minnesota Interconnection

For transfers across this Interconnection that increase by more than 55MW in 10 seconds, the two, series-connected phase-shifters will move a combined total of four taps before automatically switching to the manual mode.

For transfers that are greater than 10MW and less than 55MW, tap-changer operation will continue until the difference between the actual and the scheduled transfer is less than 10MW.

11. Contingency Conditions Examined

Sudbury Flow West Interface

- To establish the appropriate transfer level to use for the Sudbury Flow West Interface:

  A double-circuit contingency involving circuits A23P & A24P between Algoma TS and Mississagi TS

  This contingency would leave only circuit X74P between Hanmer TS and Mississagi TS to supply all of the system west of Mississagi TS

East West Tie Interface

- *For the Wawa - Marathon Section*

  i. For the *Reference Case* with a new double-circuit 230kV line, equipped with 1192.5kcmil conductors, installed between Wawa TS & Marathon TS

     A double-circuit contingency involving the *new* line would leave the existing line, with its lower-rated 795kcmil conductors, to carry the entire transfer on the East-West Tie.

  ii. For the *Alternative Case* with a new single-circuit 230kV line installed between Wawa TS & Marathon TS

     A double-circuit contingency involving the *existing* line would leave the new single-circuit line to carry the entire transfer on the East-West Tie.

- *For the Marathon - Lakehead Section*

  Depending on whether the reinforcement of the East-West Tie were to consist of either a new single- or a double-circuit line, the same contingency conditions that were identified for the previous section would also apply to this section.

  It should also be noted that for this section, there is a parallel, single-circuit 115kV connection, formed by circuits T1M, A1B & A5A between Marathon TS & Alexander TS. Since a portion of the post-contingency transfer would appear on this line, it could result in overloading.

- *For the Lakehead - Mackenzie Section*

  Since there are no plans to reinforce this section, a double-circuit contingency involving circuits A21L & A22L would require that the parallel 115kV circuit B6M be cross-tripped to avoid it being overloaded. Alternatively, this circuit could be operated normally-open.

  The net result of this contingency would be the separation of the system, with that part of the system west of Mackenzie TS remaining connected to the Manitoba & Minnesota systems via their respective Interconnections.

  Separation of this area from the East-West Tie and the transfer of its supply on to the Manitoba & Minnesota systems would therefore unload the connections between Hanmer TS and Lakehead TS, resulting in increased voltages.

12. *Study Results*

- For each of the reinforcement options, pre-contingency load-flows were performed and the results summarised in load-flow diagrams.

- For each contingency condition, two individual load-flows were performed for the following conditions and the results also summarised in separate load-flow diagrams:

  i. for the situation *prior to* the adjustment of the phase-shifters on the Manitoba & Minnesota Interconnects, and

  ii. for the situation *after* the phase-shifters had been adjusted.

  PV-analysis (Power versus Voltage) was then performed on the post-contingency case *after* the phase-shifter adjustments had been completed. The intent of this analysis was to confirm that the reactive resources available would be sufficient to provide the 5% margin on the critical transfer as required by the IESO's criteria.

Comments have only been provided on a selection of these studies.

However, the following commentary, for the initial study on the Reference Case, has been prepared to assist in the interpretation of these results.

12.1 Reference Case Commentary

With a new double-circuit 230kV line equipped with single-1192.5kcmil conductors

Diagram 5: Pre-contingency Load-Flow

For this case, the principal transfers and outputs from the SVCs were as follows:

Sudbury Flow West		353.1MW
East-West Transfer West		652.0MW
Manitoba Transfer	(positive into Ontario)	3.4MW
Minnesota Transfer	(positive into Ontario)	2.2MW
Marathon SVC	+ 200/- 100MVAr	13.6MVAr
Lakehead SVCs	+ 120/- 80MVAr	-53.4MVAr
NW Transmission Losses		83MW
NE Transmission Losses		70MW

Diagram 6: Post-contingency Load-Flow *prior to* the adjustment of the Manitoba & Minnesota phase-shifters
For a double-circuit contingency involving the Wawa to Marathon section of the new line

Sudbury Flow West		321.1MW	Δ	- 32.0MW	*Change compared to Diagram 5*
East-West Transfer West		622.8MW	Δ	- 29.2MW	
Manitoba Transfer	(positive into Ontario)	31.8MW	Δ	+ 28.4MW	
Minnesota Transfer	(positive into Ontario)	20.6MW	Δ	+ 18.4MW	
Marathon SVC	+ 200/- 100MVAr	152.5MVAr	Δ	+ 138.9MVAr	
Lakehead SVCs	+ 120/- 80MVAr	-61.4MVAr	Δ	- 8.0MVAr	
NW Transmission Losses		109MW	Δ	+ 26MW	
NE Transmission Losses		58MW	Δ	- 12MW	

Following the contingency, the transfers on the SFW & EW Tie-W Interfaces were reduced by 32MW and 29MW, respectively while the combined import via the Interconnections to Manitoba and Minnesota increased by approximately 47MW. The difference is due primarily to the increased losses on the system in the North-West

In response to the increased reactive losses on the existing line following the loss of the new line between Wawa TS and Marathon TS, the output from the SVC at Marathon is shown to increase by 139MVAr.

Diagram 7: Post-contingency Load-Flow *after* the adjustment of the Manitoba & Minnesota phase-shifters
For a double-circuit contingency involving the Wawa to Marathon section of the new line

Sudbury Flow West		373.0MW	Δ	+ 19.9MW	*Change compared to Diagram 5*
East-West Transfer West		668.6MW	Δ	+ 16.6MW	
Manitoba Transfer	(positive into Ontario)	18.0MW	Δ	+ 14.6MW	
Minnesota Transfer	(positive into Ontario)	2.5MW	Δ	+ 0.3MW	
Marathon SVC	+ 200/- 100MVAr	200.0MVAr	Δ	+ 186.4MVAr	
Lakehead SVCs	+ 120/- 80MVAr	-31.2MVAr	Δ	+ 22.2MVAr	
NW Transmission Losses		123MW	Δ	+ 40MW	
NE Transmission Losses		66MW	Δ	- 4MW	

Following the adjustment of the phase-shifters, the combined transfer from Manitoba and Minnesota would be reduced to 15MW, resulting in increased transfers over the SFW and E-W Tie-W Interfaces to supply the increased transmission losses in the North-West.

The increased transfer across the East-West Tie is shown to result in a further increase in the reactive losses on the remaining two circuits between Wawa TS and Marathon TS, causing the output of SVC at Marathon TS to reach its maximum of 200MVAr.

The combined reactive output from the two Wells units is shown as 19.5MVAr (leaving approximately 84MVAr of their capability remaining) while the combined reactive output from the two Aubrey Falls units is 20.6MVAr (leaving 45MVAr available).

Diagram 8: Results from the PV-analysis on the post-contingency case *after* phase-shifter action

A contingency involving the new double-circuit line between Wawa TS and Marathon TS would have a direct effect on the ability to transfer power westwards across the East-West Tie Interface. This study therefore examined the effect on the busbar voltages in the immediate area of increasing the transfers across this Interface. The purpose of this analysis was to confirm that adequate reactive resources would be available to provide a margin of at least 5% on the transfer that was recorded across the East-West Tie Interface in the post-contingency study.

From **Diagram 7**, the post-contingency transfer across the EW-W Interface was **668.6MW**.

The PV-analysis plots in **Diagram 8** start at this transfer level and show the effect of increasing the flow across the EW-W Interface until the load-flow fails to converge. This is shown to occur at an EW-W Transfer of **722MW**, when the voltages at Wawa TS and Marathon TS experienced excessive declines.

The final plot on **Diagram 8** shows the reactive capability remaining available from the monitored resources.

Since the SVC at Marathon TS was shown to have reached its maximum output of 200MVAr in **Diagram 7** it would no longer be able to contribute reactive support. Although the units at Wells GS are shown to provide some reactive support in response to the declining voltage at Mississagi TS, the decline at that location is not sufficient for these units to reach their maximum output. Similarly, for the units at Aubrey Falls GS. However, the greatest reactive contribution is shown to be provided by the SVCs at Lakehead TS and, from the upper plot on **Diagram 8**, they are shown to be successful in maintaining the voltage on the 230kV busbar at Lakehead TS at its set point of 243kV while they still have reactive capacity available.

Once the two SVCs at Lakehead reach their maximum combined output of 120MVAr, the load-flow fails to converge (since the output from these SVCs is shown as - 31.2MVAr in **Diagram 7**, they would therefore have 151.2MVAr remaining available for voltage support at the start of the PV-analysis.)

When the SVCs at Lakehead TS are no longer capable of maintaining the voltage at that busbar at its set point, the voltages at Wawa TS and Marathon TS will collapse, resulting in the load-flow failing to converge.

Applying a 5% margin on the limiting transfer of *722MW* at which the PV-analysis terminated would give a *voltage stability limit* of **686MW**. Since this would exceed the post-contingency transfer of 668.6MW, it would satisfy the IESO's voltage stability criterion.

The installation of a 200MVAr SVC at Marathon TS would therefore be sufficient to support the post-contingency transfer across the East-West Tie Interface of 668MW, or the equivalent pre-contingency transfer of 652MW.

In practice, this 'dynamic' reactive support could be provided by fast, mechanically-switched shunt devices with individual ratings selected to ensure that the IESO's criterion that the maximum incremental voltage change in response to their switching should be no greater than 4%, is respected. [Section 4.3.2 of ORTAC]

12.2 Summary of the results from the studies on the Sudbury Flow West Interface

To establish an appropriate value for the transfer across the Sudbury Flow West Interface to be included in the load flow model used for the analysis of the options for reinforcing the East-West Tie, an initial series of studies were completed. These studies examined the transfer capability of the existing transmission facilities between Sudbury and Mississagi TS, following the loss of the double-circuit line between Algoma TS and Mississagi TS. The results have been summarised in **Table 1**.

For these studies the proposed *Reference Case* reinforcement, involving a new 230kV double-circuit line between Wawa TS and Lakehead TS, via Marathon TS, was included in the model.

To achieve the targeted transfer of 650MW across the East-West Tie, a shunt capacitor rated at 125MVAr (at 250kV) was included at Lakehead TS on the 230kV busbar. For this analysis, no additional reactive support was included at Marathon TS.

The PV-analysis showed that with the two SVCs at Lakehead TS in-service, together with all four units at Wells GS and Aubrey Falls GS available to provide post-contingency reactive support, the voltage stability limit for the Sudbury Flow West Interface, after allowing for the required 5% margin, would be approximately 360MW.

For the transfers across Sudbury Flow West Interface, **350MW** was therefore adopted as the reference value in all of the subsequent analysis.

12.3 Summary of the results from the studies on the Reference Case

The results from the series of studies on the *Reference Case* with a new 230kV double-circuit line between Wawa TS and Lakehead TS, via Marathon TS, have been summarised in **Table 2**.

For contingencies involving the new double-circuit line between Wawa TS and Marathon TS, the PV-analysis shows that an SVC at Marathon TS with a rating of + 200MVAr would provide voltage stability limit that would be more than adequate to accommodate the targeted transfer of 650MW westwards across the East-West Tie.

However, for contingencies involving the new double-circuit line between Marathon TS and Lakehead TS, a 200MVAr SVC at Marathon would result in a voltage stability limit that would be marginally lower than the post-contingency transfer. This would mean that either a higher rated SVC would need to be installed at Marathon TS or that the replacement SVC for the existing synchronous condenser at Lakehead TS should have a higher rating than the +60/-40MVAr rating of the existing SVC.

For contingencies involving the existing double-circuit line between Lakehead TS and Mackenzie TS, that would require cross-tripping of the parallel 115kV circuit B6M and result in the separation of the system west of Mackenzie TS, the SVC at Marathon TS would need to have a reactive absorption capability of at least 100MVAr to ensure that voltages remain within the 250kV threshold.

In all of these studies the post-contingency flows on the remaining circuits were within their respective long-term emergency ratings except for those on the 115kV circuit T1M, between Marathon TS and Terrace Bay TS. Since the maximum conductor operating temperature of this circuit is only 70^{o}C, its rating is limited to just 96MVA. In **Diagram 8**, the post-contingency flow on this circuit is shown to be approximately 93MVA, but once the phase-shifters are adjusted this would increase to approximately 100MVA, as shown in **Diagram 9**.

TABLE 1:	***SFW Transfer***		***Study Results for the Reference Case*** ***With a new double-circuit line****, equipped with single-1192.5kcmil conductors*		
Diag.	*E-W Tie Transfer Westwards:* **650MW** *Sudbury Flow West (SFW) Transfer:* **350MW**			*EW Transfer W*	*SFW Transfer*
1.	Pre-contingency		*With a new 230kV double-circuit line between Wawa TS and Lakehead TS*	651MW	353MW
2.	D/C Contingency: Algoma x Mississagi circuits	No PS action	Manitoba: 38MW Minnesota: 25MW Lakehead SVCs: -80MVAr	580MW	273MW
3.		With PS action	Manitoba: 33MW Minnesota 2MW Lakehead SVCs: -45MVAr	615MW	312MW
4.		PV-analysis:	*Voltage Stability Limit for SFW Transfers:* *361MW*		

TABLE 2:	***EW Tie Transfer West***		***Study Results for the Reference Case*** ***With a new double-circuit line****, equipped with single-1192.5kcmil conductors*	
Diag.	*E-W Tie Transfer Westwards:* **650MW** *Sudbury Flow West (SFW) Transfer:* **350MW**			*EW Transfer W*
5.	Pre-contingency		*With a +200/-100MVAr SVC at Marathon TS*	652MW
6.	D/C Contingency: New Wawa x Marathon circuits	No PS action	Manitoba: 32MW Minnesota: 21MW Marathon SVC: 153MVAr Lakehead SVCs: -61MVAr	623MW
7.		With PS action	Manitoba: 18MW Minnesota: 3MW Mississagi SVC: **200MVAr** Marathon SVC: -31MVAr	669MW
8.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:* *686MW*	
9.	D/C Contingency: New Marathon x Lakehead circuits	No PS action	Manitoba: 31MW Minnesota: 21MW Marathon SVC: 89MVAr Lakehead SVCs: 77MVA	624MW
10.		With PS action	Manitoba: 15MW Minnesota: 2MW Marathon SVC: 143MVAr Lakehead SVCs: 116MVAr	**673MW**
11.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:* ***671MW***	
12.	D/C Contingency: Mackenzie x Lakehead circuits	No PS action	Manitoba: 119MW Minnesota: 75MW Marathon SVC: -100MVAr Lakehead SVCs: -69MVA	434MW
13.		With PS action	Manitoba: 130MW Minnesota: 64MW Marathon SVC: -100MVAr Lakehead SVCs: -69MVA	434MW

Notes on the Tables

PS	Phase-Shifters on the Interconnections to Manitoba and Michigan
PV-analysis	Power versus Voltage studies to confirm that the required 5% margin can be achieved on the post-contingency case
D/C Contingency	Double-circuit contingency involving adjacent circuits on a common line structure
S/C Contingency	Single-circuit contingency

As part of the project to reinforce the East-West Tie it is therefore recommended that the maximum operating temperature of circuits T1M, A1B & A5A that form the connection between Marathon TS and Alexandra SS be increased to at least 93^{O}C. This would provide a continuous rating for this connection of approximately 130MVA.

12.4 Summary of the results from the studies on the Alternative Case

The results from the series of studies on the *Alternative Case* with a new 230kV single-circuit line between Wawa TS and Lakehead TS, via Marathon TS, have been summarised in **Table 3**.

Following a double-circuit contingency involving the existing East-West Tie line, the higher reactance of the remaining single-circuit line would result in substantially higher reactive losses than would occur for the *Reference Case* that would leave a double-circuit line in-service. This would require greater amounts of reactive compensation to be installed to maintain an acceptable post-contingency voltage performance.

With the East-West Tie reinforced with a new single-circuit line equipped with twin-1192.5kcmil conductors, a 125MVAr (at 250kV) shunt capacitor would need to be installed at Marathon TS, in addition to a similarly rated bank at Lakehead TS, to compensate for the increased reactive losses.

The PV-analysis on the post-contingency case for the loss of the existing double-circuit line between Wawa TS and Marathon TS showed that an SVC at Marathon TS, rated at 350MVAr would be insufficient to achieve a voltage stability limit that would be high enough to accommodate the post-contingency transfer.

Series Compensation

Although the size of the SVC at Marathon TS could be increased, or a second SVC installed at Wawa TS to achieve the required voltage stability limit, this would not address the cause of the high reactive losses which arise as a result of the higher reactance of the single-circuit line.

Installing series compensation on the new line to reduce its effective reactance would reduce the reactive losses and hence the requirement for additional reactive compensation at Marathon TS.

Alternative Case with twin-1192.5kcmil conductors

The results from the studies for the *Alternative Case* with a new single-circuit line equipped with twin-1192.5kcmil conductors and with **40%** series compensation installed on the **Wawa TS to Marathon TS** section are summarised in **Diagrams 18 to 27** inclusive.

These show that, with 40% series compensation installed on the Wawa TS to Marathon TS section of the new line:

- for the loss of the existing double-circuit line between Wawa TS and Marathon TS, a 200MVAr SVC at Marathon TS, would be sufficient to provide a post-contingency voltage stability limit that would satisfy the IESO's criteria.

- for the loss of the existing double-circuit line between Marathon TS and Lakehead TS, the size of the SVC at Marathon TS would need to be increased to 250MVAr, to provide a post-contingency voltage stability limit that would satisfy the IESO's criteria.

TABLE 3:* *EW Tie Transfer West	***Study Results for the Alternative Case* *With a new single-circuit, high-capacity line***			
Diag.	*E-W Tie Transfer Westwards:* **650MW** *Sudbury Flow West (SFW) Transfer:* **350MW**			
With a new single-circuit line, equipped with twin-1192.5kcmil conductors				*EW Transfer W*
14.	Pre-contingency		*With a **350MVAr** SVC at Marathon TS*	664MW
15.	D/C Contingency: Existing Wawa x Marathon circuits	No PS action	Manitoba: 45MW Minnesota: 28MW Marathon SVC: 128MVAr Lakehead SVCs: -60MVAr	589MW
16.		With PS action	Manitoba: 40MW Minnesota: 0MW Marathon SVC: 233MVAr Lakehead SVCs: -42MVAr	**636MW**
17.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers with a 350MVAr SVC at Marathon TS:* ***630MW***	
18.	Pre-contingency		*With a **200MVAr** SVC at Marathon TS & **40% series compensation** on the new Wawa x Marathon line*	662MW
19.	D/C Contingency: Existing Wawa x Marathon circuits	No PS action	Manitoba: 22MW Minnesota: 14MW Marathon SVC: 68MVAr Lakehead SVCs: -38MVAr	632MW
20.		With PS action	Manitoba: 2MW Minnesota: 1MW Marathon SVC: 123MVAr Lakehead SVCs: -16MVAr	676MW
21.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:* *716MW*	
22.	D/C Contingency: Existing Marathon x Lakehead circuits	No PS action	Manitoba: 38MW Minnesota: 25MW Marathon SVC: 63MVAr Lakehead SVCs: 96MVAr	607MW
23.		With PS action	Manitoba: 27MW Minnesota: 0MW Marathon SVC: 142MVAr Lakehead SVCs: 120MVAr	**657MW**
24.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers with a 200MVAr SVC at Marathon TS:* ***646MW***	
25.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers with a **250MVAr** SVC at Marathon TS:* ***662MW***	
26.	D/C Contingency: Mackenzie x Lakehead circuits.	No PS action	Manitoba: 120MW Minnesota: 75MW Marathon SVC: -95MVAr Lakehead SVCs: -28MVA	433MW
27.		With PS action	Manitoba: 131MW Minnesota: 64MW Marathon SVC: -95MVAr Lakehead SVCs: -28MVA	433MW
With a new single-circuit line, equipped with twin-795.0kcmil conductors				*EW Transfer W*
28.	Pre-contingency		*With a **200MVAr** SVC at Marathon TS & **50% series compensation** on the new Wawa x Marathon line*	671MW
29.	D/C Contingency: Existing Wawa x Marathon circuits	No PS action	Manitoba: 22MW Minnesota: 15MW Marathon SVC: 93MVAr Lakehead SVCs: -26MVAr	656MW
30.		With PS action	Manitoba: 4MW Minnesota: 3MW Marathon SVC: 146MVAr Lakehead SVCs: -3MVAr	700MW
31.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:* *735MW*	
32.	D/C Contingency: Existing Marathon x Lakehead circuits	No PS action	Manitoba: 45MW Minnesota: 29MW Marathon SVC: 70MVAr Lakehead SVCs: 120MVAr	616MW
33.		With PS action	Manitoba: 40MW Minnesota: 1MW Marathon SVC: 164MVAr Lakehead SVCs: 120MVAr	**667MW**
34.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers with a 200MVAr SVC at Marathon TS:* ***649MW***	
35.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers with a **250MVAr** SVC at Marathon TS:* ***665MW***	

Alternatively, as indicated by the bottom plot on **Diagram 25**, where the SVCs at Lakehead are shown to have exhausted their reactive capability before the transfer margin is applied, the availability of *additional* reactive capability at Lakehead TS would avoid the need to increase the rating of the SVC at Marathon TS to 250MVAr to achieve the required voltage stability limit.

- for the loss of the existing double-circuit line between Mackenzie TS and Lakehead TS which would unload the East-West Tie following the isolation of the loads west of Mackenzie TS on to the Manitoba and Minnesota Interconnections, the new 125MVAr shunt capacitor bank at Marathon TS would need to be cross-tripped. This would be in addition to having a 100MVAr absorption capability from the SVC at Marathon TS to ensure that the post-contingency voltages are maintained below the 250kV threshold.

Alternative Case with twin-795.0kcmil conductors

The results from the studies for the *Alternative Case,* with a new single-circuit line equipped with twin-795.0kcmil conductors and with the level of series compensation installed on the **Wawa TS to Marathon TS** section increased to **50%**, are summarised in **Diagrams 28 to 35** inclusive.

These show that with the new line equipped with the smaller conductors but with the level of series compensation on the Wawa TS to Marathon TS section increased to **50%,** there would be no change in the rating required for the SVC at Marathon TS for the following double-circuit contingencies:

- for a contingency involving circuits W21M & W22M, from Wawa to Marathon: an SVC rated at **200MVAr**
- for a contingency involving circuits M21L & M22L, from Marathon to Lakehead: an SVC rated at **250MVAr**

As before, the analysis indicates that if the reactive capability of the SVCs at Lakehead TS were to be increased (by installing a higher rated SVC to replace the existing synchronous condenser) it would result in a lower rated SVC being required at Marathon TS to respond to contingencies involving the existing line between Marathon TS and Lakehead TS.

12.5 115kV Circuits T1M, A1B and A5A

In **Diagram 33**, in which the results for a contingency involving the existing double-circuit line between Marathon TS and Lakehead TS have been summarised, a post-contingency flow of 136MW is shown on circuit T1M. This would require the maximum conductor operating temperature of this circuit, as well as that for circuits A1B & A5A, to be increased from their present values (70^{o}C for T1M; 84^{o}C for A5A; and 66^{o}C for A5A) to at least 105^{o}C to provide a long-term emergency rating that could accommodate this transfer.

> Should a new single-circuit line be installed to reinforce the East-West Tie, then it is recommended that the maximum operating temperature of circuits T1M, A1B & A5A that form the connection between Marathon TS and Alexandra SS be increased to at least 105^{o}C. This would provide a long-term emergency rating for this connection of approximately 144MVA.

13. Transmission Losses

Table 4 summarises the losses on the principal 230kV circuits for the various transmission reinforcement options that were assessed.

TABLE 4	***Summary of Transmission Losses on the East-West Tie***							
	East-West Transfer West	*Marathon to Wawa Section*			*Lakehead to Marathon Section*			*Total Losses for both Sections*
			Circuit Losses	*Total Losses*		*Circuit Losses*	*Total Losses*	
Reference Case: With double-circuit lines equipped with single-1192.5kcmil conductors								
Diagram 5.	652.0MW	New line	8.6MW	20.6MW	New line	8.4MW	19.8MW	40.4MW
		Existing: W21M & W22M	12.0MW		Existing: M23L & M24L	11.4MW		
Case with: New single-circuit lines equipped with twin-1192.5kcmil conductors								
Diagram 14.	664.2MW	New line	6.0MW	23.6MW	New line	5.6MW	21.4MW	45.0MW
		Existing: W21M & W22M	17.6MW		Existing: M23L & M24L	15.8MW		
*Case with: New single-circuit lines equipped with twin-1192.5kcmil conductors with **40%** series compensation of the new Wawa to Marathon line*								
Diagram 18.	662.0MW	New line	10.0MW	20.8MW	New line	5.7MW	21.5MW	42.3MW
		Existing: W21M & W22M	10.8MW		Existing: M23L & M24L	15.8MW		
*Case with: New single-circuit lines equipped with twin-795.0kcmil conductors with **50%** series compensation of the new Wawa to Marathon line*								
Diagram 28.	670.6MW	New line	17.9MW	27.5MW	New line	8.4MW	24.8MW	52.3MW
		Existing: W21M & W22M	9.6MW		Existing: M23L & M24L	16.4MW		

Table 5 shows the corresponding flow distribution between the new and the existing circuits for each of the transmission reinforcement options.

TABLE 5	***Flow Distribution for each of the Transmission Reinforcement Options***			*Combined Flows*	
				Wawa x Marathon Section	Marathon x Lakehead Section
Reinforcement Option					
Reference Case	New double-circuit line with single-1192.5kcmil conductors	Diagram 5	New	325MW	276MW
			Existing	327MW	273MW
				Compensated Section	*Uncompensated Section*
Alternative Case	New single-circuit line with twin-1192.5kcmil conductors	Diagram 14	New	270MW *41%*	225MW *41%*
			Existing	394MW *59%*	325MW *59%*
	New single-circuit line with twin-1192.5kcmil conductors *plus* 40% series compensation on the WxM section	Diagram 18	New	353MW *53%*	226MW *41%*
			Existing	309MW *47%*	325MW *59%*
	New single-circuit line with twin-795.0kcmil conductors *plus* 50% series compensation on the WxM section	Diagram 28	New	375MW *56%*	219MW *40%*
			Existing	296MW *44%*	333MW *60%*

Table 5 shows that for the *Reference Case*, the flow distribution between the two lines is reasonably balanced even though the new line has been assumed to be equipped with larger conductors.

For the *Alternative Case* with no series compensation installed on the new single-circuit line, approximately 40% of the flow is distributed on the new line and 60% on the existing line. Although the size of the conductor installed on the new line is shown to have an effect on the flow distribution between the two lines, it is relatively small (~ 1%).

The effect that the installation of series compensation would have on the flow distribution between the two lines is summarised below:

	Effect on the flow distribution of installing Series Compensation on the new line			
Conductors on new line	Twin-1192.5kcmil Conductors		Twin-795.0kcmil Conductors	
	Uncompensated	With **40%** Series Compensation	Uncompensated	With **50%** Series Compensation
New Line	41%	53%	40%	56%
Existing Line	59%	47%	60%	44%

The transmission losses that have been summarised in **Table 4** show the following:

- For the *Reference Case* (**Diagram 5**), since the flow distribution between the new and the existing line are virtually the same, the difference in the losses of approximately 6.4MW (a reduction of approximately 27%) would represent the reduction that would result from using the larger conductor on the new line.

  [3.4MW on the Wawa to Marathon section plus 3.0MW on the Marathon to Lakehead section.]

- For the *Alternative Case* with no series compensation installed on the new line (**Diagram 14**), the unbalanced flow distribution would increase the losses on the existing line by 10.0MW (~ 43%). The results also show that because of the much lower losses on the new line there would be little benefit from equipping it with a larger conductor.
- Installing series compensation on the Wawa TS to Marathon TS section of the new line of the *Alternative Case* would increase the flow over this section of the new line, resulting in reduced losses on the existing line.

  In **Diagram 18**, for the case with the new line equipped with 1192.5kcmil conductors, installing 40% series compensation would result in combined losses for the two lines on the Wawa to Marathon section, which would be similar to those for the Reference Case.

  In **Diagram 28**, for the case with the new line equipped with 795.0kcmil conductors, increasing the level of series compensation to 50% would result in a higher proportion of the flow over the Wawa to Marathon section appearing on the new line. The combined losses on the two lines over this section are shown to be approximately 7MW higher than those for either the *Reference Case* or the version of the *Alternative Case* with the larger 1192.5kcmil conductors.

14. Reactive Compensation requirements for the lightly loaded case

To represent a typical 'lightly loaded case', the load in the North-West was reduced to 428MW and the generation was adjusted to 460MW. Since the transmission losses for the North-West totalled approximately 22MW, this was intended to result in a transfer across the East-West Tie Interface of approximately 0MW.

Diagrams 36 & 38 show the results of the studies with the same load and generation patterns but with the East-West Tie reinforced with a new double-circuit line and a new single-circuit line, respectively.

For both studies, the shunt compensation remained the same, with the following reactors assumed to be in-service:

- Wawa TS Two 36MVAr tertiary-connected reactors (existing)
- Marathon TS Two 40MVAr tertiary-connected reactors (NEW)
- Mackenzie TS One 40MVAr tertiary-connected reactor (existing)

In addition, the following reactive absorption capabilities were assumed to be available:

- At Marathon a new 230kV-connected SVC with an absorption capability of 100MVAr
- At Lakehead TS, it was assumed that the existing synchronous condenser would be replaced with an SVC having the same +60/-40MVAr rating as the existing SVC.

For the two studies, the reactive absorption by these dynamic resources was as follows:

Reactive Absorption for the lightly-loaded case		
	Diagram 36 *With a new double-circuit line*	*Diagram 38* *With a new single-circuit line*
Marathon SVC	- 97.2MVAr	- 67.0MVAr
Lakehead SVCs (combined contribution)	- 67.0MVAr	- 60.8MVAr

TABLE 6: ***EW Tie Transfer West***		***Study Results for the light-load condition with transfers of ~ 0MW on the EW Tie***	
Diag.	*E-W Tie Transfer Westwards:* Approximately **0MW** *Sudbury Flow West (SFW) Transfer:* Approximately **0MW**		*EW Transfer W*
With a new double-circuit line, equipped with single-1192.5kcmil conductors *With a +200/-100MVAr SVC & two 40MVAr reactors at Marathon*			
36.	Pre-contingency	*Marathon SVC: -97.2MVAr Lakehead SVCs: -76MVAr Lakehead: 242kV Marathon: 241kV Wawa: 245kV*	-6.4MW
37.	*Post-contingency: SVC tripped*	*Marathon SVC: 0MVAr Lakehead SVCs: -80MVAr Lakehead: 250kV Marathon: 255kV Wawa: 254kV*	-7.2MW
With a new single-circuit line, equipped with twin-1192.5kcmil conductors & with 40% series compensation of the Wawa to Marathon section *With a +200/-100MVAr SVC & two 40MVAr reactors at Marathon*			
38.	Pre-contingency	*Marathon SVC: -67.0MVAr Lakehead SVCs: -61MVAr Lakehead: 242kV Marathon: 241kV Wawa: 245kV*	-6.3MW
39.	*Post-contingency: SVC tripped*	*Marathon SVC: 0MVAr Lakehead SVCs: -80MVAr Lakehead: 245kV Marathon: 249kV Wawa: 250kV*	-6.6MW

TABLE 7: ***EW Tie Transfer West***		***Study Results for Contingencies on the 230kV system between Mississagi TS and Wawa TS***						
Diag.	*E-W Tie Transfer Westwards:* **500MW** *Sudbury Flow West (SFW) Transfer:* **350MW**							*EW Transfer W*
With a new double-circuit line, equipped with single-1192.5kcmil conductor *With a +200/-100MVAr SVC & two 40MVAr reactors at Marathon*			*With a single generating unit in-service at Wells GS and Aubrey Falls GS*					
40.	Pre-contingency		*With a* ***200MVAr*** *SVC at Marathon TS & with one unit in-service at Wells GS & one at Aubrey GS*					520MW
41.	D/C Contingency: Existing Mississagi to Wawa circuits *P25W + P26W*	No PS action	Manitoba: 44MW	Minnesota: 28MW	Marathon SVC:	-25MVAr	Lakehead SVCs: -3MVAr	427MW
42.		With PS action	Manitoba: 42MW	Minnesota: -3MW	Marathon SVC:	16MVAr	Lakehead SVCs: 9MVAr	**465MW**
43.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:*		***500MW***			
44.	D/C Contingency: Existing Mississagi to Third Line circuits *P21G + P22G*	No PS action	Manitoba: 28MW	Minnesota: 18MW	Marathon SVC:	-15MVAr	Lakehead SVCs: 6MVAr	456MW
45.		With PS action	Manitoba: 22MW	Minnesota: -3MW	Marathon SVC:	19MVAr	Lakehead SVCs: 18MVAr	***488MW***
46.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:*		***562MW***			
47.	S/C Contingency: Existing Wawa to MacKay circuit *W23K*	No PS action	Manitoba: 10MW	Minnesota: 7MW	Marathon SVC:	-14MVAr	Lakehead SVCs: 19MVAr	490MW
48.		With PS action	Manitoba: -3MW	Minnesota: -3MW	Marathon SVC:	12MVAr	Lakehead SVCs: 31MVAr	**517MW**
49.		PV-analysis:	*Voltage Stability Limit for EW Tie-W Transfers:*		***569MW***			

Studies were performed to examine the effect on the local voltages of tripping the SVC at Marathon TS at these levels of reactive absorption.

The results are summarised in **Diagrams 37 & 39** for the *Reference* and *Alternative Case*, respectively.

For the Reference Case, with the Marathon SVC absorbing 97MVAr pre-contingency, the loss of the SVC would result in voltages of 255kV at Marathon TS and 254kV at Wawa TS, which would exceed the permitted maximum of 250kV.

For the Alternative Case, with the Marathon SVC absorbing 67MVAr pre-contingency, the voltages at Wawa TS and Marathon TS would increase to 249.7kV and 249.1kV, respectively, in response to the loss of the SVC. The voltage at Marathon would therefore be only marginally within the 250kV limit.

The results from these studies, which are summarised in **Table 6,** show the following:

- A minimum of *three* new 40MVAr shunt reactors would need to be installed at Marathon TS regardless of whether the proposed reinforcement consists of a new 230kV double-circuit line or a new 230kV single-circuit line.

  Installation of the third reactor would be required to limit the reactive absorption by the SVC at Marathon TS to less than about 50MVAr so that in the event that the SVC should trip, the voltages would remain within the agreed 250kV threshold.

- Although the SVC proposed for Marathon TS would not be permitted to operate continuously at an absorption level in excess of 50MVAr because of the consequences of it tripping when loaded above this level, it would still need to have a 'dynamic' capability of at least -100MVAr.

  This requirement was identified in Section 12.3 to ensure that the post-contingency voltages would remain below the 250kV threshold following the loss of the double-circuit line between Lakehead TS and Mackenzie TS and the subsequent separation of that part of the system west of Mackenzie TS on to the Interconnections.

- The rating of the replacement SVC for the existing synchronous condenser at Lakehead TS would need to be at least the same as the existing unit so that the combined absorption capability of the two units would be at least 80MVAr to ensure that the Lakehead voltage would remain within acceptable limits.

15. Transfer Capability of the Existing Transmission Facilities between Mississagi TS and Wawa TS

Although the enhanced East-West Tie is required to have a transfer capability of at least **650MW** westwards, the OPA's assessment of the Long-Term Electricity Outlook for the North-West has identified a maximum transfer requirement during the initial period of operation of the enhanced facility, of approximately 400MW westwards.

Studies were conducted to confirm that the transfer capability of the existing transmission facilities between Mississagi TS and Wawa TS, while respecting the loss of either of the double-circuit lines in this part of the system, would be sufficient to support a transfer of at least 400MW westwards across the East-West Tie.

The results are summarised in **Table 7** and also in **Diagrams 40 to 49**, inclusive.

For these studies, the East-West Tie was assumed to be reinforced with a new double-circuit line as proposed under the *Reference Case.* A +200/-100MVAr SVC was also assumed to be installed at Marathon TS, in addition to three 40MVAr reactors, of which only two were required to be in-service for these studies.

Only a single generating unit was assumed to be in-service, pre-contingency, at Wells GS and at Aubrey Falls GS, for the following reasons:

- to limit the amount of post-contingency reactive support that could be provided from these facilities, and
- to increase the post-contingency transfer across the East-West Tie Interface.

  A contingency involving circuits P25W & P26W would result in the operational units at Aubrey Falls being isolated, while a contingency involving circuits P21G & P22G would similarly result in the isolation of the operational units at Wells GS. In response to the resulting resource deficiency from the loss of these units, there would be a significant increase in the transfers on the Manitoba and Minnesota Interconnections. Although these increased transfers would be reduced through automatic adjustments to the phase-shifters on the Interconnections, they would not be reduced to zero, particularly on the Manitoba Interconnection which allows only four tap-changer operations before locking out.

  With two units automatically isolated at either Wells GS or Aubrey Falls, the combined post-contingency transfers via the Manitoba and Minnesota Interconnections would be substantially higher following the adjustment of the phase-shifters.

  Since any *increase* in the post-contingency transfers across the Interconnections would result in a corresponding *decrease* in the transfer across the East-West Tie, the studies therefore examined the loss of only a single unit at either Wells GS or Aubrey Falls GS to minimise the reduction in the latter transfer.

In addition to examining the double-circuit contingencies involving circuits P25W & P26W; and P21G & P22G, the effect of a single-circuit contingency involving circuit W23K between Wawa TS and MacKay TS was also examined. For this contingency, since there would be no associated loss of generation capacity, the post-contingency transfer across the East-West Tie Interface would not be similarly affected.

For all three contingencies, the analysis showed that, with the new double-circuit line between Wawa TS and Lakehead and the addition of a 200MVAr SVC at Marathon, the existing transmission facilities between Mississagi TS and Wawa TS would be able to support a westward transfer of approximately **500MW** across the East-West Tie.

16. Reinforcement of the East-West Tie with a new 230kV single-circuit line rather than a double-circuit line

All of the criteria produced by NERC, NPCC & the IESO refer to a requirement to respect a second single-element contingency after experiencing an initial single-element contingency or outage, with control actions taken between the two events to adjust the flows.

The IESO's planning criteria require any control actions to re-prepare the system for a subsequent contingency be implemented within the 30 minute period following an initial contingency.

The IESO's criteria for determining the adequacy of any plans to reinforce the transmission system also limit the maximum loss to two elements, either simultaneously or with one loss following another.

With the East-West Tie reinforced with a single-circuit line, the criteria require that, following the loss of the new single-circuit line, control actions be implemented to prepare the system for the loss of one of the circuits on the remaining double-circuit line.

Following the loss of the new single-circuit line, the system configuration for the section affected by the fault would revert to the present arrangement, for which the transfer capability is approximately 350MW, when respecting the loss of only a single circuit.

Since the targeted transfer capability of the reinforced East-West Tie is 650MW, a reduction to 350MW following the loss of the new single-circuit line would therefore require, as a control action, either the dispatch of additional generating resources totalling at least 300MW, or a lesser amount if there were also the capability to arm load rejection of up to 150MW in response to the second contingency. An increase in the transfers via the Interconnections with Manitoba and Minnesota would also allow the amount of generation capacity that would need to be dispatched to be reduced.

Reinforcing the East-West Tie with a new double-circuit line would therefore offer a higher level of security since, from the planning perspective, the initial loss of the two elements of the double-circuit line would provide acceptable performance, in accordance with the prevailing standards, while requiring no control actions to be taken following the initial loss of either of the double-circuit lines.

17. Replacement SVC at Lakehead TS: Recommendation

In this study it has been assumed that the replacement SVC for the existing synchronous condenser at Lakehead TS would be rated the same as the existing SVC; namely +60/-40MVAr.

The analysis has indicated that should the East-West Tie be reinforced and its transfer capability increased, that the Lakehead area would benefit from a higher rated unit.

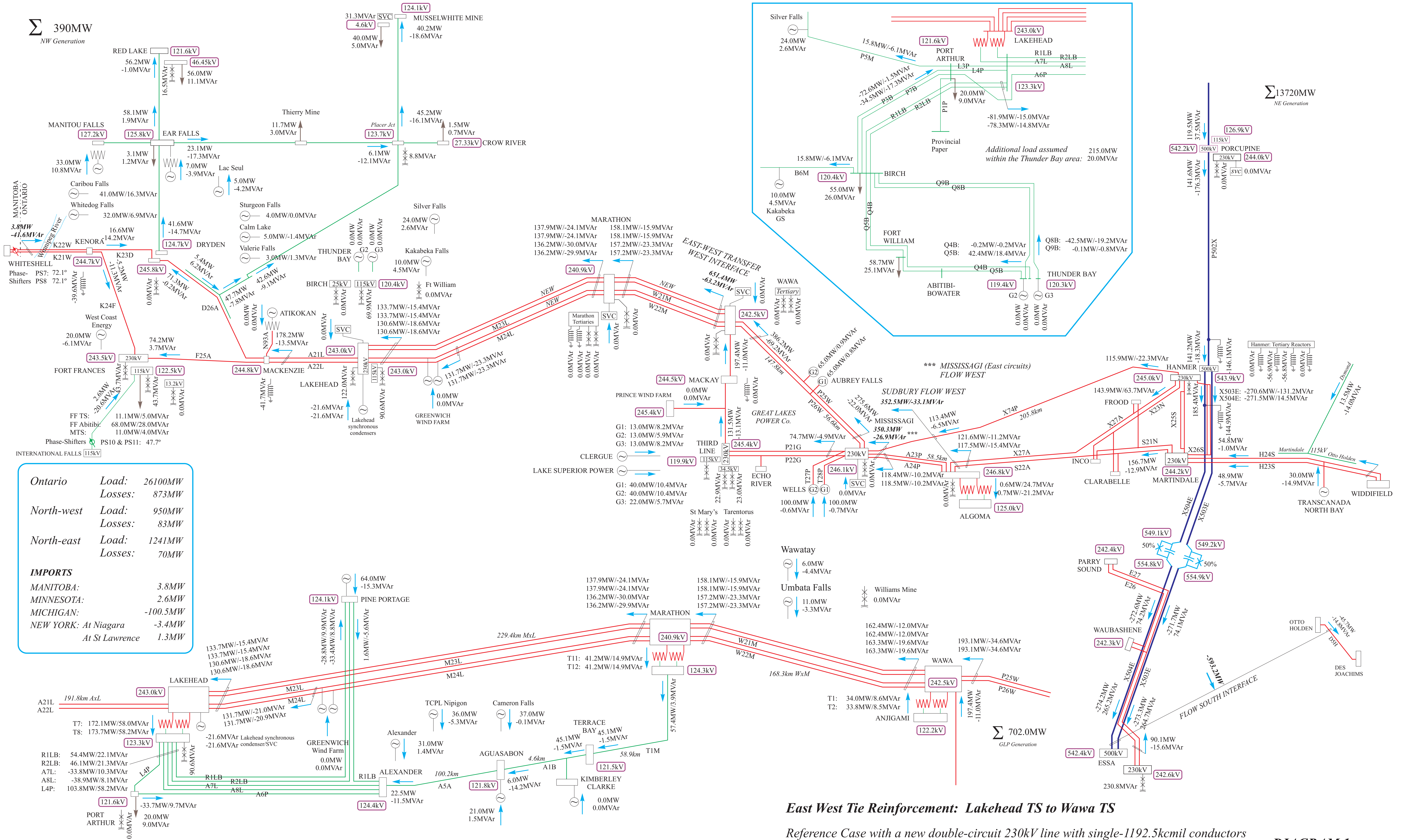
It is therefore recommended that when a decision is made to replace the existing synchronous condenser that consideration should be given to acquiring an SVC with rating of at least ± 100MVAr.

APPENDIX A Line Ratings										
230kV Line Ratings				*Ratings at 30^{o}C Ambient: 4km/hr wind: MVA at 240kV*						
Circuit	*Conductor (Limiting Section)*		*Sag Temp*	*Continuous at 93^{o}C or Sag Temperature, if lower*		*Long-Term 'Emergency' at 127^{o}C or Sag Temperature, if lower*		*15-min LTR at Sag Temperature*		
X74P Hanmer TS to Mississagi TS										
Hanmer TS to Mississagi TS	1192.5kcmil	54/19	127^{o}C	1120A	465MVA	1440A	598MVA	1650A	686MVA	*Pre-load of 1120A*
S22A: Martindale TS to Algoma TS 150.1km *(Martindale - Clarabelle 11.9km + Clarabelle - Algoma 138.1km)*										
Martindale-Clarabelle Jct	1924kcmil	69/19	127^{o}C	1500A	623MVA	1940A	806MVA	2400A	997MVA	*Pre-load of 1500A*
Clarabelle Jct to Algoma TS	1924kcmil	69/19	127^{o}C	1500A	623MVA	1940A	806MVA	2400A	997MVA	*Pre-load of 1500A*
	1307.4kcmil	28/19	127^{o}C	1160A	482MVA	1500A	623MVA	1800A	748MVA	*Pre-load of 1160A*
X27A: Hanmer TS to Algoma TS 155.6km										
Hanmer TS to Junction Point	1843.2kcmil	72/7	93^{o}C/116^{o}C	1420A	590MVA	1720A	715MVA	1990A	827MVA	*Pre-load of 1420A*
Junction Point to Algoma	1307.4kcmil	28/19	127^{o}C	1160A	482MVA	1500A	623MVA	1800A	748MVA	*Pre-load of 1160A*
A23P & A24P: Mississagi TS to Algoma TS 58.5km										
Mississagi to Algoma	795kcmil	26/7	150^{o}C	880A	366MVA	1120A	466MVA	1430A	594MVA	*Pre-load of 880A*
P25W & P26W: Mississagi TS to Wawa TS 204.4km *(Mississagi - Aubrey Falls 56.6km + Aubrey Falls - Wawa 147.8km)*										
Mississagi TS to Aubrey Falls Jct	795kcmil	26/7	110^{o}C	880A	366MVA	1010A	420MVA	1070A	445MVA	*Pre-load of 880A*
Aubrey Falls Jct to Wawa TS	795kcmil	26/7	93^{o}C	880A	366MVA	880A	366MVA	880A	366MVA	*Pre-load of 880A*
W21M & W22M: Wawa TS to Marathon TS 168.3km										
W21M	795kcmil	26/7	93^{o}C	880A	366MVA	880A	366MVA	880A	366MVA	*Pre-load of 880A*
W22M			111^{o}C	880A	366MVA	1020A	424MVA	1080A	449MVA	*Pre-load of 880A*

***230kV Line Ratings** (Continued)*				*Ratings at 30^{o}C Ambient: 4km/hr wind: MVA at 240kV*						
Circuit	*Conductor (Limiting Section)*		*Sag Temp*	*Continuous at 93^{o}C or Sag Temperature, if lower*		*Long-Term 'Emergency' at 127^{o}C or Sag Temperature, if lower*		*15-min LTR at Sag Temperature*		
M23L & M24L: Marathon TS to Lakehead TS			***229.4km***							
M23L	795kcmil	26/7	95^{o}C	880A	366MVA	890A	370MVA	900A	374MVA	*Pre-load of 880A*
M24L										

Ratings for Proposed 230kV Lines			*Ratings at 30^{o}C Ambient: 4km/hr wind: MVA at 240kV*						
Conductor		*Sag Temp*	*Continuous at 93^{o}C*		*Long-Term 'Emergency' at 127^{o}C*		*15-min LTR at 150^{o}C Temperature*		
*Double-circuit line with **single**-1192.5kcmil*	54/19	127^{o}C	1120A	465MVA	1440A	598MVA	1650A	686MVA	*Pre-load of 1120A*
*Single-circuit line with **twin**-1192.5kcmil*	54/19	127^{o}C	2230A	927MVA	2880A	1197MVA	3310A	1376MVA	*Pre-load of 2230A*
*Single-circuit line with **twin**-795.0kcmil*	26/7	127^{o}C	1750A	727MVA	2240A	931MVA	2480A	1031MVA	*Pre-load of 1750A*

115kV Line Ratings				*Ratings at 30^{o}C Ambient: 4km/hr wind: MVA at 121kV*						
Circuit	*Conductor (Limiting Section)*		*Sag Temp*	*Continuous at 93^{o}C or Sag Temperature, if lower*		*Long-Term 'Emergency' at 127^{o}C or Sag Temperature, if lower*		*15-min LTR at Sag Temperature*		
T1M: Marathon TS to Terrace Bay SS										
Marathon TS to Terrace Bay	477.0kcmil	26/7	70^{o}C	460A	96MVA	460A	96MVA	460A	96MVA	*Pre-load of 460A*
A1B: Terrace Bay SS to Aguasabon SS										
Terrace Bay SS to Aguasabon	477.0kcmil	26/7	84^{o}C	570A	119MVA	570A	119MVA	570A	119MVA	*Pre-load of 570A*
A5A: Aguasabon SS to Alexandra SS										
Aguasabon SS to Alexandra SS	477.0kcmil	26/7	66^{o}C	430A	90MVA	430A	90MVA	430A	90MVA	*Pre-load of 570A*



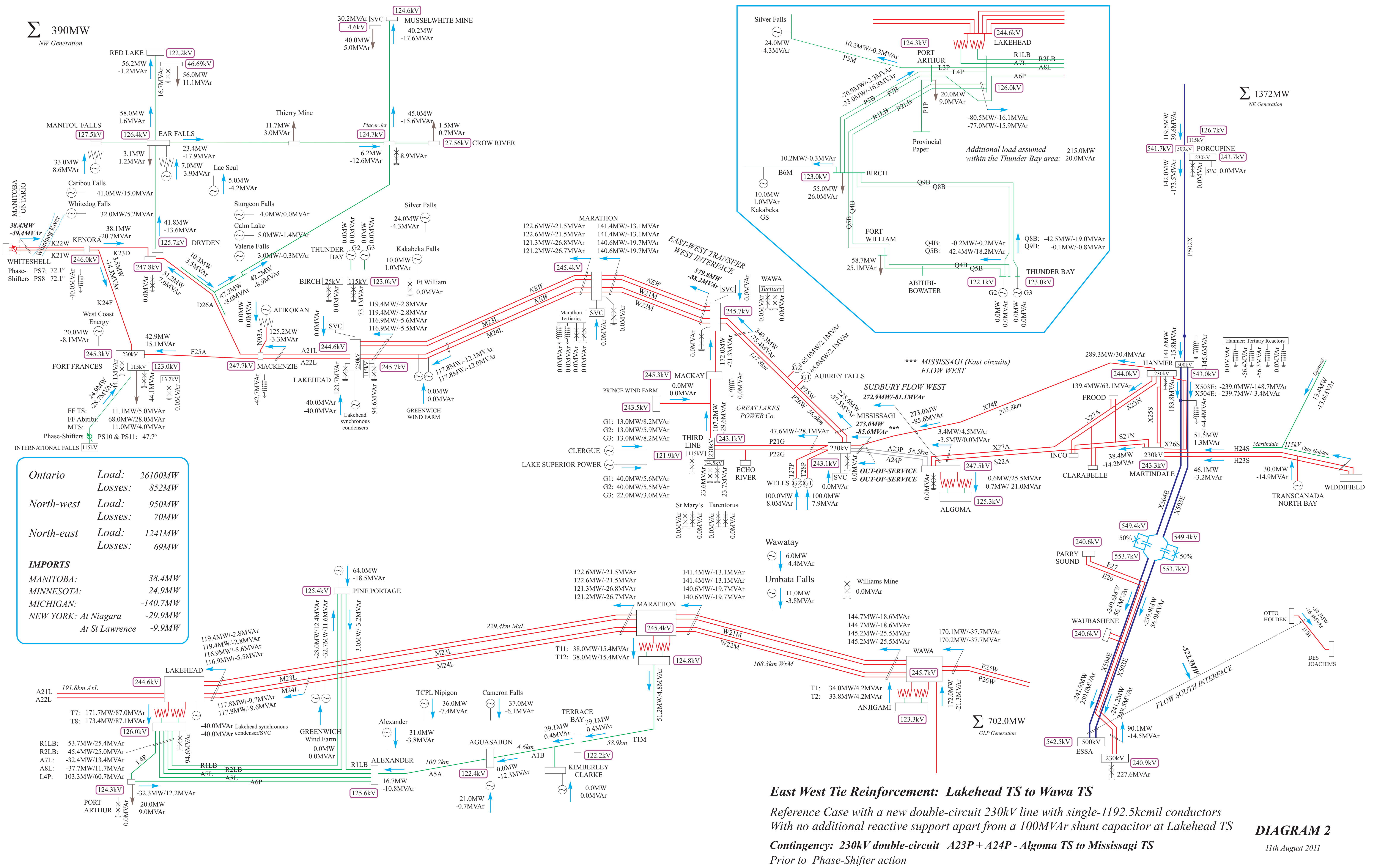
Ontario	*Load:*	*26100MW*
	Losses:	*873MW*
North-west	*Load:*	*950MW*
	Losses:	*83MW*
North-east	*Load:*	*1241MW*
	Losses:	*70MW*
IMPORTS		
MANITOBA:		*3.8MW*
MINNESOTA:		*2.6MW*
MICHIGAN:		*-100.5MW*
NEW YORK:	*At Niagara*	*-3.4MW*
	At St Lawrence	*1.3MW*

East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
With no additional reactive support apart from a 100MVAr shunt capacitor at Lakehead TS

DIAGRAM 1

11th August 2011



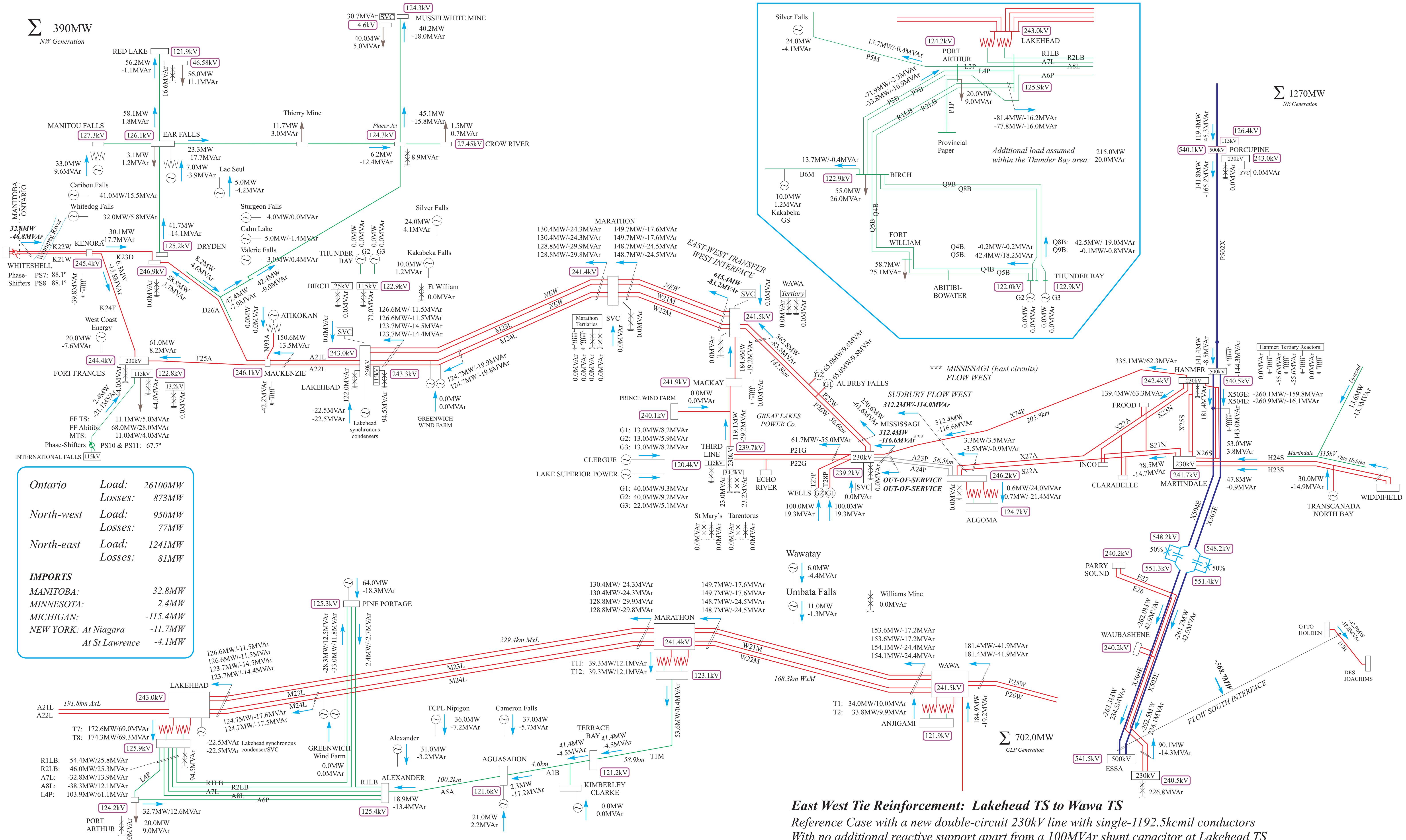
East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
With no additional reactive support apart from a 100MVAr shunt capacitor at Lakehead TS

Contingency: 230kV double-circuit A23P + A24P - Algoma TS to Mississagi TS
Prior to Phase-Shifter action

DIAGRAM 2

11th August 2011



Ontario	Load:	26100MW
	Losses:	873MW
North-west	Load:	950MW
	Losses:	77MW
North-east	Load:	1241MW
	Losses:	81MW

IMPORTS	
MANITOBA:	32.8MW
MINNESOTA:	2.4MW
MICHIGAN:	-115.4MW
NEW YORK: At Niagara	-11.7MW
At St Lawrence	-4.1MW

East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

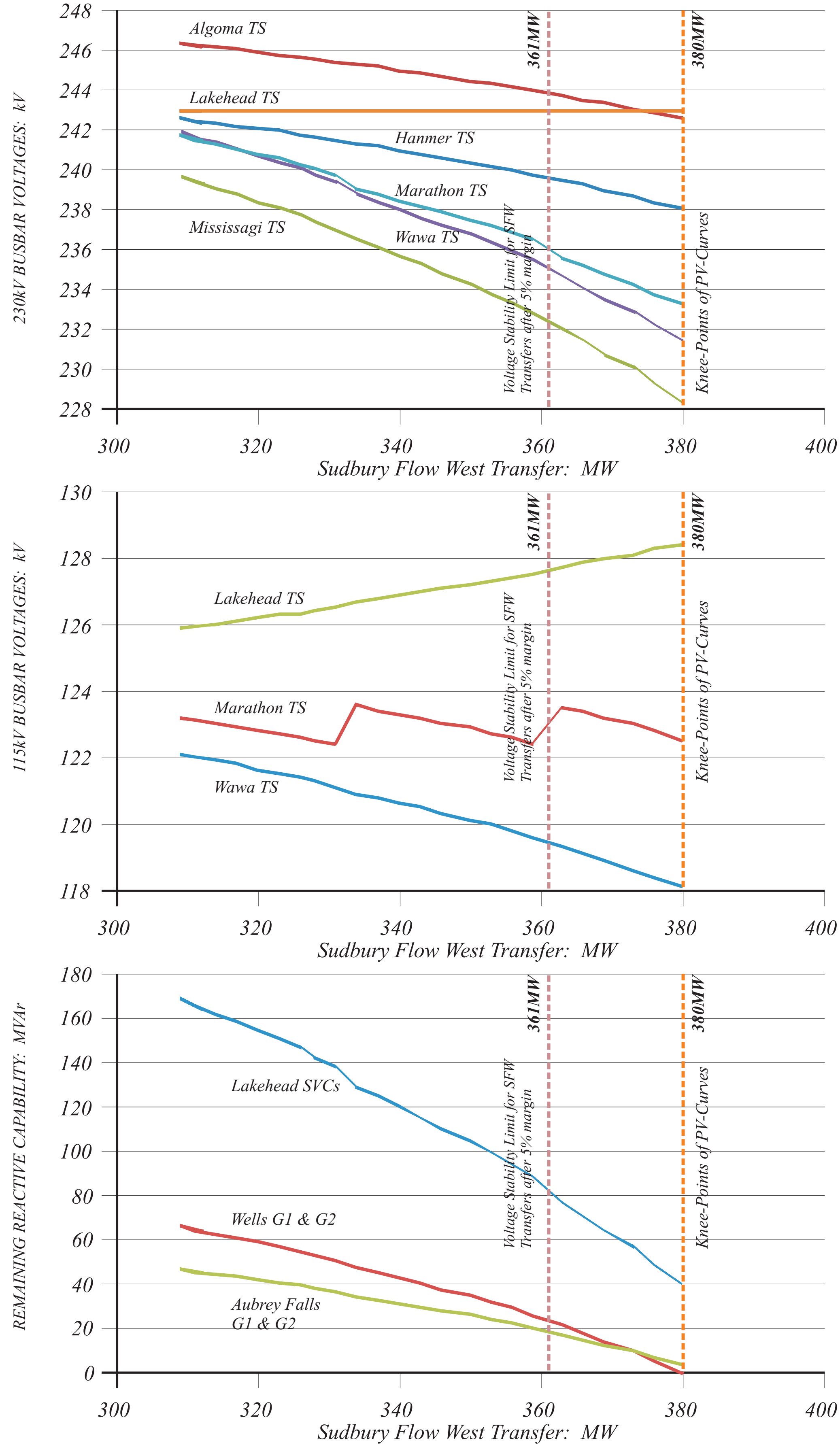
With no additional reactive support apart from a 100MVAr shunt capacitor at Lakehead TS

Contingency: 230kV double-circuit A23P + A24P - Algoma TS to Mississagi TS

After Phase-Shifter action

DIAGRAM 3

11th August 2011



PV-analysis
No additional SVCs

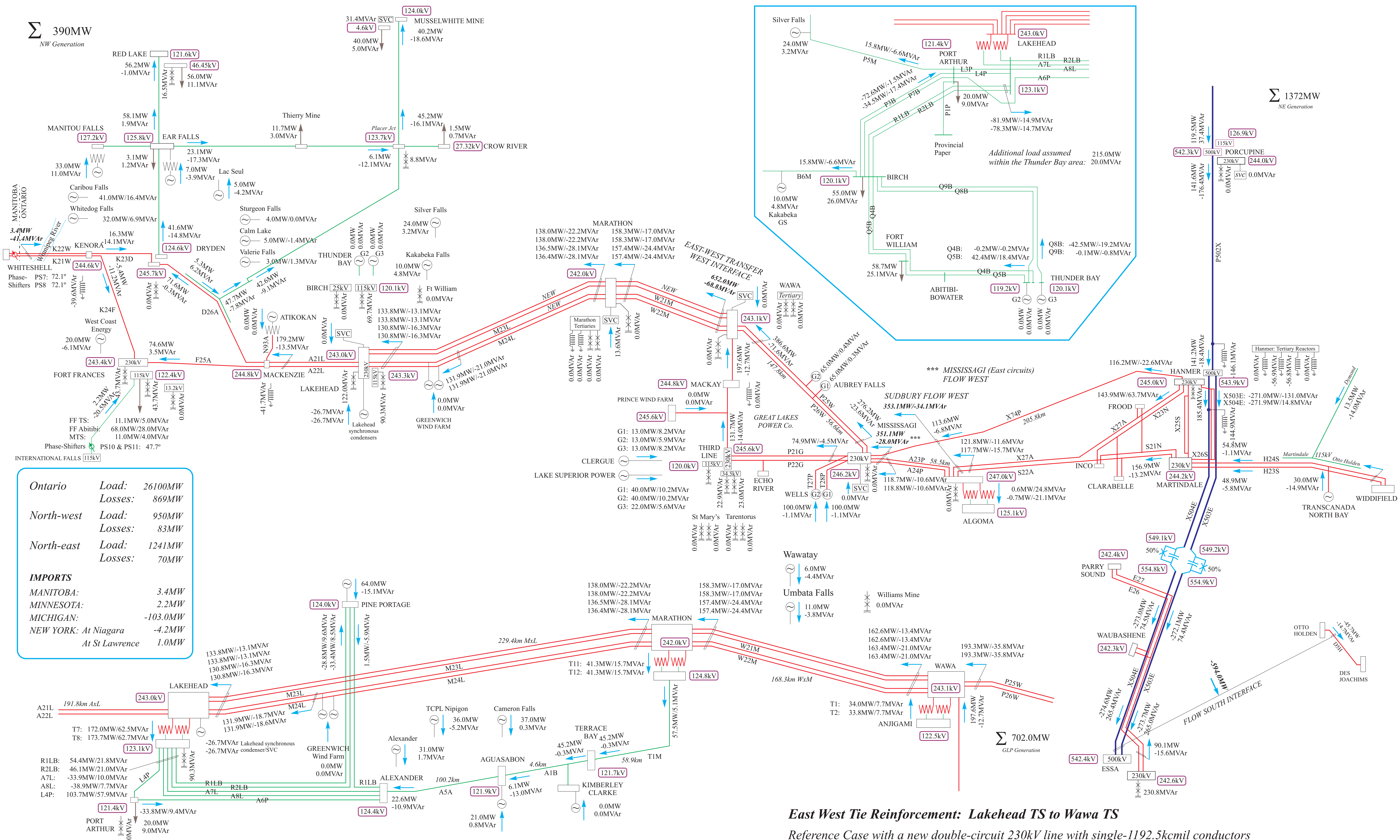
East West Tie Reinforcement: Lakehead TS to Wawa TS

Case with a new double-circuit 230kV line with 1192.5kcmil conductors

Contingency: 230kV double-circuit A23P & A24P
After Phase-Shifter action

DIAGRAM 4

26th July 2011

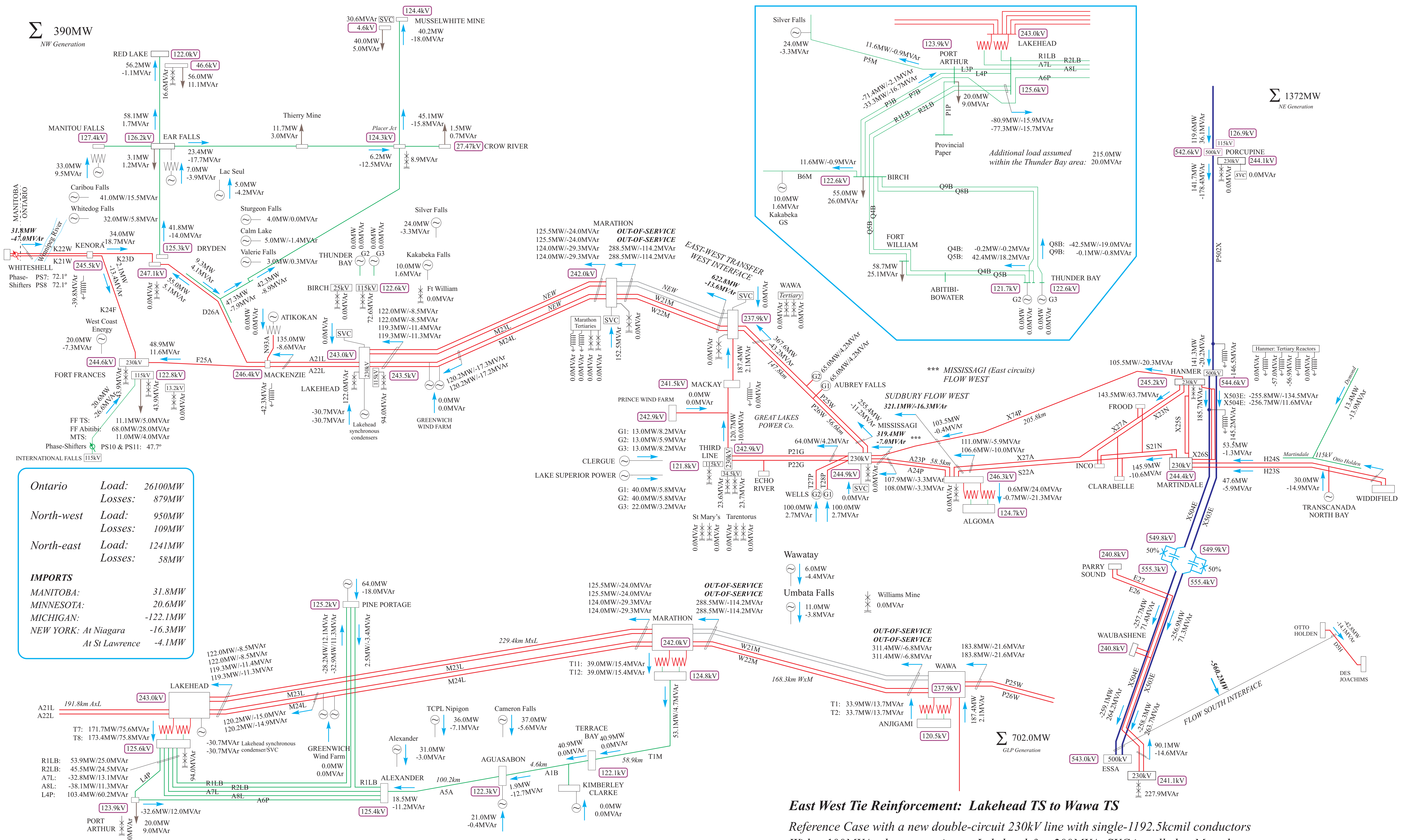


East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon

DIAGRAM 5

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

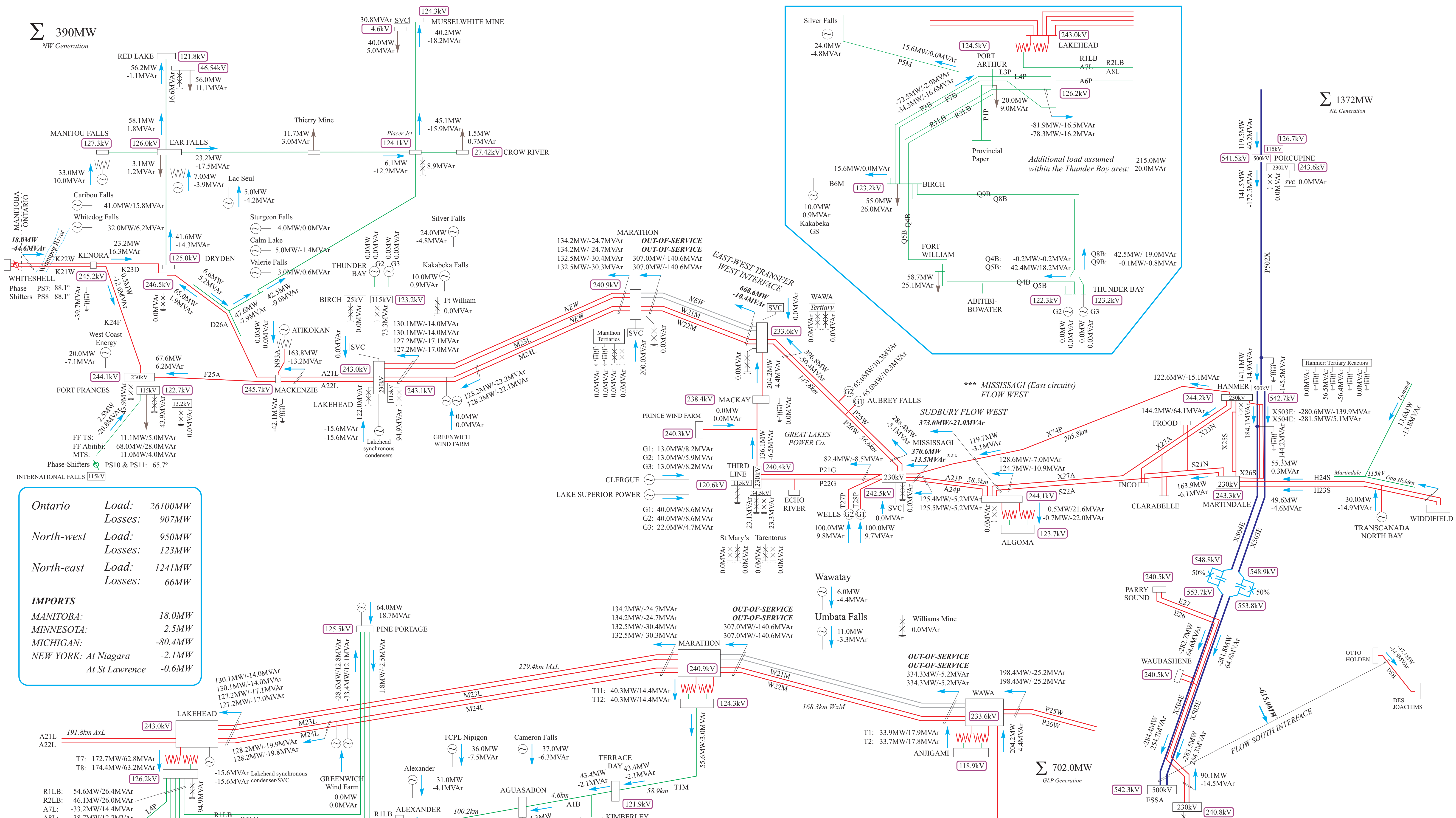
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon

Contingency: 230kV double-circuit involving the new Wawa TS to Marathon TS line

Prior to Phase-Shifter action

DIAGRAM 6

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

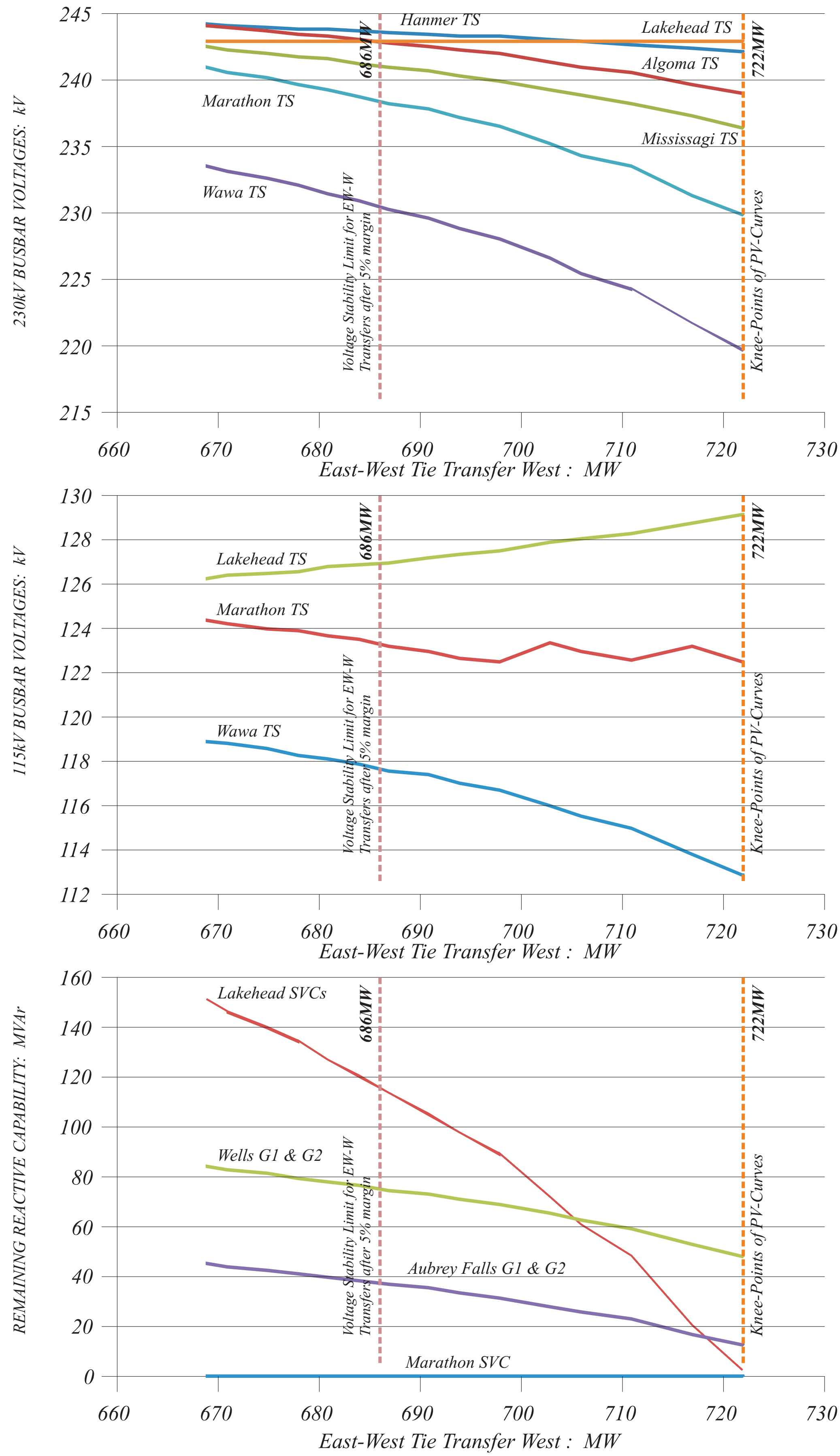
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon

Contingency: 230kV double-circuit involving the new Wawa TS to Marathon TS line

After Phase-Shifter action

DIAGRAM 7

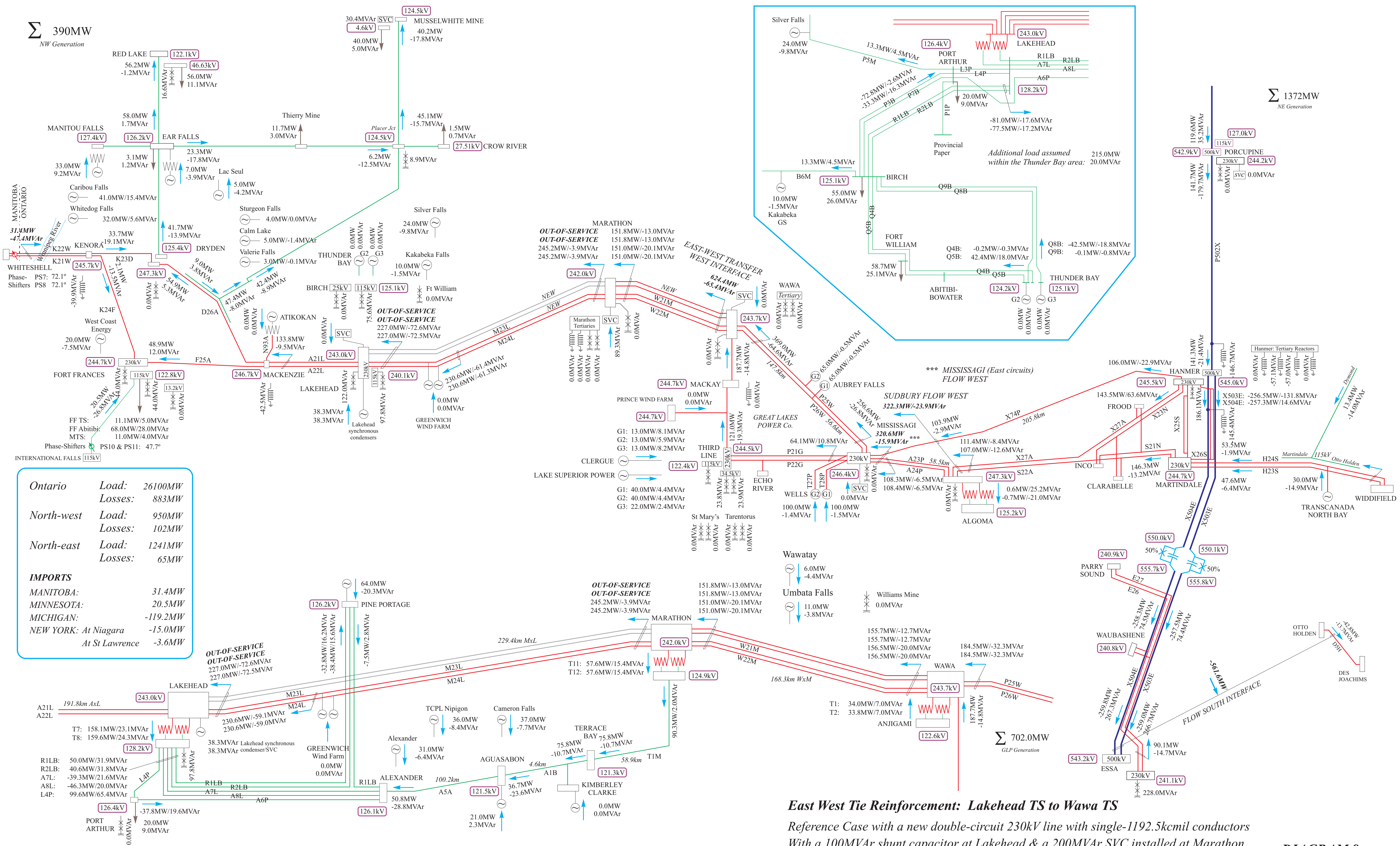
11th August 2011



PV-analysis
Marathon 200MVAr SVC

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
Contingency: new 230kV double-circuit Wawa TS to Marathon TS
After Phase-Shifter action

DIAGRAM 8
30th July 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

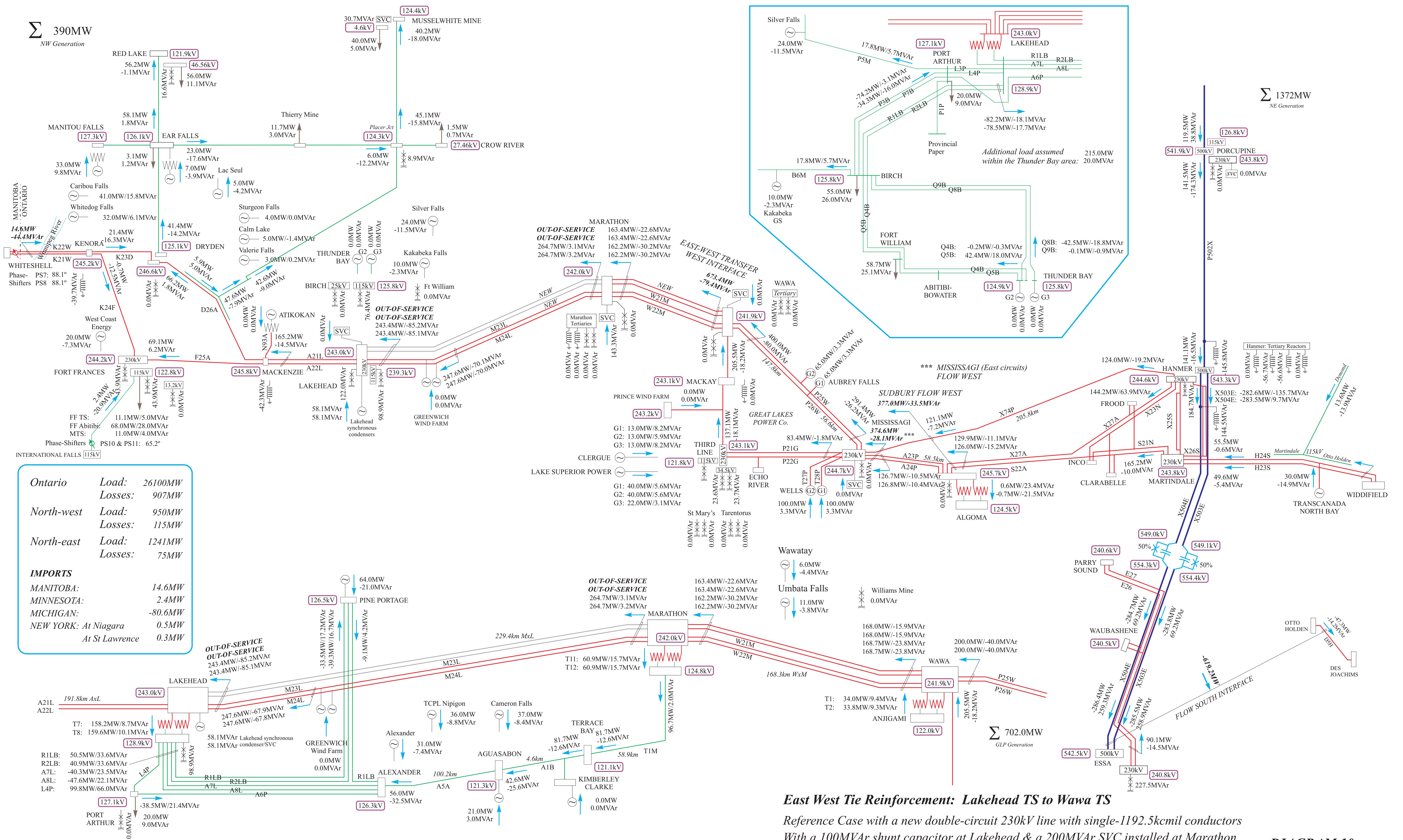
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon

Contingency: 230kV double-circuit involving the new Marathon TS to Lakehead TS line

Prior to Phase-Shifter action

DIAGRAM 9

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

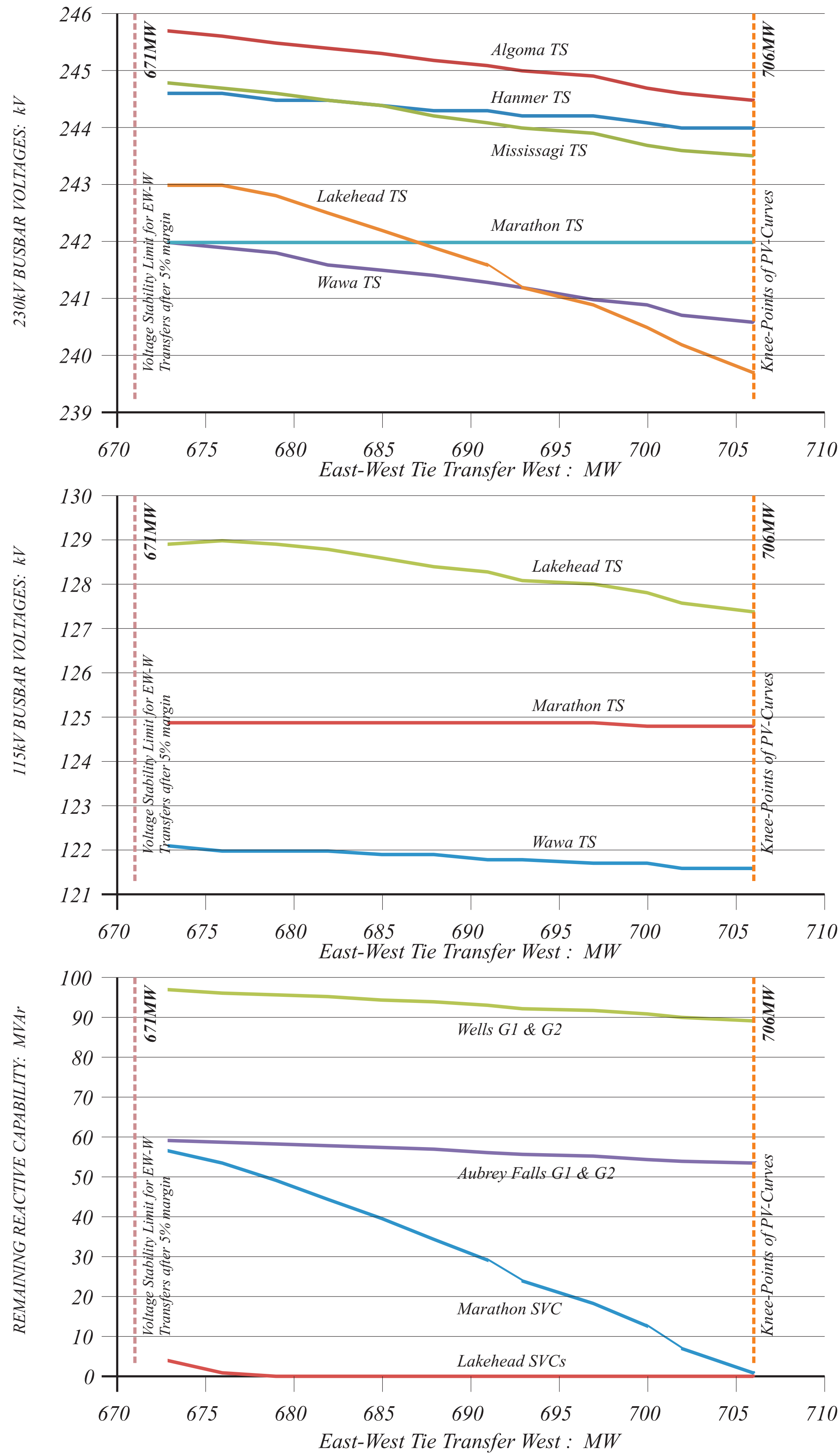
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon

Contingency: 230kV double-circuit involving the new Marathon TS to Lakehead TS line

After Phase-Shifter action

DIAGRAM 10

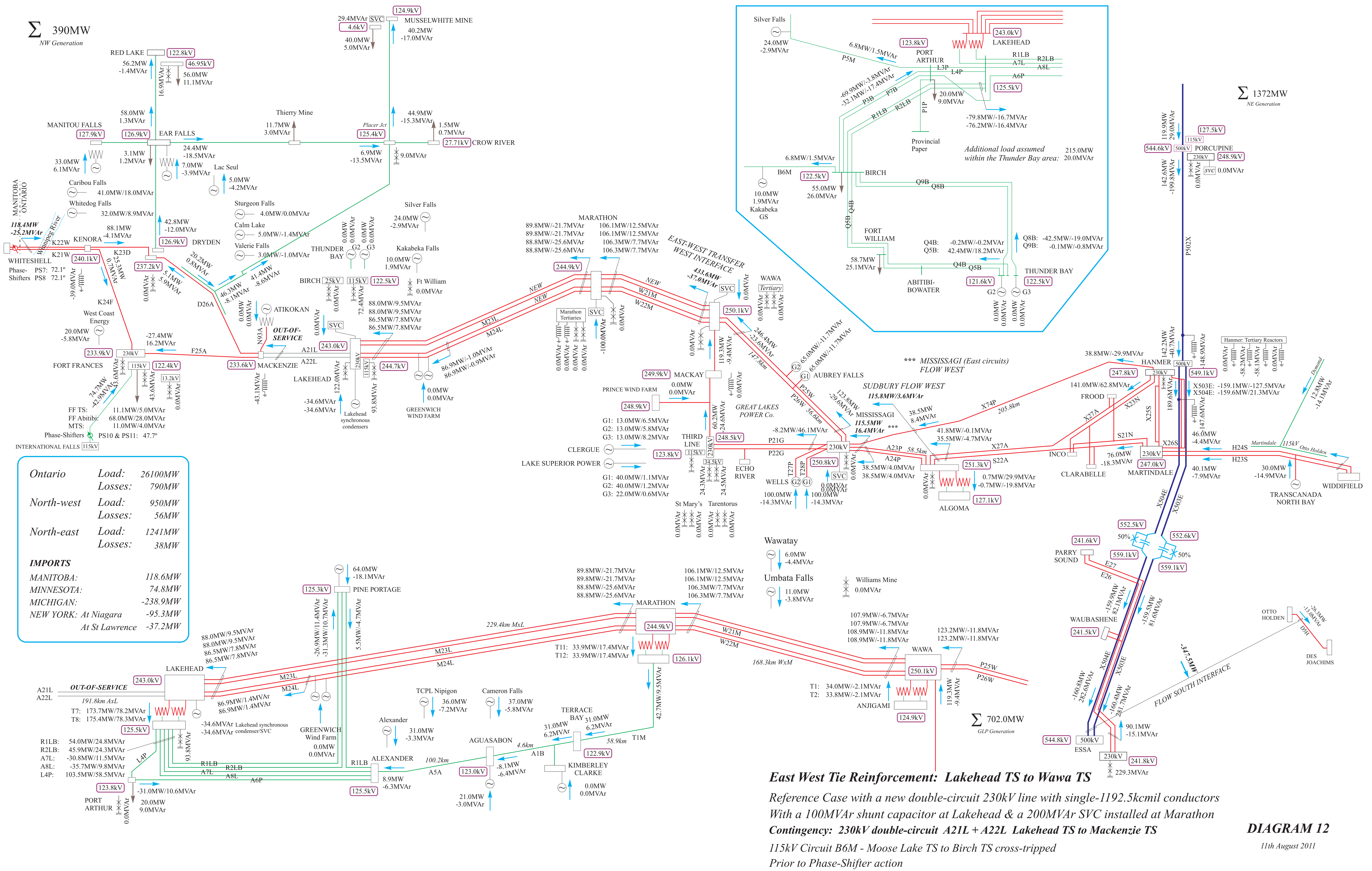
11th August 2011



PV-analysis
Marathon 200MVAr SVC

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
Contingency: new 230kV double-circuit Marathon TS to Lakehead TS
After Phase-Shifter action

DIAGRAM 11
26th July 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon

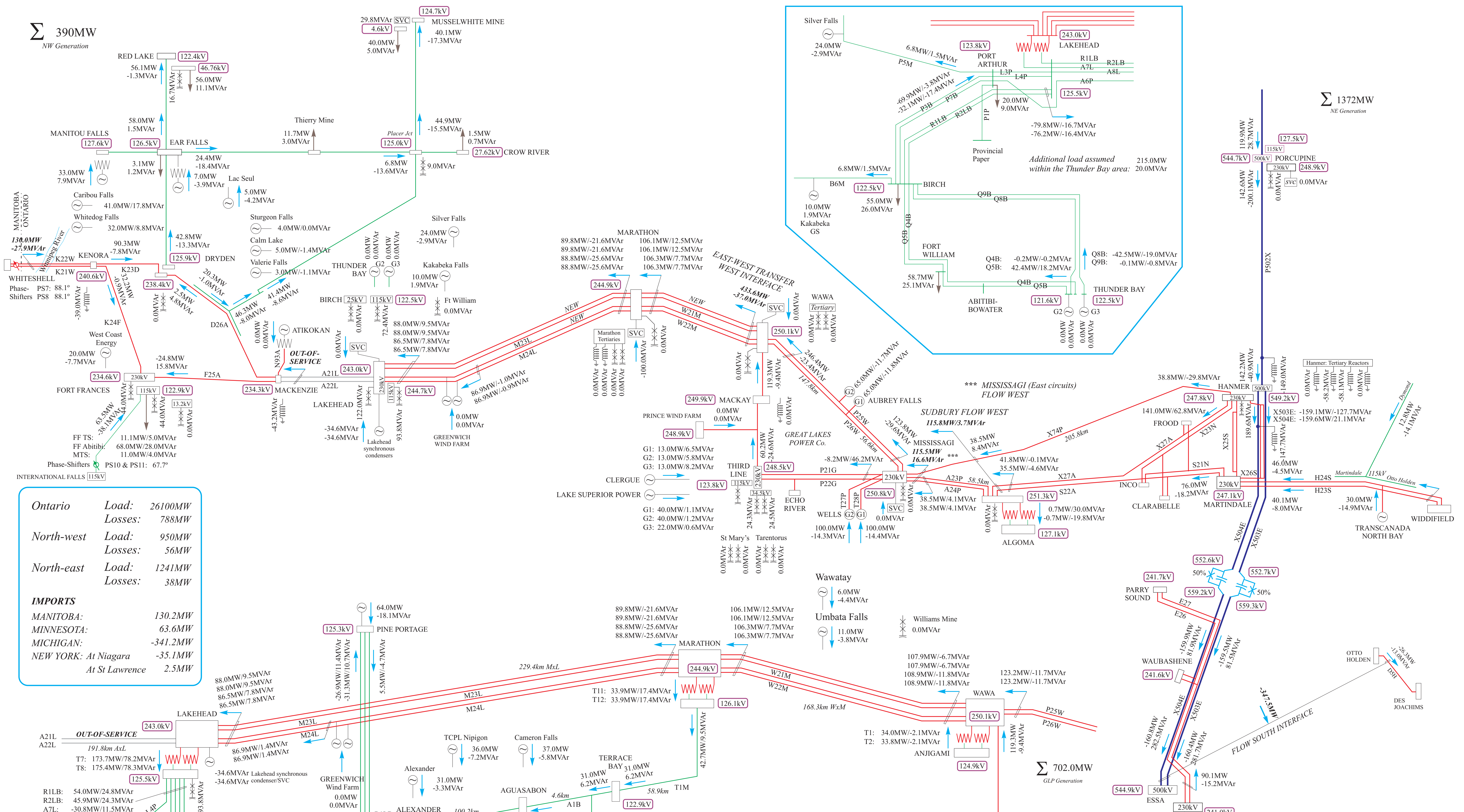
Contingency: 230kV double-circuit A21L + A22L Lakehead TS to Mackenzie TS

115kV Circuit B6M - Moose Lake TS to Birch TS cross-tripped

Prior to Phase-Shifter action

DIAGRAM 12

11th August 2011

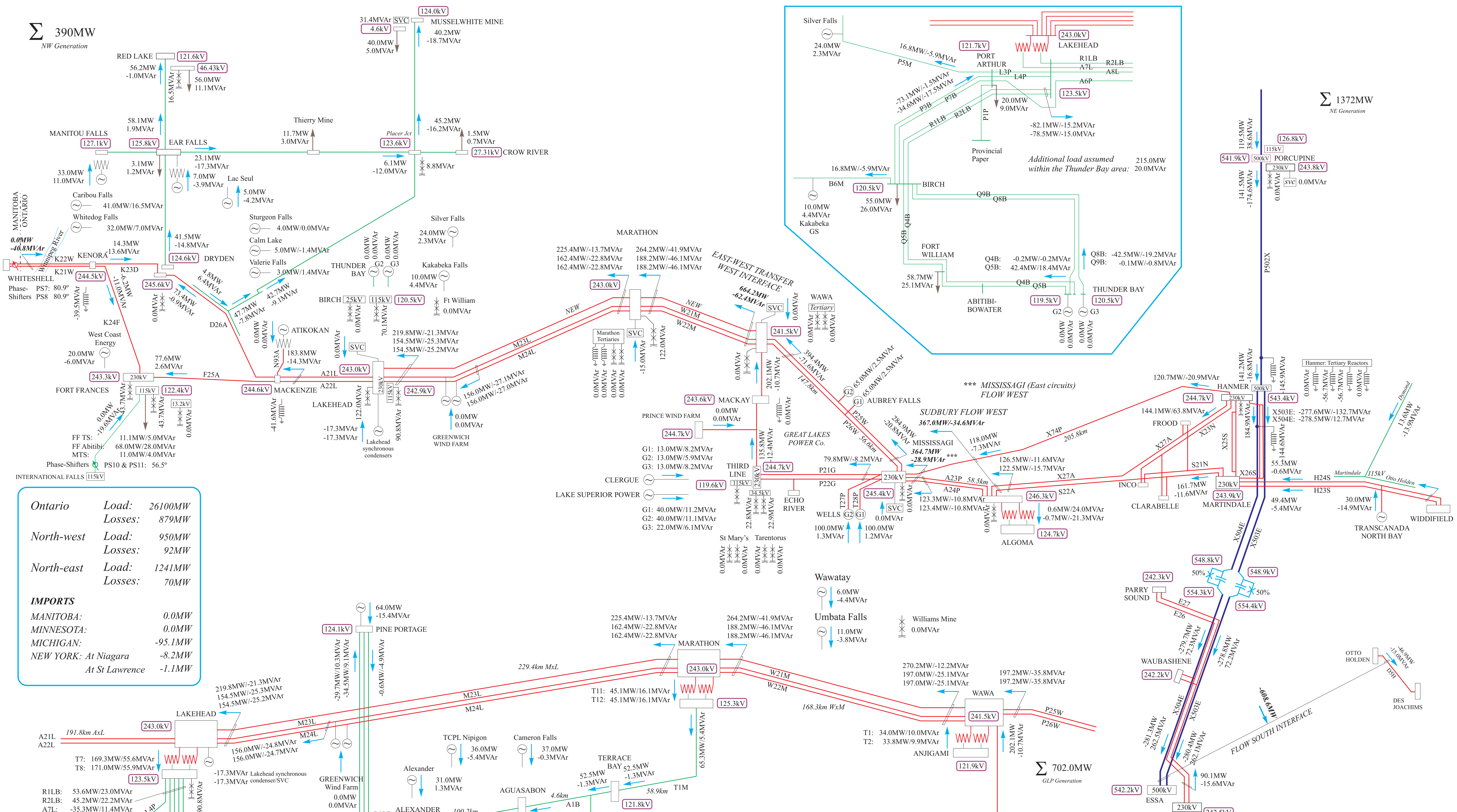


East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC installed at Marathon
Contingency: 230kV double-circuit A21L + A22L Lakehead TS to Mackenzie TS
115kV Circuit B6M - Moose Lake TS to Birch TS cross-tripped
After Phase-Shifter action

DIAGRAM 13

11th August 2011



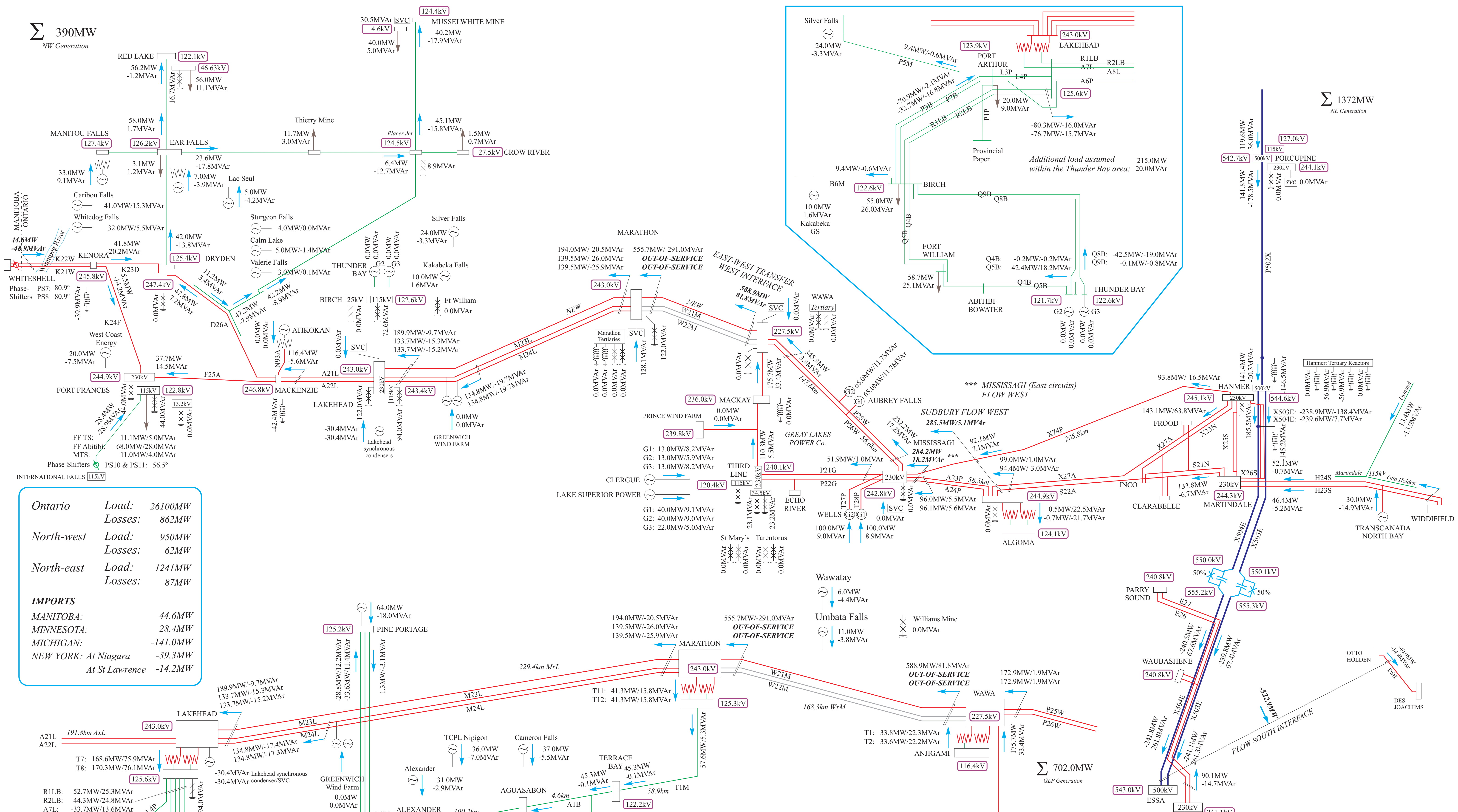
East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon and a 350MVAr SVC at Marathon

DIAGRAM 14

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

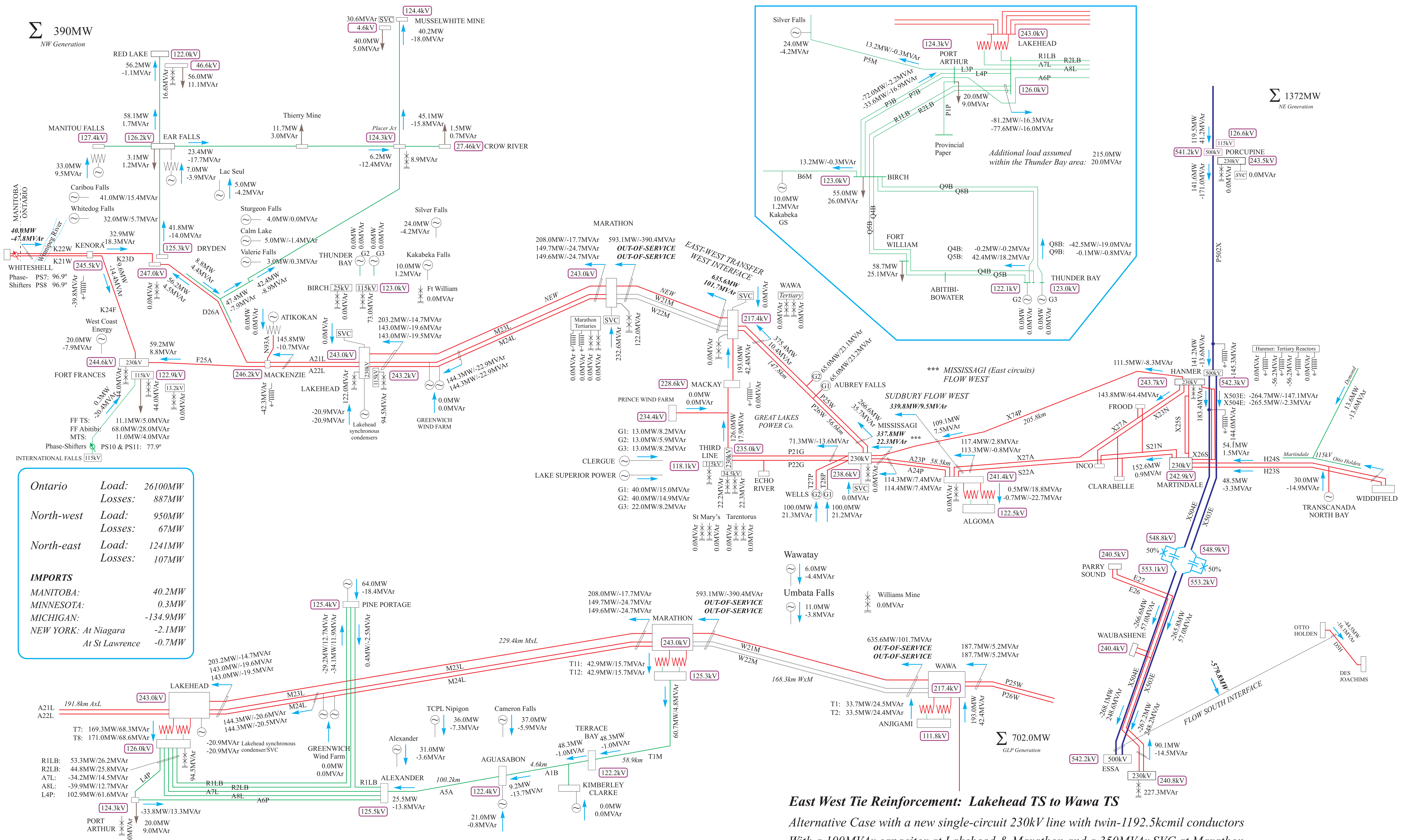
Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon and a 350MVAr SVC at Marathon

Contingency: 230kV double-circuit W21M + W22M Wawa TS to Marathon TS

Prior to Phase-Shifter action

DIAGRAM 15

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors

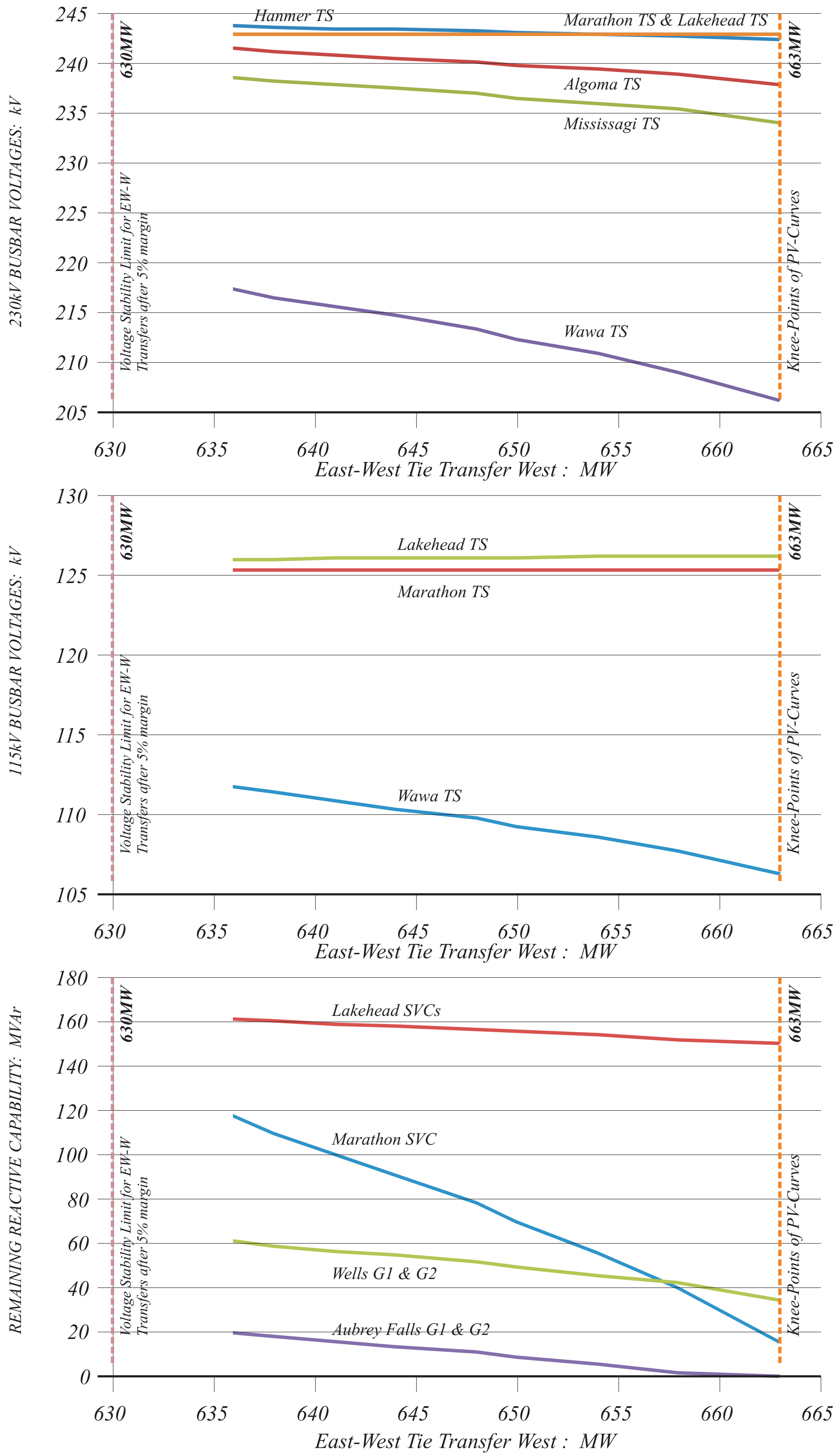
With a 100MVAr capacitor at Lakehead & Marathon and a 350MVAr SVC at Marathon

Contingency: 230kV double-circuit W21M + W22M Wawa TS to Marathon TS

After Phase-Shifter action

DIAGRAM 16

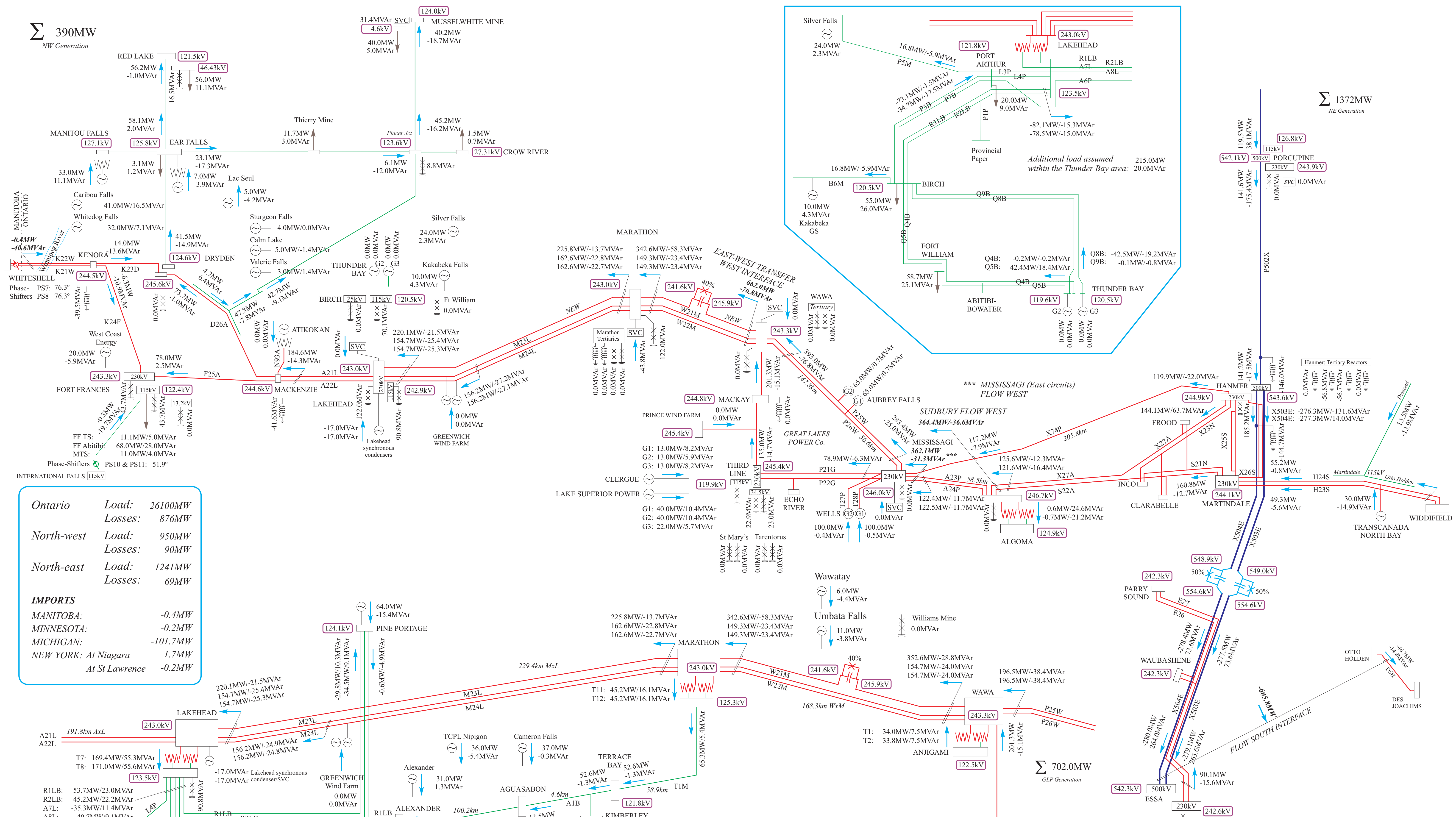
11th August 2011



PV-analysis
Marathon
350MVAr SVC

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
Contingency: new 230kV double-circuit Wawa TS to Marathon TS
After Phase-Shifter action

DIAGRAM 17
28th July 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

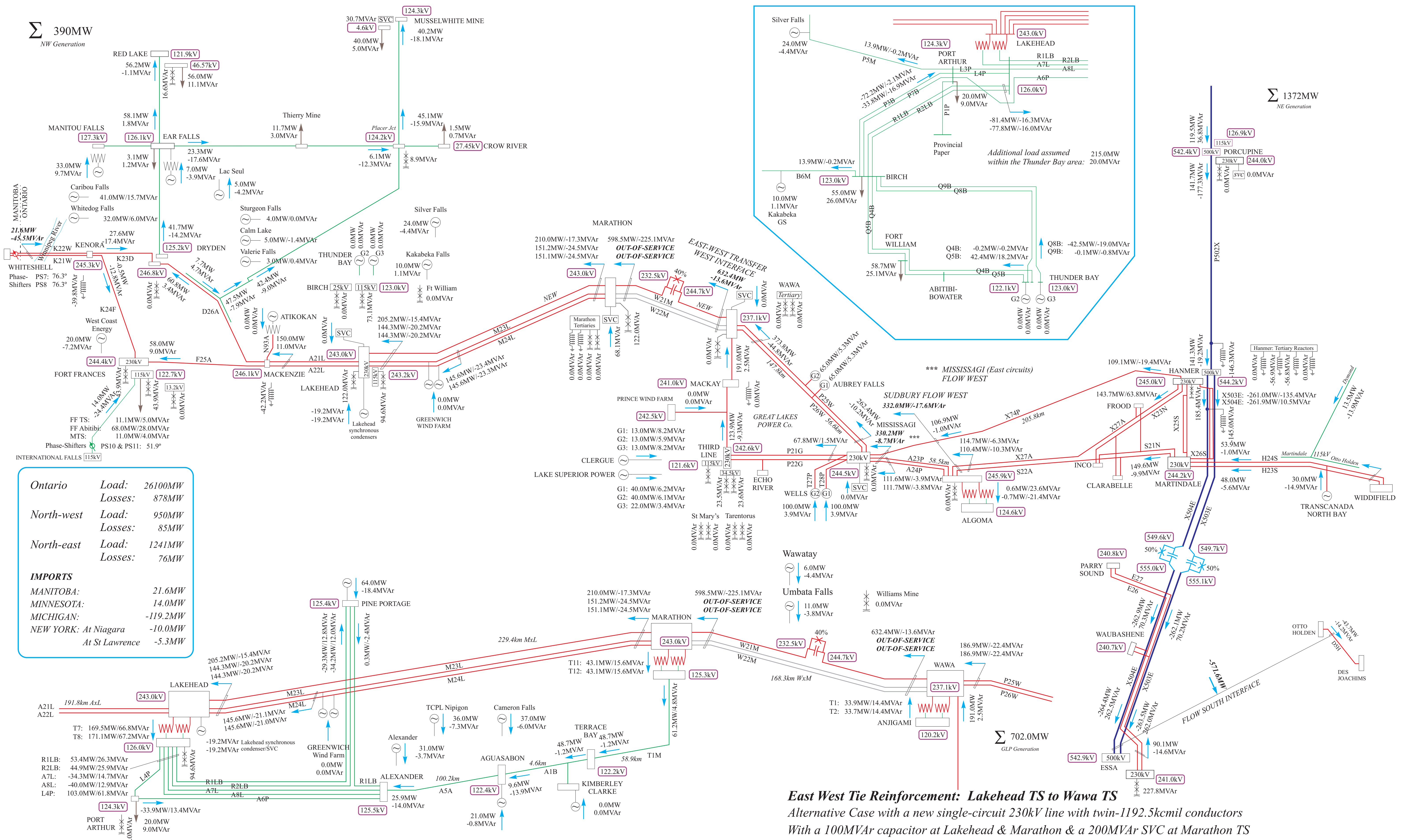
Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon and a 350MVAr SVC at Marathon

With 40% Series Compensation on the new Wawa x Marathon line

DIAGRAM 18

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS

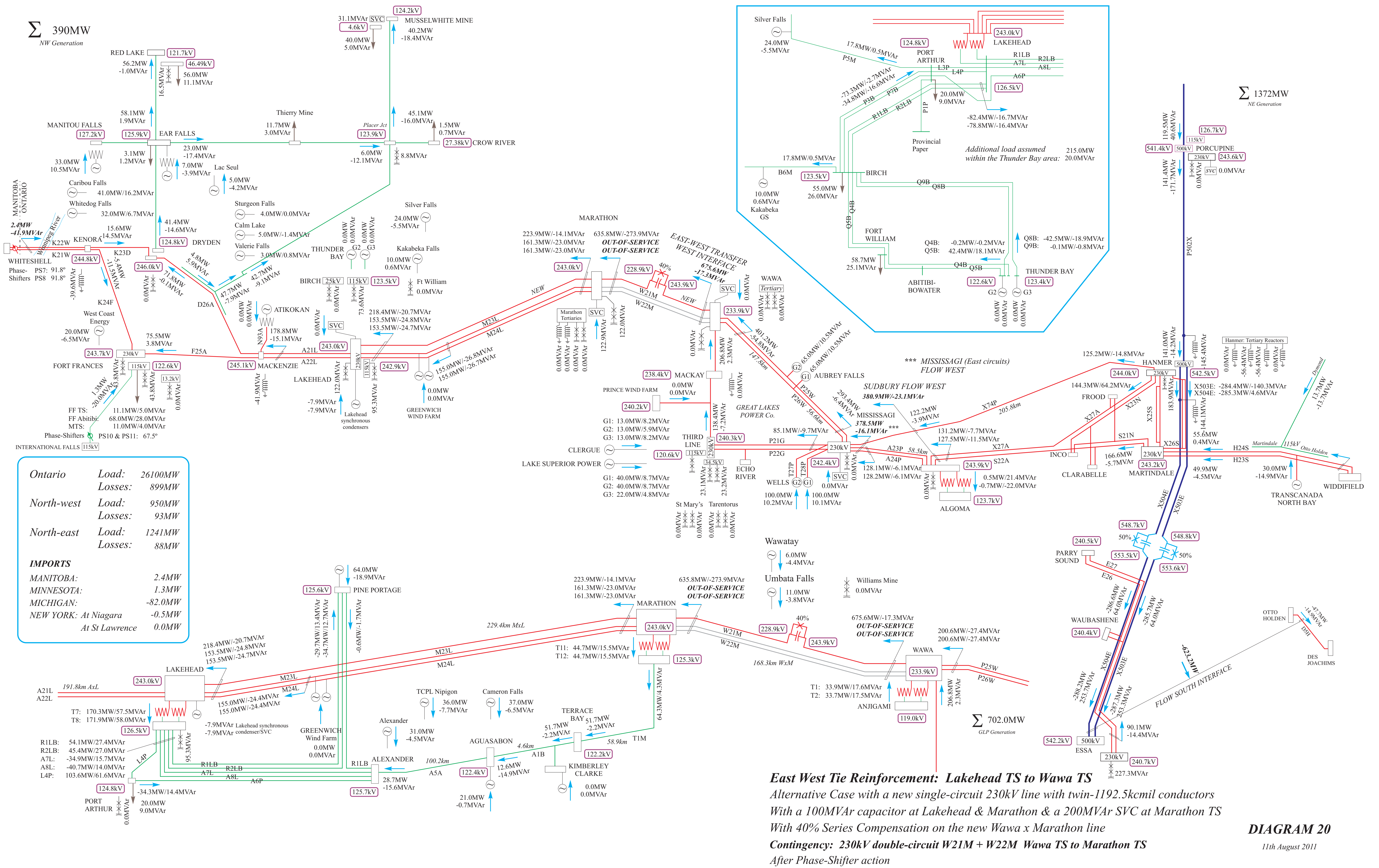
With 40% Series Compensation on the new Wawa x Marathon line

Contingency: 230kV double-circuit W21M + W22M Wawa TS to Marathon TS

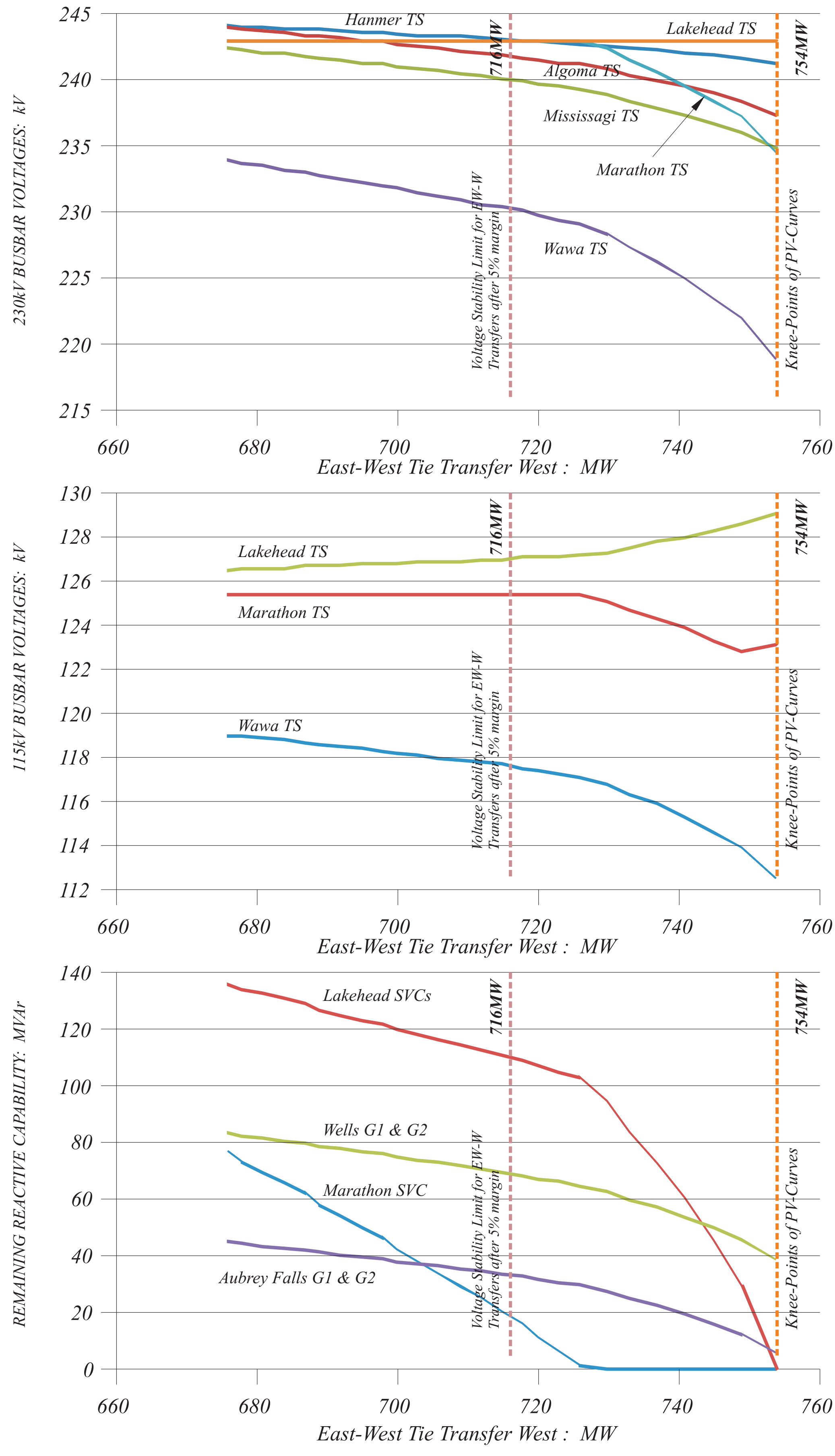
Prior to Phase-Shifter action

DIAGRAM 19

11th August 2011



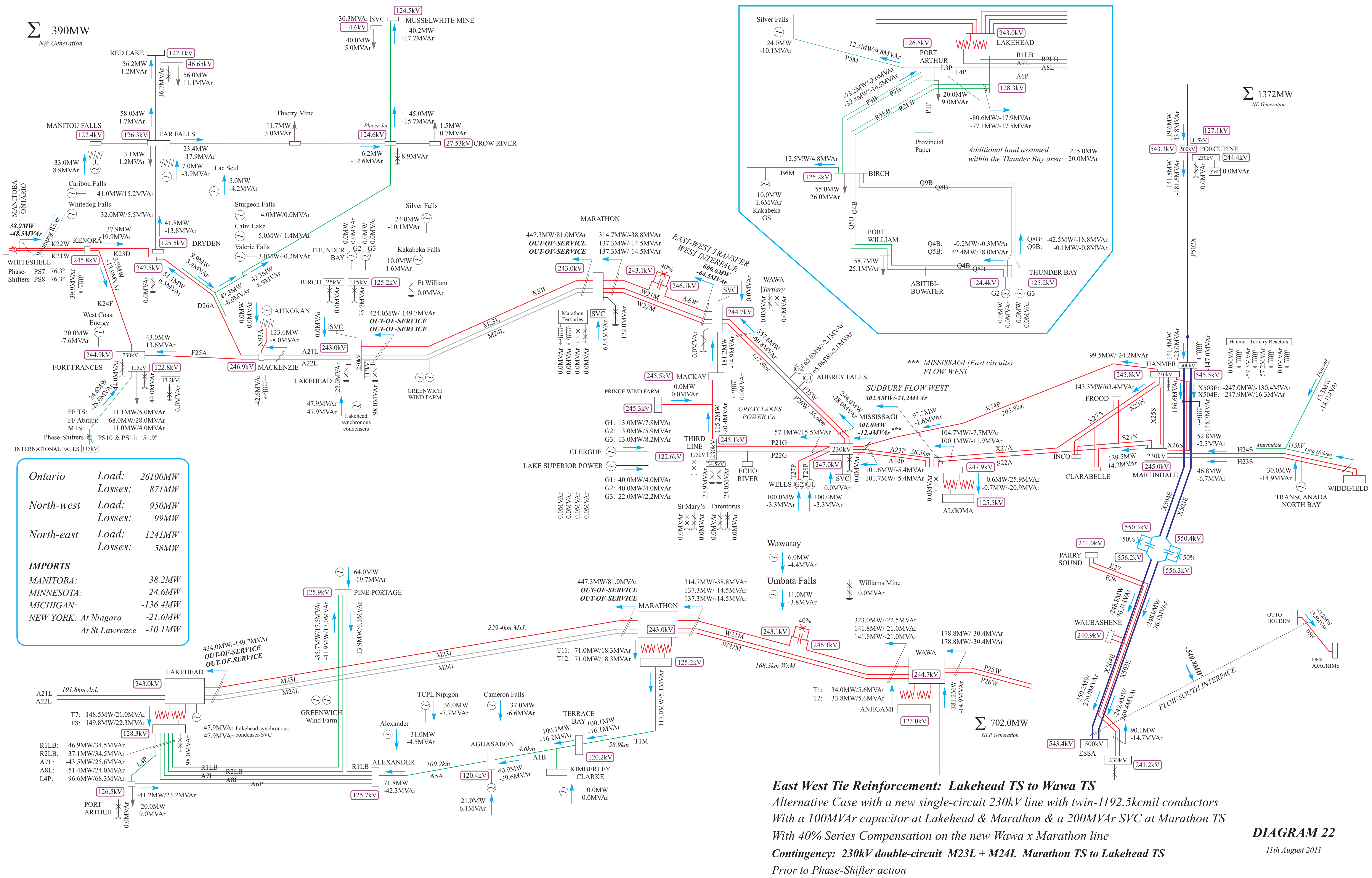
Σ 390MW
NW Generation
Σ 1372MW
NE Generation
Σ 702.0MW
GLP Generation
Ontario Load: 26100MW
Losses: 899MW
North-west Load: 950MW
Losses: 93MW
North-east Load: 1241MW
Losses: 88MW
IMPORTS
MANITOBA: 2.4MW
MINNESOTA: 1.3MW
MICHIGAN: -82.0MW
NEW YORK: At Niagara -0.5MW
At St Lawrence 0.0MW
EAST-WEST TRANSFER
WEST INTERFACE
675.6MW
-17.3MVAr
SUDBURY FLOW WEST
380.9MW/-23.1MVAr
*** MISSISSAGI (East circuits) FLOW WEST
FLOW SOUTH INTERFACE
Additional load assumed within the Thunder Bay area: 215.0MW 20.0MVAr
East West Tie Reinforcement: Lakehead TS to Wawa TS
Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS
With 40% Series Compensation on the new Wawa x Marathon line
Contingency: 230kV double-circuit W21M + W22M Wawa TS to Marathon TS
After Phase-Shifter action
DIAGRAM 20
11th August 2011



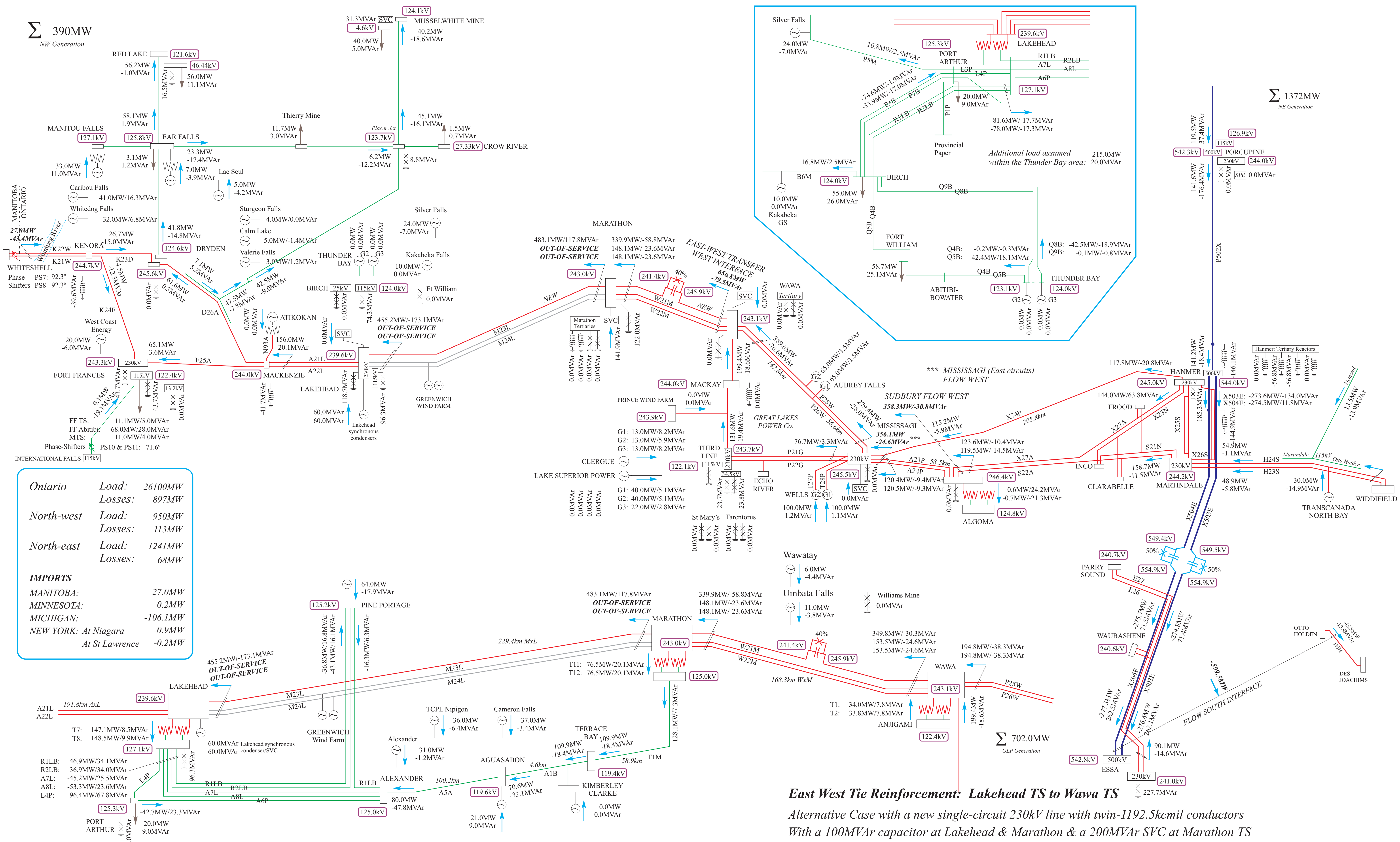
PV-analysis
Marathon 200MVAr SVC + series caps on new WxM line

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
Contingency: existing 230kV double-circuit Wawa TS to Marathon TS
After Phase-Shifter action

DIAGRAM 21
28th July 2011



Σ 390MW
NW Generation
Σ 1372MW
NE Generation
Σ 702.0MW
GLP Generation
Ontario Load: 26100MW
Losses: 871MW
North-west Load: 950MW
Losses: 99MW
North-east Load: 1241MW
Losses: 58MW
IMPORTS
MANITOBA: 38.2MW
MINNESOTA: 24.6MW
MICHIGAN: -136.4MW
NEW YORK: At Niagara -21.6MW
At St Lawrence -10.1MW
EAST-WEST TRANSFER
WEST INTERFACE
606.6MW
-64.5MVAr
SUDBURY FLOW WEST
302.5MW/-21.2MVAr
*** MISSISSAGI (East circuits) FLOW WEST
FLOW SOUTH INTERFACE
-540.8MW
Additional load assumed within the Thunder Bay area: 215.0MW 20.0MVAr
East West Tie Reinforcement: Lakehead TS to Wawa TS
Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS
With 40% Series Compensation on the new Wawa x Marathon line
Contingency: 230kV double-circuit M23L + M24L Marathon TS to Lakehead TS
Prior to Phase-Shifter action
DIAGRAM 22
11th August 2011



Ontario	Load:	26100MW
	Losses:	897MW
North-west	Load:	950MW
	Losses:	113MW
North-east	Load:	1241MW
	Losses:	68MW
IMPORTS		
MANITOBA:		27.0MW
MINNESOTA:		0.2MW
MICHIGAN:		-106.1MW
NEW YORK:	At Niagara	-0.9MW
	At St Lawrence	-0.2MW

East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS

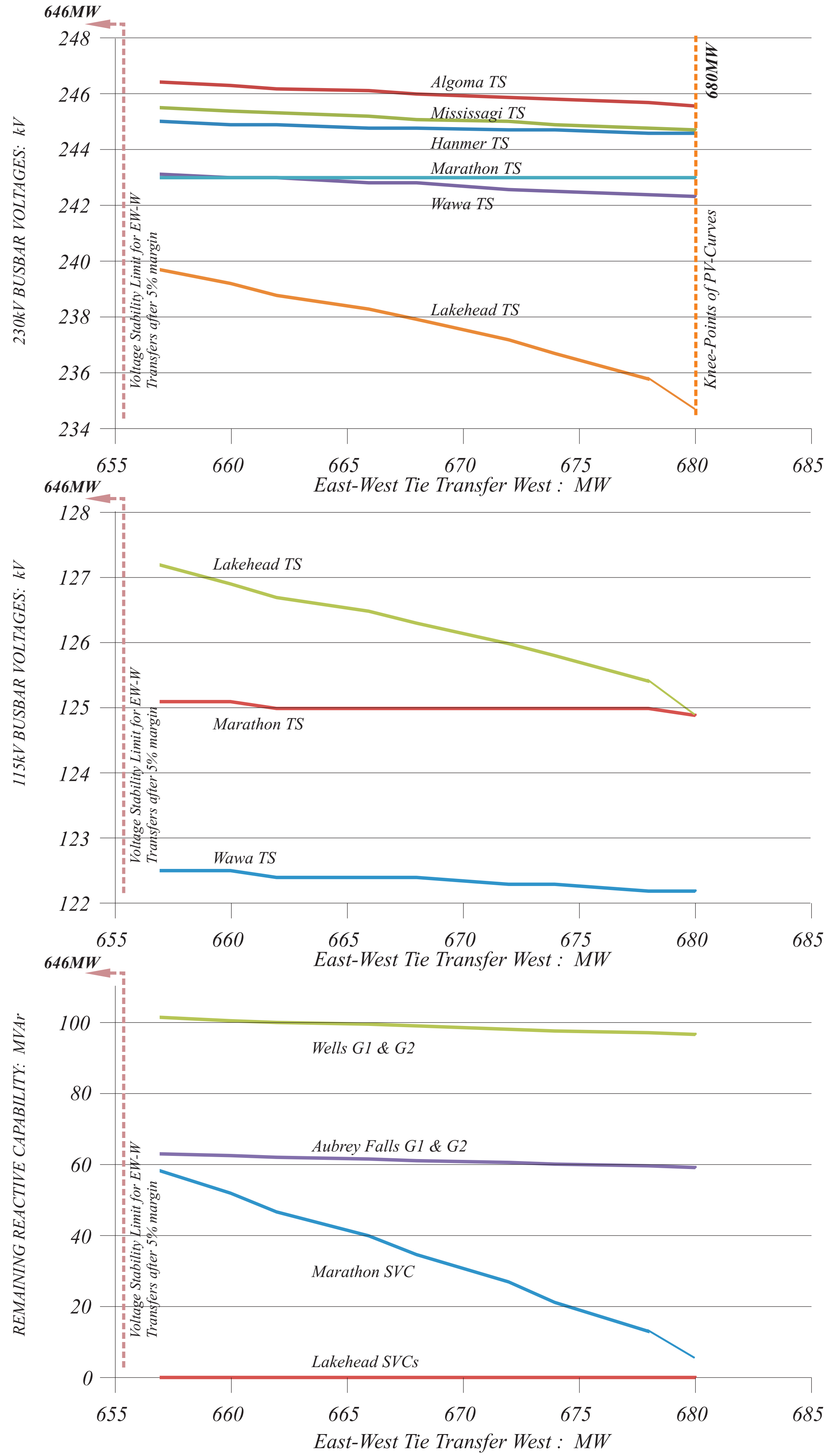
With 40% Series Compensation on the new Wawa x Marathon line

Contingency: 230kV double-circuit M23L + M24L Marathon TS to Lakehead TS

After Phase-Shifter action

DIAGRAM 23

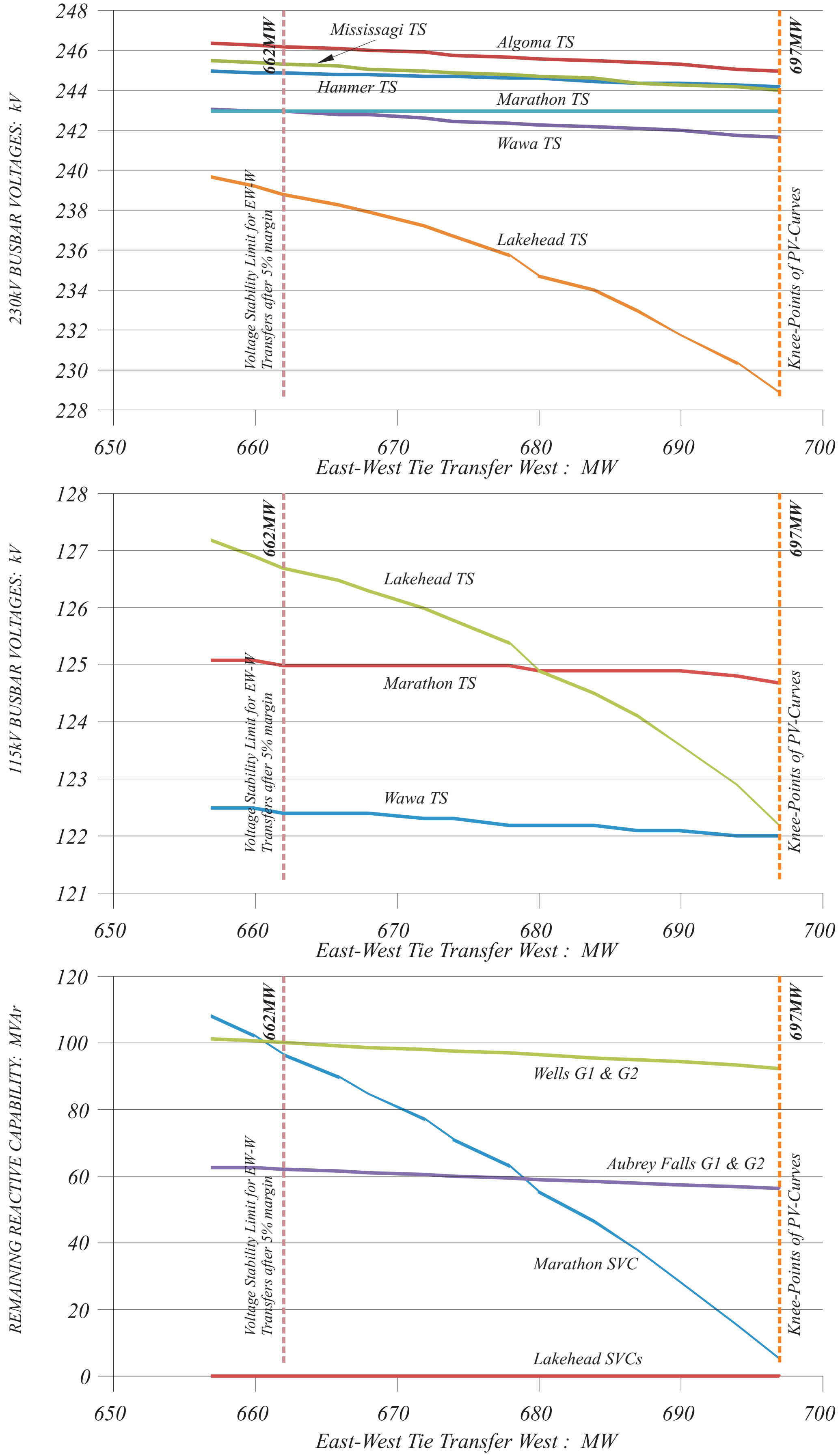
11th August 2011



PV-analysis
Marathon 200MVAr SVC + series caps on new WxM line

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
Contingency: existing 230kV double-circuit Marathon TS to Lakehead TS
After Phase-Shifter action

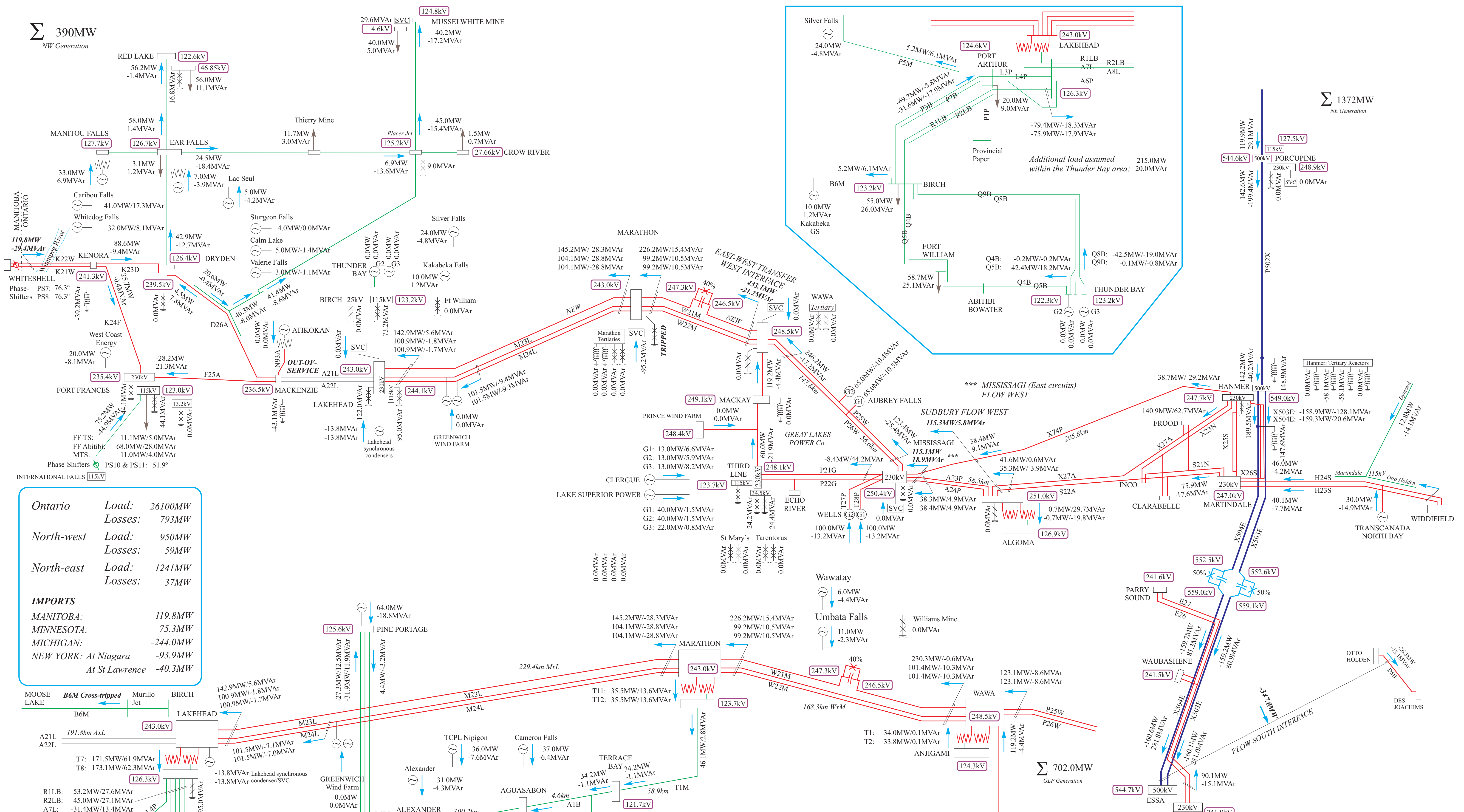
DIAGRAM 24
29th July 2011



PV-analysis
Marathon ***250MVAr***
SVC + series caps
on new WxM line

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
Contingency: existing 230kV double-circuit Marathon TS to Lakehead TS
After Phase-Shifter action

DIAGRAM 25
29th July 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

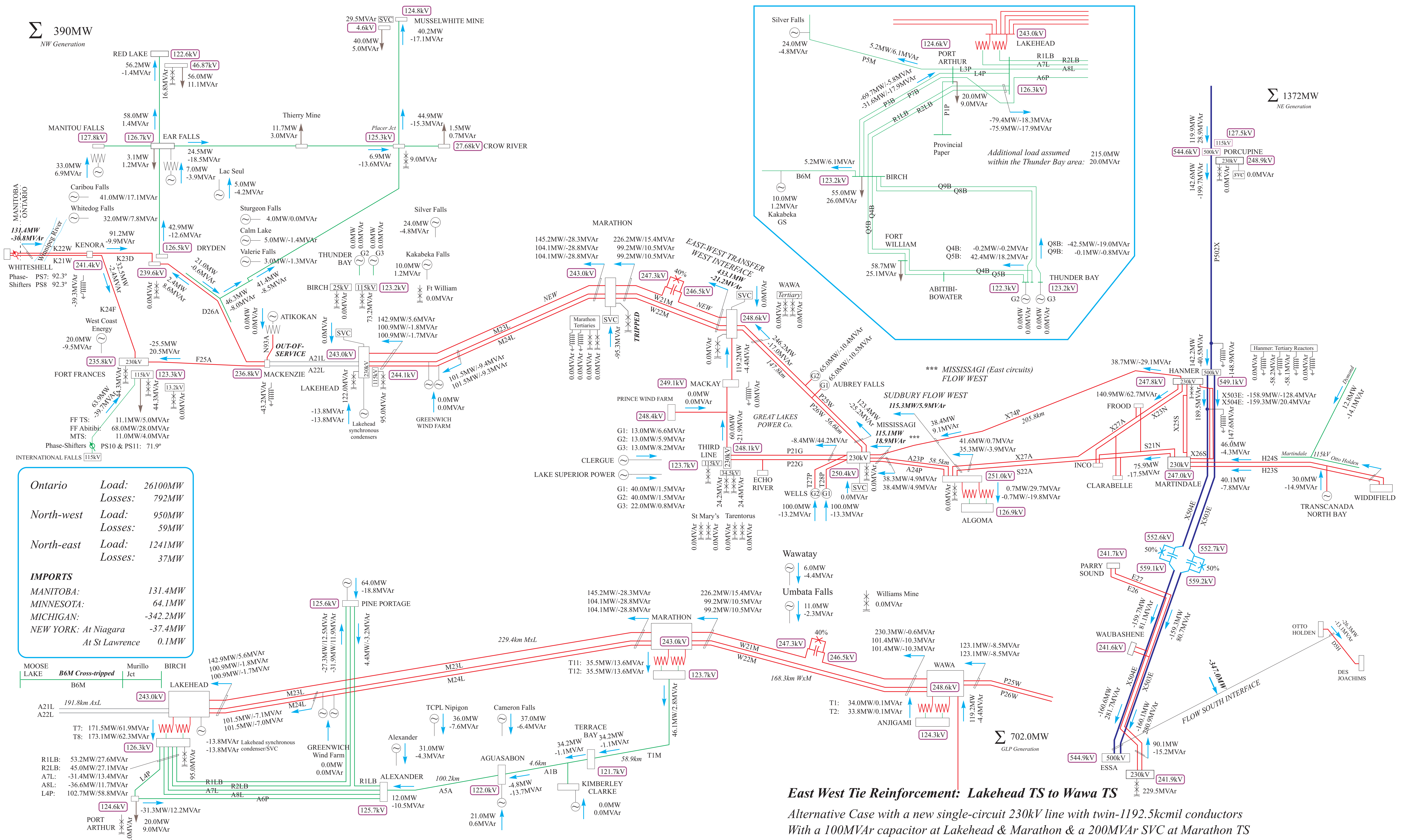
Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS
With 40% Series Compensation on the new Wawa x Marathon line

DIAGRAM 26

11th August 2011

Contingency: 230kV double-circuit A21L + A22L Lakehead TS to Mackenzie TS

Marathon capacitor tripped & Prior to Phase-Shifter action



East West Tie Reinforcement: Lakehead TS to Wawa TS

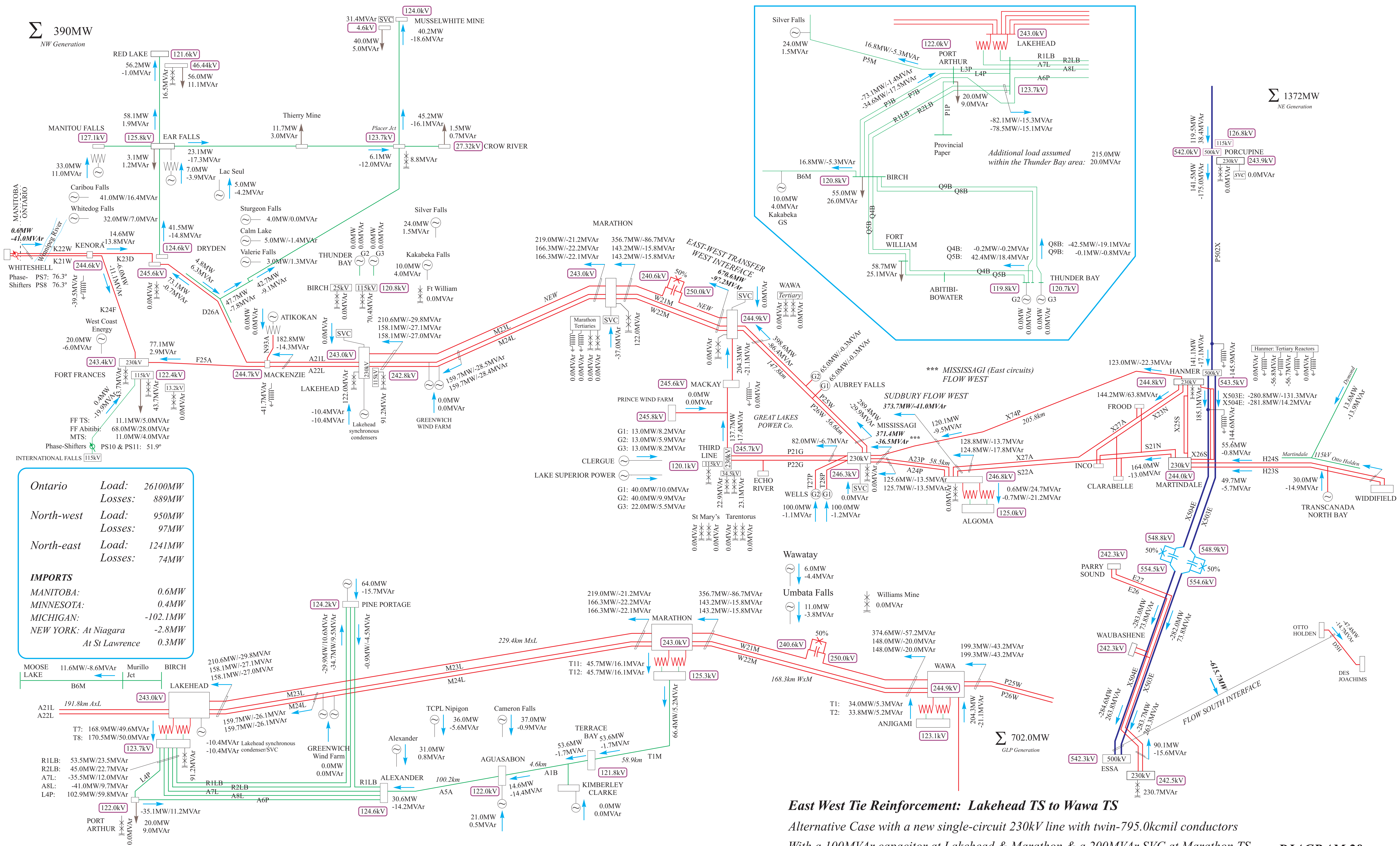
Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS
With 40% Series Compensation on the new Wawa x Marathon line

DIAGRAM 27

Contingency: 230kV double-circuit A21L + A22L Lakehead TS to Mackenzie TS

11th August 2011

Marathon capacitor tripped & After Phase-Shifter action



East West Tie Reinforcement: Lakehead TS to Wawa TS

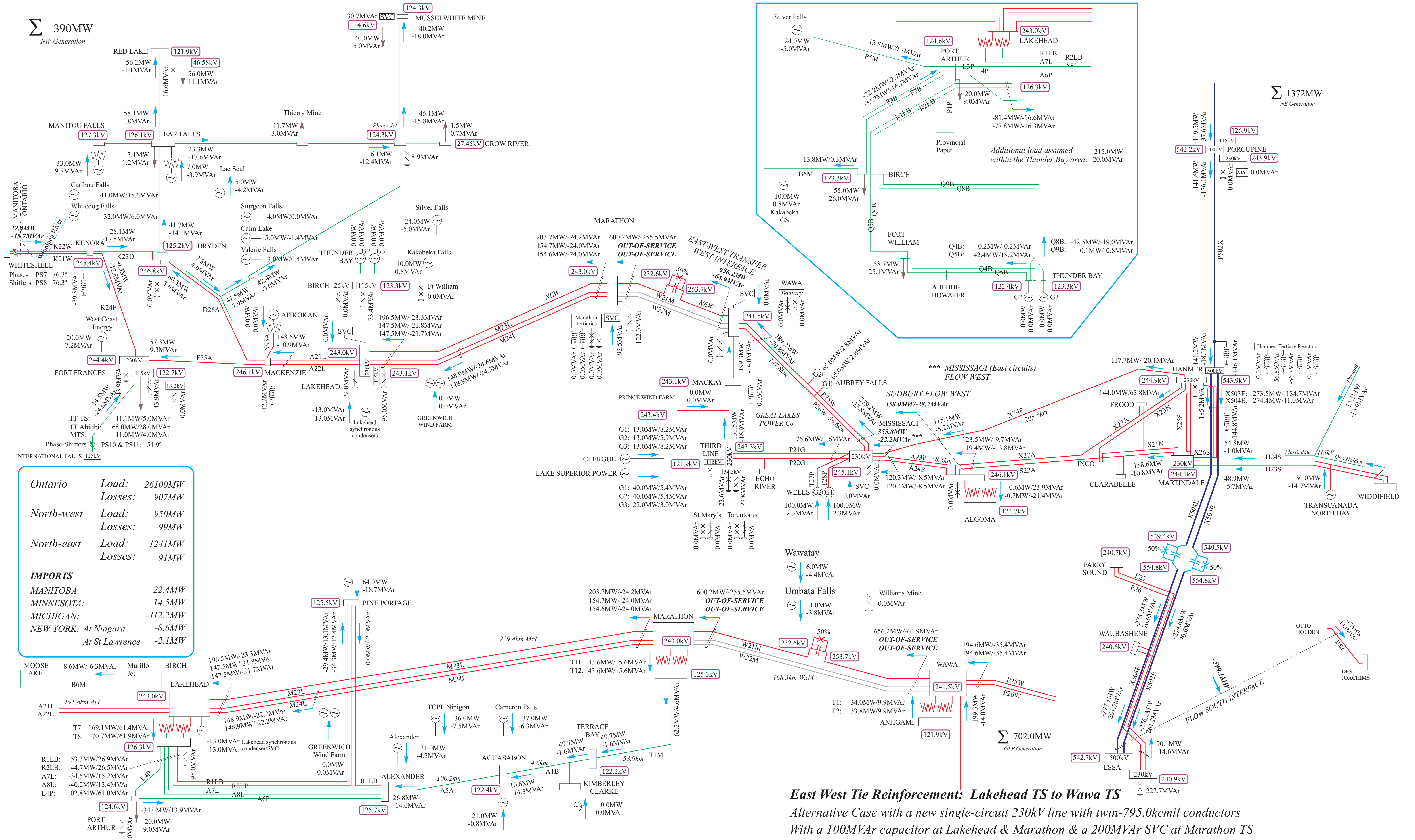
Alternative Case with a new single-circuit 230kV line with twin-795.0kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS

With 50% Series Compensation on the new Wawa x Marathon line

DIAGRAM 28

11th August 2011



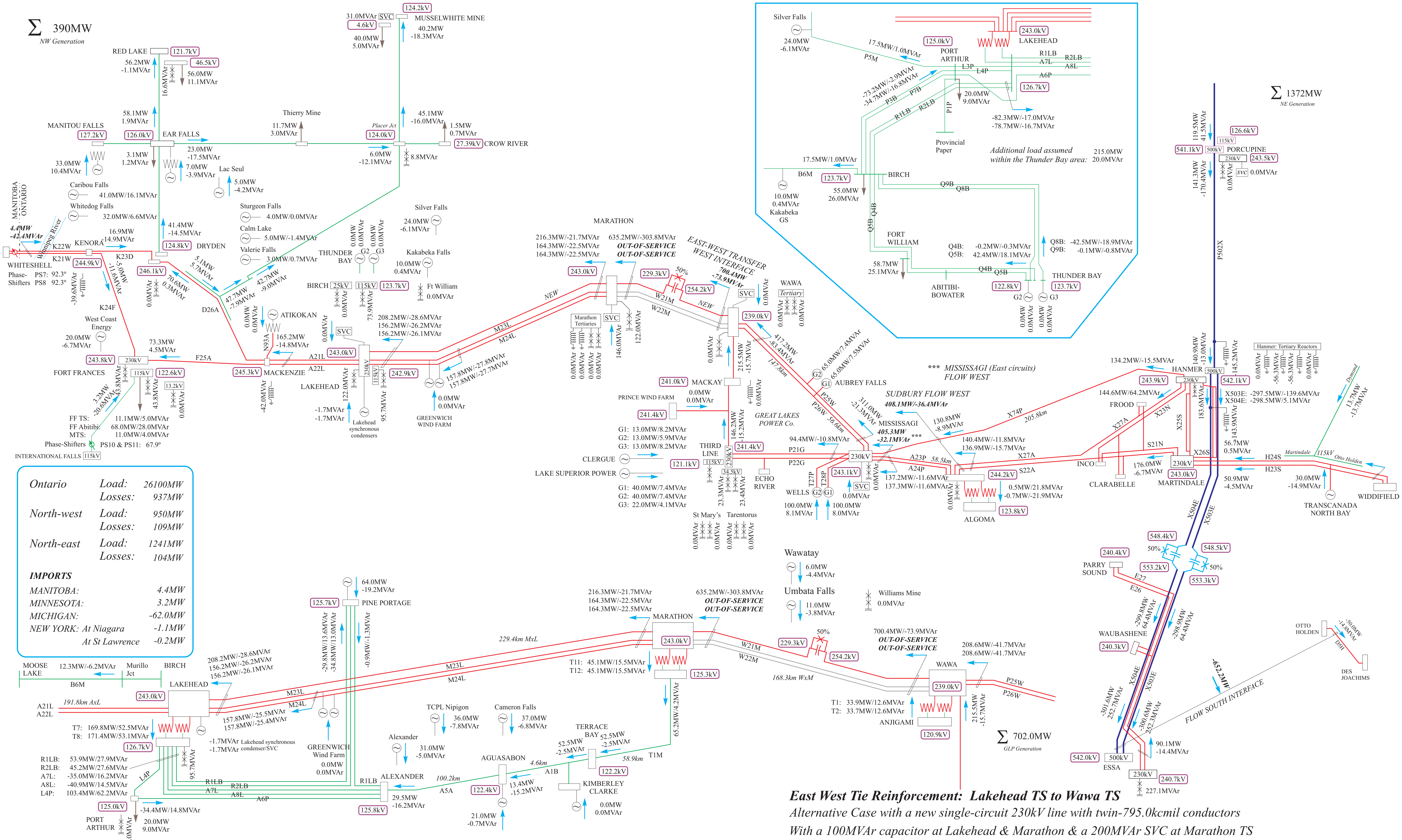
East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-795.0kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS
With 50% Series Compensation on the new Wawa x Marathon line

Contingency: 230kV double-circuit W21M + W22M Wawa TS to Marathon TS
Prior to Phase-Shifter action

DIAGRAM 29

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-795.0kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS

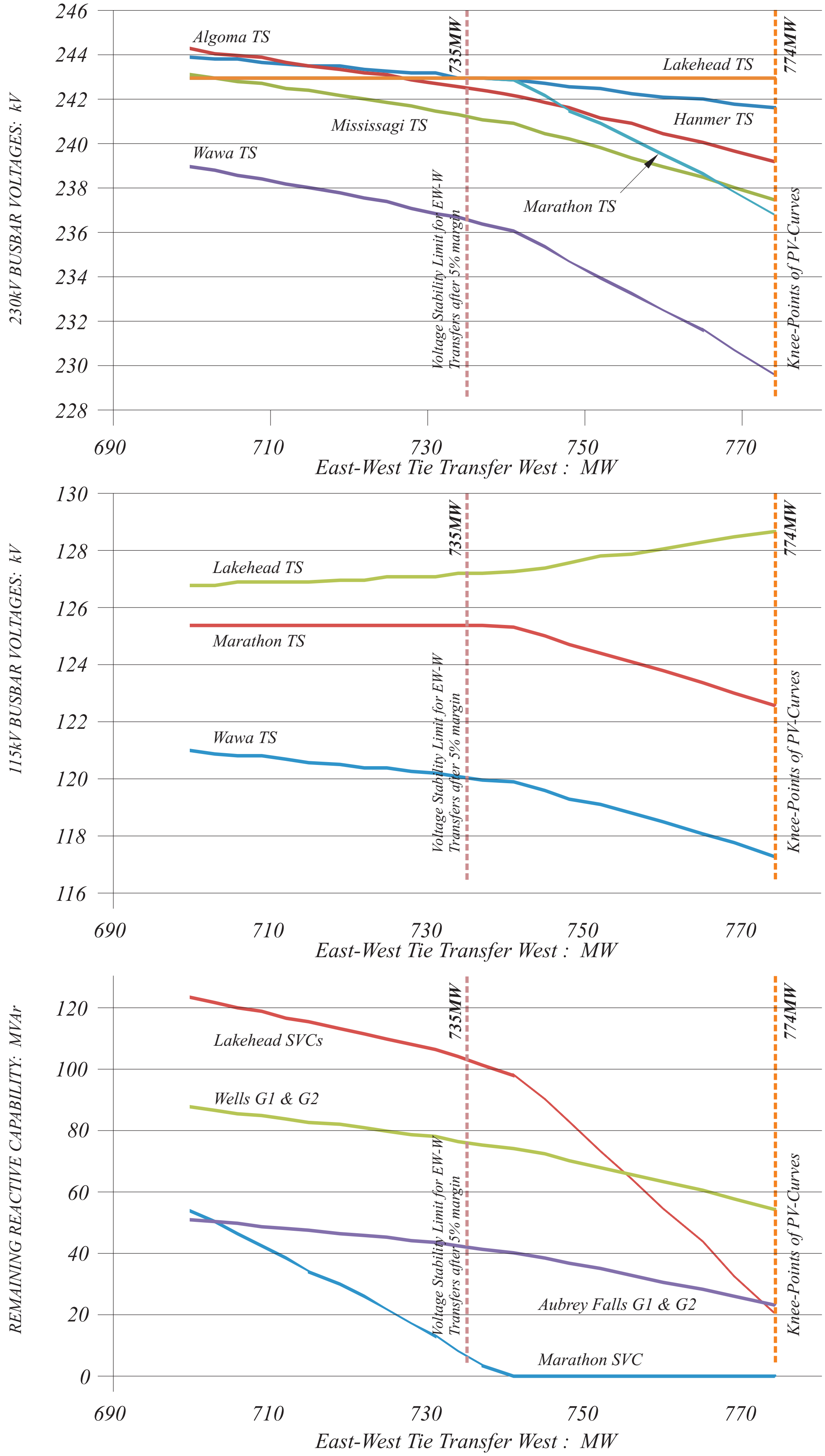
With 50% Series Compensation on the new Wawa x Marathon line

Contingency: 230kV double-circuit W21M + W22M Wawa TS to Marathon TS

After Phase-Shifter action

DIAGRAM 30

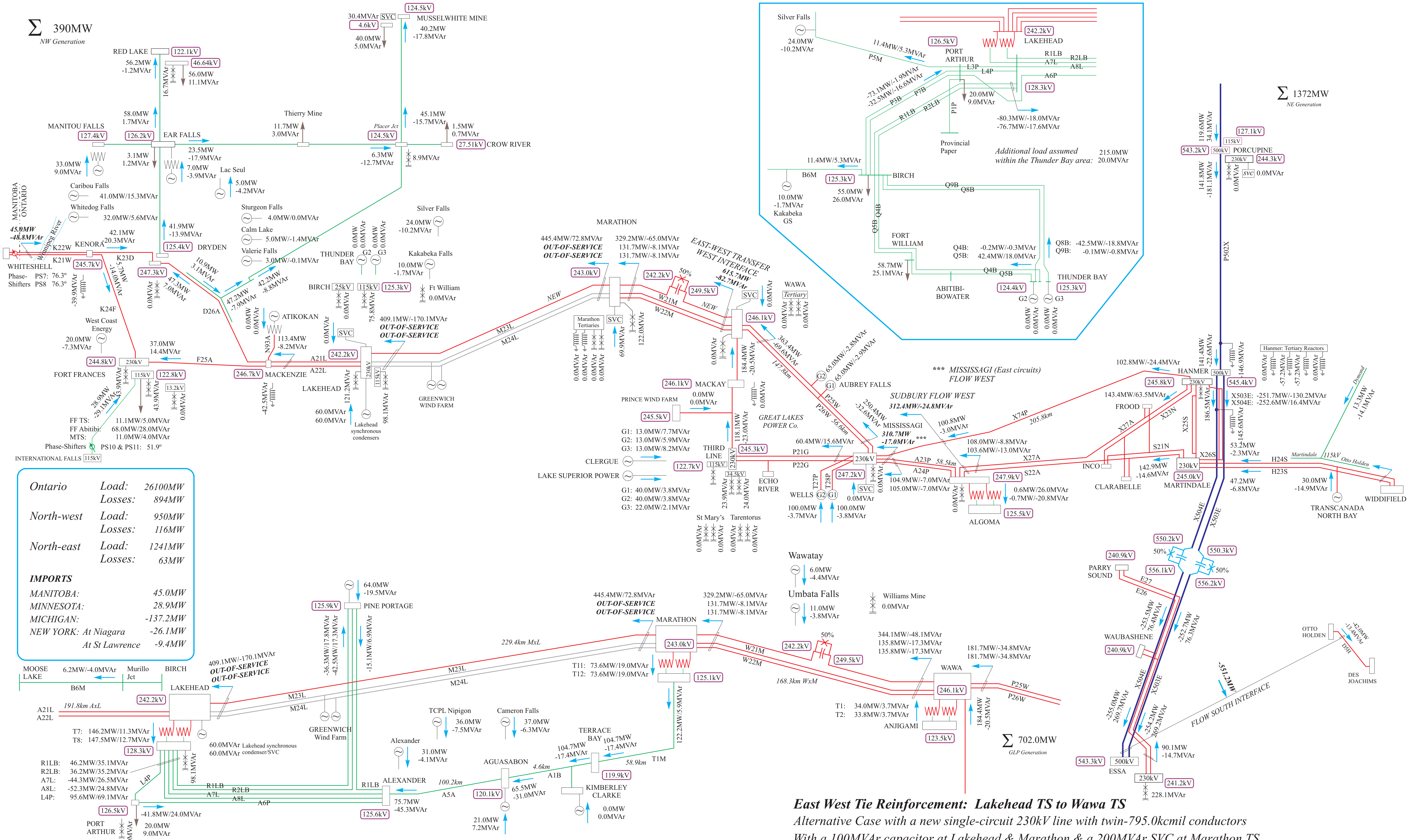
11th August 2011



PV-analysis
Marathon 200MVAr SVC + series caps on new WxM line

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
Contingency: existing 230kV double-circuit Wawa TS to Marathon TS
After Phase-Shifter action

DIAGRAM 31
1st August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-795.0kcmil conductors

With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS

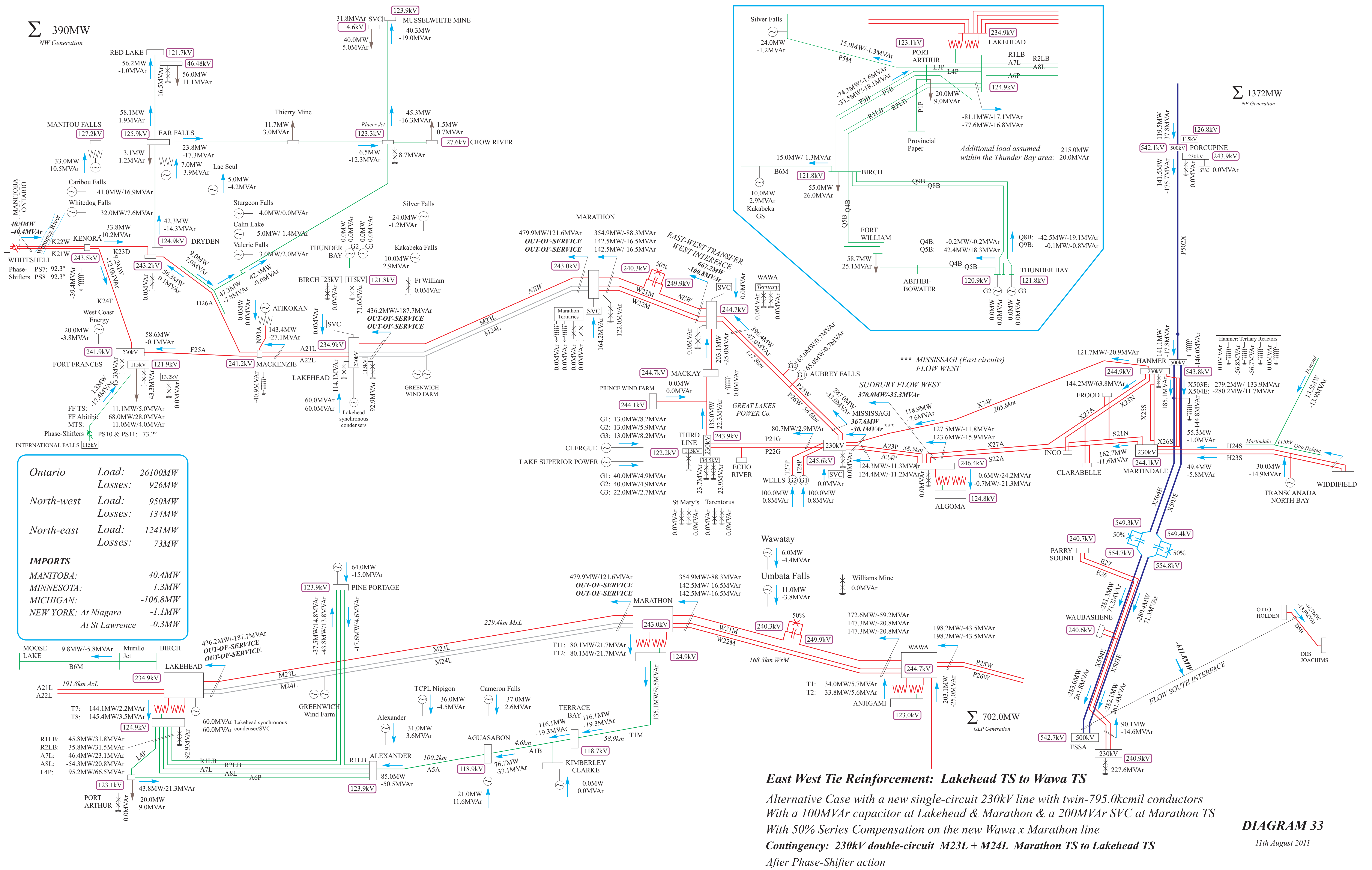
With 50% Series Compensation on the new Wawa x Marathon line

Contingency: 230kV double-circuit M23L + M24L Marathon TS to Lakehead TS

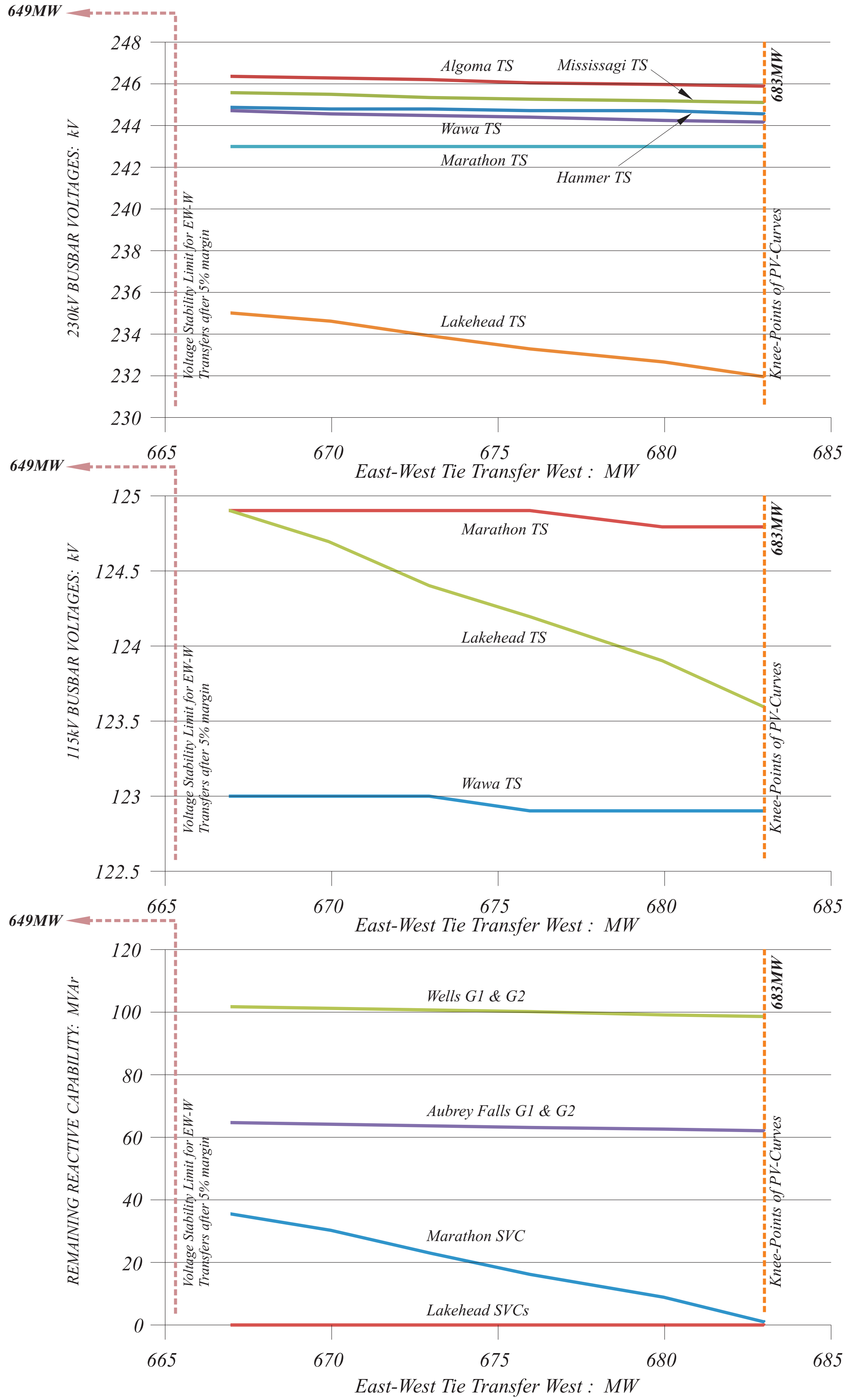
Prior to Phase-Shifter action

DIAGRAM 32

11th August 2011



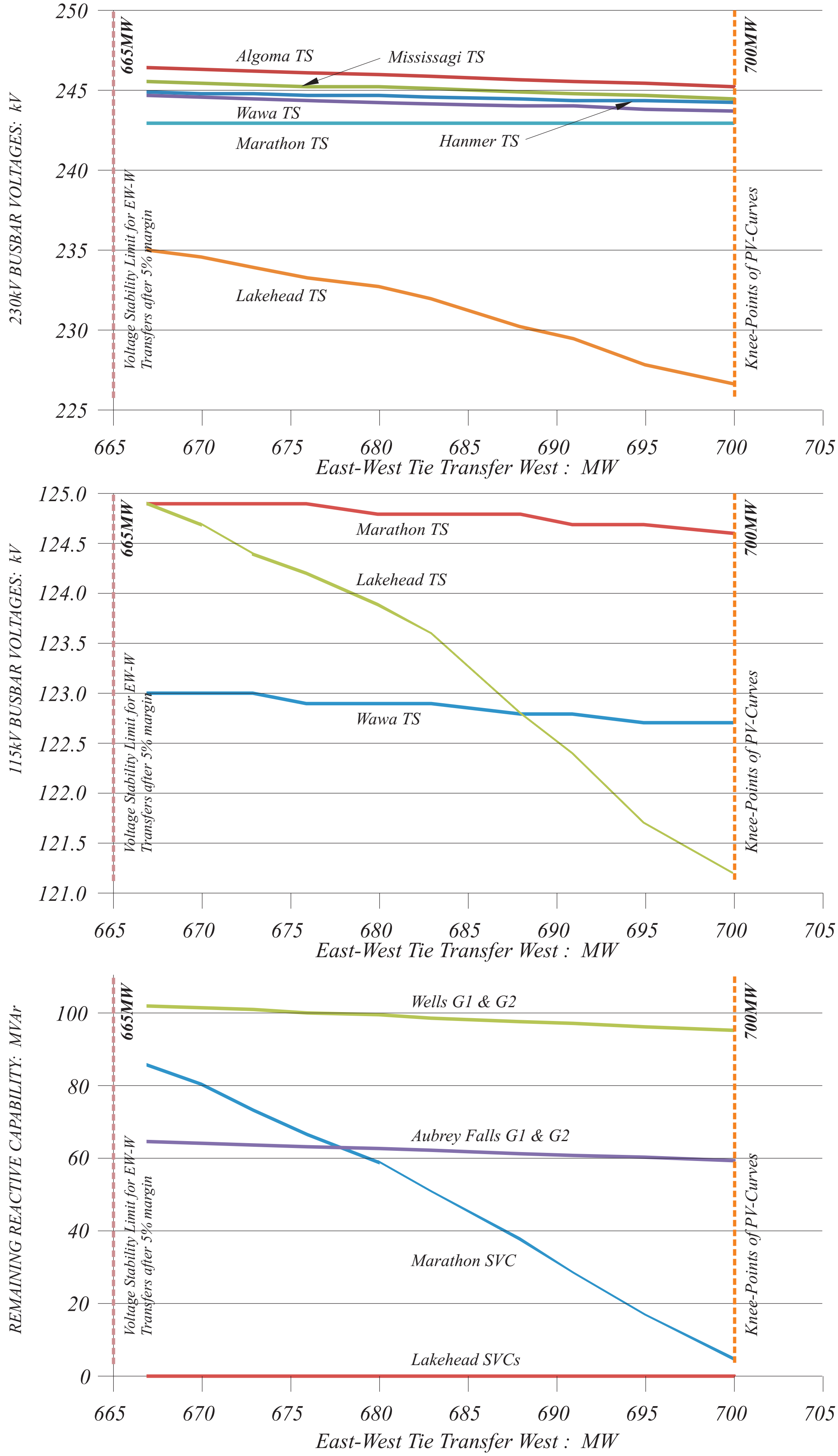
∑ 390MW
NW Generation
∑ 1372MW
NE Generation
∑ 702.0MW
GLP Generation
Ontario Load: 26100MW Losses: 926MW
North-west Load: 950MW Losses: 134MW
North-east Load: 1241MW Losses: 73MW
IMPORTS
MANITOBA: 40.4MW
MINNESOTA: 1.3MW
MICHIGAN: -106.8MW
NEW YORK: At Niagara -1.1MW
At St Lawrence -0.3MW
RED LAKE
EAR FALLS
MANITOU FALLS
Thierry Mine
MUSSELWHITE MINE
CROW RIVER
Placer Jct
Lac Seul
Caribou Falls
Whitedog Falls
KENORA
DRYDEN
WHITESHELL
Sturgeon Falls
Calm Lake
Valerie Falls
Silver Falls
Kakabeka Falls
Ft William
THUNDER BAY
BIRCH
ATIKOKAN
MACKENZIE
FORT FRANCES
West Coast Energy
INTERNATIONAL FALLS
LAKEHEAD
GREENWICH WIND FARM
Lakehead synchronous condensers
MARATHON
EAST-WEST TRANSFER
WEST INTERFACE
OUT-OF-SERVICE
WAWA
MACKAY
PRINCE WIND FARM
AUBREY FALLS
MISSISSAGI
GREAT LAKES POWER Co.
THIRD LINE
CLERGUE
LAKE SUPERIOR POWER
ECHO RIVER
WELLS
ALGOMA
St Mary's
Tarentorus
*** MISSISSAGI (East circuits) FLOW WEST
SUDBURY FLOW WEST
HANMER
FROOD
INCO
CLARABELLE
MARTINDALE
TRANSCANADA NORTH BAY
WIDDIFIELD
PORCUPINE
Hanmer: Tertiary Reactors
PARRY SOUND
WAUBASHENE
OTTO HOLDEN
DES JOACHIMS
ESSA
FLOW SOUTH INTERFACE
LAKEHEAD
PORT ARTHUR
Provincial Paper
Additional load assumed within the Thunder Bay area: 215.0MW 20.0MVAr
Kakabeka GS
FORT WILLIAM
ABITIBI-BOWATER
MOOSE LAKE
Murillo Jct
PINE PORTAGE
TCPL Nipigon
Cameron Falls
Alexander
AGUASABON
TERRACE BAY
KIMBERLEY CLARKE
ALEXANDER
ANJIGAMI
Wawatay
Umbata Falls
Williams Mine
East West Tie Reinforcement: Lakehead TS to Wawa TS
Alternative Case with a new single-circuit 230kV line with twin-795.0kcmil conductors
With a 100MVAr capacitor at Lakehead & Marathon & a 200MVAr SVC at Marathon TS
With 50% Series Compensation on the new Wawa x Marathon line
Contingency: 230kV double-circuit M23L + M24L Marathon TS to Lakehead TS
After Phase-Shifter action
DIAGRAM 33
11th August 2011



PV-analysis
Marathon 200MVAr SVC + 50% series caps on new WxM line

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-795.0kcmil conductors
Contingency: existing 230kV double-circuit Marathon TS to Lakehead TS
After Phase-Shifter action

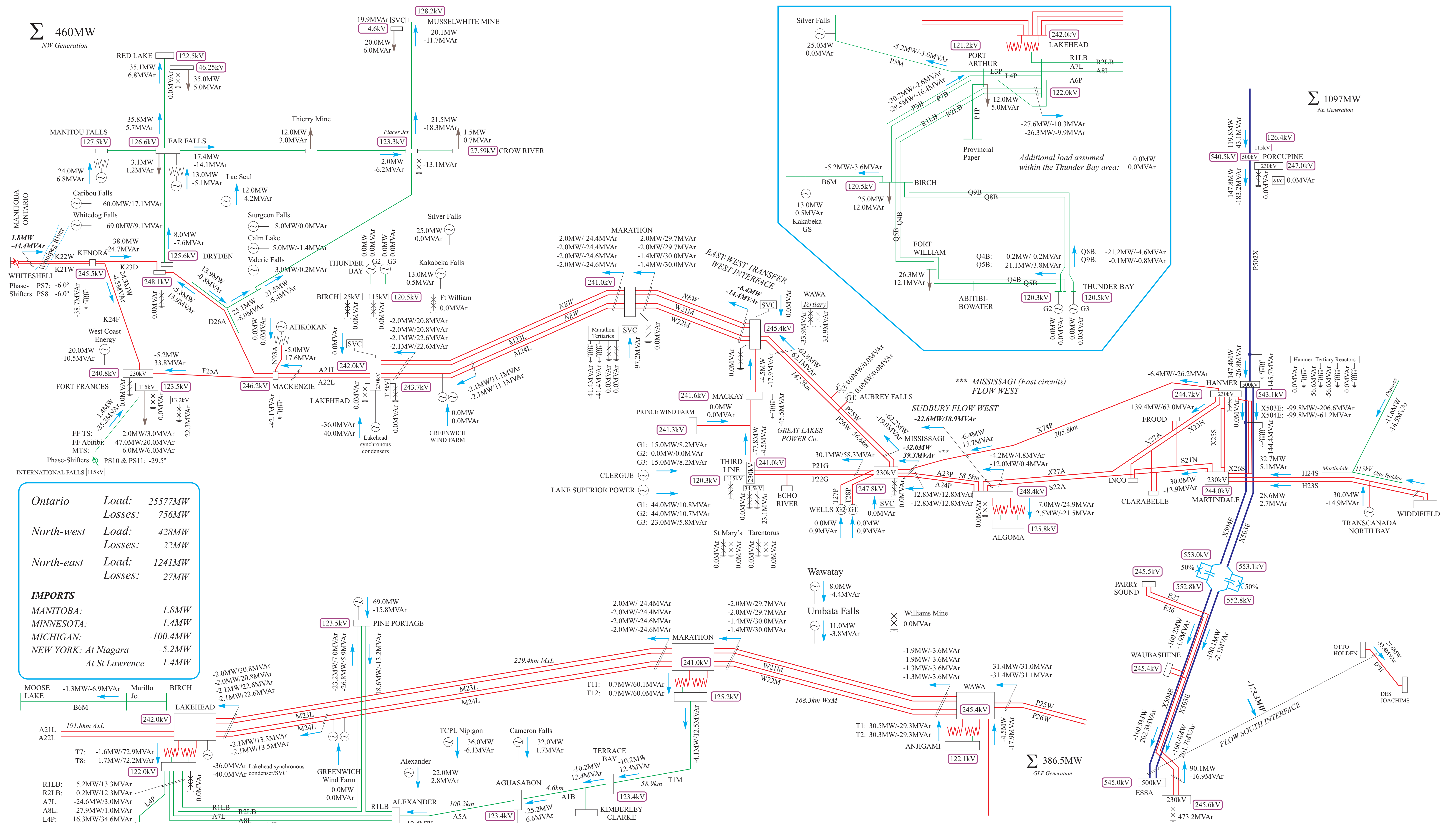
DIAGRAM 34
1st August 2011



PV-analysis
*Marathon **250MVAr***
SVC + 50% series
caps on new WxM line

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new single-circuit 230kV line with twin-795.0kcmil conductors
Contingency: existing 230kV double-circuit Marathon TS to Lakehead TS
After Phase-Shifter action

DIAGRAM 35
1st August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

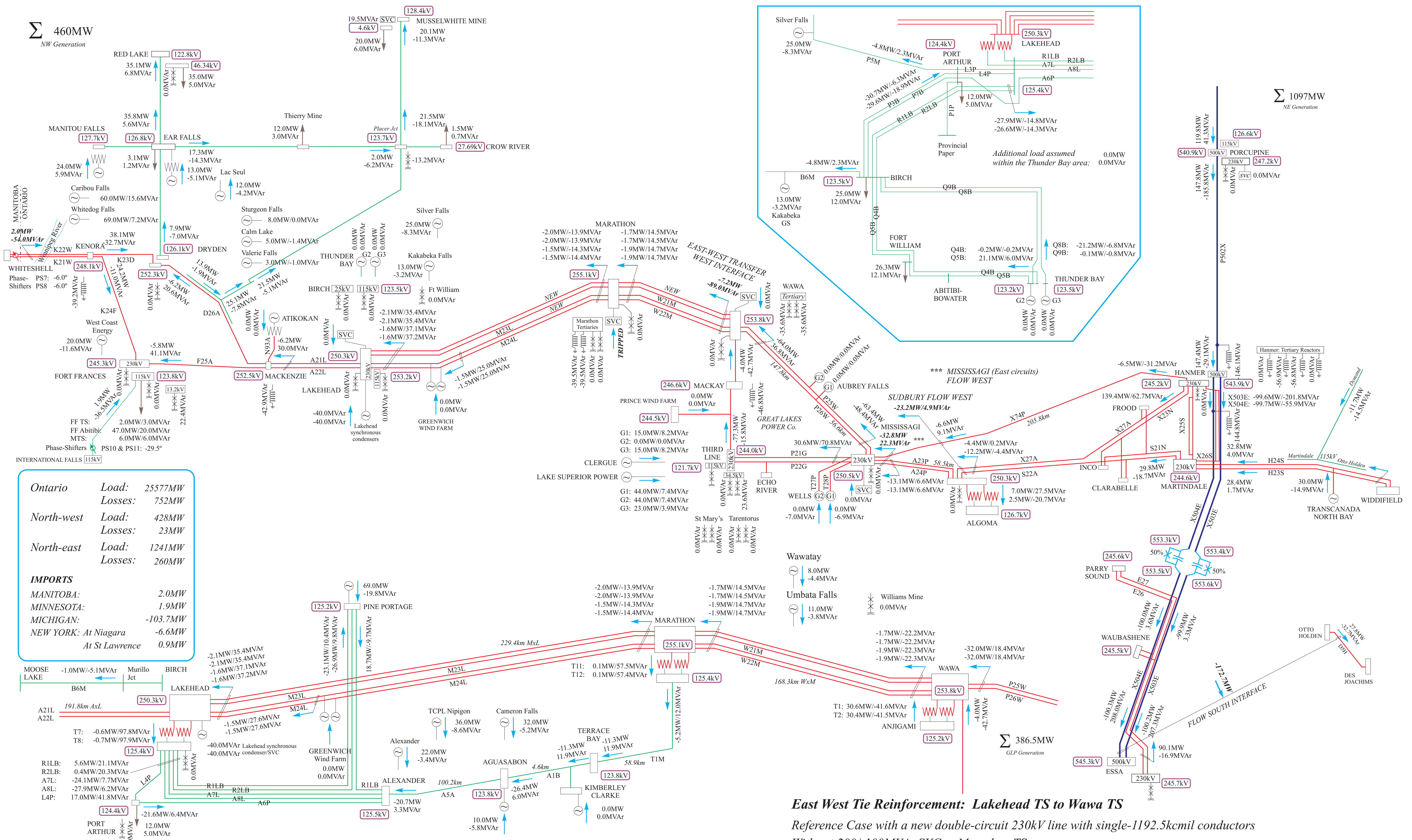
Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

With a +200/-100MVAr SVC at Marathon TS

Condition with reduced loads & transfers of approximately 0MW on the East-West Tie

DIAGRAM 36

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with single-1192.5kcmil conductors

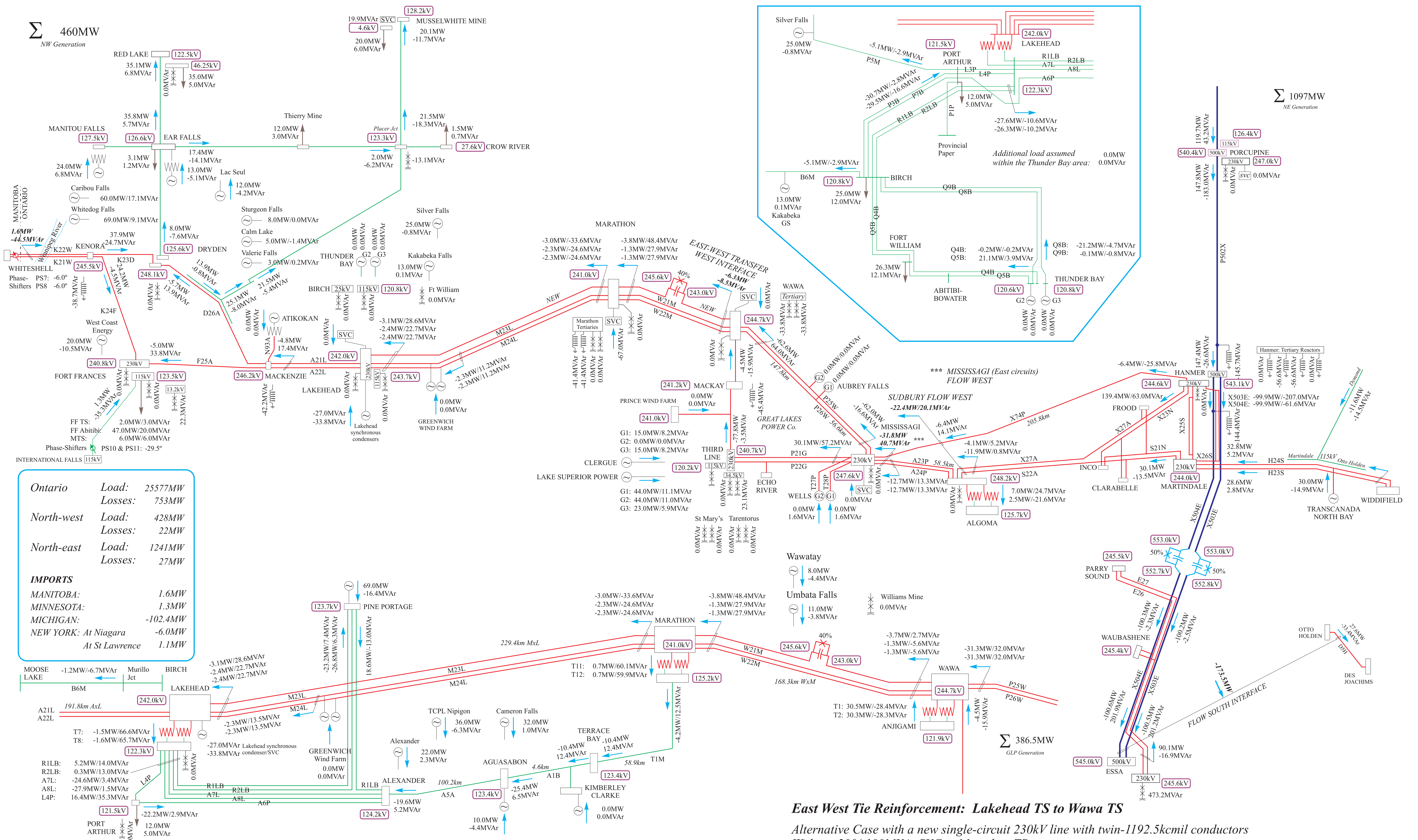
With a +200/-100MVAr SVC at Marathon TS

Condition with reduced loads & transfers of approximately 0MW on the East-West Tie

Contingency: Marathon SVC tripped

DIAGRAM 37

11th August 2011

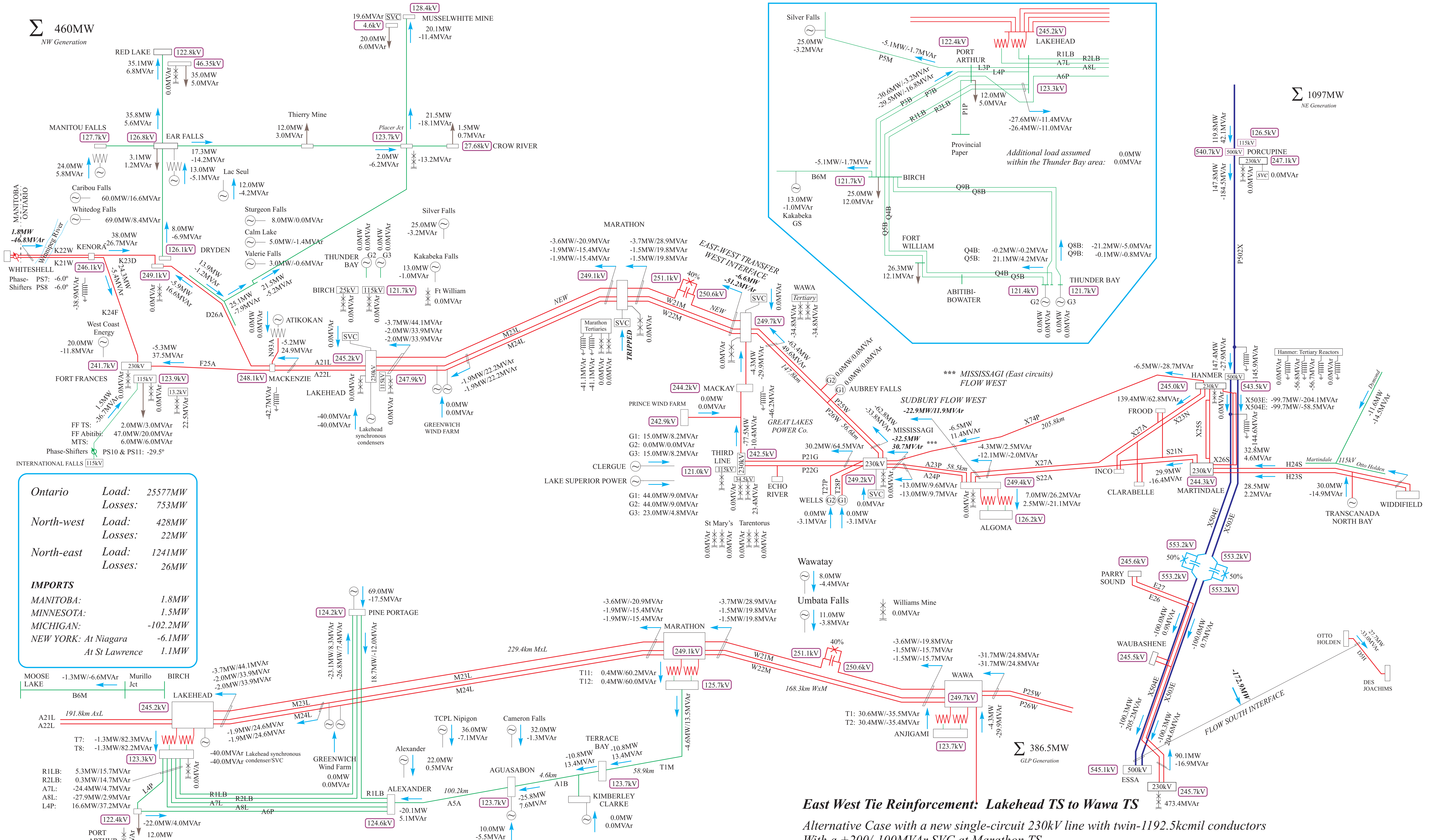


East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a +200/-100MVAr SVC at Marathon TS
With 40% series compensation at the mid-point of the new Wawa TS to Marathon TS line
Condition with reduced loads & transfers of approximately 0MW on the East-West Tie

DIAGRAM 38

11th August 2011



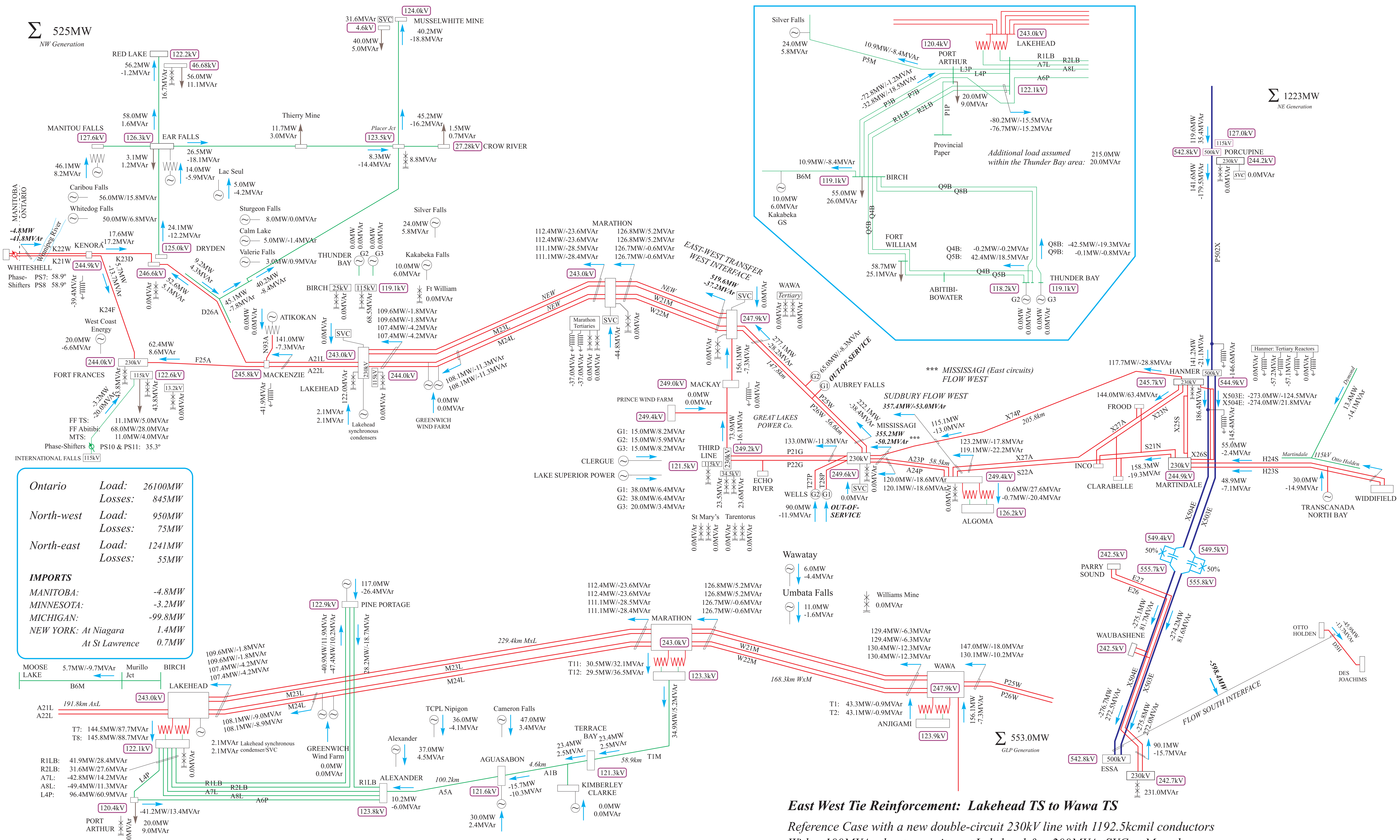
East West Tie Reinforcement: Lakehead TS to Wawa TS

Alternative Case with a new single-circuit 230kV line with twin-1192.5kcmil conductors
With a +200/-100MVAr SVC at Marathon TS
With 40% series compensation at the mid-point of the new Wawa TS to Marathon TS line
Condition with reduced loads & transfers of approximately 0MW on the East-West Tie

Contingency: Marathon SVC tripped

DIAGRAM 39

11th August 2011

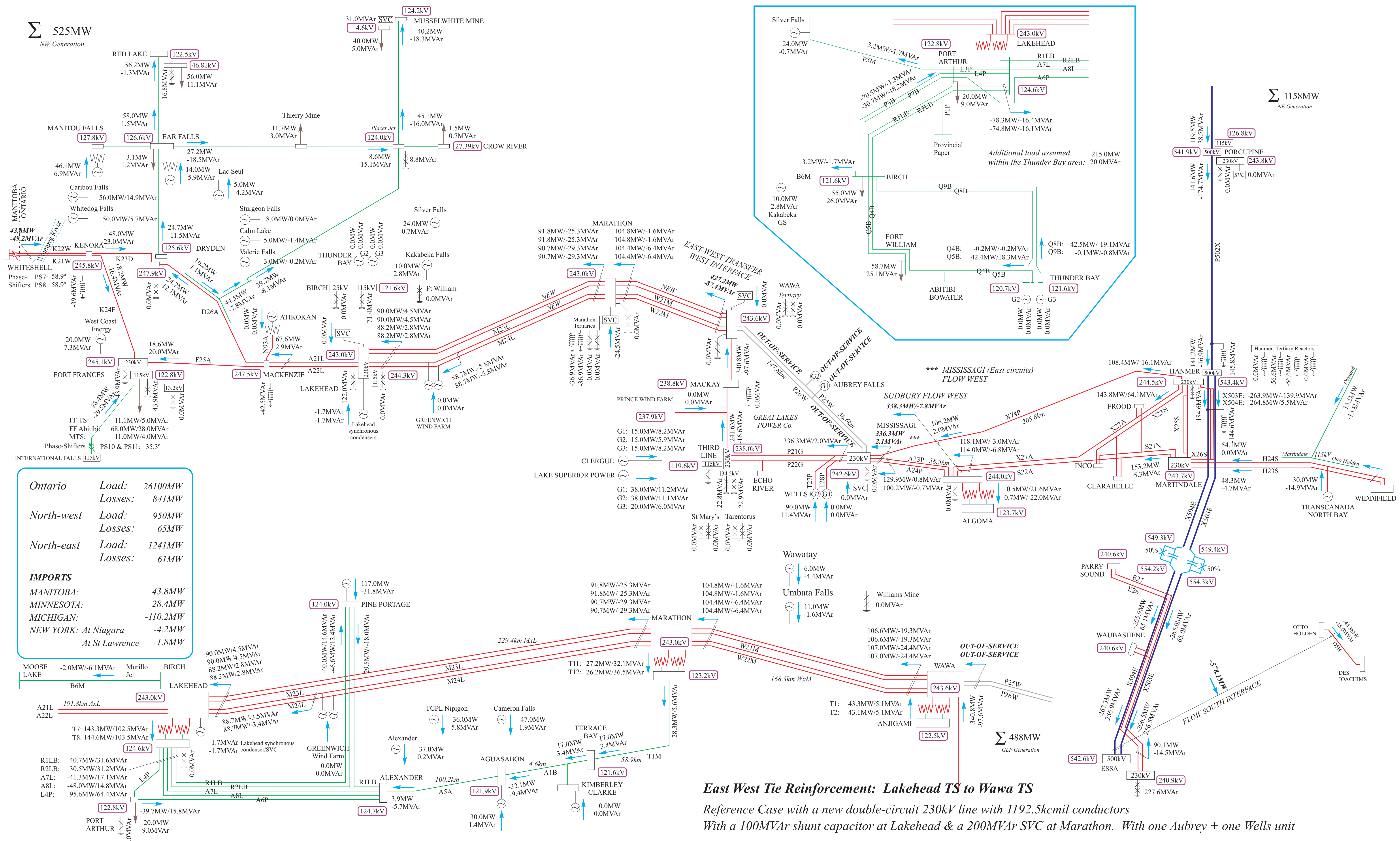


East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon
With one unit at Aubrey Falls GS & at Wells GS out-of-service
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

DIAGRAM 40

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors

With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon. With one Aubrey + one Wells unit

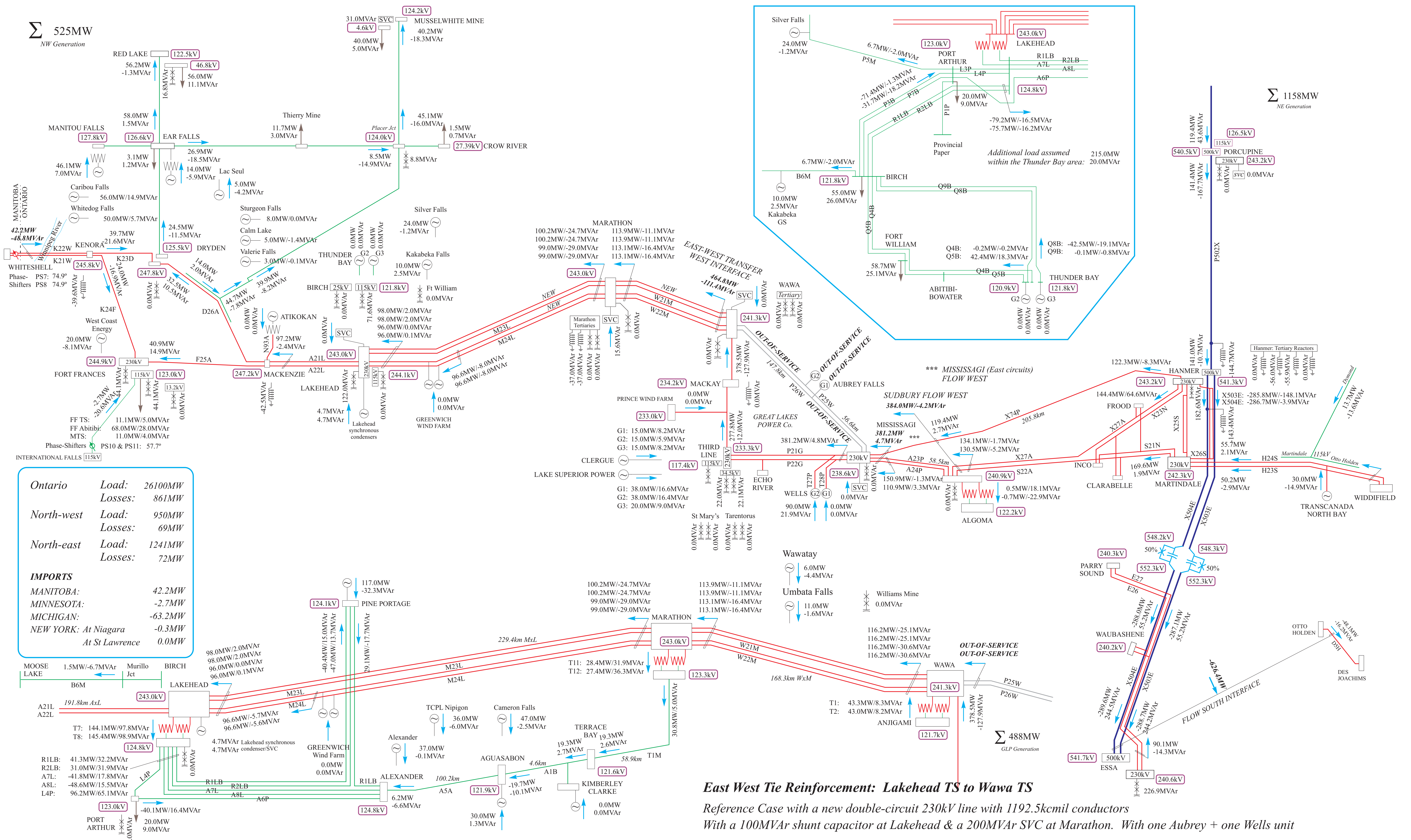
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

Contingency: 230kV double-circuit involving circuits P25W & P26W - Mississagi to Wawa

Prior to Phase Shifter action

DIAGRAM 41

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon. With one Aubrey + one Wells unit

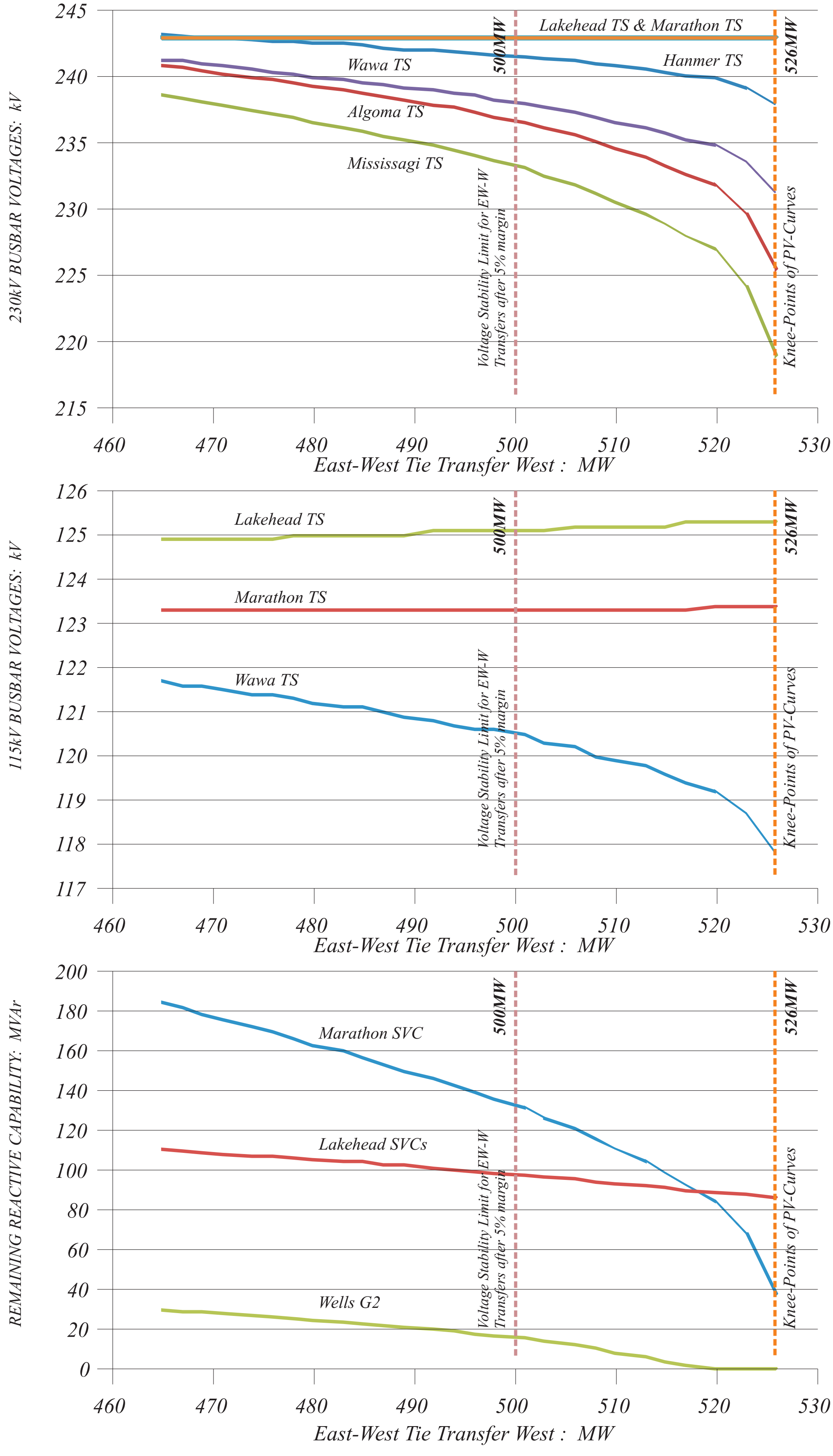
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

Contingency: 230kV double-circuit involving circuits P25W & P26W - Mississagi to Wawa

After Phase Shifter action

DIAGRAM 42

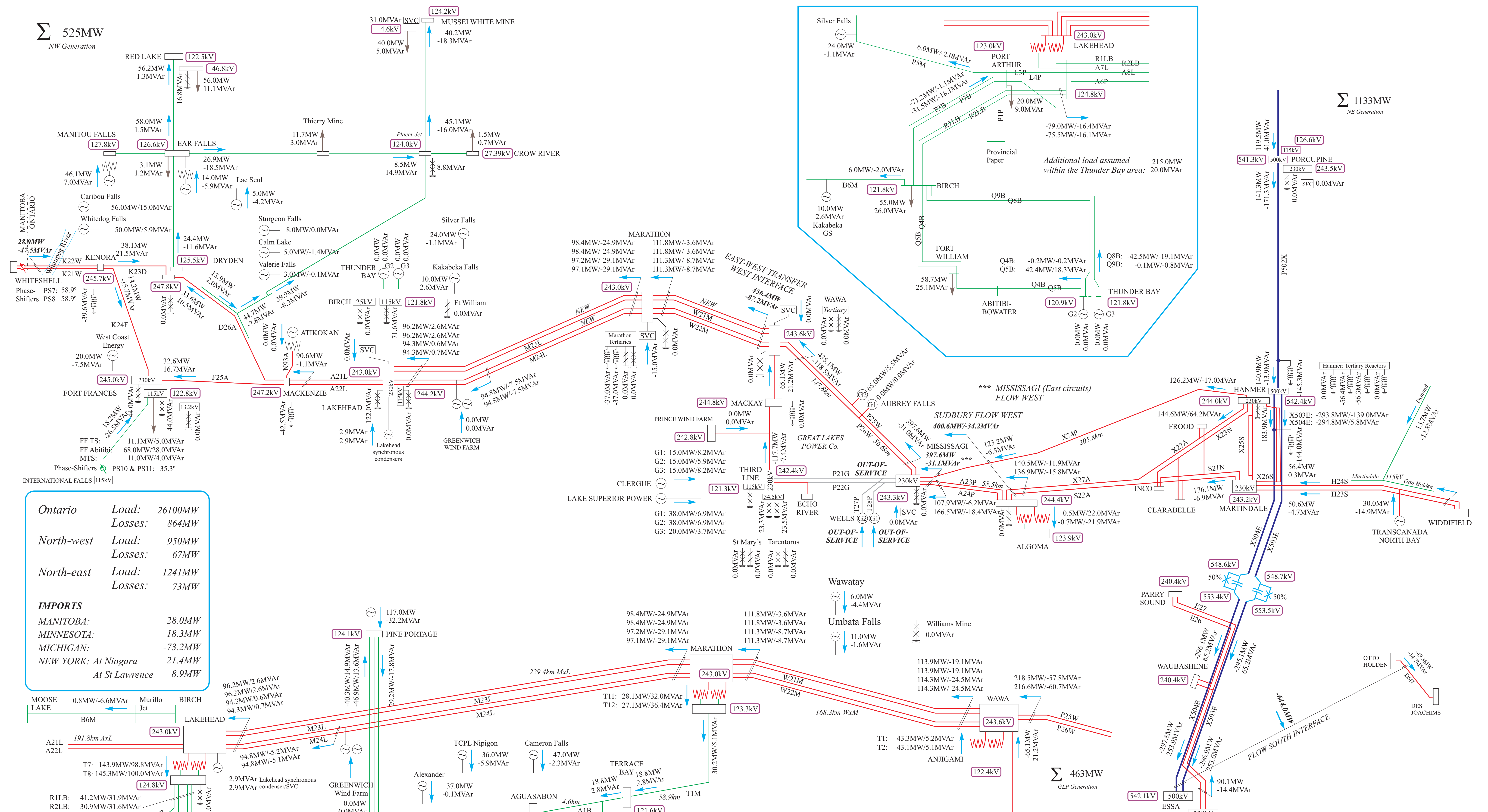
11th August 2011



PV-analysis
Marathon
200MVAr SVC

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
Contingency: 230kV double-circuit P25W + P26W Mississagi TS to Wawa TS
After Phase-Shifter action

DIAGRAM 43
7th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors

With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon. With one Aubrey + one Wells unit

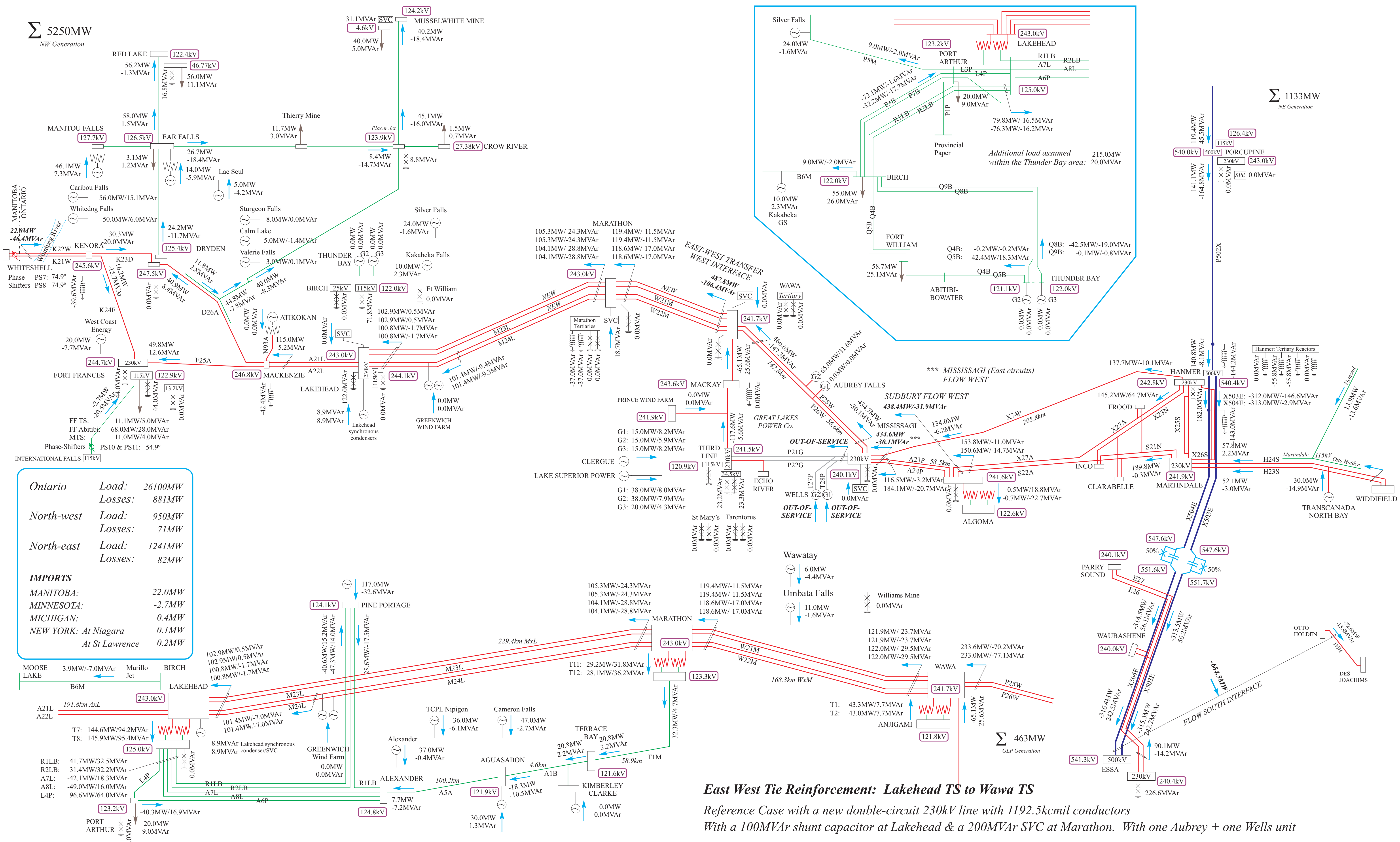
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

Contingency: 230kV double-circuit involving circuits P21G & P22G - Mississagi to Third Line

Prior to Phase Shifter action

DIAGRAM 44

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors

With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon. With one Aubrey + one Wells unit

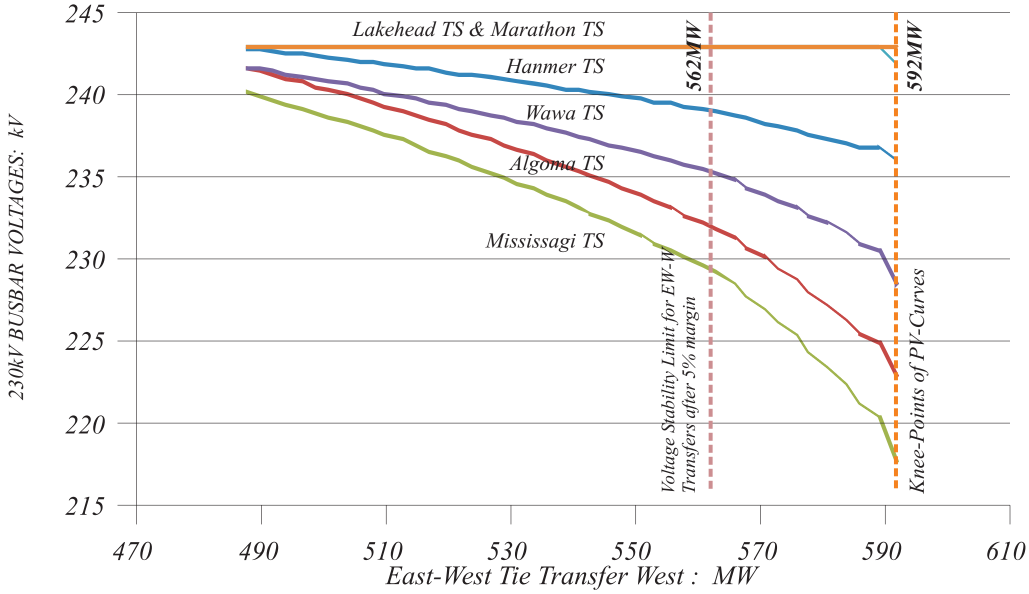
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

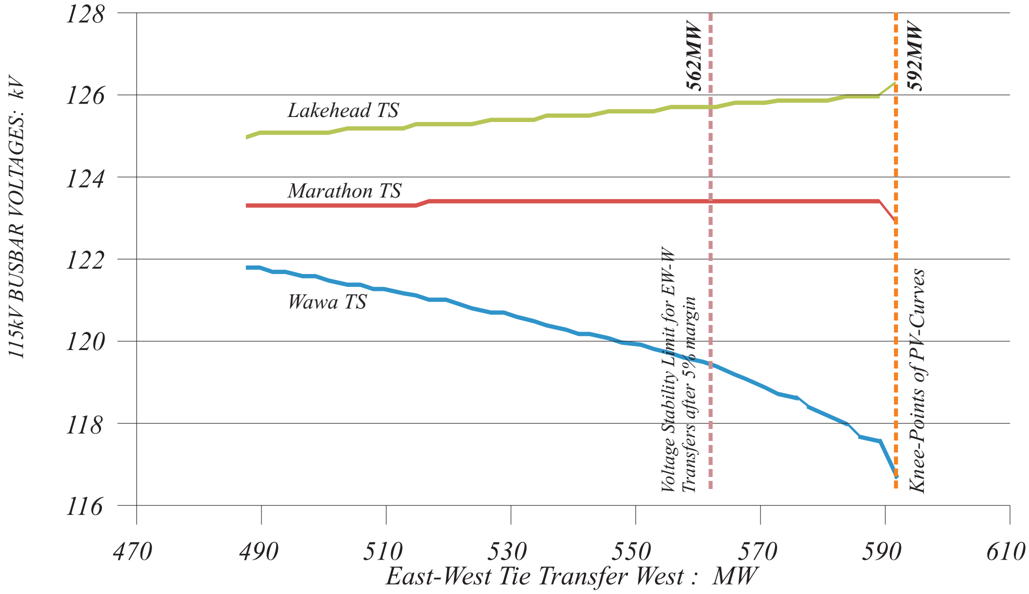
Contingency: 230kV double-circuit involving circuits P21G & P22G - Mississagi to Third Line

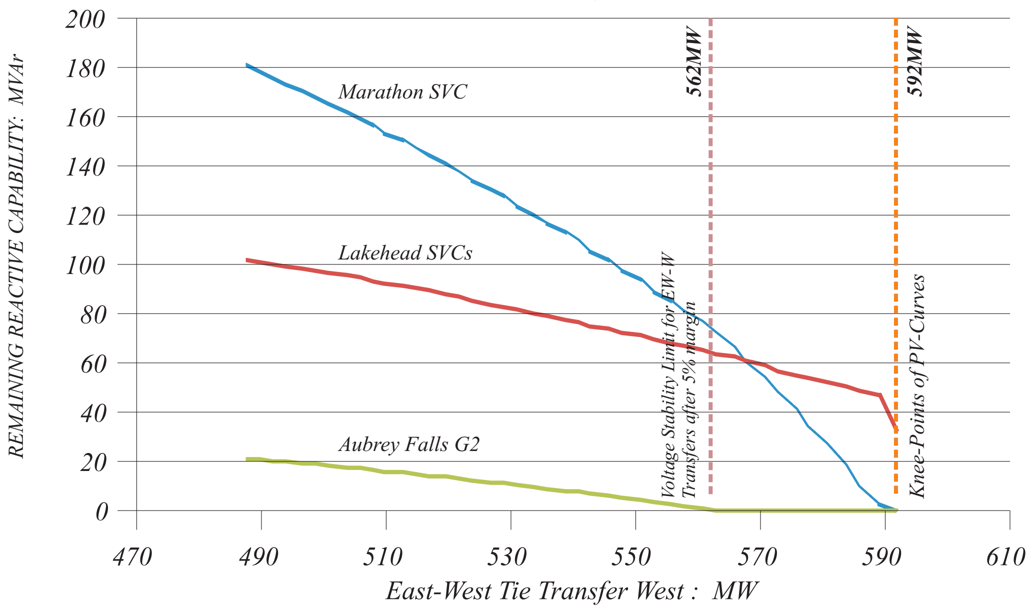
After Phase Shifter action

DIAGRAM 45

11th August 2011



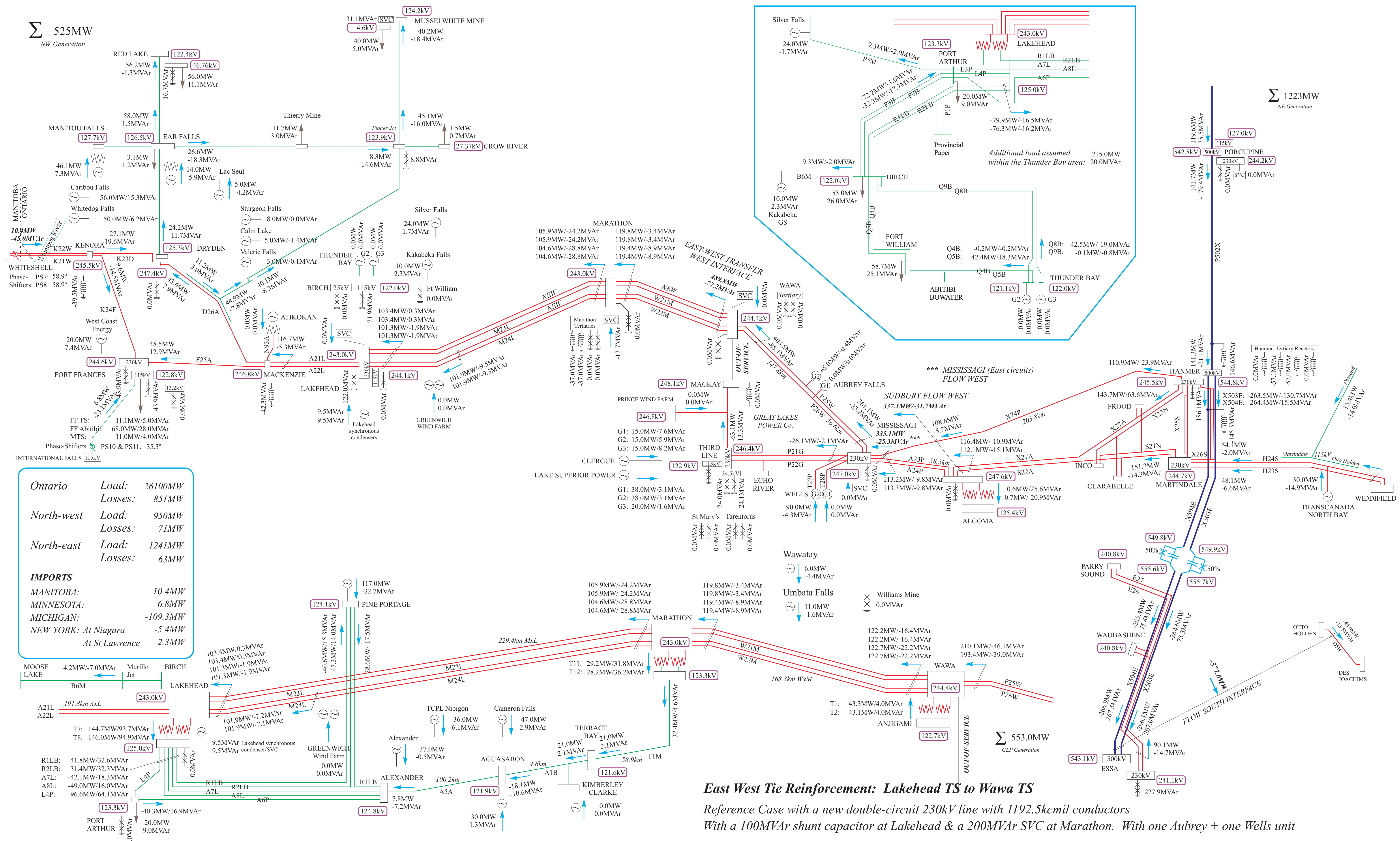




PV-analysis
Marathon
200MVAr SVC

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
Contingency: existing 230kV double-circuit P21G + P22G Mississagi to Third Line
After Phase-Shifter action

DIAGRAM 46
7th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon. With one Aubrey + one Wells unit

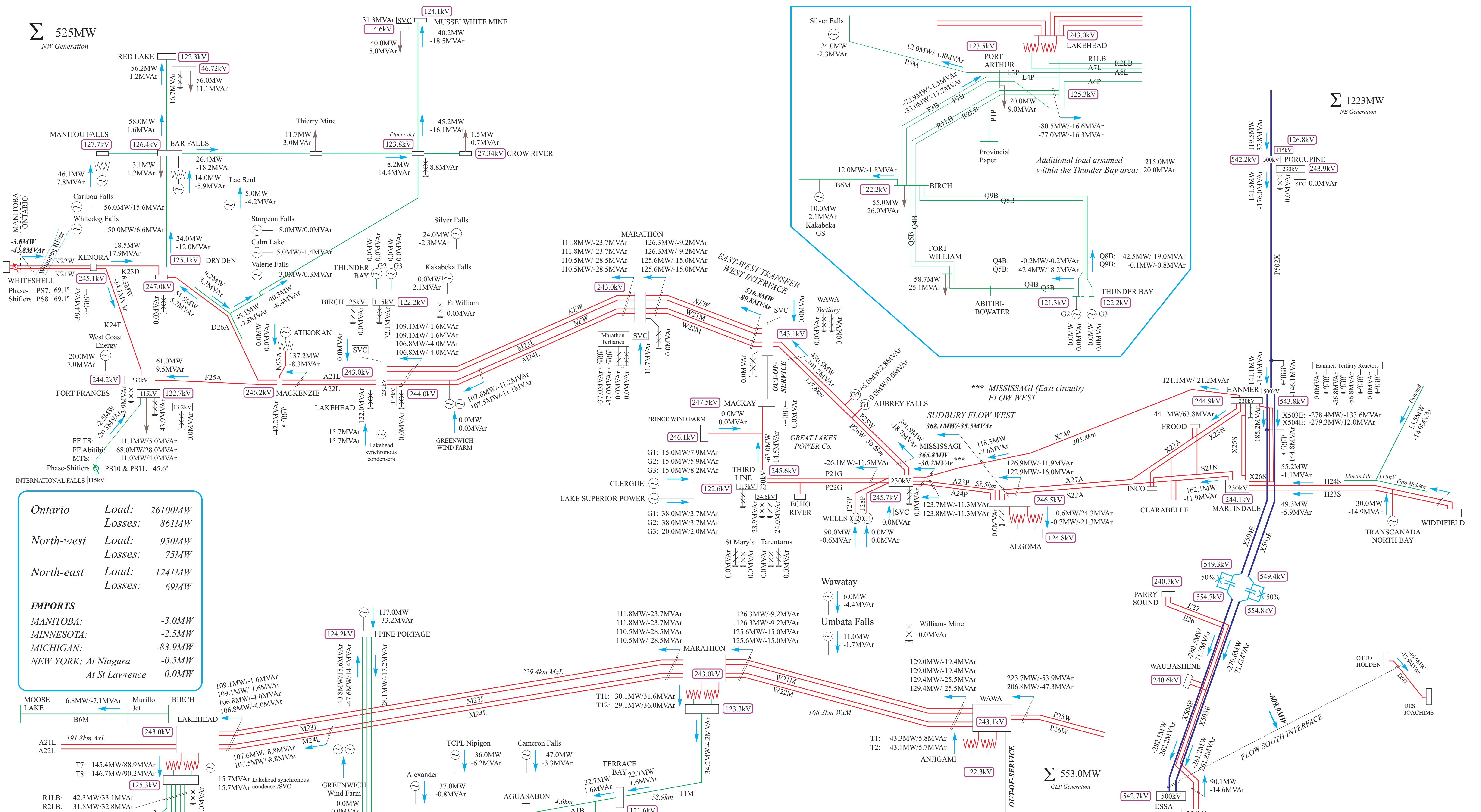
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

Contingency: 230kV single-circuit involving circuit W23K - Wawa to MacKay

Prior to Phase Shifter action

DIAGRAM 47

11th August 2011



East West Tie Reinforcement: Lakehead TS to Wawa TS

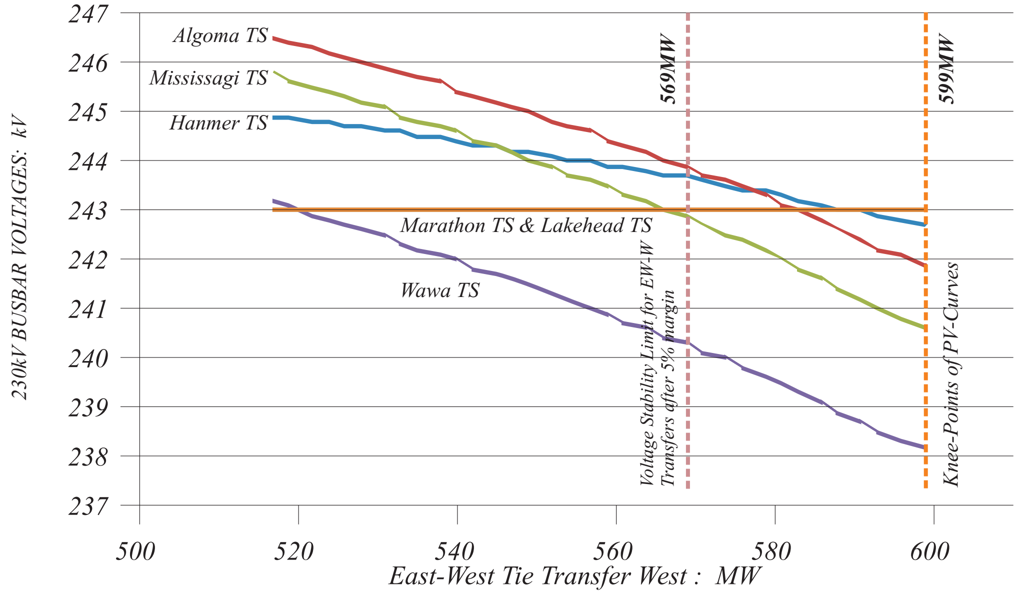
Reference Case with a new double-circuit 230kV line with 1192.5kcmil conductors
With a 100MVAr shunt capacitor at Lakehead & a 200MVAr SVC at Marathon. With one Aubrey + one Wells unit

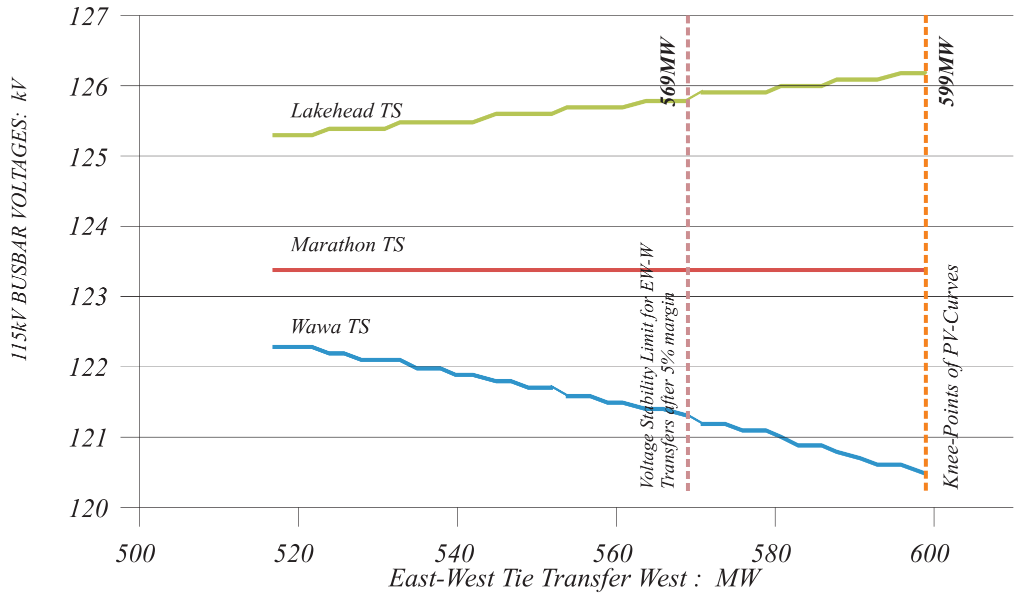
With an EW Tie transfer of 500MW westwards & a Sudbury Flow West transfer of 350MW

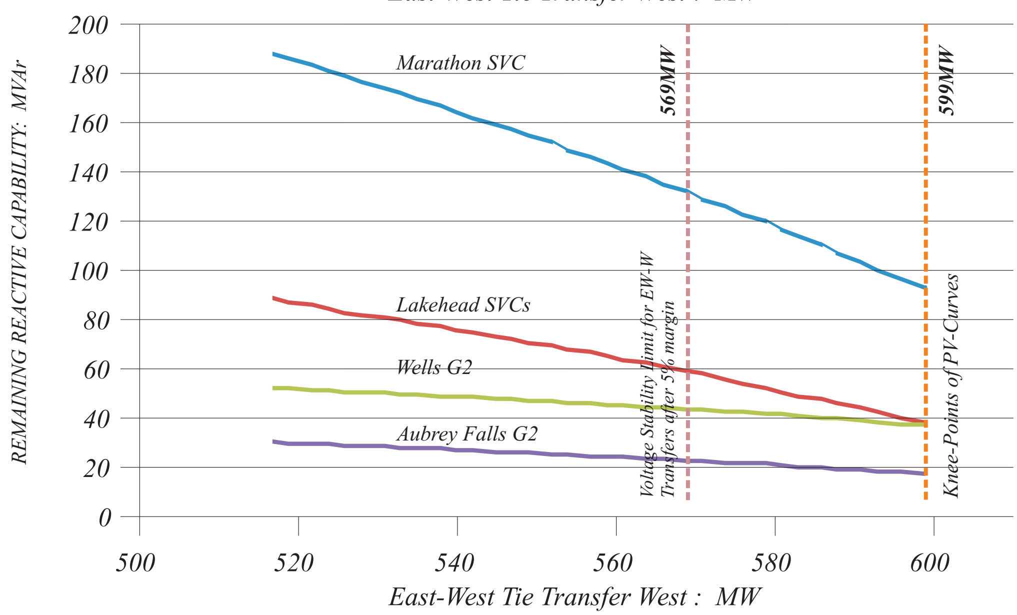
Contingency: 230kV single-circuit involving circuit W23K - Wawa to MacKay
After Phase Shifter action

DIAGRAM 48

11th August 2011







PV-analysis
Marathon
200MVAr SVC

East West Tie Reinforcement: Lakehead TS to Wawa TS
Case with a new double-circuit 230kV line with single-1192.5kcmil conductors
Contingency: 230kV single-circuit K23G Wawa TS to MacKay TS
After Phase-Shifter action

DIAGRAM 49
7th August 2011

TAB I-3-1

EB-2011-0140

ONTARIO ENERGY BOARD

IN THE MATTER OF SECTIONS 70 AND 78 OF THE *ONTARIO ENERGY BOARD ACT 1998*, S.O. 1998, c.15, (Schedule B);

AND IN THE MATTER OF A BOARD-INITIATED PROCEEDING TO DESIGNATE AN ELECTRICITY TRANSMITTER TO UNDERTAKE DEVELOPMENT WORK FOR A NEW ELECTRICITY TRANMISSION LINE BETWEEN NORTHEAST AND NORTHWEST ONTARIO: THE EAST-WEST TIE LINE

RES CANADA TRANSMISSION LP

Applicant

AFFIDAVIT OF DARRELL GERRARD

(sworn January 3rd, 2013)

I, Darrell Gerrard, of the City of Portland, in the State of Oregon, MAKE OATH AND SAY:

1. I am Vice President, System Planning of RES Canada Transmission LP and, as such, have knowledge of the matters of which I hereinafter depose. To the extent that I am informed by others, I verily believe such information to be true.

2. In accordance with Section 6.3 of the "Filing Requirements for Designation Applications" (the "**Filing Requirements**"), attached as Appendix A to the Ontario Energy Board's ("**OEB**") Phase 1 Decision and Order (July 12, 2011)

in OEB proceeding EB-2011-0140, I confirm that the double-circuit design option for the East-West Tie line (the "**Reference Design**"), as described in the RES Canada Transmission LP Application for Designation, will be designed to meet or exceed all applicable technical, reliability and other standards including the standards of the North American Electric Reliability Corporation, the Northeast Power Coordinating Council Inc. and the Independent Electricity System Operator.

3. In accordance with Section 6.3 of the Filing Requirements, I confirm that the Reference Design will be designed to meet or exceed OEB's "Minimum Technical Requirements for the Reference Option for the E-W Tie Line (November 9, 2011)."

SWORN before me at Salt Lake City,)
Utah this 3 day of January, 2013)

Commissioner for Taking Affidavits, etc.

Notary Public
KATHY GIATRAS
Commission #611841
My Commission Expires
Aug. 1, 2015
State of Utah

Darrell Gerrard

TAB I-4-1

Reference Design – Conductor Ratings

The Reference Design uses single-circuit line with a single 1192.5 kcmil conductor with the ratings in table I-2 below.

Table I-2: Conductor Ratings

Ampacity of the 1192.5 kcmil conductor[1]				
	Ratings at 240-kV			
	Continuous at 75^{O} C		Continuous at 100^{O} C	
Conductor	Amperes	MVA	Amperes	MVA
1192.5 kcmil 54/19 conductors	1120	466	1440	599

The conductor and shield wire specifications are provided in Table I-3 below.

Table I-3: Conductor and Shield Wire Specifications

Conductor Type and Size the Reference Design	**Stranding**	**Diameter (mm)**	**Weight (kg/km)**	**Rated Breaking Strength (kN)**
Grackle ACSS 1192.5 kcmil HS285 conductor	54/19	33.96	2278	184.6
1/2 in Extra High Strength Overhead Shield Wire	7	12.57	893	66.5
1/2 in Optical Ground Wire 48 fiber	10	12	431	66.5

Insulator assemblies will use toughened glass insulators with 14-ANSI[2] Class 52-5 units in suspension and 16-ANSI Class 52-11 units in deadend applications. Suspension units carry a 60 kN mechanical and electrical (working) rating while the deadend units

---

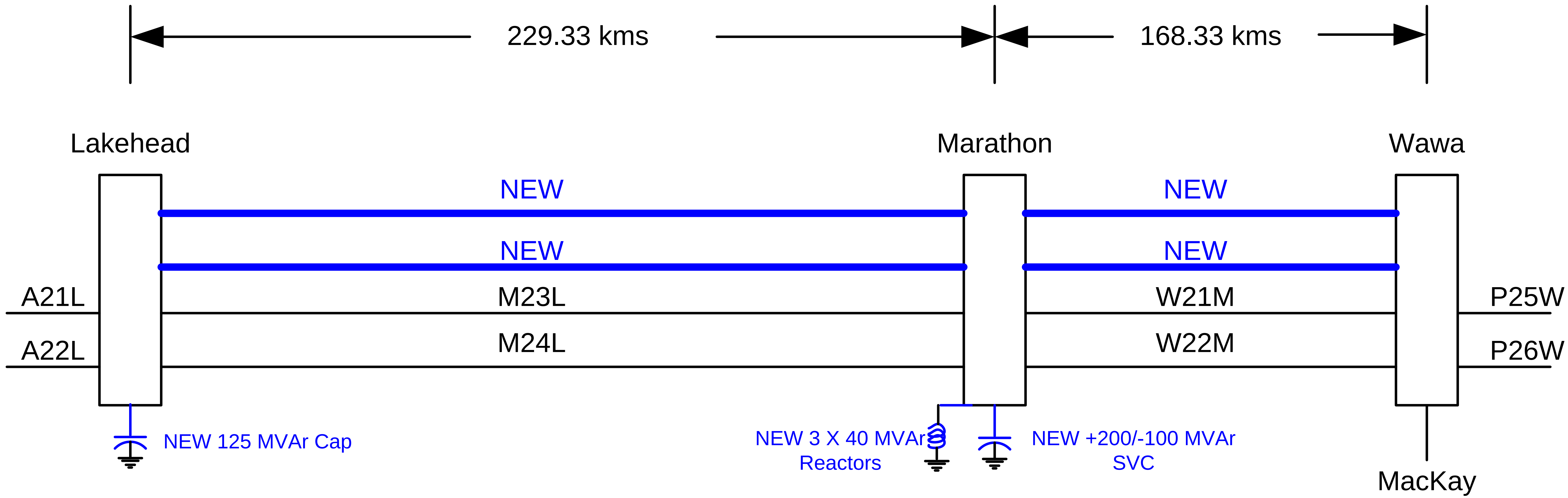
[1] Independent Electricity System Operator, "Feasibility Study: An assessment of the westward transfer capacity of various options for reinforcing the East-West Tie", August 18, 2011 at p. 11.
[2] American National Standards Institute (http://www.ansi.org/).

carry a 110 kN mechanical and electrical (working) rating. Hardware, suspension clamps, deadend bodies and splices (compression or implosive type) will be rated to match insulator strengths.

TAB I-4-2

1 **Reference Design – Conductor Interconnection**

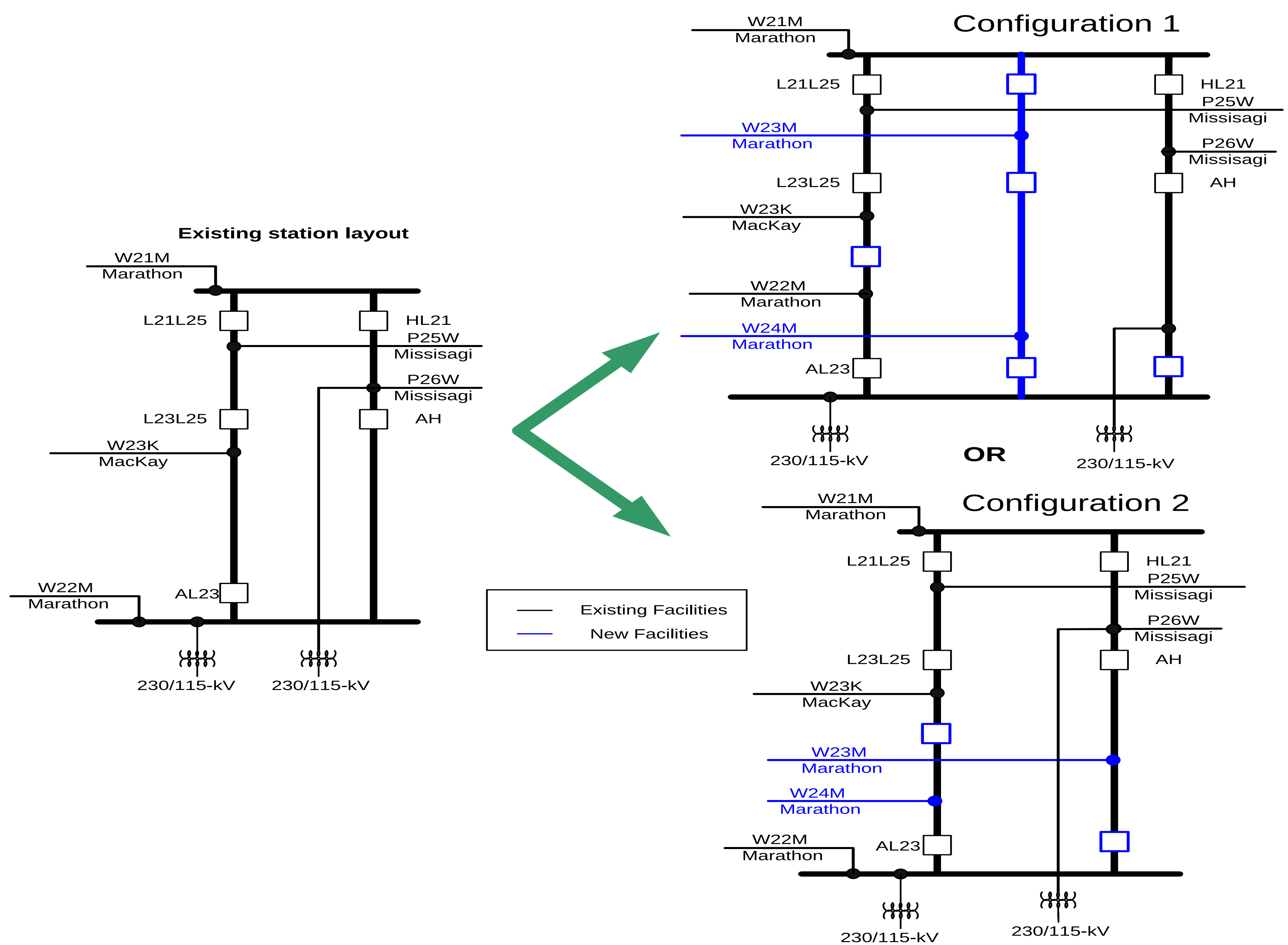
2



3

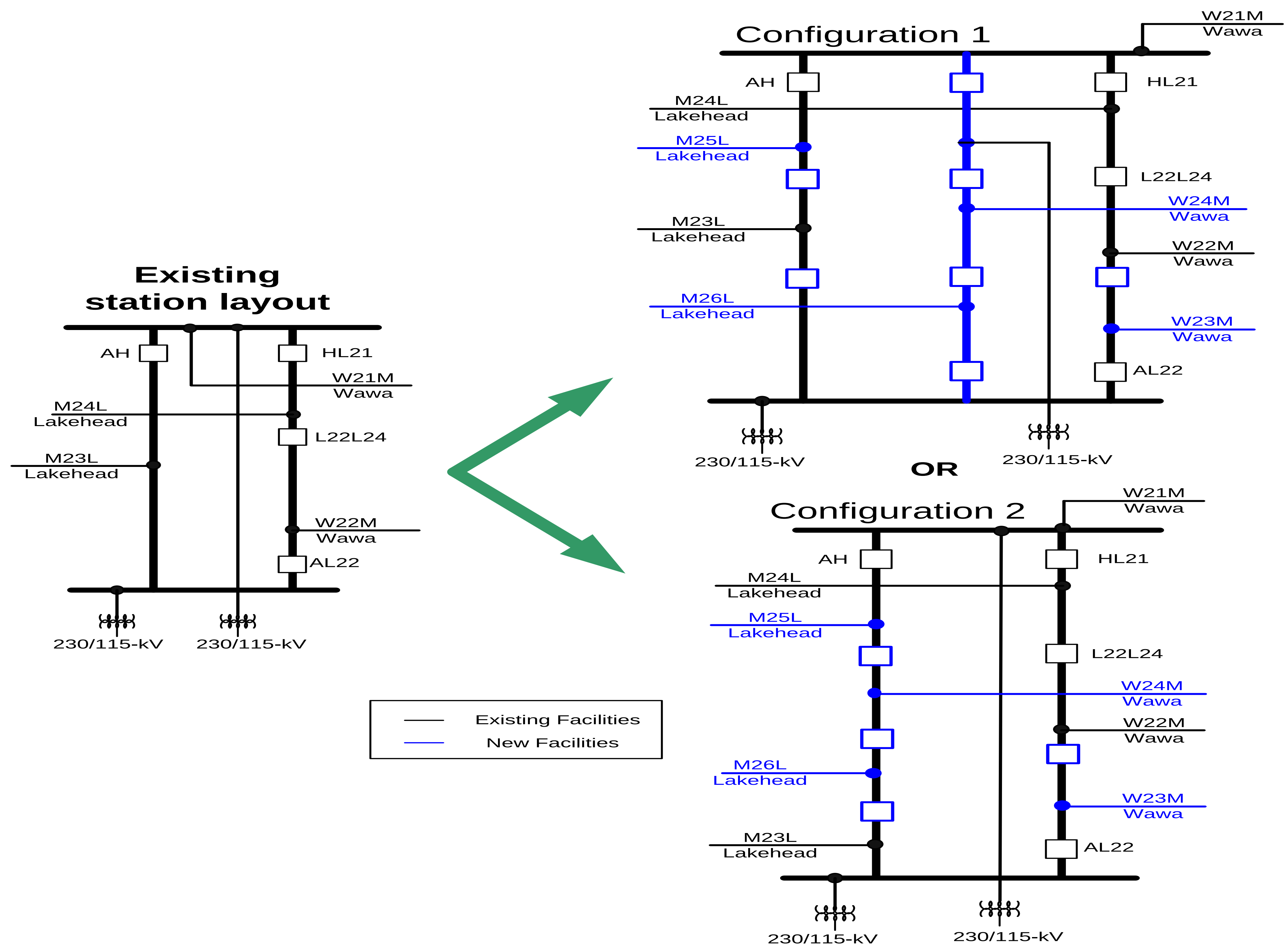
TAB I-4-3

Reference Design – Wawa TS Interconnection Schematic



TAB I-4-4

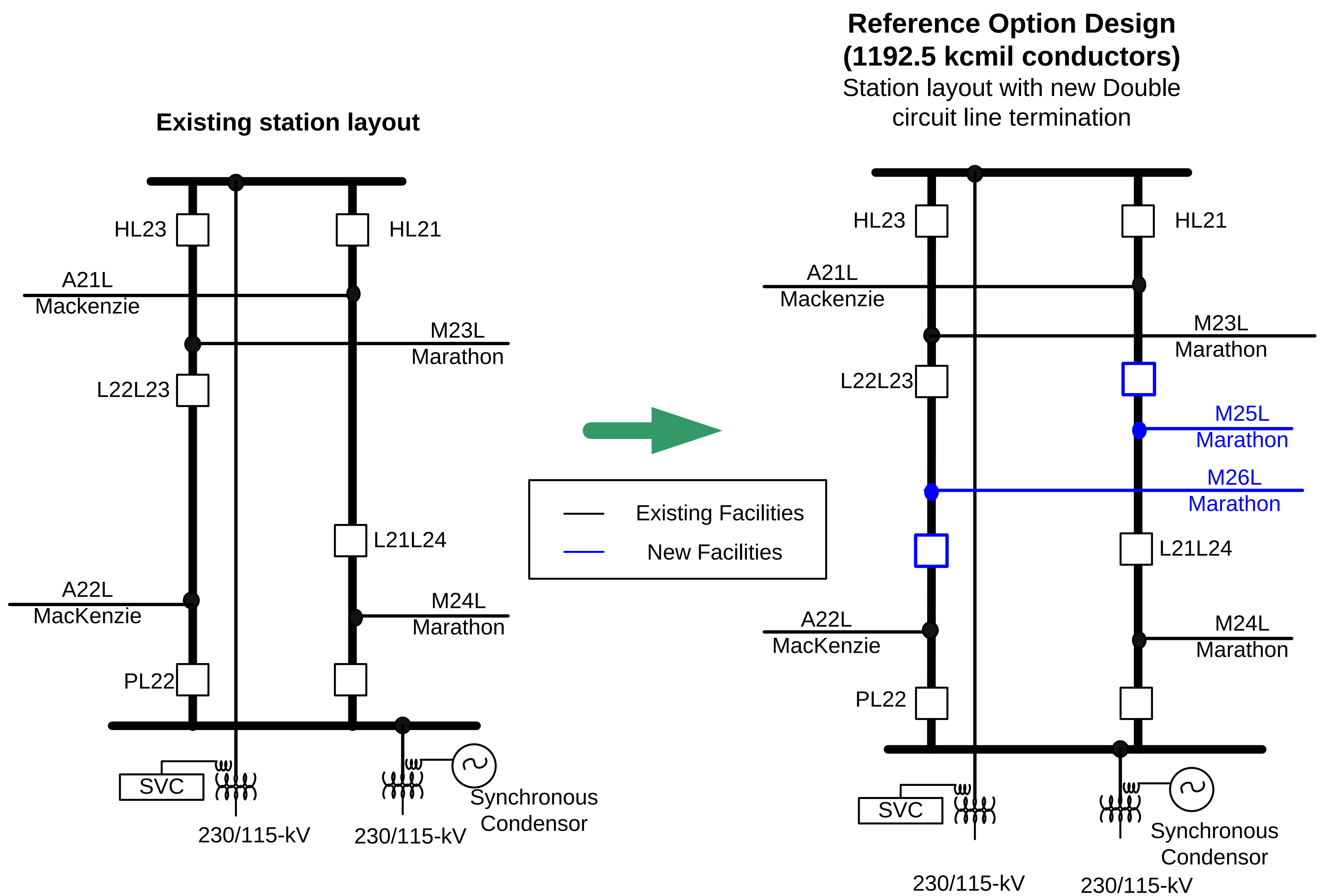
Reference Design – Marathon TS Interconnection Schematic



Note: Additional station upgrade to add shunt compensation not shown.

TAB I-4-5

1 **Reference Design – Lakehead TS Interconnection Schematic**



2
3 *Note: Additional station upgrade to add shunt compensation not shown.*

TAB I-5-1

Tower Design Assumptions and Strength Specifications

Double-Circuit Lattice Towers

Double-circuit lattice towers will be constructed from hot rolled equal leg angles and are typically fabricated in a dulled galvanized steel finish. The angles are shop cut to predetermined lengths and then drilled for field bolting. Angles are connected directly to one another or through gusset or connection plates. All materials are bundled, marked by stamping and painting or labeling, crated and shipped to the on-site material yards. The lattice towers are then bolted in discrete sections at an assembly yard prior to delivery either by truck or helicopter to the tower pad for final assembly of the complete tower. The double-circuit lattice towers used in the Reference Design will range from approximately 35 to 55 m tall.

The double-circuit lattice towers are based on similar 230 kV structure designs and are assumed to have the same load factors across the project. Uplift is the primary item of concern in the design of the double-circuit lattice structure foundations. Strength specifications for the double-circuit lattice towers are provided in Table I-4 below.

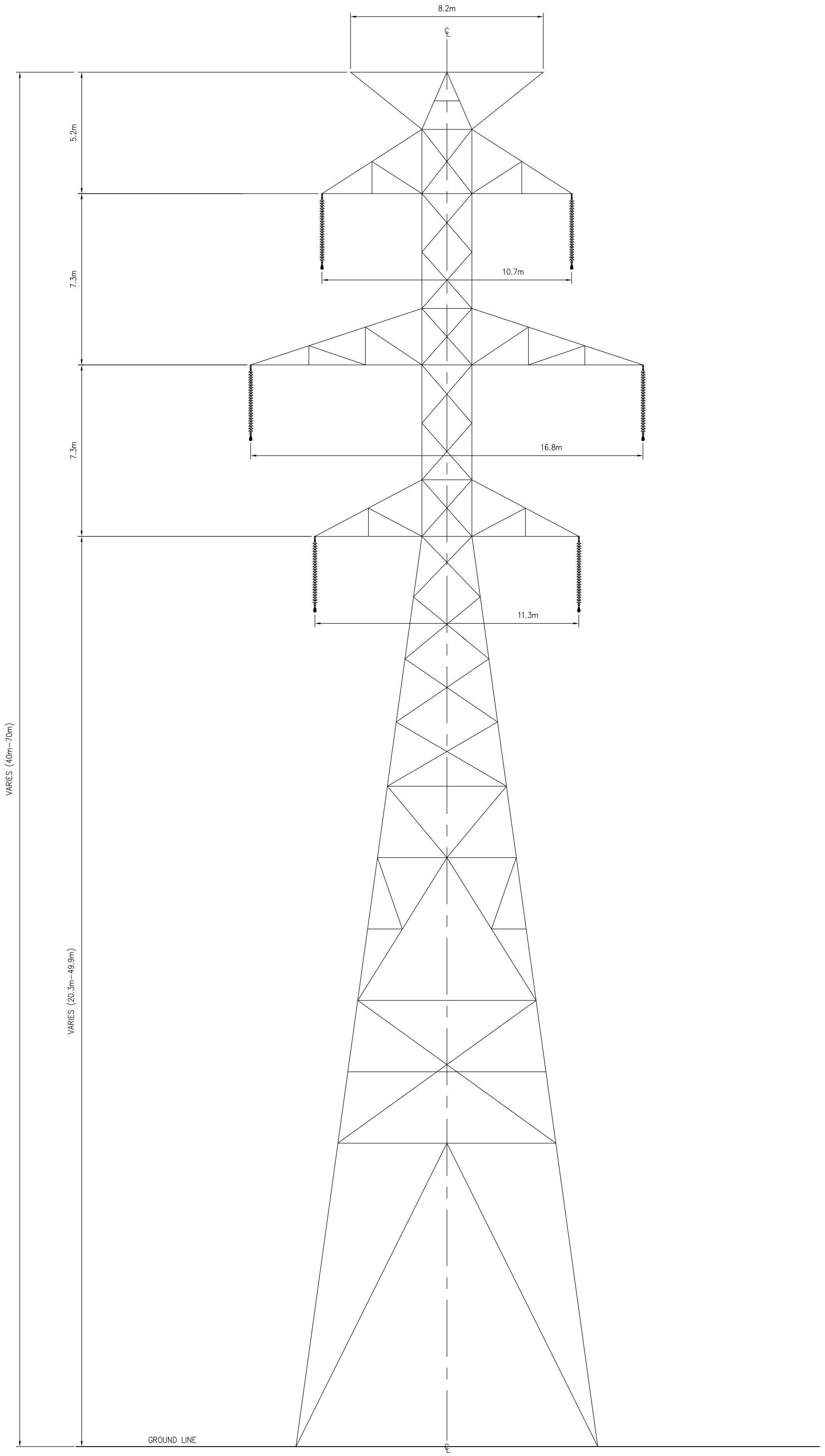
Table I-4: Strength Specifications for Double-Circuit Lattice Towers

Structure/Class	Compression (kN)	Uplift (kN)	Ground-line Moment (kN-m)	Shear (kN)
0-1 deg Tangent	396	-325	0	67
Heavy Tangent	681	-127	0	111
Deadend	1810	-1592	0	463

TAB I-5-2

Double-Circuit Lattice Tower Schematic

PLOT SCALE 1:2



ELEVATION VIEW
DOUBLE CIRCUIT LATTICE TOWER
GRACKLE ACSR (1192.5) - SHIELDED W/ OPGW AND SHIELD WIRE

NOTES:

1. PROVIDED IS A REPRESENTATIVE STRUCTURE BASED ON RFP REQUIREMENTS. THE DIMENSIONS MAY CHANGE.

NO.	DATE	REVISIONS	ENGINEER	DES./DR.	CHECKED	APPROVED

TRANSMISSION

PROJ/ER#	PL#		DISCIPLINE ENG.
DATE: 11/21/2012	LINE CODE:		
ENG. A. CALDWELL/SAIC	DES.		PROJECT ENG. A. CALDWELL/SAIC
DR. K. WHEELER/SAIC	CH. A. CALDWELL/SAIC		
SCALE:	N.T.S.		APPROVAL ENG. D. BOODY/SAIC

OEB
230kV TRANSMISSION
DOUBLE CIRCUIT TANGENT LATTICE

SHEET 1 OF 1

N/A

REVISION 0A

FILE LOCATION: O:\2071-Salt Lake City\OEB\Drawings\OEB-230kV_DOUBLE_CIRCUIT_STEEL_LATTICE ACCESSED BY: THOMPSON, LAURIE L. SAVED BY: (HICKSLL) 11/21/2012 10:29:36 AM

TAB J-1-1

Description of Alternative Routes

Overview

The Applicant has identified two potential routes for the Project: the Reference Route, a 401 km route that adjoins the existing East-West Tie Line; and the Preliminary Preferred Route, a 409 km route that departs from the existing line for 130 km. The land ownership structure along the Reference Route is divided into two major categories of land ownership: approximately one quarter of the corridor is owned in fee simple by private landowners and the majority of the remaining three quarters of the line is located on Crown lands, mostly managed by the Ontario Ministry of Natural Resources (the "**MNR**") under the *Public Lands Act*. Portions of the Reference Route would traverse First Nation reserve lands and a portion of Pukaskwa National Park. However, the proposed Preliminary Preferred Route by-passes these areas, thereby reducing the impact on First Nation and Métis communities and environmentally sensitive national park lands. The Preliminary Preferred Route also takes advantage of more favourable access conditions, anticipated permitting requirements and construction/foundation conditions, as described in greater detail in the Project Corridor Analysis and Critical Environmental Issues Assessment ("**PCA** or **CEIA**") included in Exhibit L-3-1.

It is important to note that neither the Reference Route nor the Preliminary Preferred Route represents a definitive recommendation by the Applicant as to where the Project will ultimately be located. The Applicant has identified these two options through preliminary routing studies as the most preferable apparent locations for the Project. Upon designation the Applicant will determine the final recommended route for the Project using further detailed environmental studies, engineering, design and foundation work, access and constructability analysis, community outreach and consultation. This will include coordination with private landowners, the MNR as it pertains to Crown lands, communities, municipalities, other interested stakeholders and First Nation and Métis groups with interests in the Project.

The following is a general summary of the Reference Route and Preliminary Preferred Route including a specific review of the land ownership characteristics.

Reference Route

Through a review and preliminary analysis of desktop information and on-site reconnaissance, a new transmission line corridor having an approximate width of 50 m immediately adjacent to the north side of the existing Hydro One East-West Transmission line from Wawa Substation (TS) to Lakehead TS line was identified as the Reference Route. The Applicant anticipates that route refinements are likely to require localized line crossings of the existing East-West Tie Line to parallel the southern margins of that line in some areas to avoid existing infrastructure, sensitive areas, accommodate landowners, improve access and minimize construction costs (particularly between Lakehead TS and Nipigon).

The Applicant's reconnaissance site visits confirmed that the Reference Route is largely accessible using existing access roads between Lakehead and Marathon but mostly inaccessible using existing access roads between Marathon and Wawa. Access to the route adjoining the existing Hydro One East-West Transmission line may also be facilitated by the use of the 50 m wide corridor in which the existing line is located.

For the purposes of the Applicant’s analysis, the Reference Route has been divided into five segments based on existing access, constructability, geology/terrain and vegetation. The characteristics of the five separate segments are as follows:

<u>Thunder Bay to Nipigon River (85 km):</u>

- Rolling terrain and moderate vegetation regrowth after logging
- Fair to good existing access roads
- Major waterway crossing at Nipigon River

- New four-lane highway under development (rerouting of Hwy 17)

Nipigon River to Terrace Bay-Aguabson River Crossing (86 km):

- Fair existing access roads - several private roads with controlled access
- Hills and large rock outcrops
- Significant water features including lakes and rivers

Terrace Bay to Marathon (57 km):

- Variable steep terrain with significant vertical height variation
- Limited access
- Heavy vegetation
- Major waterway crossing at Little Pic River
- Numerous railroad and highway crossings

Marathon to White River (23 km):

- Steep terrain with significant vertical height variation
- Limited to no access from Highway
- Heavy vegetation regrowth after logging

White River to Wawa (157 km):

- Low elevation
- Significant portion of the Reference Route runs through Pukaskwa National Park
- Flat terrain with dense vegetation

- Muskeg bogs with significant standing water
- Very limited road access- water hazards

Preliminary Preferred Route

The Preliminary Preferred Route encompasses the first five segments of the Reference Route described above, but as mentioned previously, it departs from the existing East-West Tie Line for 130 km for a large part of the White River to Wawa segment, thereby adding 8 km to the overall route length. The route departure avoids Pukaskwa National Park and Michipicoten First Nation Reserve and is generally characterized by better access conditions and more favourable construction conditions than the Reference Route. The Applicant identified this route during on-site reconnaissance work and based on a review of published information. The proposed route has generally been located in relatively close proximity to existing access routes and laid out in a manner which avoids the Pukaskwa National Park and First Nation Reserves and as many natural features as possible.

It must be emphasized that stakeholder consultation has not been undertaken on any of the route alternatives. Consequently, all route alternatives will be further evaluated during the ToR and EA.

Based on the evaluation of the published metrics identified in the PCA included in Exhibit L-3-1 and the preliminary findings of the CEIA and a review of detailed engineering considerations included in Exhibit L-3-1, the Preliminary Preferred Route, rather than the Reference Route, is the preliminary preferred option for the transmission line. However, finalization of the Preliminary Preferred Route requires consultation with all stakeholders during the ToR stage.

Land Ownership Categories

The Reference Route and the Preliminary Preferred Route will cross a number of land ownership categories, such as municipal road allowances and municipally owned rights of way, provincial highways, public lands including lands under water and privately owned utility corridors and/or other linear corridors such as railways, in addition to privately owned parcels of land and Crown lands managed by the MNR. Furthermore, significant portions of the line located on Crown lands are subject to other prior dispositions, mainly mining claims. The land ownership characteristics are presented in the maps contained in Exhibits J-4-1 and J-4-2 and the Applicant's Land Valuation and Acquisition Plan included at Exhibit K-4-2. These characteristics are further summarized in Table J-1 below:

Table J-1: Land Ownership Characteristics for the Project

	Units	REFERENCE ROUTE (North Side)	PRELIMINARY PREFERRED ROUTE	DIFFERENCE (from Reference Route)
Private Lands (including First Nation reserve lands)	km	120.5	106.4	14.1
Crown Lands	km	281.1	302.8	(21.7)
TOTAL		401.5	409.2	(7.6)
National Park	km	34.6	0.0	34.6
Provincial Park	km	5.1	3.3	1.8
Conservation Areas	km	12.2	12.2	- -
First Nation Reserves	km	8.3	0.0	8.3
Active Mining Claims	#	96	97	(1)
Active Mining Claims	km	86.4	90.9	(4.5)
Adjoining Existing Line	km	401.5	278.7	122.8
Municipalities (including upper and lower tier municipalities)	#	9	9	- -
First Nation Reserves	#	2	0	2

Land rights will be required to construct and maintain facilities generally within a 50 m wide corridor and to access the routes under consideration and stage construction activities. However, the width of the transmission line corridor may be reduced where adjoining the existing Hydro One East-West Transmission line on Crown lands, and potentially on private lands that may be under the control of Hydro One. In these situations, a minimum separation of 50 m from the existing line will probably be required, which may result in the widening of the existing Hydro One corridor, by no less than 25 m.

Route Refinements

Route refinements may be appropriate for portions of the Preliminary Preferred Route where: a modification or realignment will offer significant environmental or engineering advantages over the Preliminary Preferred Route; where a refinement is recommended as a result of landowner or stakeholder consultation; and in order to accommodate revisions resulting from fieldwork information or agency, aboriginal, public and landowner comments. Based on the results of the CEIA and PCA evaluation and on site reconnaissance field visits, potential route refinement areas have been identified. These are summarized in Table J-2 below:

Table J-2: Summary of Key Potential Route Refinements

Segment/Section	Potential Route Refinements
Lakehead TS to Nipigon	Greenwich GenTie could be avoided by siting the line on the south side of the existing line
Nipigon to Terrace Bay	Northern alignment would enable route refinement around Pays Plat First Nation Reserve
Terrace Bay to Marathon	
Marathon to White River	Northern alignment would enable route refinement for Pic River crossing
White River to Wawa TS	The Preliminary Preferred Route alignment would enable the avoidance of Pukaskwa National Park and the Michipicoten First Nation Reserve. Should the Applicant be designated, this alternative will be evaluated in more . The northern alignment would enable route refinement around Michipicoten First Nation Reserve.

Finalization of the preferred route will be completed during the EA process. In addition to route refinements that will be evaluated at the ToR stage, it is possible that minor route refinements may be required along portions of the Project where issues (environmental, technical) are identified, following detailed stakeholder consultation and field survey results. The Applicant will identify and assess these relatively minor deviations where necessary, and include this assessment (and supporting documentation) in the EA report.

TAB J-2-1

Transmission Route Selection Method

Overall Route Selection Method

Selection of a preferred route for a linear facility is a complex process involving several important factors. These include:

(i) life cycle costs to construct, operate, and maintain the facility;

(ii) land acquisition;

(iii) stakeholder preference;

(iv) environmental and socio-economic considerations;

(v) potential impact on existing First Nation and Métis rights; and

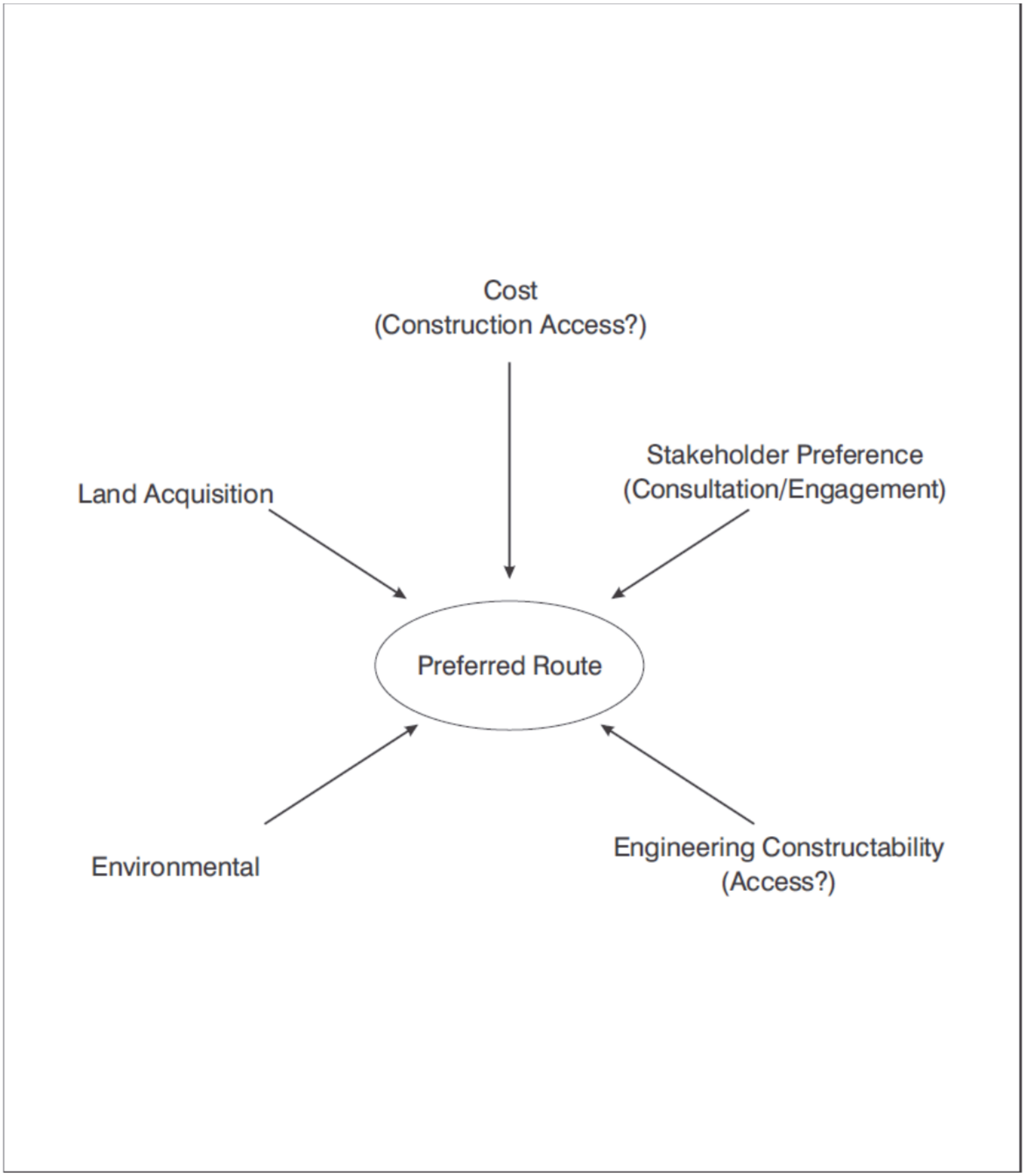
(vi) engineering and constructability.

The Applicant evaluated most of these important factors before identifying the Preliminary Preferred Route. The Preliminary Preferred Route was identified without considering stakeholder preference factors and detailed on-site environmental surveys and secondary effects, such as opening a new right-of-way. The evaluations conducted by the Applicant, to date, are not intended to replace a full routing analysis.

The Preliminary Preferred Route would take advantage of more favourable construction access issues along the Preliminary Preferred Route at Pukaskwa National Park and also more favourable permitting (potential) and construction/foundation conditions.

Figure J-1 illustrates the preferred route selection process.

Figure J-1: Preferred Route Selection



Methodology

The following is the process by which alternative transmission routes were determined and evaluated from an environmental and social perspective:

Step 1: identification of routing objectives, construction feasibility, access and environmental and social-economic constraints and opportunities:

Step 2: generation of alternative routes;

Step 3: detailed desktop evaluation of alternative routes and identification of the Preliminary Preferred Route.

The Preliminary Preferred Route represents the general location for the preferred route for the Project. However, finalization of the preferred route will be completed during the EA process and route refinement areas may be required in order to accommodate changes resulting from consultation, terrestrial, archaeological, and aquatic field work information.

Routing Objectives

As a first step, the Applicant identified routing objectives and considered environmental and socio-economic constraints and opportunities. Routing objectives are the general principles used to create reasonable and/or feasible alternate routes. Alternative routes selected within the study area were generated based on the following four objectives:

(i) routes should follow a reasonably direct path between end-points, minimizing length as well as potential for environmental and socio-economic impacts;

(ii) routes should provide a method of access and options for construction that provide economic benefit to the project;

(iii) existing linear features should be utilized or paralleled to the extent possible in order to minimize impacts to previously undisturbed land; and,

(iv) routes should avoid sensitive environmental and socio-economic features to the extent possible; where sensitive features cannot be avoided, alternative routes should be located to minimize impacts.

Environmental and Socio-Economic Constraints

Sensitive environmental and socio-economic features were identified and assessed based on the following criteria:

(i) site-specific mitigation measures would be required to minimize potential impacts;

(ii) the feature has been selected or designated for protection; and/or,

(iii) the feature has been recognized through local, regional, provincial, or federal policy, plan, or statute, or is otherwise valued as an environmental or socio-economic resource.

Generation of the alternative route options was based on the above-mentioned routing objectives and the environmental and socio-economic constraints and opportunities.

Quantitative Evaluation of Reference and Preferred Routes

The alternative route segments were comparatively evaluated, with the primary goal of determining the potential environmental and socio-economic impacts of each route segment. It is important to note that no detailed routing study has been undertaken at this stage. These route options were subject to a comparative analysis that considered the relative advantages and disadvantages of each route using both a quantitative and qualitative approach.

The quantitative evaluation of the route alternatives is a desktop exercise that involves quantifying environmental and socio-economic features (classified according to the evaluation criteria) that are traversed by each potential route. The detailed evaluation "metrics" are fully detailed in the CEIA which can be found at Exhibit L-3-1. In addition, Table J-3 below provides a summary of the key metrics for the Reference Route and the Preliminary Preferred Route that were used to evaluate the alternate routes.

Table J-3: Summary of Metrics for Route Segments

Metrics				Differentials	
METRIC CATEGORY **ENVIRONMENTAL**	UNITS	REFERENCE ROUTE (N)	PRELIMINARY PREFERRED ROUTE	AMOUNTS	PERCENT
National Park Crossed	m	34,586	0	(34,586)	-100%
Provincial Park Crossed	m	5,091	3,250	(1,841)	-36%
Steep Slopes Crossed (6-15%)	m	139,634	133,776	(5,857)	-4%
Steep Slopes Crossed (16-35%)	m	15,764	15,172	(593)	-4%
Steep Slopes Crossed (>35%)	m	138	138	0	0%
Wetlands - PSW Crossed	m	158	158	0	0%
Conservation Area Crossed	m	12,176	12,176	0	0%
Moose Wintering Area Crossed	m	3,404	3,404	0	0%
Caribou Wintering Area Crossed	m	0	0	0	0%
Forest Crossed	m	354,652	363,452	8,800	2%
Watercourse Crossed (River / Creek)	#	273	280	7	3%
Steep Slopes Crossed (0-5%)	m	245,973	260,068	14,096	6%
Waterbody Crossed (Lake)	m	13,532	15,281	1,749	13%
Bear Management Area Crossed	m	266,969	316,016	49,047	18%
SOCIAL/CULTURAL					
First Nation Reserves Crossed	#	2	0	(2)	-100%
First Nation Reserves Crossed	m	8,346	0	(8,346)	-100%
Highways Crossed	#	24	24	0	0%
Local Roads Crossed	#	26	26	0	0%
Railway Crossed	#	18	18	0	0%
Municipalities Crossed (upper and lower tier)	#	9	9	0	0%
Mining Claims Within 500 m	#	549	547	(2)	0%
Active Mining Claims Crossed	m	86,435	90,897	4,463	5%
Active Mining Claims Crossed	#	96	97	1	1%
Landfills Within 500 m	#	6	6	0	0%
TECHNICAL					
Length of Existing Transmission Lines Paralleled	m	401,527	278,726	(122,801)	-31%
Number of Existing Transmission Lines Crossed	#	25	25	0	0%
Total ROW Length	m	401,527	409,173	7,646	2%

TAB J-3-1

Environmental Challenges of Proposed Routes

The Applicant has conducted a Project Corridor Analysis and Critical Environmental Issues Assessment for the Project. The CEIA is included at Exhibit L-3-1. The CEIA is considered to be preliminary because detailed fieldwork, agency/stakeholder consultation or First Nation and Métis engagement has yet to be undertaken.

The CEIA was undertaken to evaluate potential alternative corridors in order to reduce impacts by avoiding critical environmental and/or social features. Potential route refinements will also be considered during the ToR and EA review process, in order to avoid any sensitive environmental and/or social features identified through consultation during ToR and EA studies. All environmental and social features within the corridor study and route refinement areas have been mapped using available desktop information and information obtained from three site reconnaissance field visits encompassing about 50 worker-days.

Potential environmental challenges for the proposed routes have been identified primarily in the following areas:

Weather

Annual precipitation totals for the proposed routes range from a low of 700 mm to a high of 1050 mm. Precipitation tends to increase during the summer months with an average between 80-100 mm for the month of July and decreases during the winter months with an average between 40 mm to 90 mm. It is anticipated that winter construction will be scheduled for the lower lying seasonally wet areas in order to avoid more difficult, wet summer conditions.

Ground Conditions

Topography ranges from relatively flat to areas with significant relief and slope. In general, valley lands are associated with the many watercourses which drain into Lake

Superior. Areas of steep slopes also occur, where lacustrine deposits or exposed bedrock meet moraine deposits.

Where feasible, tower placement and location of access roads will be minimized on the steep slope areas to locations of only critical need where alternate design and access is not possible. Where tower placement and access is required in steep slope areas, slope stabilization techniques will be implemented during and immediately after construction to minimize potential erosion.

Water Crossings

It is estimated that approximately 300 watercourses (rivers/creeks), 15,500 square metres of waterbodies (lakes), and 150 separate wetland pockets occur along the proposed corridor, from Wawa TS to Lakehead TS, all having the potential to support fisheries habitat. The number of water crossings affected by access road construction and removal will be minimized and impacts will be reduced by avoiding intensive construction activities during sensitive times when fish spawning occurs (biological “timing windows”). Tower placement will be such that wetland areas are generally avoided. Where access roads are required, winter construction will be proposed and wetland restoration following construction will be performed as deemed necessary. No access roads or tower sites are anticipated in any lakes.

Flora & Fauna

Both proposed routes encompass the immediate northern shore of Lake Superior. This region of Ontario is largely forested and known as the Boreal Forest Region. The forests are characterized by a variety of mixed or coniferous communities. It is anticipated that approximately 1,800 hectares of forest land will be cleared for the route. Forestry companies with existing licences and/or management agreements will be consulted regarding merchantable timber as will other resource uses.

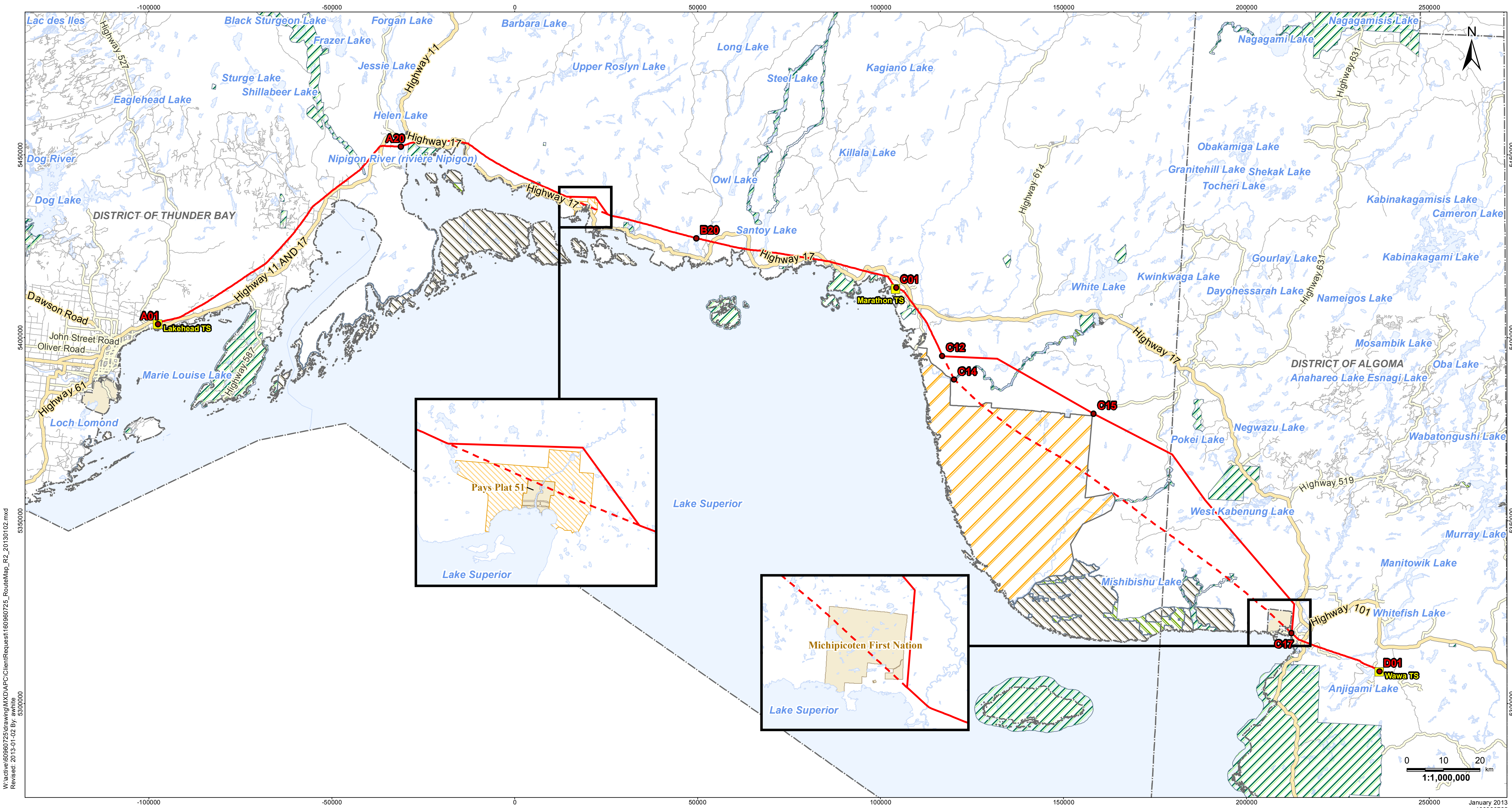
Relatively few provincially rare wildlife species at risk have been recorded in the region. A total of 35 rare species of plants, 12 rare species of terrestrial wildlife (including birds, mollusks, mammals, and insects), and 3 rare species of fish and aquatic wildlife have been documented in the MNR's Natural Heritage Information Centre ("**NHIC**") database. Many of the rare species documented in this region are plants.

Habitat for woodland caribou is one of the most potentially sensitive natural features in the area. A portion of the proposed corridor is located in the "Lake Superior Coast Caribou Recovery Zone". The MNR's Caribou Conservation Plan indicates that woodland caribou have a discontinuous distribution in the vicinity of the Project's corridor. However, there is a stable population within Pukaskwa National Park. The recovery strategy for the woodland caribou identifies some potential effects of transmission lines at the landscape level, including fragmentation and potential changes in caribou mortality. However, preliminary mapping indicates that neither the Reference Route nor the Preliminary Preferred Route pass directly through any Caribou Wintering Areas.

In response to the environmental and social challenge associated with the forested areas, rare plants and rare animals such as woodland caribou, the Applicant will consult with government agencies such as MNR and MNDMF; resource users such as forestry and mining companies; and recreational land users all for the purpose of identifying location specific concerns and developing appropriate mitigation measures.

TAB J-4-1

Project Overview Map



Legend

- Preliminary Preferred Route**
- Reference Route
- Route Marker
- Station
- Highway
- Major Road
- Local Road
- First Nation Reserve
- First Nation Addition
- Municipal Boundary
- Conservation Reserve
- Forest Reserve
- Provincial Park
- National Park
- Waterbody

** Preliminary Preferred Route located approximately 100 m north of existing transmission line, and parallels existing transmission line corridor where feasible, except between Marathon and Wawa where the line would not adjoin the existing line.

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.

Stantec

Client/Project

RES Canada Transmission LP
East-West Tie Transmission Line

Figure No.

B-3-1

Title

Route Map

TAB K-1-1

<u>Land Use Rights – Private</u>

To secure the land rights across private lands separate easements will be negotiated with each landowner identified along the selected corridor. Where needed, the Applicant will utilize the services of a professional consultant or land agent experienced with land rights acquisition in Ontario to facilitate negotiations and agreements with individual landowners.

Option Agreements

Easements rights will initially be secured through Options to Acquire a Permanent Transmission Easement (the "**Options**"). The Options will grant the Applicant the exclusive right to acquire transmission facilities easements on the privately owned properties. The Options will also include rights of access to the lands to perform required environmental surveys, development studies and other related activities.

Easements

The Applicant will acquire the easements by exercising the Options after the completion of the LTC process. The easements will give the Applicant the right to perform all required works in order to properly construct and operate the transmission line. The terms of the easements will require that the landowners permit the Applicant to have the free and unencumbered use of the land for the purposes of constructing and operating the transmission facilities and the easement rights will include, but will not be limited to, the right to enter, construct, repair, replace or supplement, operate and maintain the transmission facilities.

The easements will be for a perpetual term. As the easements will be acquired by the Applicant for the purpose of a transmission line, the easements will be exempt from the subdivision control provisions of Section 50 of the *Planning Act.*

Additionally, to facilitate the connection of renewable energy generation facilities or other types of load or generation connections, the easements will allow for additional equipment to be placed in the corridor at a later date that is compatible with the safe and reliable operation and maintenance of the Project.

Expropriation

The Applicant’s approach to securing land rights over privately owned lands through option agreements will reduce the likelihood that expropriation will be required as a mechanism to secure these rights for the Project. If necessary as a last resort, the Applicant will rely on expropriation rights in accordance with section 99 of the OEB Act.

TAB K-2-1

Land Use Rights – Crown Lands

Land Use Permits

The required rights on Crown lands will be obtained from the MNR pursuant to the *Public Lands Act*. The MNR Crown Lands policy and procedure PL 4.10.03 (Utility Corridors on Public Land) establishes a standardized approach to the granting of tenure for the occupation of public land by utility companies. According to the policy, rights for electrical transmission lines are typically granted through a Multi-Site Land Use Permit. The Land Use Permit grants rights to the permittee for the construction and operation of the line on the identified Crown Lands, along with a yearly rental payment.

Easements

The MNR retains discretion to grant more secure forms of tenure and would consider the grant of an easement in accordance with MNR Crown Lands Policy PL 4.11.04 – (Grants of Easements). Although securing the easement will require additional work, including the surveying required to describe the relevant lands for the purpose of registering the rights on title, the Applicant intends to apply for easement rights having regard to the nature of the project infrastructure.

TAB K-3-1

Land Use Rights – Other

Rights over other land ownership categories will be obtained according to the process required for each of the entities owning or managing the lands. It is anticipated that the two primary land categories will be private lands and Crown lands, as described separately in Exhibits K-1-1 and K-2-1, respectively. Other land agreements are typically expected to consist of agreements and approvals relating to highway and railway crossings and municipal road use or crossing agreements. These agreements are normally sourced during the permitting process. An outline of the Applicant's expected approach for acquiring these rights is summarized below and further outlined in the Applicant's Land Valuation and Acquisition Plan included at Exhibit K-4-2.

Highway crossings will be obtained through a Building and Land Use Permit/Entrance Permit issued by the Ontario Ministry of Transportation as well as an Encroachment Permit if equipment is placed in proximity to or in the highway corridor.

Approval for the use of municipal rights of way will generally be secured through a form of municipal land use permit or a road use agreement issued by the applicable municipality, having regard to the statutory right to locate the facilities within the municipal right of way in Section 41 of the *Electricity Act, 1998*.

Railway crossings will be obtained through a form of Right of Entry or similar agreement obtained from the railway operator. Most required railway crossings for the Project are owned and operated by CP Rail and the Applicant has engaged in discussions with CP Rail regarding sharing of the right-of-way and crossing requirements for the Project. Correspondence in this regard is included at Exhibit K-3-2.

TAB K-3-2

RES America Letter

CANADIAN PACIFIC

Jason Copping
General Manager
Gateways & Government Affairs

Suite 500 Gulf Canada Square
401 – 9th Avenue SW
Calgary Alberta
T2P 4Z4

Tel 403 319 7857

jason_copping@cpr.ca

December 18, 2012

Mr. Jerry Vaninetti
President, RES Canada Transmission LP
1040 South Service Rd E
Oakville, ON L6J2X7

RE: East-West Tie Line

Dear Mr. Vaninetti:

Pursuant to your request, this letter is formal acknowledgement of the confidential[1] discussions that have been held between Renewable Energy Systems Canada Inc.[2] ("RES") and CP Rail over the past year regarding interface issues that are likely to arise in the development, construction, and operation of the proposed East-West Tie Line ("EWTL"). To that end, we have engaged in a wide range of discussion topics that pertain to co-locating transmission and rail lines for the typical 200' wide land corridor controlled by CP Rail between Thunder Bay and Marathon, ON, potential commercial land arrangements, and CP Rail's policies, standards, and guidelines. On the basis of these discussions, CP Rail confirms that RES' generalized characterization (below) of co-locating transmission and rail lines is accurate and consistent with our discussions:

- While it is unfeasible to co-locate transmission lines with tracks over long stretches, there are instances where transmission lines may be able to share ROW, either crossing the rail line or running parallel for short distances (i.e. 1-2 miles for every 10 miles of track, depending on track block lengths).

- CP Rail is aware of certain mitigation methods to facilitate the proximity of transmission lines and reduce induction, such as increasing tower-to-track distance, transposition of conductors, and shortening track blocks. CP Rail cannot use grounding as mitigation, as it will interfere with communication and relaying signals.

- CP Rail follows EPRI Standards in determining tower-to-track distances. One simple generalization of these standards could be that for a 1-mile track section with 1000 ohm-meter soil resistivity, the minimum track-to-tower distance for a 230kV line carrying 500 A is 50 feet.

- Voltage limits are typically as follows: 25V rail-to-ground for safety personnel; 50V equipment-to-ground for equipment safety (e.g. on overhead signal/communication lines); 5 V rail-to-rail for equipment safety under steady state conditions; 650V for a faulting current scenario, depending upon soil conditions.

---

[1] Confidentiality Agreement between the parties dated January 23, 2012
[2] RES Canada Transmission LP is an affiliate of Renewable Energy Systems Canada Inc.

../2

This letter is to confirm with the OEB that RES has established a relationship with CP Rail and, through a series of iterative discussions, have determined general conditions under which the East-West Tie Line may be sited over or adjacent to CP Rail's right-of-way, pending the completion of detailed modeling and engineering studies. In the event that a RES affiliate is designated by the OEB, CP Rail would work with them to identify specific instances where this co-location can occur and, to the extent it proves valuable and feasible, enter into a commercial agreements for utilization of CP Rail right-of-way, in order facilitate the development of the East-West Tie Line.

Sincerely,

Jason Copping
General Manager, Gateways & Government Affairs
Canadian Pacific

Cc: Peter Merchant, General Manager, Real Estate, Canadian Pacific

TAB K-4-1

Plan for Obtaining Land Use Rights

The Applicant's plan for acquiring the required land use rights for the entire Project has been divided in to two separate phases. The first phase, being the period prior to applying for the LTC, will be focused on securing options for land rights to maximize flexibility of line design while minimizing the required expenditure in order to secure the rights. The second phase, being the period following approval of the LTC, will be focused on executing land rights options to allow for the financing, construction and operation of the line.

Private Land

Option agreements for easements as described in Exhibit K-1-1 will be presented to all landowners along the Project corridor and options in favour of the Applicant will be secured across the majority of the corridor. The options will allow flexibility on the final location of the easement areas as the Project moves through the EA process, detailed design phases and micro-siting of the line. Furthermore, the options will grant access rights to the Applicant in order to access the proposed right-of-way to conduct the required environmental surveys, geotechnical surveys and other field studies required for the initial design phase. Once the final corridor location is determined and the LTC is granted, the exclusive rights contained in the option agreements will be exercised and the final easements will be obtained. Expropriation rights in accordance with section 99 of the OEB Act, will be used if necessary, as a last resort.

By using the option agreements in advance of the final easements, the following advantages are achieved:

(i) there will be significant flexibility throughout the development process for effective mitigation of potential environmental impacts or land use conflicts;

(ii) the flexibility in line and corridor design will reduce the likelihood of expropriation being required as a mechanism to secure the final easements on private lands, because alternate routes will be simpler to access;

(iii) when the Applicant files its LTC application, land rights will have already been secured; and

(iv) as the option agreements will provide for interim access to the land, there is less likelihood that early access rights pursuant to section 98 of the OEB Act will be required; access for the purposes of conducting surveys and other pre-construction activities will have already been granted by private landowners to the Applicant.

Crown Land

In accordance with the MNR Crown Lands Policies and Procedures, the Applicant would initiate pre-consultation with the MNR immediately upon designation in order to identify and assess any physical, environmental or social constraints that would affect locational and development approval of the Project. This consultation would continue through the LTC application. Following approval of the LTC, the Applicant would file the formal request for the MNR Land Use Permit that will be required for the construction of the line, as described in Exhibit K-2-1. Where easements are to be obtained with respect to the Crown lands, the Applicant would finalize these easements with MNR following construction, based on "as built" surveys. This approach has been successfully used by the MNR and the Applicant for previous transmission lines in northern Ontario and allows for the required surveying costs for the easements to be reduced (as there is a smaller land area being surveyed), while also ensuring that the infrastructure is protected by more secure land rights.

Other Rights

While the rights on private lands and Crown lands are being secured, the final location of road and railway crossings and other rights, as described in Exhibit K-3-1, would be identified. After the LTC is obtained, the required applications and requests would be submitted in order to secure these rights before financing and construction activities. The Applicant has significant experience in securing crossing rights and approvals from the Ontario Ministry of Transportation, municipalities and railway companies, as described in greater detail in Exhibit K-4-2.

National Park

Although the Preliminary Preferred Route would not traverse the Pukaskwa National Park, consultation with park officials would be initiated upon designation in connection with the Reference Route and to integrate any concerns of the Park officials in line design. Under the *Canada National Parks Act*, leases and easements are permitted on federal public lands if the corridor is used for public purposes, such as a transmission line.

Reserve Land

Although the Preliminary Preferred Route would not traverse First Nation Reserve Lands, consultation with affected First Nations would be initiated upon designation in connection with the Reference Route. Consultation with First Nations and Métis will also be initiated through the stakeholder consultation process and the First Nations and Métis engagement process, as outlined in the First Nations and Métis Consultation Plan, which is included in Exhibit M-3-1.

Land Acquisition Costs

As part of the Applicant's plan for obtaining land rights, preliminary budgetary estimates relating to the acquisition of land rights have been prepared. A summary is provided in Exhibit K-4-2.

TAB K-4-2

Land Valuation & Acquisition Plan

Land Acquisition and Valuation Plan

East-West Tie Transmission Project Application to the Ontario Energy Board

Prepared by RES Canada Transmission LP

January 2nd 2013

Version 1.0

OEB Application

CONTENTS

1 Context

As suggested by the Minister of Energy in a March 29th 2011 letter to the Ontario Energy Board (the "Board"), the Board has initiated a proceeding to designate an electricity transmitter to undertake development work for a new electricity transmission line between Northeast and Northwest Ontario: the East-West Tie Line (the "Project"). The Board assigned File No. EB-2011-0140 to the designation proceeding. The Board's primary objective in this proceeding is to select the most qualified licenced transmitter to develop, construct, own, and operate the East-West Tie Line while protecting the interests of the Ontario consumer by ensuring cost effectiveness and reliability of supply.

In the context of RES Canada Transmission LP's (the "Applicant") Application for Designation to the Board this Land Acquisition and Valuation Plan (the "Plan") outlines how The Applicant will secure all the required land rights for the development, construction and operation phases of the Project. The Plan outlines the various land ownership structures, the required rights on each, the schedule and plan to acquire these rights and the estimated budget required to secure these rights.

2 Land Ownership Structure and Required Rights

Land ownership structure along the proposed transmission corridor has been identified and is more fully described in this section. The rights required for each different type of landownership structure are described as well as the expected costs to secure the rights on each different type of land.

2.1 Description of the Lands

Approximately a quarter of the corridor's lands are owned in fee simple by private landowners. The private lands are generally grouped together in pockets along the line. The majority of the private lands are on the western part between Thunder Bay and Nipigon. The balance is mostly in the Wawa area with a few interspersed private lots along the northern shore of Lake Superior from Marathon to Terrace Bay.

The majority of the remaining three quarters of the line is on Crown lands managed by the Ministry of Natural Resources and considered "public lands" under the *Public Lands Act*. The majority of the route is along unpatented public lands however some of the line crosses other lands owned by the Province of Ontario such as Provincial Parks and Conservation Areas or highways.

The private lands were identified from information available on the Ontario Geowarehouse accessing Ontario's Electronic Land Registration System[1]. Although some of the information is not available for this part of Ontario, this information gives a relatively precise picture of registered land tenure. Some of the identified lots are owned by the Province as represented by government ministries such as the Ministry of Transportation, but are presented as "private" for the purposes of this analysis (as distinguished from Crown-owned public lands under the *Public Lands Act* (which will be referred to in this report as "Crown Land" or "Crown Lands"). First Nations reserves also appear as private lands in the analysis.

[1] http://www.geowarehouse.ca

Any lots not identified in the land registration information are expected to be Crown Land and this was counter verified with the Ministry of Natural Resources (MNR) information on Crown Land extents. A full overview of the land structures along the route is presented in the map contained in **Exhibit B-3-2** of the application.

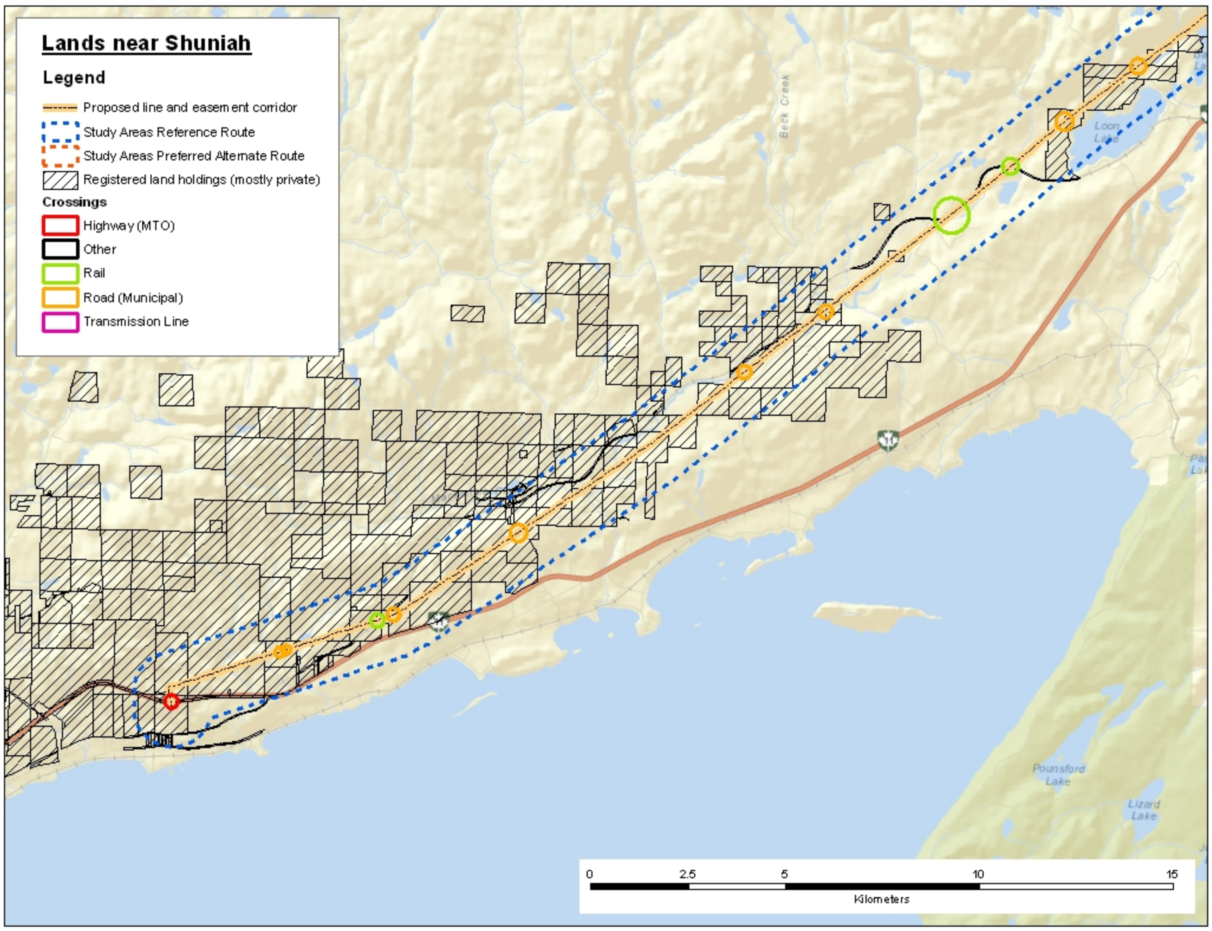
For evaluation of the land ownership structures and required rights along the line, the study area was divided into 6 sections. These sections are, from West to East:

- Lands near Shuniah
- Lands near Dorion
- Lands near Nipigon
- Lands near Terrace Bay and Marathon
- Michipicoten Forest Resources Lands
- Lands near Wawa

Each section is more fully described and illustrated below.

2.1.1 Lands near Shuniah

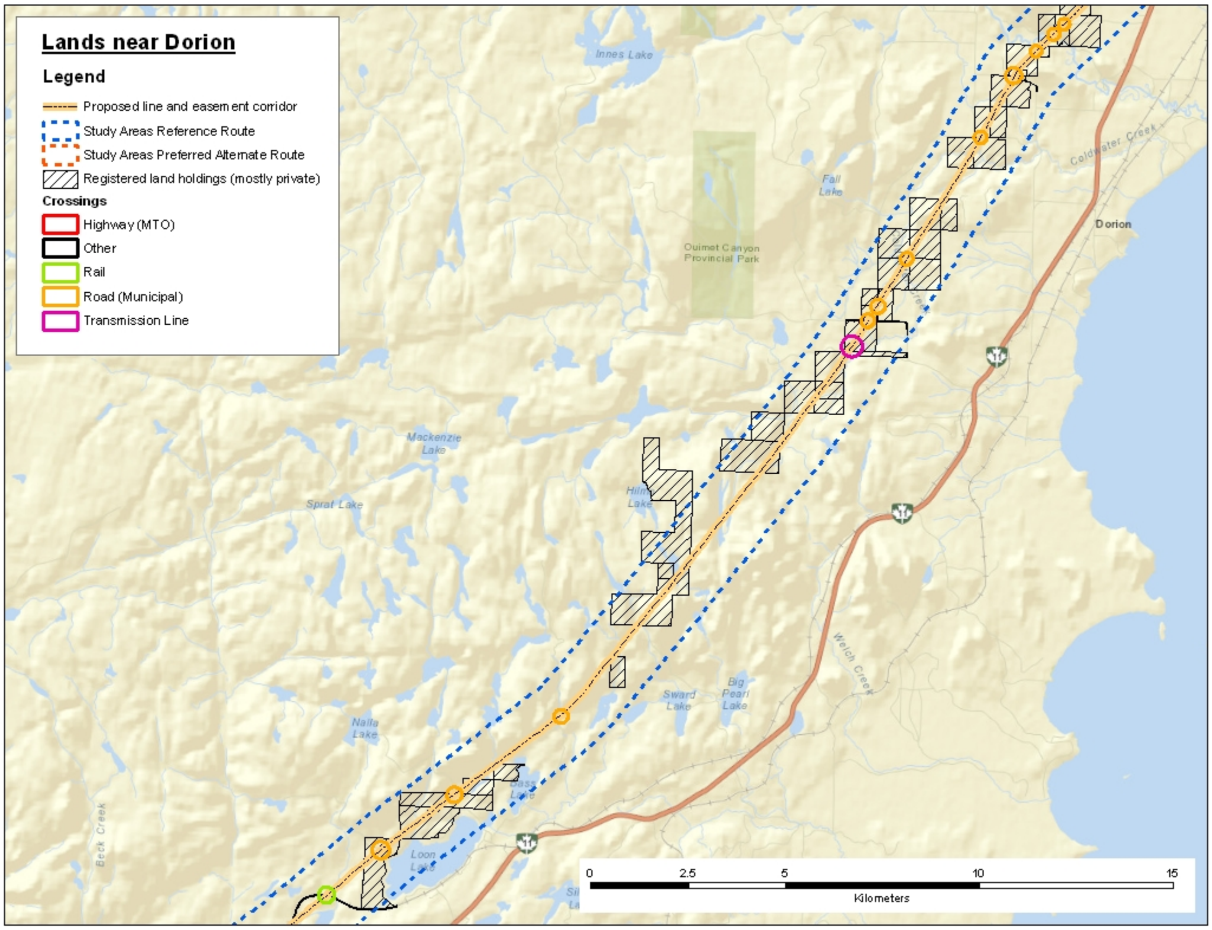
This section has the most private lands and likely the highest land values of the whole line, given its proximity to Thunder Bay. General land use is for recreation and cottages, forestry and some mining exploration. There is just over 20km of private land between the transformer station and Loon Lake. The proposed route, following the existing East-West Tie Line for this section, crosses a number of municipal roads and also crosses the railway line. The remaining (approximate) 7 km of this section is located on Crown Land.



Map 2-1: Map of Lands near Shuniah

2.1.2 Lands near Dorion

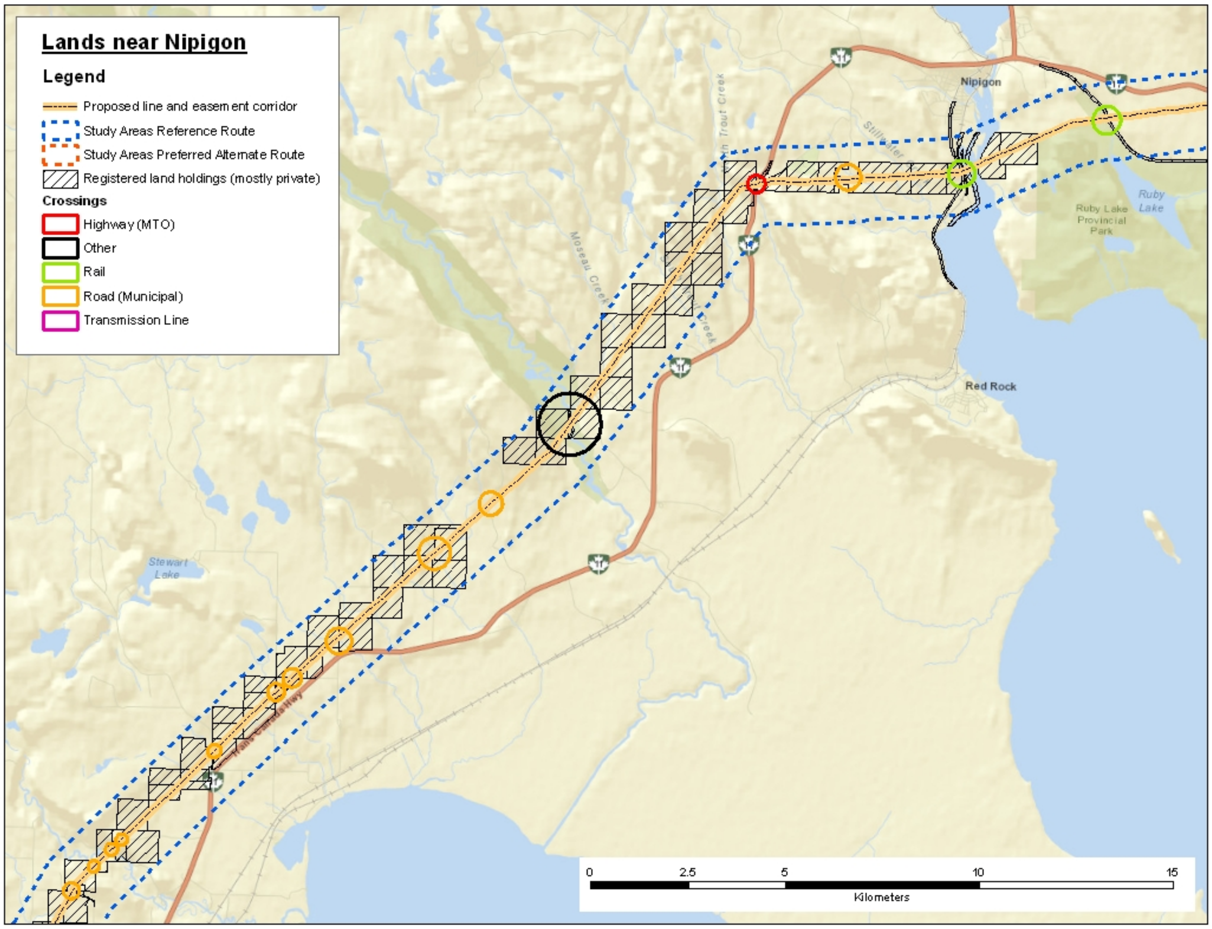
This section, between Loon Lake/Bass Lake and ending just North of Dorion is approximately half on Crown Land and half on private land. The ownership structure along the proposed route is fragmented, going from private lands to Crown Land and back again. The proposed route runs adjacent to the existing East-West Tie Line and generally follows the Transcanada Highway. The proposed route avoids Ouimet Canyon Provincial Park but it crosses municipal roads as well as a double circuit transmission line connected to the existing line.



Map 2-2: Map of Lands near Dorion

2.1.3 Lands near Nipigon

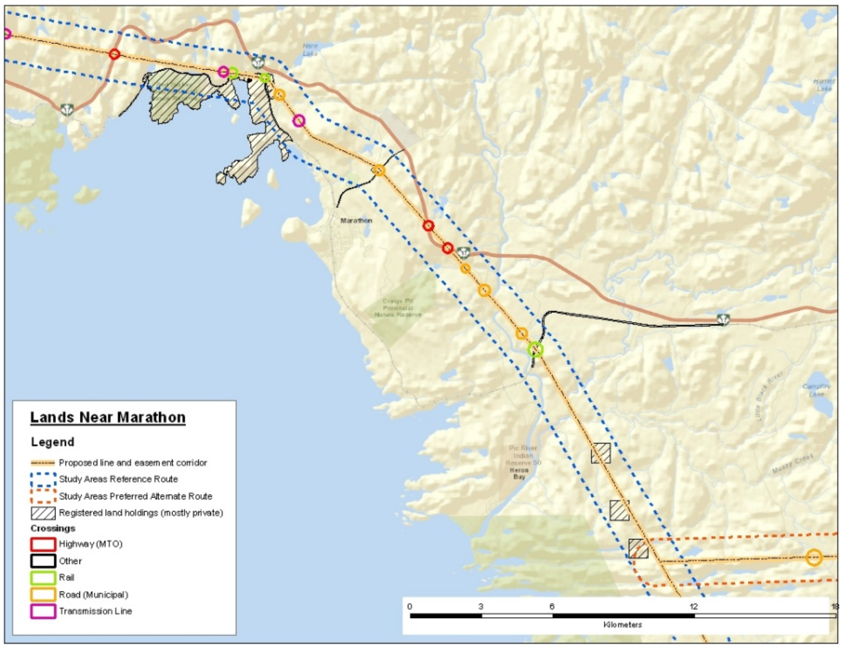
This section of the proposed route near Nipigon extends from just north of Dorion, goes through Nipigon and ends just north of the Ruby Lake Provincial Park. The middle section runs through Black Sturgeon River Provincial Park. A large part of this section of the route is located on private lands. It should be noted however that most of the lots between the Transcanada Highway and the northern edge of the Black Sturgeon River Provincial Park are in fact owned by the Province of Ontario (with registered title and not under the *Public Lands Act*) or the Township of Nipigon. The northern part of this section crosses the inlet to the Nipigon River just south of the Township of Nipigon. Several railway and highway crossing approvals will be necessary in this section.

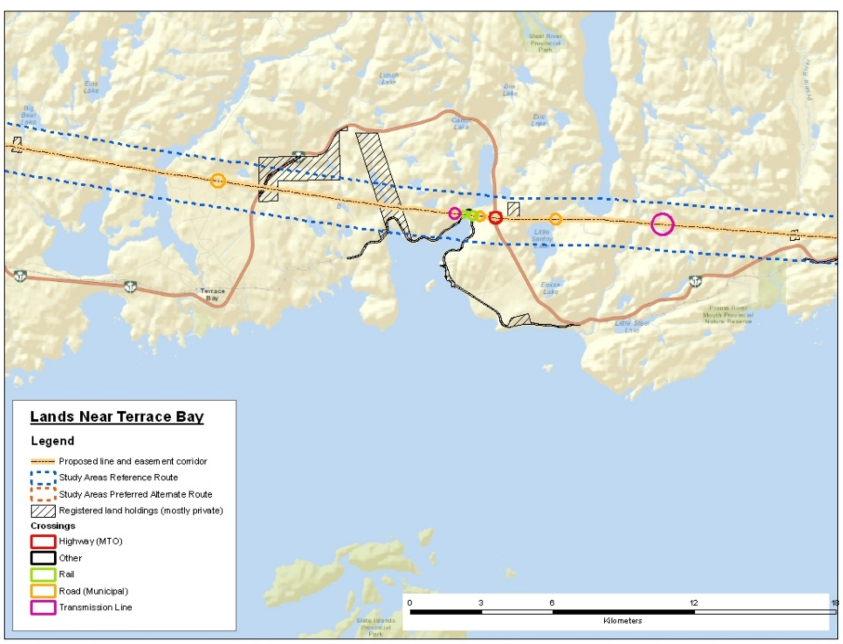


Map 2-3: Map of Lands near Nipigon

2.1.4 Lands near Terrace Bay and Marathon

The section running on the north shore of Lake Superior between Nipigon and Heron Bay is almost exclusively Crown Land. There are small pockets of private land along the line, mainly owned by forestry companies and likely used for their operations or for harvesting. This section of the proposed route crosses roads and the Provincial highway as well as railway lines and other transmission lines of lower voltage running generally parallel to the proposed line. Just south of Heron Bay, the Preliminary Preferred Route veers to the east to avoid the Pukaskwa National Park.

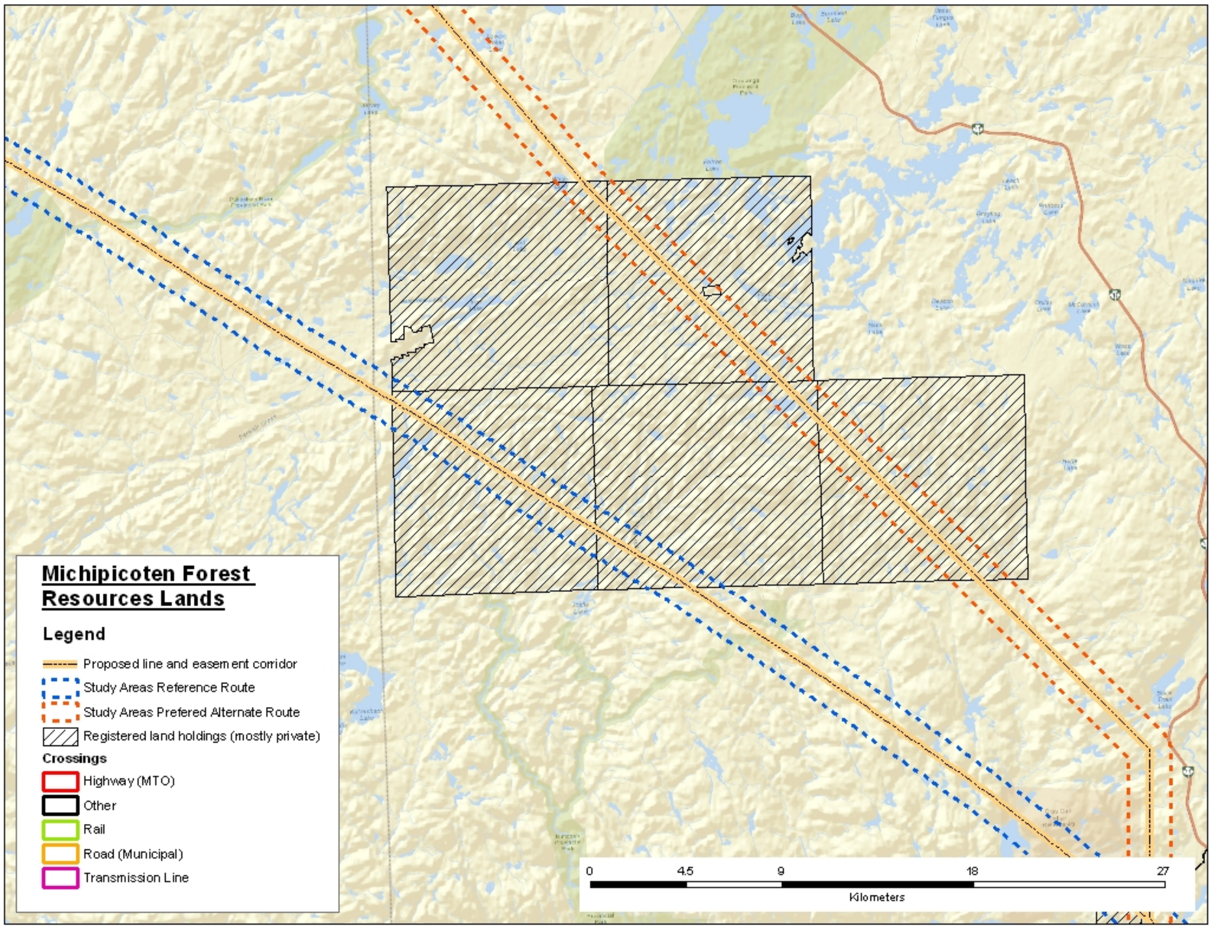




Map 2-4: Map of Lands near Terrace Bay and Marathon

2.1.5 Michipicoten Forest Resources Lands

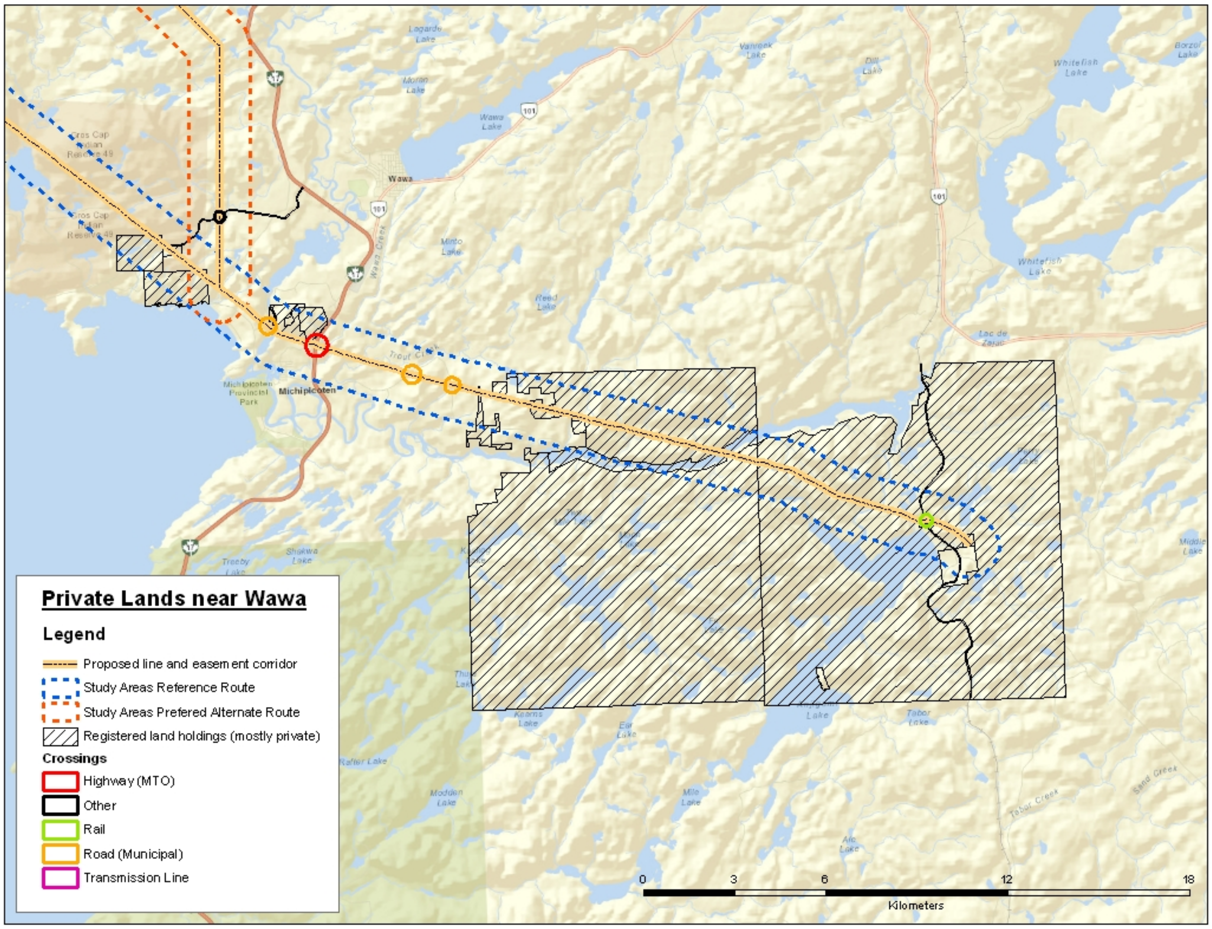
The section of the proposed route between Heron Bay and Wawa, runs east of Pukaskwa National Park for the Preliminary Preferred Route. The majority of this section is Crown Land except for a significant 26.5 km section running through a large private holding owned by Michipicoten Forest Resources. These lands are mainly used for mineral exploration activities, timber production and recreation. The Applicant has made contact with Michipicoten Forest Resources and confirmed that they are willing to negotiate a transmission easement across their land as evidenced by the included letter in **Appendix A**.



Map 2-5: Map of Michipicoten Forest Resources

2.1.6 Lands near Wawa

This section of the proposed route, generally runs along the Michipicoten River south of Wawa and crosses what are identified as large private lots. However, the registry does not have any information on certain lots in this area and it is suspected they some may be under provincial control. This section also crosses a few smaller privately owned parcels, a rail line registered to Algoma Central Railway as well as a corridor owned by Great Lakes Power Ltd., presumably for the operation of the High Falls plant on the Michipicoten River.



Map 2-6: Map of Lands near Wawa

Private Lands

2.1.7 Form of Rights on Private Lands

The required rights on private lands, generally owned in fee simple, will be secured by way of a negotiated perpetual easement for the identified corridor width of 50m. The easements will be registered on title and will grant Applicant the unobstructed and exclusive permanent rights to construct and operate transmission facilities on the identified corridor.

The easements will initially be secured through an Option to Acquire a Permanent Transmission Easement. The option agreement, to be executed with landowners along the line, will grant exclusive rights to acquire transmission facilities easements on the subject properties. The option will protect the subject property from the subordination of transmission rights to any other encumbrances that may affect the easement rights. Furthermore, the option will grant access to the land to perform required development studies and other related activities. The option will likely be registered on title in order to further secure the rights. The option to acquire transmission easements will be obtained for a much smaller fee than the actual transmission easements.

The easement will give the Applicant the right to perform all required works in order to properly construct and operate the transmission line. These rights will include, but will not be limited to, the right to enter, construct, repair and replace or supplement, operate and maintain the transmission facilities. The obligations of the owners through the contract will ensure that the Applicant will have the free and unencumbered use of the land for the purposes of constructing and operating transmission facilities.

The term of the easement will be perpetual. As the easement will be for the purposes of a transmission line, it will be exempt from the subdivision control provisions contained in Section 50 of the *Planning Act.*

One of the challenges of connecting new transmission facilities in Ontario is that often the land rights on the existing corridors do not allow for new facilities to be constructed on the existing rights of way. In order to facilitate the connection of renewable energy generation facilities or other types of load or generation connections, the new easements will contemplate future use of the corridor for the infrastructure required to connect these facilities.

2.1.8 Cost of Private Lands

Based on the Applicant's experience negotiating transmission easements in northwestern Ontario, the easements will be secured through a onetime payment to be made upon execution of the easement between the landowners and Applicant. It is expected that the payment will be equivalent to one time or two times the market value of the surface area of the land occupied by the corridor. Valuation of the cost of the corridor will depend upon the impact of the particular layout of the corridor in relation to other land uses expected for a particular lot. The table below outlines the expected cost to acquire private land sites for the various sections of the proposed route.

Table 1: Estimated Private Land Cost of Easements for Preliminary Preferred Route

Line Portion	Approximate corridor length on Private land (km)	Estimated Non-Contingent Cost of Corridor
Lands near Shuniah	24.6	$ 729,454
Lands near Dorion	23.9	$ 472,465
Lands near Nipigon	8.4	$ 124,541
Lands near Terrace Bay and Marathon	8	$ 158,147
Michipicoten Forest Resources Lands	26.5	$ 785,794
Lands near Wawa	13.7	$ 406,241
Totals	**105.1**	**$ 2,676,643**

2.2 Crown Lands

2.2.1 Required Rights on Crown Lands

The required rights on Crown Lands will be secured from the Ministry of Natural Resources (MNR) in accordance with the *Public Lands Act.* More specifically the MNR's *Utility Corridors on Public Land* policy and procedure PL 4.10.03, establishes the standardized approach to the granting on tenure for the occupation of public land by utility companies. According to the policy, rights for electrical transmission lines are typically granted through a Multi Site Land Use Permit (LUP). The LUP grants rights for the construction and operation of the line on the identified Crown Land through a yearly rental payment.

Notwithstanding this, the MNR retains discretion to consider higher forms of tenure where warranted and would consider the grant of an easement as set out in MNR policy *PL 4.11.04 – Easements (Grants of)*. Although securing the easement requires additional work, such as the surveying required to describe the lands for registering the rights on title, these easements would likely be sought instead of (or after) the LUP, given the importance of the infrastructure. The cost and effort required to secure the easement rights has been considered in the evaluation of the land acquisition efforts. In order to register the rights on title, "as built" surveys will be required for the easements. In order to minimize the cost of surveying for the overall project, construction of the line will likely be done under an LUP and easements will be secured once construction is finished and line can then be surveyed. This methodology has been used, on MNR Crown Land, by the Applicant in the past and has proven to significantly reduce the costs of surveying while ensuring that easement rights are secured for the line.

The MNR policies relevant to the granting of Crown Land for utility corridors, policies *PL 4.10.03-Utility Corridors on Public Land* and *PL 4.11.04 –Easements (Grants of)* are included in **Appendix B**.

2.2.2 Cost of Crown Lands

Rental rates for either the LUP or the easements are established by the MNR Rental Formula. The rate is based on the MNR established land value per hectare, an MNR established rate of return and an impact on the fee simple interest, established at 75% for electrical transmission lines. The land values are adjusted every five years to reflect land values and rates increase with the annual Consumer Price Index in between each re-evaluation. The official values contained in the MNR policy are currently being updated and new values have been established based on a 2010 market study and approved internally at the MNR. The current draft MNR Rental Formula is included in **Appendix C** to this report. Based on current values, the annual cost of Crown Land for the Preliminary Preferred Route would be as outlined in the table below.

Table 2: Estimated Annual Cost of Crown Lands on Preliminary Preferred Route

Element of MNR Formula	Value of MNR formula
Zonal Land Value Northern Blended Zone Rate ($/area)	910$/hectare ($368/acre)
Area Occupied per km, based on a 50m corridor width	5 hectares
Impact of fee simple for electrical transmission lines of 115kV or higher	75%
Rate of return established and applied by the Ministry on an annual basis	~ 10%
Annual Rent per km	341.25 $/km
Total number of km on Crown Lands	301 km
Annual rent for the entire line	**$102,716.25**

2.3 Other Rights

2.3.1 Other Required Rights

2.3.1.1 Crossings

Rights over other land ownership categories and corridors will be obtained according to the process required for each of the entities owning or managing each category. For instance, highway crossing rights and approvals will be obtained through a Building and Land Use Permit/Entrance Permit issued by the Ministry of Transportation as well as and an Encroachment permit if equipment is placed in, or in proximity to, the highway corridor. Municipal rights of way will generally be secured through a form of municipal land use permit or agreement issued by each of the municipalities with jurisdiction over the roads or corridors crossed by the line. Railway crossings will be obtained through a form of Right of Entry agreement obtained by the railway operators. An initial review of the proposed route has highlighted a number of crossing rights and approvals that will need to be secured for the Preliminary Preferred Route. These crossings are summarized in the table below.

Table 3: Summary of Expected Crossings

Type of Crossing	Number of Crossings (estimated on proposed corridor)
Highway managed by the Ministry of Transportation	14
Railway Corridor (various owners)	15
Transmission line crossings or in proximity to other transmission lines	8
Road Crossings (Municipal and on MNR land)	42

2.3.1.2 Mining Rights and Other Crown Land Rights

The north-western part of Ontario has seen significant development in mining, forestry and other activities requiring both surface and underground rights across the lands affected by the proposed route. As such, a portion of the route is subject to existing land rights that are potentially in conflict with the proposed use for the transmission line. More specifically, all mining claims are under the jurisdiction of the Ministry of Northern Development and Mines (“MNDM”). Surface rights to Crown Land, on the other hand, are within the jurisdiction of the MNR and all dispositions of surface rights on Crown Land, whether by way of Crown patent, lease, license of occupation or easement, are governed by the provisions of the *Public Lands Act*. In order for the MNR to grant surface rights on an area with an active mining claim, Subsection 51(2) of the *Mining Act* allows the MNR to dispose of surface rights to Crown Land that is subject to an unpatented mining claim where the holder of such a mining claim consents to the disposition. As such, in order to obtain the Land Use Permit or Easement from the MNR on Crown Lands that are subject to active mining claims, the claim holder’s consent to the disposition of surface rights will be required. An example of the consent form required for the MNR and MNDM land disposition process is included in **Appendix D.**

An initial review indicated that the Preliminary Preferred Route directly crosses 96 active mining claims, covering approximately 91km of the line, as presented in the map in **Exhibit B-3-2** of the application. In order to obtain rights in the Crown Land that is subject to these claims, it will be necessary to obtain consent from the holders of these claims to the disposition of the surface rights. A list of the active claim holders is presented in **Appendix E**. There are 38 separate claim holders that hold the 96 mining claims, either in partnership or alone.

3 Land Acquisition Plan and Schedule

The plan for acquiring the required land use rights for the entire corridor has been divided into two distinct phases. The period prior to obtaining the Leave to Construct will be focused on securing rights maximizing flexibility of line design while reducing the required spend in order to secure the rights. The period following approval of the Leave to Construct will be focused on finalizing and securing final rights, allowing for the financing, construction and operation of the line.

3.1 Private land

Initially, all private lots and landowners in the study corridor will be identified. For the identified lots, options for easements will be offered to all landowners along the corridor and options will be secured across the majority of the corridor. The option will allow flexibility on the final location of the easement as the project moves through the environmental assessment and detailed design phases. Furthermore, the option will grant access rights to the land in order to conduct the required environmental studies, geotechnical surveys and other field studies required for the initial design phase of the line. Once the exact corridor is determined and the Leave to Construct is granted, the final easements will be obtained by exercising the exclusive right to execute a transmission easement as secured by the Option agreement.

As on site environmental studies will need to be initiated approximately 12 months following designation and prior to the Leave to Construct application it is possible that it will be necessary to apply for early access rights under section 98 of the *Ontario Energy Board Act.* Recourse to Section 98 of the *Ontario Energy Board Act* would only be considered for those properties where it was impossible to secure an option for the easement granting us negotiated early access rights.

Using an option to secure the easements ahead of finalizing the final easements has a number of distinct advantages. These include:

- Significant flexibility throughout the development process that allows to effectively mitigate potential environmental impacts or impacts on conflicting land uses.
- The flexibility in line and corridor design will reduce the need to resort to expropriation as a mechanism to secure the final easements on private lands as alternate routes will be simpler to access.
- The filling of the Leave to Construct application pursuant to section 92 of the *Ontario Energy Board Act* will be done with a majority of the land rights already secured facilitating the review of the application.
- As the option agreement will provide for access to the land, the proposed strategy will reduce the need to apply for early access rights under section 98 of the *Ontario Energy Board Act*. Access to conduct surveys and other pre-construction activities will have already been granted by private landowners to the Applicant.

3.2 Crown Land

In accordance with the MNR Crown Lands policies, the Applicant would initiate pre-consultation with MNR representatives immediately upon designation in order to identify and scope any land issues or environmental and social constraints that would affect locational and development approval of the transmission facility. This consultation would continue through the Leave to Construct application. Once the Leave to Construct is approved, the Applicant would file the final request for the LUP and Easements required for the construction of the Project. As indicated, it is possible that the easements will only be secured once construction is finished allowing for "as built" surveys of the line to be completed on the finished project.

3.3 Other rights

3.3.1 Crossings

As private land rights are secured and consultation with the MNR is progressing the final location of crossings and other rights would be finalized. Prior to obtaining the Leave to Construct there would be ongoing consultations with the various land owners to identify any potential issues. Once Leave to Construct is obtained the various applications required for approval of these crossing rights would be filed in order to secure the rights before financing and construction activities. The Applicant has extensive experience in securing crossing rights from the Ontario Ministry of Transportation, railway companies and municipalities and this will help ensure that crossing agreements and approvals are obtained in due course.

3.3.2 Federal Park

Although rights through the Pukaskwa National Park would not be required for the Preliminary Preferred Route, the Applicant will consult with park officials after designation in order to have the option of following the existing East-West Tie Line and to integrate any concerns of the Park officials in line design, if applicable. Under the *Canada National Parks Act*, leases and easements are permitted on federal public lands if the lands are used for public purposes, such as a transmission line.

3.3.3 Reserve Land

Although rights through First Nation Reserve Lands would not be required for the Preliminary Preferred Route, the Applicant will consult with First Nations reservation officials after designation in order to have the option of following the existing East-West Tie Line, if applicable. Consultation with these First Nations will also be initiated through the Applicant's Stakeholder Consultation process, First Nation Consultation process and First Nation and Métis Consultation Plan.

3.3.4 Mining Rights

In order to initiate consultation with mining claim holders at an early stage, the Applicant intends to identify and contact all active mining claim holders starting immediately after designation. As the land acquisition plan and environmental studies are progressing the Applicant's project team would attempt to design the Project so as to avoid any claims that would be severely impacted by the presence of a transmission line. Through consultation, the Applicant would seek to share geotechnical information where appropriate and also co-locate common infrastructure, such as roads, in order to facilitate access to prospecting mining companies.

In order to ensure that the required consents to dispositions of surface rights are obtained from mining claim holders, the Applicant has set aside funds to compensate mining claim holders where the potential impacts of transmission line activities cannot be appropriately mitigated and compensation would be appropriate.

4 Estimated Land Acquisition costs

The Applicant has made a budgetary estimate of the costs required to secure all the required land rights for the Preliminary Preferred Route. These costs include all the costs associated with securing the rights, surveying the lands and registering the agreements, negotiating the various consents as well as managing the land acquisition process.

The total costs of acquiring the land rights for the line are expected to be as described in the table below.

Table 3: Budgetary Estimate of Land Acquisition

Estimated Land Acquisition Costs	**Accuracy**	**Amounts**
Management of Acquisition Activities	15%	$ 1,299,000
Surveying /Registration and Title Insurance	15%	$ 1,647,000
Consent for existing Rights	25%	$ 8,184,526
Access and temporary rights	20%	$ 1,403,431
Cost of Easements	10%	$ 2,944,307
	Total Capital Costs	**$ 15,478,824**
Annual Crown Land Payments	10%	$ 102,716
Annual management costs	10%	$ 30,000
	Total Annual Costs	**$ 132, 716**

Appendix A: Letter from Michipicoten Forest Resources

Michipicoten Forest Resources

One Office Park Circle, Suite 300
Birmingham, AL 35223
(205) 879-0456

December 12, 2012

Mr. Nicolas Muszynski
Senior Development Manager
RES Canada
300 Leo-Pariseau, Suite, 2516
Montreal, Quebec H2X 4B3

Michipicoten Forest Resources (registered as 3011650 Nova Scotia Ltd) owns a number of parcels, totaling 505,000 acres in North Western Ontario in the region North of Wawa and East of the Pukasawa National Park. These properties are mainly used for mineral exploration activities, timber production and recreation.

RES Canada Transmission LP (RES) has expressed interest in obtaining rights across a portion of our land holdings for a Transmission line easement if designated by the Ontario Energy Board (OEB) to develop, construct and operate the East West Tie transmission line. RES has presented two potential transmission corridors that cross lots owned by Michipicoten Forest Resources.

Michipicoten Forest Resources understands the need for development of the East West Tie transmission line, bringing reliable power to the Northwest, and is supportive of the competitive process implemented by the OEB. Michipicoten Forest Resources will be pleased to enter into discussions with RES for the use of an easement corridor, expected to be 50m wide, across our lands should they be designated.

You may contact me via email at vps@wwminvest.com or by phone at (205) 879-0456.

Respectfully Submitted,

Vaughn Stough
Vice President

Appendix B : Relevant Crown Land Policies

Ministry of Natural Resources Ontario	Subject **Utility Corridors on Public Land**		Policy **PL 4.10.03**	
	Compiled by - Branch Lands and Waters	Section Land Management	Date Issued October 27, 2006	
	Replaces Directive Title Utility Corridor Management	Number PL 4.10.03	Dated January 1, 2002	Page 1 of 12

1.0 DEFINITIONS

In this policy,

"distribution" means the lesser capacity portion of a company's utility corridor network used for the delivery of hydrocarbons, electrical energy or telecommunication services to customers within a market area;

"memorandum of agreement" means an agreement negotiated between MNR and another party (e.g. a utility company) acknowledging the party's use of certain public lands under the jurisdiction of the Ministry for the construction, maintenance and operation of utility services;

"public land" means land under the control and management of the Minister of Natural Resources including lands managed under the Public Lands Act and Provincial Parks and Conservation Reserves Act and more specifically:

- ungranted public lands (i.e. unpatented Crown land);
- acquired property which has been deemed to be public lands in accordance with subsection 38 (2) of the Public Lands Act;
- common and public highways in territory without municipal organization; and
- lands under water which are deemed public lands under provisions of the Beds of Navigable Waters Act.

"multi site land use permit" means a Public Lands Act land use permit which includes multiple locations for the same use (e.g. lines, cables, ground beds) which are identified on an Appendix accompanying the permit;

"transmission" means the higher capacity portion of a company's utility corridor network used for the transportation of hydrocarbons, electrical energy or telecommunication services over large distances to market areas; and

"utility corridor" means linear strips of land that run through public land to secure access between two points for the purpose of transmitting and distributing hydrocarbons, electrical energy or telecommunication services and includes such facilities as poles, towers, wire, cable (including fibre optic cable), apparatus or other thing that is used or is capable of being used for any operation directly connected with providing the service.

2.0 INTRODUCTION

The Ministry of Natural Resources supports the continued development, maintenance and use of utility infrastructure on public land, consistent with the Ministry's vision of sustainable development. Ontario currently has over 36,000 hectares of public land under occupational authority by the various utility companies. A lineal network of transmission and distribution lines provides electrical and hydrocarbon energy transmission and distribution throughout the Province and assists in providing accessibility to new energy generating projects.

The development of new utility corridors and the expansion of existing corridors is generally based on the location of the generating facility relative to the existing network of pipelines and hydro transmission corridors and the ultimate destination served (i.e. urban areas). Expansion proposals can take the form of new lines or widening of existing lines and is subject to receiving all necessary approvals (e.g. Environmental Assessment Act).

Prior to submitting an application to establish a new utility corridor on Crown land, an applicant is encouraged to pre-consult the local Ministry field office in order to pre-identify and scope any land use issues or environmental and social constraints that may affect locational and development approval of the facility and related infrastructure (e.g. roads). Co-location of additional lines within an existing right of way is encouraged, in order to reduce the overall impact on the Crown land base.

The Ministry's Crown Land Use Policy Atlas (CLUPA) is a useful tool for obtaining information on the land use policies affecting Crown lands in central and northern Ontario. Generally, utility corridors and related infrastructure may be permitted in all Crown land use designations, save and except conservation reserves and provincial parks, where differing land use direction, management plan or permitted use direction may apply.

MNR will review an application for a location consistent with the Ministry's legislative, policy, and procedural requirements, including those detailed in:

- Class Environmental Assessment for MNR Resource Stewardship and Facility Development Projects;
- Class Environmental Assessment for Provincial Parks and Conservation Reserves;
- PL 4.02.01 Application Review and Land Disposition Process; and
- PL 4.10.03 Utility Corridors on Public Land (Procedure).

The accompanying procedure provides greater detail with respect to the application, review, approval and issuance of tenure for a new utility corridor.

3.0 PROGRAM DIRECTION

3.1 Goal

To provide clear and consistent policy direction to the utility industry, Ministry staff and the public on land tenure arrangements and the rental fee structure for utility corridors situated on public land in Ontario.

3.2 Objectives

The objectives of this policy are to:

- provide a standardized and consistent approach to land tenure for utility corridors situated on public land;
- provide a standardized and consistent rental fee structure for utility corridors; and
- provide a fair market return to Ontario for the use of public land by the utility industry.

4.0 AUTHORIZATION AND TENURE

A standardized approach to the granting of tenure and the establishment and collection of rent for the occupation of public land by utility companies provides for fairness, consistency and equity. Rental rates, length of term, tenure type and terms and conditions within tenure documents will be applied uniformly across the province.

4.1 Memorandums of Agreement

In order to support a more efficient business relationship, this policy supports the use of memorandums of agreement (MOA) between the Ministry and utility companies for those utility companies operating either regionally or provincially. The MOA is utilized to document the number and location sites and tenure documents and provides efficiencies in invoicing and administration through tenure consolidation. The MOA is complementary to site specific tenure documents (e.g. land use permit). A new and/or extension to an existing MOA is negotiated at the end of the term, which is generally 20 years in length.

4.2 Occupational Authority and Land Tenure

The Ministry will use the following occupational authority or land tenure for utility corridors and related installations on public land:

Installation Type	Multi Site Land Use Permit	Crown Easement	Crown Lease	Crown Patent
• electrical transmission and distribution lines/cables • copper telephone lines/cables • distribution fibre optic lines/cables • water based/submarine transmission fibre optic lines/cables • cable television lines/cables • ground beds associated with pipelines • roads	X			
• transmission fibre optic lines and cables • all types of pipelines (natural gas, water, etc.)		X		
• telephone switching stations			X	
• compressor stations associated with pipelines • electrical sub-stations and transformer stations				X

5.0 RENTAL RATES AND FEES

5.1 Rental Formula

Rental rates for utility corridors are established by the Ministry consistent with *Appendix A Formula for Determining Rent for Utility Corridors*, based upon application of the following factors:

- land value per hectare;
- area occupied;
- impact on fee simple ownership; and
- an annual rate of return.

5.2 Co-Location or Multiple Use of Utility Corridors

Subject to the consent of the existing occupant of a utility corridor on Crown land, applicants proposing to install new lines, cables, pipe, etc. will be encouraged to co-locate improvements within an existing corridor. If approved, the secondary tenant will be issued the appropriate occupational authority (e.g. land use permit or easement).

The rent for additional users occupying an existing corridor is calculated as if the additional user were the only occupant of the corridor. In other words, there is no discount provided for multiple users in the same corridor, nor is there a dominant use in terms of calculating the rental formula.

For example, a telecommunication company sharing a corridor with a pipeline company would pay a rent based on the value of the easement for telecommunication corridor use, rather than the rental formula for pipeline purposes. Note: Section 42 of the Electricity Act, 1998 may exempt additional compensation.

Upgrading an existing facility (e.g. replacing existing pipelines, poles, lines, etc.) is considered part of maintaining the service and is not subject to a rental adjustment, even if the capacity of the facility is increased as a result of the upgrade.

5.3 Fibre Optic Cable Corridors

Fibre optic cable corridors are generally developed within existing single purpose utility corridors, but may also be established within new dedicated corridors. Fibre optic cable providers are required to pay fair market value to the Crown for the use of public land. Rental rates are based on a linear rate (per metre), rather than an area rate (per hectare).

Most fibre optic cable rental rates across North America are generally established at a rate based on the prevailing market conditions at the time of land disposition. Fibre optic cable values indicated in Appendix A are based on recent Ministry negotiations with the industry and are categorized more specifically as follows:

- transmission – interconnection between switching centers commonly referred to as trunk, toll or intertoll networks; or
- distribution – connection between switching centers and customers commonly referred to as feeder or access networks.

5.4 Trans Boundary Crossings

The rental formula for utility corridors that occupy public land for purposes of trans boundary crossings (e.g. New York State, Manitoba, Quebec) may be subject to individual rental review by the Ministry.

Rental rates may be determined through a site specific, market value appraisal or through analysis of the rental rate used by the connecting jurisdiction, in order to ensure consistency with the rent assessed by adjoining jurisdictions.

6.0 REFERENCES

6.1 Legislative

- Electricity Act 1998
- Public Lands Act
- Provincial Parks and Conservation Reserves Act

6.2 Directives

- PL 4.02.01 Application Review and Land Disposition Process
- PL 4.10.03 Utility Corridors on Public Land (Procedure)
- PL 4.11.04 Easements - Grants of
- PL 6.02.01 Administrative Fees for Public Land Transactions

Appendix A

Formula for Determining Rent for Utility Corridors

(A) Electrical, Hydrocarbon and Telecommunication Lines

The rental formula for electrical, hydrocarbon and certain types of telecommunication lines is based on Ministry consultation with the industry.

The annual rent formula is established based on the land value per hectare, multiplied by the area occupied (ha), multiplied by the impact on fee simple (expressed as a %) and multiplied by the established rate of return (8-10%).

Components pieces of the rental formula include:

- land value per hectare: represents the market value of the subject and surrounding lands, expressed in terms of dollars per hectare, based on the zonal land values identified in Appendix B.

- area occupied: the area public land (hectares) occupied by one or more lines, cables, pipes etc.., based on the length and width of the corridor as determined through review with the utility company.

- impact on the fee simple: that portion of the total bundle of rights (expressed as a percentage) conveyed to the tenure holder, or the degree to which other uses are precluded from the public land, including loss of resource management potential, site disturbance and longer term environmental impact. The percentage of impact on fee simple for specific utilities is as follows:
  - electrical transmission lines (115 kv & higher) - 75%
  - electrical distribution lines (less than 115 kv) – 25%
  - hydrocarbon transmission and distribution Pipelines – 50%
  - telecommunication lines – 25%

- rate of return: a formula established and applied by the Ministry on an annual basis (expressed as a percentage), based upon a number of factors including the Bank of Canada bank rate, risk of endeavor, future liability, management costs, liquidity of the asset and location.

(B) Fibre Optic Lines

The annual rent formula for fibre optic lines is established based on the linear value ($) per metre, multiplied by the length of the corridor (metres).

The linear value per metre represents the "value in use" of the fibre optic cable, based upon a Ministry review of market transactions within the fibre optics industry, which indicated that the rate per metre was the most common basis for determining value. Fibre optic cable has a value in excess of the underlying land value and therefore represents a value in use.

The linear value will be established based on the following:

- transmission lines: $0.10 per metre;
- distribution lines within urban municipalities in Northern and Southern Ontario with a population greater than 30,000: $1.00 per metre;
- all other distribution lines: $0.06 per metre

Where any of the above formulas in parts A or B of this Appendix result in a rental amount *on a per tenure document basis* that is less than $200.00, a minimum rent of $200.00 shall be charged.

(C) Telephone Switching Stations

The initial annual rent for all telephone switching stations shall be $1,070.00.

(D) Rent Adjustment in Subsequent Years

The zonal values are normally adjusted every five years based on the updated zonal studies. After the first year and in each of the next four years subsequent to the implementation of the initial rent, the rent will be adjusted by the year over year increase in the annual average Consumer Price Index , seasonally adjusted for Ontario.

(E) Other Fees

Administrative fees for document issuance and renewal will be charged, as set out in other relevant Land Management policy directives. Administrative fees will however not be charged when adding or removing a location to or from an existing tenure document (e.g. adding or removing a distribution line to or from an existing multi-site land use permit).

Appendix B

Zonal Land Values

For most utility corridors, the zonal approach is appropriate where the corridor traverses a large area crossing multiple economic zones. The zonal values are an averaging of the various land categories to develop "an overall blended land value rate" for the applicable zone. Where a utility company has extensive holdings that cross both northern zones, a blended northern rate is applied.

The following zonal values will be applied for the period of January 2006 to December 31, 2010, based upon a 2005 market analysis. For location identification, reference Appendix C maps.

Northwest Zone $1,200.00/ha ($500.00/acre)

Northeast Zone 20 mile wide Highway 17 corridor: $830.00/ha ($335.00/acre)
20 mile wide Highway 11/101/17 corridors: $520.00/ha ($210.00/acre)
Other: $430.00/ha ($175.00/acre)

Northern Blended Zone Rate: $750.00/ha ($305.00/acre) for utility corridors traversing both the Northwest and Northeast zones.

Southcentral Zone $2,200/ha ($900.00/acre)

Southeastern Zone $3,800.00/ha ($1,550.00/acre)

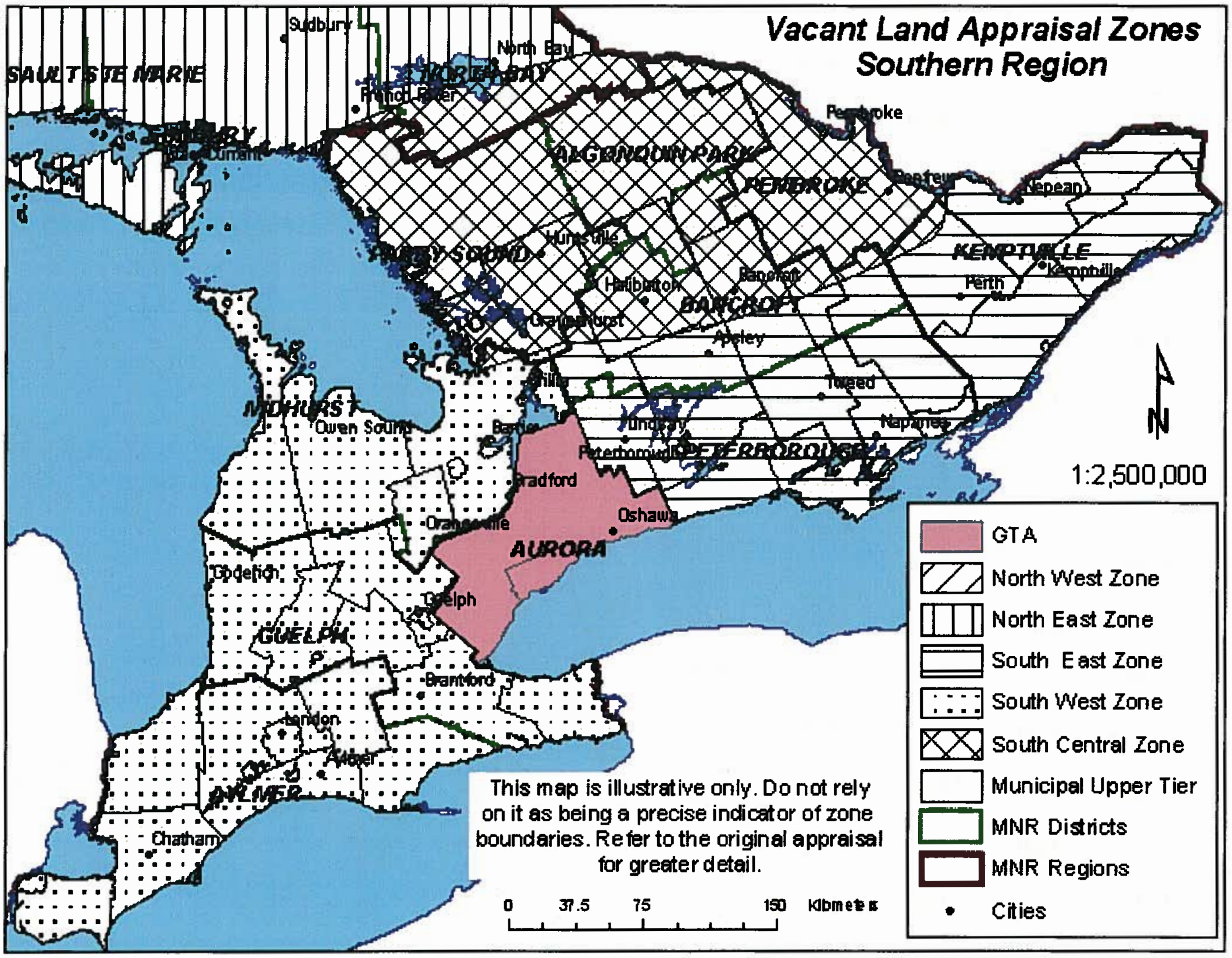
Southwestern Zone $10,100.00/ha ($4,100.00/acre)

Greater Toronto Area Zone: Individual market value appraisals will normally be required for each property being considered for use by a utility company.

Far North Zone: Zonal value appraisals have not been completed for areas within the Far North. Appropriate values will be established per area by the Ministry's Land Management Section, as opportunities warrant.

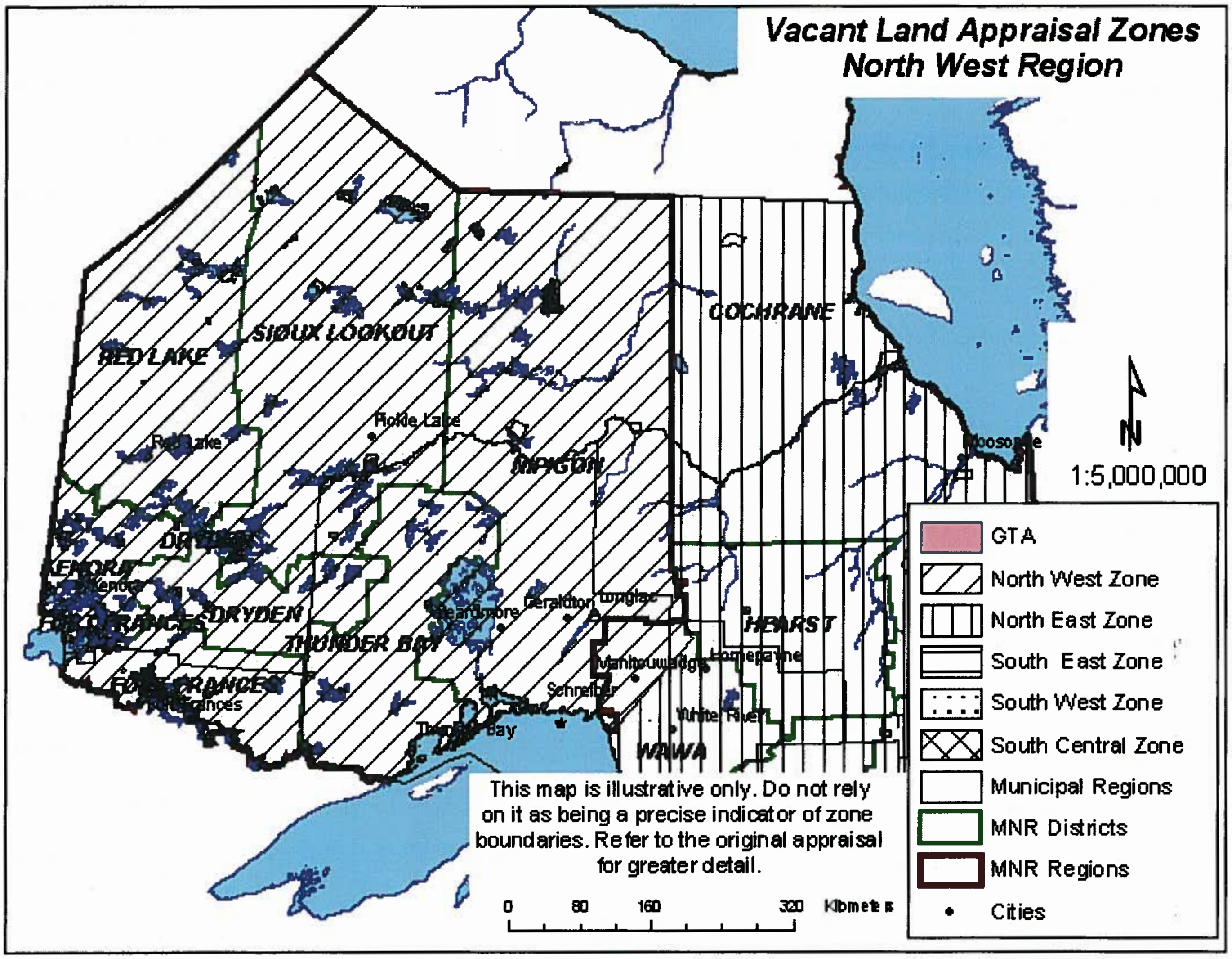
Appendix C

Zonal Land Value Map – Southern Ontario



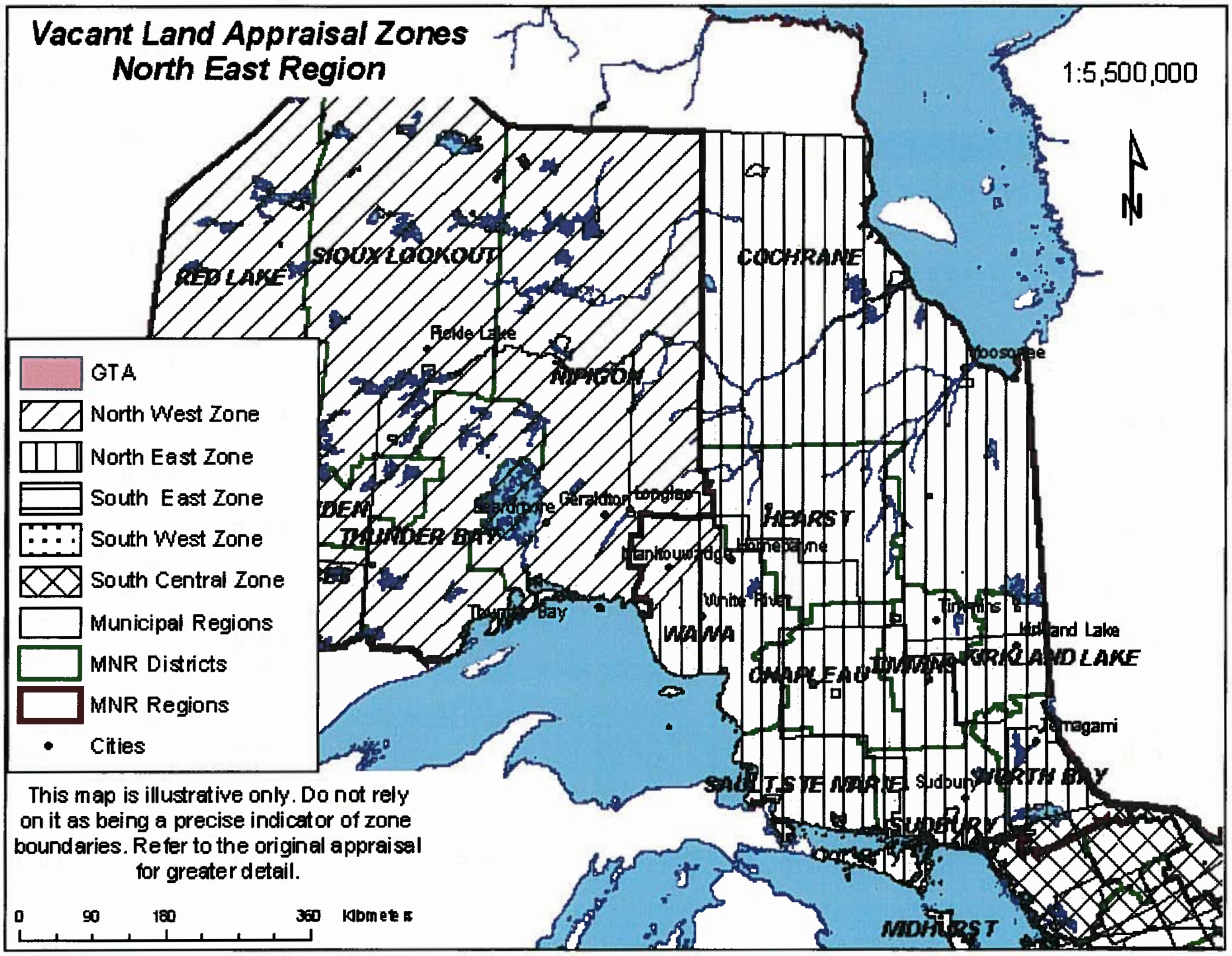
Appendix C

Zonal Land Value Map – Northwestern Ontario



Appendix C

Zonal Land Value Map – Northeastern Ontario



Ministry of Natural Resources
Ontario

Subject		Policy	
EASEMENTS (GRANTS OF)		**PL 4.11.04**	
Compiled by - Branch: Lands & Waters	Section: Land Management	Date Issued: April 7, 2006	
Replaces Directive Title: Easements (Grants Of)	Number: PL 4.11.04	Dated: July 8, 2002	Page: 1 of 4

1.0 DEFINITIONS

In this policy,

"dominant tenement" means the property which benefits from the easement;

"easement" means a right or interest of use or passage of persons, vehicles and animals over another person's owned or leased property created through an express registered grant of easement; and

"servient tenement" means the land over which the easement runs.

2.0 INTRODUCTION

Section 21 of the *Public Lands Act* provides that the Minister may grant easements in or over public lands for any purpose.

Crown easements are commonly granted for rights-of-way for communication lines, pipelines, water intakes, effluent discharge pipes, roads, etc. An easement is also the preferred form of tenure to authorize the right to flood Crown land and for contaminant, leachate, or attenuation zones associated with waste disposal sites. Since an easement grants only a specific right (e.g. to install and maintain a pipeline) the land traversed by it may be subsequently sold, leased, or otherwise disposed of, provided the conveyance is made subject to the previously granted easement. Because an easement does not grant exclusive possession, the holder of an easement cannot stop others from using the easement area for purposes, which are not inconsistent with the purpose of the easement.

The law currently indicates that to be valid, an easement must have four characteristics:

(a) there must be both a dominant and a servient tenement;

(b) the dominant tenement must benefit from the easement;

(c) the dominant and servient tenements must be owned by different persons; and

(d) a right over land cannot amount to an easement unless it is capable of forming the subject of a grant, i.e. it must be capable of definition and not vague and uncertain.[1]

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[1] The Dictionary of English Law, Sweet & Maxwell Limited, London

The granting of an easement, as an alternative to other forms of land tenure, should be considered where a client, who holds other land, wishes to obtain access across Crown land and does not require or should not be provided with exclusive possession of the servient tenement.

The granting of easements over Crown lands in Ontario first became common in the 1950's when province spanning gas pipelines were being built. Tenure by lease, licence of occupation, etc… was considered inappropriate because such authority was considered to be "exclusive possession", which placed the pipeline companies in a position to interfere with public travel across, or along the right of way.

3.0 PROGRAM DIRECTION

3.1 Application

This policy applies provincially to all right of way situations or where flooding rights are required, or where the applicant does not require, or where MNR does not wish to grant, exclusive possession of: ungranted public lands; acquired property which has been deemed to be public lands in accordance with subsection 38 (2) of the Public Lands Act; and common and public highways in territory without municipal organization.

When considering the disposition of public lands by easement, regard shall be had for the disposition review process provided in directive PL 4.02.01 Application Review and Land Disposition Process.

3.2 Guiding Principle

Easements are the preferred method of granting tenure for right-of-way purposes (e.g. hydrocarbon pipelines and fibre optic cable corridors), or where flooding will occur (e.g. hydro power development), since easements provide for other uses of the land that are not inconsistent with the purpose of granting the easement.

3.3 Goal

To use easements in granting tenure to Crown land that is fair, reasonable and consistent across the Province.

3.4 Objectives and Strategies

A) To encourage the return of the easement interest to the Crown when no longer required.

> To facilitate the return of the easement interest in the servient tenement to the Crown when it is no longer required by the grantee, or when the grantee neglects to pay the annual rent, easements will be issued with a term usually not exceeding twenty (20) years. However, where the land traversed by the easement is to be subsequently sold to a third party, the easement will be granted in perpetuity.

B) To collect an administrative fee for the preparation of all easement documents to help offset the Ministry's administrative costs.

The issuance of an easement involves substantial work for the Ministry including application review, site inspection, survey examination, document preparation, execution and registration. To recover these costs a one time, up front administrative fee will be charged in addition to annual rent. Consistent with directive PL 6.02.01 Administrative Fees for Public Land Transactions, this fee is $1,000.00.

C) To charge an annual rent for all easements and generally not make easements available at a onetime fee, subject to the exceptions noted below*. The annual rent is to be determined by one of the following three methods:

a) land value/hectare ($) x area (ha) x impact on fee simple (50%) x % of market value (10%), subject to a minimum rent of $200.00;

b) in the case of utility corridors, as set out in Policy PL 4.10.03 Utility Corridor Management; or

c) in the case of flooded lands, consult with Land Management Section staff.

* An easement will be issued for the onetime administrative fee only when an easement is to be issued:

1) to protect the interest of an owner/user of an existing occupation for the sole reason that the underlying land is to be disposed of by the Crown to a third party;
2) for a contamination attenuation zone associated with an existing MNR or municipally operated waste disposal site (see policy PL 6.01.03 Disposition at Less Than Market Value); or
3) for a water treatment plant intake or a sewage disposal pollution control plant outfall if the project is being subsidized by the Province (see policy PL 6.01.03 Disposition at Less Than Market Value).

D) To ensure that all rents for easements are based on the market value of the fee simple interest of the underlying land.

Zonal land values for the Province on a "value per hectare" basis have been estimated through MNR commissioned zonal appraisal reports (see Appendices A and B of Policy PL 4.10.03 Utility Corridor Management). These values will be used as the market value of the fee simple interest of land underlying easements where more site specific market value information is not available. However, where an easement is to be issued for a small occupation in high value areas (e.g. southern Ontario large urban areas), a site specific appraisal should be commissioned.

E) To ensure that the Ministry is compensated for any aggregate used by the grantee located near or on the easement area.

Permits as prescribed by the Aggregate Resources Act will be obtained by all easement holders and the appropriate fees and/or royalties will be collected.

F) To provide the proper documentation needed to prepare and register an easement.

Staff must ensure that the following documentation is obtained from the client:

- a Crown land plan of survey of the servient tenement;
- a legal description of the dominant tenement on legal sized paper, entitled Schedule "B", in duplicate (unless the easement is for a public utility provided by a municipality, Sec. 91 of the *Municipal Act*);
- a *Corporation Profile Report* (when applicable);
- a completed *Form 1 - Land Transfer Tax Act, Affidavit of Residence and Value of the Consideration*, in triplicate, together with, when applicable, land transfer tax (0.5% of the one-time consideration) in the form of a separate cheque made payable to the Minister of Finance. *Do not cash the cheque*; and
- the one time administrative fee and the rent to December 31 of the current year (including back rent, if applicable) plus HST in the form of a separate cheque made payable to the Minister of Finance. *Do not cash the cheque.*

Staff must submit the above noted documentation together with the following to Crown Land Registry, Land Management Section:

- a legal description of the servient tenement, entitled Schedule "A"; and
- a Requisition for a Grant of Easement.

4.0 REFERENCES

4.1 Legislative Cross References

- Public Lands Act, Sections 21, 38(2)
- Aggregate Resources Act
- Municipal Act, Section 91

4.2 Policy Cross References

- PL 4.02.01 (POL & PRO) Application Review and Land Disposition Process
- PL 4.08.01 (BUL) Land Use Occupational Authority for Waste Disposal Sites
- PL 4.10.03 (POL & PRO) Utility Corridor Management
- PL 6.01.03 (POL) Disposition of Public Land at Less than Market Value
- PL 6.02.01 (POL) Administrative Fees For Public Land Transactions

Appendix C: Draft Appendix B for Crown Land Policy

Appendix B

Zonal Land Values
(For properties =/> 25 acres in size based on 2010 Market Analysis)

For most utility corridors, the zonal approach is appropriate where the corridor traverses a large area. The zonal values are a reflection of the median values of various land categories to develop "an overall blended land value rate" for the applicable zone. Where a utility company has extensive holdings that cross both northern zones, (i.e. northeast and northwest) a blended northern rate is applied.

The following zonal values will be applied for the period of January 1, 2013 to December 31, 2015 based upon a market analysis completed in 2010. For location identification, please reference Appendix C maps.

Economic Zone	Area of Coverage	Rate
Northwest Zone	*refer to Appendix C maps*	$505/acre ($1,250/ha)
Northeast Zone	20 mile wide Hwy.17corridor (North Bay-Sault Ste. Marie)	$513/acre ($1,250/ha)
	20 mile wide Hwy. 11/101/17 corridor (Timmins-Wawa)	$247/acre ($610/ha)
	Other/Remote Areas	$208/acre ($515/ha)
Northern (provincial) Blended Zone Rate	For Corridors Traversing Northeast and Northwest Zones	$368/acre ($910/ha)
Southcentral Zone	*refer to Appendix C maps*	$2,600/acre ($6,420/ha)
Southeastern Zone	*refer to Appendix C maps*	$1,450/acre ($3,600/ha)
Southwestern Zone	*refer to Appendix C maps*	$4,500/acre ($11,120/ha)
Greater Toronto Area Zone	*refer to Appendix C maps*	Zonal value appraisals have not been completed for the Greater Toronto Area. Individual market value appraisals will normally be required for each property being considered for use by a utility company.
Far North Zone	All other areas of province not covered by above noted Zones	Zonal value appraisals have not been completed for areas within the Far North. Appropriate values will be established per area in consultation with the Ministry's Land and Water Services Section as opportunities warrant.

Note: The above Zonal Values are to be applied for properties of 25 acres or larger only. For properties in the 5 – 24 acre size category, refer to the individual Zonal Value reports. For properties less than 5 acres in size refer to the individual Small Acreage Zonal Value reports.

Appendix D: Example Consent to Disposition of Surface Rights Form

Ministry of
Northern Development
and Mines

Consent to the Disposition of Surface Rights

Under the Mining Act, R.S.O. 1990, Chapter M.14 or
the Public Lands Act, R.S.O. 1990, Chapter P.43

Information collected on this form is used to maintain a public record under section 51(2) of the *Mining Act.* Questions about this form should be directed to a Provincial Mining Recorder, Ministry of Northern Development and Mines, 3rd Floor, 933 Ramsey Lake Road, Sudbury, Ontario, P3E 6B5. Telephone number 1-888-415-9845 or (705) 670-5742.

TO THE PROVINCIAL MINING RECORDER:

RE: MINING CLAIM(S)
____

I/we ____ , being all the recorded holders of the above-noted
(print name)
claims, hereby consent(s) to the disposition of the surface rights under the Public Lands Act with respect to all or part of such claims as shown outlined in red on Sketch attached hereto as Schedule A, subject to my/our maintaining prior rights to the use of the surface rights for prospecting and the efficient exploration, development and operation of the mines, minerals, and mining rights.

Signature of Recorded Holder or Company Officer (state position held)		Date
Signature of Recorded Holder or Company Officer (state position held)		Date
Print name of witness	Signature of witness*	Date

Note: *The witness should know the recorded holder or ask for the person's identification before signing as the witness.

This form can be signed by:

a) the recorded holder of the claim or by the holder's agent authorized by recorded instrument in writing.

b) a corporation's authorized person, provided that either
  (i) the corporation's seal is affixed to the form; or
  (ii) the form contains a statement by the person that he or she has authority to bind the corporation.

Appendix E: Review of Mining Claims

Claim Number	Township Area	Recorded Holder	Preliminary Preferred Route	Preliminary Preferred Route Count	Reference Route	Reference Route Count
1205135	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	1
1238179	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	2
1238180	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	3
1238181	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	4
1245464	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	5
3002235	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	6
3014856	MUSSY LAKE AREA (G-3773)	GOLDEN MEADOW EXPLORATION INC. (100.00 %)	No	0	Yes	7
4210928	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	No	0	Yes	8
1238179	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	Yes	1	No	8
1238180	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	Yes	2	No	8
1245463	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	Yes	3	No	8
3005546	ABBIE LAKE AREA (G-3762)	2299895 ONTARIO INC. (100.00 %)	Yes	4	No	8
4257603	ABBIE LAKE AREA (G-3762)	THIBODEAU, RICHARD RENE (100.00 %)	Yes	5	No	8
4257604	ABBIE LAKE AREA (G-3762)	THIBODEAU, RICHARD RENE (100.00 %)	Yes	6	No	8
4269516	ABBIE LAKE AREA (G-3762)	2299895 ONTARIO INC. (100.00 %)	Yes	7	No	8
645710	PIC (G-0630)	BARRICK GOLD INC. (100.00 %)	Yes	8	Yes	9
657433	PIC (G-0630)	BARRICK GOLD INC. (100.00 %)	Yes	9	Yes	10
657477	PIC (G-0630)	BARRICK GOLD INC. (100.00 %)	Yes	10	Yes	11
657478	PIC (G-0630)	BARRICK GOLD INC. (100.00 %)	Yes	11	Yes	12
1233234	PIC (G-0630)	BEAUFIELD RESOURCES INC./ RESSOURCES BEAUFIELD INC. (10	Yes	12	Yes	13
1238179	MUSSY LAKE AREA (G-3773)	METALCORP LIMITED (100.00 %)	Yes	13	Yes	14
1240104	PIC (G-0630)	JIMINEX INC. (50.00 %)	Yes	14	Yes	15
1247007	PIC (G-0630)	STILLWATER CANADA INC. (100.00 %)	Yes	15	Yes	16
3012173	PIC (G-0630)	STILLWATER CANADA INC. (100.00 %)	Yes	16	Yes	17
3015153	TUURI (G-0635)	RENNER, RUSSEL PHILIP (100.00 %)	Yes	17	Yes	18
3015154	TUURI (G-0635)	RENNER, RUSSEL PHILIP (100.00 %)	Yes	18	Yes	19
3015160	PIC (G-0630)	STILLWATER CANADA INC. (100.00 %)	Yes	19	Yes	20

3015161	PIC (G-0630)	STILLWATER CANADA INC. (100.00 %)	Yes	20	Yes	21
3015208	PIC (G-0630)	STILLWATER CANADA INC. (100.00 %)	Yes	21	Yes	22
4204055	PIC (G-0630)	BEAUFIELD RESOURCES INC./ RESSOURCES BEAUFIELD INC. (10	Yes	22	Yes	23
4207490	PRISKE (G-0631)	STRIKE MINERALS INC. (100.00 %)	Yes	23	Yes	24
4207491	PRISKE (G-0631)	STRIKE MINERALS INC. (100.00 %)	Yes	24	Yes	25
4210396	LENDRUM (G-2785)	CLEMENT, GILBERT RUSTY (100.00 %)	Yes	25	Yes	26
4214081	TARTAN LAKE AREA (G-2706)	PANORAMIC PGMS (CANADA) LIMITED (100.00 %)	Yes	26	Yes	27
4214082	TARTAN LAKE AREA (G-2706)	PANORAMIC PGMS (CANADA) LIMITED (100.00 %)	Yes	27	Yes	28
4214083	TARTAN LAKE AREA (G-2706)	PANORAMIC PGMS (CANADA) LIMITED (100.00 %)	Yes	28	Yes	29
4218048	MCMURRAY (G-2795)	CLEMENT, LORNE CLIFFORD (100.00 %)	Yes	29	Yes	30
4218049	MCMURRAY (G-2795)	CLEMENT, GILBERT RUSTY (100.00 %)	Yes	30	Yes	31
4218058	MCMURRAY (G-2795)	CLEMENT, GILBERT RUSTY (100.00 %)	Yes	31	Yes	32
4218067	LENDRUM (G-2785)	CLEMENT, CLIFFORD CLAUDE (100.00 %)	Yes	32	Yes	33
4218070	LENDRUM (G-2785)	CLEMENT, CLIFFORD GUS (100.00 %)	Yes	33	Yes	34
4221602	SYINE (G-0634)	RENNER, RUSSEL PHILIP (100.00 %)	Yes	34	Yes	35
4240824	SYINE (G-0634)	RICHARDS, WAYNE LARRY (50.00 %)	Yes	34	Yes	35
4240824	SYINE (G-0634)	RICHARDS, WAYNE LARRY (50.00 %)	Yes	35	Yes	36
4241515	PIC (G-0630)	BLAKELY, GERALD ANTOINE (100.00 %)	Yes	36	Yes	37
4243789	TARTAN LAKE AREA (G-2706)	PANORAMIC PGMS (CANADA) LIMITED (100.00 %)	Yes	37	Yes	38
4246282	WALSH (G-0636)	GIONET, BRIAN DAVID (100.00 %)	Yes	38	Yes	39
4249446	MACGREGOR (G-0672)	CHINA METALLURGICAL EXPLORATION CORP. (100.00 %)	Yes	39	Yes	40
4254295	PRISKE (G-0631)	FOWLER, BRIAN DAVID (100.00 %)	Yes	40	Yes	41
4254901	MACGREGOR (G-0672)	BUNT, RALPH ALLEN (100.00 %)	Yes	41	Yes	42
4256116	WALSH (G-0636)	RARE EARTH METALS INC. (100.00 %)	Yes	42	Yes	43
4256117	WALSH (G-0636)	RARE EARTH METALS INC. (100.00 %)	Yes	43	Yes	44
4256118	WALSH (G-0636)	RARE EARTH METALS INC. (100.00 %)	Yes	44	Yes	45
4256266	PRISKE (G-0631)	STRIKE MINERALS INC. (100.00 %)	Yes	45	Yes	46
4256267	PRISKE (G-0631)	STRIKE MINERALS INC. (100.00 %)	Yes	46	Yes	47
4256270	COLDWELL (G-0781)	BESCO INTERNATIONAL INVESTMENT CO. LTD. (100.00 %)	Yes	47	Yes	48
4256977	NAVEAU (A.C.R.) (G-2480)	AUGUSTINE VENTURES INC. (100.00 %)	Yes	48	Yes	49
4256981	RABAZO (M-1556)	AUGUSTINE VENTURES INC. (100.00 %)	Yes	49	Yes	50
4256983	NAVEAU (A.C.R.) (G-2480)	AUGUSTINE VENTURES INC. (100.00 %)	Yes	50	Yes	51
4256985	PRISKE (G-0631)	FOWLER, BRIAN DAVID (100.00 %)	Yes	51	Yes	52
4258043	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	51	Yes	52

4258043	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	52	Yes	53
4258044	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	52	Yes	53
4258044	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	53	Yes	54
4258078	TUURI (G-0635)	WAHL, RUDOLF (100.00 %)	Yes	54	Yes	55
4258083	WALSH (G-0636)	MICHANO, DUNCAN MALCOLM (25.00 %)	Yes	55	Yes	56
4258085	GRAIN (G-0628)	MICHANO, JOHN GRANT (25.00 %)	Yes	56	Yes	57
4258087	WALSH (G-0636)	GIONET, BRIAN DAVID (100.00 %)	Yes	57	Yes	58
4258101	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	57	Yes	58
4258101	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	58	Yes	59
4258103	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	58	Yes	59
4258103	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	58	Yes	59
4258103	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	59	Yes	60
4258104	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	59	Yes	60
4258104	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	60	Yes	61
4258132	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	60	Yes	61
4258132	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	60	Yes	61
4258132	PIC (G-0630)	ENTOURAGE METALS LTD. (100.00 %)	Yes	61	Yes	62
4258415	MCTAVISH (G-0675)	BJORKMAN, KARL EVERETT (15.00 %)	Yes	61	Yes	62
4258415	MCTAVISH (G-0675)	BJORKMAN, KARL EVERETT (15.00 %)	Yes	62	Yes	63
4258416	MCTAVISH (G-0675)	BJORKMAN, KARL EVERETT (15.00 %)	Yes	62	Yes	63
4258416	MCTAVISH (G-0675)	BJORKMAN, KARL EVERETT (15.00 %)	Yes	63	Yes	64
4259155	GRAIN (G-0628)	RARE EARTH METALS INC. (100.00 %)	Yes	64	Yes	65
4259164	GRAIN (G-0628)	RARE EARTH METALS INC. (100.00 %)	Yes	65	Yes	66
4259173	COLDWELL (G-0781)	RARE EARTH METALS INC. (100.00 %)	Yes	66	Yes	67
4259176	COLDWELL (G-0781)	RARE EARTH METALS INC. (100.00 %)	Yes	67	Yes	68
4259189	MCCOY (G-2854)	RARE EARTH METALS INC. (100.00 %)	Yes	68	Yes	69
4259190	MCCOY (G-2854)	RARE EARTH METALS INC. (100.00 %)	Yes	69	Yes	70
4259194	MCCOY (G-2854)	RARE EARTH METALS INC. (100.00 %)	Yes	70	Yes	71
4259196	MCCOY (G-2854)	RARE EARTH METALS INC. (100.00 %)	Yes	71	Yes	72
4259205	MCCOY (G-2854)	RARE EARTH METALS INC. (100.00 %)	Yes	72	Yes	73
4259206	MCCOY (G-2854)	RARE EARTH METALS INC. (100.00 %)	Yes	73	Yes	74
4263516	PIC (G-0630)	HUSTON, CARL DAVID (100.00 %)	Yes	74	Yes	75
4263530	WALSH (G-0636)	GIONET, BRIAN DAVID (100.00 %)	Yes	75	Yes	76
4264657	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	75	Yes	76

4264657	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	76	Yes	77
4264658	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	77	Yes	78
4264660	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	77	Yes	78
4264660	MACGREGOR (G-0672)	PYHTILA, BEN (100.00 %)	Yes	78	Yes	79
4266059	TUURI (G-0635)	ROBERTS, WILLIAM JOHN (33.30 %)	Yes	79	Yes	80
4266067	TUURI (G-0635)	SHAVER, JASON ROBERT (33.30 %)	Yes	80	Yes	81
4267317	STREY (G-0633)	SHAVER, JASON ROBERT (12.50 %)	Yes	81	Yes	82
4268110	SYINE (G-0634)	ROBERTS, WILLIAM JOHN (12.50 %)	Yes	82	Yes	83
4268111	SYINE (G-0634)	FOWLER, BRIAN DAVID (25.00 %)	Yes	83	Yes	84
4268117	SYINE (G-0634)	FOWLER, BRIAN DAVID (25.00 %)	Yes	84	Yes	85
4268141	STREY (G-0633)	HAVEMAN, DAVE HENRY (50.00 %)	Yes	85	Yes	86
4268142	STREY (G-0633)	FOWLER, BRIAN DAVID (25.00 %)	Yes	86	Yes	87
4268144	STREY (G-0633)	HAVEMAN, DAVE HENRY (50.00 %)	Yes	86	Yes	87
4268144	STREY (G-0633)	HAVEMAN, DAVE HENRY (50.00 %)	Yes	87	Yes	88
4268145	PRISKE (G-0631)	FOWLER, BRIAN DAVID (25.00 %)	Yes	88	Yes	89
4268147	STREY (G-0633)	HAVEMAN, DAVE HENRY (50.00 %)	Yes	89	Yes	90
4268980	SYINE (G-0634)	ROBERTS, WILLIAM JOHN (12.50 %)	Yes	89	Yes	90
4268980	SYINE (G-0634)	ROBERTS, WILLIAM JOHN (12.50 %)	Yes	90	Yes	91
4268997	PRISKE (G-0631)	HAVEMAN, DAVE HENRY (50.00 %)	Yes	91	Yes	92
4268999	PRISKE (G-0631)	HAVEMAN, DAVE HENRY (50.00 %)	Yes	92	Yes	93
4269345	PRISKE (G-0631)	ROBERTS, WILLIAM JOHN (33.30 %)	Yes	93	Yes	94
4269745	NAVEAU (A.C.R.) (G-2480)	ANDERSON, STEVEN DEAN (100.00 %)	Yes	94	Yes	95
4271500	TUURI (G-0635)	FOWLER, BRIAN DAVID (33.40 %)	Yes	95	Yes	96
4271501	WALSH (G-0636)	ROBERTS, WILLIAM JOHN (33.30 %)	Yes	96	Yes	97

TAB K-5-1

Significant Issues Anticipated in Acquisition of Land Rights

The Applicant has identified two major challenges in securing the required land rights for the Project.

First, there is the issue of securing rights on private lands. Approximately one quarter of the length of the corridor will be secured across private lands and agreements with as many as 161 different landowners will be required to secure the entire corridor. To facilitate the acquisition of the required contiguous land rights, the following actions will be taken:

(i) route flexibility will be maximized by using the option agreements for easements;

(ii) the stakeholder consultation process will be co-ordinated with land acquisition activities so that stakeholders and landowners are informed of the status of the Project;

(iii) flexibility will be offered on certain terms of the easements in order to respond to landowners' specific concerns and requests; and

(iv) if necessary (as a last resort), expropriation rights will be relied upon in accordance with section 99 of the OEB Act.

Second, northwestern Ontario has seen significant development in mining, forestry and other activities for which surface and underground rights have been granted across the proposed Project route. As such, a portion of the route is subject to existing land rights that are potentially in conflict with the proposed transmission line use. More specifically, all mining claims are under the jurisdiction of the MNDMF. However, all dispositions of surface rights on Crown land, whether by way of Crown patent, lease, licence of occupation or easement, are under the jurisdiction of the MNR and governed by the provisions of the *Public Lands Act*.

Section 51(2) of the *Mining Act* authorizes the MNR to dispose of surface rights on Crown land that is subject to an unpatented mining claim where the holder of such a mining claim consents to the disposition. Accordingly, on any Crown lands with active mining claims, consent to the disposition of surface rights will be obtained from the claim holder before the Applicant obtains the Land Use Permit from the MNR. As the proposed route crosses 97 active mining claims, covering approximately 91 km of the line, the process of obtaining consent from every claim holder will be managed carefully. To mitigate risks related to obtaining the required consents, the Applicant has and will continue to do the following:

(i) identify all active mining claim holders and start consulting with the claim holders as early as possible to obtain consents in accordance with the Project schedule;

(ii) maximize route flexibility through land acquisition strategy and design to avoid any existing claims that would be severely impacted by the presence of the transmission line;

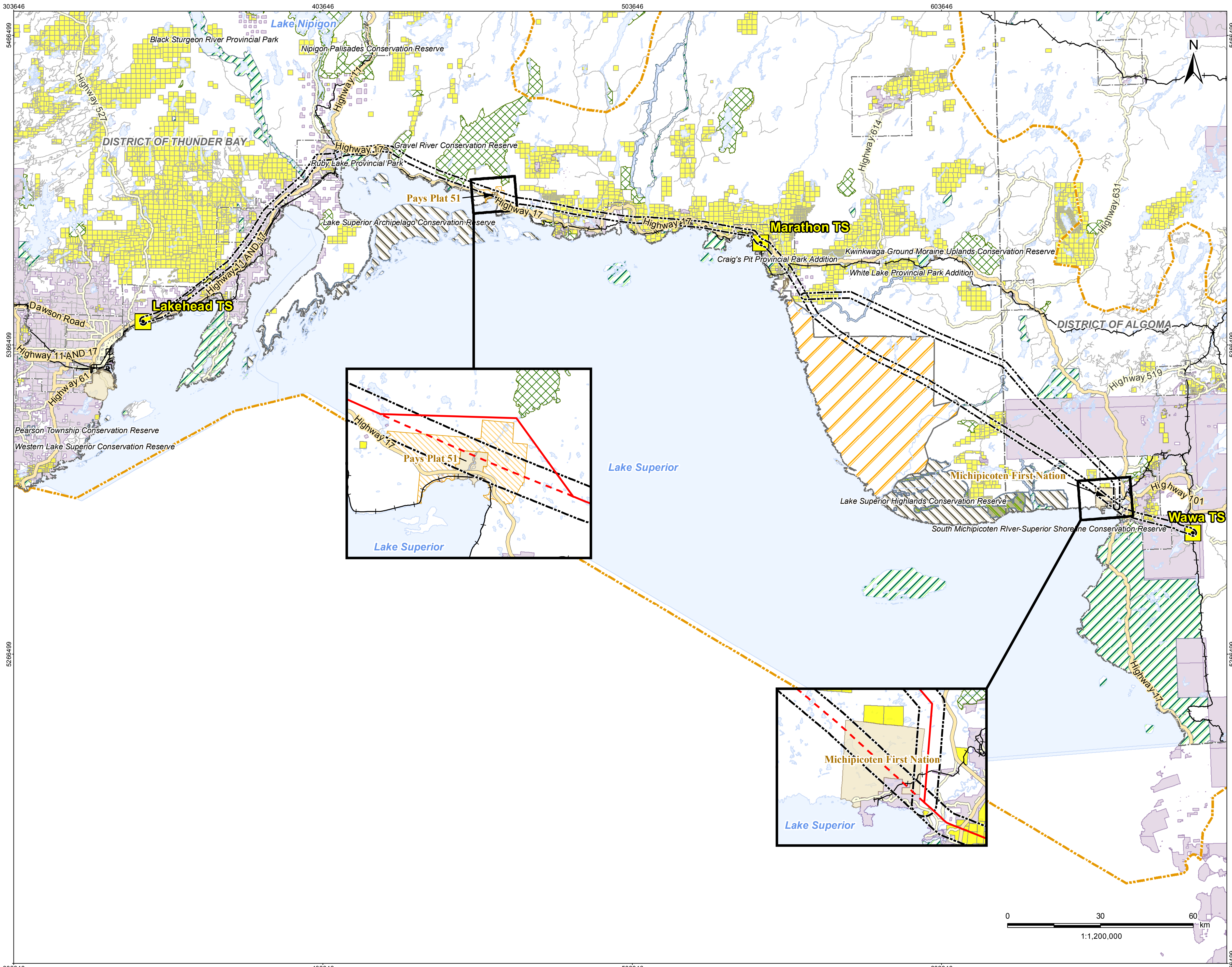
(iii) co-locate common infrastructure, such as roads where appropriate in order to facilitate access to prospecting mining companies;

(iv) share geotechnical information with mining companies as appropriate in order to facilitate design and route changes to accommodate mining activities; and

(v) reserve funds in order to compensate the holders of mining rights in cases where impact by potential transmission line activities cannot be appropriately mitigated.

TAB K-6-1

Maps of Alternative Routes Showing Categories of Required Land Rights



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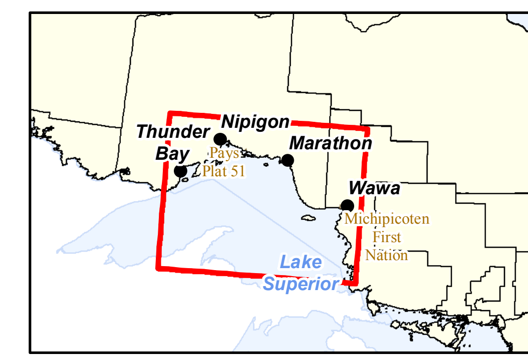
Revised: 2013-01-02 By: awhite

Legend

- Proposed Study Area Corridor*
- Preliminary Preferred Route**
- Reference Route
- Railway,
- Railway,
- Highway
- Major Road
- Local Road
- Active Mining Claim
- Conservation
- First Nation Reserve
- First Nation
- Municipal Boundary
- Conservation Reserve
- Forest Reserve
- Provincial Park
- Private Land
- National Park
- Treaty No. 60 Robinson, Superior
- Waterbody

* Preliminary Preferred Route falls within 2 km Study Area Corridor.

** Preliminary Preferred Route located approximately 100 m north of existing transmission line, and parallels existing transmission line corridor where feasible, except between Marathon and Wawa where the line would not adjoin the existing line.



Notes

1. Coordinate System: NAD 1983 UTM Zone 16N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.

Stantec

January 2013
160960725

Client/Project

RES Canada Transmission LP
East-West Tie Transmission Line

Figure No.
B-3-2

Title

Land Rights Map