Toronto Region:

Integrated Regional Resource Plan

August 9, 2019

Connecting Today.
Powering Tomorrow.

Toronto Region
Integrated Regional Resource Plan

This Integrated Regional Resource Plan (IRRP) was prepared by the Independent Electricity System Operator (IESO) pursuant to the terms of its Ontario Energy Board license, EI-2013-0066.

The IESO prepared the IRRP on behalf of the Toronto Regional Planning Working Group (Working Group), which included the following members:

- Independent Electricity System Operator
- Toronto Hydro-Electric System Limited (Toronto Hydro)
- Hydro One Networks Inc. (Hydro One)

The Working Group developed a plan that considers the potential for long term electricity demand growth and varying supply conditions in the Toronto region, and maintains the flexibility to accommodate changes to key conditions over time.

Table of Contents

List of Figures

List of Tables

List of Appendices

List of Acronyms

Acronym/ Alternative	Description
CHP	Combined Heat and Power
DER	Distributed Energy Resource
DESN	Dual Element Spot Network
DR	Demand Response
EA	Environmental Assessment
FIT	Feed-in Tariff
GTA	Greater Toronto Area
Hydro One	Hydro One Networks Inc.
IESO	Independent Electricity System Operator
IRRP	Integrated Regional Resource Plan
kV	Kilovolt
LAC	Local Advisory Committee
LDC	Local Distribution Company
LMC	Load Meeting Capability
LTE	Long-term Emergency Rating
LTR	Limited Time Rating
MVA	Mega Volt Ampere
MW	Megawatt
NWA	Non-wires Alternative
OEB	Ontario Energy Board
ORTAC	Ontario Resource and Transmission Assessment Criteria
PEC	Portlands Energy Centre
PV	Photo-voltaic (Solar)
RAS	Remedial Action Scheme
RIP	Regional Infrastructure Plan
SS	Switching Station

Acronym/ Alternative	Description
STE	Short-term Emergency Rating
Toronto Hydro	Toronto Hydro-Electric System Limited
TPSS	Traction Power Sub-station
TS	Transmission Station or Transformer Station
Working Group	Technical Working Group for Toronto Region IRRP

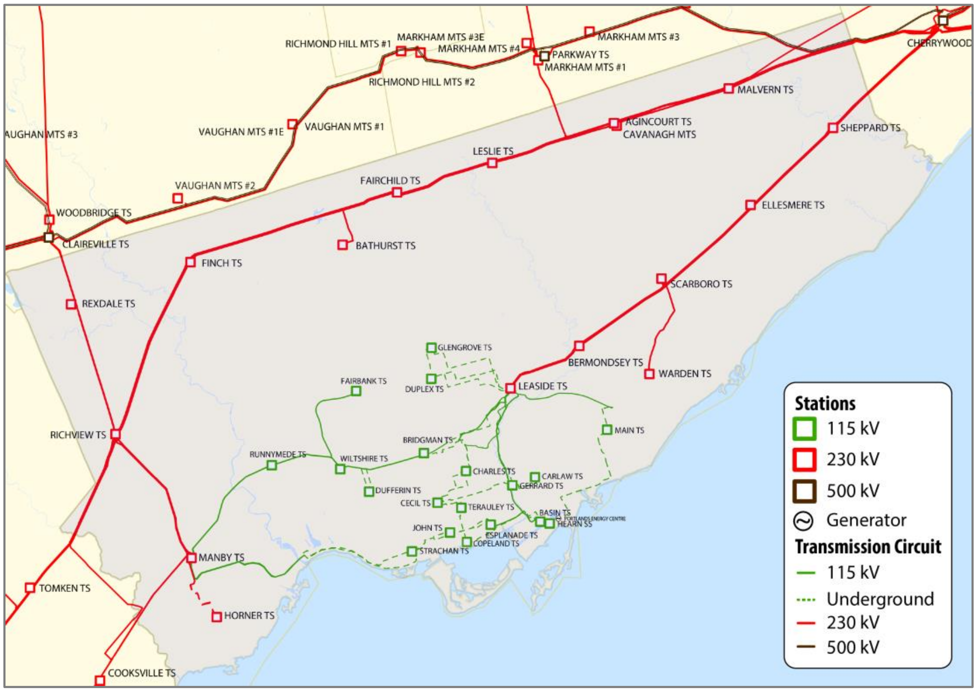
1. Introduction

This Integrated Regional Resource Plan (IRRP) addresses the regional electricity needs for the City of Toronto (Toronto region) between 2019 and 2040.[1] This report was prepared by the Independent Electricity System Operator (IESO) on behalf of a Working Group comprising the IESO, Toronto Hydro-Electric System Limited (Toronto Hydro), and Hydro One Networks Inc. (Hydro One).

In Ontario, planning to meet the electrical supply and reliability needs of a large area or region is carried out through regional electricity planning, a process that was formalized by the Ontario Energy Board (OEB) in 2013. In accordance with this process, transmitters, distributors and the IESO are required to carry out regional planning activities for 21 electricity planning regions across Ontario, at least once every five years. The Toronto region, shown in Figure 1-1, corresponds with the municipal boundaries of the City of Toronto. Other electricity planning regions adjacent to the Toronto region include Greater Toronto Area (GTA) West, GTA East, and GTA North.

[1] The planning horizon year is 2040: the different time frames within the plan period include the near term (up to five years out); medium term (six to 10 years out); and long term (11 to 20 years out).

Figure 1-1: Location of the Toronto Region



This IRRP reaffirms the needs and plans previously identified in the Metro Toronto Regional Infrastructure Plan (RIP) published in January 2016, and the Needs Assessment report completed in 2017. It identifies new capacity and reliability needs of the electric transmission system, and recommends approaches to ensure that Toronto's electricity needs can be met over the planning horizon. Specifically, the plan recommends approaches for addressing a number of end of life asset replacement needs and potential longer-term capacity needs to accommodate growth and city development.

For needs that may emerge in the longer term (11 to 20 years out), the plan maintains flexibility for new solutions. As the long term needs highlighted by the technical studies are subject to uncertainty related to future electricity demand and technological change, this IRRP does not recommend specific investments to address them at this time.

The plan identifies some near term actions to monitor demand growth, explore possible long term solutions, engage with the community, and gather information to lay the groundwork for determining options for future analysis. The near term actions recommended are intended to be completed before the next regional planning cycle, scheduled for 2024 or sooner, depending on demand growth or other factors that could trigger early initiation of the next planning cycle.

This report is organized as follows:

- A summary of the recommended plan for the Toronto region is provided in Section 2;
- The process and methodology used to develop the plan are discussed in Section 3;
- The context for regional electricity planning in the Toronto region and the study scope are discussed in Section 4;
- The demand outlook scenarios, and energy efficiency and distributed energy resource (DER) assumptions, are described in Section 5;
- Electricity needs in the Toronto region are presented in Section 6;
- Options and recommendations for addressing the needs are described in Section 7;
- A summary of engagement activities to date, and moving forward, is provided in Section 8; and
- A conclusion is provided in Section 9.

2. Summary of the Recommended Plan

The recommendations in this IRRP are focused on replacement of assets at their end of life, and preparing to address local and regional capacity needs emerging in the longer term.

The successful implementation of the recommended actions summarized below is expected to address the region's electricity needs until at least the late 2020s.

2.1 The Plan

This plan re-affirms the needs and plans identified in the previous regional planning cycle that concluded in January 2016, and recommends the actions described below to address the region's transmission needs until at least the late 2020s or early 2030s.

The recommendations set forth in this plan are summarized as follows:

Replace end of life overhead line sections H1L/H3L/H6LC/H8LC and L9C/L12C

The Working Group recommends that Hydro One proceed with planning for the like for like replacement of these overhead line sections.

Replace end of life transformers at Main TS

The Working Group recommends that Hydro One proceed with planning to replace the existing transformers with 60/100 MVA transformers.

Continue planning for replacement of C5E/C7E underground transmission cables

The Working Group recommends that Hydro One continue planning to replace the existing cables.

Continue planning to determine end of life approaches for Manby TS, John TS, and Bermondsey TS

Manby TS and John TS: The Working Group recommends that detailed planning for end of life of these assets continue, starting with the RIP.[2]

Bermondsey TS: The Working Group recommends that the plan to replace the two end of life transformers at Bermondsey TS be completed within the scope of the RIP.

Gather information to inform future capacity planning for Basin TS

Since there is currently insufficient information to characterize the needs at Basin TS and inform specific recommendations in this IRRP, the Working Group proposes that any recommendation on potential solutions be deferred until the next cycle of regional planning, or earlier, as required.

Specifically, the Working Group recommends that Toronto Hydro coordinate continued planning activities related to defining the nature, scope and timing of the future capacity need at Basin TS, and assessment of possible wires and non-wires alternative (NWA) solutions to address the need.

Proceed with reinforcement of the Richview TS to Manby TS 230 kV corridor

The Working Group recommends that Hydro One proceed with the reinforcement of the Richview TS to Manby TS 230 kV corridor and begin community engagement, as well as initiate the environmental assessment (EA).

Keep options available to address long term regional supply capacity needs

For the longer-term regional capacity needs, including the Leaside TS and Manby TS autotransformers, Manby TS to Riverside Junction lines, and Bayview Junction to Balfour Junction circuit section, the Working Group recommends that the IESO coordinate continued planning work and engagement with stakeholders and the community to:

- Define and communicate, as soon as practicable, the longer-term capacity needs

[2] The RIP is described in Section 3.1.

- Identify opportunities for a range of cost-effective solutions, including NWAs such as DERs and energy efficiency
- Identify potential wires solutions and avoidable costs should these needs be deferred through NWAs

The information and insights developed through these activities will be used to inform the next regional planning cycle.

3. Development of the Plan

3.1 The Regional Planning Process

In Ontario, planning to meet an area's electricity needs at a regional level is completed through the regional planning process, which assesses regional needs over the near, medium, and long term, and develops a plan to ensure cost-effective, reliable electricity supply. A regional plan considers the existing transmission electricity infrastructure in an area, local supply resources, forecast growth and area reliability; evaluates options for addressing needs; and recommends actions to be undertaken.

The current regional planning process was formalized by the OEB in 2013, and is conducted for each of the province's 21 electricity planning regions by the IESO, transmitters and local distribution companies (LDCs) on a five-year cycle.

The process consists of four main components:
1) A needs assessment, led by the transmitter, which completes an initial screening of a region's electricity needs;
2) A scoping assessment, led by the IESO, which identifies the appropriate planning approach for the identified needs and the scope of any recommended planning activities;
3) An IRRP, led by the IESO, which identifies recommendations to meet needs requiring coordinated planning; and/or
4) An RIP led by the transmitter, which provides further details on recommended wires solutions.

More information on the regional planning process and the IESO's approach to regional planning can be found in Appendix A: Overview of the Regional Planning Process.

3.2 Toronto Region Working Group and IRRP Development

Development of the Toronto region IRRP was initiated in late 2017 with the release of a needs assessment prepared by Hydro One on behalf of the Toronto Regional Planning Working Group comprised of the IESO, Toronto Hydro, Alectra Utilities, Veridian Connections (now elexicon energy) and Hydro One Distribution. The report identified transmission needs that may require coordinated planning in the Toronto region, with needs limited to the electrical system within the municipal boundaries of the City of Toronto.

Subsequent to the Needs Assessment Report, the IESO prepared a Scoping Assessment Outcome Report, which recommended that an IRRP be undertaken to address a number of needs, owing to the potential for coordinated solutions. No sub-regions were identified for the purpose of carrying out this IRRP. Given the location of the needs identified, the IRRP Working Group was determined at the scoping assessment stage to include the IESO, Toronto Hydro and Hydro One.[3]

In 2018, the Working Group began gathering data, conducting assessments to identify near term to long term needs in the area, and recommending actions to address Toronto's electricity transmission needs.

---

[3] Distribution system planning does not fall within the scope of a regional planning study, though regional plans may inform distribution system plans. Distribution system plans are undertaken by local distribution companies and reviewed and approved by the OEB under a separate process.

4. Background and Study Scope

This is the second cycle of regional planning for the Toronto region. When the OEB formalized the regional planning process in 2013, planning was already underway in the Central Toronto area, a sub-region of Toronto that includes the downtown core. As such, Central Toronto became one of the Group 1 planning regions, and the first to participate in the formalized regional planning process.

The first cycle of regional planning for the Toronto region was completed in January 2016 with the publication of Hydro One's RIP for the Central Toronto area. Subsequent to the completion of an IRRP for Central Toronto (in April 2015), the IESO published an update to the IRRP that accounted for plans to convert commuter heavy rail in the GTA from diesel to electric power.

The second cycle of regional planning for Toronto was initiated by Hydro One in mid-2017. Following publication of a needs assessment in October 2017, a scoping assessment, released in February 2018, identified a number of needs requiring further regional coordination, and recommended that an IRRP for the Toronto region be initiated. No sub-regions within Toronto were recommended for this IRRP.

Building on past regional studies and taking into account updates to activities, including investments in electricity infrastructure and Toronto Hydro's long term outlook for electricity, this IRRP focuses on:

- Identifying recommendations for replacing assets that are reaching end of life
- Supporting and enabling growth and planned urban development
- Maintaining a high level of reliability performance

To set the context for this IRRP, the scope of the planning study and the area's existing electricity system are described in Section 4.1.

4.1 Study Scope

This IRRP, prepared by the IESO on behalf of the Working Group, recommends options to meet the regional electricity needs of the Toronto region. Guided by the principle of maintaining an adequate level of reliability performance as per the *Ontario Resource and Transmission Assessment Criteria* (ORTAC), this study recognizes the importance of electricity service to the functioning of a large urban centre. The Toronto Region Scoping Assessment Outcome Report established the objectives, scope, roles and responsibilities, and timelines for this IRRP. The plan considers the long term outlook for electricity peak demand, energy efficiency, and transmission system capability and transmission asset condition. Options for addressing needs also considered relevant transmission and distribution system projects and capabilities, community plans, and distributed energy resources (DERs).

The transmission facilities that were included in the scope of this study are presented in Table 4-1 (stations) and Table 4-2 (circuits).

Table 4-1: Summary of Station Facilities (230 kV and 115 kV)

Leaside 115 kV	Manby 115 kV	East 230 kV	North 230 kV	West 230 kV
Basin TS	Copeland TS	Bermondsey TS	Agincourt TS	Horner TS
Bridgman TS	Fairbanks TS	Ellesmere TS	Bathurst TS	Manby TS[3]
Carlaw TS	John TS	Leaside TS[4]	Cavanagh TS	Rexdale TS
Cecil TS	Runnymede TS	Scarboro TS	Fairchild TS	Richview TS
Charles TS	Strachan TS	Sheppard TS	Finch TS	
Dufferin TS	Wiltshire TS	Warden TS	Leslie TS	
Duplex TS			Malvern TS	
Esplanade TS				
Gerrard TS				
Glengrove TS				
Main TS				
Terauley TS				
Hearn SS[5]				

[4] Includes the step-down transformers and 230/115 kV autotransformers
[5] Hearn Switching Station (SS)

Table 4-2: Summary of Transmission Circuits (230 kV and 115 kV)

230 kV	115 kV	
C10A	C5E	K11W
C14L	C7E	K12W
C15L	D11J	K13J
C16L	D12J	K14J
C17L	D6Y	K1W
C20R	H10DE	K3W
C2L	H11L	K6J
C3L	H12P	L12C
C4R	H13P	L13W
R1K	H14P	L14W
R2K	H1L	L15
R13K	H2	L16D
R15K	H2JK	L18W
R24C	H3L	L2Y
K21C	H6LC	L4C
K23C	H7L	L5D
	H8LC	L9C
	H9DE	

Transmission supply is provided to Toronto Hydro from 35 step-down transformer stations that are supplied by transmission voltages operating at either 230 kV or 115 kV. Toronto Hydro delivers electricity from these transmission supply points to its customers through its own electricity distribution system. Eighteen 230 kV step-down transformer stations supply the eastern, western and northern parts of Toronto (18 of these stations supply 27.6 kV voltage and two also supply 13.8 kV electricity to the distribution system); and 17 115 kV step-down stations supply the Central Toronto area (15 at 13.8 kV and two at 27.6 kV on the distribution side). The supply to these central 115 kV stations comes from two 230 kV/115 kV autotransformer stations (Leaside TS and Manby TS). The Toronto region also includes the Portlands Energy Centre (PEC) connected to the 115 kV transmission system (within the Leaside TS sector). The PEC 550 MW combined-cycle power plant plays an important role locally, and for the provincial electricity system, in providing reliable capacity to meet electricity demand, as well as reactive power and voltage support. Hearn SS provides 115 kV switching facilities for the Leaside area and also connects PEC to this system.

The Toronto region and its transmission supply infrastructure are shown in Figure 4-1 (map) and Figure 4-2 (single line diagram). Transmission circuit nomenclature used throughout this report (e.g., H1L, H3L, etc.) can be referenced using the single line diagram.

Figure 4-1: The Regional Transmission System Supplying Toronto

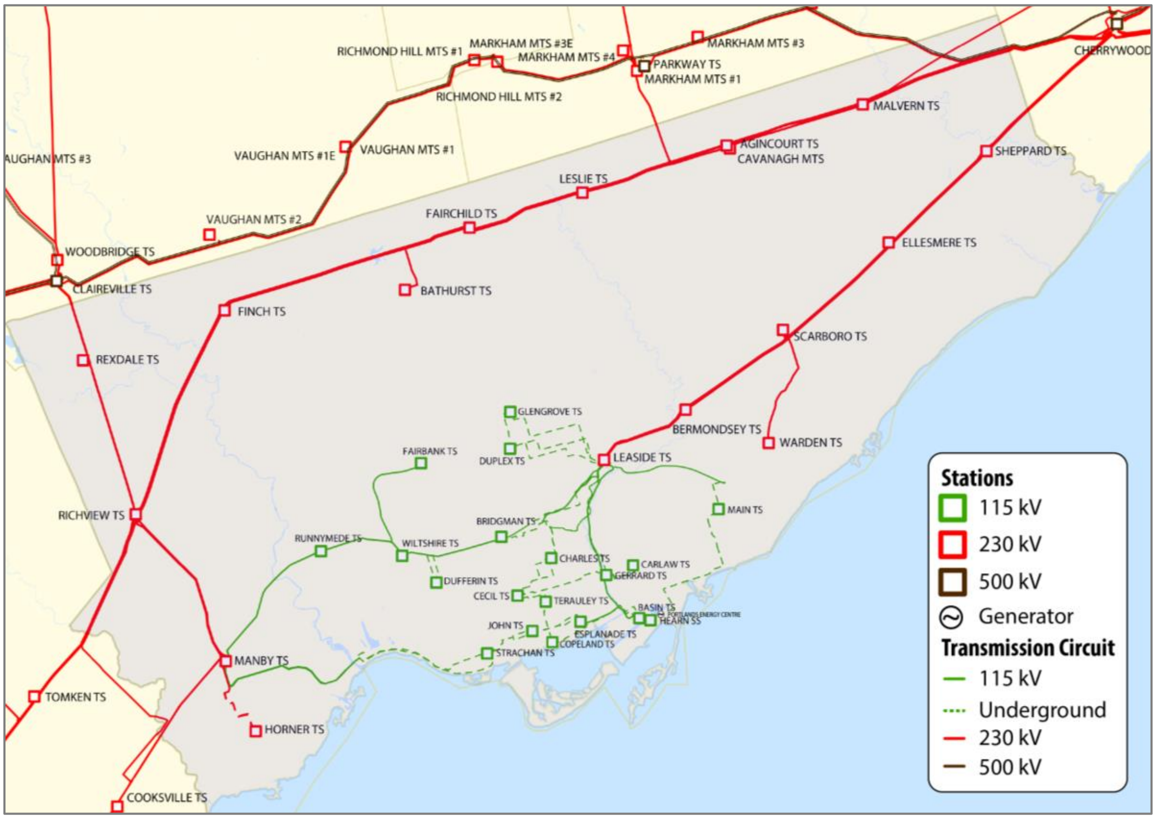
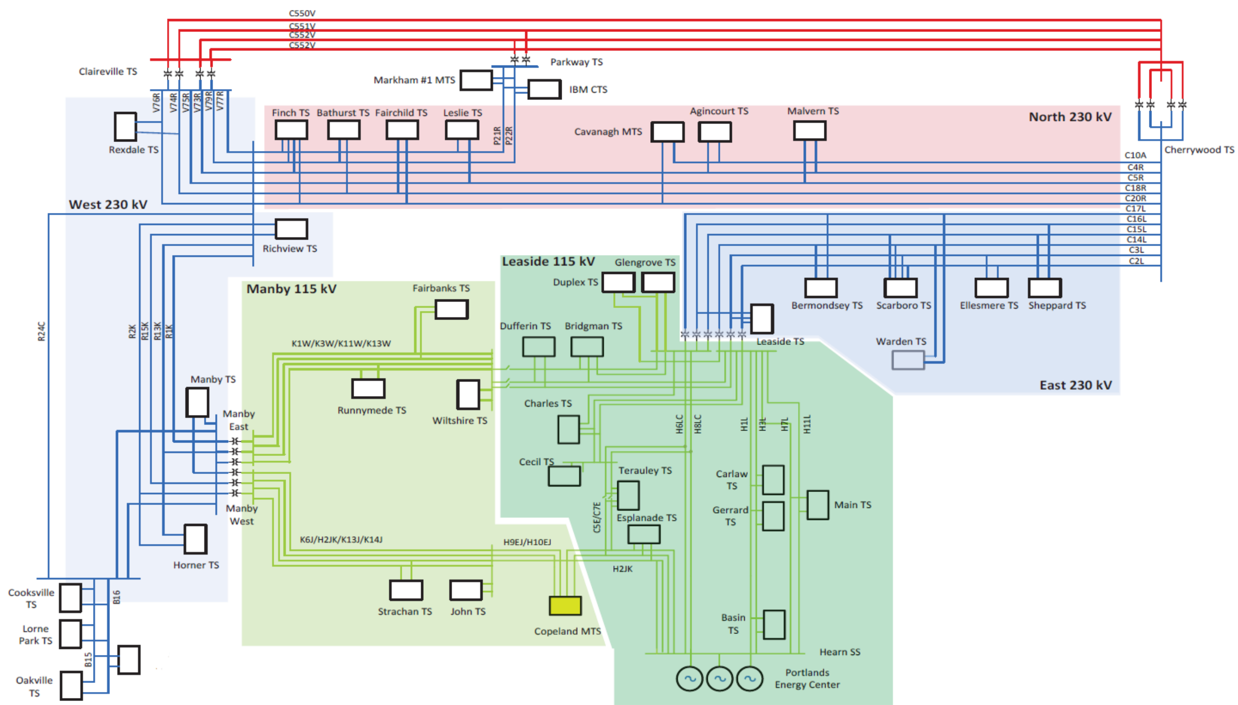


Figure 4-2: The Toronto Region Electrical System (Single-Line Diagram)



Completing the Toronto IRRP involved:

- Preparing a long term electricity peak demand outlook (forecast);
- Examining the load meeting capability and reliability of the transmission system supplying the region, taking into account facility ratings and performance of transmission elements, transformers, local generation, and other facilities (such as reactive power devices);
- Assessing system needs by applying a contingency-based assessment and reliability performance standards for transmission supply in the IESO-controlled grid as described in Section 7 of ORTAC;
- Confirming identified end of life asset replacement needs and timing with Hydro One;
- Establishing alternatives to address system needs, including, where feasible and applicable, possible energy efficiency, generation, transmission and/or distribution, and other approaches such as NWAs;
- Engaging with the community on needs, findings, and possible alternatives;
- Evaluating alternatives to address near and long term needs; and
- Communicating findings, conclusions, and recommendations within a detailed plan.

5. Peak Demand Outlook

The electricity system needs that are in scope for regional planning are driven by the limits of the transmission infrastructure supplying an area, which is sized to meet peak demand requirements (rather than energy demand requirements).[6] Peak demand requirements appearing at the station level are aggregated to understand the limits of the regional transmission system supplying the area as well as individual stations. Regional planning typically focuses on the regional-coincident peak demand to assess regional transmission needs, and individual station peaks to assess local transformer station capacity needs (the demand outlook is broken down spatially by transformer station, or each dual element spot network (DESN) that makes up a station[7]).

Individual stations within the Toronto study area typically experience peak loading at around the same time (e.g., weekdays, generally between 4 and 6 p.m. in summer, after consecutive hot days). There is also a high degree of coincidence between when individual stations peak and when the region peaks.

5.1 Demand Outlook Methodology

Toronto Hydro, in consultation with the Working Group, prepared a peak demand outlook at the transformer station bus level per IESO requirements for performing this study.

The outlook was developed in two parts:

1. Development of the Gross Peak Demand Outlook (Gross Outlook)
2. Development of the Net Peak Demand Outlook (Net Outlook)

The Gross Outlook recognizes the strengths of different forecasting methodologies for different time periods. The first 10 years is based upon the linear regression of past peak demands combined with known load additions and load redistributions. The period beyond 10 years is

---

[6] Peak demand of the electric system is typically measured in terms of megawatts (MW) capacity; energy is the capacity needed over a period of time, for example, one megawatt used over one hour is a megawatt-hour (MWh).
[7] A DESN refers to a standard station layout, where two supply transformers are configured in parallel to supply one or two medium-voltage switchgear (for example, 13.8 kV or 27.6 kV), which the distributor uses to supply load customers. This parallel dual supply ensures reliability can be maintained in the event of an outage or planned maintenance. A single local transformer station can have one, two, or more individual DESNs.

based upon the growth rates predicted from an econometric model that takes population, employment, and long term weather into account.

The Gross Outlook is a "business-as-usual" peak demand forecast under extreme weather. The Net Outlook considers load drivers that are over and above those considered in the "business as usual" Gross Outlook. These "new and emerging" load drivers were:

- electric vehicles
- electrification of mass transit
- fuel switching from natural gas to electric for space heating and water heating
- energy storage

The result was a station-by-station outlook of annual peak demand through to 2041. More details may be found in Appendix B: Peak Demand Outlook for Toronto 2017-2041.

5.2 The Outlook for Energy Efficiency

The outlook for future peak demand savings is based on mandated efficiencies from Ontario building codes and equipment standards, which set minimum energy efficiency levels through codes and regulations. To estimate the impact of efficiency codes and standards in the Toronto region, the peak demand savings for the residential, commercial and industrial sectors were estimated at the provincial level, compared with Toronto's station-based peak demand forecast, and expressed as a percentage of peak demand offset on an annual basis. This estimation took into account the breakdown of the peak demand at the station of residential, commercial, and industrial sector demand. Estimated peak demand savings, in MW, were calculated based on the percentage demand offset and the Demand Outlook described in Section 5.1.

These savings were subtracted from the demand outlook, and this forecast with efficiency codes and standards was used to test the sensitivity of the need dates as identified by the Net Outlook described in Section 5.1.

Table 5-1 shows the total peak demand savings attributable to efficiency codes and standards for the Toronto area, for selected years within the planning horizon.

Table 5-1: Estimated Peak Demand Savings from Codes and Standards

Year	2020	2025	2030	2040
Estimated savings (MW)	86	159	242	311

Source: IESO

A more detailed methodology on the outlook for energy efficiency, including assumptions and a breakdown by station and year, is provided in Appendix C: Energy Efficiency Forecast.

5.3 Outlook for Distributed Energy Resources

In addition to energy efficiency, DERs in the Toronto region have previously offset, and are expected to continue to offset peak demand. Previous procurements, including the Feed-in Tariff (FIT) Program, have helped to increase the amount of renewable DERs in Toronto. Other competitive generation procurements have also resulted in additional DER types, such as combined heat and power (CHP) projects. [8] The DERs under contract with the IESO include a mix of solar photovoltaics (PV), CHP, and wind resources.

Further to these, competitive procurement pilots run by the IESO for energy storage resources have resulted in some energy storage projects in the region, and are supporting efforts to better understand the barriers related to integration of energy storage into Ontario's electricity market.

The peak demand impact of DERs that were connected to the system at the time the demand outlook was produced would be implicitly accounted for in the outlook. Given the difficulty of predicting where future DERs may be located, and uncertainty around future DER uptake, no further assumptions have been made regarding future DER growth. Instead of assuming future DER growth implicitly as a load modifier in the demand outlook, the potential of future DERs will be considered as potential solution options.

While the FIT Program and other competitive procurements for small-scale generation, including CHP, have ended, the IESO has been engaged in developing market-based mechanisms to enable a variety of electricity resources to compete in the electricity market. In addition, the IESO is engaged in several activities to enable DERs as alternatives to wires-based solutions. This includes working with other sector participants to identify and overcome

[8] Since the IRRP forecast was developed, contracts for some generators included in the 2017 list have been terminated.

barriers to DER participation and implementation, as many of the issues extend beyond the IESO's mandate.

The IESO's work and other electricity sector initiatives related to DER barriers are expected to inform ongoing discussions on possible future DER options in Toronto, as per the recommendations made in this IRRP.

6. Power System Needs

Based on the demand outlook, system capability, identified end of life asset replacement needs, and application of provincial planning criteria, the Working Group identified electricity needs in the Toronto region in the near, medium, and long term.

6.1 Needs Assessment Methodology

ORTAC,[9] the provincial criteria for assessing the reliability of the transmission system, was applied to assess supply capacity and reliability needs. ORTAC includes criteria related to the assessment of both the bulk transmission system and local or regional reliability requirements. See Appendix D: Toronto IRRP Study Results, and Appendix E: Station Capacity Assessment, for more details.

In applying ORTAC, three broad categories of needs can be identified:

- **Local Capacity** describes the electricity transmission system's ability to deliver power to LDCs through regional step-down transformer stations. This is determined by the Limited Time Rating (LTR) of the station, which is typically determined by the rating of its smallest transformer(s), under the assumption that the largest transformer is out of service.[10]
- **Regional Capacity** is the electricity transmission system's ability to provide continuous supply to LDCs in a local area, which is limited by the load meeting capability (LMC) of the transmission facilities in the area. The LMC is determined by evaluating the maximum peak demand that can be supplied to an area accounting for limitations of the transmission element(s) (e.g., a transmission line, group of lines or autotransformer), when subjected to contingencies and criteria prescribed by ORTAC. LMC studies are conducted using power system simulations analysis (see Appendix D, Toronto IRRP Study Results, for more details). Regional capacity needs are identified when the peak demand for the area exceeds the LMC of regional transmission facilities.
- **Load Security and Restoration** is the electricity transmission system's ability to minimize the impact of potential supply interruptions in the event of a credible contingency (e.g., a transmission outage considered for planning purposes), such as an outage on a double-circuit tower line resulting in the loss of both circuits. Load security

[9] http://www.ieso.ca/imoweb/pubs/marketadmin/imo_req_0041_transmissionassessmentcriteria.pdf

[10] A station's rating is determined by its most limiting component(s), which may not always be the transformer(s).

describes the maximum limit of load interruption that is permissible in the event of a transmission outage considered for planning. These limits reflect past planning practices in Ontario. Load restoration describes the electricity transmission system's ability to restore power to a transmission customer (e.g., LDC) affected by a transmission outage within specified time frames. Specific requirements can be found in ORTAC, Section 7, Load Security and Restoration Criteria.

The plan also identifies requirements related to the end of life of transmission assets. End-of-life asset replacement needs are identified by the transmitter based on a variety of factors, such as asset age, condition, expected service life, and risk associated with the failure of the asset. Replacement needs identified in the near and early medium term time frame typically reflect the assessed condition of the assets, while replacement needs identified in the longer term are often based on the equipment's expected service life. As such, any recommendations for medium term needs or those farther out reflect a potential for the need date to change based on priority and/or updates to asset condition.

6.2 Power System Needs

Through the planning studies for the Toronto IRRP, the Working Group identified four main categories of needs: (1) end of life asset replacement, (2) local transformer station capacity, (3) regional supply capacity, and (4) load security and restoration. In addition, pursuant to ORTAC provisions, maintaining a higher level of reliability performance (i.e., above the minimum standards) was also considered which identified some 'discretionary' reliability needs.[11] The specific needs under each of these categories are explained in the sections that follow.

6.2.1 End-of-life Asset Replacement Needs

Hydro One identified a number of end of life transmission asset replacement needs for the Toronto region in the needs assessment phase of this regional planning cycle, with several needs arising in the near to medium term.

[11] 'Discretionary' reliability needs are transmission system issues that are flagged through the application of a uniform set of planning criteria for all of Toronto's transmission system (e.g., by applying 'bulk power system' criteria to 'local area' facilities). This identifies issues that are discretionary in the sense that the reliability performance of the system complies with the criteria; but may represent opportunities to improve reliability to an area if cost-effective opportunities are available.

Since end of life needs are based on the best available asset condition information at a given point, the timing of asset replacement can change, as more recent asset condition results become available. If asset deterioration occurs faster than predicted, need dates may need to be advanced. As a result, the scope and timing of some of these needs have been updated since the needs and scoping assessments were completed.

6.2.1.1 Near-term Asset End-of-life Replacement Needs

Three near term asset end of life replacement needs were addressed within the scope of this plan (Table 6-1). These needs are described further in this Section. The options considered for addressing these needs are described in Section 7.1.1.

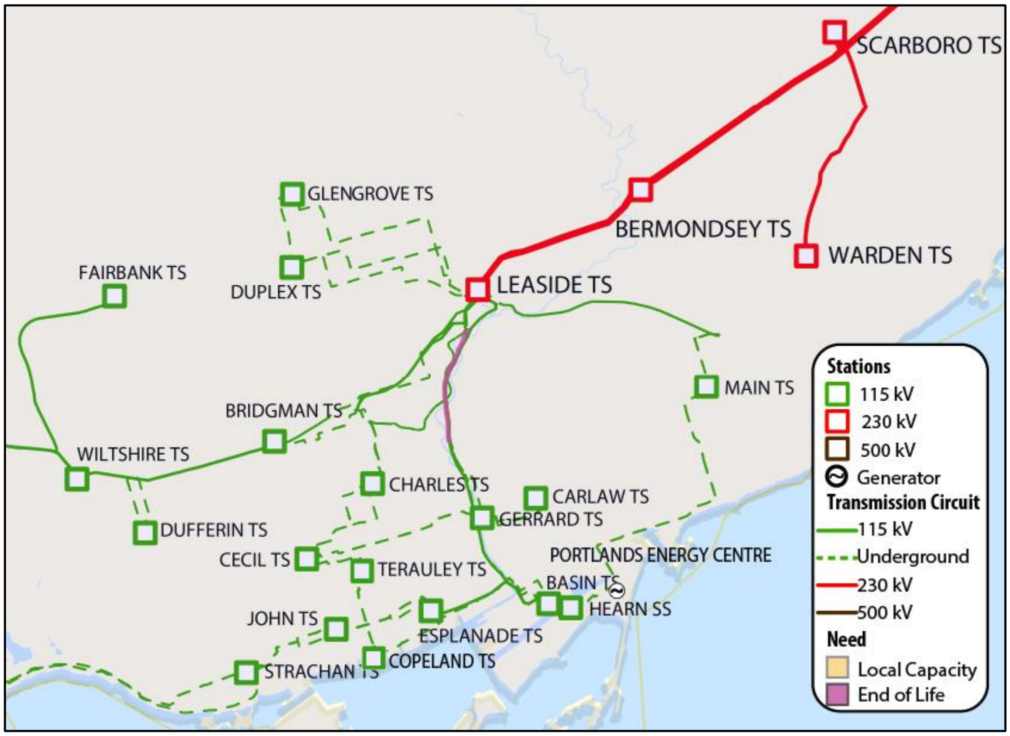
Table 6-1: Toronto Region End-of-life Asset Replacement Needs (Near term)

Facilities	Need	Expected Timing
Leaside Junction to Bloor Street 115 kV overhead transmission lines (H1L/H3L/H6LC/H8LC)	End of life of the approximate 2-km overhead line sections	2022-2023
Leaside TS to Balfour Junction 115 kV overhead transmission lines (L9C/L12C)	End of life of the approximate 3.6-km overhead line sections	2023-2024
Main TS	End of life of transformers T3 and T4, 115 kV line disconnect switches, and 115 kV current voltage transformers	2021-2022

<u>Leaside to Bloor Street 115 kV overhead transmission lines (H1L/H3L/H6LC/H8LC)</u>

The 115 kV overhead transmission lines H1L, H3L, H6LC, and H8LC provide supply to the eastern part of central Toronto from Leaside TS. The end of life part of the line is a 2-km section that runs from Leaside Junction to Bloor Street Junction in the Don Valley, and is on a common tower with four circuits (Figure 6-1). Hydro One has determined the conductors are reaching the end of their useful life, and will need to be replaced by 2022-2023 to maintain safety and reliability.

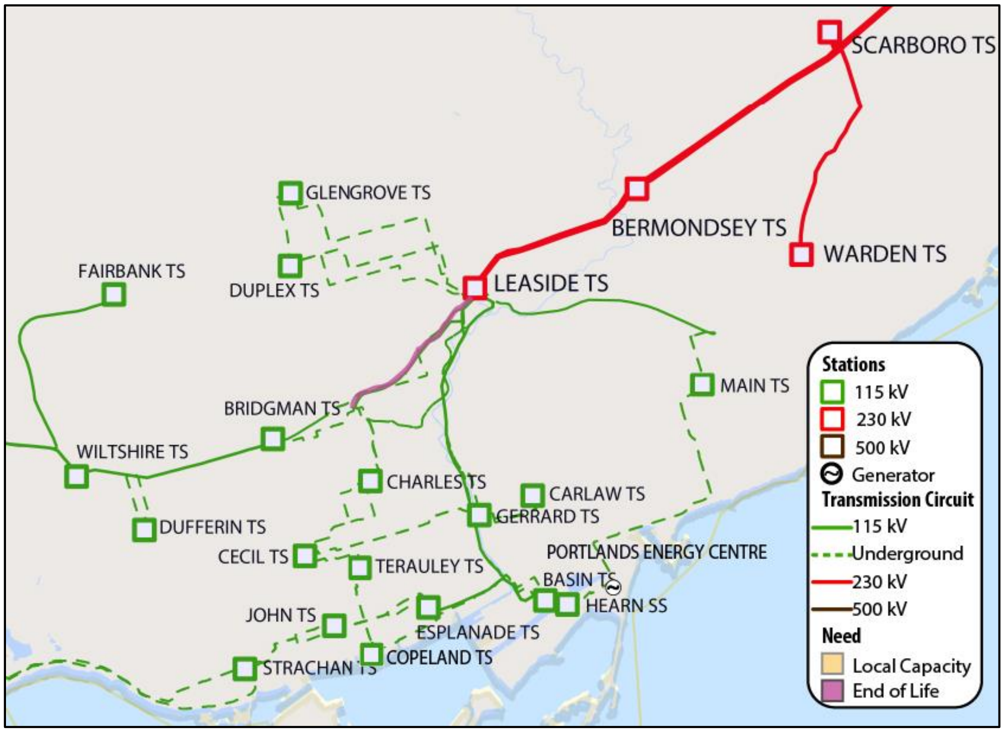
Figure 6-1: Leaside to Bloor Street Junction 115 kV Overhead Transmission Lines



Leaside to Balfour 115kV overhead transmission lines (L9C/L12C)

The 115 kV overhead transmission lines L9C and L12C provide supply to central Toronto from Leaside TS (to Cecil TS). The section of the line that runs between Leaside TS and Balfour Junction is about 3.6 km in length, and runs through the Don Valley and along an existing rail corridor (Figure 6-2). This line is more than 80 years old and the conductors have been identified by Hydro One as reaching the end of their useful life, and requiring replacement by 2023-2024 to maintain safety and reliability.

Figure 6-2: Leaside to Balfour 115kV Overhead Transmission Lines



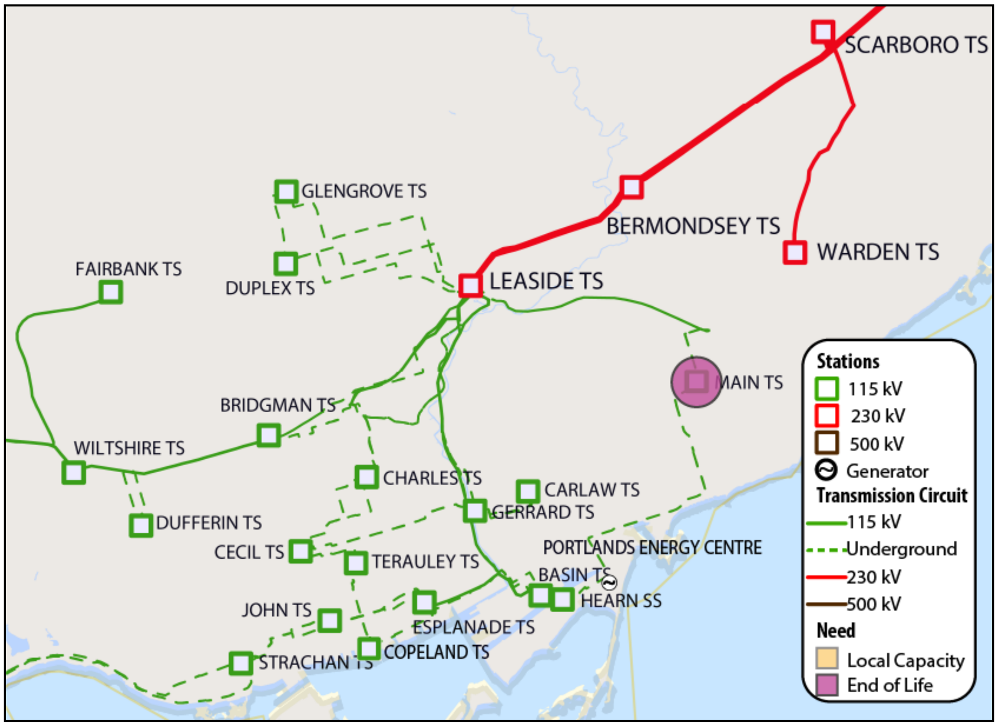
Main TS transformers and associated station equipment

Main TS is a local transformer station serving approximately 60 MW of load in east-central Toronto, including the Danforth and Beach neighbourhoods (Figure 6-3). The two transformers at the station, T3 and T4, are currently about 50 years old. Hydro One is currently working with Toronto Hydro to replace the end of life transformers, along with other equipment, such as 115 kV line disconnect switches, current transformers and voltage transformers.

Main TS is supplied by a combination of overhead and underground 115 kV circuits from Leaside TS to Hearn TS (H7L and H11L). Two sections of the original underground cable supply circuits are currently undergoing refurbishment due to their age (about 60 years old) and condition.

The station is currently more than 70 per cent utilized and resupplying the area load via adjacent station facilities is not possible. As with many established areas of the city, urban growth and development is likely in the Main TS area.

Figure 6-3: Location of Main TS



6.2.1.2 Medium-term Asset End-of-life Replacement Needs

Four asset end of life replacement needs occurring in the medium term were considered within the scope of this plan (Table 6-2). These needs are described further in this Section. The options considered for addressing these needs are described in Section 7.1.1.

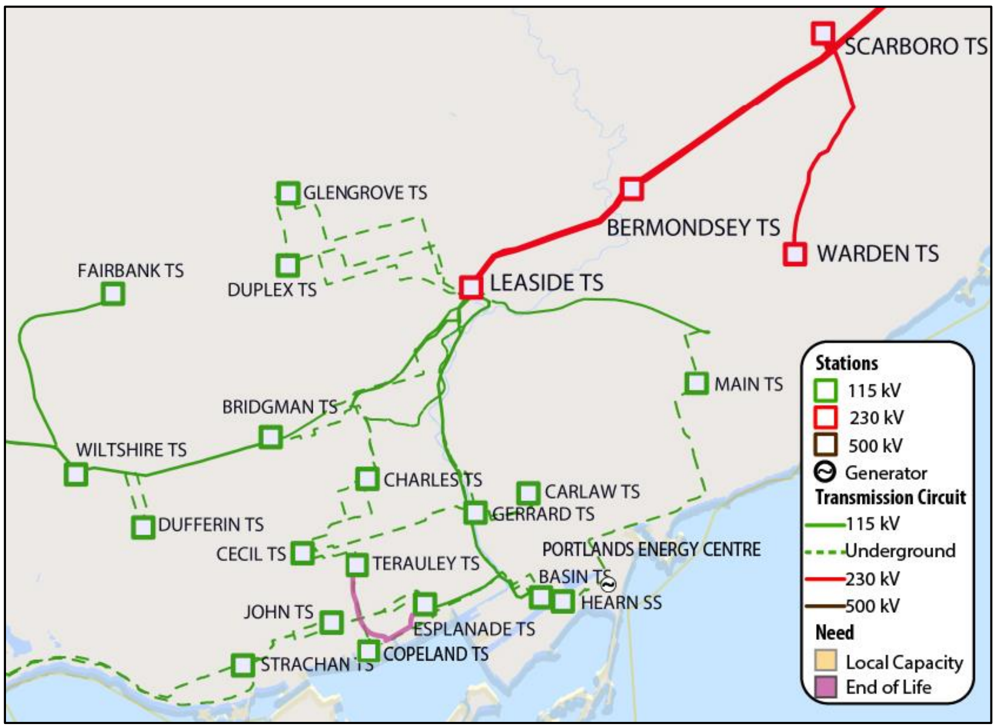
Table 6-2: Toronto Region End-of-life Asset Replacement Needs (Medium term)

Facilities	Need	Expected Timing
Esplanade TS to Terauley TS 115 kV underground transmission cables (C5E and C7E)	End of life of underground cables from Esplanade TS to Terauley TS in downtown Toronto	2024-2025
Manby TS	End of life of major station equipment, including: autotransformers T7, T9, and T12, step-down transformer T13, and the 230 kV yard	2025-2026
John TS	End of life of transformers T1, T2, T3, T4, T6, and 115 kV breakers	2026-2027
Bermondsey TS	End of life of transformers T3 and T4	2025-2026

C5E/C7E 115 kV underground transmission cables

The 115 kV underground transmission cables C5E and C7E provide supply to Terauley TS in Toronto's downtown core. Installed more than 58 years ago, these paper-insulated, low-pressure oil filled cables extend about 3.6 km from Esplanade TS to Terauley TS, and are partially routed near Lake Ontario (Figure 6-4). They have been deemed by Hydro One to be at the end of their useful life, and requiring replacement as soon as possible, given that the risk of cable failure resulting in oil leaks and adverse environmental impacts is increasing with time.

Figure 6-4: C5E/C7E 115 kV Underground Transmission Cables

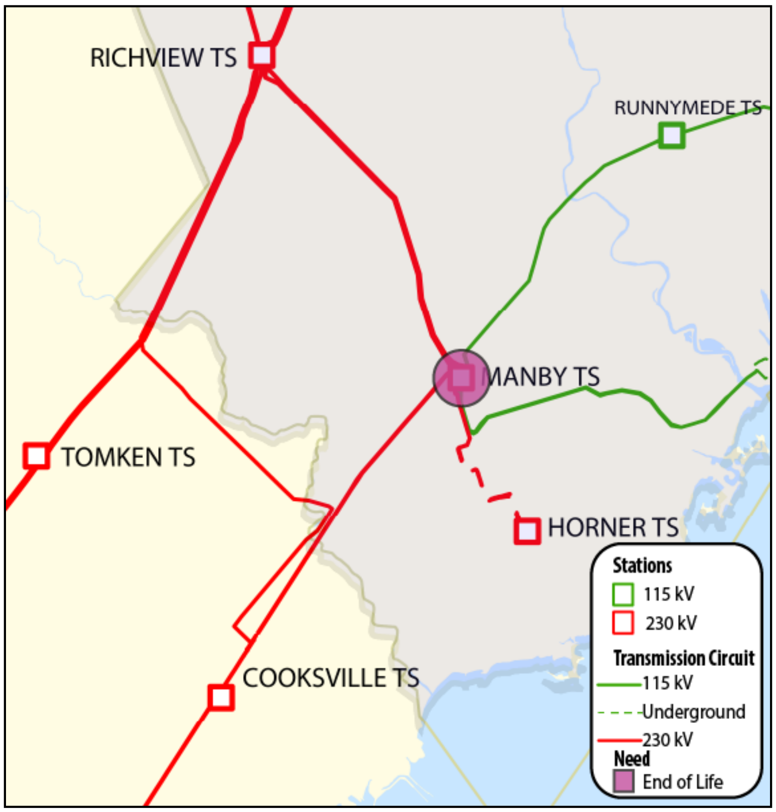


Manby TS

Manby TS is a major switching and autotransformer station supplying the western portion of the central Toronto 115 kV transmission system (Figure 6-5). Station facilities include six 230 kV/ 115 kV autotransformers (T1, T2, T7, T8, T9 and T12), a 230 kV switchyard, a 115 kV switchyard, and three DESNs with six 230/27.6 kV step-down transformers that supply customers in the immediate vicinity of the station. Three of the autotransformers (T7, T9 and T12) and one of the step-down transformers (T13) are close to 50 years old and, along with the 230 kV oil circuit breakers, have been identified to be at the end of their useful life. All of this end of life equipment is scheduled to be replaced in 2025-2026.

Addressing end of life needs at Manby TS represents a major undertaking that needs to be well coordinated in consideration of Toronto's long term needs and future supply options.

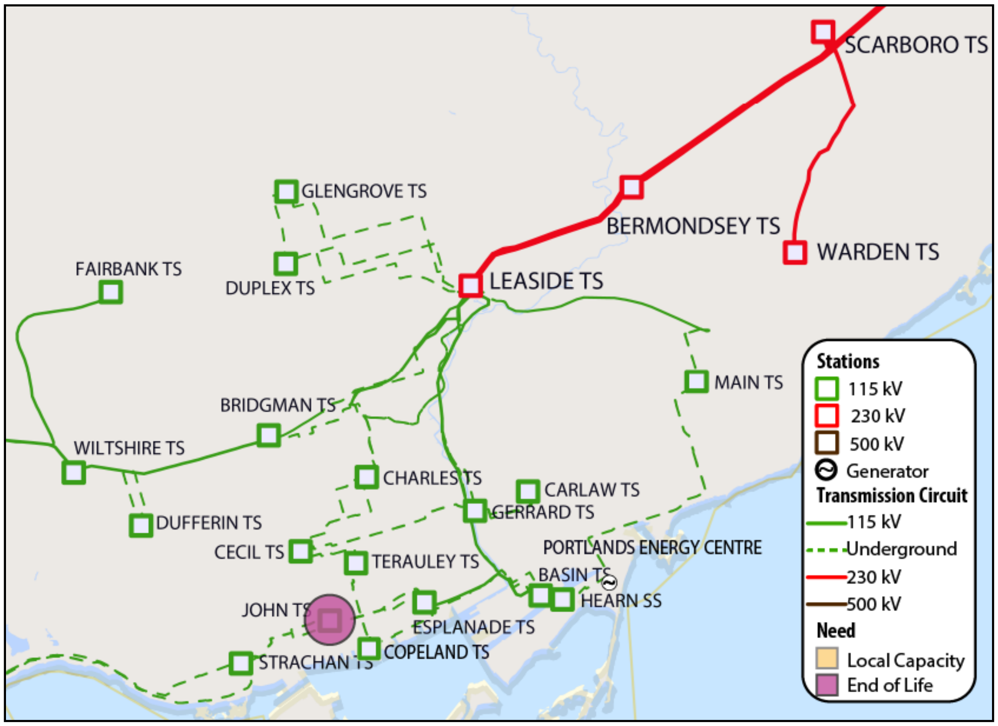
Figure 6-5: Location of Manby TS



John TS

Built in the 1950s, John TS is connected to the 115 kV Manby West system and supplies much of Toronto's downtown financial district (Figure 6-6). Station facilities include six 115/13.8 kV step-down transformers (T1, T2, T3, T4, T5 and T6) and a 115 kV switchyard. Toronto Hydro's switchgear at the station has reached the end of its useful life, and is expected to be replaced starting in 2024-2025. In addition, Hydro One has identified the step-down transformers at John TS (T1, T2, T3, T6), as well as the 115 kV breakers to be at the end of their useful life and require replacement within the near to medium term. Because of their deteriorated condition, transformer T4 has already been replaced and T1 is scheduled to be replaced in Q4 2019. The approximate timing for the station refurbishment is 2026-2027.

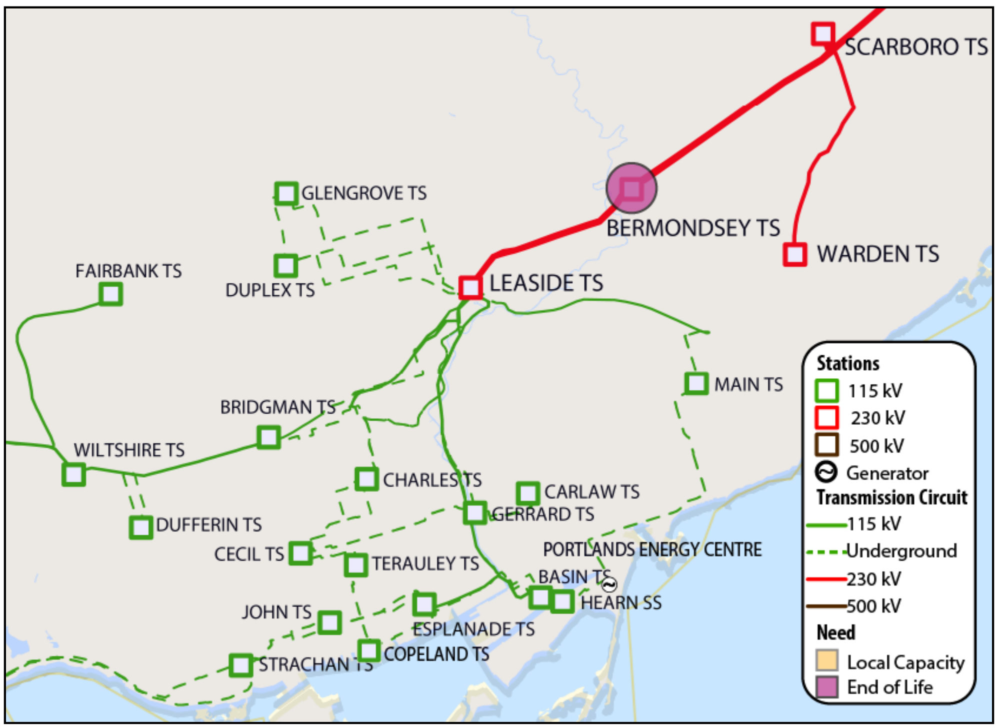
Figure 6-6: Location of John TS



Bermondsey TS

Bermondsey TS supplies customers in the western part of Scarborough (Figure 6-7). The station is comprised of two DESNs, one of which (T3/T4 DESN 2) was built in 1965, and the other (T1/T2 DESN 1) in 1990. DESN 2 has been identified by Hydro One to be at its end of life and is expected to be replaced by 2025-2026. Bermondsey TS has a total of 18 distribution feeders supplying Toronto Hydro customers: the older T3/T4 DESN 2 has 12 feeders, while the newer T1/T2 DESN 1 has six feeders. The total loading on the station is forecast to remain below its capacity over the planning horizon. This provides an opportunity to review configuration and component sizes to best meet future needs.

Figure 6-7: Location of Bermondsey TS



6.2.2 Supply Capacity Needs

Supply capacity needs at local step-down transformer stations were found at five transformer stations. A breakdown by year of the forecasted station loadings, as well as a more detailed description of the methodology for carrying out this assessment, is provided in Appendix E: Station Capacity Assessment.

6.2.2.1 Local Transformer Station Capacity Needs

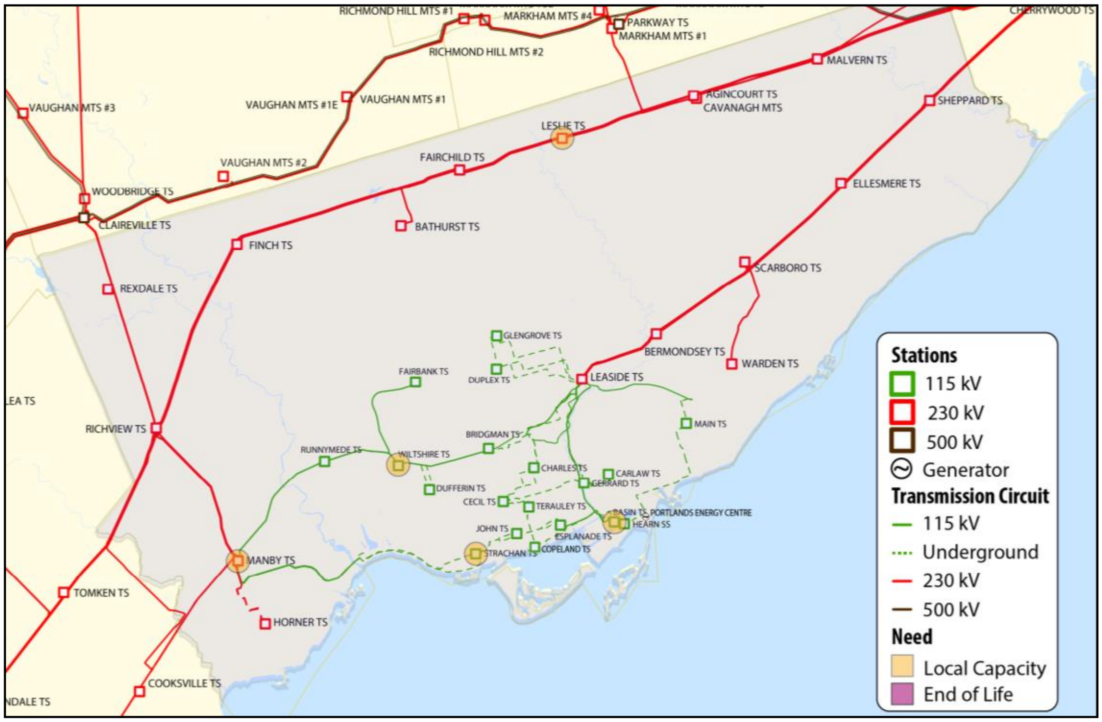
Table 6-3: Toronto Region Transformer Station Capacity Needs

Station	Description	Timing[12,13]
Manby TS	A transformer capacity need was identified for the load supplied by all three DESNs[14]	2023 for T5/T6 2032 for T3/T4 2034 for T13/T14
Strachan TS	A transformer capacity need was identified for the load supplied by both DESNs	2030 for T13/T15 2033 for T12/T14
Basin TS	A transformer capacity need was identified for the load supplied by the T3/T5 DESN (the only DESN at Basin)	2033
Leslie TS	A transformer capacity need was identified for the load supplied by the T3/T4 DESN	2033
Wiltshire TS	A transformer capacity need was identified for the load supplied by the T1/T6 DESN	2035

The locations of the local capacity needs are shown in Figure 6-8; four of the five local capacity needs are situated in the Central Toronto area.

[12] The timing presented in the table is consistent with the demand outlook provided by Toronto Hydro (net of new energy efficiency and distributed energy resources until the end of 2020); the timing of these capacity needs inclusive of future energy efficiency codes and standards is discussed in the subsections following the table.
[13] Even though local transformer station capacity needs are presented in terms of the individual DESNs within the station, for the purpose of planning and implementing solutions, the needs at each station are generally addressed as one need requiring a holistic solution.
[14] This need was identified and a solution was recommended in the 2015 Central Toronto IRRP. The status of the 2015 recommendation is discussed in Section 7.2.

Figure 6-8: Location of Local (Transformer Station) Capacity Needs



Manby TS (step-down transformation capacity)

Manby TS currently consists of three DESNs connected to the 230 kV system. This step-down transformer station, which supplies customers in the area surrounding Islington Town Centre from the Humber River west to the Toronto City limit, shares a yard with, but is separate from, the larger Manby 230/115 kV autotransformer station that provides 115 kV supply to the western portion of downtown Toronto. With a combined capacity of 240 MVA (216 MW), all three DESNs are forecast to exceed their capacity, starting in 2023 for the T5/T6 DESN 2, 2032 for the T3/T4 DESN 1, and 2034 for T13/T14 DESN 3.

The peak demand impacts of efficiency codes and standards were not taken into account for the timing of this need. Demand at Manby TS has already exceeded the station's capacity in several recent years. This issue was discussed in the 2015 Central Toronto IRRP, solutions were evaluated, and the recommendations to address the need are currently being implemented by Hydro One and Toronto Hydro. These include building a second DESN at Horner TS in south Etobicoke, and transferring load from Manby TS to the new Horner DESN.

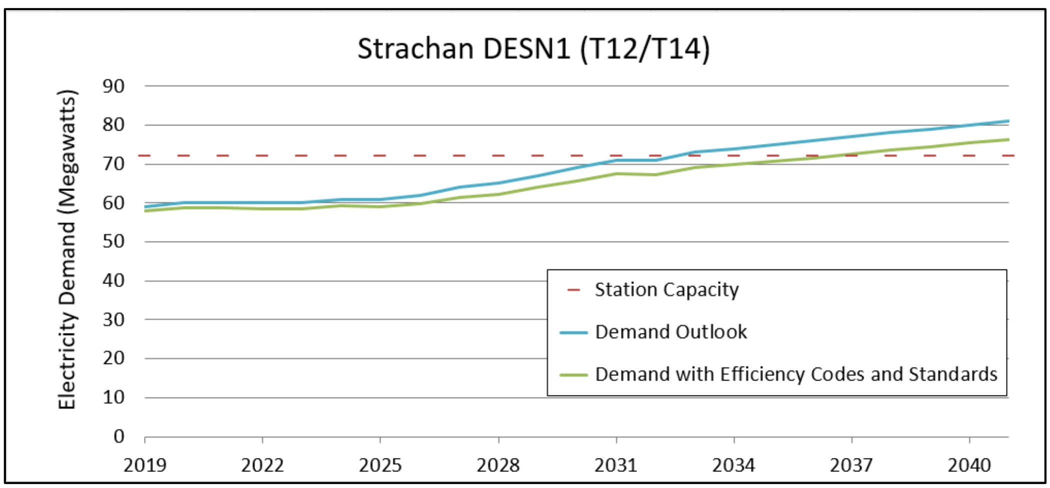
Strachan TS

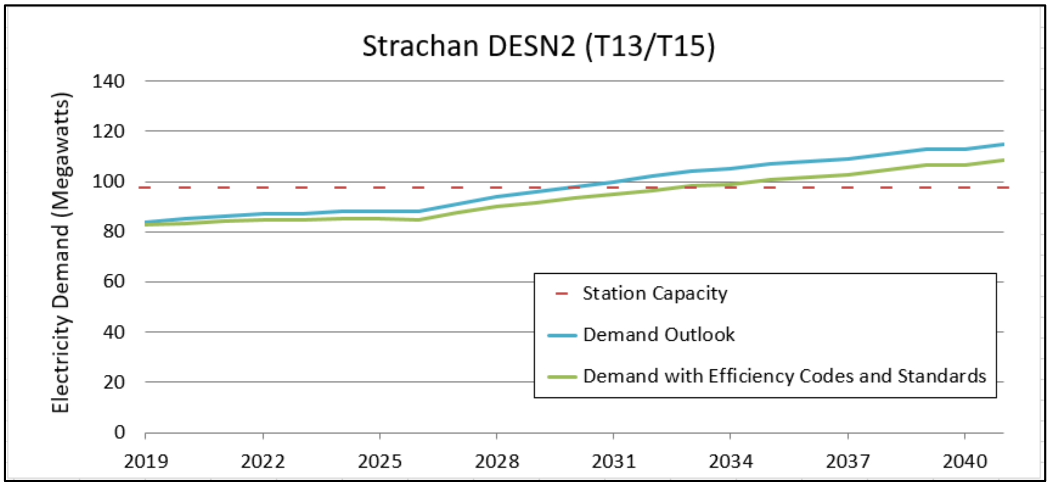
Strachan TS consists of two DESNs connected to the 115 kV system supplied from Manby TS (West Yard). Strachan TS supplies load to the west of the downtown core at 13.8 kV distribution voltage. The two DESNs have a combined capacity of 188 MVA, or 169 MW (80 MVA for T12/T14 DESN 1, and 108 MVA for T13/T15 DESN 2).

The T13/T15 DESN 2 is forecast to reach its capacity as early as 2030, while the T12/T14 DESN 1 is forecast to reach its capacity as early as 2033. Assuming the future potential impact of efficiency codes and standards, the timing of this need is deferred to 2033 and 2038 for the T13/T15 DESN 1 and T12/T14 DESN 2, respectively.

Figure 6-9 shows the demand outlook for the two DESNs at Strachan TS, as compared to the individual capacity of each DESN.

Figure 6-9: Demand Outlook for Strachan TS DESNs Compared to Capacity





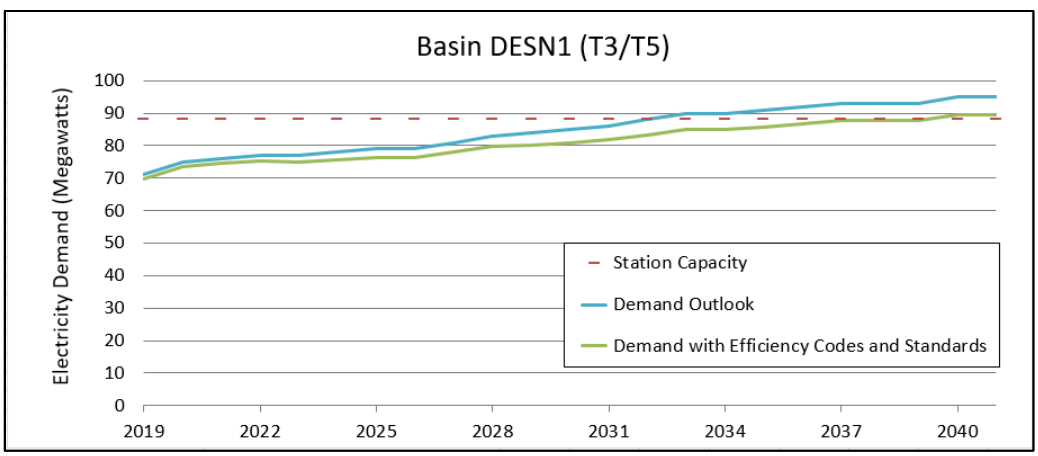
Basin TS

Basin TS has a single DESN (T1/T2) connected to the 115 kV system, supplying two low-voltage switchgear at a distribution voltage of 13.8 kV. The station has a total capacity of 98 MVA, or approximately 88 MW.

Basin TS is forecast to reach its capacity as early as 2033. Assuming the future potential impact of efficiency codes and standards (post-2020), the timing of this need is deferred to 2040.

Figure 6-10 shows the demand outlook for Basin TS, as compared to the station capacity.

Figure 6-10: Demand Outlook for Basin TS DESN Compared to Capacity



In addition to the forecast growth, the City of Toronto and Waterfront Toronto have been engaged in a master planning exercise for the Port Lands neighbourhood redevelopment and re-naturalization of the mouth of the Don River. These plans involve a number of requests to examine relocation or redesign parts of the 115 kV transmission network in and around Basin TS, including the possible relocation of Basin TS itself.

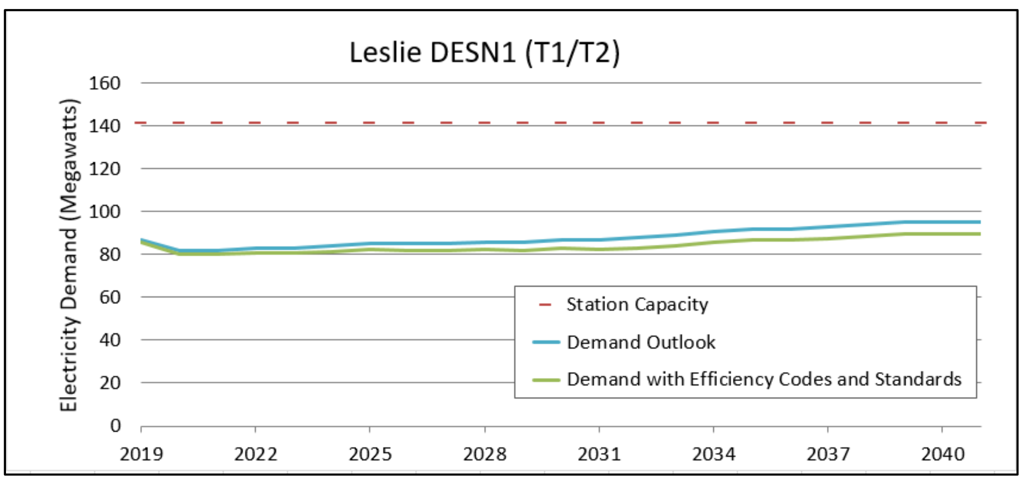
Given the absence of concrete plans and timelines for urban development in the area, the timing of the capacity need at Basin TS is uncertain.

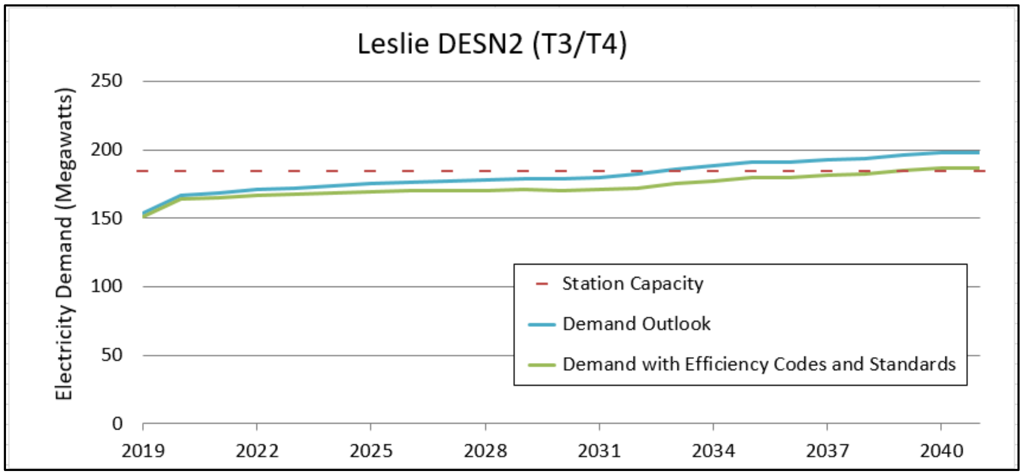
Leslie TS

Leslie TS has two DESNs connected to the 230 kV system. The T1/T2 DESN 1 supplies load at 27.6 kV and 13.8 kV, while the T3/4 DESN 2 supplies load at 27.6 kV. The total station capacity of Leslie TS is 325 MW. The T1/T2 DESN 1 has a capacity of 149 MVA (134 MW) and the T3/T4 DESN 2 has a capacity of 194 MVA (175 MW). While the other three transformers are relatively new (installed between 1988 and 2012), transformer T1, which was installed in 1963, may require replacement within the planning horizon of this IRRP, even though it has yet to be identified as being at the end of its life.

The T3/T4 DESN 2 is forecast to reach its capacity as early as 2033. Assuming the potential impact of future efficiency codes and standards, the timing of this need is deferred to 2039. Figure 6-11 shows the demand outlook for the two DESNs at Leslie TS, as compared to the individual capacity of each DESN.

Figure 6-11: Demand Outlook for Leslie TS Compared to Capacity





Wiltshire TS

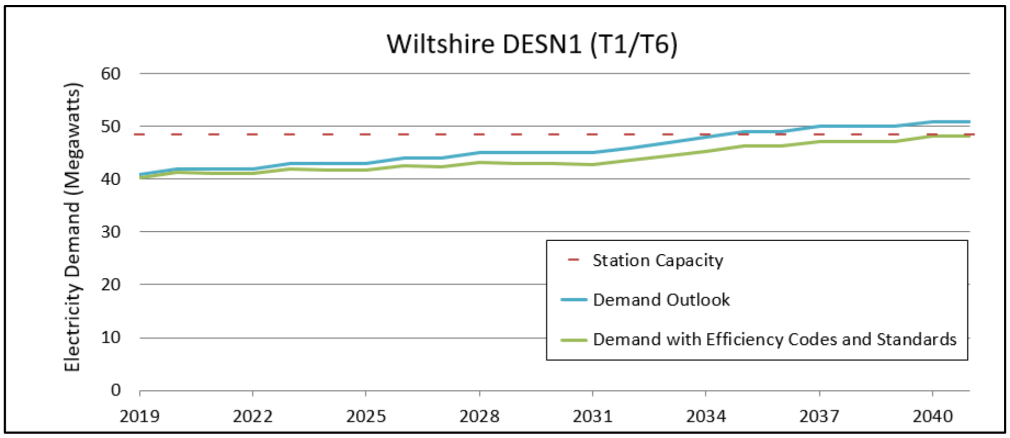
Wiltshire TS has two DESNs connected to the 115 kV system supplied from the Manby TS (East Yard). Wiltshire TS supplies customer demand to the northwest of the downtown core, including the Junction neighbourhood, at 13.8 kV distribution voltage. The two DESNs have a combined capacity of 151 MVA, or 136 MW: 51 MVA for the T1/T6 DESN 1, and 100 MVA for the T2/T7 DESN 2. These two DESNs supply three Toronto Hydro 13.8 kV buses.

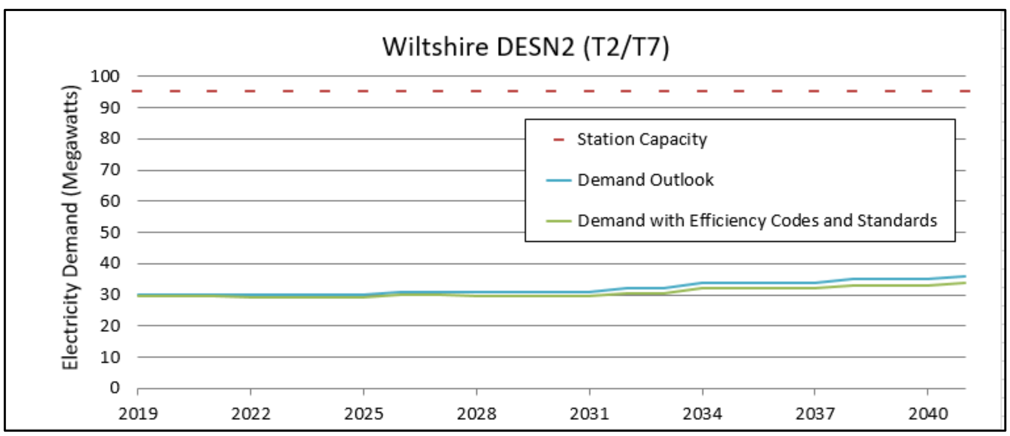
The outlook is forecasting load growth at Wiltshire TS, which can be attributed to growth and urban redevelopment in the area.

The T1/T6 DESN 1 is forecast to reach its capacity as early as 2035. Assuming the future potential impact of efficiency codes and standards, the timing of this need is beyond the study period.

Figure 6-12 shows the demand outlook for the two DESNs at Wiltshire TS, as compared to the capacity of each DESN.

Figure 6-12: Demand Outlook for Wiltshire TS DESN Compared to Capacity





6.2.2.2 Regional Supply Capacity Needs

Regional capacity needs are related to the 230 kV or 115 kV transmission system that delivers electricity from the interconnected grid into Toronto. The planning studies re-tested the need for the Richview TS to Manby TS 230 kV corridor upgrades that were recommended in the previous planning cycle. The results of this assessment reaffirm this need and are reported in this section. In the longer term, regional supply capacity needs emerge at Leaside TS, Manby TS, and on some 115 kV circuits within the Manby and Leaside Sectors.

Richview TS to Manby TS 230 kV corridor

The previous cycle of regional planning recommended that the 230 kV bulk supply to Manby TS from Richview TS be reinforced to accommodate demand growth in Toronto, primarily driven in the near term by mass transit projects. The planning studies undertaken for this IRRP re-tested the need for this additional LMC upstream of Manby TS, accounting for changes in assumptions related to the revised demand outlook provided by Toronto Hydro for the purpose of undertaking this IRRP, and the peak demand outlook for Cooksville west stations from the 2015 GTA West Needs Assessment.

The assessment confirmed that, under normal system configuration, the most limiting contingency is the loss, in 2021, of circuit R15K, which would cause R2K (also running from Richview TS to Manby TS) to exceed its capacity rating. This limitation exists regardless of whether the Metrolinx traction power substation (TPSS) is in-service; however, the additional capacity will support further mass transit electrification.

Without reinforcement to the Richview TS to Manby TS 230 kV circuits, the ability to transfer Dufferin TS to Manby East supply can become limited during summer peak conditions, following the same R15K single contingency. As discussed below (under Leaside TS and Manby TS autotransformers), transferring Dufferin TS to Manby TS supply is a possible control action in a PEC out-of-service scenario (as well as other issues that could impact supply in the Leaside TS sector). Since having this control action available helps ensure a reliable and resilient transmission supply to Toronto, the Working Group continues to recommend reinforcement of the Richview TS to Manby TS 230 kV circuits with a target in-service date as soon as possible.

The detailed assessment of the Richview TS to Manby TS corridor need is provided in Appendix F: Richview TS to Manby TS Corridor Study.

Supply to downtown Toronto from Manby West (Manby to Riverside Junction)

The Manby West supply sector comprises four 115 kV supply circuits (H2JK, K6J, K13J, and K14J), which run from Manby TS to Riverside Junction on overhead lines, with two (and in some spans, up to four) circuits on a common structure. From Riverside Junction, these circuits run underground to supply the downtown core.[15] The Manby West supply sector is considered "non-bulk" and is designed to continuously supply demand up to the loss of a single circuit.

The planning studies are showing that all four Manby TS to Riverside Junction circuits violate the reliability criteria between 2030 and 2040. Under the most severe single element loss, the remaining circuits can be as much as 120 per cent overloaded by 2040. This is a reliability concern that will need to be addressed in the long term.

Leaside TS and Manby TS autotransformers

The assessment of the Leaside autotransformer capacity is related to the presence and capacity of the 550 MW PEC facility, as both PEC and Leaside TS supply the Leaside sector. With an outage to the PEC steam turbine generator, the output of the plant would be reduced to 160 MW. Under this scenario, the Leaside autotransformers will begin to exceed their capacity limits by the 2030 to 2040 time frame, following outages on the 230 kV transmission lines that supply Leaside TS from Cherrywood TS upstream. With a full PEC outage, two of the six autotransformers at Leaside TS (T15 and T16) would be overloaded under peak demand conditions.[16]

During short-term outages of elements of PEC, system control actions to reduce the Leaside sector load through the transfer of Dufferin TS to the Manby sector will alleviate pressure on the Leaside autotransformers. While this is an acceptable short-term measure, it is not considered a permanent solution because it exposes the Manby sector, and Dufferin TS customers in particular, to supply security risks related to transmission outages in the Manby sector.

Manby TS autotransformer capacity needs were identified as emerging by the 2030 to 2040 time frame. This capacity constraint is related to the rating of the smallest autotransformer at Manby TS (T12) following the loss of a companion transformer. There may be value in factoring these findings into the end of life replacement of the Manby TS autotransformers in 2025-2026, if there is a cost-effective and technically feasible means of addressing this capacity constraint within the scope of the replacement.

---

[15] The underground section from Riverside Junction to Strachan Avenue have been recently refurbished due to its age and condition.

[16] The 2030 forecast year was used to assess the full PEC outage scenario; it is likely that if such a scenario were experienced today at the time of system peak, then the Leaside TS autotransformers could experience an overload.

Bayview Junction to Balfour circuit (L15W) thermal capacity

The planning assessment shows that following the loss of circuit L14W, the companion circuit L15 (from Bayview Junction to Balfour Junction in the Leaside sector[17]) is forecast to marginally exceed its Long term emergency rating (LTE) in 2040. This need is deferred beyond the planning horizon once the forecast efficiency codes and standards savings are taken into account.

6.2.3 Load Security Needs

The transmission system must exhibit acceptable performance while following specified design criteria contingencies. The load security criteria can be found in Section 7.1 of ORTAC, and a summary of the load security criteria can be found in Table 6-4. All transformer stations in the Toronto region have at least a dual transmission supply, which allows the load served at the station to remain uninterrupted in the event of a single element contingency. Supply interruptions may occur after multiple element contingencies, but under all possible interruption scenarios, the amount of load interrupted remains within the limits prescribed in ORTAC.

Table 6-4: Load Security Criteria

Number of transmission elements out of service	Local generation outage?	Amount of load allowed to be interrupted by configuration	Amount of load allowed to be interrupted by load rejection or curtailment	Total amount of load allowed to be interrupted by configuration, load rejection, and/or curtailment
One	No	≤ 150 MW	None	≤ 150 MW
	Yes	≤ 150 MW	≤ 150 MW	≤ 150 MW
Two	No	≤ 600 MW	≤ 150 MW	≤ 600 MW
	Yes	≤ 600 MW	≤ 600 MW	≤ 600 MW

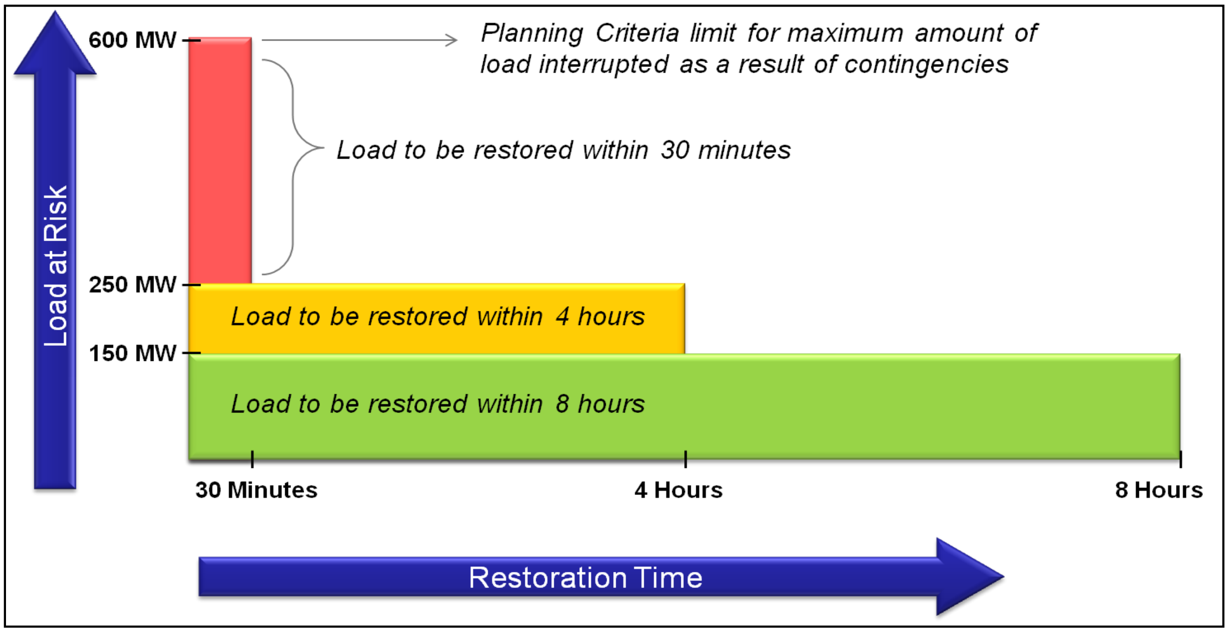
6.2.4 Load Restoration Needs

Described in Section 7.2 of ORTAC, load restoration criteria specify that the transmission system must be planned such that following design criteria contingencies, all interrupted load must be restored within approximately eight hours. When the load interrupted is greater than

[17] These circuits are part of the path supplying Wiltshire TS from Leaside TS.

150 MW, the amount of load in excess of 150 MW must be restored within approximately four hours. When the load interrupted is greater than 250 MW, the amount of load in excess of 250 MW must be restored within 30 minutes. A visual representation of the load restoration criteria is shown in Figure 6-13.

Figure 6-13: Load Restoration Criteria



No load restoration needs were identified in the Toronto region following the design criteria contingencies that were tested. Under a situation where load loss has occurred and the transmission system has been reconfigured to restore power, but some customers are still experiencing an outage, additional measures may be taken in the operational time frame. These measures may include dispatching crews to repair the transmission system, reconfiguring the transmission or distribution system to transfer load to another delivery point, and use of temporary facilities, etc. Although electricity interruptions can not be eliminated, where possible, the system operator, transmitter, and distributor will undertake measures in real time to respond to outages and restore load as quickly as possible.

6.2.5 Discretionary Reliability Needs

Reliability performance is, in part, a function of the criteria that the transmission system needs to meet. In other words, the planning criteria stipulate the functional requirements of the transmission system to ensure reliability performance. Within Toronto, specific criteria apply to different parts of the transmission system because of the function and resulting consequences of the loss of those different parts. In other words, less stringent criteria generally apply to transmission facilities where the impact is only local. Conversely, more stringent criteria apply when the consequences of a loss have a wider impact on the interconnected grid. The stringency of the planning criteria is commensurate with the severity of the consequence of contingencies that can impact the interconnected grid.

While, for study purposes, this plan applied the more stringent criteria to all parts of Toronto's transmission system (e.g., by assessing 'local area' facilities against 'bulk power system' criteria), not all areas are required to meet the more stringent criteria. ORTAC (Section 7.4) permits higher levels of reliability to be adopted for specified reasons. The results of the assessment in this study highlighted some 'discretionary reliability needs' for the purpose of generating insights as to where there may be opportunities to improve performance, but for which actions to resolve them are not required by the performance criteria that govern the planning and design of the electric power system. The discretionary reliability needs are documented in Appendix D: Toronto IRRP Study Results.

6.2.6 System Resilience for Extreme Events

One of the key measures of a resilient transmission system is its ability to withstand interruption, or restore supply during or after extreme events that impact many parts of the system. This section summarizes the capability, following analysis, of Toronto's regional transmission system to maintain supply and manage the risk posed by low-probability, high-impact events.

In 2013, the IESO conducted an assessment of the amount of load that could be restored following specific extreme contingencies involving the system that supplies downtown Toronto. The results of this assessment have not been made public due to security concerns related to the disclosure of critical energy infrastructure information and possible system vulnerabilities.

For this IRRP, key scenarios from the 2013 study were re-examined for the years 2020 and 2025. These include the loss of:

- Manby TS 115 kV switchyard
- Leaside TS 115 kV switchyard
- Four circuit tower structures emanating from the Manby TS and Leaside TS 115 kV switchyards

The results of the updated analysis found that the impact of the extreme contingencies on the 115 kV transmission system was limited to load interruptions within the Toronto region.

6.3 Summary of Needs Identified

Table 6-5 summarizes the electric power system needs identified in this IRRP. Note that discretionary needs identified in Section 6.2.5 are not included because these issues are flagged as potential opportunities to enhance reliability to Toronto but they do not require actions to address them at the present time.

Table 6-5: Summary of Needs Identified

Facilities	Need	Expected Timing
End-of-Life Assets		
Leaside Junction to Bloor Street 115 kV overhead transmission lines (H1L/H3L/H6LC/H8LC)	End of life of the approximate 2 km overhead line sections	2022-2023
Leaside TS to Balfour Junction 115 kV overhead transmission lines (L9C/L12C)	End of life of the approximate 3.6 km overhead line sections	2023-2024
Main TS	End of life of transformers T3 and T4, 115 kV line disconnect switches, and 115 kV current voltage transformers	2021-2022
Esplanade TS to Terauley TS 115 kV underground transmission cables (C5E and C7E)	End of life of underground cables from Esplanade TS to Terauley TS in downtown Toronto	2024-2025
Manby TS	End of life of major station equipment, including: autotransformers T7, T9 and T12, step-down transformer T13, and the 230 kV yard	2025-2026
John TS	End of life of transformers and 115 kV breakers	2026-2027
Bermondsey TS	End of life of transformers T3 and T4	2025-2026
Local Transformer Station Capacity		
Manby TS (DESN)	A transformer capacity need was identified for the load supplied by all three DESNs	2023
Strachan TS	A transformer capacity need was identified for the load supplied by both DESNs	2030
Basin TS	A transformer capacity need was identified for the load supplied by the	2033

	T3/T5 DESN (the only DESN at Basin)	
Leslie TS	A transformer capacity need was identified for the load supplied by the T3/T4 DESN	2033
Wiltshire TS	A transformer capacity need was identified for the load supplied by the T1/T6 DESN	2035
Regional Capacity		
Richview TS to Manby TS 230 kV Corridor	Load meeting capability upstream of Manby TS	2021
Supply to downtown Toronto from Manby West (Manby to Riverside Junction)	Load meeting capability of the 115 kV lines supplying downtown Toronto	2030-2040
Leaside TS and Manby TS	A capacity need was identified for Leaside TS and Manby TS 230/115 kV autotransformers	2030-2040
Bayview Junction to Balfour Junction Circuits	Overloading of L15 circuit for the loss of its companion circuit, L14W	2040

7. Plan Options and Recommendations

This section outlines the options considered to address transmission needs in the Toronto region, as well as the recommended plan with respect to each of these needs.

In considering options and developing recommendations, the Working Group has been mindful of the interest and preference, communicated through engagement with stakeholders, such as the City of Toronto, a local advisory committee that was in place from 2016 to 2018, and the general public, to explore NWAs, such as DERs, for dealing with electricity system needs.

Given the interest in NWAs as possible solutions for addressing Toronto's regional transmission needs, additional context on the changing landscape with respect to these resources, and on the approach to considering them, is provided below.

DERs as options to address needs in Toronto

The uptake in DERs across the province over the last decade is having an impact on the electricity system, both in terms of system demand and operability. While centralized procurement programs that supported the development of most DERs[18] are no longer in place, DER deployment is expected to continue in Toronto. Toronto Hydro has filed investment plans for approval with the OEB to increase its ability to connect DERs to its system, and the IESO has expressed support for these plans.[19]

Much of the IESO's recent work with respect to DERs has focused on identifying the barriers to their development as alternatives to wires-based solutions, and options for reducing or overcoming those barriers. Specifically, the barriers to implementation of cost-effective NWAs, including DERs, in regional planning are being investigated as part of the IESO's regional planning review initiative.[20] Further, a number of DER-focused initiatives are being undertaken

---

[18] Since 2006, nearly 2,000 distributed energy resources (DERs), including solar PV, CHP, energy storage and wind, have connected to Toronto's distribution system.

[19] See Toronto Hydro's rate application EB-2018-0165, Exhibit 2B, Section E7.2; and Exhibit 2B, Section B, Appendix F for IESO's Comment Letter.

[20] Launched in 2018, the regional planning review process is exploring a number of enhancements to regional planning, including potential barriers to non-wires solutions, opportunities for coordination between bulk system planning, community energy planning and market renewal, and a long term approach to replacing end-of-life transmission assets.

as part of the work plan associated with the IESO's *Innovation Roadmap*.[21] These initiatives include research and white papers, demonstration and evaluation projects, and capital projects and process improvements. For a full list and descriptions, visit the innovation projects page on ieso.ca.

The Working Group believes that DERs need to continue to be studied to build the necessary tools and experience required to consider and evaluate them as potential solutions to regional electricity needs. This work is being undertaken through the above mentioned work plan. In the meantime, continued dialogue with the community is expected to play an important role in defining the potential for cost-effective NWA solutions. Further details are provided in the plan recommendations.

7.1 Evaluating Plan Options for Addressing Needs Identified in Toronto

The following sections describe the options considered to address the needs identified in Section 6.2.

The evaluation of possible plan options takes into consideration a number of factors, including technical feasibility, timing, cost, and alignment with local priorities. In light of the importance of cost as a planning consideration, solutions that are cost-effective and that maximize the use of existing infrastructure and assets are typically given priority for inclusion in the evaluation.

To help ensure that solutions will be available in time to address pressing needs, the IRRP identifies specific actions to be undertaken and/or implemented in the near and medium term. Given forecast uncertainty and the potential for technological and policy changes, investment in longer-term needs is not prudent at this point in time. Instead, the long term plan focuses on developing and maintaining the viability of long term options, engaging with communities, and gathering information to lay the groundwork for making decisions on future options.

As discussed in Section 6, solutions are needed to address (1) end of life asset replacements; (2) local transformer station capacity, and (3) regional supply capacity needs. In addition, the plan identifies some discretionary needs related to maintaining a higher level of reliability performance than those prescribed in ORTAC. This recognizes Toronto's position as the largest urban centre in Canada, and the ORTAC provision allowing the transmission customer and

[21] http://www.ieso.ca/en/Get-Involved/Innovation/Innovation-Roadmap

transmitter to agree on higher (or lower) levels of reliability. Firm recommendations to address discretionary needs are dependent on the availability of cost-effective solutions and the risk of the need materializing.

In developing the plan, the Working Group examined a range of solutions to address the near term needs, as well as activities to begin to lay a foundation for addressing needs in the longer term. These options are discussed and evaluated in the following sections.

7.1.1 Options for Addressing End of Life Asset Replacement

When transmission equipment reaches end of life, a number of alternatives can be considered. Transmission or distribution facilities may have changed since the equipment was built, community needs may have evolved, equipment standards may have changed, and/or opportunities for other options, such as energy efficiency, may be able to play a role.

Options to address end of life asset replacement needs in the Toronto region included:

- Retiring the asset or facilities
- Replacing the assets to the "right size" (e.g., larger or smaller) based on considerations, including future electricity demand, or changes to the use of the asset to realize reliability, resilience, or other benefits that an alternate configuration may provide
- Replacing the assets "like for like" or with the closest current equivalent
- Implementing NWAs

Based on the assessments conducted in this IRRP, each of the assets reaching its end of life in this plan was deemed critical for maintaining a sufficient and reliable supply of electricity to customers. As such, and given the magnitude and persistence of the needs, complete retirement and replacement with NWAs was screened out as an alternative in favour of replacing the assets with the closest available equivalent.

Leaside Junction to Bloor Street Junction 115 kV overhead transmission lines (H1L/H3L/H6LC/H8LC)

Three options were assessed to inform the preferred approach for addressing this end of life overhead line section:

1. **Replace the existing lines with 230 kV capable lines to increase future capacity (but continue to operate at 115 kV, for now):** This approach was ruled out because assessment indicated that none of these circuits would be thermally limited within the planning

horizon. Also, because there is no plan to increase the transmission supply voltage (e.g., to 230 kV) to any of the stations supplied by the HxL or HxLC circuits, there would be no benefit for investing in replacement circuits at a higher operating voltage (or any associated tower investments) within the planning horizon.

2. **Replace the existing lines with 115 kV lines (like for like, built to current standards):** The planning assessments show that the LMC of the 115 kV transmission lines is adequate to supply the needs of Toronto within the planning horizon. New 115 kV transmission lines along this path built to today's standards are expected to be able to carry more load, and operate in a more reliable manner, as compared to the existing equipment.

3. **Replace end of life assets with NWAs:** As NWAs, such as energy efficiency or DERs, would be very expensive compared to replacing end of life assets, the Working Group determined that they do not present a viable approach.

Table 7-1 summarizes the considerations related to the options. Based on the evaluation of the alternatives, this IRRP recommends that Hydro One proceed with like for like replacement of the end of life line sections.

Table 7-1: Options for Addressing Leaside Junction to Bloor Street Junction 115 kV Lines

	Replace with 230 kV capable	Replace like for like
Summary of Option	• Rebuild the existing line section to meet 230 kV standard	• Refurbish the existing line section with the equivalent voltage standard
Potential Benefits	• Maintain capacity (if energized at 115 kV) or increase capacity (if energized at 230 kV) • Maintains reliability • Contributes to introducing 230 kV supply to downtown	• Maintain or improve capacity and reliability • Better in-service date certainty
Potential Risks/ Issues	• If never energized at 230 kV, incremental costs for 230 kV capability will not provide value	• None if the work is scheduled and completed outside of the peak demand season

Leaside TS to Balfour Junction 115 kV overhead transmission lines (L9C/L12C)

These two lines are critical for supplying Toronto's electricity needs. Three options were assessed to inform a recommendation on the preferred approach to address this end of life overhead line section:

1. **Replace the existing lines with 230 kV capable lines (but continue to operate at 115 kV for now):** This approach was ruled out because assessment results indicated that none of these would be thermally limited within the planning horizon. Since there is not a plan to increase the transmission supply voltage to any of the stations supplied by these lines, it would not be beneficial to invest in replacement circuits at a higher operating voltage (or any associated tower investments).

2. **Replace the existing lines with 115 kV lines (like for like, built to current standards):** The planning assessments show that the LMC of the 115 kV transmission lines is adequate to supply the needs of Toronto within the planning horizon.

3. **Replace end of life assets with NWAs:** Given that energy efficiency, DERs and other NWAs would be very expensive compared to replacing end of life assets, the Working Group determined that NWAs do not present a viable approach.

Table 7-2 summarizes the considerations related to the options. Based on the evaluation of the alternatives, this IRRP recommends that Hydro One proceed with like for like replacement of the end of life line sections.

Table 7-2: Options for Addressing Leaside TS to Balfour Junction Transmission

	Replace with 230 kV	Replace like for like
Summary of Option	• Rebuild the existing line section to meet 230 kV standard	• Refurbish the existing line section with the equivalent voltage standard
Potential Benefits	• Maintain capacity (if energized at 115 kV) or increase capacity (if energized at 230 kV) • Maintain reliability • Contributes to introducing 230 kV supply to downtown	• Maintain or improve capacity and reliability • Better in-service date certainty
Potential Risks/ Issues	• If never energized at 230 kV, incremental costs for 230 kV capability will not provide value	• None if the work is scheduled and completed outside of the peak demand season

Main TS

The IRRP looked at different approaches for addressing end of life assets at Main TS, which include the two step-down transformers and associated medium-voltage switchgear. Eliminating the station outright was not considered to be a feasible option, as it is over 70 per cent utilized and resupplying the customer demand in the area from adjacent station facilities is not possible with the existing infrastructure.

NWAs, including energy efficiency or DERs, are not suitable options for addressing asset condition-related needs. As an alternative to the step-down station, energy efficiency or DERs would be cost prohibitive as compared to replacing end of life assets.

Other options were considered and are discussed below:

1. **Converting Main TS to 230 kV operation:** Providing a 230 kV connection to Main TS could be achieved by rebuilding the existing 115 kV supply circuits from Leaside TS (H7L and H11L), or by building a new 230 kV line. New 230 kV transformers and associated high-voltage switchgear would be needed at the existing station, or at a new station location. The 115 kV rebuild option would make the existing H7L and H11L circuits unavailable to supply Hearn station from Leaside TS, while building a new 230 kV connection would be very expensive. In addition, as Main TS is space constrained, the larger 230 kV transformers may not be accommodated on the existing site. As property for building a new station in the vicinity is also limited, this alternative was deemed not viable.

2. **Supplying Toronto Hydro's switchgear from new transformers at Warden TS:** As this approach would require the building of several new distribution cable circuits from Warden TS, which is 4.5 km from Main TS, the Working Group determined that this alternative would be expensive, and impractical, considering the number and length of new distribution cables required.

3. **Replacing the transformers at the existing Main TS location with new 115 kV transformers:** This approach is technically feasible and can be accommodated at the existing station location. Given the potential for future high density urban development in the Main TS service area, Toronto Hydro has recommended, that the existing 45/75 MVA transformers at Main TS be replaced with 60/100 MVA transformers. Even with the cost differential between the two transformer sizes – which Hydro One has estimated to be about

$300,000 – the cost of this approach is far less than either option 1 or 2. The Working Group supports this recommendation.

Options 1 and 2 above would have the benefit of shifting load from the 230 kV/ 115 kV autotransformers at Leaside TS to the 230 kV system, providing capacity relief for the Leaside TS autotransformers. Option 3 is the most cost-effective, even with the marginal additional cost of replacing the existing 45/75 MVA transformers with 60/100 MVA transformers.

Table 7-3 summarizes the options assessed to address the end of life asset needs at Main TS.

Table 7-3: Options for Addressing Main TS End-of-life Assets

	Convert to 230 kV	Supply Main TS area from Warden TS	Replace Transformers at Main TS
Summary of Option	• Replace existing transformers with 230 kV transformers; rebuild the circuits supplying Main TS to 230 kV	• Install new 230 kV transformers at Warden TS and supply Main TS service area with new distribution cables from Warden TS	• Replace existing transformers at Main TS with new transformers; take the opportunity to install higher capacity transformers to supply future development in the area
Potential Benefits	• This option would provide relief to the Leaside TS 230 kV /115 kV transformers as it would move Main TS to 230 kV supply	• This option would provide relief to the Leaside TS 230 kV/ 115 kV transformers as it would move Main TS to 230 kV supply	• This option maximizes use of the existing infrastructure supplying the area • Provides capacity for area growth and development
Potential Risks/ Issues	• The cost would be very high • Capacity relief at Leaside TS may only be needed at or beyond the planning horizon • Main TS is a small station; this option may not be feasible	• The technical feasibility of running very long distribution feeders from Warden to Main TS load is uncertain; there may be reliability impacts • The cost would be very high • Capacity relief at Leaside TS may only	• This option does not provide capacity relief for Leaside TS, which may only be needed beyond the planning horizon • Does not preclude upgrading to 230 kV at a later date

		be needed beyond the planning horizon	

C5E/C7E 115 kV underground transmission cables

Given the complexity and lead time required to implement underground infrastructure through downtown Toronto, Hydro One launched an EA process for the cable replacement in May 2018. Community engagement related to the options is currently underway, with five underground routes under consideration. The route investigation will consider stakeholder input, and assess existing easements and rights-of-way, costs, and other technical and environmental considerations. OEB Leave to Construct approval will also be required.

Since the Working Group has determined that there are no suitable alternatives to replacement, this IRRP recommends that Hydro One continue with actions to replace the existing 115 kV cables.

Manby TS

Given the extent of end of life assets at Manby TS, development of a well-coordinated plan will need to consider the capacity of the station to meet future growth needs in Toronto, accommodate additional short-term transfers to the Manby sector in the event of emergencies (such as a loss of Leaside sector supply or PEC outages), and maintain reliability. For example, the plan required to address the assets reaching end of life in the 230 kV switchyard should be coordinated with the remedial action scheme (RAS) recommended in the 2015 Central Toronto IRRP, with the new terminations required to accommodate the new Richview to Manby TS circuits, and the long term need for additional capacity to supply growth in downtown Toronto. NWAs were ruled out as feasible alternatives to address this end of life need.

The Working Group will continue to assess transmission options and develop a recommendation concerning the significant end of life asset needs at Manby TS. It is recommended that this work commence in the RIP.

John TS

The end of life needs at John TS represent a major undertaking that needs to be coordinated with other plans to reinforce step-down supply capacity in the downtown core, including Toronto Hydro's Copeland TS (Phase 1 and Phase 2). For example, Copeland TS will provide an opportunity to review the configuration and major equipment capacity (i.e., right sizing) at John TS, to ensure it meets future needs. Furthermore, the 115 kV station design is in a "ring-bus" configuration and the end of life need provides an opportunity to review this configuration, while considering costs, operational flexibility, reliability to customers and transmission system development plans in the area.

Coordination of this work with Copeland TS is vital for providing the additional capacity to facilitate outage planning at John TS for the execution of a replacement plan, while maintaining reliable supply in Toronto's downtown district. Since this need is driven by the condition of the assets, NWAs were ruled out as feasible alternatives to address this end of life need.

The Working Group therefore recommends that the replacement plan for end of life equipment at John TS be further assessed through continued coordinated planning, commencing with the RIP.

Bermondsey TS

The station load is forecast to reach about 173 MW over the study period, after accounting for energy efficiency codes and standards. While there is a continuing requirement for the station to supply customers in the area, the total load on Bermondsey TS is forecasted to remain well below its current capacity over the planning horizon.

The options for addressing the asset end of life need at Bermondsey TS are summarized as follows:

1. **Retire (and decommission) the T3/T4 DESN at its end of life:** This option would mean supplying the entire load at Bermondsey TS from the T1/T2 DESN, and expanding the switchyard to accommodate new feeders (i.e., transferring the 12 feeders from the T3/T4 DESN to the T1/T2 DESN). However, this intra-station transfer would result in the remaining DESN nearing its capacity limit by the end of the study period.

2. **Replace the 84/140 MVA and 75/125 MVA end of life transformers with smaller 50/83 MVA transformers:** According to Hydro One, the cost of feeder work would be significantly more than the $600,000 savings for smaller size transformers ($300,000 per transformer).

3. **Replace like for like:** Based on the information available, this option will minimize the cost of end of life work at the station, while retaining some ability to grow and accommodate transfers within the station.

Based on the options put forth, NWAs were screened out at a feasible option to address this end of life need. Further assessment is needed to determine the cost and feasibility of option 2, above. The Working Group therefore recommends that a plan be developed within the scope of the RIP.

7.2 Options for Addressing Supply Capacity Needs

Based on the demand outlook, capacity needs in the Toronto region are centered on a number of transformer stations (DESNs) supplying local neighbourhoods in the city.

Local transformer station capacity needs at Manby TS, Strachan TS, Leslie TS and Wiltshire TS

For the need at Manby TS, the 2015 Central Toronto IRRP recommended that a second DESN be built at the adjacent Horner TS. Part of the rationale for the Horner TS expansion was to provide relief for Manby TS through permanent load transfers. The second DESN is expected to be in-service by late 2021.

The station capacity needs at Strachan TS, Leslie TS and Wiltshire TS are far enough into the future that there is sufficient time to monitor demand changes and revisit these needs in the next planning cycle. Further, based on a preliminary review of possible approaches, capacity is available either at other DESNs within the station, or at adjacent stations to permit planning for load transfers to provide relief to the DESNs that are forecast to reach their capacity. These transfers will require planning and investment to implement.[22]

To address the capacity need at Strachan TS, the capacity that is expected to be made available by Copeland TS (Phase 1 and Phase 2) is likely to allow for a permanent load transfer. While the feasibility of implementing such a transfer is not yet clear, there is sufficient time to monitor growth and assess the feasibility of various options. If demand grows faster than anticipated, or the forecast for energy efficiency changes, additional measures to address future capacity needs

[22] These types of actions are normally undertaken by the distributor as part of distribution system planning.

at Strachan TS – such as energy efficiency or other NWAs – can be explored and implemented, provided they are feasible and cost-effective.

For the needs at Leslie TS and Wiltshire TS, capacity at other DESNs within the station is sufficient to accommodate additional load. This work will be undertaken by Toronto Hydro and Hydro One, with enough lead time to plan and implement intra-station transfers, if and when they are needed.

Local station capacity need at Basin TS

The capacity need at Basin TS arises as early as 2033; however, after considering the impact of efficiency codes and standards, the timing could be deferred to 2040. That said, a number of complicating factors related to the uncertainty of future demand growth at Basin TS must be taken into account. These relate to:

- Planned urban developments at the site and neighbourhood level
- City-led district energy plans
- The potential for economic growth, specifically related to intensification of commercial activity, for example, at the former Unilever site and the film studio district
- The relocation – proposed by the City of Toronto and Waterfront Toronto – of a significant number of existing high-voltage transmission facilities in the area

These uncertainties will impact the scope and timing of the needs, as well as the configuration of the electricity infrastructure in the area, including the ultimate size and location of Basin TS.

Cost-effective NWAs, including DERs and energy efficiency, should be explored to defer the needs at Basin TS, once they are further defined. Ongoing dialogue with stakeholders will be required to help identify feasible and cost-effective solutions, as well as prospective developments that could address the specific characteristics and timing of needs in the area. Since this is driven primarily by the need to supply local customers within Toronto Hydro's service territory, the Working Group agrees that the assessment of NWAs as potential solutions should be coordinated by Toronto Hydro.

7.3 Options for Addressing Regional Supply Capacity Needs

Options to address the regional supply capacity needs identified in Toronto are described below.

Richview TS to Manby TS 230 kV corridor

Options to address this need were assessed in the 2015 Central Toronto IRRP, the 2017 IRRP Addendum and the 2016 RIP by Hydro One. Since then, there have been no material changes to either the scope of the options or the preferred approach, which is planned to occur in the following two phases:

- **Phase One:** Rebuild the existing idle 115 kV overhead line on the transmission corridor between Richview TS and Manby TS to 230 kV. The new line will operate in parallel with the existing four 230 kV circuits from Richview TS to Manby TS, which will initially be reconfigured to create two "supercircuits." This will allow for the two additional circuits to supply Manby TS, but avoid the need to build new terminations, including new breakers at Manby.
- **Phase Two:** To be coordinated with the Manby TS end of life refurbishment, new circuits will be separately terminated on the Manby 230 kV bus, and at Richview TS they will connect to existing 230 kV circuits between Claireville TS and Richview TS, thereby unbundling the two supercircuits. The scope and timing for this work will be addressed starting with the RIP.

Based on the assessments undertaken by the IESO, the IRRP Working Group recommends that Hydro One proceed with the reinforcement of the Richview TS to Manby TS 230 kV transmission reinforcement project, including initiating community engagement, the EA, and OEB Section 92 Application for Leave to Construct.

Supply capacity at Leaside TS and Manby TS autotransformers, Manby TS to Riverside Junction lines, and Bayview Junction to Balfour Junction circuit section

These regional capacity needs do not emerge until between 2030 and 2040, depending on the assumptions around continued gains in energy efficiency resulting from efficiency codes and standards.

Leaside TS and Manby TS needs are related to the 230 kV/115 kV autotransformer capacity limits. The Manby TS to Riverside Junction line needs are related to the ability to supply the demand when there is a loss of a companion circuit. The Bayview Junction to Balfour Junction needs emerge in 2040 and are related to the thermal rating of the 115 kV circuit, when there is a loss of the companion circuit.

Cost-effective NWAs, including DERs and energy efficiency, remain possible options to address each of these longer-term regional supply capacity needs. Ongoing engagement with stakeholders and the community will be important for understanding the potential for these types of options going forward. It will also be essential to gather enough information on the nature and timing of these needs to understand what performance and cost attributes NWA options will be required to address them.

7.4 Options for Addressing Discretionary Reliability Needs

These needs are included in Appendix D as discretionary because they represent possible opportunities to maintain and/or enhance the reliability of supply above the minimum performance standards prescribed in ORTAC. Their inclusion in this IRRP recognizes the importance of a reliable electricity supply to an urban centre like Toronto, should feasible, cost-effective options for improving reliability emerge as an outcome of continued planning, coordination, and engagement with electricity sector stakeholders and the community.

Although no specific solution options have been explored in the scope of this plan, these issues should be revisited in future plans, or as other opportunities arise to assess the adequacy and/or resilience of the system, including when assets approach their end of life.

7.5 The Recommended Plan

This IRRP re-affirms the needs and plans identified in the previous regional planning cycle that concluded in January 2016, and recommends the actions described below to address region's transmission needs until at least the late 2020s or early 2030s.

Replace end of life overhead line sections H1L/H3L/H6LC/H8LC and L9C/L12C

Both of these overhead line sections were deemed critical for maintaining a sufficient and reliable supply of electricity to customers in Toronto. The Working Group recommends that Hydro One proceed with planning for the like for like replacement of these overhead line sections.

Replace end of life transformers at Main TS

Both transformers at Main TS are at their end of life and need to be replaced. Considering the potential for future high density urban development in the area, the Working Group recommends that Hydro One proceed with planning to replace the existing transformers with 60/100 MVA transformers.

Continue planning for replacement of C5E/C7E underground transmission cables

When this regional plan was initiated, Hydro One was well into developing options to replace the existing C5E/C7E underground 115 kV cables running between Terauley TS and Esplanade TS in the downtown core. The Working Group recommends that Hydro One continue planning to replace the existing 115 kV cables.

Continue planning to determine end of life approaches for Manby TS, John TS, and Bermondsey TS

Manby TS and John TS: Planning for replacement of these critical electricity assets is a major undertaking that must consider a variety of factors and requires regional coordination. The Working Group recommends that detailed planning for the end of life of these assets continue, starting with the RIP.

Bermondsey TS: The Working Group recommends that the plan to replace the two end of life transformers at Bermondsey TS be completed within the scope of the RIP.

Gather information to inform future capacity planning for Basin TS

Since there is currently insufficient information to characterize the needs at Basin TS and inform specific recommendations in this IRRP, the Working Group proposes that any recommendation on potential solutions be deferred until the next cycle of regional planning, or earlier, as required.

Specifically, the Working Group recommends that Toronto Hydro coordinate continued planning activities related to defining the nature, scope and timing of the future capacity need at Basin TS, and assessment of possible wires and non-wires solutions to address the need. It is expected that this work will involve engaging with key stakeholders, including the City of Toronto and entities responsible for development in the Basin TS area.

If better information about the timing and nature of power system needs in the area indicates there is an urgent need, then Toronto Hydro will inform the Working Group of the need to initiate the next regional planning cycle early.

Proceed with reinforcement of the Richview TS to Manby TS 230 kV corridor

This IRRP re-affirms the need for the Richview TS to Manby TS 230 kV corridor reinforcement that was recommended in the previous regional planning cycle. The Working Group therefore recommends that Hydro One proceed with the reinforcement of the Richview TS to Manby TS 230 kV corridor and begin community engagement, as well as initiate the EA to ensure that the reinforced corridor is in-service as soon as possible.

Keep options available to address long term regional supply capacity needs

The IESO will monitor peak demand annually, along with achievement of energy efficiency and DER uptake, with a particular focus on the areas with forecasted capacity needs. This information will be used to determine when decisions on the long term plan are required, and to inform the next cycle of regional planning for the area. This work will include detailed planning and community engagement to define the needs and associated timing in a manner that will permit the evaluation of possible NWAs as solutions.

The Working Group therefore recommends that the IESO coordinate continued planning work and engagement with stakeholders and the community to define and communicate, as soon as practicable, the longer-term capacity needs; identify opportunities for a range of cost-effective solutions, including DERs and energy efficiency; and identify potential wires solutions and avoidable costs should these needs be deferred through NWAs. The information and insights developed through these activities will be used to inform the next regional planning cycle.

7.5.1 Implementation of Recommended Plan

To ensure that the near term electricity needs of the Toronto region are addressed, plan recommendations will need to be implemented as soon as possible. Specific actions and deliverables are outlined in Table 7-4, along with the recommended timing.

Table 7-4: Summary of Needs and Recommended Actions in Toronto Region

Need	Recommended Action(s)/Deliverable(s)	Lead Responsibility	Time frame/ Need Date
End-of-life of overhead line sections H1L / H3L / H6LC / H8LC and L9C / L12C	Proceed with replacement as needed to meet identified timelines	Hydro One	2022-2033 for HxL/HxLC circuits; 2023-2024 for LxC circuits
End-of-life of Main TS transformers, 115 kV disconnect switches and 115 kV current voltage transformers	Proceed with replacement as needed to meet identified timelines	Hydro One	2021-2022
End-of-life of C5E/ C7E underground transmission cables	Continue with EA, and proceed with replacement to meet identified timelines	Hydro One	2024-2025
End-of-life assets at Manby TS, John TS and Bermondsey TS	Continue with detailed planning to make a decision in time to address the need; initiate in the Regional Infrastructure Plan	Working Group	2025-2027
Capacity to supply projected load at Manby TS	Continue with implementation of Horner TS expansion to provide relief	Hydro One	2021
Capacity to supply projected load at Basin TS	Continue to gather information to inform assessment of future need and timing; engage with key stakeholders; trigger regional planning if necessary	Toronto Hydro	2019 to next planning cycle
Richview to Manby TS 230 kV reinforcement	Initiate EA work, community engagement, and OEB Section 92 Application	Hydro One	2021 or as soon as possible

Need	Recommended Action(s)/Deliverable(s)	Lead Responsibility	Time frame/ Need Date
Leaside TS and Manby TS autotransformer capacity; Manby TS to Riverside Junction; and Bayview Junction to Balfour Junction	Further define characteristics of longer-term needs; define information needed from local stakeholders; identify DER and energy efficiency potential; develop wires-based alternatives; assess and compare wires and NWAs	IESO	2019 to next planning cycle

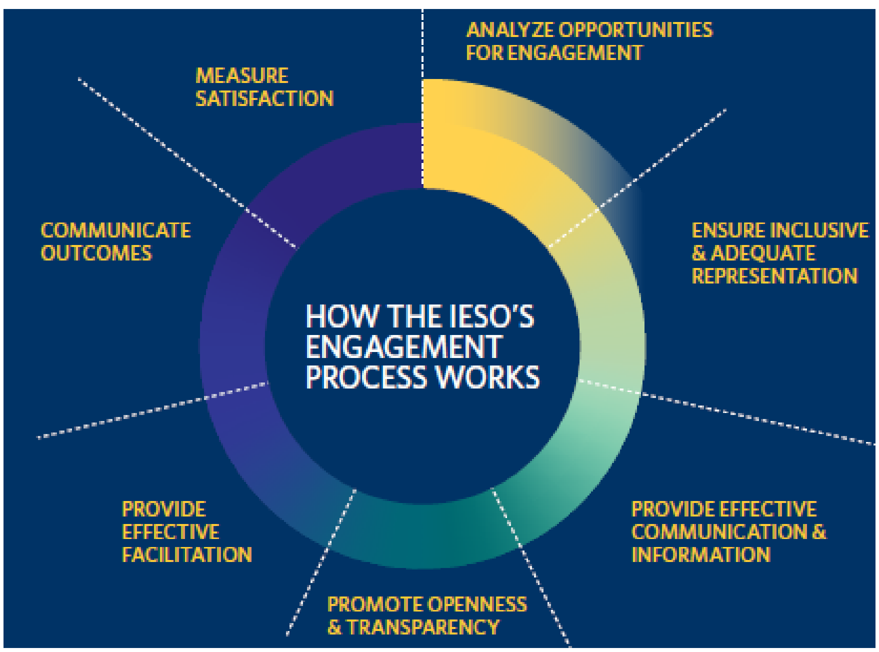
8. Community and Stakeholder Engagement

Community engagement is an integral component of the regional planning process. Providing opportunities for input in regional planning enables the views and preferences of the community to be considered in the development of an IRRP and helps lay the foundation for successful implementation. This section outlines the engagement principles and activities undertaken for the Toronto IRRP.

8.1 Engagement Principles

The IESO's Engagement Principles[23] guided the process to help ensure that all interested parties were aware of and could contribute to the development of this IRRP. The IESO uses these principles to ensure inclusiveness, sincerity, respect and fairness in its engagements, and to support its efforts to build trusted relationships.

Figure 9-1: IESO Engagement Principles



[23] http://www.ieso.ca/Sector-Participants/Engagement-Initiatives/Overview/Engagement-Principles

8.2 Creating an Engagement Approach

The outreach and engagement approach was designed to ensure the IRRP reflected input from key community and stakeholder representatives. A dedicated engagement web page[24] was also created to provide openness and transparency throughout the engagement process. This web page hosted all engagement activities, including background information, presentations and public meetings/webinars on the development of this IRRP, as well as previous plans for the area.

The IESO's email subscription service for the Toronto planning region was used to send information to interested communities and stakeholders who subscribed to receive updates. Targeted outreach to municipalities, Indigenous communities and other business sectors in the region was also conducted at the outset of this engagement and continued throughout the planning process.

In addition, regular communications were sent via the IESO's weekly Bulletin, which has subscribers from across Ontario's electricity sector.

8.3 Engage Early and Often

Leveraging relationships built during the previous planning cycle, the IESO held preliminary discussions to help inform the engagement approach during this second planning cycle – starting with the Scoping Assessment Outcome Report.

Early communication and engagement activities for the Toronto IRRP began with invitations to all subscribers and targeted communities to learn about and provide comments on the draft Toronto Region Scoping Assessment Outcome Report before it was finalized in February 2018. This scoping assessment identified the need for an IRRP for the Toronto region and included terms of reference to guide development of the plan. Following feedback, and the IESO's response to feedback – both of which are posted on the engagement web page – the final Scoping Assessment Outcome Report was also published.

Outreach then began with targeted communities to inform early discussions for the development of the IRRP. The launch of a broader engagement initiative followed with an

[24] http://ieso.ca/Sector-Participants/Engagement-Initiatives/Engagements/Integrated-Regional-Resource-Plan-Toronto

invitation to subscribers to ensure that all interested parties were made aware of this opportunity for input.

A public engagement meeting, held to give interested parties an opportunity to learn about the draft IRRP and provide comments, attracted a cross-representation of stakeholder and community representatives. Following a 14-day comment period, no further comments were received for consideration during the development of the IRRP.

As a final step in this engagement, all participating parties were invited to comment on the proposed recommendations in this IRRP. Comments received during the engagement meeting and in response to the proposed recommendations related to six major themes:

1. Non-wires alternatives
2. Considerations to inform future electricity needs in electricity system planning
3. Electrification (e.g., electric vehicles)
4. Costs of the electricity system
5. Composition of the technical working group
6. Engagement/education

Based on this feedback, it is clear that there is a strong need for ongoing monitoring of capacity and local demand growth, as well as continued discussion and engagement with communities and stakeholders. While needs do not start to emerge until the 2030s or later, the IESO recognizes the importance of sustained dialogue to ensure alignment with local priorities, initiatives and developments. The full submissions can be found on the IESO's website. Reponses to specific feedback are provided as Appendix G: Responses to Public Feedback on Proposed Recommendations.

All background information, including engagement presentations and recorded webinars, are available on the IESO's Integrated Regional Resource Plan engagement web page.

8.4 Outreach with Municipalities

As the City of Toronto was a key stakeholder in the development of this IRRP, the IESO held a number of meetings with city representatives to seek input on municipal planning and to ensure that the city's plans were taken into consideration. Meetings began in June 2018 at the outset of these discussions and continued in April and May 2019. These meetings helped to inform the city's electricity needs and provided opportunities to strengthen this relationship for ongoing dialogue beyond this IRRP process.

9. Conclusion

This report documents an IRRP that has been developed for the Toronto region, and identifies regional electricity needs and opportunities to preserve or enhance electricity system reliability in Toronto from 2019 to 2040. The IRRP makes recommendations to address near term issues, and lays out actions to monitor, defer, and address long term needs.

To further review "wires" solutions that address end of life asset replacement and other transmission supply needs, the Working Group recommends that Hydro One initiate an RIP. The IESO will continue to provide input and support throughout the RIP process, and assist with any regulatory matters arising during plan implementation.

To support the development of the plan, this IRRP includes recommendations with respect to developing alternatives, monitoring load growth and efficiency achievements, and evaluating DER potential and value in the region. Responsibility for these actions has been assigned to the appropriate members of the Working Group. Information gathered and lessons learned as a result of these activities will inform development of the next iteration of the regional plan for the Toronto region.

The Toronto region Working Group will continue to meet at regular intervals to monitor developments and track progress toward plan deliverables. In the event that underlying assumptions change significantly, local plans may be revisited through an amendment, or by initiating a new regional planning cycle sooner than the five-year schedule mandated by the OEB.