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BY EMAIL AND RESS

October 27, 2020

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

Dear Ms. Long:

**EB-2020-0188 – Hydro One Networks Inc. Leave to Construct Application - Power
Downtown Toronto LTC – Application and Evidence**

Pursuant to Section 92 of the *Ontario Energy Board Act, 1998*, Hydro One Networks Inc. seeks the Ontario Energy Board's ("OEB") approval for an Order or Orders granting leave to upgrade five circuit kilometres of transmission cable facilities in the downtown Toronto area. These facilities are required to ensure that the area continues to receive a safe and reliable supply of electricity.

An electronic copy of this Application has been filed through the OEB's Regulatory Electronic Submission System.

Sincerely,

A handwritten signature in black ink, appearing to read "Joanne Richardson".

Joanne Richardson

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- 1 3. The proposed PDT Project will decommission and upgrade the existing 115
2 kilovolt (kV) underground transmission cables (circuits C5E and C7E) between
3 Terauley Transformer Station (TS), near Bay Street and Dundas Street, and
4 Esplanade TS, near Lower Sherbourne Street and The Esplanade, with 230 kV
5 crosslinked polyethylene (“XLPE”) cables. An overview map of this area is
6 provided in **Exhibit B, Tab 2, Schedule 1, Attachment 1** and a schematic diagram
7 of the Project can be found at **Exhibit B, Tab 2, Schedule 1, Figure 1**.
- 8 4. The proposed in-service date for the PDT Project is December 2024, assuming a
9 construction commencement date of May 2021 and leave to construct approval
10 prior to March 2021. A project schedule is provided at **Exhibit B, Tab 11,**
11 **Schedule 1**.
- 12 5. The Project will relocate the cables in a tunnel 25 m below ground along a new
13 route that will not require any new permanent property rights. Should the need
14 arise, temporary construction rights for access or staging areas may be required
15 for the duration of the construction period of the PDT Project. Further
16 information on land-related matters is found in **Exhibit E, Tab 1, Schedule 1**.
- 17 6. For all intents and purposes, given that this Project is being pursued to replace
18 end-of-life facilities per laboratory testing, this Project has been identified as a
19 non-discretionary sustainment project in **Exhibit B, Tab 4, Schedule 1** and would
20 typically not require leave to construct approval. However, as part of the PDT
21 Project, Hydro One will be spending approximately \$500k more than what would
22 otherwise be incurred under a pure sustainment project solution to install 230kV
23 XLPE cables for reliability purposes. Further information on the alternatives
24 considered for this Project is provided in **Exhibit B, Tab 5, Schedule 1**.
- 25 7. The IESO has also provided an expedited and final System Impact Assessment
26 (“SIA”). The SIA concludes that the Project is expected to have no material
27 adverse impact on the reliability of the integrated power system and
28 recommends that a *Notification of Conditional Approval for Connection* be
29 issued. The IESO’s Notification of Conditional Approval is provided as **Exhibit F**,

- 1 **Tab 1, Schedule 1, Attachment 1**, and the SIA is provided as **Exhibit F, Tab 1,**
2 **Schedule 1, Attachment 2** of Hydro One’s prefiled evidence.
- 3 8. Hydro One has completed a draft Customer Impact Assessment (“CIA”) in
4 accordance with Hydro One’s connection procedures. The results confirm that
5 there will be no impacts on area customers as a result of the PDT Project. A copy
6 of the draft CIA is provided as **Exhibit G, Tab 1, Schedule 1, Attachment 1** and
7 will be updated once finalized.
- 8 9. The total cost of the transmission line facilities for which Hydro One is seeking
9 approval is approximately \$107.2 million. The details pertaining to these costs
10 are provided at **Exhibit B, Tab 7, Schedule 1, Table 1**¹.
- 11 10. Utilizing the current approved uniform transmission rates, the Project
12 economics, as filed in **Exhibit B, Tab 9, Schedule 1**, show that the total PDT
13 Project will result in a \$0.03/kw/month impact in the line connection pool rate
14 and a \$0.07 per month or 0.04% increase on the overall average Ontario
15 consumer’s electricity bill. The difference in monthly bill impacts are immaterial
16 whether a pure sustainment solution is pursued or whether the larger cable is
17 installed.
- 18 11. This Application is also for approval of the forms of the agreement offered or to
19 be offered to affected landowners, pursuant to s. 97 of the Act. The agreements
20 are in the same form as previously approved in prior Hydro One leave to
21 construct proceedings. The agreements can be found as attachments to **Exhibit**
22 **E, Tab 1, Schedule 1**.
- 23 12. The Application is supported by written evidence which includes details of the
24 Applicant’s proposal for the transmission line and station work. The written
25 evidence is prefiled and may be amended from time to time prior to the Board’s
26 final decision on this Application.

¹ This Project has already been reviewed by the OEB under Investment Summary Document – System Renewal – 27 in Hydro One’s recently approved transmission revenue requirement application under docket EB-2019-0082.

- 1 13. Given the information provided in the prefiled evidence, Hydro One submits that
2 the Project is in the public interest. The Project meets the need of the
3 transmission system and improves quality of service and reliability with minimal
4 impact on price.
- 5 14. Hydro One consents that this proceeding be disposed of without a hearing
6 pursuant to section 21(4) of the Act. As is documented in the Customer Impact
7 Assessment (“CIA”), filed at **Exhibit G, Tab 1, Schedule 1, Attachment 1**, there
8 are no directly connected customers that are adversely affected by this Project.
9 This, in concert with the aforementioned results of the SIA and the fact that the
10 Project will have no material impact on the line connection pool rate or on the
11 overall average Ontario consumer’s electricity bill relative to a pure sustainment
12 alternative, allows Hydro One to conclude that this Project will not adversely
13 affect customers in any material way.
- 14 15. This position is further supported by the fact that this Project is, in effect, a
15 sustainment project and would not trigger the need for leave to construct, i.e., it
16 would be a like-for-like sustainment solution to replace end-of-life facilities.
17 Leave to construct is required, however, because Hydro One is pursuing a
18 technical solution that will improve reliability by utilizing a larger cable size.
19 Relative to the like-for-like alternative, installation of a larger cable will increase
20 costs by only approximately \$0.5M, which is below Hydro One’s materiality
21 threshold.
- 22 16. If the OEB determines that disposing of this proceeding without a hearing is
23 appropriate, Hydro One requests that this Application be decided by an
24 employee of the OEB who has been delegated this authority pursuant to section
25 6 of the Act and that a decision be rendered within 90 days. Such a decision will
26 ensure that the in-service schedule of these facilities, as provided in **Exhibit B,**
27 **Tab 11, Schedule 1**, is met.
- 28

1 17. Hydro One requests that a copy of all documents filed with the Board be served
2 on the Applicant and the Applicant's counsel, as follows:

3

4 a) The Applicant:

5

6 Eryn MacKinnon
7 Sr. Regulatory Coordinator
8 Hydro One Networks Inc.

9

10 Mailing Address:

11

12 7th Floor, South Tower
13 483 Bay Street
14 Toronto, Ontario M5G 2P5

15 Telephone: (416) 345-4479

16 Fax: (416) 345-5866

17 E-mail regulatory@HydroOne.com

18

19 b) The Applicant's counsel:

20

21 Michael Engelberg
22 Assistant General Counsel
23 Hydro One Networks Inc.

24

25 Mailing Address:

26

27 8th Floor, South Tower
28 483 Bay Street
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30

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33 E-mail: mengelberg@HydroOne.com

Project Overview

Hydro One circuits C5E and C7E from Esplanade Transformer Station (“TS”) to Terauley TS are underground transmission cables that provide a critical supply to Toronto’s downtown core and are routed partially along Lake Ontario. These circuits were put into service in 1959 and are in poor condition. Through a detailed condition assessment, Hydro One has determined that these underground circuits are at end-of-life and require replacement.

Hydro One’s proposed Project, the Power Downtown Toronto (“PDT”) Project, involves the replacement of 7.2 circuit km of the 115 kV low-pressure oil-fill underground cables that are at end-of-life with 5 circuit km of 230 kV rated crosslinked polyethylene (“XLPE”)-type cable following an alternate route. The replacement will encompass both C5E and C7E circuits from Esplanade to Terauley TS and involves the installation of an underground tunnel in bedrock to house the replacement cables. The proposed tunnel would be approximately 3 m in diameter, 2.5 km in length, have a depth of 25 m below ground and be within the City of Toronto’s existing road allowances. The cables will continue to operate at 115 kV, but their 230 kV rating will be more able to accommodate high temporary overvoltages during fault conditions, thus reducing the likelihood of damage requiring repair and improving long-term reliability. A map showing the geographic location of the current facilities and the location of the proposed facilities is provided in **Exhibit B, Tab 2, Schedule 1, Attachment 1**. The current terminal connections and circuit configuration will remain the same as shown in Figure 1.

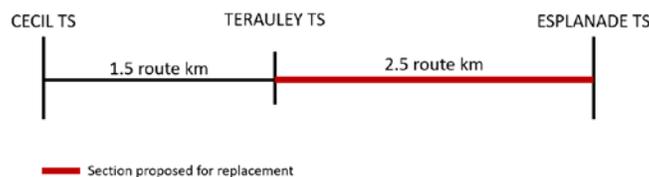


Figure 1 – C5E and C7E Single Line Diagram

Filed: 2020-10-27
EB-2020-0188
PDT Project
B-2-1
Attachment 1

CITY OF TORONTO



Power Downtown Toronto Project Notice Map

-  Proposed Entry Shaft (A)
-  Proposed Mid Shaft (B)
-  Proposed Exit Shaft (C)
-  Existing Transformer Station (TS)
-  Proposed New Underground Cable Route
-  Existing Underground Cable Route
-  Road
-  Railway

1:12,000



Toronto Harbour

Evidence In Support of Need

Hydro One circuits C5E and C7E from Esplanade TS to Terauley TS (7.2 circuit km or 3.6 route km) are 115 kV paper-insulated low-pressure oil-filled underground transmission cables that provide a critical supply to Toronto's downtown core and are routed partially along Lake Ontario. These circuits were put into service in 1959 and are in poor condition. Through a detailed condition assessment, Hydro One has determined that these underground circuits are at end-of-life, and require replacement. End-of-life means that an asset has a significant risk of failure, or loss of the ability to provide the intended functionality.

The cable jackets have been tested and were found to be in deteriorated condition, necessitating the need for cable replacement. Deteriorated jackets can adversely affect cable performance by allowing circulating currents to flow leading to overheating and therefore damaging insulation, accelerating corrosion and oil leaks. Analysis of the paper insulation was performed, and the results were indicative of thermal aging/degradation beyond what is normally seen in comparable Hydro One cables, by approximately 25%. Thermally degraded paper insulation can lead to cable failure during faults, resulting in prolonged circuit outages and negative environmental impact due to the potential release of oil. In addition to the oil pressure system being susceptible to oil leaks, the cable type is obsolete, with few spare part suppliers. Due to their deteriorated condition, the risk of cable failure and oil leaks may result in loss of supply and an adverse environmental impact that will increase with time unless the cables are replaced.

Interruption or failure of C5E and C7E can negatively impact power supply to Toronto hospitals along University Avenue, the University of Toronto, Toronto City Hall, the Toronto financial district and tourist/entertainment areas. Further, from an environmental perspective, approximately 2.6 circuit km of cable is directly buried under Queens Quay along Lake Ontario. If a leak occurs along Queens Quay, it would likely be confined to the surrounding soil.

1 However, if the leak is significant enough to contaminate ground and/or surface water (Lake
2 Ontario), the remediation will be very challenging and costly, requiring booms, wells, etc.

3
4 In lieu of replacing the current 115 kV rated cables with similar rated cables, Hydro One has
5 elected to utilize 230 kV rated cables for a minimal incremental total cost of approximately
6 \$500K¹. By replacing the existing 115 kV paper insulated low-pressure oil-filled underground
7 transmission cables with 230 kV rated crosslinked polyethylene (“**XLPE**”) type cables, Hydro
8 One will be improving reliability.

9
10 Currently, in the event of a line-to-ground fault, the unfaulted cables may experience high
11 temporary overvoltages, potentially damaging the cable and thus necessitating a repair. These
12 overvoltages occur because the line terminal breakers open prior to the DESN station breakers,
13 leaving the cable energized through the DESN station transformers for a short time. However,
14 230kV cables have a higher voltage withstand capability and are therefore less prone to failure
15 under those conditions.

16
17 Therefore, the higher-rated cables will be capable of accommodating high temporary
18 overvoltages during fault conditions reducing the likelihood of damage that would require
19 repair and, in turn, improving long-term reliability. Given that unplanned repair or replacement
20 of underground cables damaged by faults are costly and require prolonged circuit outages that
21 could have various public impacts, Hydro One submits that the minimal incremental cost to
22 install 230 kV cables is the most prudent alternative to pursue.

¹ The incremental cost is further discussed in Exhibit B, Tab 6, Schedule 1.

Project Classification and Categorization

Project Classification

Per the Board’s filing guidelines, rate-regulated projects are classified into three groups based on their purpose.

- Development projects are those which
 - (i) provide an adequate supply capacity and/or maintain an acceptable or prescribed level of customer or system reliability for load growth or for meeting increased stresses on the system; or
 - (ii) enhance system efficiency such as minimizing congestion on the transmission system and reducing system losses.
- Connection projects are those which provide connection of a load or generation customer or group of customers to the transmission system.
- Sustainment projects are those which maintain the performance of the transmission network at its current standard or replace end-of-life facilities on a “like for like” basis.

Based on the above criteria, the Project is a sustainment project to address end-of-life assets. While the new cables will be operated at 115 kV, they will be rated for 230 kV and will be able to accommodate high temporary overvoltages during fault conditions, reducing the likelihood of damage requiring repair and therefore improving long-term reliability.

Project Categorization

The Board’s filing guidelines require that projects be categorized to distinguish between a project that is a “must-do”, which is beyond the control of the applicant (“non-

1 discretionary”), from a project that is at the discretion of the applicant (“discretionary”).

2 Non-discretionary projects may be triggered or determined by such things as:

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

13
14 Based upon the above criteria, the Project is considered non-discretionary. The Project
15 is being undertaken to address end-of-life assets where replacement is the only feasible
16 alternative.

17
18 **Categorization and Classification**

		Project Need	
		Non-discretionary	Discretionary
Project Class	Sustainment	X	

Cost Benefit Analysis and Options

TRANSMISSION ALTERNATIVES

As part of the Project, Hydro One considered various replacement alternatives and options as described below:

Alternative 1: Reactive Replacement of Underground Cables is the “Do Nothing” alternative, which means Hydro One will continue to operate and maintain the existing C5E and C7E cables and replace them upon failure. This alternative was considered and has been rejected as failure of these cables will result in prolonged circuit outages, potential customer interruptions, loss of redundant supply negatively affecting operational flexibility, and potential oil leaks requiring environmental remediation; and, in all likelihood, emergency restoration will be more expensive than a proactive planned replacement of the deteriorating cables.

Alternative 2: Planned Replacement with 230 kV XLPE Underground Cables is the preferred undertaking. This alternative involves planned replacement of 7.2 circuit km of deteriorated end-of-life 115 kV low-pressure oil-filled underground transmission cable with 230 kV rated oil-free XLPE cable between Esplanade TS and Terauley TS. Due to their deteriorated condition and the increased risk of cable failure and oil leaks, planned replacement will mitigate risks to reliability and the environment. The replacement of the deteriorated cables will address reliability concerns associated with operating end-of-life assets and the use of 230 kV cables will minimize reliability risks related to temporary overvoltages under fault conditions discussed in Exhibit B, Tab 3, Schedule 1. The application of oil-free XLPE cables will also eliminate, in the event of a leak, environmental risks caused by the use of oil-filled cables. Furthermore, there is an industry shift

1 away from the use of oil-filled to XLPE cable systems, as such, in the long-term,
2 obtaining manufacturer support will become more difficult. A limited number of
3 manufacturers may lead to long delivery times and price increases.

4
5 In pursuing this alternative, Hydro One considered multiple installation methods
6 and routes. Through a comprehensive and completed Class Environmental
7 Assessment that evaluated socioeconomic, natural environment, technical and
8 financial factors in detail, Hydro One will be completing this Project utilizing a
9 tunnel installation method and route, which has the following key advantages:

- 10 • Least disruption to vehicular, and pedestrian traffic;
- 11 • Least conflicts with existing and planned infrastructure and utilities;
- 12 • The anticipated noise and vibrations from the tunnel boring machine
13 (TBM) operating at approximately 25 m below ground surface will not be
14 perceptible at the surface, minimizing disruptions to communities;
- 15 • No anticipated direct effects to institutions, emergency uses, and
16 businesses as a result of the construction method and route alignment;
- 17 • Similar costs to other route and construction methods that would be far
18 more disruptive and,
- 19 • Minimal impacts to the natural environment.

20
21 Though not specifically required for leave to construct approval, details
22 regarding the evaluated socioeconomic, natural environment, technical and
23 financial factors reviewed as part of the completed Environmental Study Report
24 (ESR) provided to the Ministry of the Environment, Conservation and Parks can
25 be found in Section 5 and Appendix F of the ESR¹.

¹ https://www.hydroone.com/abouthydroone/CorporateInformation/majorprojects/power-downtown-toronto/Documents/Final_ESR/PDT%20-%20Class%20EA%20Final%20Environmental%20Study%20Report.pdf

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Alternative 3: Planned Replacement with 115 kV Oil-Filled Underground Cables or 115 kV XPLE Cables is not the preferred undertaking. This alternative is similar to Alternative 2, with the exception that 115 kV cables would be used. While this option would address the reliability risks associated with operating end-of-life cables, it will not address risks related to temporary overvoltages under fault conditions or, if oil-filled cables were used, the environmental and obsolescence risks linked to the use of oil-filled cables. These risks are already discussed in detail in Alternative 2 above, and for these reasons this alternative was rejected.

Alternative 2 provides a long term cost-effective solution that improves reliability, mitigates customer and general public interruptions and addresses potentially imminent environmental risks. Hydro One recommends Alternative 2.

Quantitative and Qualitative Benefits of the Project

Quantitative Benefits of the Project

The PDT Project encompasses the following quantitative benefits:

Reduce OM&A Costs Associated with Locates

Hydro One is required by provincial legislation¹ to provide locate services for its underground infrastructure. Locate requests are most often requested by utilities planning construction activities in close proximity to Hydro One's underground assets. By installing the replacement cables in a tunnel at a depth of approximately 25m, these assets will be far below typical utility depth,s reducing the need to perform field locates. It is estimated that approximately \$12,000 per year in locate costs will be saved, compared to similar surface routes.

Replace Existing 115 kV Cables with 230 kV

By replacing the existing 115 kV with 230 kV rated cables, the cables will be able to more easily accommodate high temporary overvoltages during fault conditions, reducing the likelihood of damage that would require repair, and therefore improving long-term reliability. Repair or replacement of cables damaged by faults are costly and time-consuming, require prolonged circuit outages and are publically impactful. The cost to accomplish this is minimal, estimated to be approximately \$500k². Therefore, this is deemed as a prudent incremental investment for long-term asset operation.

Avoid Future Civil Replacement Costs

The tunnel and shafts, and cables have an expected service life of 100 years and 50 years, respectively. Once the replacement cables reach their end-of-life, minimal civil work will be

¹ Ontario Underground Infrastructure Notification System Act, 2012, S.O. 2012, c. 4

² Incremental cost of \$10/foot x 3 phases x 5 cct km

1 required to accommodate cable replacement since the tunnel and shafts will be reused. Based
2 on current estimates, tunnel and shaft construction accounts for 46% of the total Project cost.

3
4 **Qualitative Benefits of the Project**

5
6 The PDT Project encompasses the following qualitative benefits that cannot be specifically
7 quantified at this point in time:

8
9 *Eliminate Environmental Risks Associated with Oil-Filled Cables*

10 The existing oil-filled cables will be replaced with oil-free XLPE cables. There is a significant
11 environmental risk associated with oil-filled cables. Cable breaches can be caused by failed or
12 degraded components as well as by dig-ins from unauthorized excavation. The breach can
13 result in the discharge of large volumes of oil into the surrounding environment, which may
14 cause significant environmental issues. Approximately 2.6 circuit km of cable is directly buried
15 under Queens Quay along Lake Ontario. If a leak occurs along Queens Quay, it would likely be
16 confined to the surrounding soil. However, if the leak is significant enough to contaminate
17 ground and/or surface (Lake Ontario) water, the remediation will be very challenging and
18 costly, requiring booms, wells, etc.

19
20 *Reduce Reliability and Safety Risks Associated with Cables Buried Near the Surface*

21 The existing surface buried cables will be replaced with tunnel-installed cables, significantly
22 reducing the likelihood of accidental dig-ins by other utilities. Dig-ins pose both a safety and
23 system reliability risk, resulting in prolonged circuit outages, potential customer and public
24 interruptions and loss of redundant supply negatively affecting operational flexibility. Typical
25 repair timeline is one month.

1 *Reduce Obsolescent Risks Associated with Oil-Filled Cables*

2

3 The existing oil-filled cables will be replaced with crosslinked polyethylene (XLPE) cables.
4 Because there is an industry shift away from the use of oil-filled to XLPE cable systems,
5 obtaining manufacturer support will become more difficult in the long term if Hydro One
6 remained with the status quo cable. A limited number of manufacturers may lead to long
7 delivery times and price increases.

8

9 *Future System Expansion and Replacement*

10 The tunnel will be capable of accommodating four circuits. In the event of future expansion or
11 replacement of nearby underground assets, if practical and feasible, the tunnel may be used to
12 accommodate two additional circuits.

Apportioning Project Costs & Risks

The estimated capital cost of the Power Downtown Toronto Project, including overheads and capitalized interest, is shown below:

Table 1: Project Cost

	Estimated Cost (\$000's)
Materials	16,816
Labour	14,188
Equipment Rental & Contractor Costs	43,146
Sundry	7,941
Contingencies	8,266
Overhead ¹	8,910
Allowance for Funds Used During Construction ²	7,940
TOTAL PROJECT WORK	\$107,208

The cost of the work provided above allows for the schedule of approval, design and construction activities provided in **Exhibit B, Tab 11, Schedule 1**.

¹ Overhead costs allocated to the project are for corporate services costs. These costs are charged to capital projects through a standard overhead capitalization rate. As such they are considered "Indirect Overheads". Hydro One does not allocate any project activity to "Direct Overheads" but rather charges all other costs directly to the project.

² Capitalized interest (or AFUDC) is calculated using the Board's approved interest rate methodology (EB-2006-0117) to the projects' forecast monthly cash flow and carrying forward closing balance from the preceding month.

1 **1.0 RISKS AND CONTINGENCIES**

2
3 As with most projects, there are risks associated with estimating costs. Hydro One's
4 cost estimate includes an allowance for contingencies in recognition of these risks.

5
6 The top 3 project risks are outlined below. These risks are the major contributors to the
7 total contingency suggested for this project.

- 8 • **Approvals** – there are many risks with permits and approvals from third party
9 stakeholders. There are other utilities crossings, transportation crossings, and
10 environmental permits with the City of Toronto and MECP.
- 11 • **Outage constraints** – there is a risk that securing the needed outages will not be
12 supported by the OGCC, which may result in schedule delays and additional
13 costs.
- 14 • **Construction** - there are risks when building a tunnel under a city, e.g. are rock
15 and soil contamination, changes in ground conditions that were not anticipated
16 and damage to adjacent utilities.

17 Cost contingencies that have not been included, due to the unlikelihood or uncertainty
18 of occurrence, include:

- 19 • Labour disputes;
- 20 • Safety or environmental incidents;
- 21 • Significant changes in costs of materials since the estimate preparation;
- 22 • Any other unforeseen and potentially significant events/occurrences.

1 **2.0 COSTS OF COMPARABLE PROJECTS**

2

3 The OEB Filing Requirements for Electricity Transmission and Distribution Applications,
 4 Chapter 4, requires the Applicant to provide information about a cost comparable
 5 project constructed by the Applicant. Hydro One’s Midtown project, which was put in-
 6 service in November 2016, utilized a tunnel in downtown Toronto between Bayview
 7 Junction and Birch Junction only.

8

9 The tunnel and cable installation from Esplanade to John TS in Toronto, which was
 10 completed in December 2007, is also a comparable project with this new project.

11

12

Table 2: Costs of Comparable Line Projects

Project	Midtown Tunnel Bayview to Birch Jct	Tunnel Esplanade to John TS	Power Downtown Toronto Project
Technical	2 x 230 kV XLPE Cables installed in 3m dia. Tunnel	2 x 230kV XLPE Cables installed in 3m dia. Tunnel	
Length (circuit km)	4.6	4.4	5
Project Surroundings	Urban	Urban	Urban
Environmental Issues	None	None	None
In-Service Date	November 2016	December 2007	December 2024
Total Project Cost	\$86,150k*	\$101,200k	\$107,208
Less: Non-Comparable Costs			
Add: Escalation Adjustment (2%/year)	\$6,892k (4 yrs)	\$26,312k (13 yrs)	
Total Comparable Project Costs	\$93,042k	\$127,512k	\$107,208k
Total Cost/Circuit km	\$20,226k	\$28,980k	\$21,442

*The stations and overhead lines work has been removed from the overall project actual costs. The tunnel, 230kV cable installation, Bayview Junction and Birch Junction cost have been used for this comparison.

13

1 **Connection Projects Requiring Network Reinforcement**

2

3 This is not a connection project and thus this evidence has not been populated.

Transmission Rate Impact Assessment

1.0 ECONOMIC FEASIBILITY

Hydro One's proposed Project, the Power Downtown Toronto ("PDT") Project, involves the replacement of 7.2 circuit km of the 115 kV low-pressure oil-filled underground cables that are at end-of-life with 5 circuit km of 230 kV rated crosslinked polyethylene ("XLPE") type cable following an alternate route. The costs for the replacement of the circuits will be included in the Line Connection pool for cost classification purposes and not allocated to any individual customer. See **Exhibit B, Tab 1, Schedule 1**, for information on the proposed work. No customer contribution is required for this Project.

There are no incremental operating and maintenance costs as a result of the proposed Project. The Project will also have no impact on provincial peak load, resulting in zero incremental line connection revenue over the 25-year evaluation period.

A 25-year discounted cash flow analysis of the line connection pool work was conducted. The results show that based on the estimated initial cost of \$107.8¹ million, plus the assumed impact on the future capital cost allowance and Hydro One corporate income tax, this capacity enhancement Project will have a negative net present value of \$106.6 million. This amount will be fully recovered via the line connection rates.

¹ Initial costs of \$107.8 million include \$107.2 million of up front capital costs plus \$0.6 million cost of removals

1 **2.0 COST RESPONSIBILITY**

2
3 *Line Connection Pool*

4 Hydro One circuits C5E and C7E between Terauley TS and Esplanade TS provide a 115 kV
5 supply to downtown Toronto. They facilitate a connection between network stations
6 and load supply points and are therefore part of the Line Connection rate pool.
7 Furthermore, they are part of the Line Connection rate pool since they do not reinforce
8 the integrated transmission system that is commonly shared by a large portion of the
9 Province, or the entire Province. This is a system renewal (sustainment) project to
10 address end-of-life assets and is not tied to any load increase or customer load
11 applications; therefore, no customer contributions are required consistent with the
12 provisions of Section 6.3.5 of the Transmission System Code.

13
14 **3.0 RATE IMPACT ASSESSMENT**

15
16 The analysis of the Line Connection pool rate impacts has been carried out on the basis
17 of Hydro One's transmission revenue requirement for the year 2020, and the most
18 recently approved Ontario Transmission Rate Schedules². The Line Connection pool
19 revenue requirements would be affected by the line replacement based on the Project
20 cost allocation.

21
22 *Line Connection Pool*

23 Based on the Project's initial cost of \$107.8 million and the associated line connection
24 pool incremental cash flows, there will be a change in the line connection pool revenue
25 requirement once the Project's impacts are reflected in the transmission rate base at
26 the projected in-service date, December 2024. Over a 25-year time horizon, this change

² EB-2020-0180 – 2020 Uniform Transmission Rates - Decision and Order – Schedule B – July 30, 2020

1 in the line pool revenue requirement has a 3.09% negative incremental impact,
 2 increasing the currently approved rate of \$0.97kW/month to \$1.0kW/month. The
 3 maximum revenue shortfall related to the proposed network facilities will be \$8.06
 4 million in the year 2032. The detailed analysis illustrating the calculation of the
 5 incremental line connection revenue shortfall and rate impact is provided in Table 1
 6 below.

7

8 Impact on Typical Residential Customer

9 Based on the load forecast, initial capital costs and ongoing maintenance costs, adding
 10 the costs of the replacement of the required facilities to the line connection pool will
 11 cause a \$0.07 per month increase in a typical residential customer’s rates under the
 12 Regulated Price Plan (RPP). The table below shows this result for a typical residential
 13 customer who is under the Regulated Price Plan (RPP), utilizing the maximum impact by
 14 rate pool regardless of year.

15

A. Typical monthly bill (Residential R1 in a high density zone at 1,000 kWh per month with winter commodity prices.)	\$183.56 per month
B. Transmission component of monthly bill	\$15.31 per month
C. Line Connection Pool share of Transmission component	\$2.11 per month
D. Transformation Connection Pool share of Transmission component	\$5.07 per month
E. Network Connection Pool share of Transmission component	\$8.13 per month
F. Impact on Line Connection Pool Provincial Uniform Rates	3.09%
G. Net impact on typical residential customer bill (C x F)	\$0.07 per month or \$0.78 per year
F. Net increase on typical residential customer bill (G / A)	0.04%

Note: Values rounded to two significant digits.

Table 1: Revenue Requirement and Network Pool Rate Impact, page 1

		Revenue Requirement and Line Pool Rate Impact (Before Capital Contribution)											
		Project YE											
		15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036
		1	2	3	4	5	6	7	8	9	10	11	12
Power Downtown Project													
In-service date		15-Dec-24											
Capital Cost		107,208											
Less: Capital Contribution Required		-											
Net Project Capital Cost		107,208											
Average Rate Base		52,547	104,037	101,924	99,810	97,696	95,582	93,468	91,354	89,240	87,126	85,013	82,899
Incremental OM&A Costs		0	0	0	0	0	0	0	0	0	0	0	0
Grants in Lieu of Municipal tax		364	364	364	364	364	364	364	364	364	364	364	364
Depreciation		2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114
Interest and Return on Rate Base		3,149	6,235	6,108	5,982	5,855	5,728	5,602	5,475	5,348	5,222	5,095	4,968
Income Tax Provision		(116)	(886)	(678)	(489)	(316)	(160)	(18)	110	226	331	425	509
REVENUE REQUIREMENT PRE-TAX		5,510	7,827	7,908	7,971	8,016	8,046	8,061	8,063	8,052	8,030	7,997	7,955
Incremental Revenue		0	0	0	0	0	0	0	0	0	0	0	0
SUFFICIENCY/(DEFICIENCY)		(5,510)	(7,827)	(7,908)	(7,971)	(8,016)	(8,046)	(8,061)	(8,063)	(8,052)	(8,030)	(7,997)	(7,955)
		Base Year											
Line Pool Revenue Requirement including sufficiency/(deficiency)		233,295	241,121	241,203	241,266	241,311	241,341	241,356	241,358	241,347	241,325	241,292	241,250
Line MW		240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481
Line Pool Rate (\$/kw/month)		0.99	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Increase/(Decrease) in Line Pool Rate (\$/kw/month), relative to base year		0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
RATE IMPACT relative to base year		2.06%	3.09%										
Assumptions													
Incremental OM&A		\$15.7126694704142 k per new km of line each year.											
Grants in Lieu of Municipal tax		0.34%											
Depreciation		2.00%											
Interest and Return on Rate Base		Reflects 50 year average service life for towers, conductors and station equipment, excluding land											
Income Tax Provision		5.99%											
Capital Cost Allowance		26.50%											
		Includes OEB-approved ROE of 8.52%, 2.75% on ST debt, and 4.42% on LT debt. 40/4/56 equity/ST debt/ LT debt split											
		2018 federal and provincial corporate income tax rate											
		100% Class 47 assets except for Land											

Table 1: Revenue Requirement and Network Pool Rate Impact, page 2

Revenue Requirement and Line Pool Rate Impact		(Before Capital Contribution)												
		15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec	15-Dec
		2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049
Power Downtown Project														
Calculation of Incremental Revenue Requirement (\$000)		13	14	15	16	17	18	19	20	21	22	23	24	25
In-service date	15-Dec-24													
Capital Cost	107,208													
Less: Capital Contribution Required	-													
Net Project Capital Cost	107,208													
Average Rate Base		80,785	78,671	76,557	74,443	72,329	70,215	68,101	65,988	63,874	61,760	59,646	57,532	55,418
Incremental OM&A Costs		0	0	0	0	0	0	0	0	0	0	0	0	0
Grants in Lieu of Municipal tax		364	364	364	364	364	364	364	364	364	364	364	364	364
Depreciation		2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114
Interest and Return on Rate Base		4,842	4,715	4,588	4,462	4,335	4,208	4,081	3,955	3,828	3,701	3,575	3,448	3,321
Income Tax Provision		585	653	713	766	813	854	890	921	947	969	987	1,002	1,013
REVENUE REQUIREMENT PRE-TAX		7,904	7,845	7,779	7,705	7,625	7,540	7,449	7,353	7,252	7,148	7,039	6,927	6,812
Incremental Revenue		0	0	0	0	0	0	0	0	0	0	0	0	0
SUFFICIENCY/(DEFICIENCY)		(7,904)	(7,845)	(7,779)	(7,705)	(7,625)	(7,540)	(7,449)	(7,353)	(7,252)	(7,148)	(7,039)	(6,927)	(6,812)
Line Pool Revenue Requirement including sufficiency/(deficiency)	Base Year	241,199	241,140	241,074	241,000	240,920	240,835	240,744	240,648	240,547	240,443	240,334	240,222	240,107
Line MW	233,295	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481
Line Pool Rate (\$/kw/month)	0.97	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Increase/(Decrease) in Line Pool Rate (\$/kw/month), relative to base year		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
RATE IMPACT relative to base year		3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%	3.09%

Revenue Requirement and Line Pool Rate Impact (Before Capital Contribution)

<i>Power Downtown Project</i>	15-Dec 2037	15-Dec 2038	15-Dec 2039	15-Dec 2040	15-Dec 2041	15-Dec 2042	15-Dec 2043	15-Dec 2044	15-Dec 2045	15-Dec 2046	15-Dec 2047	15-Dec 2048	15-Dec 2049
Calculation of Incremental Revenue Requirement (\$000)	13	14	15	16	17	18	19	20	21	22	23	24	25
In-service date	15-Dec-24												
Capital Cost	107,208												
Less: Capital Contribution Required	-												
Net Project Capital Cost	107,208												
Average Rate Base	80,785	78,671	76,557	74,443	72,329	70,215	68,101	65,988	63,874	61,760	59,646	57,532	55,418
Incremental OM&A Costs	0	0	0	0	0	0	0	0	0	0	0	0	0
Grants in Lieu of Municipal tax	364	364	364	364	364	364	364	364	364	364	364	364	364
Depreciation	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114	2,114
Interest and Return on Rate Base	4,842	4,715	4,588	4,462	4,335	4,208	4,081	3,955	3,828	3,701	3,575	3,448	3,321
Income Tax Provision	585	653	713	766	813	854	890	921	947	969	987	1,002	1,013
REVENUE REQUIREMENT PRE-TAX	7,904	7,845	7,779	7,705	7,625	7,540	7,449	7,353	7,252	7,148	7,039	6,927	6,812
Incremental Revenue	0	0	0	0	0	0	0	0	0	0	0	0	0
SUFFICIENCY/(DEFICIENCY)	(7,904)	(7,845)	(7,779)	(7,705)	(7,625)	(7,540)	(7,449)	(7,353)	(7,252)	(7,148)	(7,039)	(6,927)	(6,812)
Line Pool Revenue Requirement including sufficiency/(deficiency)	241,199	241,140	241,074	241,000	240,920	240,835	240,744	240,648	240,547	240,443	240,334	240,222	240,107
Line MW	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481	240,481
Line Pool Rate (\$/kw/month)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Increase/(Decrease) in Line Pool Rate (\$/kw/month), relative to base year	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
RATE IMPACT relative to base year	3.09%												

Table 2: DCF Assumptions

Hydro One Networks -- Transmission Connection Economic Evaluation Model						
2020 Parameters and Assumptions						
Transmission rates are based on current OEB-approved uniform provincial transmission rates.						
	<table border="1"> <thead> <tr> <th colspan="2">Monthly Rate (\$ per kW)</th> </tr> </thead> <tbody> <tr> <td>Line</td> <td style="text-align: center;">0.97</td> </tr> </tbody> </table>	Monthly Rate (\$ per kW)		Line	0.97	
Monthly Rate (\$ per kW)						
Line	0.97					
Grants in lieu of Municipal tax (% of up-front capital expenditure, a proxy for property value):	0.34%	Based on Transmission system average				
Income taxes:						
Basic Federal Tax Rate - % of taxable income:	<table border="1"> <tbody> <tr> <td>2018</td> <td style="text-align: center;">15.00%</td> </tr> </tbody> </table>	2018	15.00%	Current rate		
2018	15.00%					
Ontario corporation income tax - % of taxable income:	<table border="1"> <tbody> <tr> <td>2018</td> <td style="text-align: center;">11.50%</td> </tr> </tbody> </table>	2018	11.50%	Current rate		
2018	11.50%					
Capital Cost Allowance Rate:						
Class 47 costs	<table border="1"> <tbody> <tr> <td>2018</td> <td style="text-align: center;">8%</td> </tr> </tbody> </table>	2018	8%	Current rate		
2018	8%					
Decision Support defined costs (1)	<table border="1"> <tbody> <tr> <td>2018</td> <td style="text-align: center;">0%</td> </tr> </tbody> </table>	2018	0%			
2018	0%					
Decision Support defined costs (2)	<table border="1"> <tbody> <tr> <td>2018</td> <td style="text-align: center;">0%</td> </tr> </tbody> </table>	2018	0%			
2018	0%					
Decision Support defined costs (3)	<table border="1"> <tbody> <tr> <td>2018</td> <td style="text-align: center;">0%</td> </tr> </tbody> </table>	2018	0%			
2018	0%					
After-tax Discount rate:	5.31%	Based on OEB-approved ROE of 8.52% on common equity and 2.75% on short-term debt, 4.42% forecast cost of long-term debt and 40/60 equity/debt split, and current enacted income tax rate of 26.5%				

1

Deferral Account Requests

2

3 There are no new deferral account requests being made as part of this Application.

Project Schedule

TASK	START	FINISH
Projected Section 92 Approval	October 2020	March 2021 ¹
LINES		
Detailed Engineering	January 2020	December 2020
Procurement	May 2021	July 2021
Receive Material	July 2021	November 2022
Construction	May 2021	December 2024
IN SERVICE		1 December 2024

¹ This review time is predicated on the OEB Performance Standards for Processing Leave to Construct Applications and assumes a written hearing review of this Application. However, Hydro One is certain that regulatory efficiencies can be obtained in the review of this Application and this Application will be disposed of without a hearing for the reasons articulated in Exhibit B, Tab 1, Schedule 1.

Descriptions of the Physical Design

1.0 LINE FACILITIES

Hydro One's proposed Power Downtown Toronto (PDT) Project involves the replacement of 7.2 circuit km of 115 kV low-pressure oil-fill underground cables that are at end-of-life with 5 circuit km of 230 kV rated XLPE type cable, following an alternate route. The replacement will encompass both C5E and C7E circuits from Esplanade TS to Terauley TS and involves the installation of an underground tunnel in bedrock to house the replacement cables. A map indicating the geographic location and route of the Project is provided as **Exhibit B, Tab 2, Schedule 1, Attachment 1**. A schematic diagram of the proposed facilities is included in **Exhibit B, Tab 2, Schedule 1**.

Hydro One is seeking OEB leave-to-construct approval for the installation of five circuit km of 230 kV rated XLPE cable in an underground tunnel between Terauley TS and Esplanade TS.

In concert with the above, the following works will also occur regardless of whether Hydro One proceeds with the cable upgrade solution proposed in this leave to construct application for the PDT Project, or, alternatively, proceeds with a like-for-like sustainment solution, i.e., 115 kV cable replacing a 115 kV cable, that would not trigger leave to construct approval:

- Construction of an underground tunnel between Terauley and Esplanade TS. The proposed tunnel would be approximately 3 m in diameter, 2.5 km in length, have a depth of 25 m below ground and be within the City of Toronto's existing road allowances. Example tunnels are shown in Figures 1 and 2.
- Construction of three tunnel access shafts:

- 1 ○ Entry Shaft – The entry shaft is to be located on Hydro One’s property at
2 Esplanade TS. This shaft will be approximately 12 m in diameter and will
3 be the entry point for the tunnel boring machine (TBM). Example shafts
4 and TBMs are shown in Figures 3 through 5.
- 5 ○ Mid Shaft – The mid shaft is to be located within existing road allowance
6 near the intersection of Sherbourne Street and Shuter Street. The exact
7 location of the mid shaft is to be determined through detailed design and
8 consultation with the City of Toronto.
- 9 ○ Exit Shaft – The exit shaft is to be located either inside or near Terauley
10 TS. The shaft will be approximately 8 m in diameter and will be the exit
11 point for the TBM. The exit shaft location is being determined through
12 detailed design and consultation with Toronto Hydro-Electric System
13 Limited, the City of Toronto and CreateTO.
- 14 ● Replacement 12 terminations, arresters and associated components at Terauley
15 and Esplanade TS. An example termination is shown in Figure 6.
- 16 ● Installation of on-line temperature and partial discharge monitoring systems.
- 17 ● Adjustment of line protections due to the change in cable type and length.
- 18 ● Decommissioning of the existing oil-filled cables and associated components
19 between Terauley TS and Esplanade TS.

1



2

3

Figure 1 – Example Tunnel

4



5

6

Figure 2 – Example Tunnel



1
2
3

Figure 3 – Example Tunnel Shaft



4
5

Figure 4 – Example Tunnel Boring Machine



1

2

Figure 5 – Example Tunnel Boring Machine



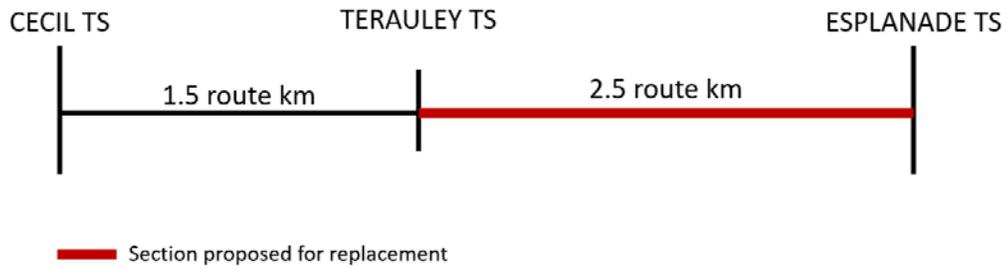
1
2

Figure 6 – Example Termination

Maps

A map indicating the geographic location of the circuits is provided as Attachment 1 of this **Exhibit B, Tab 2, Schedule 1**. Additionally, a schematic of the section of the line that is planned to be upgraded as part of this Project is provided again below:

Figure 1 – C5E and C7E Single Line Diagram



Operational Details

1
2
3
4
5
6
7
8
9
10
11

Hydro One's proposed PDT Project involves the replacement of 7.2 circuit km of 115 kV low-pressure oil-fill underground cables that are at end-of-life, with 5 circuit km of 230 kV rated XLPE type cable following an alternate route. The replacement will encompass both C5E and C7E circuits from Esplanade TS to Terauley TS and involves the installation of an underground tunnel in bedrock to house the replacement cables. The current ampacity ratings, terminal connections and circuit configuration will remain the same. Toronto Hydro-Electric System Limited is the only customer and will remain connected to the same locations at Esplanade TS and Terauley TS. A schematic diagram of the proposed facilities is included in **Exhibit B, Tab 2, Schedule 1**.

Land Matters

1.0 Description of Land Rights

The proposed Power Downtown Toronto Project (the “Project”), for which Hydro One is seeking approval, involves replacing the existing end-of-life C5E and C7E 115 kV underground transmission cables with the installation of an underground tunnel that will house the new C5E and C7E 115 kV transmission cables. The proposed underground tunnel housing the transmission cables will be approximately 25 metres (m) below grade and will require a typical right-of-way (“ROW”) width of approximately 3 m. The underground tunnel will be approximately 2.5 km in length and will connect Esplanade Transformer Station (“TS”), located near Lower Sherbourne Street and The Esplanade, to Terauley TS, located near Bay Street and Dundas Street in the City of Toronto. Outside of Esplanade TS and Terauley TS, the 2.5 km underground tunnel is planned to be sited entirely within existing municipal road allowances (the “Route”). For illustrative purposes, details of the Route are shown in **Attachment 1**¹ (Project Route Map) of this exhibit.

The entry shaft for the underground tunnel will be located at Esplanade TS, and the exit shaft will be located at Terauley TS. The contemplated mid-shaft location will be required along the Route and will be sited within road allowance, geographically located near the intersection of Sherbourne Street and Shuter Street in the City of Toronto.

The Project, as contemplated at this time, will require no new permanent land rights associated with the proposed Route. The proposed Route will be sited on and rely on the following land and occupation rights:

¹ This map is analogous to the map provided in Exhibit B, Tab 2, Schedule 1, Attachment 1 and is provided here again for ease of reference.

- 1 • Hydro One-owned property (no land rights required);
- 2 • Toronto Hydro-Electric System Limited-owned property (no land rights required);
- 3 • Municipal road allowance, occupation rights under Section 41 of the *Electricity*
- 4 *Act, 1998* (no land rights required).

5

6 Temporary rights for the underground tunnel construction may be required at specific

7 locations along the Route. These locations, if required, will be identified in advance of

8 construction start date and acquired where needed. Hydro One expects that

9 construction of the Project will not require extensive construction temporary rights for

10 the Route, given that the construction of the underground tunnel will be subsurface,

11 and limited surface impact is contemplated along the Route.

12

13 The construction of the entry shaft located at Esplanade TS does not contemplate any

14 temporary rights. The exit shaft located at Terauley TS requires temporary rights

15 adjacent to this location in the form of a short-term licence with the impacted

16 landowner, City of Toronto, for the forecast term of Q1 2022 to Q2 2025. Hydro One has

17 engaged with the City of Toronto, and will continue to do so, to discuss the Project and

18 the acquisition of temporary rights. The contemplated temporary rights required for

19 the construction of the exit shaft at Terauley TS are illustrated in **Attachment 2**.

20

21 **2.0 Description of New Land Rights Required**

22

23 Hydro One will rely primarily on existing land and legislated occupation rights to

24 construct, operate and maintain the proposed new transmission facilities. No new

25 permanent land rights have been identified at this time for properties impacted by the

26 Route; but as referenced above, temporary land rights may be required for construction

27 purposes. Where required, and if necessary, Hydro One will employ the following land

1 rights agreements associated with Hydro One’s temporary use during construction that
2 have been previously approved by the OEB in previous leave to construct applications²:

- 3 • Temporary Rights Agreement
- 4 • Damage Claim Agreement

5
6 The proposed Route impacts land uses, including TS lands and municipal road
7 allowances. In total, the Route impacts approximately 17 properties under the
8 ownership/jurisdiction of the following landowners:

- 9 • 1 Hydro One (Esplanade TS);
- 10 • 1 Toronto Hydro-Electric System Limited (Terauley TS);
- 11 • 15 municipal road allowances under the jurisdiction of the City of Toronto

12
13 The impacted land ownership/land use, approximate ROW area and approximate
14 relative proportions impacted by the Route are as follows:

15

Land Ownership Land Use	Approximate Area (Square Metres/Hectares)	Proportion of Route (%)
Hydro One Networks Inc. Esplanade TS	86 sq. m./0.009 ha.	1%
Toronto Hydro-Electric System Limited Terauley TS	216 sq. m./0.022 ha.	3%
City of Toronto Municipal Road Allowances	8,251 sq. m./0.825 ha.	96%

16
17 Details of all impacted properties and associated ownership information are included in
18 **Attachment 5** of this exhibit.

² These land agreements were approved as part of Hydro One’s Barrie Area Transmission Upgrade Project under docket EB-2018-0117

1 **3.0 Early Access to Land**

2
3 Hydro One will be relying on existing land rights to conduct various activities/studies
4 associated with engineering and design of the Route. It is expected that no early access
5 agreements will be required, and it is not anticipated that Hydro One will be required to
6 apply to the Board under section 98 of the *Ontario Energy Board Act, 1998* for early
7 access in advance of a leave to construct approval.

8
9 **4.0 Land Acquisition Process**

10
11 Hydro One has not identified any permanent land right requirements associated with
12 the Project at this time. Temporary rights will be acquired as identified with the
13 impacted landowner, City of Toronto. This requirement is identified in **Attachment 2**.

14
15 *Land Rights on Public Roads and Highways*

16 Hydro One intends to locate within road allowance, under the jurisdiction of the City of
17 Toronto, for the route. Given Hydro One's legislated occupation rights under Section 41
18 of the *Electricity Act, 1998*, it does not require consent of the owner or any other person
19 having an interest in public streets or highways to locate its proposed project corridor
20 ROW. Hydro One will engage with representatives from the City of Toronto having
21 jurisdiction over these public roads to ensure compliance with section 41(9) of the
22 *Electricity Act, 1998*.

23
24 **5.0 Land Related Forms**

25
26 **Attachments 3 and 4** to this exhibit contain the land right agreements that Hydro One
27 intends to utilize to obtain any identified land rights for the Project.

Filed: 2020-10-27
EB-2020-0188
PDT Project
E-1-1
Attachment 1

CITY OF TORONTO



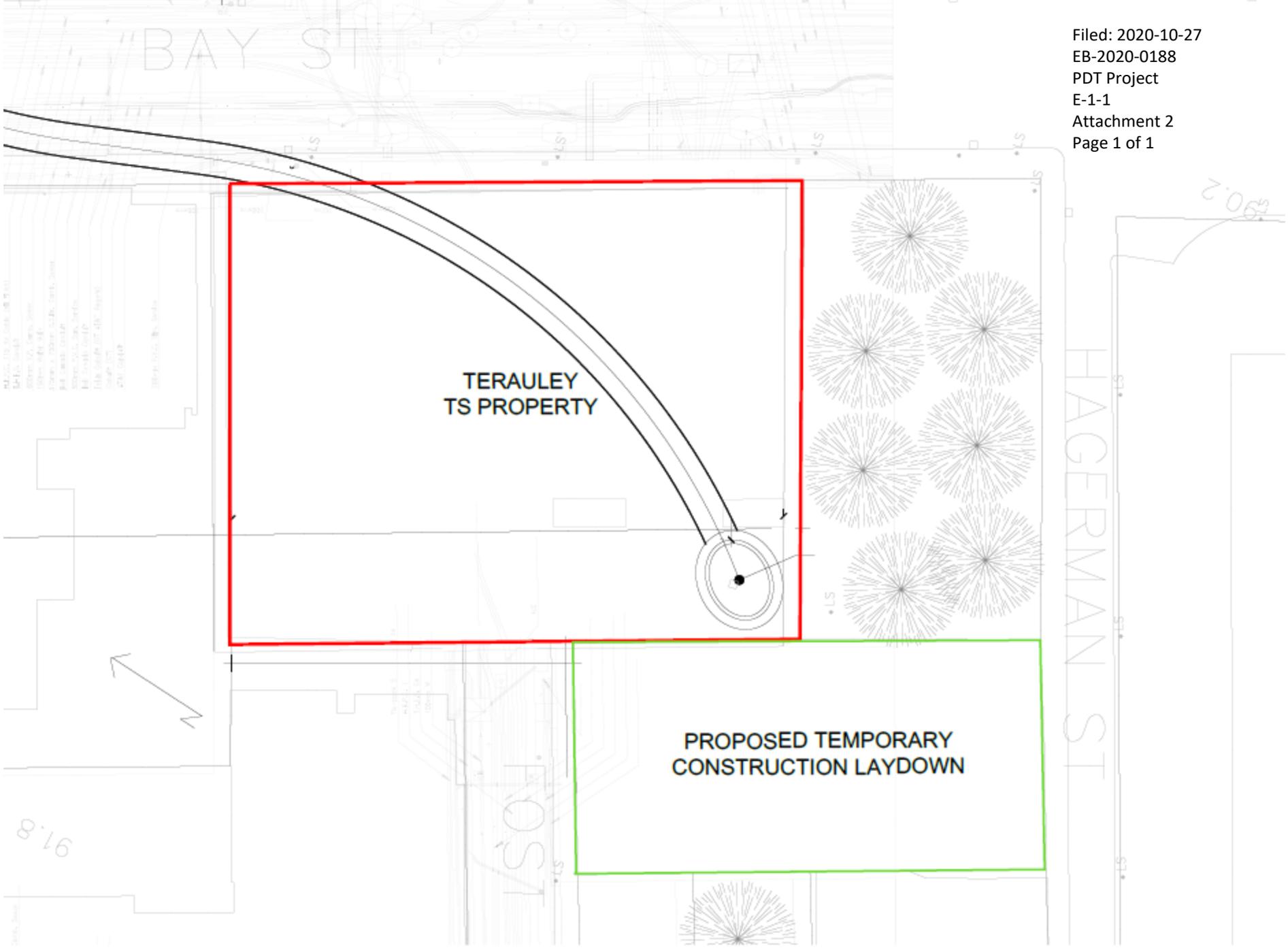
Power Downtown Toronto Project Notice Map

- Proposed Entry Shaft (A)
- ▲ Proposed Mid Shaft (B)
- ⬢ Proposed Exit Shaft (C)
- Existing Transformer Station (TS)
- Proposed New Underground Cable Route
- — — Existing Underground Cable Route
- Road
- +— Railway

1:12,000



Toronto Harbour



**TERAULEY
TS PROPERTY**

**PROPOSED TEMPORARY
CONSTRUCTION LAYDOWN**

Map scale: 1" = 100 feet
North arrow
Scale: 1" = 100 feet
Date: 10/27/2020
Author: [illegible]
Title: [illegible]

91.8

99.0.2

THIS AGREEMENT made in duplicate the XXXXX day of XXXXXX 201X.

BETWEEN:

(INSERT NAME)

[NTD – ENSURE FULL LEGAL NAMES OF ALL OWNERS INSERTED]

[NTD – IF MORE THAN 1 OWNER THEN AMEND TO “(collectively the “**Owner**”)”

(the “**Owner**”)
OF THE FIRST PART

AND:

HYDRO ONE NETWORKS INC.

(“**HONI**”)
OF THE SECOND PART

WHEREAS:

1. The Owner is the registered owner of lands legally described as **(INSERT LEGAL DESCRIPTION)** (the “Lands”)
2. The Owner is agreeable in allowing HONI to enter onto a portion of the Lands highlighted in yellow as shown on the sketch attached hereto as Schedule “A” (the “Strip”), for the purposes of certain construction activities in conjunction with the XXXXXX (the “Project”), which shall include but are not limited to a temporary material storage yard for the purposes of storage of materials and equipment, including but not limited to construction equipment and machinery, requisite to the construction on the Strip subject to the terms and conditions contained herein (collectively the “Activities”).

NOW THEREFORE THIS AGREEMENT WITNESSES THAT in consideration of Two Dollars (\$2.00) now paid by HONI to the Owner, and the respective covenants and agreements of the parties hereinafter contained and other valuable consideration, the receipt and sufficiency of which are hereby acknowledged by the parties hereto, the parties hereto agree as follows:

1. The Owner hereby grants to HONI and its respective officers, employees, workers, permittees, servants, agents, contractors and subcontractors, with or without vehicles, supplies, machinery, plant, material and equipment, as of the date this Agreement, (i) the right to commence the Activities on the Strip; and (ii) the right to enter upon and exit from, and to pass and repass at any and all times in, over, along, upon, across, and through the Strip and so much of the Lands as may be reasonably necessary.
2. The permission granted herein shall commence as of the date this Agreement (the “Commencement Date”) and shall terminate three (3) years from the Commencement Date (the “Initial Term”).
3. The Initial Term may be extended upon 60 days prior written notice from HONI to the Owner for an additional two (2) years on the same terms and conditions contained herein save for this right to extend (the “Extended Term”).
4. All agents, representatives, officers, directors, employees and contractors and property of HONI located at any time on the Lands shall be at the sole risk of HONI and the Owner shall not be liable for any loss or damage or injury (including loss of life) to them or it however occurring except and to the extent to which such loss, damage or injury is caused by the negligence or willful misconduct of the Owner.
5. Upon execution of this Agreement by all parties, HONI shall pay to the Owner the amount of XXXXX Dollars (\$XXXX), which is compensation for the permission granted herein.
6. HONI shall repair any physical damage to the Lands resulting from the Activities and, shall restore the Lands to its original condition so far as possible and practicable to the satisfaction of the Owner, acting reasonably.
7. HONI agrees that it shall indemnify and save harmless the Owner from and against all claims, demands, costs, damages, expenses and liabilities (collectively the “Costs”) whatsoever arising out of HONI’s presence on the Lands or of its activities on or in connection with the Lands arising out of the



permission granted herein except to the extent any of such Costs arise out of the negligence or willful misconduct of the Owner.

- 8. This Agreement does not commit the Owner to enter into any further agreements with HONI in conjunction with the Project.
- 9. This Agreement shall be governed by and construed in accordance with the laws of the Province of Ontario and the laws of Canada applicable herein. The parties hereto submit themselves to the exclusive jurisdiction of the Courts of the Province of Ontario.

IN WITNESS WHEREOF the Parties have hereunto set their respective hands and seals to this Agreement of Purchase and Sale.

SIGNED, SEALED AND DELIVERED

In the presence of)
)
)
)
)
)
 _____) _____ (seal)
 Print Name of Witness) **(INSERT NAME)**

)
)
)
)
 _____) _____ (seal)
 Print Name of Witness) **(INSERT NAME)**

IF OWNER IS CORPORATION – USE THE FOLLOWING

[INSERT FULL LEGAL NAME]

Per: _____
Print Name:
Print Title:

Per: _____
Print Name:
Print Title:

We/I have authority to bind the Corporation

HYDRO ONE NETWORKS INC.

Per: _____
Print Name: Tony Seravalle
Title: Manager, Facilities & Real Estate Acquisitions

I have authority to bind the Corporation



SCHEDULE "A"

Damage Claim

THIS MEMORANDUM OF AGREEMENT dated the _____ day of _____ 20XX

Between:

_____ herein called the "Claimant"

-and-

Hydro One Networks Inc.

_____ herein called "HONI"

Witnesseth:

The Claimant agrees to accept(\$ _____) in full payment and satisfaction of all claims or demands for damages of whatsoever kind, nature or extent which may have been done to date by HONI during the construction, completion, operation or maintenance of the works of HONI constructed on Lot(s) _____, Concession(s) _____ or according to Registered Plan No. _____ in the _____ of _____ of which property the Claimant is the _____ and which damages may be approximately summarized and itemized as:

WITNESS

CLAIMANT

Name:

Name:

Address:

Address:

Address:

HYDRO ONE NETWORKS INC.

HYDRO ONE
HST#

Per: _____
Name:
Title:

I have authority to bind the Corporation

RELEASE AND WAIVER
FULL AND FINAL RELEASE

IN CONSIDERATION of the payment or of the promise of payment to the undersigned of the aggregate sum of [INSERT SETTLEMENT AMOUNT] (\$), the receipt and sufficiency of which is hereby acknowledged, I/We, the undersigned, on behalf of myself/ourselves, my/our heirs, executors, administrators, successors and assigns (hereinafter the "Releasors"), hereby release and forever discharge HYDRO ONE NETWORKS INC., its officers, directors, employees, servants and agents and its parent, affiliates, subsidiaries, successors and assigns (hereinafter the "Releasees") from any and all actions, causes of action, claims and demands of every kind including damages, costs, interest and loss or injury of every nature and kind, howsoever arising, which the Releasors now have, may have had or may hereafter have arising from or in any way related to [INSERT DESCRIPTION OF THE DAMAGE CAUSED] on lands owned by [INSERT PROPERTY OWNER NAME] and specifically including all damages, loss and injury not now known or anticipated but which may arise or develop in the future, including all of the effects and consequences thereof.

AND FOR THE SAID CONSIDERATION, the Releasors further agree not to make any claim or take any proceedings against any other person or corporation who might claim contribution or indemnity under the provisions of the *Negligence Act* and the amendments thereto from the persons or corporations discharged by this release.

AND FOR THE SAID CONSIDERATION, the Releasors further agree not to disclose, publish or communicate by any means, directly or indirectly, the terms, conditions and details of this settlement to or with any persons other than immediate family and legal counsel.

AND THE RELEASORS hereby confirm and acknowledge that the Releasors have sought or declined to seek independent legal advice before signing this Release, that the terms of this Release are fully understood, and that the said amounts and benefits are being accepted voluntarily, and not under duress, and in full and final compromise, adjustment and settlement of all claims against the Releasees.

IT IS UNDERSTOOD AND AGREED that the said payment or promise of payment is deemed to be no admission whatsoever of liability on the part of the Releasees.

AND IT IS UNDERSTOOD AND AGREED that this Release may be executed in separate counterparts (and may be transmitted by facsimile) each of which shall be deemed to be an original and that such counterparts shall together constitute one and the same instrument, notwithstanding the date of actual execution.

IN WITNESS WHEREOF, the Releasors have hereunto set their respective hands this day of, 20XX.

SIGNED, SEALED & DELIVERED
In the presence of:

Witness

SIGNED, SEALED & DELIVERED
In the presence of:

Witness

Name

Name

Initials _____

PIN	LEGAL DESCRIPTION	OWNER(S)
[REDACTED]	[REDACTED]	HYDRO ONE NETWORKS INC.
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	CITY OF TORONTO
[REDACTED]	[REDACTED]	TORONTO ELECTRIC COMMISSIONERS

1

System Impact Assessment

2

3 Please refer to **Attachment 1** for the Notification of Conditional Approval of Connection
4 Proposal and **Attachment 2** for the Final System Impact Assessment prepared by the
5 Independent Electricity System Operator (SIA reference # CAA ID: 2020-EX1104). Hydro
6 One confirms that it will implement the requirements noted by the IESO in the SIA.

Filed: 2020-10-27
EB-2020-0188
PDT Project
F-1-1
Attachment 1

October 8th, 2020



Independent Electricity System Operator
Station A, Box 4474
Toronto, ON M5W 4E5
t 905.403.6900
www.ieso.ca

Farooq Qureshy
Manager, Transmission System Planning
Hydro One Networks Inc.
483 Bay Street, Toronto, Ontario
M5G 2P5

Dear Farooq Qureshy:
C5E/C7E - Underground Cable Replacement (the “project”)
Notification of Conditional Approval of Connection Proposal
CAA ID Number: 2020-EX1104

Thank you for the information regarding the project. The IESO has concluded that the proposed changes will not result in a material adverse impact on the reliability of the integrated power system. The IESO is therefore pleased to grant **conditional** approval as detailed in the attached expedited System Impact Assessment report. Please note that any material changes to your proposal, or changes to the information available to or system assumptions made by the IESO at the time the assessment for the project was carried out may require a re-assessment by the IESO and may nullify your conditional approval.

The likelihood of your project being re-assessed due to changes in the system assumptions made by the IESO will be reduced once your project attains the “committed” status as per Section 3.3 of [Market Manual 1.4: Connection Assessment and Approval](#) (formerly Market Manual 2.10). Therefore, if your project is not “committed” at this point, you are reminded of your obligation to provide updates and notifications in order for the IESO to give your project this classification. Meanwhile, in the event you are required to make a project related decision and are concerned about the validity of the Notification of Conditional Approval of this project and the connection requirements presented in the System Impact Assessment, please contact us at connection.assessments@ieso.ca.

You may now initiate the IESO’s **Market Registration** process. To do so, please contact Market Registration at market.registration@ieso.ca as soon as possible/at least eight months prior to your expected energization date. The SIA report, attached hereto, details the requirements that your company must fulfill during this process, including demonstrating that the equipment *as installed* will not be materially different from the equipment *as approved* by the IESO.

Your conditional right to connect is balanced by an obligation to demonstrate installed equipment meets performance requirements. During the **Market Registration** process, you shall be required to demonstrate this obligation has been fulfilled in accordance with [Market Manual 1.6: Performance Validation](#) (formerly Market Manual 2.20).

When your company has successfully completed the IESO’s **Market Registration** process, the IESO will provide you with a **final approval**, in the form of a Registration Approval Notification (RAN) document, thereby confirming that the equipment is fully authorized to connect to the IESO-controlled grid.

If you have any questions or require further information, please contact me via connection.assessments@ieso.ca.

All information submitted in this process will be used by the IESO solely in support of its obligations under the *Electricity Act, 1998*, the *Ontario Energy Board Act, 1998*, the *Market Rules* and associated policies, standards and procedures and in accordance with its licence. All information submitted will be assigned the appropriate confidentiality level upon receipt.

Confidential

revision 2017-November

Yours truly,

Samuel Jager, P.Eng.

Engineering Manager – Connection Assessments

Telephone: (905) 855-6331

E-mail: samuel.jager@ieso.ca

cc: IESO Records



Expedited System Impact Assessment Report

Final Report – Public

CAA ID: 2020-EX1104

Project: C5E and C7E Underground Cable Replacement

Connection Applicant: Hydro One Networks Inc.

October 16th, 2020



Acknowledgement

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

Disclaimers

IESO

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

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

If the connection applicant has engaged a consultant to perform connection assessment studies, the connection applicant acknowledges that the IESO will be relying on such studies in conducting its assessment and that the IESO assumes no responsibility for the accuracy or completeness of such studies including, without limitation, any changes to IESO base case models made by the consultant. The IESO reserves the right to repeat any or all connection studies performed by the consultant if necessary to meet IESO requirements.

Conditional approval of the proposed connection means that there are no significant reliability issues or concerns that would prevent connection of the proposed project to the IESO-controlled grid. However, the conditional approval does not ensure that a project will meet all connection requirements. In addition, further issues or concerns may be identified by the transmitter(s) during the detailed design phase that may require changes to equipment characteristics and/or configuration to ensure compliance with physical or equipment limitations, or with the Transmission System Code, before connection can be made.

This report has not been prepared for any other purpose and should not be used or relied upon by any person for another purpose. This report has been prepared solely for use by the connection applicant and the IESO in accordance with Chapter 4, section 6 of the Market Rules. This report does not in any way constitute an endorsement of the proposed connection for the purposes of obtaining a contract with the IESO for the procurement of supply, generation, demand response, demand management or ancillary services.

The IESO assumes no responsibility to any third party for any use, which it makes of this report. Any liability which the IESO may have to the connection applicant in respect of this report is governed by Chapter 1, section 13 of the Market Rules. In the event that the IESO provides a draft of this report to the connection applicant, the connection applicant must be aware that the IESO may revise drafts of this report at any time in its sole discretion without notice to the connection applicant. Although the IESO will use its best efforts to advise you of any such changes, it is the responsibility of the connection applicant to ensure that the most recent version of this report is being used.



Project Description

Hydro One Networks Inc. (the "connection applicant" and "transmitter") is proposing to replace the 115 kV underground cables from Terauley Transformer Station (TS) to Esplanade TS on circuits C5E and C7E (the "project"). The electrical parameters of the new cables are included in Appendix A of this report.

The connection applicant will also tune the settings of the existing line protections for transmission circuits C5E and C7E to account for the slightly different impedances of the proposed cables. The functionality and operating times of the protection system will remain unchanged.

The proposed in service date is in December 2024.

Notice of Conditional Approval

This assessment concludes that the proposed connection of the project is expected to have no material adverse impact on the reliability of the integrated power system, provided that all requirements in this report are implemented. Therefore, the assessment supports the release of the Notification of Conditional Approval for connection of the project.

IESO Requirements for Connection

General Requirements: The connection applicant shall satisfy all applicable requirements specified in the Market Rules, the Transmission System Code and reliability standards. The most relevant requirements are presented in Appendix B of this report.

Appendix A: Data Verification

Table 1 Disconnect switch specifications

Parameter	Existing C5E	Existing C7E	Proposed C5E	Proposed C7E
Sections	Terauley TS to Esplanade TS			
Length (km)	3.57	3.57	2.5 ¹	2.5 ¹
Positive sequence R (pu)	0.001891	0.001722	0.000364	0.000367
Positive sequence X (pu)	0.004875	0.004526	0.004289	0.004289
Positive sequence B (pu)	0.077123	0.081672	0.028442	0.028442
Zero sequence R (pu)	0.014093	0.013768	0.003087	0.003106
Zero sequence X (pu)	0.001459	0.001387	0.002571	0.002592
Zero sequence B (pu)	0.077123	0.081672	0.028442	0.028442
Winter continuous rating (A)	750	750	1200	1200
Winter 15 min STE rating (A)	2240	2240	6733	6733
Winter pre-loading used for STE calculation (A)	600	600	500	500
Winter LTE rating (A)	N/A ²	N/A ²	2174	2174
Summer continuous rating (A)	700	700	1200	1200
Summer 15 min STE rating (A)	2390	2390	6733	6733
Summer pre-loading used for STE calculation (A)	500	500	500	500
Summer LTE rating (A)	N/A ²	N/A ²	2174	2174

¹ The cable lengths have changed due to a change in routes

² At the time of this assessment the connection applicant did not provide the long term emergency (LTE) ratings of the existing cables, however, the connection applicant confirmed that the LTE ratings of the new cables are higher than the existing ones.

Appendix B: General Requirements

The connection applicant shall satisfy all applicable requirements specified in the Market Rules and reliability standards. The following requirements highlight some of the general requirements that are applicable to the project.

1. The connection applicant shall notify the IESO at connection.assessments@ieso.ca as soon as it becomes aware of any changes to the project scope or project data used in this assessment. The IESO will determine whether these changes require a re-assessment.
2. The connection applicant must initiate the IESO's Market Registration process prior to the commencement of any project related outages. Once the IESO's Market Registration process has been successfully completed, the IESO will provide the connection applicant with a Registration Approval Notification (RAN) document, confirming that the project is fully authorized to connect to the IESO-controlled grid. For more details about this process, the connection applicant is encouraged to contact IESO's Market Registration at market.registration@ieso.ca.

The connection applicant is required to provide "as-built" equipment data for the project during the IESO Market Registration process. If the "as-built" equipment data differs materially from the ones used in this assessment, then the IESO may decide that further analysis of the project is required.

3. The connection applicant shall ensure that the project's equipment meet the voltage requirements specified in section 4.2 and section 4.3 of the Ontario Resource and Transmission Assessment Criteria (ORTAC).
4. The connection applicant shall ensure that the telemetry requirements for the project are satisfied as per the applicable Market Rules requirements. The finalization of telemetry quantities and telemetry testing will be conducted during the IESO Market Registration process.
5. The connection applicant shall ensure that the connection equipment is designed to be fully operational in all reasonably foreseeable ambient conditions. Failures of the connection equipment must be contained within the project and have no adverse impact on the IESO-controlled grid.
6. As per Market Manual 1.4: Connection Assessment and Approval (formerly Market Manual 2.10), the connection applicant will be required to provide a status report of its proposed project with respect to its progress upon request of the IESO using the [project status report form](#) on the IESO website. Failure to comply with project status requirements listed in Market Manual 1.4: Connection Assessment and Approval (formerly Market Manual 2.10) will result in the project being withdrawn.



Appendix C: Technical Assessment

C.1 Equipment Technical Characteristics

Based on the data submitted by the connection applicant in Table 1 in Appendix A: Data Verification, the thermal ratings of the replacement cables of the 115 kV C5E and C7E transmission circuits are the same or better than those of the existing ones. In addition, the impedance of the replacement cables is not materially different from that of the existing ones and is therefore acceptable. Of note, the susceptance of the replacement cables is lower than that of the existing ones, however, this has an immaterial impact on the voltage levels in the vicinity of the project and is therefore acceptable.

The existing protections for transmission circuits C5E and C7E will be tuned to account for the slightly different impedances of the proposed cables. The transmitter confirmed that the functionality and operating times of the protection system will remain the same. As such, the proposed changes to protection settings are not expected to have any adverse impact on the reliability of the integrated power system.

**Independent Electricity
System Operator**

1600 120 Adelaide Street West
Toronto, Ontario M5H 1T1

Phone: 905.403.6900

Toll free: 1.888.448.7777

E mail: customer.relations@ieso.ca

ieso.ca

 [@IESO_Tweets](https://twitter.com/IESO_Tweets)

 facebook.com/OntarioIESO

 linkedin.com/company/IESO

1 **Customer Impact Assessment**

2

3 Please refer to **Attachment 1** for the Draft Customer Impact Assessment (“**CIA**”)
4 prepared by Hydro One. The CIA will be finalized once all customer comments have
5 been received or 30 days have elapsed since the issuance of the CIA, whichever is
6 earlier. Once finalized, the draft CIA provided herewith the prefiled evidence will be
7 updated accordingly.



Hydro One Networks Inc.
483 Bay Street
Toronto, Ontario
M5G 2P5

CUSTOMER IMPACT ASSESSMENT
C5E/C7E Esplanade TS x Terauley TS
HV Cable Replacement

CIA ID: 2020-05
Revision: Draft R1
Date: October 26th 2020
Issued by: System Planning Division
Hydro One Networks Inc.

Prepared by:

Approved by:

Eva Ping
Network Management Engineer
System Planning Division
Hydro One Networks Inc.

Farooq Qureshy
Manager, Transmission Planning - Central
System Planning Division
Hydro One Networks Inc.

Disclaimer

This Customer Impact Assessment was prepared based on preliminary information available about the proposed HV cable replacement of the circuits C5E and C7E between Esplanade TS and Terauley TS in downtown Toronto. It is intended to highlight significant impacts, if any, to affected transmission customers early in the project development process and thus allow an opportunity for these parties to bring forward any concerns that they may have including those needed for the review of the connection and for any possible application for leave to construct. Subsequent changes to the required modifications or the implementation plan may affect the impacts of the proposed connection identified in this Customer Impact Assessment. The results of this Customer Impact Assessment and the estimate of the outage requirements are also subject to change to accommodate the requirements of the IESO and other regulatory or municipal authority requirements. The fault levels computed as part of this Customer Impact Assessment are meant to assess current conditions in the study horizon and are not intended to be for the purposes of sizing equipment or making other project design decisions.

Hydro One Networks shall not be liable to any third party which uses the results of the Customer Impact Assessment under any circumstances whatsoever, for any indirect or consequential damages, loss of profit or revenues, business interruption losses, loss of contract or loss of goodwill, special damages, punitive or exemplary damages, whether any of the said liability, loss or damages, arises in contract, tort or otherwise.

CUSTOMER IMPACT ASSESSMENT

C5E/C7E ESPLANADE TS X TERAULEY TS HV CABLE REPLACEMENT

1.0 INTRODUCTION

The Esplanade TS to Terauley TS 115kV underground cable circuits C5E/C7E provides a critical supply to the core of downtown Toronto. The 3.6km cable circuits have been in service since 1959 and are nearing end of life. The replacement of these cable circuits is essential.

In accordance with section 6 of the Ontario Energy Board’s Transmission System Code (“TSC”), Hydro One Networks Inc. (Hydro One) is to carry out a Customer Impact Assessment (“CIA”) study to assess the impact of this HV cable replacement on existing customers in the affected area.

This report presents the results of a Customer Impact Assessment (CIA) study completed by Hydro One to assess the potential impact of the proposed cable replacement on the transmission customers in the local vicinity. This study is intended to supplement the System Impact Assessment (SIA) CAA ID 2020-EX1104 entitled “C5E/C7E - Underground Cable Replacement”, issued by the IESO. In their report, the IESO concluded that there is no adverse impact of this project on the transmission system.

2.0 BACKGROUND

The 115kV circuits C5E/C7E provides a critical supply to the core of downtown Toronto including Hospital Row, the University of Toronto, and Toronto City Hall. The 3.6km cable sections between Esplanade TS and Terauley TS are paper-insulated low-pressure oil-filled underground cables. They have been in service for over 60 years. The cable jackets and paper insulation were found to be in deteriorated condition which can lead to overheating, oil leaks, and cable failure. Furthermore, the oil pressure system has been a source of many nuisance oil leaks and is obsolete with few spare part suppliers. A part of these cables is buried under Queens Quay along Lake Ontario. A large oil leak would cause adverse environmental impact.

These cables are therefore proposed to be replaced by cross-linked polyethylene (XLPE) cables installed in a tunnel about 2.5km long on a different route. The cables will have a minimum summer continuous rating of 1200A. The current proposed in-service date is December 2024. The map and single-line diagram of this area are shown in Figure A1 and A2 in Appendix A.

3.0 CUSTOMER LIST

The focus of this study is on transmission connected customers supplied by C5E and C7E circuits. The stations supplied by these circuits and the corresponding connected customers are listed in Table 1 below.

Table 1: Connected Customers

Transformer Station	Customer
Cecil TS	Toronto Hydro-Electric System Limited
Esplanade TS	Toronto Hydro-Electric System Limited
Terauley TS	Toronto Hydro-Electric System Limited

4.0 STUDY RESULTS

Table 2 below compares the characteristics of the new cables with the existing cables for the subject replacement section of circuits C5E and C7E.

Table 2: C5E and C7E Esplanade TS x Terauley TS Cable Electrical Characteristics

Circuit	From Bus	To Bus	Length (km)	Existing (3.6km)			New (2.5km)		
				R (pu)	X (pu)	B (pu)	R (pu)	X (pu)	B (pu)
C5E	Terauley TS	Manhole A	1.835	0.001038	0.002633	0.036665	0.000364	0.004289	0.028442
	Manhole A	Esplanade	1.722	0.000853	0.002242	0.040458			
	Total		3.557	0.001891	0.004875	0.077123			
C7E	Terauley TS	Manhole A	1.835	0.001038	0.002633	0.036665	0.000367	0.004289	0.028442
	Manhole A	Esplanade	1.722	0.000869	0.002284	0.041214			
	Total		3.589	0.001907	0.004917	0.077879			

PU Voltage Base = 118.05kV

The cable replacement changes the route of the Esplanade TS x Terauley TS line section. The new cable length for this line section is about 1km shorter than the existing one. However, the total line impedance is slightly less. The reduction of the line impedance is not significant and therefore power flows, area station voltages and short circuits are not expected to be materially impacted by the change.

4.1 Short- Circuit Studies

There is an insignificant increase in the fault level primarily at the Esplanade TS 115kV buses as a result of the HV cable replacement. The short circuit levels at all area HV and LV buses are given in Appendix B Tables 1 for the before and after scenarios.

All local customers are advised to review the short circuit results to ensure that their equipment ratings are adequate for the increased fault current level.

4.2 Customer Reliability

The proposed cable replacement work will increase supply reliability for customers connected to these circuits as it reduces the chance of cable failure.

4.3 Preliminary Outage Impact Assessment

The new cables will be routed in a different path than that of the existing cables. Therefore, no major outages are expected to impact the supply of customer's load. Exact outage schedule will be made available during the execution phase of the project and will be established in consultation with load customers in the area. The outage duration, if any, will be minimized and risk managed with proper outage planning and co-ordination.

5.0 CONCLUSIONS AND RECOMMENDATIONS

This Customer Impact Assessment (CIA) study has reviewed the impact of the cable replacement for the local customers connected to these 115kV circuits C5E and C7E. The study concludes that the proposed project does not have any adverse impact on Hydro One Transmission customers.

The fault levels at the studied stations in the area experience an insignificant increase. Customers are requested to review the fault levels provided in Appendix B to ensure that the capability of their equipment is not exceeded.

6.0 APPENDIX A



Figure A1: Map of Toronto Downtown Core Showing Existing C5E/C7E Route and Future Tunnel Route

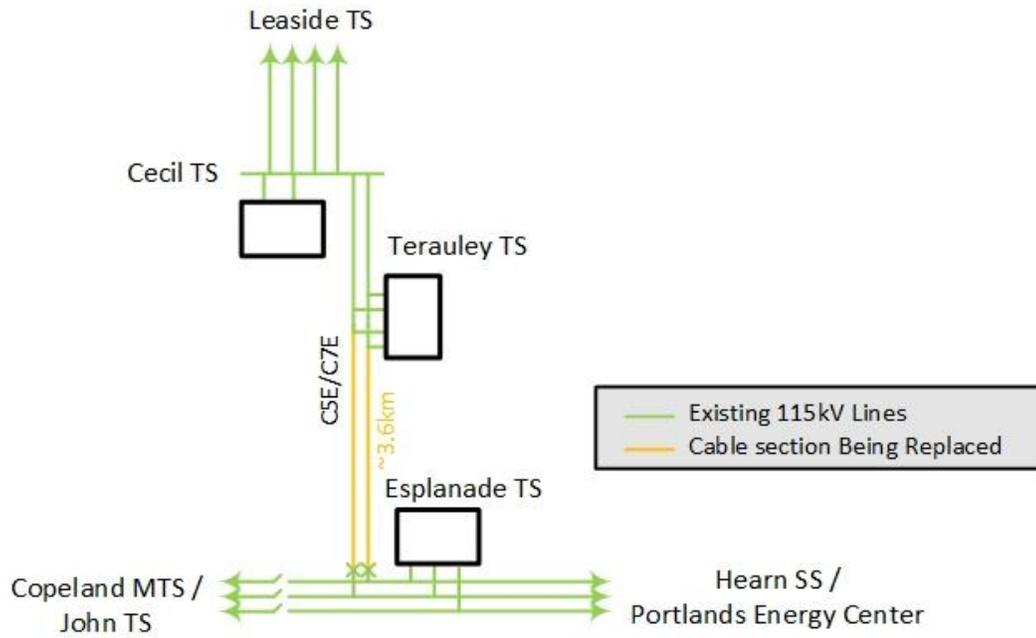


Figure A2: Simplified Single-Line Diagram of C5E and C7E

7.0 APPENDIX B

Table B1: Short Circuit Levels¹

Area Station Buses	Base kV	Existing Fault Level (kA)				New Fault Level (kA)				Breaker Ratings (kA)	
		3-phase		Line to Ground		3-phase		Line to Ground			
		Sym	Asym	Sym	Asym	Sym	Asym	Sym	Asym	3ph Sym	3ph Asym
Cecil (HP Bus)	118.05	42.37	49.47	38.05	41.42	42.45	50.26	38.10	42.11	55	67
Cecil (A1A2 Bus)	13.8	18.75	22.33	1.96	2.62	18.75	22.37	1.96	2.62	11.5 ²	13.8
Cecil (A3A4 Bus)	13.8	18.08	21.20	10.29	13.46	18.09	21.24	10.29	13.47	11.5 ²	13.8
Cecil (A5A6 Bus)	13.8	18.80	22.56	10.48	13.76	18.81	22.60	10.48	13.77	28	33.6
Cecil (A7A8 Bus)	13.8	18.90	22.76	2.18	2.96	18.91	22.81	2.18	2.96	23	27.6
Esplanade (H2JK)	118.05	33.05	36.16	29.02	29.74	33.07	36.20	29.02	29.75	--	--
Esplanade (H10DE)	118.05	34.73	37.98	31.53	32.55	35.25	40.38	31.67	33.67	37.9	45.5
Esplanade (H9DE)	118.05	34.65	37.86	31.49	32.50	35.20	40.31	31.64	33.64	37.9	45.5
Esplanade (J Bus)	13.8	17.99	21.12	10.40	13.61	18.00	21.19	10.40	13.63	25	30
Esplanade (Q Bus)	13.8	17.02	19.76	1.95	2.59	17.03	19.82	1.95	2.59	25	30
Esplanade (A Bus)	13.8	19.31	22.47	1.97	2.62	19.32	22.56	1.97	2.62	20.3	24.4
Terauley (D1D2 Bus)	118.05	39.45	44.83	34.64	36.39	39.56	45.66	34.74	37.11	--	--
Terauley (D3D4 Bus)	118.05	39.47	44.84	34.64	36.39	39.58	45.68	34.73	37.11	--	--
Terauley (A1A2 Bus)	13.8	16.96	19.51	1.98	2.62	16.97	19.55	1.98	2.62	25.4	30.5
Terauley (A3A4 Bus)	13.8	15.39	17.90	1.96	2.61	15.39	17.93	1.96	2.61	20.3	24.4
Terauley (A5A6 Bus)	13.8	15.39	17.90	1.96	2.61	15.39	17.93	1.96	2.61	23	27.6
Terauley (A9A10 Bus)	13.8	18.60	21.40	1.99	2.64	18.60	21.44	1.99	2.64	31.5	37.8
Leaside (EJ Bus)	118.05	44.55	56.16	47.92	62.46	44.56	56.18	47.93	62.48	63 ³	75
Leaside (KP Bus)	118.05	43.62	55.27	45.74	60.34	43.65	55.43	45.76	60.47	63 ³	75
Hearn	118.05	46.17	52.41	45.26	52.51	46.20	52.49	45.27	52.61	63 ⁴	80

¹ The short circuit study assumes all facilities in service with Leaside 115kV bus tie open and Hearn Bus tie close.

² LV transformer breakers only – they are not seeing the full fault current.

³ Leaside Cap bank breakers rated at 40kA. However, fault level at Cap bank breaker is 31kA with series reactors.

⁴ Hearn Cap bank breaker SC12SC rated at 40kA. However, fault level at Cap bank breaker is 31kA with series reactors.