ENVIRONMENTAL AND SOCIO-ECONOMIC ASSESSMENT

Line 10 Westover Segment Replacement Project

Prepared for

Enbridge Pipelines Inc.

November 2015

CH2M HILL Energy Canada, Ltd.
72 Victoria St. South Suite 300
Kitchener, Ontario N2G 4Y9

Dillon Consulting Limited
235 Yorkland Blvd Suite 800
Toronto, Ontario M2J 4Y8

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Acronyms and Abbreviations

AAQC	Ambient Air Quality Criteria
ACEP	Alberta Clipper Expansion Project
asl	above sea level
CA	Conservation Authority
CAC	Criteria Air Contaminants
CAPP	Canadian Association of Petroleum Producers
CSA	Canadian Standards Association
CEA	*Canadian Environmental Assessment* (Agency or *Act*)
CCME	Canadian Council of Ministers of the Environment
CH2M	CH2M HILL Energy Canada, Ltd.
CO	carbon monoxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSA	Canadian Standards Association
Dillon	Dillon Consulting Limited
DFO	Fisheries and Oceans Canada
D.R. Poulton	D.R. Poulton & Associates Incorporated
DUC	Ducks Unlimited Canada
EGC	Enbridge's Environmental Guidelines to Construction
EIL	Environmental Issues List
ELC	Ecological Land Classification
EMS	Emergency Medical Services
Enbridge	Enbridge Pipelines Inc.
EPP	Environmental Protection Plan
ESA	Environmental and Socio-Economic Assessment
Footprint	Footprint Study Area
FPWC	Federal Policy on Wetland Conservation
GHG	greenhouse gas emissions
GRCA	Grand River Conservation Authority
HAHA	Hamilton Angling and Hunting Association
Hamilton	City of Hamilton, Ontario
Hamilton Airport	John C. Munro Hamilton International Airport
HCA	Hamilton Conservation Authority

HDD	horizontal directional drill
HORU	Human Occupancy and Resource Use
IBA	Important Bird Area
L4EP	Line 4 Extension Project
LSA	Local Study Area
LRT	light rail transit
MOECC	Ontario Ministry of Environment and Climate Change
MTCS	Ontario Ministry of Tourism, Culture and Sport
NEB	National Energy Board
NEB OPRs	*National Energy Board Onshore Pipeline Regulations*
NHIC	Natural Heritage Information Centre
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
NPCA	Niagara Peninsula Conservation Authority
NRCan	Natural Resources Canada
OAS	Online Application System
OBBA	Ontario Breeding Bird Atlas
O&MM	Enbridge's Operation and Maintenance Manual
OMMAH	Ontario Ministry of Municipal Affairs and Housing
OMNRF	Ontario Ministry of Natural Resources and Forestry
O_3	ozone
PCEM	Post-Construction Environmental Monitoring
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PPS	Provincial Policy Statement
PSW	Provincially Significant Wetland
RSA	Regional Study Area
RSV	Remote Sectionalizing Valve
ROW(s)	right(s) of way
SARA	*Species at Risk Act*
SO_2	sulphur dioxide
SO_x	sulphur oxides
The Project	The construction and operation of approximately 35 km of replacement pipeline (the Line 10 Westover Segment Replacement pipeline) and the decommissioning in-place of approximately 32 km of the corresponding segment of the pipeline (the existing Line 10 pipeline).

TLRU	Traditional Land and Resource Use
TSS	Total Suspended Solids
UNESCO	United Nations Educational, Scientific and Cultural Organization
VOCs	volatile organic compounds
ZOI	zone of influence

Glossary of Terms

Construction right of way (ROW): An area comprised of the easement of the ROW and temporary workspace in which the construction of a pipeline will occur. For this Project, The replacement pipeline will be constructed in a construction ROW consisting of both permanent easement and temporary workspace. The permanent easement for the replacement pipeline is approximately 10 m wide. Temporary workspace along the construction ROW is expected to be approximately 23 m wide.

Cultivated land: Lands that are under annual crop or fallow at the time of construction.

Centre line: For the purpose of this ESA, the centre line is considered to be the centre of the construction ROW.

Easement: An agreement that provides Enbridge with specific rights to use property owned by another party to construct, own and operate a pipeline within the agreed upon area. The agreement sets out the rights and obligations of both Enbridge and the party in regards to the use of the lands and will often specify restrictions on the use of the land.

Environmental Alignment Sheets: Photomosaics showing the Project alignment that are included as Appendix 1 of the ESA in order to summarize and/or illustrate pertinent environmental information gathered during field surveys or desktop research.

Environmental Inspector: Field personnel who along with other responsibilities, monitor construction or operational work to ensure environmental compliance with permits, regulatory approvals, applicable Enbridge environmental plans and environmental contract specifications, and other environmental requirements.

Environmental Protection Plan (EPP): Following the submission of the Project Application, Enbridge intends on filing a comprehensive Project-specific EPP with the National Energy Board (NEB). Mitigation measures provided in the ESA as well as Enbridge's environmental compliance strategy (Section 6.0 and Section 8.0, respectively) are intended to identify the specific goals for protecting environmental elements and addressing socio-economic elements potentially interacting with the Project. The EPP will be written in construction specification format for inclusion in construction contract documents, and will include mitigation commitments found in the ESA. In addition, contingency plans and management plans will be appended to the EPP.

Footprint: The land area directly disturbed by Project construction and clean-up activities, including associated physical works and activities (i.e., construction ROW, permanent facilities, temporary facilities, temporary infrastructure and workspace).

Landowner: The person in whose name a Title has been issued pursuant to applicable legislation.

Mitigation Measures: Measures for the elimination, reduction or control of the adverse environmental effects of a project, and includes restitution for any damage to the environment caused by those effects through replacement, restoration, compensation or any other means. For the purpose of this ESA, mitigation measures were generally derived from the measures contained in Enbridge's Environmental Guidelines for Construction (EGC) and/or Enbridge's Operation and Maintenance Manual, on file with the NEB.

Project Application: Under Section 58 of the *NEB Act* and Section 45.1 of the *National Energy Board Onshore Pipeline Regulations (NEB OPR)*, Enbridge is applying for approval to operate and construction the proposed Line 10 Westover Segment Replacement Project, including the decommissioning of this portion of the existing Line 10 pipeline. For the purposes of this ESA, the Project Application refers to relevant chapters associated with the NEB application, including the "Lands Matters", Aboriginal Matters" and "Consultation Filing Requirements" chapters, filed with the NEB under separate cover.

Rare species: A species identified as having small population numbers within its natural geographical range. Species may be considered rare at the local, regional, provincial/state, national or global level.

Reclamation: The process of returning land to its former use or other productive uses.

Shoo-fly: Temporary access routes or bypasses used to move equipment or travel around portions of the ROW.

Temporary Infrastructure and Workspace: Additional land required temporarily during the construction phase of a project for multiple users and may be located adjacent, or near to, the permanent easement, but may also include temporary access and laydown areas.

1.0 Introduction

1.1 Project Overview

Enbridge Pipelines Inc. (Enbridge) is applying to the National Energy Board (NEB) under Section 58 of the *NEB Act* for approval to construct and operate a replacement pipeline (the Line 10 Westover Segment Replacement pipeline) and Section 45.1 of the *National Energy Board Onshore Pipeline Regulations* (*NEB OPR*) for approval to decommission in-place the corresponding segment of the existing Enbridge Line 10 pipeline (the Project).

Enbridge currently operates the existing Line 10 pipeline, which transports a variety of crude oils from the Westover Terminal in the City of Hamilton, Ontario (Hamilton) to United Refining Company's Kiantone Pipeline in West Seneca, New York, which serves a refinery in Warren, Pennsylvania.

The Project consists of the replacement of approximately 32 km of existing 324 mm O.D. (NPS 12) pipeline with 508.0 mm O.D. (NPS 20) pipeline in southern Ontario from Enbridge's existing Westover Terminal to the existing Nanticoke Junction Facility (Figure 1.1-1). The portion of the existing Line 10 pipeline that will be decommissioned is approximately 32 km long; however, with the planned deviations from the existing pipeline, the replacement pipeline will be approximately 35 km long. In recent years, this segment of the existing Line 10 pipeline has experienced an increasing number of preventative maintenance digs to visually inspect and repair the line, and has therefore, reached Enbridge's conservative threshold for replacement. Based on a predictive model, it is less impactful to the environment and the public, while also more economical to replace this segment of pipeline in the short-term, rather than continually dig and subsequently inspect the line. Enbridge strives to identify and address any potential future concerns before they can pose a threat to the public or the environment. As such, strategic and regular investments in routine maintenance, technology and upkeep (e.g., the Westover Segment Replacement Project) are critical to the ongoing fitness of all of Enbridge's pipelines and infrastructure.

The replacement pipeline will be constructed within a construction right of way (ROW) typically 33 m wide, with a permanent easement approximately 10 m wide and temporary workspace approximately 23 m wide. The pipeline will be placed in the existing ROW subject to existing easement agreements, where feasible. New ROW will be acquired adjacent to the existing easement when the replacement pipeline cannot be placed within the existing easement. There are planned deviations to avoid features such as golf courses and residences. Additional temporary workspace may be required at bends, corners, road crossings, bores, horizontal directional drill (HDD) locations, as well as for construction activities such as stockpile sites, equipment loading and unloading locations, parking, and access to the ROW.

In accordance with Canadian Standards Association (CSA) Z662-15, the decommissioned segment of the existing Line 10 pipeline will be cleaned, isolated, left in place, and be subject to ongoing monitoring. Physical excavation activities necessary to decommission the existing Line 10 segment will be focused at both ends of the pipeline segment and any locations where segmentation is planned.

Pending regulatory approval, construction of the replacement pipeline is anticipated to commence in Q3 2017 and be in-service by Q1 2018. The existing pipeline will remain in operation until it is decommissioned, following the replacement pipeline in-service date. Design, construction and operation of the Project will be in compliance with all applicable codes, standards and regulations.

Enbridge commissioned CH2M HILL Energy Canada, Ltd. (CH2M) to prepare an Environmental and Socio-Economic Assessment (ESA) in collaboration with Dillon Consulting Limited (Dillon). The ESA has been prepared in accordance with the NEB *Filing Manual* (NEB 2015a) under Section 58 of the *NEB Act* and Section 45.1 of the *NEB OPR*.

1.2 Project Justification

The existing Line 10 pipeline was built in 1962 and is approximately 143 km, carrying a variety of crude oils, operating safely and reliably for more than half a century. Enbridge's inline inspection program determined that an approximate 32 km segment of Line 10 could be replaced in order to eliminate the requirement for numerous maintenance digs in the upcoming years.

1.3 Regulatory Framework

The Project requires NEB approval pursuant to Section 58 of the *NEB Act* for the Line 10 replacement section and Section 45.1 of the *NEB OPR* for the decommissioning of the segment of the existing Line 10 pipeline. Pursuant to Guide A.2.1 and K.2 of the NEB *Filing Manual*, the level of detail contained in this report corresponds to the nature and magnitude of the anticipated environmental impacts, and has been prepared to meet NEB requirements for a Section 58 and 45.1 application. An ESA checklist of NEB *Filing Manual* requirements is provided in Section 1.8. In addition, the ESA has been prepared to meet the requirements of the NEB Online Application System (OAS) guidance. This ESA has been prepared having regard for the NEB *Filing Manual*, OAS guidance, and concerns identified through regulatory, stakeholder and public consultation as well as Aboriginal engagement. An environmental assessment under the *Canadian Environmental Assessment* (CEA) *Act, 2012* is not required since the Project is not considered a designated project under the *CEA Act, 2012*.

In addition to the federal authorities, provincial and local authorities are also anticipated to have environmental interests in the Project, including:

- Ontario Ministry of Environment and Climate Change (MOECC);
- Hamilton Conservation Authority (HCA);
- Grand River Conservation Authority (GRCA);
- Niagara Peninsula Conservation Authority (NPCA); and
- the City of Hamilton.

A list of potential environmental permits, authorizations and notifications is presented in Table 2.9-1.

1.4 Scope of the Project

As per the NEB *Filing Manual*, the scope of the Project includes the physical components and activities required to carry out the Project enabling it to proceed (NEB 2015a).

This combination of activities and components includes:

- construction of approximately 35 km of the Line 10 replacement pipeline from the Westover Terminal to the Nanticoke Junction Facility;
- decommissioning of an approximate 32 km segment of the existing Line 10 pipeline between the Westover Terminal and the Nanticoke Junction Facility;
- construction of permanent facilities and associated permanent access;
- use of temporary facilities (e.g., construction office sites, pipe stockpile sites and equipment storage sites); and
- use of existing infrastructure (e.g., ROW and access roads).

1.5 Scope of the Assessment

Scoping is the process of identifying the physical works and activities to include within the ESA and what biophysical and socio-economic elements are likely to be affected. Proper scoping reduces the risk of including unimportant or irrelevant information in the assessment or excluding factors that should be assessed (NEB 2015a). This environmental assessment includes the construction and operation of the replacement pipeline and the decommissioning of the existing pipeline, taking into account the factors listed in the NEB *Filing Manual* (NEB 2015a) and pertinent issues and concerns identified through regulatory, stakeholder and public consultation and Aboriginal engagement.

For projects such as this that do not require an environmental assessment under the *CEA Act*, *2012*, the NEB usually determines the scope of the assessment by applying similar scoping principles to those applied under the *CEA Act, 2012* (NEB 2015a). Enbridge must submit an ESA for the replacement pipeline and facilities, and decommissioning of the existing Line 10. This ESA includes a description of the following:

- the environmental and socio-economic setting;
- the predicted beneficial and adverse effects of the Project on the socio-economic and biophysical environment over the life of the Project;
- the methods used for effects analysis and the rationale for selecting the methods chosen;
- the recommended inspection, monitoring and mitigation measures; and
- the predicted significance of residual Project effects and residual cumulative effects.

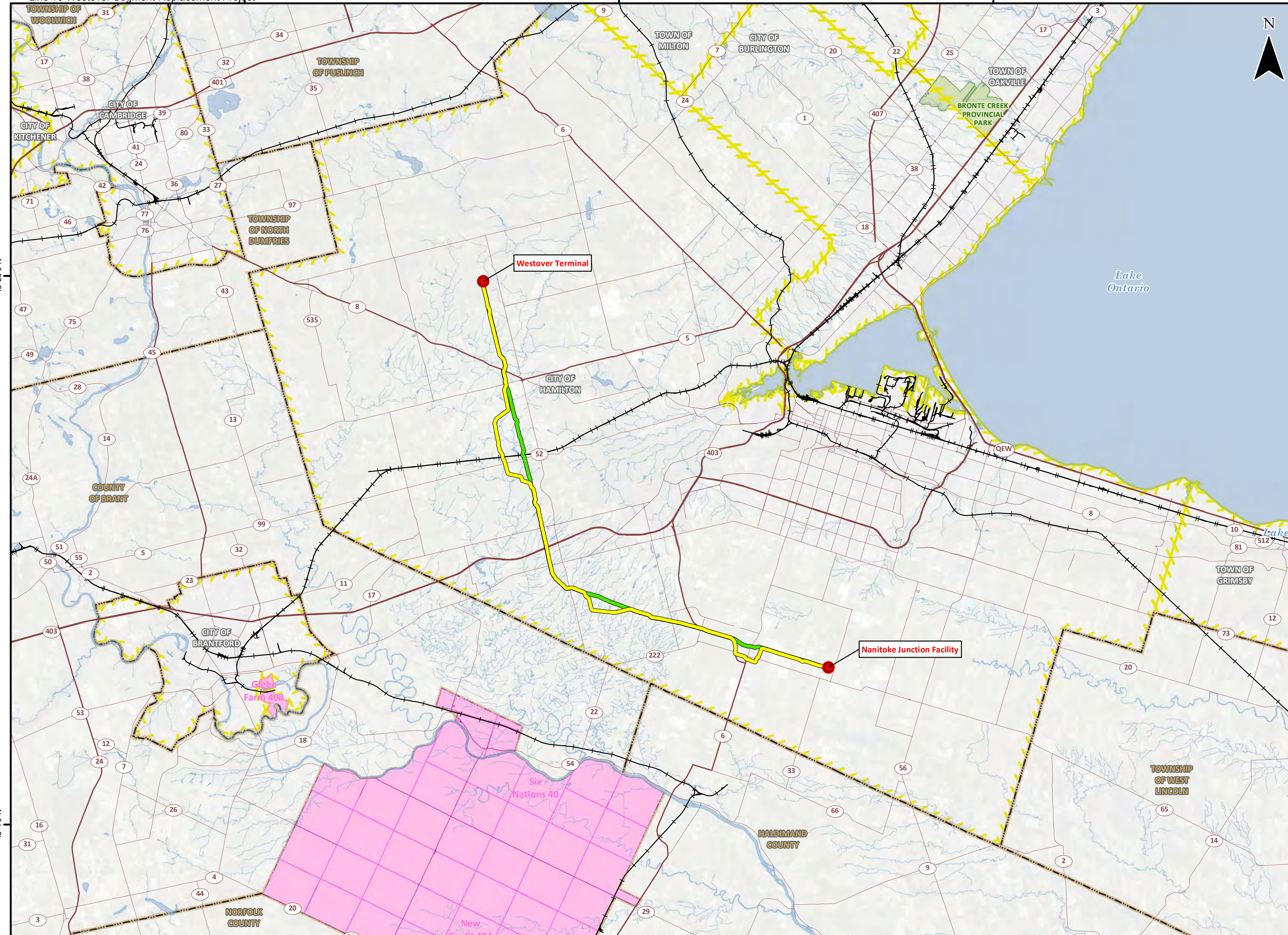
The scope of the assessment considers the factors listed in the NEB *Filing Manual* (NEB 2015a), and pertinent issues and concerns identified through consultation and engagement with landowners, communities and municipalities near the Project, government and regulatory authorities, and other stakeholders and the general public, including Aboriginal groups. It should be noted that Aboriginal engagement and stakeholder consultation does not end with the filing of the application with the NEB. Consultation, engagement, and refinement of the environmental and socio-economic mitigation measures will continue through the next phases of the regulatory process and Project execution.

The ESA considers the potential effects of the Project on the environmental and socio-economic conditions within defined spatial and temporal boundaries.

The spatial boundaries consider a Footprint Study Area (Footprint), Local Study Area (LSA) and a Regional Study Area (RSA). Spatial boundaries considered for the potential Project effects are described in detail in Section 6.0 and Section 7.0.

Reconnaissance and field studies as well as detailed desktop studies considered the proposed construction ROW, at a minimum, estimated to be approximately 50 m on both sides of the existing centre line and planned deviations. Areas requiring ground disturbance to accommodate decommissioning activities are planned within existing facilities. This study area was established to account for permanent and temporary workspace easements and in order to accommodate any minor route deviations, if required.

The environmental assessment also considered cumulative environmental effects that are likely to result from the Project in combination with existing activities and known future developments that have been or will be carried out (Section 7.0). For this Project, spatial boundaries were expanded for the assessment of potential cumulative effects, as described in detail in Section 7.0.



ENBRIDGE

November 2015

FIGURE 1.1 - 1

REGIONAL LOCATION

ENBRIDGE PIPELINES INC.
PROPOSED LINE 10
WESTOVER SEGMENT
REPLACEMENT PIPELINE
PROJECT

664756

- Facility
- Line 10 Replacement Pipeline
- Existing Line 10 Pipeline
- Highway
- Road
- Railway
- Watercourse
- Waterbody
- City/Town/Village
- Indian Reserve/Métis Settlement
- Park/Protected Area
- Rural Municipality

SCALE: 1:200,000

0 2 4 6 8 km

(All Locations Approximate)

ch2m

Projection: NAD83 UTM Zone 17N
Imagery: Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community 2015; Roads, Indian Reserves, Hydro, Railways, City/Town/Municipal Boundaries: Ontario Ministry of Natural Resources, 2015.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

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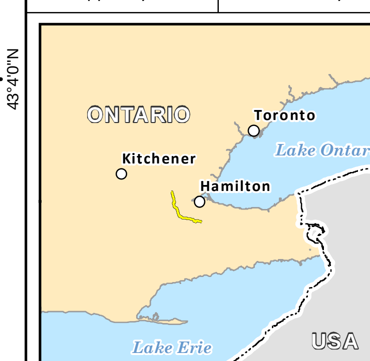

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1.6 Report Structure

The ESA is divided into the following sections:

1.0 Introduction: Provides background information on the Project, and describes the regulatory framework and the purpose of the ESA.

2.0 Project Description: Provides a description of the Project components, alternative means to the Project and Project activities.

3.0 Consultation and Engagement: Provides a reference to the stakeholder consultation and Aboriginal engagement activities conducted in association with the preparation of the Project Application, include this ESA.

4.0 Route Selection: Provides a detailed description of the proposed replacement pipeline routing process and associated facility site selection.

5.0 Environmental and Socio-Economic Setting: Provides a description of the current environmental and socio-economic conditions present along the pipeline routes.

6.0 Environmental and Socio-Economic Effects Assessment: Describes the effects assessment and identifies the potential environmental and socio-economic effects, mitigation measures and potential residual effects as well as an assessment of their significance.

7.0 Cumulative Effects Assessment: Provides a description of the potential cumulative effects as well as an assessment of their significance.

8.0 Environmental Compliance Strategy: Provides a description of the environmental policies, orientation, inspection and monitoring policies to be applied during construction and operation of the Project.

9.0 Post-Construction Environmental Monitoring (PCEM): Describes the plans for the environmental monitoring program to be conducted following construction, including criteria for success.

10.0 Supplemental Studies: Provides a description of the plans to carry out supplemental studies.

11.0 Conclusion: Provides a summary of the environmental assessment.

1.7 Project Team

This ESA report was prepared by CH2M, with the assistance of several other firms. Identified below are the companies responsible for the various supporting studies and activities to support Enbridge in developing the Project Application.

CanACRE Ltd.	Landowner Consultation and Acquisition
Sexton McKay/J.D. Barnes Limited	Survey
Worley Parsons Ltd.	Engineering
CH2M	Environmental and Socio-Economic Assessment
	Decommissioning Environmental Technical Report
	Environmental Protection Plan (EPP)
	Environmental Alignment Sheets (Appendix 1)

Dillon Consulting Limited	Environmental and Socio-Economic Baseline Information Provincial Environmental Permitting (in progress) Soil Surveys Ecological Land Classification (ELC) Vegetation Survey Supplemental Field Studies
D.R. Poulton & Associates Incorporated	Stage 1 Archaeological Assessment
Timmins Martelle Heritage Consultants	Stage 2 Archaeological Assessment Stage 3 and 4 Archaeological Assessment, if required

1.8 Concordance with the NEB *Filing Manual*

Table 1.8-1 identifies where information requirements outlined in Guide A – A.2 and Guide K – K.2 of the NEB *Filing Manual* (2015a) are provided in this ESA.

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

Filing Manual No.	Filing Requirement	In Application? References	Not in Application? Explanation
A.2.5 Description of the Environmental and Socio-Economic Setting			
K.2 Environment and Socio-Economic Assessment			
A.2.5.1	Identify and describe the current biophysical and socio-economic setting of each element (i.e., baseline information) in the area where the project is to be carried out.	• ESA Section 5.0	---
K.2.1	Describe the ecological setting and current land use of the project footprint as well as adjacent areas.	• ESA Section 5.0 • ESA Appendices 2A and 2B	---
K.2.2	Describe any known areas of contamination in the project areas as well as historical, ongoing or planned remediation activities associated with those sites. Describe any regulatory requirements for the reclamation and remediation of these sites and how these requirements will be met.	• ESA Sections 5.0 and 9.0 • ESA Appendix 3	---
A.2.5.2	Describe which biophysical or socio-economic elements in the study area are of ecological, economic or human importance and require more detailed analysis taking into account the results of consultation (see Table A-1 for examples). Where circumstances require more detailed information in an ESA, see: • Table A-2 – Filing Requirements for Biophysical Elements; and • Table A-3 – Filing Requirements for Socio-economic Elements.	• ESA Section 5.0	---

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

***Filing Manual* No.**	**Filing Requirement**	**In Application? References**	**Not in Application? Explanation**
A.2.5.3	Provide supporting evidence (e.g., references to scientific literature, local and traditional knowledge, previous environmental assessment and monitoring reports) for: • information and data collected; • analysis completed; • conclusions reached; and • the extent of professional judgment or experience relied upon in meeting these information requirements, and the rationale for that extent of reliance.	• ESA Sections 5.0 and 6.0 • ESA Appendices 2A and 2B	---
A.2.5.4	Describe and substantiate the methods used for any surveys, such as those pertaining to wildlife, plants, species at risk or species of special status, soils, heritage resources or traditional land use, and for establishing the baseline setting for the atmospheric and acoustic environment.	• ESA Appendix 2A	---
A.2.5.5	Applicants must consult with other expert federal, provincial or territorial departments and other relevant authorities on requirements for baseline information and methods.	• ESA Sections 3.0 and 5.0 • ESA Appendices 2A and 2B	---
K.2.4	For decommissioning projects that are located outside of lands owned or leased by the applicant, provide an explanation of how natural regeneration of the project footprint in forested areas or native prairie have been considered in the planning for decommissioning. This should include: • a discussion of whether or not non-agricultural lands will be allowed to naturally re-vegetate while the facility is in a decommissioned state; and • a discussion of any limitations that this would have on the ability to monitor the facilities. A discussion of whether allowing re-vegetation of the project footprint would limit future physical abandonment choices (i.e., pipeline removal vs. abandonment in-place). And if so, how that has been factored into decommissioning planning.	• ESA Sections 6.5 and 9	---
A.2.6 Effects Assessment			
A.2.6.1 Identification and Analysis of Effects			
A.2.6.1.1	Describe the methods used to predict the effects of the project on the biophysical and socio-economic elements, and the effects of the environment on the project.	• ESA Section 6.0	---

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

***Filing Manual* No.**	**Filing Requirement**	**In Application? References**	**Not in Application? Explanation**
A.2.6.1.2	Predict the effects associated with the proposed project, including those that could be caused by construction, operations, decommissioning or abandonment, as well as accidents and malfunctions. Also include effects the environment could have on the project. For those biophysical and socio-economic elements or their valued components that require further analysis (see Table A-1), provide the detailed information outlined in Tables A-2 and A-3.	• ESA Section 6.0	---
A.2.6.2 Mitigation Measures for Effects K.2 Environment and Socio-economic Assessment			
A.2.6.1.2	Describe the standard and project specific mitigation measures and their adequacy for addressing the project effects, or clearly reference specific sections of company manuals that provide mitigation measures. Ensure that referenced manuals are current and filed with the NEB.	• ESA Sections 6.0 and 8.0 • ESA Appendix 4	---
K.2.3	For decommissioning projects that are located outside of lands owned or leased by the applicant, provide a monitoring plan outlining how the decommissioned facility will be monitored for the period of time between decommissioning and abandonment. This plan should include: • A description of the baseline data that has been collected or obtained for future monitoring results to be measured against. Baseline data should be of sufficient scale, scope and intensity to meet project monitoring requirements. A description of how soils, vegetation establishment, invasive weeds, wetland hydrology and surface and ground water quality will be monitored. • Contingency plans for the discovery of soil and water contamination, loss of depth of cover, or extreme weather events affecting the integrity of the decommissioned facilities. • Input from interested parties. Any comments from stakeholders should be considered and, where appropriate, incorporated into the plan.	• ESA Section 6.5, 9.0 • ESA Appendix 3	---
A.2.6.2.2	Ensure that commitments about mitigation measures will be communicated to field staff for implementation through an EPP. Describe any plans or programs that may be used to mitigate potential effects (e.g., waste management plans, invasive species plans, HDD contingency plans, and heritage resource discovery contingency plans).	• ESA Sections 6.0 and 8.0	---
A.2.6.2.3	Describe plans and measures to address potential effects of accidents and malfunctions during construction and operation of the project.	• ESA Section 6.0	---

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

Filing Manual **No.**	**Filing Requirement**	**In Application? References**	**Not in Application? Explanation**
A.2.6.3 Evaluation of Significance			
A.2.6.3.1	After taking into account any appropriate mitigation measures, identify any remaining residual effects from the project.	• ESA Section 6.0	---
A.2.6.3.2	Describe the methods and criteria used to determine the significance of adverse effects, including defining the point at which any particular effect on a valued component is considered “significant”.	• ESA Section 6.0	---
A.2.6.3.3	Evaluate the significance of residual adverse environmental and socio-economic effects against the defined criteria.	• ESA Section 6.0	---
A.2.6.3.4	Evaluate the likelihood of significant, residual adverse cumulative environmental and socio-economic effects occurring and substantiate the conclusions made.	• ESA Section 7.0	---
A.2.7 Cumulative Effects Assessment			
A.2.7.1 Scoping and Analysis of Cumulative Effects			
A.2.7.1.1	Identify the valued components for which residual effects are predicted, and describe and justify the methods used to predict any residual effects.	• ESA Section 7.0	---
A.2.7.1.2	For each valued component where residual effects have been identified, describe and justify the spatial and temporal boundaries used to assess the potential cumulative effects.	• ESA Section 7.0	---
A.2.7.1.3	Identify other physical facilities or activities that have been or will be carried out within the identified spatial and temporal boundaries for the cumulative effects assessment.	• ESA Section 7.0	---
A.2.7.1.4	Identify whether the effects of those physical facilities or activities that have been or will be carried out would be likely to produce effects on the valued components within the identified spatial and temporal boundaries.	• ESA Section 7.0	---

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

***Filing Manual* No.**	**Filing Requirement**	**In Application? References**	**Not in Application? Explanation**
A.2.7.1.5	Where other physical facilities or activities may affect the valued components for which residual effects from the applicant's proposed project are predicted, continue the cumulative effects assessment, as follows: • consider the various components, phases and activities associated with the applicant's project that could interact with other physical facilities or activities; • provide a description of the extent of the cumulative effects on valued components; and • where professional knowledge or experience is cited, explain the extent to which professional knowledge or experience was relied upon and justify how the resulting conclusions or decisions were reached.	• ESA Section 7.0	---
A.2.7.2 Mitigation Measures for Cumulative Effects			
A.2.7.2.1	Describe the general and specific mitigation measures, beyond project-specific mitigation already considered, that are technically and economically feasible to address any cumulative effects.	• ESA Section 7.0	---
A.2.7.3 Applicant's Evaluation of Significance of Cumulative Effects			
A.2.7.3.1	After taking into account any appropriate mitigation measures for cumulative effects, identify the remaining residual cumulative effects.	• ESA Section 7.0	---
A.2.7.3.2	Describe the methods and criteria used to determine the significance of remaining adverse cumulative effects, including defining the point at which each identified cumulative effect on a valued component is considered "significant".	• ESA Section 7.0	---
A.2.7.3.3	Evaluate the significance of adverse residual cumulative effects against the defined criteria.	• ESA Section 7.0	---
A.2.7.3.4	Evaluate the likelihood of significant, residual adverse cumulative environmental and socio-economic effects occurring and substantiate the conclusions made.	• ESA Section 7.0	---
A.2.8 Inspection, Monitoring and Follow-up			
A.2.8.1	Describe inspection plans to ensure compliance with biophysical and socio-economic commitments consistent with sections 48, 53 and 54 of the *NEB OPR*.	• ESA Sections 6.0 and 8.0	---
A.2.8.2	Describe the surveillance and monitoring program for the protection of the pipeline, the public and the environment as required by Section 39 of the *NEB OPR*.	• ESA Sections 6.0, 8.0 and 9.0	---

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

***Filing Manual* No.**	**Filing Requirement**	**In Application? References**	**Not in Application? Explanation**
A.2.8.3	Consider any particular elements in the Application that are of greater concern and evaluate the need for a more in-depth monitoring program for those elements.	• ESA Sections 8.0 and 9.0	---
A.2.8.4	For *CEA Act, 2012* designated physical activities, identify which elements and monitoring procedures would constitute follow-up under the *CEA Act, 2012*.	• Not in Application	The Project is not a designated physical activity under the *CEA Act, 2012*
Table A-1 Circumstances and Interactions Requiring Detailed Biophysical and Socio-Economic Information			
Physical and Meteorological Environment		• ESA Sections 5.0	---
Soil and soil productivity		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendix 2A	---
Water Quality and Quantity		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendices 2A, 2B, 3 and 4	---
Air Emissions		• ESA Sections 5.0, 6.0 and 7.0, Appendix 2A	
Greenhouse Gas Emissions		• ESA Sections 5.0 and	---
Acoustic Environment		• ESA Sections 5.0, 6.0 and 7.0	---
Fish and Fish Habitat (including any fish habitat compensation required)		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendices 2A, 2B, 3 and 4	---
Wetlands		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendix 2A	---
Vegetation		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendix 2A	---
Wildlife and Wildlife Habitat		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendices 2A and 2B	---
Species at Risk or Species of Special Status and Related Habitat		• ESA Sections 5.0, 6.0 and 7.0, ESA Appendices 2A and 2B	---
Human Occupancy and Resource Use		• ESA Sections 5.0, 6.0 and 7.0	---
Heritage Resources		• ESA Sections 5.0 and 6.0, Appendix 2A	---
Traditional Land and Resource Use		• ESA Sections 5.0 and 6.0, ESA Appendix 3	---
Social and Cultural Well-Being		• ESA Sections 5.0, 6.0 and 7.0	---

Table 1.8-1. NEB *Filing Manual* Checklist for Guide A-A.2 and Guide K-K.2 Environment and Socio-Economic Assessment

***Filing Manual* No.**	**Filing Requirement**	**In Application? References**	**Not in Application? Explanation**
Human Health and Aesthetics		• ESA Sections 5.0, 6.0 and 7.0	---
Infrastructure and Services		• ESA Sections 5.0, 6.0 and 7.0	---
Navigation and Navigation Safety		• ESA Sections 5.0 and 6.0	---
Employment and Economy		• ESA Sections 5.0 and 6.0	---

2.0 Project Description

This section describes and identifies the purpose of the Project, alternative means, Project location, Project components and Project construction phases, as well as operations and maintenance, and decommissioning. Figure 1.1-1 (Section 1.0) provides the regional location of the Project.

2.1 Project Purpose

The Project is required to replace a segment of the existing Line 10 pipeline where preliminary data suggests that this segment, which dates from the 1960s, has experienced an increasing number of preventative maintenance digs to visually inspect and repair the line, and has therefore, reached Enbridge's conservative threshold for replacement. As noted, the Project consists of the decommissioning of approximately 32 km of existing pipeline, however, with the planned deviations from the existing pipeline route, the replacement pipeline will be approximately 35 km long. The safety of the public and workers, along with the protection of the environment are Enbridge's top priorities. Through the course of regular inspections, this segment of the existing Line 10 pipeline has been identified for replacement. This approach will eliminate the need for extensive, multi-year preventative maintenance digs, as well as restore Line 10 to its approved operating capabilities. The Project will address pipeline maintenance requirements, improve reliability and safety of the system, and restore the pipeline to its approved operating capacity.

2.2 Alternative Means

Alternative means are the various technically and economically feasible ways in which to implement and carry out the Project (CEA Agency 2015a). Only buried pipeline options realistically meet the need and purpose of the Project and no existing Enbridge pipelines can provide enough capacity to provide a feasible alternative for transportation between in the Project-specific control points (see Section 4.0). The replacement pipeline segment is considered the most economical option to continue safely operating the pipeline. The replacement pipeline will be installed using standard pipeline construction methods and mitigation measures. Due to the diameter of the pipe, alternative means of pipe installation (e.g., plowing in) are not feasible.

Enbridge evaluated whether alternative routes and deviations from the existing Enbridge pipeline ROW could meet the Project's needs and purpose. The route selection process for the Project is discussed further in Section 4.0.

2.3 Location of the Project

The Project is located in an agricultural setting extending from Enbridge's existing Westover Terminal to its existing Nanticoke Junction Facility, both within Hamilton. The segment of Line 10 to be decommissioned is located adjacent to another pipeline within an easement that has been in use by Enbridge since the 1960s (Line 11). The existing Line 10 pipeline to be decommissioned is located on a mixture of privately-owned land and "Fee Simple Other" lands.

The Line 10 replacement pipeline new ROW will be adjacent to the existing Line 10 pipeline corridor. The pipeline is located on a mixture of privately-owned land (67%) and "Fee Simple Other" lands which are a mixture of Industry, Municipalities, Conservation Authorities, and Provincial Ministries, including the following Ministry of Transportation, Hydro One, the City of Hamilton, Conservation Authorities, Rail Roads and Pipeline ROW's. The replacement pipeline will cross approximately 27 km (78%) of agricultural land.

The Line 10 replacement pipeline is adjacent to or within the existing pipeline ROW along the majority of its length. Consideration was given to alternative routes, however, paralleling and using the existing Enbridge ROW where possible was deemed preferable to reduce the amount of overall disturbance. The paralleling of Enbridge's existing pipeline ROW reduces the potential environmental and socio-economic effects associated with the Project for the following reasons.

- A portion of the existing ROW can be used as workspace for construction activities due to Enbridge's ability to safely construct and operate a replacement pipeline adjacent to an existing Enbridge pipeline ROW. This will reduce the potential effects by limiting the amount of new disturbance necessary to install the replacement pipeline. This approach subsequently reduces the potential effects on agricultural operations. The width of the permanent easement required can be reduced in certain locations by utilizing Enbridge's existing ROW.
- Company Operations are able to monitor an additional pipeline located in a common pipeline corridor safely and efficiently.

In some areas where there are Project, community and environmental benefits to do so, the replacement pipeline deviates from the existing ROW. Approximately 11 km of new ROW is necessary for planned deviations around several golf courses and residences (Figure 1.1-1), resulting in a total length of approximately 35 km for the replacement pipeline.

The total Footprint required for the Project is 135.4 ha with approximately 36.0 ha for the permanent ROW, 99.0 ha for temporary workspace, 0.1 ha for work at the existing Westover Terminal and 0.35 ha for the valve sites and associated access road.

2.4 Replacement Pipeline

2.4.1 Components

The replacement pipeline will be constructed within a construction ROW that extends from the existing Westover Terminal to the Nanticoke Junction Facility (Figure 1.1-1), including the planned deviations. Construction equipment will travel along the construction ROW and access the route via existing and temporary access roads. Design, construction and operation of the replacement pipeline will be in compliance with applicable codes, standards and regulations. The technical details of the replacement pipeline are summarized in Table 2.4-1.

Table 2.4-1. Technical Details of the Line 10 Replacement Pipeline

Pipeline Design	Technical Details
Total Length	Approximately 35 km
Pipeline Diameter	508.0 mm O.D. (NPS 20)
Length Adjacent/Within Existing ROW	Approximately 22 km parallel with the existing Line 10
Length Deviating from Existing Rights-of-way	Approximately 13 km
Product	Oil
Source Point	Westover Terminal
Delivery Point	Nanticoke Junction Facility
Pipe Coating	Fusion bond epoxy and dual powder system under bored or drilled crossings.

Table 2.4-1. Technical Details of the Line 10 Replacement Pipeline

Pipeline Design	Technical Details
Minimum Depth of Cover	The pipeline will be installed with a minimum depth of ground cover over the pipeline of 0.9 m, however, the pipeline may be installed deeper in areas where it crosses under existing infrastructure (e.g., roads, railways, and pipeline) or sensitive environmental or socio-economic features.
Typical Trench Width	Approximately 1.5 m
Hydrostatic Test Medium	Water

2.4.2 Footprint

The replacement pipeline will be installed adjacent to an existing ROW for most of its length and will terminate at the Nanticoke Junction Facility near Binbrook in Hamilton.

The replacement pipeline will be constructed in a construction ROW consisting of both permanent easement and temporary workspace. The permanent easement for the replacement pipeline is approximately 10 m wide. Temporary workspace along the construction ROW is expected to be approximately 23 m wide. Additional temporary workspace may be required at bends, corners, road crossings, bores, HDD's, as well as for construction activities such as stockpile sites, equipment loading/unloading locations, parking, and access to the ROW.

The total Footprint necessary to construct the replacement pipeline is approximately 135.4 ha, with approximately 36.0 ha for the permanent ROW, 99.0 ha for temporary workspace, 0.07 ha for work at the existing Westover Terminal and 0.35 ha for the valve sites and associated access road.

2.4.3 Construction

2.4.3.1 Pipeline Construction Activities

The total length of pipeline to be installed for the Project is approximately 35 km. Pipeline construction activities are presented in Table 2.4-2 in the general order of occurrence during construction. Note, some activities may occur concurrently.

Table 2.4-2. Replacement Pipeline Construction Activities

Construction Phase	Associated Activities
Engineering	The pipeline will be designed and constructed in accordance with all applicable regulations, as well as industry and company standards.
Construction Survey and Geotechnical Investigation	Activities include line-of-sight flagging and staking of the boundaries of the construction ROW and temporary workspace, as well as marking trench lines and existing utilities. Avoidance areas will be appropriately fenced or flagged, where warranted.
Clearing	Vegetation (grasses, brush and other woody vegetation) will be mowed or cleared from the construction ROW and temporary workspace. Snow, if present, trees, stumps, brush, crops and other vegetation will be generally cleared or mowed from the construction ROW and temporary and extra temporary workspace.
Topsoil Salvage	Topsoil will be salvaged to maintain soil productivity. The width and depth of topsoil salvage depends on a number of factors including, but not limited to: land use; soil conditions; topography; landowner requests; and grading requirements. Equipment used during topsoil handling activities may include dozers, graders, hoes, and/or excavators. At this time, Enbridge plans for full width ROW stripping.

Table 2.4-2. Replacement Pipeline Construction Activities

Construction Phase	Associated Activities
Grading	Following topsoil salvage, grading will be conducted on irregular ground surfaces (including temporary workspace), if necessary, to provide a safe work surface. Graders, excavators, hoes, and dozers may be used for this activity.
Stringing and Welding	The pipe will be strung (lined-up) along the ROW, bent where required, welded, examined (non-destructive), joint-coated, and inspected prior to being lowered into the trench. Equipment used during stringing and welding activities includes, but is not limited to: pipe trucks, booms, pick-up trucks, excavators, and X-Ray or ultrasonic inspection equipment mounted on trucks.
Trenching	The trench will be excavated using tracked excavators or hoes to a depth sufficient to ensure the depth of cover is in accordance or in excess of applicable codes. The replacement pipeline will be installed at a minimum depth of cover of at least 0.6 m in rock areas and 0.9 m for the remainder of the route.
Lowering-In	The pipe will be lowered into the trench using sideboom tractors. Trench dewatering may be necessary at certain locations during lowering-in (e.g., to ensure acceptable bedding for pipe, to prevent the pipe from floating, or for performing tie-in welds).
Backfilling	Prior to backfilling, subsurface erosion control structures such as trench breakers will be installed, if warranted. The trench will be backfilled using excavators, graders, dozers, hoes, or specialized backfilling equipment. Backfill material will generally consist of native trench spoil material. Displaced subsoil will be crowned over the trench to compensate for settlement and any excess trench spoil will be feathered-out over adjacent portions of the ROW where topsoil salvage has occurred.
Testing and Caliper Tool Runs	All piping will be hydrostatically pressure tested and relevant provincial and federal regulations for hydrostatic testing will be followed. Caliper tool runs will be performed after hydrostatic pressure testing.
Clean-Up and Reclamation	Initial clean-up and reclamation activities along disturbed portions of the construction ROW and temporary access trails (shoo-flies) will be initiated following backfilling, once weather and soil conditions permit. Final clean-up and reclamation will follow post-construction as soon as practical, however, the majority is planned for summer 2018. Clean-up and reclamation procedures will be initiated using dozers, excavators, hoes and/or graders. Garbage or debris will be managed throughout the construction phase through good housekeeping, but any remaining on-site will be removed and disposed of in compliance with local regulations. The construction ROW will be graded to restore pre-construction contours, where practical. The pipeline easement will be returned to an equivalent land capability and to pre-disturbance site conditions. All disturbed, non-cultivated, upland areas will be seeded with an appropriate seed mix.
Watercourse and Wetland Crossings	Waterbodies and wetlands have been confirmed and classified during field surveys conducted by Dillon in June and July 2013 and August 2015. Additional watercourse and wetlands crossing information is provided in Appendix 2A and Appendix 4.

2.4.4 Final Decommissioning or Abandonment of the Proposed Line 10 Replacement Pipeline

It is indeterminate when or how the proposed replacement pipeline and facilities will be ultimately decommissioned or abandoned at the end of their useful life. In May 2011, Enbridge filed physical plans with the NEB for abandonment as part of the NEB Land Matters Consultation Initiative. The document considers assumptions for the types of facilities that would be abandoned in place, abandoned in place with special treatment, or removed. It is expected that most of the replacement pipeline will be decommissioned or abandoned in-place with potentially only a few segments of the pipeline being removed. The methods of decommissioning or abandonment that will ultimately be implemented for the replacement pipeline will be determined at the time of the decommissioning or abandonment application. However, those determinations will be based on the most current, sound, scientific studies and accepted industry practices at that time. All final decommissioning or abandonment activities will require prior approval by the NEB and other applicable agencies. Final decommissioning or abandonment of the replacement pipeline is discussed further in Section 6.6.

2.5 Permanent Facilities

2.5.1 Components

A description of the permanent facilities associated with the replacement pipeline is provided below. Access to the Westover Terminal and Nanticoke Junction Facility will be via existing roads.

- The existing Westover Terminal will be extended to the west, measuring approximately 20 m x 33 m to accommodate a new pig launching trap complete with a facility valve Remote Sectionalizing Valve (RSV)-0.
- RSV-1 and RSV-2 will be located along the replacement pipeline permanent ROW measuring approximately 18 m x 21 m (RSV-1) and 13 m x 21 m (RSV-2). Land will be acquired for these valve sites overlapping and adjacent to the permanent ROW for the pipeline. A new access road is required at RSV-1. Upgrades to the existing access road and approach are planned at RSV-2.
- RSV-3 will be installed at the existing Nanticoke Junction Facility. No new lands are required.

2.5.2 Footprint

Work at the Westover Terminal will require an extension of the existing yard site by approximately 20 m x 33 m for a total of 0.1 ha. This would involve extending the fenceline out on the western side of the property. At the Westover Terminal, Enbridge already owns adequate land area for the required extension and no new land will be required. RSV-1 and RSV-2 will be installed overlapping the existing and new pipeline ROW. There is no new land required for the installation of RSV-3 at the Nanticoke Junction Facility.

2.5.3 Construction

Standard activities and typical equipment requirements for the permanent facilities are described below.

Permanent Facility Construction	Associated Activities
Engineering	The permanent facilities will be designed and constructed in accordance with all applicable CSA standards, as well as federal, provincial and municipal requirements, and conditions of permits or authorizations.
Site Preparation	Initial site preparation will involve clearing of vegetation where present, salvaging of topsoil and grading of the site, as needed, using equipment similar to that described for construction of the pipeline.
Installation of Permanent Facilities	Activities include installing RSVs, associated above-ground pipeline connections, electrical buildings and communication equipment, sending and receiving traps as well as extending the fenceline at the Westover Terminal.
Clean-Up and Reclamation	The area around the valve sites and associated access road will be recontoured. The Westover Terminal will be fenced and gravelled following construction.

2.5.4 Final Decommissioning or Abandonment of the Permanent Facilities Associated with the Line 10 Replacement Pipeline

The final decommissioning or abandonment of the permanent facilities associated with the construction and operation of the replacement pipeline will follow the same considerations as the proposed replacement pipeline. Final decommissioning or abandonment of the permanent facilities is discussed further in Section 6.6.

2.6 Temporary Infrastructure and Workspace

Construction activities for temporary infrastructure and workspace will consist of engineering, site preparation, construction, as well as clean-up and reclamation.

The following temporary facilities may be needed during construction of the Project:

- stockpile sites;
- temporary construction offices;
- temporary bridges for watercourse crossings;
- new temporary access roads (shoo-flies); and
- material and equipment staging areas.

2.7 Line 10 Decommissioning

2.7.1 Components

In accordance with CSA Z662-15, the decommissioning segment of the existing Line 10 pipeline will consist of fluids displacement, cleaning, isolation, and segmentation. Enbridge proposes to leave the existing Line 10 pipeline in place within Enbridge's corridor and continue to monitor it. Decommissioning activities will be focused at both ends of the pipeline to be decommissioned where excavation is required. All ground disturbance associated with decommissioning the existing pipeline will occur within Enbridge property or lease sites (i.e., Westover Terminal and Nanticoke Junction Facility), existing ROWs or additional temporary workspace obtained as part of construction for the Line 10 replacement pipeline.

Several steps will be undertaken to manage this process safely and in a manner that reduces effects on stakeholders and the environment. Enbridge will conduct:

- pipeline cleaning, including displacing fluids from the pipeline, and post-displacement cleaning;
- physical isolation of the pipeline from existing infrastructure (e.g., Westover Terminal and Nanticoke Junction);
- the removal of above ground stand-alone valves (up to 1 m below ground) which are not co-located with other Enbridge facilities associated with the pipeline;
- segmentation of the pipeline, including engineering isolation and segmentation and environmental segmentation location;
- mitigation, as needed, to reduce potential environmental and socio-economic effects;
- maintaining cathodic protection on the pipeline; and
- ongoing monitoring and maintenance of the decommissioned pipeline ROW.

Equipment used for decommissioning activities will travel along existing access routes to access either end of the segment, where possible. Temporary access may be needed to access the valve site and any segmentation locations, as required. No extensive travel along existing Enbridge ROWs is anticipated for decommissioning activities. Decommissioning of the Line 10 segment pipeline will be in compliance with CSA Z662-15 and *NEB OPR*. Pending regulatory approval, decommissioning activities are scheduled to commence once the replacement section has gone into service. The technical details of the pipeline to be decommissioned are listed in Table 2.7-1.

Table 2.7-1. Technical Details of the Line 10 Decommissioning

Pipeline Design	Technical Details
Total Length	Approximately 32 km
Product	Oil
Start	Westover Terminal
End	Nanticoke Junction Facility
Pipe Size	324 mm O.D. (NPS 12)

2.7.2 Footprint

The work associated with decommissioning the existing segments of the Line 10 pipeline is anticipated to be conducted within Enbridge property or on existing Enbridge ROWs. If additional temporary workspace is needed, it will be obtained by Enbridge at the time of the decommissioning activities. Initial decommissioning activities will be focused at both ends of the decommissioned segments where excavation is necessary. Typically, decommissioning activities along the existing Line 10 pipeline ROW will take place within a 30 m x 12 m area at each location.

2.7.3 Construction

2.7.3.1 Pipeline Decommissioning Activities

Standard activities and typical equipment requirements for decommissioning are described below in Table 2.7-2.

Table 2.7-2. Pipeline Decommissioning Activities

Construction Phase	Associated Activities
Engineering	Pipeline decommissioning will be engineered to abide by all applicable industry standards and specifications in place at the time, and any NEB-imposed conditions.
Survey	Activities include staking the boundaries of the work area and temporary workspace, as well as marking the excavation and existing utilities. Avoidance areas will also be appropriately fenced or flagged, as needed.
Topsoil Salvage	Topsoil will be salvaged where ground disturbance activities are planned to maintain soil productivity (e.g., segmentation locations). The width and/or depth of topsoil salvage depends upon a number of factors, including, but not limited to: land use; soil conditions; season; topography; landowner requests; and grading requirements. Equipment used during topsoil handling activities may include dozers, graders and/or excavators.
Excavation	Bellholes will be excavated using a hydrovac truck, tracked excavators and/or hand tools to expose the pipeline. The bellholes will be sufficiently large to allow for workers to enter the excavation and adequately sloped to ensure worker safety.

Table 2.7-2. Pipeline Decommissioning Activities

Construction Phase	Associated Activities
Draining/Cleaning of Pipeline Segment	The fluids will be displaced from the pipeline using pigs. Buffers (e.g. water or cleaning solution) will be run to further clean the pipeline. The buffers will be collected in on-site storage tanks for treatment and disposal. The existing Line 10 pipeline will be cleaned with an engineered cleaning solution (water and/or water and biodegradable cleaning agents). Cleaning activities will take place separately of the displacement activities.
Welding	End caps will be welded into place where the pipeline has been cut to effectively seal the pipeline.
Backfilling	The excavation will be backfilled using excavators, graders or dozers. Backfill material will generally consist of native trench spoil material.
Clean-Up and Reclamation	Initial clean-up and reclamation activities will be initiated following backfilling, once weather and soil conditions permit. Final clean-up and reclamation will be conducted following decommissioning. Clean-up and reclamation procedures will be initiated using dozers, excavators and/or graders. Garbage or debris remaining on-site will be removed and disposed of in compliance with local regulations. The work area will be graded to restore pre-construction contours, where practical. At segmentation locations, the topsoil will be replaced, where possible. All disturbed, non-cultivated, upland areas will be seeded with an appropriate seed mix.
Cathodic Protection	Cathodic protection of the decommissioned pipeline will remain in-place.
Monitoring	The decommissioned pipeline will be continually monitored as part of Enbridge's mainline monitoring program.

2.8 Estimated Workforce Requirements

Estimated workforce requirements for all components of the Project are described in this subsection. Construction of the Line 10 replacement pipeline will involve a peak workforce of approximately 300 workers. It is anticipated that Project activities at the Westover Terminal and Nanticoke Junction Facility will utilize an average workforce of 10 to 20 individuals. Decommissioning of the existing Line 10 pipeline will involve approximately 30 to 50 workers. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, teamsters, mechanics, foremen, surveyors, inspectors, and field office support personnel. No new permanent jobs will result from the Project.

2.9 Environmental Permits/Approvals

The potential environmental permits and authorizations required prior to the commencement of Project activities or construction activities at a particular site (e.g., watercourse crossing) are identified in Table 2.9-1.

Table 2.9-1. Environmental Permits/Approvals

Agency	Permit, Approval, Authorization and/or Notification
Federal	
National Energy Board	Order pursuant to Section 58 of the *NEB Act*, and Section 45.1 of the *NEB OPR.*
Fisheries and Oceans Canada (DFO)	If serious harm to fish is anticipated as a result of Project activities, a request for Project Review may be initiated as a result of the NEB assessment. If the NEB concludes a proposed energy infrastructure project may require a DFO authorization, the NEB will refer the application to DFO. The issuance of an authorization under paragraph 35(2) (b) of the *Fisheries Act* will remain the responsibility of DFO. See Appendix 4 for further details.

Table 2.9-1. Environmental Permits/Approvals

Agency	Permit, Approval, Authorization and/or Notification
Provincial	
Ontario Ministry of Environment and Climate Change	A Permit to Take Water is required if more than 50,000 L/day will be moved from a natural water source for the purpose of Project activities (e.g., construction dewatering, hydrostatic testing). An amendment to the existing Environmental Compliance Approval (sewage works) for Westover Terminal will be required due to the terminal extension and catchment area at the site.
Local/Municipal	
HCA	A permit to cross watercourses and work within regulated areas under the *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation*. Letter of Advice related to avoidance of impacts to fish and fish habitat.
GRCA	A permit to cross watercourses and work within regulated areas under the *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation*. Letter of Advice related to avoidance of impacts to fish and fish habitat.
NPCA	A permit to cross watercourses and work within regulated areas under the *Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation*. Letter of Advice related to avoidance of impacts to fish and fish habitat.
Ministry of Tourism, Culture and Sport	Archaeological clearance.
City of Hamilton	A permit to Injure or Remove Trees, as applicable. Noise Bylaw exemption if work is scheduled to be completed outside of the permitted house specified in Bylaw No. 11-285.

2.10 Project Schedule

Pipeline construction activities are progressive, commencing with survey and ROW preparation and continuing through pipe stringing, welding, pipe inspection, trenching, lowering-in, backfilling, clean-up, and reclamation. Pipeline construction will performed sequentially, generally moving from south to north, starting at the Nanticoke Junction Facility, however, reverse lays will be required to switch to the other side of the pipeline. It is expected that the average duration that crews will be working at a given location on the construction ROW is approximately 2 weeks per month. Tie-in locations (i.e., where the pipeline connects to the associated facilities) generally take longer to construct since they are routinely completed and tested last. Hydrostatic testing will be conducted following installation of the replacement pipeline. As stated earlier, Enbridge anticipates that final clean-up and reclamation will follow post-construction as soon as practical, however, the majority is planned for summer 2018 so that reclamation can occur under dry ground conditions. Construction activities are expected to take less than one year.

2.11 Operation and Maintenance

Enbridge has systems in place to manage the safe operation and long-term integrity of its existing facilities. These programs will be expanded to include these Project components. Operation and maintenance activities will include regular patrol programs along the pipeline ROW and associated facilities. Flow in the replacement pipeline will be remotely monitored and controlled from the existing Enbridge Control Centre. No new permanently-staffed facilities will be needed. Enbridge actively and routinely conducts oil spill and emergency response exercises, and has detailed emergency response plans in place (see Section 8.0).

Enbridge will implement its Integrity Management Plan to ensure that the ongoing requirements of the replacement pipeline segments are met throughout their service life. Internal inspection is an integral part of the current Enbridge Integrity Management Plan. In-line inspection tools will be used regularly to inspect the pipeline for internal and external corrosion, dents, and cracks that could lead to a failure in the pipeline.

3.0 Consultation and Engagement

The stakeholder consultation program was undertaken by Enbridge for this Project. Detailed information relating to the program is provided in the Stakeholder Consultation and Aboriginal Engagement sections of the NEB Section 58 Project Application filed by Enbridge.

Input received as a result of consultation with stakeholders was incorporated in the ESA (where possible) with respect to routing and design, as well as identifying potential effects and mitigation measures. Enbridge is committed to ongoing consultation with Project stakeholders.

Enbridge has initiated engagement with three Aboriginal groups. Input received as a result of engagement with Aboriginal groups has been incorporated in the ESA (where possible) with respect to identifying potential effects and mitigation measures. Enbridge is committed to, and will continue to, engage with potentially affected Aboriginal groups.

4.0 Route Selection

Pipeline route selection is first and foremost based on protecting the safety and reliability of the pipeline. Appropriate route selection and siting is an important mitigation strategy to avoid or reduce potential environmental and socio-economic effects as well as address concerns identified during the Project consultation and engagement program.

4.1 Control Points

The primary routing control points (e.g., start and end points) for the Line 10 replacement pipeline are identified as follows:

- tie-in at existing Westover Terminal, KP 0 (start point); and
- tie into the existing Nanticoke Junction Facility, approximately KP 35 (end point).

4.2 Replacement Pipeline Routing Consideration

Line 10 has been operating safely for over 50 years and during that time the physical landscape has changed (e.g., houses and golf courses have been built). The replacement segment will run parallel to the existing Line 10 ROW for the majority of its approximately 35 km length. Enbridge is currently exploring opportunities, through in-depth consultation with landowners, local communities and officials, to deviate from the existing pipeline route in some areas where there are Project, community and environmental benefits to do so. The Project is expected to deviate from the existing route for a total of approximately 13 km, requiring new ROW.

The existing Enbridge pipeline system between the Westover Terminal and Nanticoke Junction Facility is predominantly located within an agricultural setting. In addition to input received during stakeholder consultation and Aboriginal engagement, route selection of the replacement pipeline takes into consideration the constraints of the control points (listed above), as well as the preferred placement adjacent to the existing Enbridge pipeline corridor. Other considerations include:

- avoiding residences and urban development;
- avoidance, to the extent practical, of known locations that provide site-specific habitat for species of concern, or the application of special mitigation measures (see Section 6.0);
- complying with applicable regulatory requirements;
- avoiding socially and culturally important areas;
- crossing all highways and all-season roads at as close to right angles as feasible;
- where practical, following existing linear infrastructure (e.g., pipelines and roads);
- locating the pipeline to accommodate future maintenance operations to the extent feasible;
- avoiding wetlands, where feasible; and
- using the shortest route practical.

The existing Enbridge pipeline ROWs were generally chosen as the preferred alignment due to the reason listed below.

- The existing Enbridge corridor has been in use for over 50 years and is well known to all parties (i.e., environmental and socio-economic conditions along an existing easement are generally better understood than along a new easement).

- Effects associated with widening an existing pipeline corridor would be incremental, while a new route would affect additional lands and increase the amount of land disturbance.
- Pipeline surveillance and maintenance activities can be conducted more efficiently for pipeline located within a common ROW than for two ROWs that are geographically separated.

Enbridge's Line 11 pipeline is also located adjacent to the existing Line 10 ROW, and adjoining the existing Line 10 ROW also allows for the concentration of operational and maintenance resources. Deviations from the existing Line 10 ROW were considered and determined in part based on the results of environmental surveys and consultation and engagement efforts.

The construction ROW will be approximately 33 m wide. This will include approximately 10 m of new permanent easement, with an additional 23 m of temporary workspace for safe and efficient construction. The Project will use the existing Enbridge Line 10 corridor were possible to reduce the workspace required during construction of the replacement pipeline.

4.3 Site Selection

4.3.1 Permanent Facilities

Permanent facilities required to support the Project include:

- the extension of the existing Westover Terminal (RSV-0) along the west yard site boundary;
- the addition of RSV-1 and RSV-2 on the replacement pipeline ROW ; and
- the installation of RSV-3 at the existing Nanticoke Junction Facility.

Siting of the permanent facilities was influenced by Enbridge's desire to limit the amount of new disturbance, reduce potential environmental effects by siting away from waterbodies and wetlands as well as to optimize maintenance activities and use existing infrastructure (e.g., powerlines and fenced site boundaries). As such, permanent facilities are to be located as near as possible to the existing facilities and new permanent disturbance will be reduced to the extent feasible. Site selection criteria are discussed below.

4.3.2 Temporary Infrastructure and Workspace

Additional temporary workspace will be required at bends, corners, road crossings, bores, HDDs, as well as for construction activities, such as stockpile sites, equipment loading/unloading locations, parking, and access to the ROW. Enbridge will also obtain access to temporary workspace for Project construction needs such as shoo-flies, as well as material and equipment staging.

The location of the temporary infrastructure and workspace will be determined by Enbridge and their Contractor(s) during detailed engineering and construction planning. Once the approximate location of temporary workspace or temporary facility sites for use during construction have been identified, the sites will be assessed and, where appropriate, approved by the applicable party (e.g., Environmental Inspector). Locations of known temporary workspace have been included in this assessment. Where temporary facilities or workspace are needed but have not been identified prior to the application, each location will be selected in the field following the process for environmental review outlined in the Project-specific EPP and ensure adherence to the site selection criteria noted below. It is of note that there is a degree of flexibility for some temporary facilities, while other temporary facilities must be located at or in the immediate vicinity of a particular location (e.g., temporary workspace where heavy grading is necessary).

4.3.3 Site Selection Criteria

In addition to stakeholder inputs, the following site selection criteria will be used to evaluate and select sites for permanent facilities and temporary infrastructure and workspace.

- Selection of an optimal location for construction needs, which reduces travel distance to the ROW and have optimal spacing along the replacement pipeline route.
- Avoidance, to the extent practical, of areas of native vegetation by maximizing the use of previously cleared or broken lands, or lands currently under industrial land use.
- Avoidance, to the extent practical, of waterbodies and/or existing water wells.
- Preferential selection of grassed areas over bush or treed areas when temporary workspace is necessary on lands supporting native vegetation.
- Avoidance, to the extent practical, of known locations that provide site-specific habitat for wildlife or plant species of concern or the application of special mitigation (see Section 6.0).
- Avoidance, to the extent practical, of steep slopes, organic soils, and poorly-drained areas.
- Avoidance, to the extent practical, of areas with known heritage resource or Traditional Land and Resource Use (TLRU) sites, or apply special mitigation (see Section 6.0).
- Avoidance of locations adjacent to a conflicting land use where potential noise, dust or visual concerns could not be readily mitigated.
- Locate temporary facilities that require the use of utilities at sites already serviced by roads and utilities.

The evaluation of potential temporary facility sites/workspace will be conducted as far in advance of their intended use as practical to allow adequate time to choose and evaluate alternative sites. Mitigation measures will be used at temporary facility sites and temporary work areas as described in Section 6.0. All applicable landowner as well as municipal, provincial, and federal approvals for a temporary facility site or workspace will be acquired prior to the commencement of work at the site.

4.4 Line 10 Decommissioning

In accordance with CSA Z662-15, decommissioning of the existing Line 10 pipeline will consist of fluids displacement, cleaning, isolation, and segmentation. The existing Line 10 pipeline will be left in-place within Enbridge's pipeline corridor and will continue to be monitored.

Enbridge will use infrastructure associated with existing cathodic protection systems on the decommissioned pipeline segments.

Enbridge is currently conducting an evaluation of the existing Line 10 pipeline to be decommissioned in order to determine where decommissioning activities requiring physical ground disturbance are required (e.g. segmentation locations).

The following criteria have been considered to evaluate and select the need for decommissioning treatment locations:

- the potential for environmental effects associated with a decommissioned pipeline;
- results from consultation and engagement with various governing bodies, the public, and technical experts;
- applicable regulatory requirements; and
- technical and engineering constraints.

The environmental and socio-economic setting associated with each location will be reviewed against the proposed activity to determine the potential effects and the appropriate mitigation. Mitigation available for implementation at decommissioning sites requiring ground disturbance is identified in the Section 6 and the Decommissioning Environmental Technical Report (Appendix 3).

5.0 Environmental and Socio-Economic Setting

Table 5.1-1 describes the environmental and socio-economic setting along the existing Line 10 pipeline route as well as the planned deviations, using the spatial boundaries described in Section 6. In addition, select environmental information is provided on the Environmental Alignment Sheets (Appendix 1) and supporting environmental and socio-economic baseline information is provided in Appendix 2A. Information collected for the setting was obtained from existing literature, regulatory bodies, government databases, and internet searches, all of which are cited in Section 12.0. Additionally, the results of the supporting biophysical studies are summarized in Table 5.1-1 and Appendix 2A.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	**Summary of Consideration**
Physical and Meteorological Environment	• Approximately 24 km (69%) of the replacement pipeline will be constructed alongside and contiguous to an existing Enbridge pipeline ROW and other linear disturbances, with 11 km (31%) requiring new non-contiguous ROW. • Topography along the replacement and existing pipeline routes is generally level. The replacement pipeline does not encounter any steep slopes. • The Project is located within three physiographic regions including the Flamboro Plain (starting at the Westover Terminal and extending for approximately 5 km), the Norfolk Sand Plain (for the next approximate 12 km) and the Haldimand Clay Plain (for the remainder of the route). Elevations in the Flamboro Plain range from 235-365 m above sea level (asl). In the Norfolk Sand Plain, elevations range from 175-260 m asl, and in the Haldimand Clay Plan, elevations range from 210-225 m asl (Chapman and Putnam 1984). • The Project is predominantly underlain by the Guelph Formation characterized by Lower Silurian-aged sandstones, shales, dolostones, and siltstones. Approximately 8 km of the route is underlain by the Guelph Formation, but is interspersed with sandstones, shales, dolostones, and siltstones of the Lockport Formation, as well as a narrow band of Upper Ordovician-aged shales, limestones, dolostones, and siltstones of the Queenston Formation (Waterloo Hydrogeologic Inc. 2004). • Mapping indicates that Paleozoic bedrock may be exposed at the surface in certain locations (e.g., south of the Westover Terminal), and where overburden exists. Paleozoic bedrock is generally comprised of coarse-grained glaciolacustrine deposits interspersed with minor amounts of finer-grained silts. There are Pleistocene-aged deposits consisting of sands, gravelly sands, and gravels interspersed with finer silts and clays. The south-eastern portion of the pipeline is generally fine-grained, consisting of silts and clays with minor amounts of sand with discontinuous sections of Pleistocene-aged silts and silty clay (Ontario Geological Survey 1991). • According to Natural Resources Canada (NRCan), the Project is located in the Southern Great Lakes Seismic Zone which generally has a low to moderate seismic rating. There have been three major earthquakes with a magnitude of 2.5 or larger recorded in the past 30 years in this Seismic Zone (NRCan 2012). • The Project is not located in an area subject to permafrost formation (NRCan 2009a). • No major tornadoes have been recorded in the Project RSA (NRCan 2009b).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Physical and Meteorological Environment (cont'd)	• The following meteorological data were obtained from the Environment Canada meteorological station at the John C. Munro Hamilton International Airport (Hamilton Airport) between 1981 and 2010 (Environment Canada 2013). The data were taken approximately 10 km from the existing pipeline route. – The average annual daily temperature was 7.9°C. The warmest month was July, averaging 20.9°C, and the coolest month was January, averaging -5.5°C. In July 1988, Hamilton experienced its warmest day of 37.4°C, and in January 2004, experienced its coolest day at -30.0°C. – The average total annual precipitation was 929.8 mm, of which approximately 89% occurred as rainfall. The highest rainfalls typically occur between April and November with a monthly average of 81.0 mm. In July 1989, Hamilton recorded its highest daily rainfall of 107.0 mm, which is above the monthly average of 100.7 mm for July. – The average total annual snowfall was 156.5 cm. Snowfall typically occurs between October and May with a monthly average of 19.6 cm. In January 1966, Hamilton recorded its highest daily snowfall of 43.2 cm, above the 40.8 cm average for the month of January.
Soil and Soil Productivity	• Soils information is derived from the Wentworth County Soil Report (No. 32) (Presant et al. 1965) along with associated mapping. Detailed information on the soil series and family, parent material, drainage characteristics, and area comprised of each soil type along the pipeline route is provided in Appendix 2A. A brief summary of dominant soils is provided below. • The existing pipeline is located in an area where soils have been previously disturbed when the pipeline was initially installed. Supplemental soil surveys are planned for late 2015 or early 2016 along the replacement pipeline, where the route deviates from the existing pipeline to confirm soil types and existing conditions (see Section 10). • The dominant soils along the existing pipeline route are Grimsby sandy loam and Brantford silt loam units, and Alberton silt loam or silty clay loam units (Presant et al. 1965). • The Grimsby sandy loam soils developed on alluvial and lacustrine deposits of medium and fine sandy loam and have a gently to moderately sloping topography which allows the soils to drain well. The Grimsby soils tend to have a thin Ah horizon and an Ae horizon up to 0.6 m thick. The B horizons are relatively thick, have a reddish colour and contain clay and iron. The calcareous C horizons are also relatively thick and are usually found greater than 0.9 m from the surface (Presant et al. 1965). • The Brantford silt loam soils developed on lacustrine deposits of silty clay loam and silty clay, are well-drained and have a gently to moderately sloping topography. The silt loam in the A horizon has a granular or platy structure, is very friable and consists of two parts: a dark greyish-brown silt loam Ap horizon approximately 0.1 m thick or less; and a brown silt loam Ae horizon. The dark greyish-brown silty clay B horizon tends to be well-developed and up to 0.3 m thick. The C horizon is comprised of brown, calcareous, silty clay or silty clay loam and occurs approximately 0.6-0.8 m below ground surface (Presant et al. 1965). • The Alberton silt loam or silty clay loam soils are fairly undeveloped and are found in level areas of valley lands where they were deposited during periods of flooding. The Alberton soils primarily consist of an organic surface horizon ranging between 0.15-0.25 m thick overlying silty sediments or clay (Presant et al. 1965). • Other less dominant soils encountered by the pipeline routes include Vineland sandy loam, Beverly silt loam, Smithville silt loam, Binbrook silt loam, Toledo silt loam and silty clay loam, Farmington loam, Colwood silt loam, Tuscola silt loam, London loam, Flamborough sandy loam, Parkhill loam, and muck (i.e., deposits of well-decomposed organic debris greater than 0.3 m thick) (Presant et al. 1965). Details on these soils are provided in Appendix 2A.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Soil and Soil Productivity (cont'd)	• During construction of the Project, there is a possibility that contaminated soils could be unexpectedly encountered due to the presence of potentially contaminated sites, however, a search of the Federal Contaminated Sites Inventory revealed no registered contaminated sites within 5 km of both sides of the centre line (Treasury Board of Canada Secretariat 2015). Additionally, there are no reportable incidents of contamination in the Project area on file with the NEB (NEB 2015b), however, there are two areas of known contamination at the existing Westover Terminal (see Appendix 3 for details). • Potentially contaminated sites include existing and former gas stations, vehicle repair shops, waste disposal sites, road and railway ROWs, utility corridors, public works yards, transformer stations, utility pole storage yards, lumber yards, and industrial and commercial areas. The likelihood of encountering these facilities is low as the Project area is primarily rural and agricultural. Potential contaminants that may be encountered include hydrocarbons (e.g., gas, diesel fuel, and oil), lead, trace heavy metals, phenols, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and fuel additives. • To date, no concerns have been raised regarding soil diseases in the LSA.
Water Quality and Quantity	• The Project is located within the West Spencer Creek subwatershed within the Spencer Creek watershed, the Big Creek subwatershed within the Grand River watershed, the Upper Welland River subwatershed within the Welland River watershed, and the Twenty Mile Creek watershed. These watersheds are managed by three Conservation Authorities (CAs) including HCA, GRCA, and NPCA. • The Spencer Creek watershed, managed by the HCA, drains approximately 49,000 ha of agricultural lands, with highly developed urban lands below the Niagara Escarpment. The northern portion of the LSA lies within the middle section of the Spencer Creek watershed, crossing a portion of the Westover Creek, the Middle Spencer Creek, and the West Spencer Creek subwatersheds. • The Grand River watershed, managed by the GRCA, drains an area of approximately 650,000 ha and incorporates portions of the municipalities of Kitchener-Waterloo, Cambridge, Guelph, and Brantford. Land use within the watershed varies from agricultural and rural uses dominant in the northern and southern portions to urban uses concentrated in the central portion (GRCA 2014, Grand River Implementation Committee 1982). The central portion of the LSA lies within the Big Creek subwatershed of the Lower Grand River watershed. • The Welland River watershed, managed by the NPCA, drains approximately 102,300 ha of land and is the most westerly and largest watershed within the NPCA boundary. Land use within the Welland River watershed is characterized by a wide range of agricultural, rural residential, and urban development patterns (NPCA 2011). The southern portion of the LSA lies within the Upper Welland River subwatershed of the Welland River watershed. • The Twenty Mile Creek watershed, managed by NPCA, drains approximately 29,100 ha of land and is the second largest watershed in the NPCA boundary. Land use within the Twenty Mile Creek watershed is characterized by a wide range of agricultural, livestock, residential, and recreational development (Durley 2006). The southern portion of the LSA lies within the Twenty Mile Creek watershed. • The replacement pipeline route crosses 69 watercourses including: West Spencer Creek; Big Creek; the Welland River; and tributaries to West Spencer Creek, Big Creek, the Welland River, and Twenty Mile Creek (see Appendix 4). In addition, the replacement pipeline route crosses 13 wetlands. Although Westover Creek and Middle Spencer Creek are not crossed by the replacement pipeline route, portions of these watercourses lie within the LSA. In general, the Project is located within an agricultural landscape containing mostly ephemeral (i.e., a watercourse that flows for short periods of time after spring freshet or in response to large precipitation events) and intermittent (i.e., a non-continuously occurring watercourse present in the spring due to high groundwater discharge) watercourses. Most of the land has been tiled to maximize agricultural use (Ontario Ministry of Transportation 2009, Toronto and Region Conservation Authority and Credit Valley Conservation 2014).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Water Quality and Quantity (cont'd)	• The Water Survey of Canada maintains several hydrometric monitoring stations on watercourses in the vicinity of the pipeline replacement route (Environment Canada 2015a). Although the replacement pipeline route does not cross these specific watercourses, the data is representative of general streamflow patterns in the area. The hydrometric data from the stations on Spencer Creek (Stations No. 02HB15, 02HB023, and 02HB007) and on Ancaster Creek (Station No. 02HB021) show a general trend of mean monthly flows being highest in March/April and lowest in August/September (Environment Canada 2015a). • Groundwater sources in the vicinity of the replacement pipeline route are the Queenston, Gasport, Lockport, and Guelph formations (Halton-Hamilton Source Protection Region 2015, Lake Erie Region Source Protection Committee 2012). • The Queenston Formation shale is approximately 150 m thick, is characterized as a regionally significant aquitard (i.e., a low permeability geologic unit) and, although usually weathered in the upper 5 m, provides adequate yields for individual domestic wells below the Niagara Escarpment (Halton-Hamilton Source Protection Region 2015). • The Guelph Formation is one of the most important formations for groundwater supply in the area, with the dolomite bedrock aquifer (i.e., a water-bearing geologic unit with high permeability) considered highly vulnerable to pollution (Lake Erie Region Source Protection Region Technical Team 2008). Most domestic wells in the vicinity of the pipeline route access this aquifer. • According to the Assessment Report for the Hamilton Region Source Protection Area (2015), the water table in the area generally lies at approximately 3 m depth within shallow bedrock, with seasonal fluctuations of between 0.5-2 m. • The replacement pipeline route traverses lands assigned a low to moderate annual groundwater stress level and a moderate to high aquifer vulnerability index (Halton-Hamilton Source Protection Region 2015, Lake Erie Region Source Protection Committee 2012, NPCA 2013). • According to MOECC water well records, there are approximately 311 documented wells within the LSA. Most of the wells are used for domestic purposes, with the remainder used for irrigation and/or livestock and commercial purposes. A small number of the wells were abandoned, or did not have any information regarding completion details (e.g., depth, geology, and casing material) (MOECC 2012a). • Hamilton's water supply is sourced from Lake Ontario. The water is filtered, cleaned, and treated at the Woodward Avenue Water Treatment Facility. • There are no known springs within the LSA (Land Information Ontario 2015).
Air Emissions	• Air quality in the RSA is influenced by local sources from the Hamilton region as well as by long-range transport of contaminants from other regions. Typical air emission sources in the RSA include vehicles, farming equipment, industrial activities, and manufacturing facilities. • Characterization of current air quality conditions for the RSA was based on data collected at the Ontario Ministry of Environment's Hamilton West, Hamilton Downtown, and Hamilton Mountain monitoring stations from 2010 to 2012 (MOECC 2013). Measurements for nitrogen oxides (NO_x) (measured as nitrogen dioxide [NO_2]), ozone (O_3), and particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) were taken from the Hamilton West Monitoring Station. Measurements for carbon monoxide (CO) were taken from the Hamilton Downtown Monitoring Station. Measurements for sulphur oxides (SO_x) (measured as sulphur dioxide [SO_2]) were taken from the Hamilton Mountain Monitoring Station. All of these stations are considered to be representative of the existing air quality along the pipeline route. • The most relevant air quality criteria for assessing emissions from the Project are the Ontario Ambient Air Quality Criteria (AAQC) (MOECC 2012b) and the Environment Canada Canada-Wide Standards and National Ambient Air Quality Objectives (Health Canada and Environment Canada 1998).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Air Emissions (cont'd)	• Relevant provincial and federal objectives for air quality as well as background concentrations (50th, 70th, and 90th percentiles and maximum values) of relevant air quality contaminants for the Hamilton West, Hamilton Downtown, and Hamilton Mountain monitoring stations are summarized in Appendix 2A. • The results indicate that measured ambient concentrations for SO_2, CO, and NO_2 for the Hamilton region are well below the provincial and/or federal objectives. The maximum 24-hour $PM_{2.5}$ concentration approaches the Ontario AAQC and Canada-Wide Standard. However, the compliance for Canada-Wide Standard of $PM_{2.5}$ is assessed based on the 98th percentile of 24-hour ambient measurements over the course of a year, averaged over 3 consecutive years which was 16 µg/m^3 at Hamilton West station between 2010 and 2012, and therefore below the Canada-Wide Standard. There were a few smog days in the Hamilton region due to elevated O_3 concentrations, which may be attributable, in part, to trans-boundary air pollution. • The primary sources of air emissions during construction and maintenance activities will be from fuel combustion and dust related to the use of transportation vehicles and heavy equipment. The air emissions expected to be emitted during construction and maintenance activities include NO_x, CO, PM, and volatile organic compounds (VOCs). • The scope of the Project does not include the addition of any facilities nor any modifications to existing facilities that are known to emit substantial amounts of air emissions (e.g., large combustion engines). To date, there are no outstanding stakeholder concerns regarding air emissions. As such, detailed air quality information is not warranted as per Table A-1 of the NEB *Filing Manual* (NEB 2015a).
Greenhouse Gas (GHG) Emissions	• The Project does not include any permanent components or activities that are known to be a major source of GHG emissions during operations (e.g., compressor station). • The primary sources of GHG emissions during construction or maintenance-related activities will be from fuel combustion while transporting crews to and from the work site and along the ROW, as well as from the operation of heavy equipment. At this time, the burning of slash is not anticipated to be required to support construction activities. In the unlikely event that burning is necessary to accommodate construction activities, this will contribute to GHG emissions. • Participation in provincial or federal reporting programs is not considered necessary since the Project is not expected to produce substantial amounts of GHGs during the construction or operation phases that trigger reporting requirements. • Since the Project is not anticipated to generate high or medium volumes of GHG emissions during construction, detailed quantitative assessment of GHG emissions is not warranted as per Table A-1 of the NEB *Filing Manual* (NEB 2015a).
Acoustic Environment	• The potential sources of noise along the pipeline route are from traffic (highway and local roads), the Hamilton Airport, farming equipment, and recreational activities. • Residential communities located within the LSA (defined in Section 6) include Copetown, Orkney (in the LSA, but not crossed by either route), and Mount Hope (crossed by the existing ROW only). • Project activities will occur within the limits of Hamilton, Ontario, where Bylaw No. 11-285 indicates that construction activities shall be carried out between the hours of 7:00 a.m. and 7:00 p.m. A permit under this bylaw is required in the event that construction activities are required outside of this time. Some construction activities at select locations (e.g., HDD) may involve 24-hour noise. • A temporary increase in noise levels is anticipated during construction of the Project. The Project is not anticipated to result in an increase in noise emissions during operations aside from occasional site-specific maintenance, and there are no outstanding concerns associated with an increase in noise levels. Therefore, detailed information related to noise is not warranted for the Project as per Table A-2 of the NEB *Filing Manual* (NEB 2015a).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Acoustic Environment (cont'd)	• There are approximately 84 human receptors along the existing ROW, however, only 4 of these receptors are expected to be influenced by construction traffic during decommissioning activities since ground disturbance activities required to decommission the pipeline will occur within the existing facilities. Along the replacement pipeline route, there are approximately 26 human receptors: 4 along the existing route and 22 along the anticipated deviations. • Noise arising from construction activities associated with the Project and the potential effects on wildlife are discussed under the Wildlife and Wildlife Habitat element of this table.
Fish and Fish Habitat	• The Project location contains numerous waterbodies including streams, ponds and wetlands that provide and contribute to fish habitat. Watercourses crossed by the replacement pipeline route include: West Spencer Creek, Big Creek, and the Welland River; as well as tributaries to West Spencer Creek, Big Creek, the Welland River and Twenty Mile Creek. In addition, the replacement pipeline route crosses the Sheffield-Rockton wetland complex which may provide habitat for fish. Although Westover Creek and Middle Spencer Creek are not crossed by the replacement pipeline route, portions of these subwatersheds lie within the LSA. In general, the Project is located within an agricultural landscape containing mostly ephemeral and intermittent watercourses. As noted, most of the land has been tiled to maximize agricultural use. • Desktop review identified 72 potential watercourses along the replacement pipeline route. Of these 72 potential watercourses, 10 were assessed in the field and confirmed not to be watercourses while an additional 7 watercourses were identified during field studies that were not previously identified by background mapping. Therefore, field surveys confirmed that there is a total of 69 watercourse crossings along the replacement pipeline route. • Aquatic habitat assessments were conducted at 64 watercourse crossings in reaches that were approximately 100 m in length, where feasible. Five watercourse crossings (WC 18, WC 36, WC 37, WC 39, and WC 40) were not assessed due to land access issues. Assessment methodology was based on Section 4 of the Ontario Stream Assessment protocol as well as the Pipeline Associated Watercourse Crossings – 4th Edition (Canadian Association of Petroleum Producers [CAPP] et al. 2012, Stanfield 2010). Aquatic assessments were completed between June 3 and August 21, 2013, and were confirmed during site visits in August 2015. The detailed results of the aquatic habitat assessments are provided in Appendix 4. • Fish habitat information gathered included channel morphology type (e.g., riffle, run, pool, and flat), substrate composition (e.g., cobble, gravel, sand, silt, and clay), in-stream cover type (e.g., woody debris, in-stream aquatic vegetation, organic debris, and overhanging vegetation), presence of riparian vegetation, and percentage of shoreline vegetative coverage. Results are summarized in Appendix 4. • Fish sampling was not conducted. A desktop review identified 76 fish species and 38 mussel species that have the potential to occur within watersheds or subwatersheds crossed by the replacement pipeline route (refer to Appendix 4 for a complete list of species). Fish species at risk are discussed below under the Species at Risk element of this table. • The fish communities along the replacement pipeline route are primarily mixed assemblages containing both coolwater (e.g., percids and esocids) and warmwater (e.g., ictalurids and centrarchids) species. • All of the watercourses crossed by the replacement pipeline route have restricted activity timing windows in order to protect sensitive life history stages of fish from being negatively affected by instream activities. Restricted activity timing windows for watercourses crossed by the replacement pipeline route extend from March 15 to July 15 of each year (Ontario Ministry of Natural Resources and Forestry [OMNRF] 2013a) (refer to Appendix 4 for additional information).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Wetlands	• The Project crosses the Eastern Temperate Wetland Region of Canada. Characteristic wetlands within the Eastern Temperate Wetland Region are basin and stream swamps dominated by hardwood trees. Less common are basin and flat bogs. Shore and stream marshes, as well as fens, can be found along the shores of many ponds, lakes, and waterways. Peat accumulation is on average 2 m for swamps and 3 m for bogs (Energy, Mines and Resources Canada 1986). • Wetland distribution in the area of the Project is less than 5% (NRCan 2009c). • The replacement pipeline route does not encounter, and is not in the vicinity of, any of the following: – Migratory Bird Sanctuaries (Environment Canada 2015b); – National Wildlife Areas (Environment Canada 2015b); – Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserve Network 2012); and – Ramsar Wetlands (Ramsar Convention Secretariat 2015). • At KP 13.1, the replacement pipeline is approximately 649 m west of the Dundas Valley and Dundas Marsh Important Bird Area [IBA] (Bird Studies Canada and Nature Canada 2015). • At KP 13.0, the replacement pipeline route is approximately 408 m west of the Niagara Escarpment World Biosphere Reserve (United Nations Educational, Scientific and Cultural Organization [UNESCO] 2015). • The replacement pipeline route crosses 13 wetland ecosystems (approximately 1.6 km and 3.0 ha in total). Wetland ecosystems crossed include 11 swamp complexes and 2 marsh complexes. • Ducks Unlimited Canada (DUC) has identified three levels of priority for wetland conservation in Canada. Priority areas are threatened landscapes identified for conservation in order to provide a healthier environment for waterfowl. The Project is situated within the DUC Great Lakes Level 2 Priority Landscapes (DUC 2015). The Great Lakes area of Ontario has been identified as an important landscape for breeding and migrating waterfowl species. One of the main issues facing this area is the need for more retention of coastal wetlands and offshore habitats including agricultural areas near these coastal habitats for foraging. The Level 2 Priority Landscape designation indicates an area where conservation efforts are being focused and provides awareness to the sensitive nature of many ecosystems found in this area. The Level 2 Priority Landscape does not have any special regulatory requirements or guidelines. • A review of existing background information identified four Provincially Significant Wetland (PSW) complexes within the LSA. The PSWs in the LSA include the Sheffield-Rockton, the Hayesland-Christie, the Big Creek Headwaters complexes, and the Copetown Bog. All development through these areas require consultation and approval from the CAs that they are located within. • The Sheffield-Rockton PSW Complex is located at the northern two thirds of the LSA. The complex is made up of 28 individual wetlands, composed of two wetland types (94% swamp and 6% marsh). Two of these wetlands are crossed by the replacement pipeline route. • The Hayesland-Christie PSW Complex is located at the southern end of the LSA, just north of Concession 4 West. The complex is made up of 86% swamp and 14% marsh. The replacement pipeline route crosses five of the wetlands associated with this complex. • The Big Creek Headwaters PSW Complex is made up of 33 individual wetlands, composed of two wetland types, 77% swamp and 23% marsh. Dominant vegetation includes 55% tall shrubs, 18% narrow-leaved emergents, 2% robust emergents, 1% free-floating plants, and 2% submergents. The Project crossed five of the wetlands associated with this complex. • Refer to Appendix 2A for a figure showing the wetland units overlapping the LSA.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	**Summary of Consideration**
Wetlands (cont'd)	• The Copetown Bog PSW encompasses the Summit Bog Area of Natural and Scientific Interest and is composed of two wetland types (65% bog and 35% marsh). The Project does not cross any wetland components associated with the Copetown Bog PSW, although, a portion of it is in the LSA. • After the completion of field studies, it was determined that 13 wetland ecosystems are located along the replacement pipeline route. Of these 13 wetland ecosystems, 1 was previously evaluated as "not significant" by OMNRF protocols (wetland 13 [KP 28.30 to KP 28.33]) and 12 are part of PSW complexes (Welland River Headwaters Tributaries Wetland Complex, OMNRF 2013b): – Sheffield-Rockton: wetlands 1 (KP 0.28 to KP 0.73) and 2 (KP 2.65 to KP 2.72); – Hayseland-Christie: wetland 3 (KP 3.03 to KP 3.07), wetland 4 (KP 3.23 to KP 3.33 and KP 3.36 to KP 3.42), wetland 5 (KP 3.80 to KP 3.88), wetland 6 (KP 5.26 to KP 5.26), and wetland 7 (KP 5.51 to KP 5.70); and – Big Creek Headwaters: wetland 8 (KP 8.84 to KP 8.85 and KP 8.87 to KP 8.91, KP 8.88 to KP 8.88 and KP 9.01 to KP 9.21), wetland 9 (KP 9.56 to KP 9.61), wetland 10 (KP 9.73 to KP 9.75), wetland 11 (KP 11.76 to KP 11.82 and KP 12.00 to KP 12.08), and wetland 12 (KP 14.07 to KP 14.18).
Vegetation	• The Project is located in the Lake Erie Lake Ontario Ecoregion. • The LSA has fragmented natural features interspersed amongst an agricultural landscape. Natural features within the LSA include woodlands, wetlands, meadows, and open spaces, which together, provide a diversity of plant life and wildlife habitat. • Two Environmentally Significant Areas, including Westover Southwest Complex and Rockton Northeast Woodlot, fall within the boundaries of the LSA and generally overlap woodlands. The Westover Southwest Complex is comprised of a mix of previously disturbed terrestrial communities and wetland areas. This feature has been identified as environmentally significant because of its ecological function (i.e., riparian area serves as a link between natural areas in Flamborough, provides habitat for significant species, and contains interior forest habitat). • Field investigations were conducted between May and September 2013. Vegetation along both the existing pipeline route and the replacement pipeline route was characterized using the ELC System for Southern Ontario (Lee et al. 1998). A site walk was completed in August 2015 to determine if land use changes have occurred since ELC information was collected in 2013. A spring botanical survey is planned in 2016. • ELC surveys conducted within the LSA identified 48 natural communities and 18 cultural classifications. All vegetation communities surveyed in the LSA are considered very common in Ontario. Additional ELC information is presented in Appendix 2A. • A total of 360 plant species were documented during site visits. A list of plant species observed during field studies within the LSA is included in Appendix 2A. Of the 360 species identified, 60% are considered native species, 30% are considered non-native species, and 10% are considered cryptogenic species, meaning their origins are unknown. • All of the native plant species observed in the LSA are considered very secure or secure in the Province of Ontario (S Rank of S5 or S4), with the exception of honey-locust (*Gleditsia triacanthos* L.), Davis' sedge (*Carex davisii* Schwein. & Torr.), and butternut (*Juglans cinerea* L.). Honey locust and Davis' sedge are considered Imperiled (S Rank S2) due to their restricted range, steep declines in abundance, and few populations. Butternut is addressed under Species at Risk.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Vegetation (cont'd)	• Honey-locust is a deciduous tree reaching heights of greater than 30 m with furrowed bark. It forms thorn-bearing twigs that persist on the trunk for many years. The leaves are alternate, evenly-pinnate and are either single or double-compound. It forms long, flat, twisting pods which reach 15-40 cm in length and have a leathery brown husk. Honey-locusts occur in forests scattered with other broadleaf trees, generally in moist rich woods, but they are tolerant of drought (Farrar 2006). Pods drop late in the year, often in the middle of winter, and the seeds remain viable for years. • Davis' sedge is a tufted perennial that grows 30-90 cm in height. It has blades that are pubescent on the lower surface and that are tinged purple at the base. The flowers are in terminal, drooping spikes that are 2-4 cm in length. It is found in dry to moist woods and meadows (Gleason 1952). • A search of the Natural Heritage Information Center (NHIC) records identified numerous occurrences of 21 rare plant species (i.e., not including historical or extirpated species) within 5 km of the anticipated replacement pipeline route (NHIC 2015). • Of the non-native species observed, 10 are listed as Noxious weeds by the Ontario *Weed Control Act*: dodder species; annual ragweed; climbing poison ivy; spotted knapweed; Canada thistle; bull thistle; European buckthorn; sow-thistle (annual and perennial); common sow-thistle; and colt's-foot. • Some of the commonly observed non-native, invasive species that are considered pests in the Project area are phragmites (European common reed), glossy buckthorn, purple loosestrife, and garlic mustard. • Soybean cyst nematode may be a concern in this region, however, it is not recorded as occurring in Hamilton-Wentworth County (Tylka and Marett 2014) or in the Project area (Canadian Food Inspection Agency 2013). The Canadian Food Inspection Agency stopped regulating soybean cyst nematode in 2013, basing the decision on the inability to stop the natural movement and the availability of resistant varieties and crop rotations. • An arborist assessment is planned in 2016 to determine the presence, abundance, and merchantability of all timber within the Footprint. The assessment will also determine the presence and location of emerald ash borer, which is a tree pest with the potential to occur in the region.
Wildlife and Wildlife Habitat	• The replacement pipeline route does not encounter and is not in the vicinity of any of the following: – Parks and Protected Areas (Ontario Parks 2015); – Migratory Bird Sanctuaries (Environment Canada 2015b); – National Wildlife Areas (Environment Canada 2015b); – Western Hemisphere Shorebird Reserves (Western Hemisphere Shorebird Reserve Network 2012); and – Ramsar Wetlands (Ramsar Convention Secretariat 2015). • The replacement pipeline route is located within two provincially identified deer wintering areas from KP 11.7 to KP 12.1 and from KP 14.0 to KP 14.2 (OMNRF 2015). These deer wintering areas are associated with the Big Creek Headwaters PSW Complex.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Wildlife and Wildlife Habitat (cont'd)	• A review of existing background information identified four PSW complexes (i.e., Sheffield-Rockton, Hayseland-Christie, Big Creek Headwaters, and Copetown Bog) and one locally significant wetland within the LSA. The Hayesland-Christie PSW Complex and Sheffield-Rockton PSW Complex have been identified as areas that provide winter cover for wildlife. The Hayesland-Christie PSW Complex is also known to serve as a stopover area of migratory passerines, shorebirds, and raptors. The Hayesland-Christie PSW Complex was identified as a nesting site for colonial waterbirds, and a foraging area for great blue heron. The Sheffield-Rockton PSW Complex has been known to provide nesting habitat for colonial waterbirds. The Big Creek Headwaters PSW Complex is known to provide winter cover for wildlife, including white-tailed deer, ruffed grouse, and ring-necked pheasant, colonial waterbirds breeding habitat, and waterfowl staging and breeding habitat. Refer to the Wetlands element of this table for more information regarding the location of wetlands. • During the 2013 wildlife field work, several seasonal concentration areas as defined by the Ontario Ministry of Natural Resources (2000) were identified on the Project Footprint. A turtle overwintering area, a turtle nesting area, waterfowl nesting areas, and marsh breeding bird habitat were identified in association with the Sheffield-Rockton PSW Complex. Marsh breeding bird habitat was identified in association with the Big Creek Headwaters PSW Complex and the Greenbelt Natural Heritage System. In addition, several potential amphibian woodland breeding habitats were identified throughout the Project Footprint. • An area of fissured rock near KP 1.0 located on the Project Footprint may provide suitable reptile hibernaculum habitat. An eastern gartersnake and an eastern milksnake were observed in the vicinity in 2013 and 2015 respectively. • Areas of large diameter trees (> 25 cm diameter at breast height) that provide potential bat maternity colony habitat on the Project Footprint are located near approximately KP 1, KP 3, KP 7, KP 12, KP 14, KP 15, KP 27, KP 28, KP 33, and KP 35. • Habitat that provides potential nesting habitat for woodland raptors is located on the Project Footprint within Woodland B and U based on woodland/forest stand size requirements. • In addition, potential breeding habitat for Jefferson/Blue-spotted Salamander (i.e., Habitat for Species of Conservation Concern [Ontario Ministry of Natural Resources 2000]) was identified on the Project Footprint. • During 2013 wildlife field work, which included breeding bird surveys, amphibian surveys, and ground surveys, 70 wildlife species or their sign were observed, and during the 2015 field reconnaissance, 25 wildlife species or their sign were observed. • At KP 13.1, the replacement pipeline is approximately 650 m west of the Dundas Valley and Dundas Marsh IBA (Bird Studies Canada and Nature Canada 2015). This nationally significant IBA is an extensive natural area located along the Niagara Escarpment. The Dundas Valley contains a nationally significant community of forest birds. Breeding evidence for hooded warbler, Louisiana waterthrush, cerulean warbler, yellow-breasted chat, and Acadian flycatcher have been recorded within the valley on an irregular basis. Dundas Marsh is an important area for migrating waterfowl, shorebirds, herons, raptors, gulls, terns, and songbirds. There is breeding evidence for least bittern, cerulean warbler and prothonotary warbler, yellow-breasted chat, and king rail in the marsh. At the municipal level, the Dundas Valley is identified as an Environmentally Sensitive Area in the Hamilton-Wentworth Regional Official Plan. At the provincial level, it is identified as a Life Science and Earth Science Area of National and Scientific Interest. At the international level, it is recognized as part of the Niagara Escarpment World Biosphere Site (see below) (Bird Studies Canada and Nature Canada 2015). • At KP 13, the replacement pipeline route is approximately 410 m west of the Niagara Escarpment World Biosphere Reserve (UNESCO 2015). The Niagara Escarpment Biosphere Reserve is approximately 725 km long and extends from Lake Ontario (near Niagara Falls) to the tip of the Bruce Peninsula (between Georgian Bay and Lake Huron). The Niagara Escarpment represents the largest contiguous stretch of primarily forested land in south-central Ontario (UNESCO 2015).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Species at Risk or Species of Special Status	<u>Fish</u> • There were 76 fish species identified that have been documented in the watersheds or subwatersheds crossed by the replacement pipeline route (see Appendix 4 for a complete list of species). Seven of these species were considered to be species at risk, including grass pickerel (*Esox americanus vermiculatus*), redside dace (*Clinostomus elongatus*), American eel (*Anguilla rostrata*), river redhorse (*Moxostoma carinatum*), black redhorse (*Moxostoma duquesnei*), eastern sand darter (*Ammocrypta pellucida*), and silver shiner (*Notropis photogenis*). Species at risk include those that are federally listed under Schedule 1 of the *Species at Risk Act* (*SARA*) or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or are provincially listed under the Ontario *Endangered Species Act*. • Four of the species at risk (i.e., river redhorse, black redhorse, eastern sand darter, and silver shiner) are known to occur within the mainstem of the Grand River within the Southern Grand River watershed (Holm et al. 2009, MacDougall and Ryan 2012, OMNRF 2013a). The replacement pipeline route crosses the Southern Grand River watershed within the Big Creek subwatershed, approximately 37 km upstream of the Grand River mainstem. Due to known distribution and habitat requirements of these fish species, it is unlikely that they will occur within the small rivers and tributaries crossed by the replacement pipeline route and they are considered unlikely to interact with the Project. • Grass pickerel is listed as Special Concern under the Ontario *Endangered Species Act* and as Special Concern under Schedule 1 of *SARA* (Government of Canada 2015). Grass pickerel prefer streams and wetlands with warm, shallow water and an abundance of aquatic plants (Holm et al. 2009). They have been documented to occur in the LSA within the Twenty Mile Creek and Welland River watersheds (DFO 2015a, Durley 2006, Morrison Hershfield 2012, NPCA 2011). • The redside dace is listed as Endangered under the Ontario *Endangered Species Act*, and is listed as Endangered by COSEWIC (COSEWIC 2015). The redside dace is also listed as Special Concern under Schedule 3 of SARA (Government of Canada 2015). Redside dace prefer clear, cool streams with rubble and gravel bottoms, with a mixture of pool and riffle habitat (DFO 2015b, Holm et al. 2009, Scott and Crossman 1998). Within the Aquatics RSA, they are found in the Sheffield-Rockton wetland complex (DFO 2015c), which drains into the Westover Creek subwatershed. They are also known from coolwater systems within the Spencer Creek watershed, but have not been documented in watercourses in this watershed that are crossed by the Project (Bowlby et al. 2009). Within the Spencer Creek watershed, the replacement pipeline route crosses the West Spencer Creek subwatershed including West Spencer Creek and unnamed tributaries. West Spencer Creek is considered a small, warm water riverine zone (Bowlby et al. 2009), and given the known temperature preferences for redside dace, they are unlikely to occur within West Spencer Creek or other watercourses crossed by the replacement pipeline route. Redside dace may occur in Westover Creek, which flows into Spencer Creek. The proposed crossing of West Spencer Creek is approximately 750 m upstream from Spencer Creek which may support redside dace, however, considering the temperature preferences of redside dace, the potential for their occurrence in West Spencer Creek is limited. • American eel is listed as Endangered under the Ontario *Endangered Species Act* and as Threatened by COSEWIC (COSEWIC 2015), however, they have no status or schedule under *SARA* (Government of Canada 2015). American eel may occur within the Grand River within the Aquatics RSA (defined in Section 6.0) (DFO 2015d, Grand River Fisheries Management Plan Implementation Committee 2005). They are also known to occur in Lake Ontario and are known to inhabit freshwater habitats accessible to the Atlantic Ocean (DFO 2015e, Pickett, pers. comm.). They utilize a variety of habitats throughout their life stages and, in freshwater, prefer substrates consisting of gravel, sand, and silt (Holm et al. 2009). Although they have not been documented within the watercourses crossed by the replacement pipeline route, they have the potential to occur if suitable habitat and connectivity exists.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Species at Risk or Species of Special Status (cont'd)	• River redhorse is listed as Special Concern under the Ontario *Endangered Species Act* and as Special Concern under Schedule 1 of *SARA* (Government of Canada 2015). River redhorse are known to occupy medium to large-sized rivers (DFO 2015f) with a preference for swift current, riffle-run habitat, and clean, coarse substrates (COSEWIC 2006). Within the Aquatics RSA, river redhorse are known to occur in the Southern Grand River watershed, within the mainstem Grand River (COSEWIC 2006, DFO 2015f, Holm et al. 2009). • Black redhorse is listed as Threatened under the Ontario *Endangered Species Act* and is listed as Threatened by COSEWIC (COSEWIC 2015), however, they have no status or schedule under *SARA* (Government of Canada 2015). Black redhorse generally prefer moderate-sized rivers with moderate to fast flows, with a variety of substrates including boulders, rubble, gravel, sand, and silt (DFO 2015g). Within the Aquatics RSA, black redhorse are known to occur in the Southern Grand River watershed, within the mainstem Grand River (Holm et al. 2009). • Eastern sand darter is listed as Endangered under the Ontario *Endangered Species Act* and is listed as Threatened under Schedule 1 of *SARA* (Government of Canada 2015). They primarily inhabit streams, rivers, and sandy shoals in lakes, with habitats dominated by fine sand and gravel substrates (DFO 2012). Similar to the river redhorse and black redhorse, the eastern sand darter is present within the mainstem of the Grand River in the Southern Grand River watershed (DFO 2012). • Silver shiner is listed as Threatened under the Ontario *Endangered Species Act* and is listed as Threatened by COSEWIC (COSEWIC 2015). The silver shiner is also listed as Special Concern under Schedule 3 of *SARA* (Government of Canada 2015). The silver shiner is found in deep riffles or pools, and in the cool to warm, clear waters of medium to large streams (Holm et al. 2009). Silver shiner have been documented in the Grand River mainstem within the Aquatics RSA (Government of Ontario 2015a). • Therefore, based on known habitat requirements and geographic distributions, only three species have reasonable potential to interact with the Project: grass pickerel; redside dace; and American eel. • There are 38 mussel species that have been documented in southwest Ontario (see Appendix 4 for a complete list of species) and 14 of these species are species at risk: round pigtoe (*Pleurobema sintoxia*); mapleleaf mussel (*Quadrula quadrula*); salamander mussel (*Simpsonaias ambigua*); northern riffleshell (*Epioblasma torulosa rangiana*); snuffbox (*Epioblasa triquentra*); wavyrayed lampmussel (*Lampsilis cardium*); eastern pondmussel (*Ligumia nasuta*); threehorn wartyback (*Obliquaria reflexa*); hickorynut (*Obovaria olivaria*); round hickorynut (*Obovaria subrotunda*); kidneyshell (*Ptychobranchus fasciolaris*); lilliput (*Toxolasma parvus*); rayed bean (*Villosa fabalis*); and rainbow mussel (*Villosa iris*). Two of these species at risk have the potential to interact with the Project: eastern pondmussel and rainbow mussel (Pickett pers. comm.). • Eastern pondmussel is listed as Endangered on *SARA* Schedule 1 and by the Ontario *Endangered Species Act*. Rainbow mussel is listed as Endangered on *SARA* Schedule 1 and as Threatened by the Ontario *Endangered Species Act.*

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Species at Risk or Species of Special Status (cont'd)	Vegetation • There are 10 vegetation species at risk (i.e., *SARA* Schedule 1 and Ontario *Endangered Species Act*) identified as having the potential to occur in the vicinity of the Project (based on known ranges and preferred habitat availability) including: American chestnut; American columbo; American ginseng; broad beech fern; butternut; eastern flowering dogwood; green dragon; hoary mountain mint; red mulberry; and white wood aster. Two additional vegetation species at risk are known to occur within the Study Area, but their potential habitat does not occur within the Study Area: spotted wintergreen; and few-flowered club-rush. There are no bryophyte or lichen species at risk that are known from the RSA. One vegetation species at risk, butternut (*Juglans cinerea* L.), was observed in the LSA during vegetation surveys (see Plate 4, below). Butternut is considered Vulnerable (S Rank S3) due to its restricted range, few populations, and recent and widespread declines in abundance, and is listed as Endangered both federally and provincially. Butternut occurred within section 1 north of Concession 4, west of the existing line, and directly south of Concession 2 within 50 m of the existing line. • Butternut is a protected species under the *Endangered Species Act* of Ontario. This species is impacted by butternut canker, a fungal disease that has spread across its range throughout Ontario. In an effort to maintain a healthy population of butternut, the removal of these species is regulated by the OMNRF. Individuals or organizations wishing to remove individual trees must have them appraised by a butternut health assessor, defined as a person designated by the Minister for the purpose of assessing the extent to which butternut trees are affected by the canker. Depending on the health of the individuals and the results of the assessment, additional actions may be required. Planting younger trees in the vicinity of the removed trees may be required based on the size of the individuals. If the individuals are healthy and exhibit resistance to butternut canker, the butternut health assessor may restrict the removal of the individuals entirely. • A search of the NHIC records identified occurrences of the following five vegetation species at risk within 5 km of the anticipated replacement pipeline route: American chestnut; broad beech fern; butternut; green dragon; and spotted wintergreen (NHIC 2015). Wildlife • Wildlife species with special conservation status that are federally listed on Schedule 1 of *SARA* (Government of Canada 2015) and/or by COSEWIC (2015), or provincially listed under the Ontario *Endangered Species Act* that have the potential to occur within the LSA were identified based on a desktop review of available information from the area, species ranges, habitat requirements, and professional judgement, and include the following: – little brown myotis: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – northern myotis: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – tri-colored bat: Endangered on Schedule 1 of *SARA* and by COSEWIC; not listed on the Ontario *Endangered Species Act*; – woodland vole: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – Acadian flycatcher: Endangered on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*; – bald eagle: Special Concern on the Ontario *Endangered Species Act*; – barn owl: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – barn swallow: Threatened by COSEWIC and on the Ontario *Endangered Species Act*; – black tern: Special Concern on the Ontario *Endangered Species Act*; – bobolink: Threatened by COSEWIC and on the Ontario *Endangered Species Act*;

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Species at Risk or Species of Special Status (cont'd)	– Canada warbler: Threatened on Schedule 1 of *SARA* and by COSEWIC; Special Concern on the Ontario *Endangered Species Act*; – cerulean warbler: Endangered on Schedule 1 of *SARA* and by COSEWIC; Threatened on the Ontario *Endangered Species Act*; – common nighthawk: Threatened on Schedule 1 of *SARA* and by COSEWIC; Special Concern on the Ontario *Endangered Species Act*; – eastern meadowlark: Threatened by COSEWIC and on the Ontario *Endangered Species Act*; – eastern whip-poor-will: Threatened on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*; – eastern wood-pewee: Special Concern by COSEWIC and on the Ontario *Endangered Species Act*; – golden-winged warbler: Threatened on Schedule 1 of *SARA* and by COSEWIC; Special Concern on the Ontario *Endangered Species Act*; – grasshopper sparrow: Special Concern by COSEWIC and on the Ontario *Endangered Species Act*; – Henslow's sparrow: Endangered on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*; – hooded warbler: Threatened on Schedule 1 of *SARA*; Special Concern on the Ontario *Endangered Species Act*; – king rail: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – least bittern: Threatened on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – Louisiana waterthrush: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – northern bobwhite: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – peregrine falcon: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – prothonotary warbler: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – red-headed woodpecker: Threatened on Schedule 1 of *SARA* and by COSEWIC; Special Concern on the Ontario *Endangered Species Act*; – short-eared owl: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – wood thrush: Threatened by COSEWIC, Special Concern on the Ontario *Endangered Species Act*; – yellow-breasted chat: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – Jefferson salamander: Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – Blanding's turtle: Threatened on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – common snapping turtle: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – eastern hog-nose snake: Threatened on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*;

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Species at Risk or Species of Special Status (cont'd)	– eastern milksnake: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – eastern musk turtle: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; – eastern ribbon snake: Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*; and – wood turtle: Threatened on Schedule 1 of *SARA* and by COSEWIC; Endangered on the Ontario *Endangered Species Act*. – A search of the NHIC records (NHIC 2015) identified occurrences of 11 wildlife species listed on Schedule 1 of *SARA* (Government of Canada 2015) and/or by COSEWIC (2015) within 1 km of the replacement pipeline route, including: – woodland vole (Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); – Acadian flycatcher (Endangered on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*); – bobolink (Threatened by COSEWIC and on the Ontario *Endangered Species Act*); – eastern meadowlark (Threatened by COSEWIC and on the Ontario *Endangered Species Act*); – eastern whip-poor-will (Threatened on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*); – Henslow's sparrow (Endangered on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*); – Louisiana waterthrush (Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); – northern bobwhite (Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); – yellow-breasted chat (Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); – eastern milksnake (Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); and – Jefferson salamander (Endangered on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*). • A total of 13 species of special conservation status or their sign were observed during field work, including: – barn swallow (Threatened by COSEWIC and on the Ontario *Endangered Species Act*); – bobolink (Threatened by COSEWIC and on the Ontario *Endangered Species Act*); – chimney swift (Threatened on Schedule 1 of *SARA* and by COSEWIC; Special Concern on the Ontario *Endangered Species Act*); – eastern meadowlark (Threatened by COSEWIC and on the Ontario *Endangered Species Act*); – eastern wood-pewee (Special Concern by COSEWIC and on the Ontario *Endangered Species Act*); – grasshopper sparrow (Special Concern by COSEWIC and on the Ontario *Endangered Species Act*); – least bittern (Threatened on Schedule 1 of *SARA*, by COSEWIC on the Ontario *Endangered Species Act*);

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Species at Risk or Species of Special Status (cont'd)	– red-headed woodpecker (Threatened on Schedule 1 of *SARA* and by COSEWIC; Special Concern on the Ontario *Endangered Species Act*); – wood thrush (Threatened by COSEWIC, Special Concern on the Ontario *Endangered Species Act*); – common snapping turtle (Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); – eastern milksnake (Special Concern on Schedule 1 of *SARA*, by COSEWIC and on the Ontario *Endangered Species Act*); – monarch (Special Concern on Schedule 1 of *SARA,* by COSEWIC and on the Ontario *Endangered Species Act*); and – West Virginia white (Special Concern on the Ontario *Endangered Species Act*). • The replacement pipeline route crosses two proposed critical habitat units (Ontario Breeding Bird Atlas [OBBA]) squares (17TNH79 and 17TNH88), which contain areas of suitable nesting and/or foraging habitat for eastern whip-poor-will based on criteria outlined in the *Recovery Strategy for Eastern Whip-poor-will (*Antrogstomus vociferous*) in Canada [Proposed]* (Environment Canada 2015c). Proposed critical habitat units are located from KP 0 to KP 8.4 (17TNH79) and from KP 22.9 to KP 23.1 (17TNH88). Eastern whip-poor-will use forested edges for nesting and adjacent open areas for foraging. Clearing activities will increase the amount of habitat available for foraging in the vicinity of potential nesting areas. • Within proposed critical habitat unit 17TNH79, the Project crosses approximately 875 m of treed habitat which provides potential nesting habitat for eastern whip-poor-will. Potential nesting habitat is located at KP 1.25 to KP 1.34, KP 2.65 to KP 2.75, KP 3.03 to KP 3.04, KP 3.25 to KP 3.32, KP 3.55 to KP 3.59, KP 3.77 to KP 3.88, KP 5.55 to KP 5.70, and KP 6.91 to KP 7.19. The Project does not cross treed habitat within proposed critical habitat unit 17TNH88 from KP 22.9 to KP 23.1 and no locations of potential nesting habitat for eastern whip-poor-will were identified along the replacement pipeline route within this proposed critical habitat unit.
Human Occupancy and Resource Use	• The Project is located entirely within the single-tier of Hamilton, Ontario. Hamilton is located in southern Ontario on the western end of the Niagara Peninsula and Lake Ontario, and covers approximately 1,372 km^2 (Statistics Canada 2012a). In January 2001, Hamilton was created through the amalgamation of the former city and other lower-tier municipalities of the former Regional Municipality of Hamilton-Wentworth, including Stoney Creek, Ancaster, Flamborough, Dundas, and Glanbrook. • The results of the preliminary Traditional Territory Assessment completed by the NEB for the Project indicate that the following Aboriginal groups were identified as having known or traditional territory in the Project area which may be impacted by the Project: Mississaugas of the New Credit First Nation; Six Nations of the Grand River First Nation; Métis Nation of Ontario; and Haudenosaune Development Institute. See the TLRU section of this table for further information regarding Aboriginal groups in the area. • Land use in the LSA is primarily rural/agricultural interspersed with farmhouses and natural features (e.g., woodlots, watercourses, wetlands, and open space). There is a mix of agricultural fields that are both actively farmed and dormant. Infrastructure located in the LSA includes hydro transmission corridors, rail lines, existing pipelines, roads, and highways. • The lands located in the LSA are primarily designated as *Agriculture*, *Rural* and *Open Space* in the Rural Hamilton Official Plan (Schedule D: Rural Land Use Designations; City of Hamilton 2012a). Two areas within the LSA are identified as *Urban Area* in the Urban Hamilton Official Plan (City of Hamilton 2013). The first is east of Trinity Road and south of Garner Road and the second includes the community of Mount Hope located along Upper James Street. The south end of the community (immediately north of White Church Road West) is designated for park space, institutional and commercial uses.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Human Occupancy and Resource Use (cont'd)	• The primary intent of lands designated as *Agriculture* in the Rural Hamilton Official Plan (City of Hamilton 2012a) is to protect prime agricultural areas for agriculture use. Permitted uses are limited to agricultural uses, agricultural-related commercial and agricultural-related industrial uses, and on-farm secondary uses. Agricultural land uses along the pipeline route include crop production and the rearing of livestock. • Lands designated as *Rural* in the Rural Hamilton Official Plan (City of Hamilton 2012a) are characterized as having lower capability for agriculture due to a range of factors. Permitted uses include agriculture and other resource-based rural uses, and institutional uses serving the rural community. • Lands designated as *Open Space* in the Rural Hamilton Official Plan (City of Hamilton 2012a) include public and private areas where land is used predominately for recreational activities, conservation management, and other open space uses. These uses include parks, resource-based recreational and tourism uses, recreation/community centres, pedestrian pathways, trail, bikeways, walkways, campgrounds, marinas, woodlots, forestry and wildlife management areas, fishing reserves, hazard lands and cemeteries. • The City of Hamilton has indicated a need to expand the airport to the south and is proposing to expand infrastructure in the area including watermains and trunk sewers (proposed along various roads including Fiddlers Green, White Church Road, Highway 6, and Glancaster Road), as well as a new sewage pumping station along White Church Road, south of the airport and east of Glancaster Road (City of Hamilton 2011a). Although the pipeline ROWs (existing and anticipated replacement pipeline) cross this area, the Project does not encounter any specific locations that have been identified for future airport expansion. • The LSA also crosses lands that the Hamilton Airport Employment Growth District Secondary Plan has designated *Airport Related Business*, south of the existing airport (City of Hamilton 2010a). Lands to the south of the airport are also identified for a future light rail expansion (Highway 6) and proposed multi-use trails and sidewalks (City of Hamilton 2011b). • Most of the LSA is located on lands designated as Protected Countryside in the Ontario Greenbelt Plan (Ontario Ministry of Municipal Affairs and Housing [OMMAH] 2005). Sections of the replacement and existing ROWs also cross lands designated as part of the Natural Heritage System. The Protected Countryside is comprised of an agricultural system and a natural system, together with a series of settlement areas. As per Section 4.2.1 (General Infrastructure Policies) of the Ontario Greenbelt Plan (OMMAH 2005), infrastructure projects, including oil and gas pipelines and associated facilities, approved by the NEB are permitted on lands designated as Protected Countryside, provided they serve the growth and economic development expected in southern Ontario beyond the Greenbelt by providing for the appropriate infrastructure connections among urban growth centres and between these centres and Ontario's borders. • The Growth Plan for the Greater Golden Horseshoe (OMMAH 2006) aims to: revitalize downtown areas; create complete communities; provide a range of housing options; curb urban sprawl; and reduce traffic gridlock. Downtown Hamilton has been identified as an Urban Growth Centre surrounded by lands identified as a Built-Up Area. Urban Growth Centres are focal areas for investment. They can accommodate major transit infrastructure, they are recognized for employment potential, and they accommodate a significant share of the population growth. Future growth will also be directed to the Built-Up Areas identified in the plan. • The Provincial Policy Statement (PPS) (OMMAH 2014) focuses on the efficient use of land and infrastructure, environmental protection, and opportunities for mixed housing and employment growth. In the PPS, the Project would be considered as "infrastructure" and the PPS indicates that infrastructure should be provided in a coordinated, efficient, and cost-effective manner to accommodate projected needs.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Human Occupancy and Resource Use (cont'd)	• Hamilton's Strategic Plan spans from 2012 until 2015 and outlines three main priorities of a prosperous and healthy community, valued and sustainable services, and improved leadership and governance. Specific goals related to each of these objectives include promoting economic opportunity, engaging and informing citizens, and building organizational capacity to ensure that Hamilton has a skilled workforce that can meet the needs of the residents (City of Hamilton 2012b). • Hamilton's water supply is sourced from Lake Ontario. Lake water enters an intake pipe and is pumped to the Woodward Avenue Water Treatment Facility where it is treated. Treated water is pumped through the Central Water Distribution System to residential homes and businesses in Hamilton and surrounding communities (City of Hamilton 2015a). Hamilton owns, operates, and maintains central and communal well water distribution systems, which consist of approximately 1,874 km of water mains, 12,000 fire hydrants, 14,000 water valves, 123,000 service connections, and various related system accessories (City of Hamilton 2015a). However, residences in the Project LSA use domestic water wells and septic systems. • Recreational features located in the LSA include open spaces, trails, and golf courses. The Chippewa Trail is located approximately 1 km west of the replacement pipeline end point, and the Hamilton-Brantford (Highway 52) Rail Trail is located southwest of Power Line Road West and Highway 52 (Trinity Road). Both the Chippewa Trail and the Hamilton-Brantford Rail Trail are crossed by the existing pipeline ROW. The Chippewa Trail is approximately 15 km in length and links Hamilton with Caledonia to become part of the Niagara branch of the Trans Canada Trail (Ontario Trails Council 2015). The Hamilton-Bruce Rail Trail is approximately 32 km in length connecting the west side of Hamilton (i.e., Westdale community) to Brantford, crossing under Highway 403. • Golf courses located in the area include the Copetown Woods Golf Club, Flamborough Hills Golf Club, Mystic Golf Club, Knollwood Golf Club, and the Southern Pines Golf and Country Club. • Other recreational features identified in the LSA include the Copetown Holiday Park and the Ancaster Fairgrounds. The facility is located at 630 Trinity Road South and is approximately 40 ha in size, and is used for a variety of events that range from weddings to trade shows. The Ancaster Fairgrounds is the location of the annual Ancaster Fair, which is generally held in September of every year. The west end of the property is crossed by the existing pipeline ROW south of Wilson Street West. • The Hamilton Angling and Hunting Association (HAHA) is located in Ancaster, approximately 4 km east of the replacement pipeline ROW. The HAHA professes to be one of the oldest in Ontario, formed in 1921 (HAHA 2015). The HAHA has approximately 25 ha of property and includes sections for skeet rifles, archery, handguns, training, conservation, and safety. Applications for membership are available for individuals aged 12 and older (HAHA 2015).
Heritage Resources	• A Stage I Archaeological Assessment was conducted by D.R. Poulton & Associates Incorporated (D.R. Poulton) in accordance with the provisions of the *Ontario Heritage Act* and the Standards and Guidelines for Consultant Archaeologists formulated by the Ontario Ministry of Tourism, Culture and Sport (MTCS) (MTCS 2011). As per the guidelines, the spatial boundary used for the Stage 1 Archaeological Assessment was a 1 km radius around the Project. • Within that spatial boundary, it was determined that 227 archaeological sites have been registered (see Table 2 of D.R. Poulton 2015). Of these, 19 have more than one cultural component, and 258 discrete cultural components are represented in the inventory. Further study concluded that there are eight registered archaeological sites are located within 100 m of the existing and replacement pipeline routes. • In accordance with the provisions of the *Ontario Heritage Act* and the MTCS, a Stage 2 Archaeological Assessment is planned for fall 2015/spring 2016 to confirm if areas of archaeological potential identified in the Stage 1 Archaeological Assessment have sufficient cultural heritage value or interest to require a Stage 2 assessment.

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Heritage Resources (cont'd)	• Correspondence with the Ontario Heritage Trust and the MTCS Heritage Registrar in July 2015 confirmed that the following are not within or immediately adjacent to the replacement pipeline route: – provincial heritage properties (managed by MTCS); – lands designated as protected under Section 29 of the *Ontario Heritage Act*; and – lands with a notice of intention to designate under Section 41 of the *Ontario Heritage Act*. • Further research also indicated that the following do not occur within or immediately adjacent to the replacement pipeline route: – National Historic Sites as indicated by Parks Canada; – plaques designated provincially by the Ontario Heritage Trust; and – protected properties present on the City of Hamilton's register.
Traditional Land and Resource Use (TLRU)	• A traditional land use study was not completed for the Project as land use along the existing and replacement pipeline routes is primarily rural and agricultural, with considerable urban and residential development. Land along the existing and replacement pipeline routes is privately-owned or fee simple land which limits access to the public, including Aboriginal groups. The results of the preliminary Traditional Territory Assessment completed by the NEB for the Project indicate that Mississaugas of the New Credit First Nation, Six Nations of the Grand River First Nation, Métis Nation of Ontario, and Haudenosaunee Development Institute (representing the Haudenosaunee Confederacy Chiefs Council) were identified as having known or traditional territory in the Project area which may be impacted by the Project. • Enbridge's consultation and engagement program included contact with Aboriginal groups in proximity to the Project. Details are provided in the "Aboriginal Matters" chapter of the Project Application. A review of applicable mapping and correspondence with the Ministry of Aboriginal Affairs and Aboriginal Affairs and Northern Development Canada revealed no First Nation reserves or Métis communities located in the LSA. In addition to the four communities listed as having known asserted traditional territory listed above, the closest Aboriginal groups are Grand River Community Métis Council, Hamilton-Wentworth Métis Council, Niagara Region Métis Council, and Windsor-Essex Métis Council. • Any concerns raised during Aboriginal engagement activities to date have been incorporated into Section 6.0. Refer to the "Aboriginal Matters" chapter of the Project Application for full details regarding Aboriginal engagement.
Social and Cultural Well-Being	• The Province of Ontario experienced a population increase of approximately 5.7% between 2006 (12,160,282 people) and 2011 (12,851,821 people). The median age of the population is 40.9 years old with 83.5% of individuals aged 15 and over (Statistics Canada 2012a). • In 2011, Hamilton had a total population of 519,949 people, which is a 3.1% increase compared to 504, 559 people in 2006. The median age of the population is 40.9 years old and 83.5% of the population is 15 years or older. Of the total population, the portion identifying as Aboriginal included 10,320 individuals. Hamilton had a total labour force of 424,055 individuals including 205, 210 males and 218,840 females (Statistics Canada 2012a). • According to the Mississaugas of the New Credit First Nation, as of 2015, the registered on-reserve population is 931 individuals, the population on other reserves is 40 individuals, and the off-reserve population is 1,352 individuals, for a total population of 2,324 individuals. The linguistic affiliation is Algonquin (Ojibway) with 99% fluent in English (Mississaugas of the New Credit First Nation 2015). • According to the Six Nations of the Grand River First Nation, the on-reserve population increased from 4,907 individuals in 1972 to 25,660 individuals in 2013. The off-reserve population has increased from 4,148 individuals in 1972 to 13,389 individuals in 2013. The 50-year on-reserve population growth rate for the Six Nations of the Grand River First Nation is 41,563 individuals (Six Nations of the Grand River 2015).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Social and Cultural Well-Being (cont'd)	• There are no publically available data or statistics for the Métis Nation of Ontario and Haudenosaune Development Institute. • Construction of the replacement pipeline will involve a peak workforce of approximately 300 workers. It is anticipated that Project activities at the Westover Terminal and Nanticoke Junction Facility will use an average workforce of 10 to 20 individuals. Decommissioning of the existing Line 10 pipeline will involve approximately 30 to 50 workers. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, teamsters, mechanics, foremen, surveyors, inspectors, and field office support personnel. No new permanent jobs will result from the Project. • The ongoing operation and maintenance of the Project will be sporadic and limited in scope. In addition, such activities will be consistent with other land uses and industrial activities being conducted in the area.
Human Health	• Given the limited scope of the Project and the short duration of Project activities, only nuisance-related health effects such as dust, smoke, and noise are anticipated to be created by the Project. The assessment of these effects is discussed under the air quality and acoustic environment elements, respectively. • During pipeline construction, a temporary increase in airborne emissions and noise levels is anticipated. The Project will not result in an increase in airborne emissions or noise levels during normal operations. The nearest community to the Project is Mount Hope: the existing pipeline to be decommissioned is located within the community while the anticipated replacement pipeline route will deviate around the community (see Section 4.0). • No issues or concerns regarding human health effects have been raised to date.
Infrastructure and Services	• Several existing local and regional linear infrastructure corridors were noted within the LSA and the RSA during desktop and land use surveys, including utility corridors, oil and gas pipeline ROWs, rail lines, an airport, roads, and highways. • Hamilton is located at the western end of Ontario's Golden Horseshoe and provides access to several highways, railways, and the Hamilton Airport. • The Hamilton Airport is located within 1 km of the eastern portion of the route. The Hamilton Airport is a regional passenger and cargo airport serving the greater Hamilton, Niagara, and Burlington areas (John C. Munro Hamilton International Airport 2015). • Highway 403 is the only major highway located in the LSA. There are three smaller highways also identified, including Highway 8, Highway 5 West, and Highway 6. The Project crosses Highway 403 near the middle of the route. Many of the local roads in the area are one lane and paved, however, there are some connecting roads which are unpaved and are consistent with the typical rural area. Hamilton is also serviced by several railways. • Electricity distribution in the LSA is managed by Hydro One. • Hamilton collects and treats both sanitary and combined sewage (wastewater) and currently owns and operates two wastewater treatment plants. Hamilton's wastewater collection system consists of both sanitary sewers and combined sewers (sewers that collect both sanitary sewage and storm runoff into one pipe) (City of Hamilton 2015a). • Hamilton offers all major services including police, fire, hospitals and Emergency Medical Services (EMS), hotels and accommodations, restaurants, and recreational facilities. • The Hamilton Fire Department is responsible for the delivery of fire protection services to Hamilton. The Fire Department has 30 fire stations across the city including 26 emergency response stations with volunteer or full-time firefighters. The closest fire stations to the LSA include Fire Station #27 (Old Highway 8 and Valens Road), Fire Station #26 (Lynden Road and Governor's Road), Fire Station #21 (Wilson Street and Highway 403), and Fire Station #19 (Homestead Drive and White Church Road). The fire stations are equipped with a variety of equipment and vehicles including pump, support, tanker, rescue, engine, ladder, and brush trucks (City of Hamilton 2015a).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Infrastructure and Services (cont'd)	• Hamilton EMS receives approximately 61,000 calls per year for paramedic service, and in over 41,000 of those cases, the patient is taken to the hospital. The paramedics are dispatched by the Central Ambulance Communications Centre (City of Hamilton 2015a). • Hamilton Health Sciences includes several hospitals and a cancer centre serving residents of Hamilton and Central South and Central West Ontario. Facilities located in the RSA offer a range of acute and specialized services. Hamilton Health Sciences is considered to have one of the most comprehensive health care systems in Canada (City of Hamilton 2015a). • The Hamilton Police Department services the Project LSA. Most of the LSA is located in Division Three, which is headquartered at 400 Rymal Road East between Upper Wentworth and Upper Wellington (Hamilton Police 2015). • Hamilton offers a wide range of hospitality services including hotels, motels, campgrounds, and bed and breakfast venues, which are expected to have adequate capacity for transient workers. • Hamilton manages many recreational facilities including pools, community centres, and arenas, in addition to an extensive network of parks and trails (City of Hamilton 2015a).
Navigation and Navigation Safety	• Transport Canada and the NEB are responsible for the administration of the *Navigation Protection Act*. Navigable waters may be affected by Project components such as temporary and permanent bridges, and generally include canals, lakes, and watercourses. • A review of the navigable waters listed by the *Navigation Protection Act* was completed and no navigable waterways were identified within the LSA. However, based on a desktop review and field reconnaissance regarding the replacement pipeline, the main branch of West Spencer Creek has attributes (e.g., deep wet depth and wide wet width) that could make it suitable for recreational navigation. There is also a possibility that recreational boats could access West Spencer Creek through one of its tributaries during peak runoff seasons.
Employment and Economy	• The Hamilton Economic Development Strategy spans from 2010 until 2015. The primary goals are to develop infrastructure that: encourages innovation; ensures housing; education and health services promote a high quality of life; and develops skills within existing sectors to allow for the retention of key businesses within the economy (Hamilton Economic Development 2013). Through local hiring initiatives, the Project aligns with the retention of key businesses' initiative outlined in the development strategy. • According to Statistics Canada, the median after-tax income in 2010 for all economic families (two or more persons who live in the same dwelling) in Hamilton was $76,937. A total of 92,385 individuals over the age of 15 years old living in Hamilton have no certificate, diploma, or degree, 115,720 individuals have a high school diploma, and 215,945 individuals have a post-secondary certificate or diploma/degree (Statistics Canada 2012b). • In 2014, Hamilton had a labour participation rate of 64% (compared with 62.8% in 2011) and an unemployment rate of 5.8% (compared with 8.7% in 2011). Of the total population aged 15 years and over by labour force status, approximately 407,000 individuals identified themselves as an employee (Statistics Canada 2015). • The top three occupations in Hamilton in 2011 were sales and service occupations, business, finance and administration, and trades, transport and equipment operators. The top three industries that residents of Hamilton were employed in over the same timeframe included health care and social assistance, manufacturing, and retail trade (Statistics Canada 2012b). • Top employers in Hamilton included the Hamilton Health Sciences Corporation, McMaster University, the City of Hamilton, Hamilton-Wentworth District School Board, and ArcelorMittal Dofasco Incorporated (Hamilton Economic Development 2013). • Data collected during the 2011 National Household Survey at the New Credit 40A Indian Reserve indicate a low response rate, however, citizens reported a labour participation rate of 57.9% and an unemployment rate of 18.2%. Of the total population aged 15 years and over by labour force status (a total of 95 individuals reported), 50 identified themselves as an employee (Statistics Canada 2012b).

Table 5.1-1. Summary of Environmental and Socio-Economic Settings

Environmental and Socio-Economic Element	Summary of Consideration
Employment and Economy (cont'd)	• Data for the Six Nation Indian Reserve No. 40 has been suppressed for data quality or confidentiality reasons (Statistics Canada 2012b). There are no publically available data or statistics for the Métis Nation of Ontario and Haudenosaune Development Institute. • Direct government revenues expected to be generated by the Project include fees for agency permits, and any taxes associated with the pipeline easements. Given the scope of the Project, a detailed economic analysis was not deemed warranted for the Project. • Construction of the Line 10 replacement pipeline will involve a workforce of approximately 300 workers with a peak workforce of approximately 250 workers. Decommissioning of the existing Line 10 pipeline will involve up to 30 to 50 workers. It is anticipated that Project activities at the Westover Terminal and Nanticoke Junction Facility will use an average workforce of 10 to 20 individuals. The skills of the anticipated workforce will include heavy equipment operators, welders, labourers, teamsters, mechanics, foremen, surveyors, inspectors, and field office support personnel. • There are no new permanent jobs that will result from the Project. • Enbridge will encourage their Contractors to hire locally and to hire qualified Aboriginal workers where existing contracts permit.

Plate 1 Existing Line 10 ROW south of Governors Road, facing north. Photograph taken on August 6, 2013.

Plate 2 Existing Line 10 ROW north of Concession 4 W at treed riparian zone, facing north. Photograph taken on June 18, 2013.

Plate 3 Naturalized coniferous plantation west of existing Line 10 ROW, south of Governors Road. Photograph taken on August 6, 2013, facing west.

Plate 4 Butternut tree observed adjacent to the Trans-Canada Trail, south of the existing Line 10 ROW. Photograph taken on August 31, 2015.

Plate 5 West Spencer Creek watercourse crossing (Site 6), looking downstream. Photograph taken on August 27, 2015.

Plate 6 West Spencer Creek watercourse crossing (Site 6), looking downstream. Photograph taken on July 22, 2013.

Plate 7 Wetland complex south of Governors Road, facing east. Photograph taken on August 6, 2013.

Plate 8 Silver Maple Mineral Deciduous Swamp west of Westover Terminal, facing west. Photograph taken on June 17, 2013.

Plate 9 Song sparrow in Fresh Moist Mixed Meadow Community near Hydro Line west of Trinity Road South. Photograph taken on July 3, 2013.

Plate 10 Northern leopard frog observed in a wetland along the existing Line 10 ROW. Photograph taken on July 9, 2013.

Plate 11 Watercourse crossing south of Governors Road, facing south. Photograph taken August 6, 2013.

Plate 12 Dry Fresh Mixed Meadow in Southern Pines Golf and Country Club, facing east. Photograph taken on July 9, 2013.

6.0 Environmental and Socio-Economic Effects Assessment

The description of the environmental and socio-economic setting, and current state of the environment within the Project area (Section 5.0), is compared in this section of the ESA against the Project Description (Section 2.0) to assess potential environmental and socio-economic effects that might be caused by the Project. The environmental and socio-economic effects assessment uses the information provided in the environmental and socio-economic setting and Project Description to:

- evaluate the environmental and socio-economic elements of importance in the Project area;
- identify the potential effects of the environment on the Project;
- develop appropriate technically and economically feasible site-specific mitigation measures; and
- identify and evaluate potential Project effects associated with each environmental and socio-economic element of importance.

In addition, the environmental and socio-economic effects assessment has determined the significance of potential residual effects resulting from construction and operation activities after taking into consideration proposed mitigation

6.1 Methodology

The assessment evaluated the environmental and socio-economic effects of construction, operations and final decommissioning or abandonment phases of the Project for all Project components (see Section 2.0) in an integrated manner. The assessment also evaluated the decommissioning of the existing Line 10 (Section 6.5). The assessment method applies the following process.

1. Identify the environmental and socio-economic elements.
2. Determine the spatial and temporal boundaries for the assessment.
3. Describe the environmental and socio-economic setting.
4. Identify the potential environmental and socio-economic effects.
5. Develop appropriate technically and economically feasible site-specific mitigation and, where warranted, enhancement measures.
6. Identify anticipated potential residual effects and cumulative effects.
7. Determine the significance of potential residual effects and the Project's contribution to cumulative effects.

This environmental and socio-economic effects assessment methodology has been developed based on:

- the CEA *Act Responsible Authority's Guide Part II*: *The Practitioner's Guide* (CEA Agency 1994);
- *A Reference Guide for the CEA Act: Addressing Cumulative Environmental Effects* (Federal Environmental Assessment Review Office [FEARO] 1994a);
- *A Reference Guide for the CEA Act: Determining Whether a Project is Likely to Cause Significant Environmental Effects* (FEARO 1994b);
- the *CEA Agency Cumulative Effects Assessment Practitioners Guide* (Hegmann et al. 1999);

- *Operational Policy Statement: Assessing Cumulative Environmental Effects under the CEA Act, 2012* (CEA Agency 2015b); and
- the NEB *Filing Manual* (NEB 2015a).

6.1.1 Environmental and Socio-Economic Elements

Guide A.2.6.1 of the NEB *Filing Manual* assumes that the identification of potential environmental and socio-economic effects reflects a valued component based approach where the valued components could be the broad elements or a subset of those elements, as described in:

- Table A-1 Circumstances and Interactions Requiring Detailed Biophysical and Socio-economic Information;
- Table A-2 Filing Requirements for Biophysical Elements; and
- Table A-3 Filing Requirements for Socio-economic Elements.

Given the scope of the Project, the identification of the potential environmental and socio-economic effects generally focuses on the broad environmental (i.e., biophysical) and socio-economic elements as the valued components.

6.1.1.1 Identification of Environmental and Socio-Economic Elements

The potential environmental (i.e., biophysical) and socio-economic effects resulting from the Project were identified through:

- engagement with landowners, Aboriginal groups, residential communities and municipalities near facilities and along the pipeline ROW, the general public, government and regulatory agencies;
- experience gained during previous pipeline projects, including those with similar conditions/potential issues; and
- the professional judgement of the assessment team.

The potential environmental and socio-economic effects arising from the construction and operation of the replacement pipeline and associated facilities are identified in Sections 6.2 and 6.3, respectively. Section 6.4 outlines the potential effects associated with temporary facilities.

The potential environmental and socio-economic effects arising from decommissioning of the existing Line 10 are identified in Sections 6.5 and those arising from the final decommissioning of the replacement pipeline are identified in Section 6.6.

Environmental and socio-economic elements potentially interacting with the replacement pipeline are summarized in Table 6.2-1, and include:

- physical elements, such as soil and soil productivity, water quality and quantity, air emissions, GHG emissions and the acoustic environment;
- biological elements such as fish and fish habitat, wetlands, vegetation, wildlife and wildlife habitat, and species at risk; and
- socio-economic elements such as human occupancy and resource use (HORU), heritage resources, TLRU, social and cultural well-being, human health, infrastructure and services, navigation and navigation safety, and employment and economy.

Effects arising from potential accidents and malfunctions, and changes to the Project caused by the environment were considered for all Project components (Section 6.7).

Those environmental and socio-economic elements which are not considered to interact with the Project are identified and justified in Sections 6.2, 6.3 and 6.5. In accordance with Guide A.2.6 of the NEB *Filing Manual*, no further analysis is necessary for those elements where interactions between the Project component and an environmental or socio-economic element are not predicted.

6.1.2 Assessment Boundaries

The ESA considered the potential effects of the Project on the environmental and socio-economic conditions within defined spatial and temporal boundaries (Section 1.5). These boundaries will vary with the issues and biophysical or socio-economic elements or interactions to be considered, and will reflect:

- the biophysical and socio-economic baseline setting within the spatial boundaries of the Project;
- the construction, operations and decommissioning and abandonment phases of the proposed physical works and physical activities;
- the time required for an effect to become evident;
- the time required for an element to recover from an effect and return to a pre-effect condition;
- the area directly affected by proposed physical works and physical activities; and
- the area in which an element functions and within which a Project effect may be felt.

6.1.2.1 Spatial Boundaries

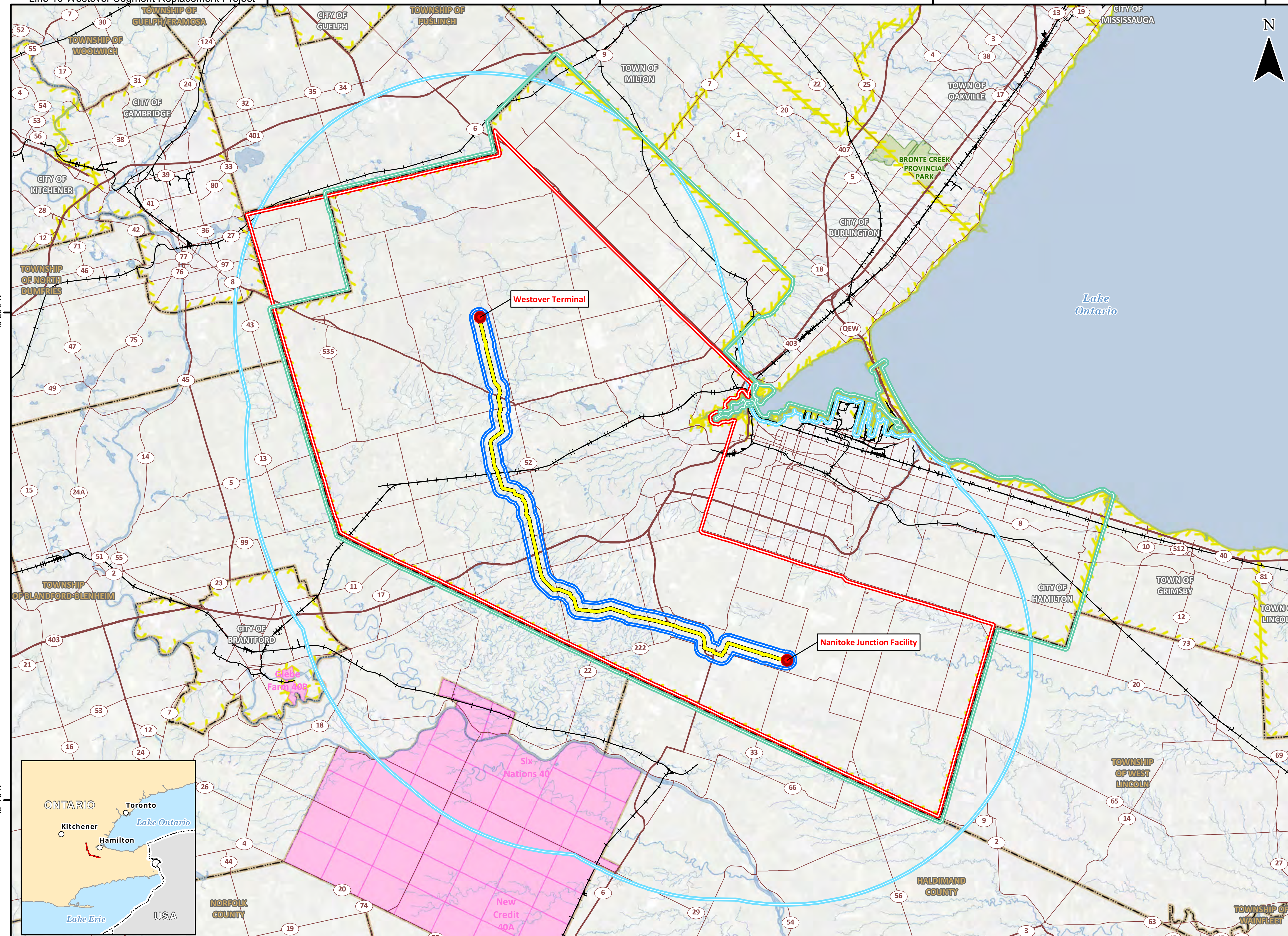
Spatial boundaries were determined by the distribution, movement patterns or potential zones of interaction between the element and the Project. The spatial boundaries used in the environmental and socio-economic effects assessment considered one or more of the following areas: Footprint Study Area (Footprint), Local Study Area (LSA), Regional Study Area (RSA), as well as a Provincial, National and International area. All spatial boundaries associated with the effects assessment are described in Table 6.1.7-1.

The spatial boundary used to assess the potential effects may be limited to the Project Footprint or may extend beyond the physical boundaries of the Project Footprint, since the interaction of the Project with an element can be local, regional, provincial, national or international in extent.

The Project Footprint is consistent for all elements assessed. The Footprint assumes certain quantitative values for the area that will be directly disturbed by Project facilities and activities along the route, including a 33 m wide pipeline construction ROW (including permanent easement and temporary workspace), stockpile sites and permanent facilities (see Section 2.0 for a detailed description of Project components and breakdown of the Project Footprint).

6.1.2.2 Temporal Boundaries

The time frames used in the assessment of the Project included the construction, operations, as well as decommissioning or abandonment phases of the replacement pipeline (Table 6.1.7-1). A list of construction activities and the construction schedule for the Project is provided in Section 2.0. The operations phase was considered to commence in Q1 2018 following the completion of construction and extend for a term estimated to exceed 50 years.



ENBRIDGE

November 2015

FIGURE 6.1 - 1

EFFECTS ASSESSMENT SPATIAL BOUNDARIES

ENBRIDGE PIPELINES INC. PROPOSED LINE 10 WESTOVER SEGMENT REPLACEMENT PIPELINE PROJECT

664756

- Facility
- Line 10 Replacement Pipeline
- Highway
- Road
- Railway
- Watercourse
- Waterbody
- City/Town/Village
- Indian Reserve/Métis Settlement
- Park/Protected Area
- Rural Municipality
- Project RSA
- Project LSA
- RSA - Aquatics
- LSA - Socio-Economic Elements

SCALE: 1:5,000,000

0 2 4 6 8 km

(All Locations Approximate)

ch2m

Projection: NAD83 UTM Zone 17N
Imagery: Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community 2015; Roads, Indian Reserves, Railways, Hydro, City/Town/Municipal Boundaries: Ontario Ministry of Natural Resources, 2015.

Although there is no reason to believe that there are any errors associated with the data used to generate this product or in the product itself, users of these data are advised that errors in the data may be present.

Mapped By: LA | Checked By: WL

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6.1.3 Integration of Consultation and Engagement

Through its consultation and engagement program, Enbridge works closely with affected stakeholders and Aboriginal groups to identify and address interests and concerns related to the Project. Public feedback about the Project has been and will continue to be collected during the following activities:

- open house events;
- presentations to community groups and municipalities;
- regular newsletters distributed to affected stakeholders;
- monitoring the Project Email Address; and
- monitoring the toll-free telephone line.

Where applicable, feedback has informed the discussion of potential residual effects and cumulative effects in Sections 6.2, 6.5, 6.7 and 7.0. Additional Project-specific consultation and engagement efforts and outcomes are summarized in the "Stakeholder Consultation", "Lands Matters", and "Aboriginal Matters" chapters in Project Application.

6.1.4 Potential and Residual Environmental and Socio-Economic Effects

The potential environmental (i.e., biophysical) and socio-economic effects resulting from the Project were identified through:

- engagement with landowners, Aboriginal groups, residential communities and municipalities near facilities and along the replacement pipeline ROW, the general public, government and regulatory agencies;
- experience gained during previous pipeline projects, including those with similar conditions/potential issues; and
- the professional judgement of the assessment team.

The potential environmental and socio-economic effects arising from construction and operations of the Project are identified throughout Section 6.0 for each component and element assessed. The effects arising from decommissioning of the existing pipeline, potential accidents and malfunctions and changes to the Project caused by the environment are considered in Sections 6.5, 6.7 and 6.8, respectively.

Residual effects are the environmental and socio-economic effects remaining following the implementation of mitigation and enhancement measures, including offsets. In many situations, the recommended mitigation measures will completely mitigate the potential adverse effects, in which case, no residual effect is identified. In other situations, the mitigation measures will lessen the effects, but do not entirely eliminate them. Elements for which no residual effects are predicted require no further analysis (i.e., significance evaluation).

An evaluation of the combined residual effects has been conducted for those elements where more than one identified potential effect may occur at a particular location, where applicable. The evaluation of the combined effects considers only those residual effects that are likely to occur (i.e., of high probability). A discussion of the combined effects has been included in the significance evaluation to provide further understanding of the overall effect of the Project on the element or indicator in question.

6.1.5 Mitigation and Enhancement

Mitigation, as defined under the *CEA Act, 2012*, is considered to be the elimination, reduction or control of a project's adverse environmental effects, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means. This definition also applies to reducing or managing a project's adverse socio-economic effects. For the purposes of this assessment, CH2M defines an enhancement measure as a recommendation that aims to promote the likelihood of potential positive environmental or socio-economic residual effects.

To ensure that potential adverse environmental and socio-economic effects are reduced and potential positive socio-economic effects are enhanced during all phases of the Project, general and site-specific mitigation and enhancement measures have been recommended based upon current industry-accepted standards, Enbridge’s best management practices, consultation/engagement with regulatory authorities, interested groups, individuals and Aboriginal groups, and the professional experience of the assessment team. Additionally, mitigation measures that have been successful during past Enbridge projects (e.g., Enbridge’s Line 4 Expansion Program [L4EP] and Alberta Clipper Expansion Project [ACEP]) have been included throughout the effects assessment, where applicable.

Mitigation and enhancement measures are identified for each element assessed in Sections 6.2 to 6.8. In addition, various requirements and guidelines of federal and provincial regulatory authorities, and industry standards and guidelines have been taken into consideration in this ESA, and the documents are referenced for each applicable element in Sections 6.2 to 6.8, or Appendix 2B.

Following the submission of the Project Application, Enbridge intends on filing a comprehensive Project-specific EPP with the NEB. Mitigation measures provided in the ESA as well as Enbridge’ Environmental Compliance Strategy (Section 6.0 and Section 8.0, respectively) are intended to identify the specific goals for protecting environmental elements and addressing socio-economic elements potentially interacting with the Project. Mitigation measures were generally derived from the measures contained in Enbridge’s Environmental Guidelines for Construction (EGC) and/or Enbridge’s Operation and Maintenance Manual (O&MM), on file with the NEB. The Project-specific EPP will be written in construction specification format for inclusion in construction contract documents, and will include mitigation commitments found in the ESA as well as additional commitments that may occur during ongoing consultation or as a result of the regulatory process. In addition, contingency plans and management plans will be appended to the EPP.

Environmental Inspector(s) and Construction Manager(s) retained by Enbridge as well as environmental staff in local offices will ensure that the mitigation measures within this ESA are understood in the field and properly implemented during construction.

Environmental inspection is further described in Section 9.0. In addition, it is expected that through the ongoing consultation and engagement program, additional issues related to the Project may be identified and further mitigation and enhancement measures may be developed.

Enbridge is committed to implementing the mitigation proposed herein.

6.1.6 Evaluation of Potential Residual Effects

The determination of significance of potential residual effects generally followed the guidelines and principles of the NEB *Filing Manual*, *The CEA Act Responsible Authority's Guide Part II: The Practitioner’s Guide* (CEA Agency 1994), *A Reference Guide for the CEA Act: Addressing Cumulative Environmental Effects* (FEARO 1994a), *A Reference Guide for the CEA Act: Determining Whether a Project is Likely to Cause Significant Environmental Effects* (FEARO 1994b), *and CEA Agency Cumulative Effects Assessment Practitioners Guide* (Hegmann et al. 1999). The agencies identify several possible methods for the determination of whether residual environmental or socio-economic effects are significant. These include:

- the use of regulatory environmental standards, guidelines or objectives in relation to potential residual effects;

- quantitative assessment of the potential residual effects; and
- qualitative assessment of the potential residual effects.

The NEB *Filing Manual* indicates that the quantitative method should be used where possible, otherwise, the qualitative method can be used. Some elements and indicators can be assessed quantitatively using regulatory standards and guidelines. Where there are no standards, guidelines, objectives or other established and accepted thresholds to define quantitative rating criteria or where quantitative thresholds are not appropriate, a qualitative method that is based on available literature is considered to be the appropriate method for determining the significance of most of the identified potential residual effects.

6.1.7 Effect Characterization

Residual effects were characterized according to a set of qualitative criteria based on those identified by Hegmann et al. (1999). These criteria are identified below and their definitions are presented in Table 6.1.7-1. In some cases, the definitions were modified to accommodate element-specific parameters.

- Impact balance (i.e., determination as to whether the residual effect is positive or negative).
- Spatial boundary (i.e., Project Footprint, LSA, RSA, Provincial, National and International).
- Temporal context (i.e., duration, frequency and reversibility of the residual effect).
- Magnitude (i.e., severity of the residual effect).
- Probability or likelihood of occurrence of the residual effect.
- Level of confidence or uncertainty (based on the availability of information to substantiate the assessment conclusion, previous success of mitigation measures and precedent).

Table 6.1.7-1. Characterization of Residual Effects for Evaluation of Significance

Assessment Criteria	Definition
IMPACT BALANCE – of the Residual Effect	
Positive	Residual effect has a net benefit to the environment or socio-economic conditions.
Neutral	Residual effect has no net benefit or loss to the environment or socio-economic conditions.
Negative	Residual effect has a net loss or is a detriment to the environment or socio-economic conditions.
SPATIAL BOUNDARY - Location of the Residual Effect	
Footprint	The Footprint of the area directly disturbed by Project construction, decommissioning and clean-up activities, including associated physical works and activities (i.e., construction ROW, RSV sites, temporary infrastructure and workspace).
LSA	The LSA consists of the Footprint and extends to 500 m on both sides of the centre line. The LSA was defined in order to collect general site-specific baseline data (i.e., between 50 m and 500 m from the centre line) for the prediction of potential effects of the Project that are expected to extend beyond the Footprint. For social elements (e.g., human occupancy and resource use), local potential effects are related to specific communities considered in the socio-economic assessment (e.g., Ancaster, Mount Hope). The communities considered were based on whether there would be direct potential effects, such as a physical, social or economic interaction between the Project and the community or community residents and their economic, social or cultural resources and pursuits (see Figure 6.1-1).

Table 6.1.7-1. Characterization of Residual Effects for Evaluation of Significance

Assessment Criteria	Definition	
RSA	The RSA consists of the area extending beyond the LSA boundary up to 2 km on both sides of the centre line. The RSA was defined to assist with determining more general baseline data collection requirements and for the prediction of the potential direct and indirect effects of the Project. The RSA was the spatial scale for the collection of secondary source baseline data and effects assessment for element where impacts are expected to extend beyond the LSA (e.g., the Project contribution to air emissions). For socio-economic elements, the RSA is extended to the municipal limits of Hamilton (see Figure 6.1-1). The exception to this is the 1 km radius around the Project for Heritage Resources, as directed by MTCS (2011), as well as an Aquatics RSA that extends up to 15 km on both sides of the centre line, up to the boundary of Lake Ontario.	
Provincial	The area that extends beyond regional or administrative boundaries, but is confined to Ontario.	
National	The area extending beyond Ontario, but is confined to Canada.	
International	The area extending beyond Canada.	
TEMPORAL CONTEXT – of the Residual Effect		
Duration – (period of the potential residual effect)	Immediate	Residual effect is limited to 2 days or less.
	Short-term	Residual effect is limited to the construction phase or any 1 year during the life of the Project.
	Medium-term	Residual effect extends into the operations phase for up to 10 years.
	Long-term	Residual effect extends into the operations phase for more than 10 years, but ceases during the operational life of the Project or upon decommissioning or abandonment.
	Extended-term	Residual effect extends beyond the operational life of the Project.
Frequency (how often the potential residual effect would occur)	Rare	Residual effect occurs uncommonly or unpredictably (e.g., as a result of an accident or malfunction) over the assessment period.
	Isolated	Residual effect is confined to specified phase of the assessment period.
	Occasional	Residual effect occurs intermittently and sporadically over the assessment period.
	Periodic	Residual effect occurs intermittently but repeatedly over the assessment period.
	Continuous	Residual effect occurs throughout the assessment period.
Reversibility	Reversible	Residual effect is reversible to pre-construction or equivalent conditions.
	Irreversible	Residual effect is permanent.
MAGNITUDE - of the Residual Environmental Effect		
Negligible	Residual effects are not detectable.	
Low	Residual effects are detectable, but well within environmental or regulatory standards.	
Medium	Residual effects are detectable and may approach, but are still within the environmental or regulatory standards.	
High	Residual effects are beyond environmental or regulatory standards.	
MAGNITUDE - of the Residual Socio-economic Effect		
Negligible	No detectable change from existing (baseline) conditions.	
Low	Change is detectable, but has no effect on the socio-economic environment beyond that of an inconvenience or nuisance value.	

Table 6.1.7-1. Characterization of Residual Effects for Evaluation of Significance

Assessment Criteria	Definition
Medium	Change is detectable and results in moderate modification in the socio-economic environment.
High	Change is detectable and is large enough to result in a severe modification in the socio-economic environment.
PROBABILITY OF OCCURRENCE - Likelihood of Residual Effect	
High	Likely
Low	Unlikely
LEVEL OF CONFIDENCE - Degree of Certainty Related to Significance Evaluation	
Low	Determination of significance is based on an incomplete understanding of cause-effect relationships and incomplete information pertinent to the Project area.
Moderate	Determination of significance is based on a good understanding of cause-effect relationships using information from outside the Project area or incompletely understood cause-effect relationships using information pertinent to the Project area.
High	Determination of significance is based on a good understanding of cause-effect relationships and information pertinent to the Project area.

The characterization of residual effects using the criteria ratings defined in Table 6.7.1-1 took into consideration ecological and regulatory context. Context is informed by the setting information provided in Section 5.0, as well as regulatory policy, guidelines, standards, thresholds or targets and levels of existing disturbance. Context provides an indication of the resilience of the receiving environment to effects and is summarized in Section 6.0 for each applicable residual effect. Context is particularly influential in the determination of magnitude ratings. For elements where quantitative thresholds or targets are available, the magnitude rating is determined by or strongly influenced by the Project's effect relative to the threshold or target.

For many of the elements and construction, operations, decommissioning or abandonment issues under evaluation, there are no environmental standards, guidelines, thresholds, targets or objectives. Therefore, the determination of magnitude of the residual effects often entailed consideration of previous assessments of magnitude made by regulatory authorities. The assessment team was also aware of the increasingly stringent societal norms related to environmental effects.

6.1.8 Significance Determination

A determination of significance was completed for all identified potential residual effects. All assessment criteria were considered by the assessment team for each potential residual effect when determining the significance of the potential residual effect. Qualitative significance determinations incorporate professional judgment, which allows for the integration of all effects criteria ratings to provide relevant significance conclusions that are sensitive to context and facilitate decision-making (Lawrence 2007). The extent to which the professional experience of the assessment team was used in the evaluation of significance of potential residual effects is described for each element and is reflected in the confidence criteria ratings. The assessment team consisted of discipline experts, experienced assessment practitioners, and senior reviewers.

For environmental elements, the most influential criteria are probability, duration, reversibility, and magnitude. For environmental elements, a potential residual effect is considered significant if the effect has a high probability of occurrence and is predicted to be:

- irreversible and of high magnitude; or
- long to extended-term duration, reversible and high magnitude.

For socio-economic elements, a potential residual effect is considered significant if the effect has a high probability of occurrence, and is predicted to be:

- of high magnitude, short to medium-term duration, reversible and regional, provincial or national in extent; or
- of high magnitude, long to extended-term duration, reversible within any spatial boundary; or
- of high magnitude and irreversible, within any spatial boundary.

6.2 Effects Assessment – Pipeline Construction and Operation

Using the assessment methodology described in Section 6.1, the following subsections evaluate the potential environmental and socio-economic effects associated with construction and operations of the replacement pipeline component of the Project.

Environmental and socio-economic elements potentially interacting with construction and operations of the replacement pipeline are identified in Table 6.2-1.

Table 6.2-1. Element Interaction with the Project

Element	Interaction with Project Phase	
	Construction[1,2]	**Operations[3]**
Physical and Meteorological Environment	No – since the replacement pipeline is located on relatively level, stable terrain, no interaction with physical and meteorological environment is anticipated during pipeline construction or operations.	
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	Yes
GHG Emissions	Yes	Yes
Acoustic Environment	Yes	Yes
Fish and Fish Habitat	Yes	Yes
Wetlands	Yes	Yes
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes
Species At Risk	Yes	Yes
Human Occupancy and Resource Use	Yes	Yes
Heritage Resources	Yes	No – since a Stage 2 archaeological field assessment is planned along the replacement pipeline route prior to construction activities to confirm the presence or absence of surface or buried heritage resources sites.

Table 6.2-1. Element Interaction with the Project

Element	Interaction with Project Phase	
	Construction[1,2]	Operations[3]
TLRU	Yes	Yes
Social and Cultural Well-Being	Yes	Yes
Human Health	Yes	Yes
Infrastructure and Services	Yes	No - since maintenance activities typically entail a comparatively small workforce using the services of local communities over a short period, no interaction is anticipated during operation.
Navigation and Navigation Safety	Yes	No - since waterways deemed navigable will generally not be affected during the operations phase since the pipeline will be buried under the watercourse and the usage of new permanent vehicle crossings at navigable watercourses is not anticipated.
Employment and Economy	Yes	Yes

Notes:

1 Activities during pipeline construction include engineering, construction surveys, clearing, disposal, topsoil/strippings handling, grading, stringing and welding, trenching, lowering-in, backfilling, testing, clean-up and reclamation as well as watercourse crossings (see Section 2.4).

2 Activities for temporary infrastructure construction include engineering, site preparation, facility construction, access, facility dismantle and reclamation (see Section 2.6).

3 Activities during operations include periodic site visits, transportation of maintenance crews to facility or site, vegetation/weed management, aerial patrols and preventative maintenance digs.

In accordance with Guide A.2.6 of the NEB *Filing Manual*, no further analysis is necessary for those elements where interactions between the Project component and the element are not predicted (e.g., physical and meteorological environment).

The potential environmental and socio-economic effects associated with construction and operations of the replacement pipeline, as well as the recommended mitigation measures (including enhancement measures) and resulting potential residual effects are presented in the following subsections for each environmental and socio-economic element. The potential environmental and socio-economic effects associated with the construction and operation of the replacement pipeline for accidents and malfunctions are presented in Section 6.7. In addition, an evaluation of significance using the criteria presented in Table 6.1.7-1 for the potential residual effects associated with the applicable environmental and socio-economic elements is also provided.

A key consideration in the assessment of the potential effects arising from operations of the replacement pipeline as well as the potential effects related to accidents and malfunctions during the operations phase, is that the purpose of the Project is to replace and then decommission the existing Line 10 pipeline. Consequently, the potential effects related to operations and maintenance activities as well as accidents and malfunctions during the operations phase of the replacement pipeline will not result in a net increase in those effects since the decommissioning of the Line 10 pipeline will reduce the need for the presently ongoing operations and maintenance of the existing Line 10 pipeline. Maintenance activities required for the replacement pipeline are expected to be much less than the current maintenance activities required for the existing Line 10. In some cases, due to the relatively high intensity of the maintenance activities (i.e., preventative maintenance digs), the overall effects arising from the replacement pipeline will be less than is presently experienced along the existing Line 10 pipeline.

6.2.1 Physical and Meteorological Environment

6.2.1.1 Context

The Project generally encounters plateaus gently sloping southwest from the Niagara Escarpment with young forming extensive undulating till plains. Topography along the replacement pipeline route is generally level and the replacement pipeline does not encounter any steep slopes.

Given the setting of the replacement pipeline and the absence of steep slopes, no potential effects on the physical and meteorological environment have been identified. For a discussion of the changes to the Project caused by the environment, including the effects of the meteorological environment, refer to Section 6.8.

No further evaluation of effects of the replacement pipeline on the physical and meteorological environment is warranted.

6.2.2 Soil and Soil Productivity

6.2.2.1 Context

A variety of surficial deposits occur along the replacement pipeline route with sandy loam, silt loam and silty clay loam being the dominant surficial deposits. The medium and fine sandy loam has a gently to moderately sloping topography which allows the soils to drain well. The silt loam soils are well-drained with a gentle to moderately sloping topography. The silty clay loam is fairly undeveloped and found in level areas of valley land. The dominant soil series along the replacement pipeline are Grimsby sandy loam, Brantford silt loam and Alberton silt loam or silty clay loam.

6.2.2.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with construction and operations of the replacement pipeline on soil and soil productivity were identified by the assessment team, based on past experience along the Enbridge mainline corridor, information collected as part of PCEM programs along existing Enbridge pipeline systems (e.g., L4EP and ACEP), relevant land use plans and from consultation with stakeholders including municipalities (e.g., representative from the City of Hamilton), Aboriginal groups and landowners along the replacement pipeline route.

Landowners along the replacement pipeline raised concerns about soil drainage since some portions of the land are systematically tiled. No further concerns have been raised to date. Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of mitigation measures provided in Table 6.2.2-1 were principally developed in accordance with industry and provincial regulatory guidelines.

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1. Lowering of Soil Productivity			
1.1 Lowering of topsoil productivity during topsoil salvaging	• Footprint • Entire route	Topsoil Depth • Salvage topsoil, to the extent feasible, to the plow layer, to the colour change or to approximately 10 cm, whichever is greatest, at locations where there is little to no topsoil on hay and cultivated lands. • Salvage all available root zone material, to the extent feasible, to the colour change or to approximately 10 cm, whichever is greatest, at locations where there is little to no topsoil on tame pasture, hay pasture, shrub pasture, treed pasture or treed lands. • Locations with deep topsoils (over 25 cm) will be identified on the Environmental Alignment Sheets upon completion of soil surveys (see Section 10.0 of the ESA). Extra temporary workspace may be needed for topsoil storage for construction during non-frozen soil conditions. Salvage to full depth, where practical. Topsoil Salvage (General) • Salvage topsoil from all areas, to the extent feasible. Avoid overstripping. The area salvaged is to correspond with the area to be graded. Store topsoil salvaged prior to grading along the work side, taking into consideration space requirements for grade and trench spoil, existing nearby hotlines, local topography, cross ROW access requirements and drainage. • At locations where topsoil salvage is conducted to accommodate grading requirements, differentiate the soil piles from the graded materials as deemed necessary by field personnel to reduce the risk of confusion at the time of replacement, if warranted. • Salvage topsoil, to the extent feasible, from the entire construction ROW area (full width) on all land uses during non-frozen. Exceptions where the topsoil salvage width is to be reduced include, however, are not limited to: rare plant sites or where requested in the Line List.	• Mixing of topsoil and subsoil

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.1 Lowering of topsoil productivity during topsoil salvaging (cont'd)	See above	• Keep spoil pile separate from the topsoil pile to limit potential for admixing. Maintain adequate separation between topsoil piles and spoil piles to prevent admixing. Alternatively, install a physical barrier (e.g., landowner approved straw, coloured tackifier, geotextile buffer). Topsoil Salvage (Non-Frozen) • Disc well-sodded lands, or use similar methods, in areas to be salvaged, prior to topsoil salvage in order to facilitate topsoil salvaging activities as per the direction of the Environmental Inspector, or Enbridge designate. • Salvage topsoil from the full construction ROW during non-frozen soil conditions where possible, in the event that localized weed infestations are encountered. Separate the spoil pile containing noxious weeds where feasible, as will be identified in EPP[1] and in the Environmental Alignment Sheet Package, to prevent mixing with the surrounding soil during regrading and final clean-up. Store or mark topsoil salvaged from the affected area separately. • Reduce topsoil salvage widths at all wetlands containing surface water and/or saturated soils to the width of the trench area, where possible. Consult with the Environmental Inspector or Enbridge designate to identify the boundaries and appropriate salvage widths in the field at the time of construction. For wet wetlands, store wetland topsoil and spoil separately from upland topsoil and spoil and mark/flag appropriately. Topsoil Salvage (Frozen) • Salvage entire ROW (e.g., permanent easement and temporary workspace) either by mulching or another acceptable method, if the ROW needs to be stripped in frozen conditions. • Frozen topsoil will also be salvaged across the ROW, if required, to limit thawing condition potential impacts. • All topsoil salvage operations are to be completed prior to freeze, to the extent feasible, up unless otherwise directed by the Construction Manager, Environmental Inspector or Enbridge designate. Follow measures for non-frozen topsoil salvage.	See above

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.1 Lowering of topsoil productivity during topsoil salvaging (cont'd)	See above	• Limit topsoil salvaging activities to specialized equipment capable of accurately separating variable depths of topsoil from subsoil (e.g., frozen topsoil cutter, topsoil mulcher or equivalent). Cut frozen topsoil to the same depth as the salvage requirements at select areas where topsoil was not salvaged during non-frozen conditions, or if specialized equipment is not available. Note that multiple shallow passes with a topsoil cutter are preferred in order to avoid topsoil/subsoil mixing that commonly occurs when attempting to cut the full salvage depth. • Maintain snow cover over the area to be salvaged as long as practical. Remove snow immediately prior to topsoil salvage and windrow snow to the edges of the construction ROW. • Limit removal of snow from the spoil side during topsoil salvage. Remove excess snow that could interfere with backfilling operations. An approximate 8-10 cm layer of snow may be left in place to avoid topsoil/subsoil mixing during backfilling. • Do not over cut frozen topsoil in order to prevent overstripping and soil admixing. Topsoil Replacement • Replace topsoil as evenly as feasible over areas of the construction right of way where topsoil salvage was conducted. • Postpone replacing topsoil during wet weather (refer to Wet/Thawed Soils Contingency Plan) or high winds to prevent damaging soil structure or erosion of topsoil.	See above
1.2 Lowering of topsoil productivity through trench instability during trenching	• Footprint Pipeline ROW	• Salvage entire ROW (e.g., permanent easement and temporary workspace). Refer to the Criteria for Alternate Topsoil Salvage Width (to be included in the EPP[1]) where the trench may be prone to sloughing or the trench walls may be sloped in order to prevent topsoil from sloughing into the trench. • Weld up pipe prior to trenching at locations with soils prone to sloughing in order to reduce the time the trench is left open.	• Minor amount of topsoil/subsoil mixing due to trench instability

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.2 Lowering of topsoil productivity through trench instability during trenching (cont'd)	See above	• Limit the length of open trench and reduce the time the trench will be left open to lessen the amount of trench sloughing and interference with wildlife, landowners and livestock. The length of open trench may vary based on an evaluation of the stability of the trench, weather forecast (i.e., likelihood of precipitation), safety issues, and potential for disruption of land use and risk to wildlife/livestock.	See above
1.3 Degradation of soil structure and lowering of soil productivity through compaction and rutting	• Footprint • Entire route	• Implement the Wet/Thawed Soil Contingency Measures provided in the EPP[1] during wet/thawed conditions. • Postpone construction, suspend equipment travel or utilize construction alternatives in the event of wet/thawed soils in order to reduce terrain disturbance and soil structure damage. • Initiate contingency measures outlined in the Wet/Thawed Soil Contingency Plan that will be appended to the EPP[1] once one of the following indicators occurs: rutting of topsoil to the extent that admixing may occur; excessive wheelslip; excessive build-up of mud on tires and cleats; formation of puddles; or tracking of mud as vehicles leave the construction ROW. • Decompact compacted subsoils on the construction ROW and temporary access trails, as well as soils damaged during wet weather to a target depth of 30 cm, prior to topsoil replacement. If soils are wet, postpone decompaction until soils dry to ensure that compaction alleviation measures are effective. • Employ equipment to breakup lumps and smooth the surface of subsoil (e.g., cultivator, discs), if warranted. Limit discing to that necessary to breakup lumps in order to prevent further compaction or pulverization of the subsoils. • Cultivate the construction ROW where it crosses cultivated fields, hay or tame pasture to a depth adequate to alleviate surface compaction if warranted and as per the Line List. Do not cultivate into the subsoil. • Postpone replacing topsoil during wet weather to prevent damage to soil structure.	• Minor amount of topsoil/subsoil mixing during subsoil plowing or ripping to relieve compaction • Minor amount of topsoil/subsoil mixing due to rutting

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

	Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0	Loss of topsoil through wind erosion	• Footprint • Entire route	• Suspend topsoil handling during high wind conditions. • Postpone replacing topsoil during high winds to prevent damaging soil structure or erosion of topsoil. Implement the Soil Erosion Contingency Measures when wind erosion of the topsoil windrow is a concern. • Refer Tackification Measures in the Adverse Weather Contingency Plan for general soil erosion control measures. • Monitor soil windrows/piles for erosion until the soil windrows are replaced. Direct the Contractor to initiate erosion control (e.g., watering down, tackifier application) if warranted.	• Minor surface erosion of topsoil can be expected until a vegetative cover has been established
3.0	Loss of topsoil through surface water erosion	• Footprint • Entire route	• Limit grubbing to areas where soil removal is necessary (e.g., trench line, areas to be graded). • Avoid or reduce grading within 10 m of watercourses, wetlands, and natural drainage channels, where practical. Reduce the width of grading in order to limit the potential for erosion and subsoil compaction. • Crown the trench with remaining spoil to allow for settlement. • Leave breaks in the trench crown at obvious drainages and wherever seepage occurs to avoid or reduce interference with natural drainage. Leave breaks in the crown at frequent intervals where sidehill is encountered. Compact backfill where breaks have been left. • Feather out excess spoil over the salvaged portion of the construction right of way to avoid the creation of a permanent mound. Ensure that excess spoil is not feathered out over the salvaged area to an extent that may cause excessive subsidence of the trench. • Recontour the construction ROW and restore the pre-construction grades and drainage channels. Where restoration of the pre-construction grade is not feasible due to the risk of the failure of fill on slopes, recontour to grades as directed by Enbridge. Typical diversion berm spacing is indicated in the EGC.	• Minor surface erosion of topsoil can be expected until a vegetative cover has been established

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Loss of topsoil through surface water erosion (cont'd)	See above	• Implement the Soil Erosion Contingency Measures (to be appended to the EPP[1]) when wind or water erosion of the topsoil is a concern. Measures may include the seeding of a cover crop until vegetation has re-established.	See above
4.0 Increased stoniness in surface horizons	• Footprint • Entire route	• Limit the topsoil salvage width to reduce the potential for bringing stones to the surface in stony and rocky terrain. • Pick rocks after backfilling and after grade restoration (refer to Soil Handling Contingency Measures). • Remove stones (i.e., stones larger than approximately 10 cm in diameter) from disturbed subsoil to achieve equivalence with the surrounding off ROW subsoil. • Efforts will cease when the size and density of rocks on the ROW are similar to adjacent undisturbed areas.	• Stone picking may result in disposal issues
5.0 Pulverization of soil and sod	• Footprint • Entire route	• Minimize traffic on the construction ROW. • Limit cultivation in areas of fine-textured soils to prevent soil pulverization. • Implement the Soil/Sod Pulverization Contingency Measures in the event that pulverization is identified.	• Pulverization resulting in fugitive dust and loss of soil structure can be expected during dry conditions • Pulverization of soil due to rutting may result in minor topsoil/subsoil mixing
6.0 Disturbance of previously contaminated soil	• Footprint • Entire route	• Consider soils contaminated if free product is present, the soil is a notably different colour than the surrounding soil (black, shades of grey, blue and green), hydrocarbon odours are present or there is a sheen on excavation water. Immediately notify the Environmental Inspector, Construction Manager and/or Enbridge designate. • Implement the Contaminated Soils Discovery Contingency Plan in the event that contaminated or potentially contaminated soils are encountered. • Follow the remediation procedures outlined in the Contaminated Soils Discovery Contingency Plan in the event that contaminated sites are encountered during construction.	• No residual effect identified

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
7.0 Soil contamination due to spot spills during construction	• Footprint • Entire route	• Report spills immediately to the Construction Manager, Environmental Inspector or Enbridge designate. The Environmental Inspector will report spills to the Enbridge Environment Lead and appropriate government agencies in accordance with the Fuels and Hazardous Materials Contingency Plan. • Maintain equipment in good working condition and ensure that equipment and vehicles are free of leaks. • Place drip pans, impervious tarps or other forms of secondary containment underneath equipment/vehicles when servicing equipment/vehicles with the potential for accidental spills (e.g., oil changes, servicing of hydraulic systems). • Ensure that bulk fuel trucks, service vehicles and pick-up trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency material on bulk fuel and service vehicles that is suitable for use on land and water (i.e., sorbent pads, sorbent boom and rope). • Transport, handle, use and dispose of hazardous materials in accordance with provincial and federal regulatory requirements, and as identified in the Enbridge Waste Management Plan (Enbridge 2014) and the Fuels and Hazardous Materials Contingency Plan. • Place tarps or other impermeable material on the ground to catch drippings/overspray for spray or paint-on coating application at weld joints and areas where repairs to the coating are made. Dispose of spilled coating at an approved location. • Do not leave spent welding rods, or cut off pipe rings on the ground or in the trench. During bevelling operations, collect pipe bevel shaving debris to prevent livestock and wildlife from ingesting the shavings. Contain and collect debris from sandblasting operations.	• No residual effect identified

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
8.0 Trench subsidence	• Footprint • Entire Route	• Compact the backfill, if feasible, during non-frozen soil conditions to reduce trench settlement to the level of the surrounding ground. • Crown the trench with remaining spoil to allow for settlement, if warranted. • Leave a higher trench crown to compensate for settlement after thawing along portions of the route constructed during frozen soil conditions.	• Localized areas of subsidence or a remnant crown may occur
9.0 Reduction in soil productivity resulting from changes in evaporation and transpiration rates	• Footprint • Entire route	• Conduct straw crimping on wind erosion prone soils where vegetation may be difficult to re-establish, where identified by the Environmental Inspector or Enbridge designate and approved or requested by the landowner. Ensure landowner approved straw is used for erosion control. • Use an appropriate seed mix (in consultation with landowners, where applicable) for agronomic (i.e., non-native) seed mixes, to the extent feasible. Obtain seed from a local source whenever possible and retain the Certificates of Analysis for future documentation. All seed mixes must have Certificates of Analysis for weed and undesirable species content, and germination tests for each lot of each species in the mix. For native seed, obtain the highest seed grade available. Do not accept seed that contains any noxious weeds.	• Reduction in soil productivity on agricultural areas resulting from changes in evaporation and transpiration rates
10.0 Lowering of soil productivity due to damage to drain tiles	• Footprint • Drain tiles	• Mark the location of any drain tiles cut during trenching. Cap the ends, or adequately prevent clogging of the drains with soil or debris and install a temporary flume, if necessary, to maintain drainage. • Repair any drain tiles cut during trenching or crushed by heavy equipment. • If warranted, obtain assistance from a drainage tile expert to ensure that permanent damage to the drainage does not result from damage to drainage tiles. • Backfill around drain tiles in lifts and compact each lift. • Consult with affected landowners. • Implement measures identified in the Line List specific to potentially affected landowners.	• No residual effect identified

Table 6.2.2-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Soil and Soil Productivity

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
10.0 Lowering of soil productivity due to damage to drain tiles (cont'd)	See above	• Review and adhere to the mitigation measures outlined in the Summary of Mitigation for Lands with Drain Tiles and Irrigated Lands (to be appended to the EPP[1]).	See above
11.0 Flooding, erosion or contamination of soil as a result of release of hydrostatic test water on land	• LSA • Discharge locations, if applicable	• Ensure that the appropriate testing and treatment measures are implemented in accordance with the applicable provincial notification/approval if test water is released into a natural waterbody. If hydrostatic test water is to be discharged onto land, obtain soil chemistry analysis, if required by the applicable provincial notification/approval, prior to discharging. • Follow all conditions of provincial and federal approvals, if applicable during hydrostatic testing. Ensure that water withdrawal rates and volumes do not exceed those specified in the respective approval/notification. Follow all applicable notification, sampling and reporting requirements as identified in the approval/notification conditions for the withdrawal and discharge of hydrostatic test water. • Discharge the water at an acceptable location on-site in a manner that does not cause erosion or allow unfiltered or silted water to directly re-enter a waterbody. • Maintain low velocities, dissipate water energy and utilize protective rip-rap, sheeting, tarpaulins or an equivalent to prevent washouts, flooding or erosion during dewatering or circulating (if heated water is used). The rate of discharge must be reduced if these measures are ineffective.	• No residual effect identified

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.2.3 Residual Effects Characterization and Significance Determination for Soil and Soil Productivity

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on soil and soil productivity due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. This qualitative assessment relied on available research literature, previous PCEM programs (e.g., L4EP and ACEP) and the professional judgement of the assessment team.

Table 6.2.2-2 provides a summary of the significance evaluation of the potential residual environmental effects of the construction and operation of the replacement pipeline on soil and soil productivity. The rationale used to evaluate the significance of each of the above potential residual environmental effects is provided below, with the exception of the impact balance which is considered negative for all potential residual effects on soil and soil productivity. All assessment criteria were considered but the most influential were magnitude, reversibility and probability. An evaluation of significance is not required for those potential effects where no residual effect is identified (i.e., disturbance of previous site contamination).

Table 6.2.2-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Soil and Soil Productivity

Potential Residual Effects	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[1]
(a) Minor topsoil/subsoil mixing	Footprint	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
(b) Minor surface erosion of topsoil can be expected until a vegetative cover has been established	Footprint	Short to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
(c) Stone picking may result in disposal issues	LSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(d) Pulverization of soil due to rutting may result in minor topsoil/subsoil mixing	Footprint	Medium-term	Isolated	Reversible	Low	Low to high	High	Not significant
(e) Localized areas of subsidence or a remnant crown may occur	Footprint	Short to medium-term	Isolated	Reversible	Low	High	High	Not significant
(f) Reduction in soil productivity on agricultural areas resulting from changes in evaporation and transpiration rates	Footprint	Medium-term	Occasional	Reversible	Low	High	Moderate	Not significant
(g) Combined effects of the Project on soil productivity (points [a-f])	Footprint	Medium-term	Isolated to occasional	Reversible	Low	Low	High	Not significant

Minor Topsoil/Subsoil Mixing

During the construction of the replacement pipeline and, to a lesser extent, during maintenance activities, it is likely that a minor amount of topsoil and subsoil mixing will occur along the pipeline route. The impact balance of this residual effect is considered negative since admixing could decrease soil productivity. Since admixing can be alleviated over time through tilling, the addition of soil amendments (e.g., green feed or manure) and the importation of topsoil or natural processes, the residual effect is reversible. For example, the results of PCEM for Enbridge's L4EP show that issues related to topsoil/subsoil mixing can be resolved within 2 to 3 years (i.e., in the medium-term) (TERA Environmental Consultants 2009, 2011a, 2012a, 2013a, 2014a). The results of PCEM on L4EP also demonstrated that topsoil and subsoil mixing is generally minor in severity and limited in extent (TERA Environmental Consultants 2009, 2011a, 2012a, 2013a, 2014a). In addition, PCEM results from Enbridge's ACEP show that 98% (all, but one) of the issues observed from admixing had been resolved by the fourth year of monitoring when mitigation measures similar to those listed in Table 6.2.2-1 were used (TERA Environmental Consultants 2011b, 2012b, 2013b, 2014b). Given the proven effectiveness of the mitigation measures to reduce admixing along the construction ROWs with similar land use as Line 10, it is anticipated that the extent and severity of admixing will be minor. As a result, the limited amount of admixing expected is considered to be well within environmental standards and, consequently, the potential residual effect is not significant (Table 6.2.2-2, point [a]).

Minor Surface Erosion

Construction and maintenance activities that disturb the soil will likely result in some minor surface erosion of topsoil until a stable vegetative cover can be established, particularly on slopes that are more susceptible to water erosion. The impact balance of this residual effect is considered negative since erosion could decrease soil productivity. It is expected that a vegetative cover can be established on non-cultivated disturbed slopes within a year, with the seeding of a rapidly establishing cover crop in addition to the appropriate seed mix for the location.

During the construction of the Enbridge ACEP, a proactive approach was undertaken to reduce the potential for wind and water erosion. As a result of construction scheduling, topsoil windrows and stockpiles were exposed to the elements for over eight months so Enbridge hired a contractor to tackify all windrows and stockpiles to reduce the potential for wind and water erosion over this extended period. During final reclamation, straw crimping was widely implemented as a mitigation measure to reduce erosion until a vegetative cover could be established (Enbridge 2011a-f). Soil erosion control measures pertaining to water issues were instituted at areas where the risk of erosion was apparent. After each large rainfall, an inspection of all of the erosion prone areas was carried out and temporary erosion control measures were maintained or repaired as needed throughout the construction (Enbridge 2011a-f). PCEM results show that all erosion issues noted along ACEP were resolved within 2 years following final clean-up activities (TERA Environmental Consultants 2011b, 2012b).

The construction and final clean-up activities were completed in 2008/2009 for the existing Enbridge L4EP. Similar to ACEP, measures to control water erosion were implemented at several sites following construction of L4EP in 2009 (TERA Environmental Consultants 2009). Salvaged topsoil was windrowed over the winter along most of the route. Areas with high risk for soil erosion were tackified and silt fences were installed at select locations. All of the sites initially identified as having erosion issues were resolved as of 2011 (i.e., within 2 years after construction) (TERA Environmental Consultants 2011a, 2012a). Additional localized erosion issues were identified at a small number of sites during the 2011 and 2012 PCEM reconnaissance's, but were successfully resolved by the final year of PCEM in 2013 (TERA Environmental Consultants 2012a, 2013a, 2014a).

Based on the results of the PCEM for L4EP and ACEP, issues related to erosion can generally be resolved within 2 to 3 years following final clean-up. Similar mitigation measures will be included in the Project-specific EPP since they are planned for the construction of the replacement pipeline route. Consequently, minor surface erosion is reversible. Given the proven effectiveness of the mitigation measures to reduce the severity of erosion outlined in Table 6.2.2-2, minor surface erosion until a vegetative cover is established is considered to be of low magnitude and, consequently, the potential residual effect is not significant (Table 6.2.2-2, point [b]).

Disposal Issues as a Result of Stone Picking

Stones picked from the top of the backfilled subsoil and from the topsoil may result in disposal issues depending upon the volume accumulated. Stones may be disposed of off the ROW, including areas within the LSA, depending upon landowner or government land authority preferences. Stone picking was conducted during clean-up activities for the existing Enbridge L4EP in 2009 (TERA Environmental Consultants 2009). Following the 2011 PCEM program for the pipeline, all sites previously identified as requiring additional stone picking were resolved (TERA Environmental Consultants 2012a). Final clean-up was conducted for ACEP in late 2009, during which time stone picking was conducted where an excess of coarse fragments was evident as a result of construction activities (TERA Environmental Consultants 2011b). Following the 2011 ground reconnaissance for ACEP, there was only one unresolved site requiring additional stone picking and this issue was resolved by the fourth year of PCEM (TERA Environmental Consultants 2011b, 2012b, 2013b, and 2014b). Bedrock within trench depth was not encountered during construction of Enbridge's ACEP and L4EP. The impact balance is negative as this potential effect could result in disposal issues. The magnitude of this residual effect is considered to be low and, consequently, the potential residual effect is not significant (Table 6.2.2-2, point [c]).

Pulverization of Soils

Construction activities during dry conditions may result in pulverization of soil and sod along the replacement pipeline route. The impact balance of this residual effect is negative since pulverization of soil and sod could lead to increased fugitive dust and loss of soil structure. Given the mitigation measures in Table 6.2.2-2 to reduce soil/sod pulverization, degradation of soil structure from pulverization is considered to be reversible, consequently, the potential residual effect is not significant (Table 6.2.2-2, point [d]).

Localized Areas of Subsidence or Remnant Crown

Construction activities may result in localized areas of excessive trench subsidence and/or a remnant crown over the trench. The impact balance of this residual effect is considered negative since excessive trench subsidence or a remnant crown may reduce soil productivity through erosion and drainage issues. Trench subsidence does not always occur to the degree anticipated during the year following construction and reclamation, and will be greatly influenced by the amount of precipitation (see Table 5.1-1 for precipitation averages in Hamilton).

Following the construction of ACEP in 2009, PCEM results indicate that mitigation measures to prevent or reduce trench subsidence were generally effective as trench subsidence was only an issue along approximately 12% of the line. Areas where subsidence was noted were monitored in following years and repaired where necessary, generally by stripping the topsoil and recontouring the subsoil. By the second year of PCEM, approximately 83% of subsidence issues were resolved while the most recent PCEM results (4th year) indicate that almost 97% of the subsidence issues identified in the first year of monitoring in 2010 have been resolved (TERA Environmental Consultants 2011b, 2012b, 2013b, 2014b). Similarly, the results of the PCEM program for L4EP indicate that the mitigation measures used during construction were generally effective at reducing the amount of trench subsidence along the route, although some localized subsidence issues were noted and, in some instances, subsidence issues appeared in sequential years of monitoring (TERA Environmental Consultants 2009, 2011a, 2012a). In 2013, during the final PCEM reconnaissance, all outstanding subsidence issues had been resolved (TERA Environmental Consultants 2014a). During the first year of PCEM for ACEP, remnant trench crowns were noted as issues mainly for wetland areas. The majority of these issues did not persist into the second year but those that did were resolved by the time the third year reconnaissance was completed (TERA Environmental Consultants 2011b, 2012b, 2013b). Likewise, a remnant trench crown was observed at a couple of locations during the 2010 PCEM reconnaissance, but the issues were resolved by 2011 during the third year of PCEM (TERA Environmental Consultants 2011a, 2012a). Similar mitigation measures are planned for the construction of the replacement pipeline and will be included in the Project-specific EPP. Remedial work associated with a remnant crown and trench subsidence is typically conducted within a year of construction, however, localized trench subsidence may also arise 2 or 3 years after construction. Consequently, the trench subsidence and remnant crown is considered to be reversible. With effective compaction of the backfilled trench, establishment of an appropriate trench crown and feathering out any remaining material over portions of the construction ROW where topsoil salvage was conducted, the magnitude of the effect of trench subsidence and remnant crown on soil and soil productivity is considered low and, consequently, the potential residual effect is not significant (Table 6.2.2-3, point [e]).

Evaporation and Transpiration

Loss of vegetation and soil disturbance will result in changes to evaporation and transpiration rates on agricultural areas following construction, potentially reducing soil productivity. The potential effects on soil productivity will be reduced by scheduling construction activities during late summer/fall when vegetation will be either desiccated or harvested and soil will likely be dry.

Segments of the construction ROW located on cultivated land will be returned for agricultural use following final clean-up. Following tilling and seeding activities, evaporation and transpiration rates on the construction ROW will not differ from off the construction ROW, unless compaction or lower nutrient levels from admixing reduce vegetation yield. Mitigation measures outlined in Table 6.2.2-2 2 will reduce the potential for changes of soil structure and available nutrients and will be included in the Project-specific EPP. Furthermore, any notable decrease in soil productivity will be identified during PCEM and appropriate procedures will be implemented (e.g., soil compaction alleviation, fertilization and landowner consultation).

The loss of vegetation on agricultural land will not result in any considerable alteration of wind patterns and resultant changes in evaporation rates of adjacent vegetation, nor are increased surface temperatures of bare soil resulting from losses in evaporative cooling expected to affect adjacent vegetation. However, exposure of the soil may cause increased evaporation and surface temperatures on the construction ROW, delaying or impeding productivity compared to adjacent untilled lands. In general, PCEM reports for ACEP and L4EP demonstrate that soil productivity on ROW and off ROW are comparable with proper revegetation (TERA Environmental Consultants 2009, 2011a,b, 2012a,b, 2013a,b, 2014a,b). Locations along the construction ROW where seeding or natural revegetation have not been as successful will be recorded and appropriate measures will be implemented (e.g., fencing to prevent grazing, reseeding, soil decompaction and fertilization).

Through appropriate scheduling and implementation of soil conservation and vegetation management measures in Table 6.2.2-2, the magnitude of changes in evaporation and transpiration resulting from construction of the replacement pipeline is considered to be low. A reduction in soil productivity resulting from changes in evaporation and transpiration rates is considered reversible in the short to medium-term depending upon land use, vegetation type and the success of soil handling and revegetation efforts. Consequently, the potential residual effect is not significant (Table 6.2.2-3, point [f]).

Combined Effects on Soil and Soil Productivity

Due to the proven effectiveness of the recommended mitigation measures and environmental inspection during construction/maintenance activities, it is unlikely that several of the potential adverse effects could occur at one location. Nevertheless, this assessment considers the combined effects on soil productivity of potential effects that could potentially occur at a single location. Only those potential residual effects that are likely to occur have been considered in combination.

The potential exists for the following potential residual effects to occur in combination at localized sites:

- minor topsoil/subsoil mixing;
- minor surface erosion of topsoil;
- stone picking;
- pulverization of topsoils;

- localized areas of trench subsidence or a remnant trench crown; and
- change in evaporation and transpiration rates.

The combined effects on soil productivity of these potential residual effects occurring at one location would be not significant due to the low probability of all of the effects occurring at a particular location and the overall low magnitude of the potential effects which is based in part on the limited areal extent where the effects would occur (i.e., Footprint). Consequently, the potential residual effects are not significant (Table 6.2.2-3, point [g]).

6.2.2.4 Summary

As identified in Table 6.2.2-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on soil and soil productivity of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of construction and operation of the replacement pipeline on soil and soil productivity will be not significant.

6.2.3 Water Quality and Quantity

6.2.3.1 Context

The replacement pipeline route crosses the West Spencer Creek subwatershed within the Spencer Creek watershed, the Big Creek subwatershed within the Grand River watershed, the Upper Welland River subwatershed within the Welland River watershed, and the Twenty Mile Creek watershed. The replacement pipeline route crosses 69 watercourses including West Spencer Creek, several tributaries to Big Creek, several tributaries to the Welland River, two tributaries to Twenty Mile Creek, and several wetlands, including the Sheffield-Rockton complex, which may support fish populations.

The watercourses crossed by the replacement pipeline route are primarily ephemeral and intermittent watercourses through agricultural lands. Agricultural land use contributes to surface water quality risk due to point and non-point sources of pollution. Potential contributing factors also include urban runoff and habitat modifications (e.g., removal of riparian vegetation).

Hydrostatic test water will be used to pressure test the replacement pipeline. An estimated total of 10,000 m^3 of water will be used to conduct hydrostatic testing for the replacement pipeline. At this time, it is anticipated that test water will be withdrawn from municipal or other appropriate sources. The water used for hydrostatic testing will be sampled and disposed of accordingly at that time (i.e., at an approved facility or released to land). The potential residual effect related to hydrostatic testing has been included in Section 6.2.3.2 to account for the event that test water is withdrawn from and/or discharged to natural sources.

There are 311 registered groundwater wells identified within the LSA, most of which are used for domestic purposes (MOECC 2012a).

Springs are defined as places where "*without the agency of man, water flows from a rock or soil upon the land or into a body of surface water*" (Borneuf 1983). It is not expected that construction of the replacement pipeline will encounter any springs, as there are no known recorded springs within the LSA (Land Information Ontario 2015). An effect on groundwater spring flow has been included to account for the unlikely event that springs are encountered.

The replacement pipeline route traverses lands assigned low to moderate annual groundwater stress levels, and a moderate to high aquifer vulnerability index (Halton-Hamilton Source Protection Committee 2015, Lake Erie Region Source Protection Committee 2012, NPCA 2013).

6.2.3.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with the construction and operation of the replacement pipeline on water quality and quantity were identified by the assessment team, based on past experience, relevant land use and watershed management plans, and from consultation with stakeholders including government agencies, Aboriginal groups, and landowners along the replacement pipeline route. Concerns regarding water quality and quantity identified by landowners during the consultation process include:

- disruption of the watershed in the area;
- proximity of water wells to the replacement pipeline ROW; and
- flooding and long term damage, since the land is systematically tiled.

Concerns regarding water quality and quantity that were identified by Aboriginal groups during the engagement process include an increase in sediment concentrations at watercourse crossings, which is considered in the assessment for the potential effect regarding the reduction of surface water quality in Table 6.2.3-1.

No further concerns have been raised to date. Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

Watercourse crossings along the replacement pipeline route will be constructed using trenched techniques (i.e., isolated open-cut during flowing conditions or open-cut during dry or frozen-to-bottom conditions). The Sheffield-Rockton Wetland Complex will be crossed using a trenchless (HDD) technique. Standard pipeline construction activities are designed to avoid circumstances that result in diversion and/or unnatural retention of water along the construction ROW by following recommendations from various industry and provincial guidelines (CAPP et al. 2012). In addition, applicable mitigation measures from several industry, provincial and federal regulatory requirements and/or guidelines are presented in Table 6.2.3-1 to reduce the severity of the potential effects of construction and operations of the replacement pipeline on water quality and quantity, including CAPP (2004), CAPP et al. (2012), the Canadian Pipeline Environment Committee (2009) and DFO (1995, 2013).

Pursuant to the *Clean Water Act, 2006,* Grand River, Hamilton and Niagara CAs released assessment reports for their respective source protection areas identifying present threats to drinking water sources, including: handling, storage and application of fertilizer and pesticides; storage of snow; handling and storage of fuel, non-aqueous dense liquids and organic solvents; water withdrawal and return; and, conveyance of oil by way of underground pipelines (Halton-Hamilton Source Protection Committee 2015, Lake Erie Region Source Protection Committee 2012, NPCA 2013). Subsequently, source protection plans and watershed management plans have been developed by the local CAs to include goals, objectives and policies for preserving water quality and quantity for their respective areas:

- Amended Proposed Source Protection Plan for the Grand River Source Protection Area (Lake Erie Region Source Protection Committee 2015);
- Source Protection Plan for the Hamilton and Halton Source Protection Areas (Halton-Hamilton Source Protection Committee 2015); and
- Source Protection Plan for the Niagara Peninsula Source Protection Area (NPCA 2013).

Additional plans and guidelines considered in the present assessment include, but are not limited to:

- Greenbelt Plan (OMMAH 2005);

- Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario (Ontario Energy Board 2011);
- Grand River Watershed Water Management Plan (GRCA 2014);
- Westover Creek Watershed Stewardship Action Plan (HCA 2011a);
- West Spencer Creek Watershed Stewardship Action Plan (HCA 2011b);
- Middle Spencer Creek Watershed Stewardship Action Plan (HCA 2011c);
- Upper Welland River Watershed Plan (NPCA 2011); and
- Twenty Mile Creek Watershed Plan (Durley 2006).

With the successful implementation of the recommended mitigation measures, it is anticipated that the Project's environmental protection efforts will be in line with the objectives of the plans (detailed in Appendix 2B) related to protecting and sustaining water quality and quantity, and will not result in any issues pertaining to sustainability principles and goals for the protection of water quality and quantity.

A summary of mitigation measures is provided in Table 6.2.3-1. Mitigation measures were principally developed in accordance with industry and provincial regulatory guidelines.

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration of natural surface water flow patterns	• LSA • Entire route, watercourse crossings	• Ensure all necessary approvals, licences, and permits required for a particular activity or construction site are obtained prior to the commencement of the applicable activity or construction at that site. • The Environmental Inspector or Enbridge designate will monitor the implementation of the EPP mitigation during all critical phases (clearing/mowing, topsoil salvage and replacement, grading, drainage and wetland crossings, and clean-up) of construction. • Maintain drainage across the construction ROW during all phases of construction. Ensure construction activities do not cause the ponding of water or unintentional channelization of surface water flow. • Ensure appropriate approvals (e.g., PTTW from the Ontario MOECC where dewatering in excess of 50,000 L/day is required) are in place prior to dewatering and obtain approval from the Environmental Inspector(s) and Enbridge Lands, Construction and/or Engineering departments for all water discharge locations. • Discharge water to approved locations. Monitor the site to ensure erosion, flooding or excessive accumulation doesn't occur.	• Localized alteration of natural surface drainage patterns until trench settlement is complete • Alteration of stream flow from temporary blockages during instream activities

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration of natural surface water flow patterns (cont'd)	See above	• Recontour the construction ROW and restore the pre-construction grades and drainage channels. Where restoration of the pre-construction grade is not feasible due to the risk of the failure of fill on slopes, recontour to grades as directed by Enbridge. Typical diversion berm spacing is indicated in the EGC. • The Environmental Inspector shall inspect berms after heavy rains and the first spring following construction; replace or restore berms, if warranted. • Determine location and direction of berm based on local topography and drainage patterns. • Recontour the streambed to approximate the pre-construction profile and channel configuration to ensure that flow patterns are unaltered. Watercourses are not to be realigned or straightened in any way nor have their hydraulic characteristics changed. • Review the provincial notification requirements related to the installation of vehicle crossings and watercourse crossing construction. Confirm that notifications have been provided with the appropriate interval prior to the commencement of the installation of vehicle crossings and watercourse crossing construction. • Follow instream restricted activity timing windows for watercourses). • Complete all instream activity within a reasonable period of time, having regard for the site-specific conditions, to limit the duration and severity of disturbance. Schedule crossing construction, to the extent practical, to complete trenching, lowering-in and backfill with continuous effort or to the satisfaction of the Environmental Inspector or Enbridge designate.	See above

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration of natural surface water flow patterns (cont'd)	See above	• Provide generic watercourse crossing plans or, where warranted, site-specific, detailed watercourse crossing plans for fish-bearing watercourses, including the planned equipment to be used, isolation dam materials to be used, pump/generator sizes and quantities, discharge and bypass locations, grey water control/management measures, spoil containment locations and materials, a description of the excavation procedure and the anticipated duration of instream activity to the Environmental Inspector or Enbridge designate for approval prior to the commencement of watercourse crossing construction. • Abide by applicable instream restricted activity. No instream construction activity will occur within the instream restricted activity timing windows at any watercourse, unless the watercourse is dry or frozen to the bottom at the time of construction or approval has been granted by the qualified fish biologist and the appropriate regulatory agency. • Maintain the quantity and quality of stream flow, if present, throughout crossing construction. Trench through the watercourse after isolation is installed and operational, and maintain stream flow at all times. • Disruption of stream flow and the potential effects on fish and fish habitat are discussed in Section 6.2.7 (Fish and Fish Habitat). • Disruption of stream flow and the potential effect on navigability of watercourses are addressed in Section 6.2.18 (Navigation and Navigation Safety). **Hydrostatic Testing** • Conduct all hydrostatic testing activities in accordance with the NEB OPR, provincial regulations as well as the latest version of CSA Standard Z662-15. • Follow all conditions of provincial and federal approvals, if applicable, during hydrostatic testing. Ensure that water withdrawal rates and volumes do not exceed those specified in the respective approval/notification. Follow all applicable notification, sampling and reporting requirements as identified in the approval/notification conditions for the withdrawal and discharge of hydrostatic test water.	See above

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration of natural surface water flow patterns (cont'd)	See above	• Ensure that the appropriate testing and treatment measures (e.g., filtering) are implemented in accordance with the applicable provincial notification/approval if test water is released into a natural waterbody. If hydrostatic test water is to be discharged onto land, conduct any necessary analyses prior to discharging. • Abide by the instream restricted activity timing window of the withdrawal source as well as provincial or federal approval conditions.	See above
2.0 Changes in groundwater quantity or flow	• LSA • Entire route	• Ensure that all necessary approvals, licences, and permits required for a particular activity or construction site have been obtained prior to the commencement of the applicable activity or construction at that site. • The Environmental Inspector or Enbridge designate will monitor the implementation of the EPP mitigation during all construction phases (mowing/brushing, topsoil salvage and replacement, grading, watercourse and wetland crossings, and clean-up) of pipeline construction. • Avoid springs, where practical. Install trench breakers and subdrains to manage groundwater if springs are encountered. Recontour the construction ROW to the pre-construction profile as discussed. • Install subdrains, where applicable, if there is evidence of seepage or a flowing spring on a slope once the trench is excavated.	• Disruption of groundwater flow where springs are encountered
3.0 Reduction in surface water quality	• LSA • Entire route	• Ensure all necessary approvals, licences and permits required for a particular activity or construction site prior to the commencement of the applicable activity or construction at that site. • Enbridge will monitor the implementation of the EPP mitigation during all critical phases (mowing/brushing, topsoil salvage and replacement, grading, watercourse and wetland crossings, and clean-up) of pipeline construction. • Ensure that snowfills do not interfere with or impede stream flows. Notify the Environmental Inspector or Enbridge designate in the event that stream flow is or may be impeded by a snowfill vehicle crossing.	• Reduction in surface water quality due to increased concentrations of suspended solids during construction of trenched crossings and vehicle crossings • Reduction in surface water quality due to increased sediment concentrations resulting from erosion from approach slopes and banks

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Reduction in surface water quality (cont'd)	See above	• Complete all instream activity within a reasonable period of time, having regard for the site-specific conditions, to limit the duration and severity of disturbance. Schedule crossing construction, to the extent practical, to complete trenching, lowering-in and backfill with continuous effort or to the satisfaction of the Environmental Inspector or Enbridge designate. **<u>Clearing and Grading</u>** • Prevent or control soil erosion and water siltation immediately and proactively to the satisfaction of the Environmental Inspector or Enbridge designate. Make available sufficient personnel and equipment to control erosion when warranted (see the Soil Erosion Contingency Measures, Siltation of Watercourses or Wetlands Contingency Measures, Adverse Weather Contingency Plan for Watercourse Crossings in (to be appended to the EPP[1]). • Restrict root grubbing near watercourses and wetlands. Do not grub within riparian buffers adjacent to watercourses and wetlands, except along the trench line, spoil pile area (only if deemed absolutely necessary) and travel lane if a vehicle crossing is to be installed. • Implement the Siltation of Watercourses or Wetlands Contingency Plan (to be appended to the EPP[1]) in the event that siltation is occurring. • Avoid or reduce grading within 10 m of watercourses, wetlands, and natural drainage channels, where practical. Reduce the width of grading in order to limit the potential for erosion and subsoil compaction. • Install and maintain erosion control measures, as needed, prior to commencing grading in the vicinity of watercourse and wetland crossings. • Limit brushing in the vicinity (e.g., 10 m buffer) of watercourse and wetland crossings to the removal of trees and shrubs along the trench line and work side area needed for the vehicle crossing to protect riparian areas. Following brushing, the low-lying understory vegetation is to remain intact. Reduce disturbance of soil adjacent to wetlands.	• Contamination of surface water due to a spill during construction or maintenance activities • Alteration or contamination of surface water as a result of the withdrawal and release of hydrostatic test water • See Section 6.7 Accidents and Malfunctions for a discussion of inadvertent release of HDD mud during construction • See Section 6.7 Accidents and Malfunctions for a discussion of pipeline release during operations

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Reduction in surface water quality (cont'd)	See above	• Install temporary sediment barriers to prevent sediment from disturbed areas from flowing into the watercourse or wetland if grading within the riparian buffer. • Adhere to the measures related to the maintenance of a vegetative buffer within the 10 m (minimum) wide riparian buffer on both sides of watercourse crossings. The buffer is measured from the high watermark of the watercourse and should be maintained in accordance with permit conditions, wherever practical and at the discretion of the Environmental Inspector or Enbridge designate. Where the 10 m (minimum) buffer cannot be maintained, adequate minimize measures are to be in place to prevent sediment from entering the watercourse. • Pile all spoil on the banks above the high watermark, if feasible. Excavate a pit or construct berms of packed earth or staked straw bales, if the spoil is likely to be highly saturated, to prevent spoil or silty water from flowing back into the watercourse. Maintain existing riparian buffers up to 10 m distance from the high water line. **Vehicle Crossings** • Review the provincial notification requirements related to the installation of vehicle crossings and watercourse crossing construction. Confirm that notifications have been provided with the appropriate interval prior to the commencement of the installation of vehicle crossings and watercourse crossing construction (see Section 5.0). • All pre-construction vehicle traffic will use existing vehicle crossings (e.g., existing bridge) or install temporary crossings to cross flowing watercourses. Fording of flowing streams by vehicles will not be permitted. • Adhere to measures related to the vehicle crossing techniques. Ensure that the crossing is installed as per the notifications provided to the Local CA. • Install, maintain and monitor erosion control measures (e.g., coir matting, coir logs, silt fences, temporary berms, rollback), if warranted, following installation of the temporary vehicle crossing to reduce the risk of erosion during the period that the vehicle crossing will be in place.	See above

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Reduction in surface water quality (cont'd)	See above	• Construct all bridges (single span bridges, or equivalent) beyond the ends of the banks in a manner that protects the banks from erosion. Do not place fill within the primary banks of a watercourse during bridge abutment construction, unless otherwise approved by the appropriate regulatory authority and in accordance with notification provided to the local CA. **<u>Bank and Riparian Restoration</u>** • Implement the bank and riparian protection and reclamation measures at all watercourse crossings that were trenched or where disturbance of the bank or riparian area occurred. • Seed disturbed riparian buffer areas with an appropriate seed mix, approved by the landowners (based on Ecoregion), if no woody material (e.g., willow, dogwood) will be installed within the riparian area. If woody material is planned to be installed within the riparian area, seed the riparian area with an appropriate seed mix. • Install temporary berms on approach slopes to watercourses and wetlands (where required), and erect silt fence or an equivalent temporary erosion/sediment control device (e.g., hay bales, coir logs) near the base of approach slopes to watercourses and wetlands immediately following grading. Monitor the temporary erosion control structures on a regular basis and repair, if warranted. **<u>Hydrostatic Testing</u>** • Conduct all hydrostatic testing activities in accordance with the NEB OPR, provincial regulations as well as the latest version of CSA Z662-15. • Ensure that test water containing chemical additives is sampled and, if warranted, treated and discharged or collected in accordance with applicable provincial and federal requirements.	See above

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Reduction in surface water quality (cont'd)	See above	**Spills** • Review and adhere to the Fuels and Hazardous Materials Contingency Plan and the Enbridge Waste Management Plan (Enbridge 2014) to avoid contaminant introduction during construction. • Maintain equipment in good working condition and ensure that equipment and vehicles are free of leaks. • Ensure operators and on-site construction foremen have been trained to contain spills or leakage from equipment. Ensure that Contractor equipment operators and foremen are aware of the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]). • Do not store fuel tanks, containers or stationary equipment within the normal high water mark of a watercourse or wetland, unless otherwise indicated. If this is not feasible, secondary containment must be provided regardless of container size. If the fuel tank is double-walled, tertiary containment must be provided. Fuel storage areas, pumps, generators and other sources of deleterious substances must be within a containment system of sufficient capacity to ensure that deleterious substances do not enter fish habitat. Appropriate spill kits will be kept at fuel or hazardous materials storage, refuelling and maintenance or refuelling service vehicles. • Ensure that bulk fuel trucks, service vehicles and pick-up trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency material on bulk fuel and service vehicles that is suitable for use on land and water (i.e., sorbent pads, sorbent boom and rope). • Implement the measures outlined in the Fuels and Hazardous Materials Contingency Plan to be appended to the EPP[1]). • Do not wash equipment or machinery in watercourses or wetlands. Control wastewater from construction activities, such as equipment washing or concrete mixing, to avoid discharge directly into any body of water.	See above

Table 6.2.3-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Water Quality and Quantity

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Reduction in surface water quality (cont'd)	See above	• See Section 6.2.2 (Soil and Soil Productivity) for a discussion on the release of hydrostatic test water on land.	See above
4.0 Reduction of groundwater quality	• RSA • Entire route	• Implement the Contaminated Soils Discovery Contingency Plan (to be appended to the EPP[1]) in the event that contaminated or potentially contaminated soils are encountered. • Review and adhere to the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]) and the Enbridge Waste Management Plan (Enbridge 2014) to avoid contaminant introduction during construction. • Maintain equipment in good working condition and ensure that equipment and vehicles are free of leaks. • Install monitoring wells at select locations near residences in the vicinity of the replacement pipeline route to monitor water quality and support the Permit to Take Water requirements. • Conduct pre and post-construction testing for all water wells, as approved by the applicable regulatory authority, and/or landowners.	• Reduction in groundwater quality resulting from a spill during construction or maintenance activities • See Section 6.7 Accidents and Malfunctions for a discussion of pipeline releases during operations

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.3.3 Residual Effects Characterization and Significance Determination for Water Quality and Quantity

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on water quality and quantity due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. The evaluation of significance of each of the potential residual effects relied on CCME guidelines, available scientific literature, the results of previous Environmental As-built and PCEM reports, available management plans and the professional judgment of the assessment team.

A summary of the significance evaluation of potential residual environmental effects of the construction and operation of the replacement pipeline on water quality and quantity is provided in Table 6.2.3-2. The rationale used to evaluate the significance of each of the potential residual environmental effects is provided below, with the exception of the impact balance which is considered negative for all potential residual effects on water quality and quantity. All assessment criteria were considered but the most influential were duration, magnitude, reversibility and probability.

Table 6.2.3-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Water Quality and Quantity

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Localized alteration of natural surface drainage patterns until trench settlement is complete	LSA	Short to medium-term	Isolated to occasional	Reversible	Low to medium	High	High	Not significant
(b) Alteration of stream flow from temporary blockages during instream activities	LSA	Short to medium-term	Isolated	Reversible	Low	High	High	Not significant
(c) Disruption of groundwater flow where springs are encountered	LSA	Short to medium-term	Isolated	Reversible	Low	Low	High	Not significant
(d) Reduction in surface water quality due to increased concentrations of suspended solids during construction of trenched crossings and vehicle crossings	LSA	Immediate to short-term	Isolated	Reversible	Low	High	High	Not significant
(e) Reduction in surface water quality due to increased sediment concentrations resulting from erosion from approach slopes and banks	LSA	Short to medium-term	Isolated	Reversible	Low	High	High	Not significant
(f) Contamination of surface water due to a spill during construction or maintenance activities	Aquatics RSA	Immediate to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
(g) Alteration or contamination of surface water as a result of the withdrawal and release of hydrostatic test water	LSA	Short-term	Isolated	Reversible	Low	Low	Moderate	Not significant
(h) Reduction in groundwater quality resulting from a spill during construction or maintenance activities	LSA	Medium to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
(i) Combined effects of the Project on reduction of surface water quality due to instream construction and erosion from banks or approach slopes (points [d] and [e])	LSA	Immediate to medium-term	Isolated to occasional	Reversible	Low to medium	Low	High	Not significant

Localized Alteration of Natural Surface Drainage Patterns

Localized alteration of natural surface drainage patterns may occur during construction of the replacement pipeline until trench settlement is complete. The impact balance of this potential residual effect is considered negative since alteration or disruption of natural above-ground hydrologic conditions could occur.

Construction activities may contribute to some localized alteration of natural surface drainage patterns until trench settlement is complete. However, with the successful implementation of the recommended mitigation measures, disruption of surface flow patterns following construction is likely to be minor along the replacement pipeline route.

During construction of the ACEP pipeline, where seasonal drainages or wetlands were backfilled, the trench crown was left in a manner that would not impede the drainage or flow from the channel. The results of the PCEM program for the ACEP indicate that the mitigation measures used during construction were generally effective at maintaining drainage patterns and preventing subsidence of the trench (TERA Environmental Consultants 2012b, 2013b, 2014b). Most areas were successfully remediated within 2 to 3 years after construction.

In the event that construction or maintenance activities for the replacement pipeline result in changes in surface water regimes, corrective action and consultation with the appropriate authorities will be conducted to resolve the issue. The PCEM program will identify locations of altered drainage patterns (e.g., sunken trench and ponded water) and remedial work will be conducted, as needed. Consequently, the residual effect is reversible. Generally, the residual effect of localized sunken trench or ponded water on the construction ROW is considered to be of low magnitude, however, ponded water on the construction ROW within an agricultural field that results in lost farm income would be considered to be of medium magnitude. When crop losses or other damages are mitigated with financial reimbursement, the potential residual effect is not significant (Table 6.2.3-2 point [a]).

Alteration of Stream Flow during Instream Activities

Pipeline construction (e.g., trenched crossings and vehicle crossings) and maintenance activities at some watercourses may cause an alteration to the watercourse bed and banks, which will cause an alteration of natural stream flow at some watercourses.

In the event that alterations to watercourse hydrology result from construction or maintenance activities, corrective action, in consultation with the appropriate regulatory authorities, will be conducted to resolve the issue. The PCEM program will identify locations of altered stream flow (e.g., damaged bed and banks) and remedial work will be conducted. Although this potential residual effect is of high probability, it is of low magnitude and reversible. Consequently, the potential residual effect is not significant (Table 6.2.3-2 point [b]).

Disruption of Groundwater Flow Where Springs are Encountered

If springs are encountered, a disruption of shallow groundwater flow may occur during construction. There are no known springs located along the replacement pipeline route, so it is expected that replacement pipeline construction can occur without disruption of groundwater flow. However, in the event that a disruption occurs, it will be of short to medium-term duration and low magnitude, and is reversible. Consequently, the potential residual effect is not significant (Table 6.2.3-2 point [c]).

Reduction in Surface Water Quality during Construction of Trenched Crossings and Vehicle Crossings

The selection of appropriate watercourse crossing techniques designed to meet federal and provincial regulatory requirements as well as implementation of surface erosion controls and riparian revegetation will substantially reduce the potential for adverse effects on surface water quality at watercourses crossed by the replacement pipeline route. During construction of trenched crossings, a minor sediment release is expected during installation of the dams prior to the isolation and during removal of the downstream dam at the conclusion of the isolation. The impact balance of this potential residual effect is considered to be negative since it could decrease surface water quality.

However, the residual effects on water quality are of low magnitude and reversible, and consequently, the potential residual effect is not significant (Table 6.2.3-2 point [d]).

Reduction in Surface Water Quality from Erosion from Approach Slopes and Banks

Following grading, it is possible for some erosion to occur on approach slopes and banks that could cause increased suspended sediment in surface water. The impact balance of this potential residual effect is considered to be negative since the suspended sediment could decrease water quality.

Although erosion and sedimentation may occur during construction of the replacement pipeline, the proposed mitigation measures are expected to reduce the magnitude of increased suspended sediment in surface water to low levels. The results of the PCEM of the ACEP demonstrate that the watercourse crossing methods and mitigation measures implemented were effective in avoiding or reducing the introduction of sediments into watercourses during construction and reducing erosion on the banks and approach slopes to watercourses (TERA Environmental Consultants 2012b, 2013b, 2014b).

This potential residual effect is of high probability, however, it is of low magnitude and reversible, and consequently, not significant (Table 6.2.3-4 point [e]).

Contamination of Surface Water Due to Spills

Despite best intentions, small scale spills into water are possible during construction and site-specific maintenance activities when there are multiple vehicles and equipment on site. In the highly unlikely event of a large spill such as a fuel truck rollover in a waterbody, the adverse residual effects could, depending upon the size of the spill, be of high magnitude with potentially long-lasting ramifications to the health of the watercourse. Although spill contingency and clean-up measures would reduce the magnitude and reversibility of the residual effects, such an incident could be considered of high magnitude due to the adverse residual effects if it were to occur in a highly sensitive environment.

During construction of the Enbridge ACEP, the Spill Contingency Plan was implemented to deal with spot spills occurring during construction. All spills or accidental releases of potentially harmful materials (i.e., oil or diesel fuel) were recorded. Every machine was equipped with a spill kit that included absorbent pads. Spills and leaks were cleaned up immediately using on-site resources or using hydrovac trucks to clean up contaminated material. A buffer for fueling and equipment maintenance was enforced at all watercourses (Enbridge 2011a-i).

Similar mitigation is planned for the replacement pipeline. Spill prevention measures outlined in Table 6.2.3-1 will be followed. In the event of a spill, Enbridge will implement Enbridge's Fuel and Hazardous Materials Contingency Plan. Depending upon the nature, volume and location (e.g., sensitivity of receiving waterbody) of a spill, the magnitude could vary from low to high. However, this residual effect is reversible and is of low probability, and consequently, not significant (Table 6.2.3-2 point [f]). See Section 6.7 for a discussion about an accidental product release during operations.

Alteration or Contamination of Surface Water as a Result of Withdrawal and Release of Hydrostatic Test Water

With the successful implementation of the recommended mitigation measures, the residual effect of hydrostatic test water release and withdrawal is considered to be of low magnitude. This potential residual effect is also considered to be reversible since suspended sediments resulting from test water release will likely settle out of suspension within 24 hours after the release or, if the water chemistry is not suitable, water will be disposed of at a licensed facility. Any sediments that are deposited on the substrate of a watercourse are expected to be flushed from the system during the first flushing event following hydrostatic testing. This potential residual effect of low magnitude, reversible and of low probability, consequently, the potential residual effect is not significant (Table 6.2.3-2 point [g]).

Reduction in Groundwater Quality due to Spills

The impact of a spill during construction or operation (i.e., maintenance activities) is considered to be negative since this could potentially affect groundwater quality. This residual effect is unlikely to extend beyond the Water Quality and Quantity LSA, and is considered to represent a short to medium-term influence on groundwater and the properties of the aquifer, as well as overlying material (i.e., is reversible).

Contamination of groundwater may result if the spilled material migrates through the surficial materials into the first water-bearing unit. The rate of migration is dependent upon the permeability of the materials, presence or absence of fractures, the properties of the spilled contaminant (e.g., density, viscosity) and the vertical hydraulic gradients. A spill during the construction phase of the Project is likely to be noted quickly and to be of small volume. Appropriate pre-construction and post-construction testing of water quality in domestic wells will be conducted to address potential landowner concerns.

With the implementation of clean-up and remediation measures, spills potentially affecting groundwater are considered to be unlikely and of low to high magnitude, depending upon the sensitivity of the aquifer, and reversible. Consequently, the potential residual effect is not significant (Table 6.2.3-2 point [h]).

Combined Effects on Surface Water Quality

An evaluation of the combined effects considers those residual effects that are likely to occur and that may act in combination with one another. Residual effects [d] and [e] in Table 6.2.3-2 are likely to occur and may act in combination to cause a reduction in surface water quality through increased suspended sediments. Other residual effects that may cause a decrease in surface water quality (points [f-h] in Table 6.2.3-2) are not considered in the evaluation of combined effects on surface water quality since the probability of these effects occurring is low.

The following potential residual effects may act in combination to result in combined effects on surface water quality:

- reduction in surface water quality due to increased concentrations of suspended solids during construction of trenched crossings and vehicle crossings; and
- reduction in surface water quality due to increased sediment concentrations resulting from erosion from approach slopes and banks.

The potential adverse effects identified have the potential to act in combination on waterbodies and watercourses crossed by the replacement pipeline route. This residual effect is reversible. The magnitude of the combined effects on surface water is considered to be low to medium since the combined effect is likely to be reduced by the successful implementation of the recommended mitigation strategies (Table 6.2.3-1). In addition, the probability of these potential residual effects acting in combination at a particular location is low, consequently, the potential residual effect is not significant (Table 6.2.3-4 point [i]).

Combined Effects on Surface Water Quantity

An evaluation of combined effects considers those effects that are likely to occur and could act in combination. The potential residual effects on surface water quantity (i.e., localized alteration of natural drainage patterns until trench settlement is complete, and alteration of stream flow during instream activities), are both of high probability but are not expected to act in combination with one another since these effects are spatially separated and, therefore, an evaluation of the combined effects on surface water quantity is not required.

Combined Effects on Groundwater Quality and Quantity

An evaluation of combined effects considers those effects that are likely to occur and could act in combination. The potential residual effects on groundwater (i.e., disruption of groundwater flow where springs are encountered and reduction in groundwater quality resulting from a spill during construction or operation) are of low probability and are not expected to act in combination with one another and, therefore, an evaluation of the combined effects on groundwater quality and quantity is not required.

6.2.3.4 Summary

As identified in Table 6.2.3-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on water quality and quantity of high magnitude, or a high probability of occurrence of an irreversible residual environmental effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of pipeline construction and operation on water quality or quantity will be not significant.

6.2.4 Air Emissions

6.2.4.1 Context

The primary sources of Criteria Air Contaminants (CACs) during construction of the replacement pipeline will be from fuel combustion by transportation and construction vehicles (e.g., dozers, excavators, sidebooms), dust related to the use of transportation vehicles and heavy-duty construction equipment. During operations of the replacement pipeline, air emissions will be limited to transportation and equipment use during maintenance activities (e.g., regular patrols and occasional site-specific preventative maintenance digs).

CACs expected to be emitted from Project-related activities include NOx, CO, PM, VOCs and very small volumes of SOx from the combustion of low sulphur diesel fuel. Emissions from the construction of the replacement pipeline will be limited to on -road and off-road vehicle and equipment use. In the unlikely event that burning is required during construction (see Section 6.2.5.1 for a further explanation), there will be minor CO and PM emissions emitted as a result. During operations and maintenance activities along the replacement pipeline route, CAC emissions and PM from dust are expected to be infrequent and localized. As per Table A-1 of the NEB *Filing Manual*, a detailed air quality assessment is not warranted since emissions for the Project are expected to be low and short-term during the construction and operations phases.

6.2.4.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with construction and operations of the replacement pipeline on air emissions were identified by the assessment team, based on past experience with pipeline projects, relevant land use plans and regulatory documents.

During the stakeholder engagement process, landowners expressed concern about dust. Some of these landowners requested dust control measures to be implemented during the construction and to be notified prior to commencement of activities.

No further concerns have been raised to date. Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of the potential effects associated with construction and operations of the replacement pipeline on air emissions and associated mitigation measures included in Table 6.2.4-1 were principally developed in accordance with industry and provincial regulatory guidelines including Cheminfo Services Inc. (2005) and CAPP (1999).

Table 6.2.4-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Air Emissions

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Project contribution to CAC emissions	• LSA • Entire route	• Use well maintained equipment to reduce air pollution. • Limit the duration that vehicles and equipment are allowed to sit and idle, unless air temperatures are less than 5°C. • Use multi-passenger vehicles for the transport of crews to and from the job sites, to the extent practical, to reduce noise and air emissions during construction.	• Increase in air emissions during construction, site-specific maintenance activities and operations
2.0 Dust and smoke during construction	• LSA • Entire route	• Control construction-related road dust near residential areas and other areas as advised by the Enbridge designate. Apply water to the construction ROW and access roads if traffic and wind conditions result in pulverized soils and dust problems. Alternatively, control dust emissions by applying dust suppressants, if warranted. Ensure dust suppressants are approved by the municipal district/rural municipality, Enbridge and landowners. • In the event burning is required, obtain Burning Permits from the City of Hamilton or the applicable municipal authority prior to burning activities. • Suspend topsoil handling during high wind conditions. • Post speed signs at nearby residences affected by pipeline construction traffic to aid in dust emission control.	• Increase in air emissions during construction

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.4.3 Residual Effects Characterization and Significance Determination for Air Emissions

A detailed quantitative analysis of air emissions was not considered necessary for the Project since it is not anticipated to generate high or medium volumes of air emissions during any phase. Consequently, the evaluation of significance relied on the professional judgement of the assessment team.

Table 6.2.4-2 provides a summary of the significance evaluation of the potential residual environmental effects of construction and operations of the replacement pipeline on air emissions. The rationale used to evaluate the significance of the residual environmental effect is provided below, with the exception of impact balance which is considered negative for all potential residual effects on air emissions. All assessment criteria were considered but the most influential criteria was magnitude. Refer to Section 6.2.16 Human Health for a discussion of nuisance emissions during construction.

Table 6.2.4-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operations on Air Emissions

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance [1]
		Duration	Frequency	Reversibility				
(a) Increase in air emissions during construction, site-specific maintenance activities and operations	LSA	Short-term	Isolated to periodic	Reversible	Low	High	Moderate	Not significant

Air Emissions during Construction, Site-Specific Maintenance Activities and Operations

Ambient air quality in the LSA for the replacement pipeline is rated as good with rare occurrences of degraded air quality (see Section 5.0). Increases in CAC emissions as a result of the Project are anticipated however, are expected to be small compared to existing emissions in the LSA.

The CACs expected to be emitted during construction and maintenance include NOx, CO, PM, and VOCs. The primary source of CAC emissions during construction will be from land clearing, and vehicle and equipment operation. Land clearing will account for the largest sources of SO_2 and CO emissions. Off-road equipment operation will be the largest source of NOx during construction. Fugitive dust from on-road equipment travel and off-road equipment use and material handling will be the largest source of PM. This residual effect is confined to construction and reclamation activities completed during frozen conditions. During operations, increases in CAC emission will be resultant of periodic equipment use during site-specific maintenance and operations. The amount of CAC emissions associated with construction, site-specific maintenance activities and operations will be reduced by using well-maintained vehicles, reduction of vehicle and equipment idling and dust control measures. The residual effects of increased air emissions during construction, site-specific maintenance activities and operations are considered to have a negative impact balance and are of high probability. Although air emissions will increase during construction activities, the magnitude of the potential residual effect is considered low since it is expected that air emission concentrations will quickly attenuate to below standards within the LSA boundary. The increase in air emissions is anticipated to be of short-term duration and is considered reversible. Confidence is considered moderate due to the inherent uncertainties involved in accurately predicting fugitive emissions of PM, particularly for material handling and movement activities, and resuspension of dust due to on-road equipment and vehicle travel. Therefore, the potential residual effect is considered to be not significant (Table 6.2.4-2, point [a]).

6.2.4.4 Summary

As identified in Table 6.2.4-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on air emissions of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of pipeline construction and operation on air emissions will be not significant.

6.2.5 Greenhouse Gas Emissions

6.2.5.1 Context

Construction-related GHG emissions primarily result from the exhaust emissions of on-road and off-road vehicles and equipment during construction. As noted in Section 5.0, Enbridge does not anticipate burning slash in order to support construction activities. Alternatively, vegetation (including trees) will be cleared and mowed as appropriate. The arborist assessment planned in 2016 will determine the presence, abundance and merchantability of all timber on the Project Footprint. As such, any slash burning during land clearing where timber salvage is not feasible will contribute to construction –related GHG emissions. During the operations phase, sources of GHG emissions will be attributable to exhaust emissions from equipment and vehicles used for maintenance activities.

6.2.5.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with the construction and operation of the replacement pipeline on GHG emissions were identified by the assessment team based on past experience along the Enbridge pipeline system, relevant land use plans and regulatory documents.

To date, no concerns regarding GHG emissions have been identified by landowners, Aboriginal groups or government agencies along the replacement pipeline route during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of potential effects associated with the construction and operation of the replacement pipeline on GHGs and associated mitigation measures are included in Table 6.2.5-1 and were principally developed in accordance with industry and provincial regulatory guidelines including Cheminfo Services Inc. (2005) and CAPP (1999), as well as in accordance with the Enbridge (2013) EGC.

Table 6.2.5-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Greenhouse Gas Emissions

Potential Effect		Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0	Project contribution to GHG emission levels	• International • Entire Route	• Reduce the amount of GHG emissions associated with clearing of vegetation by following existing linear disturbances, where feasible. • Use well maintained equipment to reduce air pollution. • Control the duration that vehicles and equipment are allowed to sit and idle, unless air temperatures are less than 5°C. • Use multi-passenger vehicles for the transport of crews to and from the job sites, to the extent practical, to reduce noise and air emissions during construction. • During operations, combine maintenance activities for the replacement pipeline with activities for other pipelines within the Enbridge mainline corridor.	• Increase in GHG emissions during construction, site-specific maintenance activities and operations

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.5.3 Residual Effects Characterization and Significance Determination for Greenhouse Gas Emissions

The assessment of GHG emissions for the Project was based on guidance provided in *Incorporating Climate Change Considerations in Environmental Assessment* (CEA Agency 2003). Table A.1 of that document provides examples of the types of projects that are considered to have high and medium GHG emissions (i.e., coal-fired generating plants, petroleum refining and large-scale forest harvesting operations). A detailed quantitative analysis of GHG emissions was not considered necessary for the Project since it is not anticipated to generate high or medium volumes of GHG emissions during any phase, and it is not going to have large-scale effects on forest cover or wetlands that may serve as carbon sinks. Consequently, the evaluation of significance relied on the professional judgement of the assessment team.

Table 6.2.5-2 provides a summary of the significance evaluation of the potential residual environmental effect of construction and operations of the replacement pipeline on GHG emissions. The rationale used to evaluate the significance of the residual environmental effect is provided below, with the exception of impact balance which is considered negative for all potential residual effect on GHG emissions. All assessment criteria were considered but the most influential criteria was magnitude.

Table 6.2.5-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Greenhouse Gas Emissions

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Increase in GHG emissions during construction, site-specific maintenance activities and operation	International	Long-term	Isolated to periodic	Irreversible	Low	High	High	Not significant

Increase in Greenhouse Gas Emissions during Construction, Site-Specific Maintenance Activities and Operation

The primary sources of GHG emissions during construction will be from fuel combustion while transporting crews to and from the work site and along the ROW, as well as from the operation of heavy equipment required for construction. The amount of GHG emissions associated with construction and site-specific maintenance activities and operations will be reduced by using multi-passenger vehicles for the transport of crews to and from job sites to the extent practical, as well as using well-maintained equipment. When timber salvage or mulching is not feasible as determined by the arborist assessment, land clearing along the construction ROW will result in direct emissions of GHGs from burning and, as consequently reduce the carbon sequestration potential of the cleared land. The potential for reduction in the effectiveness of carbon sinks and subsequent effect on GHG totals associated with clearing of vegetation will be reduced by following existing pipeline ROWs for most of the route, and using shared workspace, wherever practical, thereby limiting the amount of clearing necessary. Carbon sequestration will continue following reclamation and the re-establishment of vegetation. Additionally, Enbridge will implement their Tree for a Tree component of the Enbridge Neutral Footprint Plan (see Section 8.1.2), in compliance with applicable provincial and municipal regulations.

The primary source of GHG emissions during pipeline operations and site-specific maintenance activities will be from preventative maintenance digs, vehicular transportation and mobile utility equipment, such as power generators. During operations of the replacement pipeline, Enbridge will integrate the patrol of the pipeline ROW within its ongoing program for there to be little to no additional contribution to increased GHG emissions for this particular operational activity.

GHG emissions associated with Project construction, site-specific maintenance activities during operation will increase provincial and Canadian GHG emissions, and contribute permanently to global cumulative GHG emissions, therefore, the spatial boundary is international, the impact balance negative, the residual effect is irreversible and the duration is long-term since emissions will occur for the operational life of the Project. The residual effect is periodic, occurring as a result of the use of vehicles and equipment during construction and site-specific maintenance activities. The probability for the emissions occurring is high and the confidence in the assessment is high. The magnitude of the emissions is rated as low since the contribution to provincial emissions will be small and not reportable. Therefore, the potential residual effect is considered to be not significant (Table 6.2.5-2, point [a]).

6.2.5.4 Summary

As identified in Table 6.2.5-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on GHG emissions of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of construction and operations of the replacement pipeline on GHG emissions will be not significant.

6.2.6 Acoustic Environment

6.2.6.1 Context

The acoustic environment will vary based on the level of development and geography along the replacement pipeline route. Human developments, the presence of infrastructure, the amount of foliage and weather all influence sound level in the outdoor environment. It is normal for sound levels to fluctuate over the course of a day or night, with the amount and timing of those fluctuations being influenced by the local sources of sound.

Project construction will result in increased noise levels in the LSA as a result of the operation of equipment and vehicles. Site-specific maintenance activities (e.g., regular patrols of the ROW) may result in minor increases in noise along the replacement pipeline route during operations.

Applicable provincial noise guidelines include the MOECC NPC-115 – Construction Equipment and NPC-119 – Blasting. These two guidelines are part of the Model Municipal Noise Control Bylaw (MOE 1978). Construction activities are often regulated at the municipal level through bylaws such as the City of Hamilton Bylaw 11-285, which limits construction activities to certain days of the week and hours of the day. NPC-115 stipulates the maximum noise emission rating for construction equipment and NPC-119 stipulates the maximum air and ground vibration limits. The MOECC does not specify any limits for construction noise levels at points of reception, but it does require the use of good practices be implemented to reduce noise impacts, which Enbridge is committed to.

6.2.6.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with construction and operations of the replacement pipeline on the acoustic environment were identified by the assessment team based on relevant noise bylaws and consultation with stakeholders including landowners along the replacement pipeline route and are listed in Table 6.2.6-1.

Landowners along the replacement pipeline route expressed concerns regarding nuisance noise during construction and operations.

No further concerns have been raised to date. Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes. Nuisance noise on livestock is assessed in Section 6.2.12.

Enbridge will ensure that construction activities will be in compliance with the City of Hamilton Noise Control Bylaw 11-285 (City of Hamilton 2011c).

Table 6.2.6-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on the Acoustic Environment

	Potential Effect	Spatial Boundary /Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0	Noise during construction	• LSA • Entire route	• Take reasonable measures to control construction-related noise near residential areas. Alter equipment, erect noise barriers or change the work schedule if excessive noise becomes a nuisance to nearby residents. • Ensure that noise abatement equipment (e.g., mufflers) on machinery is in good working order. Where practical, turn off Turn off equipment when not in use. Enclose noisy equipment, as needed, to limit the transmission of noise beyond the construction-site. Locate stationary equipment, such as compressors and generators, away from noise receptors. Replace or repair equipment parts generating excessive noise, if practical. • Schedule construction activities near residential areas or community facilities (e.g., golf courses, parks) during the period from 7 AM to 7 PM, or in accordance with applicable noise bylaws or approval conditions. Note that some construction activities, once started, must continue on a 24 hour basis (e.g., an HDD may be continuous until completion). In the event of afterhours noise during construction (e.g., potential use of generators at HDD sites), Enbridge will ensure affected landowners are notified in advance and any required approvals are obtained.	• Increase in nuisance noise during construction
2.0	Noise during operation	• LSA • Entire Route	• Schedule activities near residential areas or community facilities (e.g., golf courses, campgrounds or parks) during the period from 7 AM to 7 PM, or in accordance with applicable noise bylaws or approval conditions. • Ensure that noise abatement equipment (e.g., mufflers) on machinery is in good working order. Turn off equipment when not in use. Enclose noisy equipment, as needed, to limit the transmission of noise beyond the construction-site. Locate stationary equipment, such as compressors and generators, away from noise receptors. Replace or repair equipment parts generating excessive noise, if practical.	• Increase in noise levels during site-specific maintenance activities

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.6.3 Residual Effects Characterization and Significance Determination for Acoustic Environment

With the exception of periodic inspection and maintenance, no additional noise sources are anticipated as a result of operation activities. There are no stationary noise sources planned as part of the Project, such as metering or pump stations and construction noise is expected to be localized to the area of the activity. As a result, a qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on the acoustic environment. This qualitative assessment relied on available research literature and the professional judgement of the assessment team.

Table 6.2.6-2 provides a summary of the significance evaluation of the potential residual environmental effects of construction and operations of the replacement pipeline on the acoustic environment. The rationale used to evaluate the significance of each of the residual environmental effects is provided below, with the exception of impact balance which is considered negative for all potential residual effects on the acoustic environment. All assessment criteria were considered in the significance determination for the acoustic environment but the most influential were magnitude and reversibility.

Table 6.2.6-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on the Acoustic Environment

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Increase in nuisance noise during construction	LSA	Short-term	Isolated	Reversible	Medium	High	High	Not significant
(b) Increase in noise levels during site-specific maintenance activities	LSA	Immediate to Short-term	Periodic	Reversible	Low	High	High	Not significant

Increase in Nuisance Noise during Construction

Noise arising from construction activities will occur along the entire replacement pipeline route and this residual effect is considered to have a negative impact balance. However, the residual effects of an increase in nuisance noise will be limited to areas in proximity to human receptors (e.g., permanent residences). While the duration of construction of the replacement pipeline route will be approximately one year, the linear progression of pipeline construction results in a much shorter duration of concentrated construction activity at any given location. It is expected that the average duration that crews will be working at a given location on the construction ROW is approximately 2 weeks per month. Scheduling hours of work in accordance with best management practices for noise control will reduce nuisance noise concerns. In addition, construction equipment and vehicles will be equipped with noise abatement equipment (e.g., mufflers). There may be some situations where after hours noise such as generators, HDD or pumps may be used. Affected landowners will be notified in advance and consulted prior to any activities of this type. The residual effect of construction noise on nearby residents or other users (e.g., recreational users) is of low magnitude and reversible and is therefore considered to be not significant (Table 6.2.6-2, point [a]). The potential effect of construction noise on wildlife is discussed in Section 6.2.10 and the effect of nuisance noise during construction on human health is discussed in Section 6.2.16.

Increase in Noise Levels during Site-Specific Maintenance Activities

Similar to noise during construction, noise resulting from periodic site-specific maintenance will be limited to the same receptors in close proximity to the replacement pipeline. As noted in Section 5.0, the Project is not anticipated to result in an increase in noise emissions during operations aside from occasional site-specific maintenance. During operations of the replacement pipeline, Enbridge will integrate the patrol of the replacement pipeline route within its ongoing program for there to be little to no additional Project contribution to increase noise for this particular operational activity. Noise associated with other maintenance and operation activities, including vegetation management and maintenance digs, will occur as needed over the life of the pipeline. The residual effect of noise due to site-specific maintenance activities is reversible, depending upon how long the maintenance activity extends, and is of low magnitude and is therefore considered to be not significant (Table 6.2.6-2, point [b]).

Combined Effects on Acoustic Environment

An evaluation of the combined effects considers those residual effects that are likely to occur. Since the two residual effects associated with acoustic environment are mutually exclusive, it would not be feasible for these effects to occur at a particular location at the same time. Consequently, an evaluation of combined effects of the pipeline on acoustic environment is not warranted.

6.2.6.4 Summary

As identified in Table 6.2.6-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on the acoustic environment of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of pipeline construction and operation on the acoustic environment will be not significant.

6.2.7 Fish and Fish Habitat

6.2.7.1 Context

The replacement pipeline route crosses portions of the West Spencer Creek subwatershed within the Spencer Creek watershed, Big Creek subwatershed within the Grand River watershed, the Upper Welland River subwatershed within the Welland River watershed, and the Twenty Mile Creek watershed. Although Westover Creek is not crossed by the replacement pipeline route, portions of this watercourse lie within the LSA.

There are 69 proposed watercourse crossings along the replacement pipeline route. Aquatic habitat assessments were conducted at 64 watercourse crossings between June 3 and August 21, 2013. Due to land access constraints, assessments were not conducted at the remaining five locations (i.e., WC18, WC36, WC37, WC39 and WC40). As described in Section 10.0, a supplemental aquatic habitat survey will be conducted in 2016 at these crossings, if landowner access is obtained. A summary of the proposed watercourse crossings is provided in Appendix 4.

Fish communities vary along the replacement pipeline route according to geographic location and size of the watercourses. Fish communities along most of the route are coolwater assemblages (e.g., percids and esocids) and warm water assemblages (e.g., ictalurids and centrarchids). Many of the smaller watercourses crossed by the replacement pipeline route are ephemeral or intermittent. Fish species that may occur within the Aquatics RSA, their respective designations, and spawning seasons are provided in Appendix 4.

Fish and fish habitat sensitivity for all species is generally highest during spawning, egg incubation and emergence, and at other times when fish concentrate in spatially restricted habitats (e.g., winter). During the spawning and emergence period, fish require suitable habitat, including clean, well-oxygenated water which is when eggs and fry of some species can be particularly susceptible to the effects of sedimentation. Overwintering habitat in flowing waters for many species often occurs in large, deep pools and runs with suitable substrates and dissolved oxygen levels, and areas warmed by groundwater inflow, as opposed to locations that encounter adverse ice conditions.

6.2.7.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with construction and operations of the replacement pipeline on fish and fish habitat were identified by the assessment team, based on past experience, relevant fisheries management plans and watershed plans, and from consultation with stakeholders including government agencies and Aboriginal groups along the replacement pipeline route.

Concerns regarding fish and fish habitat that were identified by Aboriginal groups during the engagement process include increased sediment concentrations at watercourse crossings, which is considered in the assessment for the potential effect regarding the alteration of instream habitat function in Table 6.2.7-1.

There were no concerns specific to fish and fish habitat identified by landowners along the replacement pipeline route during the consultation process.

Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

Mitigation measures to reduce the severity of potential effects of the replacement pipeline on fish and fish habitat are provided in Table 6.2.7-1. These measures were developed in accordance with several industry, provincial and federal regulatory guidelines including CAPP et al. (2012) and DFO (1995).

Fisheries management, watershed and stewardship action plans with objectives or goals relating to fish and fish habitat have been developed for areas along the replacement pipeline route and include:

- A Community-based Approach to Fisheries Management in the Grand River Watershed: Part A Grand River Fisheries Management Plan (Grand River Fisheries Management Plan Implementation Committee 2005);
- Grand River Watershed Management Plan (GRCA 2014);
- Hamilton Harbour and Watershed Fisheries Management Plan (Bowlby et al. 2009);
- Upper Welland River Watershed Plan (DRAFT) (NPCA 2011);
- Twenty Mile Creek Watershed Plan (Durley 2006);
- Westover Creek Watershed Stewardship Action Plan (HCA 2011a);
- West Spencer Creek Watershed Stewardship Action Plan (HCA 2011b); and
- Middle Spencer Creek Watershed Stewardship Action Plan (HCA 2011c).

Details regarding the objectives or goals relating to fish and fish habitat in the Project area are provided in Appendix 2B.

With the successful implementation of the key mitigation measures (Table 6.2.7-1), it is anticipated that the Project’s environmental protection efforts will be aligned with the goals or objectives of the plans related to protection, management and recovery efforts, and will not result in any issues pertaining to fish and fish habitat sustainability (see Appendix 2B for detailed goals or objectives).

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration or loss of riparian habitat function	• Footprint • Watercourse crossings	**General** • Ensure all necessary approvals, licences and permits required for a particular activity or construction site prior to the commencement of the applicable activity or construction at that site have been obtained. **Clearing and Grading** • Prevent or control soil erosion and water siltation immediately and proactively to the satisfaction of the Environmental Inspector or Enbridge designate. Make available sufficient personnel and equipment to control erosion when warranted (see the Soil Erosion Contingency Measures, Siltation of Watercourses or Wetlands Contingency Measures, and Adverse Weather Contingency Plan for Watercourse Crossings in the EPP[1]). • Maintain the watercourse setback buffer distance in the vicinity of watercourse and wetland crossings to the removal of trees and shrubs along the trench line and work side area needed for the vehicle crossing to protect riparian areas. Following brushing, the low-lying understory vegetation is to remain intact. Reduce disturbance of soil adjacent to wetlands. • Delay grading, if practical, on the approach slopes to watercourses until immediately prior to the commencement of construction of the crossing. • Install temporary berms on approach slopes to watercourses and wetlands, and erect silt fence or an equivalent temporary erosion/sediment control device (e.g., land owner approved hay bales, coir logs) near the base of approach slopes to watercourses and wetlands immediately following grading. Monitor the temporary erosion control structures on a regular basis and repair, if warranted. Bank and Riparian Restoration • Unless required as the result of an engineer's recommendation, avoid the use of rock rip-rap and use alternative methods to protect banks, such as, however, not limited to: hedge/brush layering, and live willow/shrub staking. • Seed disturbed areas of the construction ROW, except for watercourses or wetlands, as soon as practical after topsoil replacement and weather and soil conditions permit.	• Alteration or loss of riparian habitat function resulting from construction • Alteration or loss of riparian habitat function resulting from maintenance and operation • Alteration or loss of riparian function resulting from spills during construction or maintenance (see Section 6.7 for a discussion of pipeline leaks or failure during operations)

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration or loss of riparian habitat function (cont'd)	See above	**Spill Prevention** • Review and adhere to the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]) and the Enbridge Waste Management Plan (Enbridge 2014) to avoid contaminant introduction during construction. • Maintain equipment in good working condition and ensure that equipment and vehicles are free of leaks. • Do not store fuel tanks, containers or stationary equipment within the normal high water mark of a watercourse or wetland, unless otherwise indicated. If this is not feasible, secondary containment must be provided regardless of container size. If the fuel tank is double-walled, tertiary containment must be provided. Fuel storage areas, pumps, generators and other sources of deleterious substances must be within a containment system of sufficient capacity to ensure that deleterious substances do not enter fish habitat. Appropriate spill kits will be kept at fuel or hazardous materials storage, refuelling and maintenance or refuelling service vehicles. • Ensure that bulk fuel trucks, service vehicles and pick-up trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency material on bulk fuel and service vehicles that is suitable for use on land and water (e.g., sorbent pads and sorbent boom). • Immediately implement the Fuels and Hazardous Materials Contingency Plan to be appended to the EPP[1]) in the event of a spill.	See above
2.0 Alteration or loss of instream habitat function	• LSA • Watercourse crossings	**General** • Ensure all necessary approvals, licences and permits required for a particular activity or construction site prior to the commencement of the applicable activity or construction at that site have been obtained.	• Alteration of instream habitat at trenched crossings resulting from construction

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Alteration or loss of instream habitat function (cont'd)	See above	• Prevent or control soil erosion and water siltation immediately and proactively to the satisfaction of the Environmental Inspector or Enbridge designate. Make available sufficient personnel and equipment to control erosion when warranted (see the Soil Erosion Contingency Measures, Siltation of Watercourses or Wetlands Contingency Measures and Adverse Weather Contingency Plan for Watercourse Crossings, to be appended to the EPP[1]). • Monitor the temporary erosion control structures on a regular basis and repair, if warranted. Conduct repairs immediately if erosion into a waterbody is imminent. • Do not wash equipment or machinery in watercourses or wetlands. Control wastewater from construction activities, such as equipment washing or concrete mixing, to avoid discharge directly into any body of water. • Refer to mitigation measures pertaining to spill prevention, containment, and clean-up in Water Quality and Quantity Table 6.2.3-1 (Section 6.2.3). Trenched Crossing Technique • Construct watercourse crossings in accordance with applicable existing provincial and federal guidelines and mitigation measures recommended in the *Fisheries Act* self-assessments, as well as the conditions of the Fisheries Act Authorization, if applicable. • Abide by applicable instream restricted activity timing windows. No instream construction activity will occur within the instream restricted activity timing windows at any watercourse, unless the watercourse is dry or frozen to the bottom at the time of construction or approval has been granted by the qualified fish biologist and the appropriate regulatory agency.	• Alteration of instream habitat at trenched crossings resulting from maintenance and operations • See Section 6.7 Accidents and Malfunctions for discussion of inadvertent release of HDD mud during construction • Alteration of instream habitat function within the zone of influence (ZOI) from sediment deposition resulting from instream construction and erosion from the construction ROW • Alteration of instream habitat function resulting from spills during construction or operations

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Alteration or loss of instream habitat function (cont'd)	See above	• A water quality monitoring plan should be developed and implemented by a qualified fisheries biologist to coincide with instream activities at sites with potential to support species at risk. Turbidity levels and total suspended solids (TSS) concentrations should not exceed guidelines provided by the CCME (2007). A qualified fisheries biologist should be on-site during construction to ensure regulatory compliance and to provide environmental protection advice to an Environmental Inspector of Enbridge designate, as required. • Ensure that pump intakes avoid or reduce disturbance to the streambed and are screened with a maximum mesh size of 2.54 mm as per the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995). Ensure the screens are free of debris. • Retain backup equipment (e.g., pumps and generators) on-site and ready to use immediately in the event that any operating equipment fails during crossing activities. Ensure maintenance of downstream flow (in terms of quantity and quality) at all times when constructing an isolated crossing. • Implement the Siltation of Watercourses or Wetlands Contingency Plan to be appended to the EPP[1]) in the event that siltation is occurring. • Salvage any fish from between the dams. Dewater the segment of the watercourse between the isolation structures, if feasible and safe to do so. Pump any silt-laden water out from between the dams onto stable surfaces in a manner that does not cause the erosion of soils, sedimentation of watercourses or where icing will not be a problem. • Recontour the streambed to approximate the pre-construction profile and channel configuration to ensure that flow patterns are unaltered. Watercourses are not to be realigned or straightened in any way nor have their hydraulic characteristics changed. • Unless required as the result of an engineer's recommendation, avoid the use of rock rip-rap and use alternative methods to protect banks, such as, however, not limited to: hedge/brush layering, and live willow/shrub staking.	See above

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Alteration or loss of instream habitat function (cont'd)	See above	• Backfill with native material/washed gravel immediately after lowering-in. Cap the upper portion of the trench (e.g., approximately 50 cm) with the salvaged upper substrate material, if present. Where there is not sufficient native material or where the salvage and replacement of the native granular material is not practical, backfill the upper portion of the trench (e.g., approximately 50 cm) with clean, coarse, non-native granular material (gravel to cobble). Ensure that any imported backfill material is obtained from above the average high watermark of any watercourse and obtain approval from the Environmental Inspector or Enbridge designate and the land authority prior to obtaining granular material from any location off the construction ROW. **<u>Vehicle Crossings</u>** • Adhere to measures related to the vehicle crossing techniques identified in the EPP[1]. Ensure that the crossing is installed as per the notifications provided to the local CA. • Construct all bridges (single span bridges, or equivalent) beyond the ends of the banks in a manner that protects the banks from erosion. Do not place fill within the primary banks of a watercourse during bridge abutment construction, unless otherwise approved by the appropriate regulatory authority and in accordance with notification provided to the local CA. • Install and maintain erosion control measures (e.g., coir matting, coir logs, silt fences, temporary berms, rollback), if warranted, following installation of the temporary vehicle crossing to reduce the risk of erosion during the period that the vehicle crossing will be in place. • Withdraw no more than 10% of the instantaneous stream flow at any given time if water extraction is necessary for the construction of a temporary crossing. Screen water intakes with a maximum mesh size of 2.54 mm and ensure the intake complies with the Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995). Ensure that appropriate approvals have been obtained for water withdrawal, if necessary. Ensure secondary screening supplies are on-site in the event that the primary screens are damaged and/or are not effectively operating.	See above

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Alteration or loss of instream habitat function (cont'd)	See above	**Hydrostatic Testing** • Conduct all hydrostatic testing activities in accordance with the *NEB OPR*, provincial regulations as well as the latest version of CSA Standard Z662-15. • Follow all conditions of provincial and federal approvals, if applicable during hydrostatic testing. Ensure that water withdrawal rates and volumes do not exceed those specified in the respective approval/notification. Follow all applicable notification, sampling and reporting requirements as identified in the approval/notification conditions for the withdrawal and discharge of hydrostatic test water. • Do not exceed permitted withdrawal rates or 10% of the instantaneous flow or volume of the water source, unless otherwise approved by provincial and, when applicable, federal authorities. • Take all reasonable measures to abide by the instream restricted activity timing window of the withdrawal source as well as provincial or federal approval conditions. • Ensure that the appropriate testing and treatment measures (e.g., filtering) are implemented in accordance with the applicable provincial notification/approval if test water is released into a natural waterbody. If hydrostatic test water is to be discharged onto land, obtain soil chemistry analysis, if required, prior to discharging.	See above
3.0 Fish and freshwater mussel mortality or injury	• RSA • Watercourse crossings • Hydrostatic test source/ release locations	**Watercourse Crossings** • Assign a qualified fish biologist to salvage fish from the isolated area prior to and during dewatering where isolated crossing techniques are used. Fish salvage activities will need to be conducted in accordance with applicable approvals. Provide the fish and freshwater mussel salvage team with the appropriate amount of notice prior to the start of crossing construction. • Take all reasonable measures to abide by applicable instream restricted activity timing windows. No instream construction activity will occur within the instream restricted activity timing windows at any watercourse, unless the watercourse is dry or frozen to the bottom at the time of construction or approval has been granted by the qualified fish biologist and the appropriate regulatory agency.	• Fish mortality or injury due to construction activities • Fish mortality or injury due to maintenance during operations • Fish mortality or injury due to increase in suspended solids within the ZOI during construction of trenched crossings and vehicle crossings

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Fish and freshwater mussel mortality or injury (cont'd)	See above	• Ensure that pump intakes avoid or reduce disturbance to the streambed and are screened with a maximum mesh size of 2.54 mm as per the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995). Ensure the screens are free of debris. • Implement the Siltation of Watercourses or Wetlands Contingency Plan (to be appended to the EPP[1]) in the event that siltation is occurring. • A water quality monitoring plan should be developed and implemented by a qualified fisheries biologist to coincide with instream activities at sites with potential to support species at risk. Turbidity levels and TSS concentrations should not exceed guidelines provided by the CCME (2007). A qualified fisheries biologist should be on-site during construction to ensure regulatory compliance and to provide environmental protection advice to an Environmental Inspector of Enbridge designate, as required. • Assess for the presence of freshwater mussels within the construction ROW prior to the commencement of crossing construction by visual examination of the bed (if water clarity conditions allow) and banks of the watercourse. • Should freshwater mussels be encountered during crossing construction, relocate the mussels to suitable habitat. Consult an aquatic resource specialist for proper mussel handling and relocation procedures to avoid injury and/or mortality. • Do not disturb or relocate freshwater mussels when water temperatures are less than 16°C. Limit exposure of mussels to air, (i.e., maximum exposure 15 to 60 minutes). • If construction will occur during seasons when water temperatures are expected to be less than 16°C, survey crossing locations prior to September to determine presence of freshwater mussels and relocate mussels at water temperatures of 16°C or higher. • Implement the applicable measures from the Fish Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) should freshwater mussel species of concern be discovered during construction.	• See Section 6.7 Accidents and Malfunctions for discussion of inadvertent release of HDD mud during construction • Fish mortality or injury due to increase in suspended solids within the ZOI due to maintenance during operations • Injury or mortality to freshwater mussels due to increase in suspended sediment concentrations during construction or operations • Fish and freshwater mussels mortality or injury resulting from spills during construction or maintenance • See Section 6.7 for a discussion of a leak or failure of the pipeline during operations • No potential residual effect identified for fish mortality or injury related to increased access during operations

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Fish and freshwater mussel mortality or injury (cont'd)	See above	<u>**Hydrostatic Testing**</u> • Screen test-water intakes (maximum mesh size of 2.54 mm) at all intake sources, including non-fish bearing sources, in accordance with the DFO screening requirements (DFO 1995) to prevent the entrapment of fish, amphibians, wildlife and the intake of debris. Ensure pump intakes do not disturb the streambed and the approach velocity does not cause the entrainment or entrapment of fish. Ensure secondary screening supplies are on-site in the event that the primary screens are damaged and/or are not effectively operating. • Ensure that test water withdrawn from one drainage basin will not enter surface waters in another drainage basin to prevent inter-basin transfer of aquatic organisms or diseases. Ensure that pigs and other testing equipment are properly loaded in the pipe to allow the test water to be discharged at the intended location. • Ensure that test water containing chemical additives is sampled and, if warranted, treated and discharged or collected in accordance with applicable provincial and federal requirements. • See item 2 of this table for additional hydrostatic testing mitigation measures. Other • Recreational fishing by Project personnel on or in the vicinity of the construction ROW, associated Project facility sites and use of the construction ROW by Project personnel to access fishing is prohibited. • All temporary construction access roads and shoo-flies will be reclaimed to their pre-construction conditions. Newly created access points will be blocked, unless otherwise directed by Enbridge or the landowner and occupant. • Efforts to control off-road vehicle use will be coordinated with government authorities and landowners, and will be conducted until the construction ROW has been satisfactorily reclaimed. Methods to control will include posting of appropriate signs or barriers at all points of access. • See item 1 of this table for spill prevention measures to avoid fish and freshwater mussel mortality or injury.	See above

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
4.0 Interbasin transfer of aquatic organisms	• Aquatics RSA • Watercourse crossings • Hydrostatic test source/release locations	• Ensure equipment used during the installation of pipeline and vehicle crossings at watercourses is clean. Examine and clean all equipment and parts of equipment, including pumps that have been in contact with water, following completion of pipeline or vehicle crossing construction and prior to moving to other watercourse crossings ensure that the equipment does not transfer mud, debris, invasive plants or aquatic pests along the construction ROW. • Implement additional cleaning procedures where required by provincial permits following work at watercourses or watersheds where aquatic invasive species are known or suspected to be present. • Ensure that test water withdrawn from one drainage basin will not enter surface waters in another drainage basin. • Clean and disinfect fish salvage equipment (e.g., waders, boots, nets, and anything used to capture, hold or transfer fish) before using in any watercourse to prevent the potential spread of pathogens and/or invasive plant species. Ensure that washed-off mud and dirt is disposed of at a location that will prevent the reintroduction of these untreated materials into a watercourse. • Determine the presence of any aquatic or riparian plants and pests prior to the commencement of construction activities within the riparian buffer. Notify the Contractor of any special measures to be implemented to prevent the transfer of these organisms from one watercourse to another.	• Introduction or spread of invasive aquatic organisms
5.0 Blockage of fish movements	• Aquatics RSA • Watercourse crossings	• Complete all instream activity within a reasonable period of time, having regard for the site-specific conditions, to limit the duration and severity of disturbance. Schedule crossing construction, to the extent practical, to complete trenching, lowering-in and backfill with continuous effort or to the satisfaction of the Environmental Inspector or Enbridge designate. • Ensure all necessary equipment and materials are on-site and ready for installation prior to commencing watercourse crossing construction. Complete pipe stringing, welding, pre testing (if necessary), coating and weighting, if warranted, prior to the commencement of instream construction.	• Temporary blockage of fish movement during construction of isolated watercourse crossings

Table 6.2.7-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Fish and Fish Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Blockage of fish movements (cont'd)	See above	• Assign a qualified fish biologist to salvage fish from the isolated area prior to and during dewatering where isolated crossing techniques are used. Fish salvage activities will need to be conducted in accordance with applicable approvals. Provide the fish salvage team with minimum appropriate notice prior to the start of crossing construction. • Release captured fish to pre-determined areas of similar or better habitat where possible, preferably downstream of the work site. • Take all reasonable measures to abide by applicable instream restricted activity timing windows. No instream construction activity will occur within the instream restricted activity timing windows at any watercourse, unless the watercourse is dry or frozen to the bottom at the time of construction or approval has been granted by the qualified fish biologist and the appropriate regulatory agency. • Maintain the quantity and quality of stream flow, if present, throughout crossing construction. Trench through the watercourse after isolation is installed and operational, and maintain stream flow at all times. • Remove all vehicle crossing structures at watercourses prior to spring breakup, unless otherwise approved by the appropriate regulatory authority. Temporary vehicle crossings may be left in place through spring breakup if this is allowed by provincial regulatory requirements or is otherwise approved by provincial and federal authorities, and if the vehicle crossing has been designed to withstand high flows during spring breakup. Otherwise, remove the vehicle crossing prior to spring breakup and reinstall for use during final clean-up.	Temporary blockage of fish movement during construction of isolated watercourse crossings

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.7.3 Residual Effects Characterization and Significance Determination for Fish and Fish Habitat

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on fish and fish habitat, due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. This qualitative assessment relied on available research literature and the professional judgement of the assessment team.

The potential effects associated with fish and freshwater mussel mortality (e.g., fishing and off-road vehicle operation) due to increased access during operations were considered to be minimal since the replacement pipeline route will be constructed alongside and contiguous to an existing ROW or other linear disturbances for 69% of its length, is generally located on privately-owned or fee simple land with limited public access, and is located in an area with substantial access due to an extensive existing road network. Any remaining potential effects related to fish and freshwater mussel mortality due to increased access during operations are eliminated through successful implementation of mitigation measures (Table 6.2.7-1) and therefore, no residual effect has been identified.

A summary of the significance evaluation of the potential residual environmental effects of construction and operations of the replacement pipeline on fish and fish habitat is provided in Table 6.2.7-2. The rationale used to evaluate the significance of each of the potential residual environmental effects is provided below, with the exception of the impact balance, which is considered negative for all potential residual effects on fish and fish habitat. All assessment criteria were considered but the most influential were duration, magnitude, reversibility and probability.

Table 6.2.7-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Fish and Fish Habitat

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Alteration or loss of riparian habitat function resulting from construction	Footprint	Short to extended-term	Isolated	Reversible	Low	High	High	Not significant
(b) Alteration or loss of riparian habitat function resulting from maintenance and operation	Footprint	Short to extended-term	Occasional	Reversible	Low	Low	High	Not significant
(c) Alteration or loss of riparian habitat function resulting from spills during construction or operation	Footprint	Immediate to extended-term	Rare	Reversible	Low to high	Low	High	Not significant
(d) Alteration of instream habitat at trenched crossings resulting from construction	LSA	Short to medium-term	Isolated	Reversible	Low to medium	High	High	Not significant
(e) Alteration of instream habitat at trenched crossings resulting from maintenance during operations	LSA	Short to medium-term	Occasional	Reversible	Low to medium	Low	High	Not significant
(f) Alteration of instream habitat function within the ZOI from sediment deposition resulting from instream construction and erosion from the ROW	LSA	Short-term	Isolated	Reversible	Low	High	High	Not significant

Table 6.2.7-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Fish and Fish Habitat

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(g) Alteration of instream habitat function resulting from spills during construction or operation	Aquatics RSA	Short to long-term	Rare	Reversible	Low to high	Low	High	Not significant
(h) Fish mortality or injury due to construction activities or due to maintenance during operations	LSA	Short-term	Isolated to occasional	Reversible	Low to medium	Low	High	Not significant
(i) Fish mortality or injury due to increase in suspended solids within the ZOI during construction of trenched crossings and vehicle crossings	LSA	Short-term	Isolated	Reversible	Low to medium	Low	High	Not significant
(j) Fish mortality or injury due to increase in suspended solids within the ZOI due to maintenance during operations	LSA	Short-term	Occasional	Reversible	Low to medium	Low	High	Not significant
(k) Injury or mortality to freshwater mussels due to increase in suspended sediment concentrations during construction or operations	LSA	Short-term	Isolated to occasional	Reversible	Low to high	Low	Moderate	Not significant
(l) Fish and freshwater mussel mortality or injury resulting from spills during construction or operations	Aquatics RSA	Short to long-term	Rare	Reversible	Low to high	Low	High	Not significant
(m) Introduction or spread of invasive aquatic organisms	Aquatics RSA	Extended-term	Rare	Irreversible	High	Low	Moderate	Not significant
(n) Temporary blockage of fish movement during construction of isolated watercourse crossings	Aquatics RSA	Immediate to short-term	Isolated	Reversible	Low	High	High	Not significant
(o) Combined effects on fish and fish habitat during trenched crossings (Combined effects of [a] [d], [f] and [n])	Aquatics RSA	Short to extended-term	Isolated	Reversible	Low to medium	High	Moderate	Not significant

Alteration or Loss of Riparian Habitat Function Resulting from Construction

Riparian vegetation within the construction ROW and temporary workspace will be disturbed at all trenched (i.e., isolated or open-cut) watercourse crossings and watercourses where a temporary vehicle crossing will be installed. The impact balance of this residual effect is considered to be negative. During construction, disturbance of riparian vegetation will be kept to a minimum leaving as much existing vegetation intact as practical and efforts to control erosion and sedimentation in disturbed areas will be implemented. Disturbed riparian areas will be seeded following construction with the appropriate native seed mix and a quick-establishing cover crop where appropriate. Revegetation plans and associated mitigation are presented in Table 6.2.7-1 and will be included in the Project-specific EPP.

Similar mitigation was implemented in 2009 following construction of the Enbridge ACEP. PCEM was conducted for all crossing sites. Revegetation was not immediately successful at every crossing, however, of 93 watercourse crossings on the route (TERA Environmental Consultants 2007), all but 2 sites were successfully revegetated after 4 years (TERA Environmental Consultants 2014b).

Results of the PCEM for the Southern Lights Project showed all watercourse crossing sites successfully revegetated after 5 years, while PCEM for the L4EP in 2009 indicated that riparian vegetation had been restored at all five watercourse crossings after 1 year (TERA Environmental Consultants 2009). Riparian revegetation measures similar to those applied for Enbridge ACEP, Southern Lights Project and L4EP will be applied for the replacement pipeline route.

Although the residual effect of pipeline construction on clearing riparian vegetation is of high probability, it is of low magnitude, and, consequently, not significant (Table 6.2.7-2, point [a]).

Alteration or Loss of Riparian Habitat Function Resulting from Maintenance during Operations

Routine vegetation control along the construction ROW during operations will exclude riparian areas. However, a situation may occur during the life of the pipeline where riparian vegetation disturbance may be necessary to accommodate maintenance activities (e.g., in the event of a flood that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). In such cases, riparian vegetation would be removed above ground but grading would not occur. The residual effect is considered to be similar to that which occurs during construction but is expected to be on a smaller scale and with less frequency. The residual effect of clearing riparian vegetation during operation of the replacement pipeline is considered to be of low magnitude and low probability and, consequently, not significant (Table 6.2.7-2, point [b]).

Alteration or Loss of Riparian Function Resulting from Spills during Construction or Operations

Despite best intentions, small-scale spills into water are possible during construction and site-specific maintenance activities when there are multiple vehicles and equipment on site, and this is the nature of spills assessed in this section. See Section 6.7 for a discussion related to a leak or failure of the pipeline during the operations phase.

In addition to the direct effects on riparian vegetation from a large spill such as a fuel truck rollover and spill in a riparian area, clean-up and reclamation measures are likely to result in riparian habitat disturbance. The potential adverse residual effects may be of low to high magnitude, depending upon the volume of the spill and the sensitivity of the receiving environment. During the construction of the Enbridge ACEP, the Spill Contingency Plan was implemented to deal with spot spills occurring during construction. All spills or accidental releases of potentially harmful materials (i.e., oil or diesel fuel) were recorded. Every machine was equipped with a spill kit that included absorbent pads. Spills and leaks were cleaned up immediately using on-site resources or using hydrovac trucks to clean up contaminated material. The fuelling and equipment maintenance buffer was enforced at all watercourses and no spills occurred within a waterbody (Enbridge 2009). These measures were effective in preventing the contamination of watercourses due to spills during construction. Similar mitigation measures are planned for the construction of the replacement pipeline.

Since large spills rarely occur within the construction ROW during construction and maintenance activities, and occur even more rarely in riparian habitat, the probability of a significant adverse residual effect is low and, consequently, the potential residual effect is not significant (Table 6.2.7-2, point [c]).

Alteration of Instream Habitat at Trenched Crossings Resulting from Construction

The proposed crossing techniques have taken into consideration the sensitivity of the watercourses, including habitat characteristics, fish species present and instream restricted activity timing windows in addition to the construction schedule and technical and economic feasibility of each crossing. Instream habitat may be affected directly by construction activities or indirectly by deposition of sediment from the construction site onto downstream fish habitat. The potential residual effects associated with downstream deposition of sediments originating from the watercourse crossing and the construction ROW are addressed in the subsection Alteration or Loss of Instream Habitat Function within the ZOI from Sediment Deposition Resulting from Instream Construction and Erosion from the ROW.

During construction of Enbridge's ACEP in 2009, an open-cut crossing of Eagle Creek was carried out under frozen conditions in winter. The watercourse was frozen to the bottom and, therefore, isolation was not required. The crossing was recontoured and seeded with native grass seed and silt fence was installed. Revegetation was successful and there were no outstanding issues within 2 years following construction (TERA Environmental Consultants 2011b).

An isolated, open-cut crossing of Little Pipestone Creek was constructed in September 2009 as part of Enbridge's ACEP. Approximately 2,000 fish (e.g., creek chub, brook stickleback and fathead minnow) were successfully removed from the isolated area and relocated. The bed and banks were reshaped and erosion control was installed. Additional silt fences and berms were installed in 2010. Inspection in 2011 showed that revegetation was successful and there were no outstanding issues (TERA Environmental Consultants 2011b).

The implementation of the recommended mitigation measures in accordance with the DFO Self-Assessment and Measures to Avoid Harm will reduce the severity of effects on instream habitat and the potential for serious harm to fish, pursuant to Section 35(1) of the *Fisheries Act*. DFO self-assessments were conducted for all watercourses crossed by the replacement pipeline route (see Appendix 4). As needed, a Section 35(2) authorization from DFO will be applied for and appropriate offsetting measures developed to ensure compliance with the requirements of the *Fisheries Act*. The potential residual effects of the alteration of instream habitat at trenched crossings are expected to be reversible and within regulatory standards and, consequently, of low magnitude. In the event that serious harm to fish is determined and offsetting measures are implemented, the potential residual effect will be of medium magnitude. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [d]).

Alteration of Instream Habitat at Trenched Crossings Resulting from Maintenance during Operations

During operations, a situation may occur where instream disturbance is necessary to accommodate maintenance activities (e.g., in the event of a flood event that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). The residual impact is similar to that which occurs during construction, but expected to be on a smaller scale and less frequent. The residual effect of alteration of instream habitat during operations is considered to be of low to medium magnitude, reversible and is of low probability and, consequently, the potential residual effect is not significant (Table 6.2.7-2, point [e]).

Alteration of Instream Habitat Function within the Zone of Influence from Sediment Deposition Resulting from Instream Construction and Erosion from the Construction Right-of-Way

An evaluation of increased suspended solids concentrations during instream construction is provided in Section 6.2.3. The introduction of fine sediment to watercourses from instream activities and construction ROW runoff and erosion can cause downstream sediment deposition that alters substrate composition and modifies the availability and suitability of habitat for spawning, overwintering and rearing of fish (Anderson et al. 1996, Newcombe and MacDonald 1991).

Turbidity will be visually monitored during instream construction activities to provide an indication of suspended sediment levels. As needed, suspended sediment concentrations will be monitored during instream activities at isolated crossings of watercourses having the potential to support fish species of commercial, recreational or Aboriginal interest (if identified during ongoing engagement) to confirm that sediment events caused by construction activities remain below the CCME standard of 25 mg/L above baseline (CCME 2007). Monitoring, combined with appropriate corrective actions, will ensure that suspended sediment concentrations remain within CCME guidelines. Through the selection of appropriate watercourse crossing techniques and vehicle crossing methods, and the implementation of surface erosion controls and riparian area revegetation as outlined in Section 6.2.3, the potential for elevated levels of suspended sediment and associated adverse effects on instream habitat from sediment deposition downstream of watercourse and temporary vehicle crossings along the replacement pipeline route is reduced. In addition, any sediment that may be deposited onto instream habitat is expected to be flushed from the system following the first spring freshet or high flow event following construction.

The residual effects of the alteration of instream habitat within the ZOI from sediment deposition resulting from instream construction and erosion from the construction ROW are of low magnitude and reversible. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [f]).

Alteration of Instream Habitat Function Resulting from Spills during Construction or Operation

Despite best intentions, small-scale spills into water are possible during construction and site-specific maintenance activities when there are multiple vehicles and equipment on site, and this is the nature of spills assessed in this section. See Section 6.7 for a discussion related to a leak or failure of the replacement pipeline during the operations phase.

In the event of a large spill such as a fuel truck rollover or a pipeline spill in a riparian area or watercourse, the adverse residual effects on instream habitat may be of low to high magnitude, depending upon the volume of the spill and the sensitivity of the receiving environment. During the construction of Enbridge's ACEP, the Spill Contingency Plan was implemented to deal with spot spills occurring during construction. All spills or accidental releases of potentially harmful materials (e.g., oil or diesel fuel) were recorded. Every machine was equipped with a spill kit that included absorbent pads. Spills and leaks were cleaned up immediately using on-site resources or using hydrovac trucks to clean up contaminated material. The fuelling and equipment maintenance buffer was enforced at all watercourses and no spills occurred within a waterbody (Enbridge 2011a-i). These measures were effective in preventing the contamination of watercourses due to spills during construction. Similar mitigation measures are planned for the construction of the replacement pipeline.

Since large spills rarely occur within the construction ROW during construction and maintenance activities, and occur even more rarely in riparian or instream habitat, the probability of a significant adverse residual effect is low and, consequently, the potential residual effect is not significant (Table 6.2.7-2, point [g]).

Fish Mortality or Injury Due to Construction Activities or Due to Maintenance during Operations

Some construction activities may lead to an increase in fish mortality or injury. Water withdrawal at or near the water crossings may cause sublethal or lethal effects on fish from entrainment or impingement. Efforts to remove fish from isolated areas prior to construction may contribute to fish injury and lead to increased fish mortality. Removing fish from the water for even short periods of time during cold temperatures (e.g., -20°C) has the potential to compromise fish health (e.g., the potential for freezing injury to fish increases if fish are held out of the water for more than a few seconds during salvage and transfer). Under non-frozen conditions, fish rescue during watercourse construction is unlikely to result in injury or mortality to fish.

During operations, a situation may occur where instream disturbance is necessary to accommodate maintenance activities (e.g., in the event of a flood that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). Subsequent construction activities could lead to an increase in fish mortality or injury.

With the successful implementation of the recommended mitigation measures, the potential residual effect of construction activities or operations or the replacement pipeline on fish mortality and injury is considered reversible, is of low to medium magnitude depending upon the extent, timing and duration of a given construction or maintenance activity, and is of low probability. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [h]).

Fish Mortality or Injury Due to Increase in Suspended Solids within the Zone of Influence during Construction of Trenched Crossings and Vehicle Crossings

An evaluation of increased suspended solids concentrations during instream construction is provided in Section 6.2.3. Through the selection of appropriate watercourse crossing techniques and vehicle crossing methods, and the implementation of surface erosion controls and riparian area revegetation as outlined in Tables 6.2.3-1 and 6.2.7-1, the potential for adverse effects on aquatic systems along the route due to suspended solids in the water column is reduced.

Suspended sediment released at isolated crossings during instream activities could cause behavioural, sublethal (e.g., irritation of gill tissue) or lethal (e.g., suffocation of developing embryos) effects on fish within the ZOI (Anderson et al. 1996, Newcombe and MacDonald 1991). Suspended sediment concentrations will, as needed, be monitored during instream activities at isolated crossings with potential to support fish populations of commercial, recreational or Aboriginal interest (if identified during ongoing engagement) to confirm that TSS averages remain below the CCME standard of 25 mg/L above baseline (CCME 2007). This is the level, based on 24 hours of exposure, when mortalities of the most sensitive life history stage begin to occur (Newcombe 1994). DFO (2000) has further identified risk levels to protect aquatic resources. The risk levels are determined based on the relationship between increasing suspended sediment concentrations and the level of risk that increasing sediment concentrations can have on fish and fish habitat. DFO (2000) indicates that concentrations <25 mg/L, 25-100 mg/L, 100-200 mg/L, 200-400 mg/L and >400 mg/L have very low, low, moderate, high and unacceptable risks, respectively. Additional background on these risk levels is discussed in Birtwell (1999).

Minor releases of sediment may be associated with use of the temporary vehicle crossings. Although elevated suspended sediment concentrations may result from instream construction and vehicle crossing use, pulses of suspended solids are generally expected to settle out of the water column within the ZOI in a time frame measuring from minutes to a few hours. Turbidity and TSS levels will be monitored during construction of crossings at fish-bearing watercourses to ensure that levels remain within CCME guidelines. Maintaining TSS levels within CCME guidelines will ensure that no mortalities from the effects of elevated suspended sediments will occur.

With the successful implementation of the recommended mitigation, the residual effect of increased suspended sediment concentrations on fish mortality or injury is considered reversible and of low to medium magnitude depending upon the extent and duration of the potential sediment release. The probability of increased fish mortality or injury due to an increase of suspended sediment within the ZOI during instream construction at trenched crossings is low since appropriate mitigation will be implemented to reduce levels of suspended sediment and, thereby, prevent fish mortality and injury. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [i]).

Fish Mortality or Injury Due to Increase in Suspended Solids within the Zone of Influence Due to Maintenance during Operations

During operations, a situation may occur where instream disturbance is necessary to accommodate maintenance activities (e.g., in the event of a flood that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). Subsequent maintenance activities could lead to an increase in suspended sediment in the ZOI which could result in fish mortality or injury (see previous section for a discussion of the effect of various levels of suspended solids on fish).

The residual effect is considered to be similar to that which occurs during construction, but is expected to be on a smaller scale and less frequent. Maintenance activities that involve in-water disturbance at fish-bearing watercourses will be monitored in a similar manner to construction activities to ensure adherence to CCME guidelines for turbidity and TSS. Maintaining TSS levels within CCME guidelines will ensure that no mortalities from the effects of elevated suspended sediments will occur. With the successful implementation of the recommended mitigation, the residual effect of increased suspended sediment concentrations on fish mortality or injury is of low to medium magnitude depending upon the extent and duration of sediment release and of short-term duration. The probability of increased fish mortality and injury due to an increase of suspended sediment during maintenance activities at trenched crossings with the ZOI is low since appropriate mitigation will be implemented to reduce levels of suspended sediment and, thereby, prevent fish mortality and injury. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [j]).

Injury or Mortality to Freshwater Mussels due to Increase in Suspended Sediment Concentrations during Construction or Operations

An increase in suspended sediments during instream construction activities may lead to injury or mortality to freshwater mussels. The introduction of fine sediment to watercourses from instream activities or construction ROW erosion can have sublethal (e.g., shell erosion) and lethal (e.g., smothering) effects on freshwater mussels. Additionally, the introduction of fine sediment can cause downstream sediment deposition that alters substrate composition and modifies the availability and suitability of habitat for freshwater mussel populations (Buendia et al. 2013, Watters 1999). Freshwater mussels are capable of temporarily varying their filtration capabilities to maximize energy gain when conditions change due to either natural (e.g., storms and waves) or human (e.g., instream construction) activities (Payne et al. 2011). Frequent turbulence (i.e., once per 30 minutes) and high concentrations of suspended sediment (600-750 mg/L) may substantially decrease freshwater mussel oxygen uptake, nitrogen elimination capabilities and food clearance rates (Watters 1999). These filtration adaptations vary, however, amongst mussel species (Payne et al. 2011) and prolonged suspended sediment or increases in suspended sediment may influence species richness within an area over time (Robertson et al. 2006). Due to their relative immobility, freshwater mussels are more susceptible to suspended sediments than fish (CCR Environmental Inc. 2011).

With the successful implementation of mitigation, the residual effects of increased suspended sediment concentrations on freshwater mussel mortality or injury are considered reversible and are of low to high magnitude depending upon the extent and duration of sediment release (Table 6.2.7-2, point [k]). The probability of increased freshwater mussel mortality and injury due to an increase of suspended sediment during construction, maintenance and operations is low since appropriate mitigation will be implemented to reduce levels of suspended sediment and, thereby, prevent mortality or injury to freshwater mussels. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [k]).

Fish and Freshwater Mussel Mortality or Injury Resulting from Spills during Construction or Operations

Despite best intentions, small-scale spills into water are possible during construction and site-specific maintenance activities when there are multiple vehicles and equipment on site, and this is the nature of spills assessed in this section. See Section 6.7 for a discussion related to a leak or failure of the pipeline during the operations phase.

Spills released at watercourse crossings with fish habitat potential or freshwater mussel populations could cause behavioural or sublethal/lethal effects on fish and mussels that may extend beyond the ZOI to the Aquatics RSA. Freshwater mussels are more susceptible to spills than fish due to their limited mobility. A large spill such as a fuel truck rollover in a riparian area or watercourse could cause increased fish and mussel mortality or injury, however, the proposed spill contingency and clean-up measures would reduce the magnitude and shorten the duration of the residual effects. Adverse residual effects on fish and freshwater mussel mortality or injury may be of low to high magnitude, depending upon the volume of the spill and the sensitivity of the receiving fish and/or freshwater mussel populations. For example, a large-volume spill directly into a fish-bearing watercourse could result in mortality of fish or mussel populations in the immediate area of the spill. During the construction of the Enbridge ACEP, the Spill Contingency Plan was implemented to deal with spot spills occurring during construction. All spills or accidental releases of potentially harmful materials (i.e., oil or diesel fuel) were recorded. Every machine was equipped with a spill kit that included absorbent pads. Spills and leaks were cleaned up immediately using on-site resources or using hydrovac trucks to clean up contaminated material. The fuelling and equipment maintenance buffer was enforced at all watercourses and no spills occurred within a waterbody (Enbridge 2011a-i). These measures were effective in preventing the contamination of watercourses due to spills during construction. Similar mitigation measures are planned for the construction of the replacement pipeline.

Since large spills rarely occur within the construction ROW during construction and maintenance activities, and occur even more rarely in riparian or instream habitat, the probability of an adverse residual effect is low and, consequently, the potential residual effect is not significant (Table 6.2.7-2, point [l]).

Introduction or Spread of Invasive Aquatic Organisms

Construction activities at the replacement pipeline route may lead to the introduction or spread of invasive aquatic organisms. Invasive species (e.g., zebra and quagga mussels, Didymo algae) threaten the health of aquatic ecosystems and are one of the primary reasons native species are becoming rare, threatened or endangered (Lui et al. 2010). Once invasive species have established they are difficult to eradicate, thus, avoiding accidental introduction is a key step in preventing damage to the ecosystem (Lui et al. 2010). Equipment used for instream activities (e.g., construction and personal use equipment and vehicles) has been linked to the transfer of invasive species to previously unaffected locations (DiVittorio et al. 2010). Accumulation of soil and mud, lodged plant or animal materials, or hidden foreign material can be sources of introduction or pathways for the spread of invasive species (DiVittorio et al. 2010). Keeping equipment free of mud, soil and vegetation prior to use in or adjacent to a watercourse or waterbody is one mitigation measure that is commonly used to reduce the potential for the introduction and spread of invasive species. Additionally, discharging hydrostatic test water (if used) into the same drainage basin from which it was withdrawn will mitigate the spread of invasive aquatic organisms.

During operations, a situation may occur where instream disturbance is necessary to accommodate maintenance activities (e.g., the result of a flood event that causes scouring over the pipeline trench that would require measures to restore depth of cover and pipe integrity). Subsequent instream activities could lead to the introduction or spread of invasive species, as discussed above.

The introduction or spread of invasive aquatic organisms is of extended-term duration, irreversible (the introduction of invasive aquatics species, if it occurs, will be permanent) and of high magnitude. However, the potential residual effect of construction activities or operations on the introduction or spread of invasive aquatic organisms is considered to be of low probability with the successful implementation of the mitigation measures outlined in Table 6.2.7-1. Consequently, the potential residual effect is considered to be not significant (Table 6.2.7-2, point [m]).

Temporary Blockage of Fish Movement during Construction of Isolated Watercourse Crossings

Localized blockage of fish movements may occur during instream construction activities. The impact balance of this potential residual effect is considered negative since it could affect the ability of fish species to migrate upstream or downstream of the crossings during spawning or feeding migrations. Permanent crossings for vehicles can create barriers to fish passage and contribute to habitat fragmentation for fish communities (Harper and Quigley 2000, Park et al. 2008, Scrimgeour et al. 2003), however, no new permanent vehicle crossings are associated with the construction of the replacement pipeline and, therefore, the replacement pipeline is not expected to contribute to habitat fragmentation for fish communities within the Aquatics RSA. During the open-water season, it is expected that vehicle access to sites will be by existing crossings or by temporary clear-span bridges. Under frozen conditions, vehicle access will be by existing crossings and inadvertent or clear-span bridges. The mitigation measures outlined in Table 6.2.7-1 will reduce the potential for blockage of fish movements by instream construction. The residual effect of the construction of the pipeline on blockage of fish movements is reversible, of immediate to short-term duration, and is of low magnitude and, consequently, the potential residual effect is not significant (Table 6.2.7-2, point [n]).

Combined Effects on Fish and Fish Habitat during Trenched Crossings

An evaluation of the combined effects considers only those residual effects that are likely to occur and, therefore, only potential residual effects (points [a], [d], [f] and [n] of Table 6.2.7-2) that are likely to occur, and could act in combination on fish and fish habitat, are evaluated.

The following potential residual effects are likely to act in combination to result in overall effects on fish and fish habitat during a trenched crossing:

- alteration or loss of riparian habitat function resulting from construction;
- alteration of instream habitat at trenched crossings resulting from construction;
- alteration of instream habitat function within the ZOI from sediment deposition resulting from instream construction and erosion from the construction ROW; and
- temporary blockage of fish movement during construction of isolated watercourse crossings.

Trenched crossings are planned at all watercourses. Many are crossings of watercourses that are expected to be dry or frozen to bottom at the time of construction, or watercourses that do not provide fish habitat. In both cases, a DFO Self-Assessment will be conducted and appropriate measures to avoid causing harm to fish and fish habitat will be implemented. A small number of trenched watercourse crossings will, however, be constructed at watercourses with fish habitat and, although it is not expected, may require an authorization under the *Fisheries Act*.

The implementation of the recommended mitigation measures in accordance with the DFO Self-Assessment and *Measures to Avoid Causing Harm to Fish and Fish Habitat* (DFO 2013) will reduce the severity of the potential effects on instream habitat and the potential for serious harm to fish, pursuant to Section 35(1) of the *Fisheries Act*. DFO self-assessments were conducted for all watercourses crossed by the replacement pipeline route (see Appendix 4). As needed, a Section 35(2) authorization from DFO will be applied for and appropriate offsetting measures will be developed to ensure compliance with the requirements of the *Fisheries Act*. The potential residual effects of the alteration of instream habitat at trenched crossings are expected to be reversible and within regulatory standards and, consequently, of low magnitude. In the event that serious harm to fish is determined and offsetting measures are implemented, the potential residual effect will be of medium magnitude. Consequently, the potential residual effect is not significant (Table 6.2.7-2, point [o]).

6.2.7.4 Summary

As identified in Table 6.2.7-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on fish and fish habitat of high magnitude, or a high probability of occurrence of an irreversible residual environmental effect of high magnitude. Consequently, it is concluded that the potential residual effects of pipeline construction and operation on fish and fish habitat will not be significant.

6.2.8 Wetlands

6.2.8.1 Context

Regulatory Context

The objective of the Federal Policy on Wetland Conservation (FPWC) (Government of Canada 1991) is to promote conservation of Canada's wetlands to sustain their ecological and socio-economic functions. To support this objective, several goals have been established by the FPWC that identify the importance of wetland function. Therefore, the identification of potential residual effects related to wetlands focuses on wetland function (see Table 6.2.8-1). Goals of the FWPC include:

- "no net loss" of wetland function on federal lands and waters;
- enhancement and rehabilitation of wetlands in areas where the continuing loss or degradation of wetlands or their functions have reached critical levels; and
- recognition of wetland functions in resource planning, management and economic decision-making with regard to all federal programs, policies and activities (i.e., including federally-regulated projects).

The FPWC commits all federal departments to the goal of "no net loss" of wetland function on federal lands and waters (Government of Canada 1991, Lynch-Stewart 1992, Lynch-Stewart et al. 1996) and guiding principles for use by the Federal Government in pursuing the objective of the FPWC acknowledge that wetland conservation function can only be achieved through the co-operation of the private sector. Enbridge commits to the objective of the FPWC.

To reduce the amount of disturbance of wetland ecosystems and meet the intent of the FPWC, Enbridge has implemented a routing decision framework that manages the potential effects on wetlands by taking into consideration the careful routing and siting (Section 4.0) as well as other mitigation measures (Table 6.2.8-1).

In Ontario, wetlands are currently regulated on private lands under the Natural Heritage Section (Section 2.1) of the PPS under Ontario's *Planning Act* (OMMAH 2014). The PPS provides protection for wetlands in specific Ecoregions that meet the criteria of being "significant wetlands" as determined by the OMNRF through a series of evaluation procedures. Development and site alteration is not permitted in wetlands that are determined to be significant unless it can be demonstrated that the proposed activity will not have any negative effects on these natural features or their functions

(OMMAH 2014). Wetlands on private land that do not meet the criteria of being "significant" are not protected in Ontario under the PPS but are protected under other legislation.

The *Conservation Authorities Act* enabled the creation of CAs across Ontario. There are 36 CAs that oversee the "*conservation, restoration, development and management of resources*" in specific watersheds. The CAs in Ontario are responsible to regulate, prohibit, restrict or require permission to construct in a watercourse, swamp or area susceptible to flooding (e.g., wetlands) (Conservation Ontario 2013).

Each CA has Development, Interference and Alteration Regulations. These regulations allow CAs to regulate any development within their boundaries that is in or adjacent to riverine valleys, the shores of the Great Lakes or inland lakes, watercourses, wetlands and hazardous lands (i.e., areas prone to flooding or erosion). Permission from a CA may be required in order for any development to take place. This permission may be required to show that "*the control of flooding, erosion, dynamic beaches, pollution or the conservation of land are not affected.*" CA also "*regulate the straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream, watercourse or for changing or interfering in any way with a wetland*" (Conservation Ontario 2013).

The CA of Hamilton, Niagara Peninsula and Grand River have developed wetland objectives aimed at conservation, stewardship and education. Each of the CA have developed regulations under their respective *Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* legislation that outline the regulatory process around wetlands in each of the jurisdictions (GRCA 2006, Hamilton Region Conservation Authority 2006, NPCA 2006).

Ecological Context

The Project is located within the Eastern Temperate Wetland Region (Energy, Mines and Resources Canada 1986). Characteristic wetlands within the Eastern Temperate Wetland Region are basin and stream swamps dominated by hardwood trees. Less common are basin and flat bogs. Marshes and fens can be found along the shores of ponds, lakes and waterways. Peat accumulation is on average 2 m for swamps and 3 m for bogs (Energy, Mines and Resources Canada 1986).

Wetlands found within the LSA were initially identified based on OMNRF mapping and further assessed and refined by Dillon during ELC investigations in 2013. Following the initial assessment, wetland boundaries were delineated using the protocols outlined in the Southern Manual of the Ontario Wetland Evaluation System (OMNRF 2013b) by a Qualified Wetland Evaluator who has undergone the training delivered by the OMNRF. For the purposes of this assessment the wetland boundaries delineated by Dillon will be used going forward.

The 2013 field surveys determined that 13 wetlands are located within the Footprint (comprising 1.61 km and 3.03 ha). Of these 13 wetlands, 12 are part of PSW Complexes (i.e., Sheffield-Rockton, Hayseland-Christie and Big Creek Headwaters) and 1 was previously evaluated as "not significant" by OMNRF protocols (OMNRF 2013b). The location of the wetlands crossed by the replacement pipeline route are outlined on the Environmental Alignment Sheets (Appendix 1).

6.2.8.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with the construction and operation of the replacement pipeline on wetlands were identified through consultation and engagement with government agencies, CAs and municipalities along the replacement pipeline route and are listed in Table 6.2.8-1. There were no concerns specific to wetlands identified by landowners or Aboriginal groups along the replacement pipeline route during the consultation process.

Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes

The mitigation measures recommended to avoid or reduce the severity of the potential effects of the replacement pipeline construction and operations on wetlands are presented in Table 6.2.8-1. These measures were developed in accordance with Enbridge standards, federal and provincial regulations and guidelines, peer-reviewed publications on wetland function (Price et al. 2005, Ryder et al. 2005, Shem et al. 1993, Van Dyke et al. 1994) as well as, but, not limited to the following:

- Assessment Report for the Hamilton Region Source Protection Area (Halton-Hamilton Source Protection Region 2015);
- Draft Source Protection Plan for the Grand River Source Protection Area within the Lake Erie Source Protection Region (GRCA 2012);
- Source Protection Plan for the Niagara Peninsula South Protection Area (NPCA 2014a);
- Greenbelt Plan (OMMAH 2005); and
- Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario (Ontario Energy Board 2011).

Table 6.2.8-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wetlands

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration of wetland habitat function (e.g., habitat for wildlife, amphibians, waterfowl and wetland vegetation)	• LSA • Wetlands	• Abide by all applicable provincial notifications/approvals. • Ensure Contractor activities adhere to applicable wildlife RAPs during ROW preparation, temporary vehicle crossing installation and wetland crossing construction, when feasible, unless otherwise approved by the applicable provincial and federal authorities. In the event that clearing or construction activities begin within the migratory bird primary nesting period, Wildlife Resource Specialists will use non-intrusive methods to conduct an area search for evidence of nesting (e.g., presence of territorial males, alarm calls, distraction displays, adults carrying nesting material/food). In the event that an active nest is found, site-specific mitigation measures will be implemented (e.g., clearly marked species-specific buffer around the nest or non-intrusive monitoring). • Salvage live, flagged or fenced willows and other shrubs and trees from the banks of wetlands. • Implement the Wet/Thawed Soil Contingency Measures, to be appended to the EPP[1] during wet/thawed conditions. • If deemed necessary, conduct amphibian salvage prior to the commencement of heavy equipment activity at known locations of breeding amphibians with special conservation status, in accordance with amphibian salvage approval conditions. Ensure that those conducting the amphibian salvage have the experience/training necessary to meet the approval conditions.	• Alteration of wetland habitat function during and following construction and operations activities until vegetation is re-established

Table 6.2.8-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wetlands

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Alteration of wetland habitat function (e.g., habitat for wildlife, amphibians, waterfowl and wetland vegetation) (cont'd)	See above	• In the circumstance that a wetland to be crossed is known to harbour aquatic or riparian weed plant species or pests, notify the Contractor of any special measures to be implemented to prevent the transfer of these organisms from one wetland to another wetland or watercourse, prior to the commencement of wetland crossing construction. For wetlands adjacent to or associated with watercourses, review cleaning procedures related to the spread of aquatic pests and notify the Contractor of special measures to be implemented. • Restrict root grubbing near watercourses and wetlands. Do not grub within 10 m riparian buffers adjacent to watercourses and wetlands, except along the trench line, spoil pile area (only if deemed absolutely necessary) and travel lane if a vehicle crossing is to be installed. • If feasible, schedule construction through open water wetlands to occur in the late fall when wetlands are generally at their driest or during frozen conditions. • Salvage the upper surface material on all wetlands to full depth, where to maintain root stocks for replacement, or as advised by the Environmental Inspector or Enbridge designate. • Recontour the wetland and restore surface hydrology patterns to as close to their pre-construction profile as practical during reclamation.	See above
2.0 Alteration of wetland hydrological function	• LSA • Wetlands	• Hand broadcast an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion, within the margins of Class I and II wetlands, unless otherwise requested by the landowner. • Do not seed marsh wetlands. Allow for natural revegetation, unless otherwise requested by a landowner. • Do not dewater any wetland. Although temporary dewatering may be necessary during trenched wetland crossings, trench water should not be permanently removed from a wetland. • Install trench breakers, where required as per engineering and construction specifications, in the adjacent upland at the edge of perched wetlands to prevent the pipe trench from acting as a drain. Hard plugs should be left in both banks until channel excavation begins in order to minimize the duration of watercourse sediment loading.	• Alteration of wetland hydrological function during and following construction and maintenance activities until pre-construction elevation, contours and natural drainage patterns are restored

Table 6.2.8-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wetlands

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Alteration of wetland hydrological function (cont'd)	See above	• If feasible, schedule construction through open water wetlands to occur in the late fall when wetlands are generally at their driest or during frozen conditions. • Install a shoo-fly for construction traffic around wetlands, if practical, in consultation with the Construction Manager and Environmental Inspector or Enbridge designate. If a shoo-fly is not used, see Vehicle Crossing Structures – Wetlands in this subsection. • Recontour the wetland and restore surface hydrology patterns to as close to their pre-construction profile as practical during reclamation. • Dispose of excess rock displaced from the trench as directed by the landowner or the land authority. Do not dispose of rocks in wetlands or watercourses. • Do not pile chips, mulch or mechanically cut woody debris in a wetland and do not dispose of upland woody debris in a wetland, unless otherwise directed by the appropriate regulatory authority.	See above
3.0 Alteration of wetland biogeochemical function	• LSA • Wetlands	• Postpone clearing of wetland margins, watercourse approach slopes and banks until immediately prior to crossing construction, except, if necessary to install vehicle crossing structures. Where pre-clearing is approved by the Environmental Inspector or Enbridge designate, leave the vegetative ground mat and root structure intact. • Delay topsoil salvage on approach slopes, flood plains and wetland margins until immediately prior to construction. • Enbridge will acquire all necessary shoo-flies prior to construction around wetlands or watercourse crossings that would impede standard construction traffic. If additional shoo-flies are required at the time of construction, they will be approved by the Enbridge Construction Management Team and the Environmental Inspector or qualified Enbridge designate. If a shoo-fly is not practical or available at the time of construction, a temporary vehicle crossing will be used, once approved by the Enbridge Construction Management Team and the Environmental Inspector.	• Alteration of biogeochemical function in wetlands during and following construction and maintenance activities until sedimentation is controlled, vegetation is re-established, hydrology is restored and biological/ chemical processes in the salvaged soil/substrate have recovered

Table 6.2.8-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wetlands

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Alteration of wetland biogeochemical function (cont'd)	See above	• If shallow water is encountered, salvaged surface material and trench spoil may be used as a containment berm/barrier in associated with a silt curtain to prevent turbidity within the main wetland water column. Consider using spoil material from the trench line as a containment barrier where salvaged surface material is not able to support the berm/barrier. If deep water is encountered, alternative dam devices such as an Aquadam or bag weights are other options. Pump excess water from the work area and trench to the opposite side of berms or work ramps within the wetland. Maintain hydrologic connectivity (i.e., flow) through temporary access areas as required. • Use wide-track equipment, low-ground-pressure equipment or conventional equipment operated from the recommended vehicle crossing when working on saturated soils during non-frozen conditions. • Do not apply fertilizer or lime in wetlands. Do not fertilize the banks or steep approaches of wetlands where the potential exists for fertilizer to wash into the wetlands. • Salvage the upper surface material of all wetlands to full depth, where practical, or to the depth of colour change, or as advised by the Environmental Inspector or Enbridge designate. • Use trench area only salvage at wetland crossings that are dry or frozen at the time of construction, unless otherwise advised by the Environmental Inspector or Enbridge designate. • Install temporary erosion control structures (e.g., silt fences and/or straw bales) immediately following the backfilling of wetland crossings. Ensure that silt fences have been installed properly, are solid and filter fabric is tight	See above
4.0 Contamination of wetlands from spills during construction and maintenance activities	• LSA • Wetlands	• If feasible, schedule construction through open water wetlands to occur in the late fall when wetlands are generally at their driest or during frozen conditions. • Maintain equipment in good working condition and ensure that equipment and vehicles are free of leaks. • Do not wash equipment or machinery in watercourses or wetlands. Control wastewater from construction activities, such as equipment washing or concrete mixing, to avoid discharge directly into any body of water.	• Reduction of wetland habitat function in the event of a spill during construction and maintenance activities • See Section 6.7 for the potential effect of pipeline failure on wetlands during operation

Table 6.2.8-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wetlands

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
4.0 Contamination of wetlands from spills during construction and maintenance activities (cont'd)	See above	• Ensure that no vehicles or equipment containing petroleum, oil or lubricants are parked or stationed in a wetland at any time, except for equipment that is necessary for that particular phase of wetland crossing construction. • Do not store fuel tanks, containers or stationary equipment within the normal high water mark of a watercourse or wetland, unless otherwise indicated. If this is not feasible, secondary containment must be provided regardless of container size. If the fuel tank is double-walled, tertiary containment must be provided. Fuel storage areas, pumps, generators and other sources of deleterious substances must be within a containment system of sufficient capacity to ensure that deleterious substances do not enter fish habitat. Appropriate spill kits will be kept at fuel or hazardous materials storage, refuelling and maintenance or refuelling service vehicles. • Ensure that during the course of the Project, no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides or other chemicals are released on the ground or into a drainage or wetland. In the event of a spill, implement the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]). • Review and adhere to the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]) and the Enbridge Waste Management Plan (Enbridge 2014) to avoid contaminant introduction during construction.	See above

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.8.3 Residual Effects Characterization and Significance Determination for Wetlands

A qualitative method was considered the most appropriate method to evaluate the significance of the potential residual effects on wetlands based upon accepted standards, guidelines and regulations. Where appropriate, the qualitative assessment relied on available research literature and the professional judgement of the assessment team. The professional judgement of the assessment team is based on decades of industry knowledge as well as the experience obtained from numerous past projects with similar wetland types.

All assessment criteria were considered when determining the significance of each potential residual effect, however, the most influential assessment criteria were magnitude and reversibility. A summary of the significance evaluation of potential residual environmental effects of construction and operations of the replacement pipeline on wetlands is provided in Table 6.2.8-2. The rationale used to evaluate the significance of each of the potential residual environmental effects is provided below, with the exception of impact balance which is considered negative for all potential residual effects on wetlands.

Table 6.2.8-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Wetlands

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Alteration of wetland habitat function during and following construction and operation activities until vegetation is re-established	LSA	Medium to extended-term	Isolated to occasional	Reversible	Low to medium	High	High	Not significant
(b) Alteration of wetland hydrological function during and following construction and operation activities until pre-construction elevation, contours and natural drainage patterns are restored	LSA	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
(c) Alteration of wetland biogeochemical function during and following construction and operation activities until hydrology is restored, sedimentation is controlled, vegetation is re-established and biological/chemical processes in the salvaged soil/substrate have recovered	LSA	Medium to long-term	Isolated to occasional	Reversible	Low	High	High	Not significant
(d) Reduction of wetland habitat function in the event of a spill during construction and maintenance activities	LSA	Short to long-term	Rare	Reversible	Low to high	Low	High	Not significant
(e) Combined effects of the Project on wetland function (points [a-c])	LSA	Medium to extended-term	Isolated	Reversible	Low to medium	High	High	Not significant

The evaluation of significance was based on the anticipated level of residual effect the pipeline construction and operations will have on wetlands. Three components of wetland function (i.e., wetland habitat, hydrological and biogeochemical) were used to help in this analysis.

Alteration of Wetland Habitat Function

Pipeline construction and operation activities within wetlands will likely result in some disruption of the function of wetlands, and this is considered to have a negative impact balance. Examples of potential adverse environmental effects on wetland habitat function include potential changes in vegetative species composition for some wetland classes, stress on vegetative species, interruption of wildlife movements, and fragmentation of natural habitats.

Wetland sensitivity to disturbance can be described in terms of hydraulic connectivity and resiliency of vegetation (Trettin et al. 1997, Hill and Devito 1997). Hydrologically isolated wetlands are more susceptible to disturbance as a result of decreased vegetation resilience. Plant community composition and structure may change in certain wetland types (i.e., treed and shrub wetlands) following pipeline construction. Standard practice with respect to pipeline construction and operations is to ensure pipeline integrity and safe access for maintenance. As a result, larger woody vegetation, mostly trees, are often not allowed to regrow along a pipeline ROW during the life of the pipeline. The roots of the trees can affect the integrity of the pipe walls and coating. This may result in a decrease in wetland habitat function when only herbaceous vegetation, and in some cases shrub vegetation, returns to the ROW post-construction (Santillo 1993, Shem et al. 1993, Van Dyke et al. 1994). In addition, habitat fragmentation and the removal of woody vegetation, potentially compromises the stability of the substrate, and may reduce nesting and foraging habitat for songbirds and ungulates.

Furthermore, tree and shrub removal during operations often results in an increased soil moisture regime, which may cause wetlands to return to a previous successional state (i.e., an alteration of wetland type). The increased growth of early successional species may result in an increase in plant diversity following tree removal, which can lead to an alteration of wetland structure (Shem et al. 1993, Van Dyke et al. 1994). Commonly, treed wetlands revert to sedge-dominant marshes following an increase in groundwater level, which was previously suppressed by transpiration and water uptake by trees (Lee and Boutin 2006).

Marshes are more resilient to changes in successional status resulting from vegetation removal than treed or shrub wetlands, as herbaceous vegetation cover is generally well-established within one to three years after pipeline construction (i.e., medium-term duration of the residual effect) (Santillo 1993, Shem et al. 1993, Van Dyke et al. 1994). Minor differences, however, in the final ROW surface elevation can strongly influence the type of vegetation that re-establishes on the ROW and the successional trajectory of a wetland (Shem et al. 1993, Van Dyke et al. 1994).

With proper construction methods and mitigation measures (i.e., profile contours returned and the appropriate protection and use of the seedbanks), these adverse effects can be successfully reduced. For example, Zimmerman and Wilkey (1992) monitored wetlands for effects on vegetation for 20 years post-disruption from pipeline construction. Findings of these long-term monitoring programs show that adjacent natural wetland areas were not altered in habitat type (e.g., species composition) when the proper construction and mitigation measures were carried out (i.e., wetland contours and elevations match those off the construction ROW), no non-native plant species invaded natural areas and the ROW increased in diversity.

Additional studies on the effects of pipeline construction on wetland vegetation support natural regeneration of wetlands after disturbance (Shem et al. 1993, Van Dyke et al. 1994). Shem et al. (1993) assessed four locations where pipeline construction had occurred in wetlands. Natural regeneration was implemented at three of the sites and seeding and fertilizer was used at one site on the disturbed portion of the ROW. After one year post-construction, it was found that many plant species re-established on the construction ROW at sites where natural regeneration was allowed. These sites also had more plant species coverage and less bare soil, when compared to the site where seeding occurred (Shem et al. 1993).

Van Dyke et al. (1994) assessed the establishment of vegetation at wetland crossings ranging from 8 months to 31 years following pipeline construction. General observations made during the study suggest that diverse vegetation communities can re-establish on the construction ROW as a result of the germination of species in the seedbank and the migration of species from surrounding undisturbed areas. Proper salvage and handling of wetland substrate, along with the return of wetland contours to pre-construction profiles, were found to be important components in natural regeneration. Seeding of disturbed wetland areas did not accelerate vegetation establishment (Van Dyke et al. 1994).

PCEM of wetland function (TERA Environmental Consultants 2009, 2011a-g, 2012a,c-g, 2013a,c-f, 2014a,c) at wetlands along recent large pipeline projects has shown that mitigation measures implemented during construction (e.g., re-establish pre-construction contours, allowing natural regeneration) can be successful. This has been demonstrated by the absence of environmental issues related to wetland function restoration documented during previous pipeline projects (TERA Environmental Consultants 2009, 2011a-c, 2012a,c-e, 2013a, 2014a). These projects encounter similar wetland types as the replacement pipeline route. TERA has completed the final year of PCEM programs for some of these projects and has documented the successful return of wetland habitat function within two to three years of the temporary disturbance (TERA Environmental Consultants 2013a,d,e, 2014a).

The potential residual effect is considered low (i.e., herbaceous and shrub-dominated wetlands) to medium (i.e., treed wetlands) magnitude and reversible. The duration of the residual effect is considered medium-term for wetlands with mainly herbaceous and/or shrub vegetation and extended-term for treed wetlands. Therefore, the potential residual effect is considered not significant (Table 6.2.8-2, point [a]).

Alteration of Wetland Hydrological Function

Construction of the replacement pipeline route and associated infrastructure as well as pipeline operations has the potential to cause changes to the hydrologic flow (i.e., surface or groundwater flow) of a wetland by diverting water away from the wetland and/or impeding natural flow through the wetland. Excessive water diversion will result in an unnatural decrease of water flow within the wetland, while flow impedance (i.e., inadequate drainage) results in a more saturated wetland habitat. These alterations are an interruption to the natural hydrologic regime.

Vertical and horizontal water movements in wetlands can be disrupted by any berm-like structure. For example, linear disturbances to wetlands (e.g., pipelines), may impound water, resulting in flooding upstream and drying downstream (Olson and Doherty 2012). Drying on the downslope face in treed wetlands (i.e., treed swamps, bogs and fens) can increase tree productivity, water demand and evapotranspiration, which facilitates further drying (Baisley 2012). In mineral wetlands (e.g., marshes), this type of disturbance (i.e., drying downstream due to flow impedance, improper contouring, soil admixing or raised seedbanks) may also result in increases in productivity of drought-tolerant wetland plant species (e.g., grass, sedge and rush species). This may lead to increases in water demand, which, similar to treed wetlands, leads to further drying. This compounded drying can result in permanent alteration of the peatland and mineral wetland hydrologic regimes, overall wetland function and potentially vegetative cover (e.g., treed wetland to forest, or marsh to wet meadow or moist grassland) (Baisley 2012, Sherwood 2012).

On the upstream side, increased saturation from impounded water can result in the loss of trees and other woody vegetation, while allowing the establishment of emergent vegetation in treed wetlands (e.g., bogs, fens and swamps) (Baisley 2012). Alternatively, in seasonal wetlands (e.g., marshes), increased inundation may result in a decrease in emergent vegetation, and an increase in aquatic vegetation and open water characteristics. Prolonged impoundment may potentially convert a treed wetland to a marsh wetland and a more seasonal wetland into a permanent shallow water wetland (Baisley 2012). These alterations (i.e., drying or ponding) are not anticipated to occur during the Project's temporary disturbances due to the implementation of appropriate mitigation and the maintenance of hydrology across the construction ROW and temporary infrastructure and workspace (Table 6.2.8-1).

Among the most important considerations for limiting disturbances to hydrological function is assuring that the restoration of pre-construction elevations and contours is achieved (Gartman 1991, Shem et al. 1993, Van Dyke et al. 1994), and that there is no unnatural impedance to flow. Some alteration of hydrological function in wetlands are anticipated during trenching, however, the fall/winter construction schedule, in conjunction with mitigation measures implemented to reduce drainage of wetlands (see Table 6.2.8-1), will reduce the potential for hydrologic changes since water flow is likely to be diminishing from peak levels. Short-term disturbances (i.e., the above are short-term disturbances that can be mitigated) to wetlands are anticipated during pipeline and temporary infrastructure and workspace construction. These short-term disturbances will be mitigated by using crossing techniques that reduce terrain disturbances and soil structure damage.

Long-term effects on wetland hydrological function are not anticipated if the construction ROW within the wetland is restored to its pre-construction contours and proper hydrologic flow is established through the replacement of salvaged wetland substrates. PCEM of wetland hydrological function at wetlands associated with projects located in similar terrain as the Project (TERA Environmental Consultants 2009, 2011a-g, 2012a,c-g, 2013a,c-f, 2014a,c) have shown that mitigation measures implemented during construction (e.g., re-establish pre-construction contours) can be successful in returning surface water to pre-construction levels.

The potential residual effect is considered low magnitude and reversible and, therefore, is considered not significant (Table 6.2.8-2, point [b]).

Alteration of Wetland Biogeochemical Function

Changes in wetland hydrologic regime can directly and indirectly affect wetland biogeochemical function. Potential adverse effects on biogeochemical function are primarily related to water quality (e.g., turbidity), carbon storage and overall biogeochemical cycling. Maintenance of wetland hydrology is critical to the preservation of soil biogeochemical cycles that occur under varying degrees of saturation. Biological decomposition of organic matter in soils, and release of stored carbon, is controlled by the rate of microbial respiration, which is influenced by saturation (i.e., temperature and oxygen availability). Microbes preferentially use oxygen, however, under anaerobic, saturated conditions, the rate and type of respiration is altered (McLatchey and Reddy 1998). In addition, the heat capacity of saturated soils is higher than that of dry soils. Therefore, maintenance of wetland hydrology ensures that cool conditions are prevalent and slow decomposition rates characteristic of wetland substrates occur, favouring the storage of carbon.

Activity in or near wetlands during replacement pipeline construction may result in an increased sediment supply and turbidity of surface waters (particularly in mineral wetlands), thereby affecting biogeochemical function of the wetland. The shallow nature of marshes (e.g., seasonal and semi-permanent) and shallow water wetlands allows for the growth of emergent and submerged aquatic vegetation, which absorbs dissolved nutrients, stabilizes sediments and provides habitat for zooplankton (Scheffer et al. 1993, Scheffer and van Nes 2007, Bayley et al. 2013, Sullivan et al. 2014). As a result, surface water in these wetlands is often of high quality, with limited growth of phytoplankton or cyanobacteria and low levels of suspended sediments. Persistent increases in water turbidity, following dissolved nutrient inputs or increases in the suspension of sediment, can shade out submerged aquatic vegetation and compromise the mechanism by which marshes and shallow water wetlands maintain high quality surface waters (Scheffer and van Nes 2007, Bayley et al. 2013). In the event of an oxygen decrease, particularly in the water column but also in the soil boundary layer, wetland biogeochemical function may be altered and harm to aquatic organisms can occur. However, given the implementation of sedimentation control mitigation measures (i.e., sediment fencing), the likelihood of alteration in this manner resulting from the Project is reduced.

Indirectly, hydrologic regime can impact biogeochemical function by altering wetland habitat function. For example, decreases in water table position can increase tree productivity rates. This may decrease the quality of litter deposited in the soil and increase nutrient turnover rates. This can change understory community composition as a result of nutrient and light limitations and soil processes (e.g., decomposition rates). It may also stimulate changes in wetland hydrologic regime through increased transpiration and interception by root systems (Baisley 2012, Kotowska 2012, Laiho et al. 2003).

Mitigation measures will be employed during construction and operation activities to ensure that the severity of potential effects on wetland biogeochemical function is reduced (Table 6.2.8-1). However, permanent loss of wetland biogeochemical function is not anticipated at wetlands crossed by the replacement pipeline route as pipeline construction through wetlands is considered a temporary disturbance and experience indicates that residual effects on wetland function can be mitigated. With the implementation of these measures, the residual effects of pipeline construction on wetland biogeochemical function are considered to be reversible in the medium to long-term and of low magnitude. Therefore, the potential residual effect is considered not significant (Table 6.2.8-2, point [c]).

Reduction of Wetland Habitat Function

In the unlikely event of a spot spill during construction occurring near or in a wetland, depending on the size of the spill, there is the potential for infiltration into surficial deposits and surface water to occur resulting in a reduction in wetland function. The residual effect on wetland function resulting from a spot spill during construction would be considered to have a negative impact balance.

The implementation of preventative measures (e.g., avoidance of refuelling near wetlands) will minimize the occurrence of spot spills in or near wetlands. Although the implementation of preventative measures (Table 6.2.8-1) is expected to mitigate spot spills in wetlands, spill mitigation may result in some loss or disturbance of soil, peat and vegetation.

With mitigation efforts, the potential effects of spot spills on wetland function could range from low to high magnitude (low to medium for potential reduction of wetland habitat function and low to high for potential reduction of wetland biogeochemical function), with reversibility in the short to long-term, depending upon the volume spilled, the wetland type and the hydrological characteristics of the wetland. The probability of the potential residual effect is low and, therefore, is considered not significant (Table 6.2.8-2 point [d]).

Combined Effects on Wetlands

Based on the recommended mitigation measures and the PCEM literature, wetland integrity is resilient, provided that habitat, hydrological and biogeochemical functions are not permanently altered. Permanent loss of wetland function is not anticipated at wetlands crossed by the replacement pipeline route, as construction and operations through wetlands are considered a temporary disturbance, however, should permanent loss of wetland function be identified upon completion of the PCEM Program, Enbridge will consult with Environment Canada and CAs regarding potential remedial or compensatory measures for any functional loss, if warranted.

Mitigation measures implemented during construction, operations and maintenance activities for all temporary infrastructure (i.e., construction ROW and temporary workspace) will reduce the potential residual effect of the alteration of wetland function. The potential residual effect of pipeline construction and maintenance activities on wetland function is considered to be reversible, low (i.e., herbaceous and shrub-dominant wetlands) to medium magnitude (i.e., treed wetlands) and of medium to extended-term duration and, therefore, is considered not significant (Table 6.2.8-2, point [e]).

6.2.8.4 Summary

As identified in Table 6.2.8-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on wetlands of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of pipeline construction and operation on wetlands will be not significant.

6.2.9 Vegetation

6.2.9.1 Context

The replacement pipeline route primarily crosses privately-owned lands in the Lake Erie Lake Ontario ecoregion (See Appendix 2A for a description of this Ecoregion).

The replacement pipeline route encounters a diversity of land uses including agriculture interspersed with natural features (i.e., woodlands, wetlands, meadows and open spaces).

The relationship of native vegetation with other ecosystem components is that it provides: protection of gene pools for future use; protection of native plant and wildlife species and their habitats; preservation of climax ecosystems and native biodiversity; and conservation of representative samples of different habitats characteristic of the region.

Approximately 24 km (69%) of the replacement pipeline will be constructed alongside and contiguous to an existing Enbridge pipeline ROW and other linear disturbances, with 11 km (31%) requiring a new non-contiguous ROW. Revegetation measures have been developed to reclaim the lands affected by construction of the replacement pipeline.

6.2.9.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects associated with construction and operations of the replacement pipeline on vegetation were identified through consultation and engagement with government agencies, Aboriginal groups and landowners along the replacement pipeline route.

During the engagement process, Aboriginal groups expressed interest in harvesting medicinal plants along the replacement pipeline ROW (see Section 6.2.14). There are no outstanding concerns regarding vegetation identified by landowners, Aboriginal groups or government agencies along the replacement pipeline route identified during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

The key mitigation measures provided in Table 6.2.9-1 were principally developed in accordance with the following industry and provincial regulatory guidelines:

- Environmental Assessment Best Practice Guide for Wildlife at Risk in Canada (Canadian Wildlife Service 2004);
- Post-Construction Restoration Guidelines (Toronto Region Conservation Authority 2004);
- Don Mouth Naturalization and Port Lands Flood Protection Project-Standard Construction Techniques and Mitigation Measures (Toronto Region Conservation Authority 2014);
- Environmental Reference for Contract Preparation (Ontario Ministry of Transportation 2007); and
- Erosion and Sediment Control Guideline for Urban Construction (Greater Golden Horseshoe Area Conservation Authorities 2006).

Table 6.2.9-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Vegetation

	Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0	Loss or alteration to native vegetation composition	• LSA • Lands supporting native vegetation (e.g., woodlands, wetlands, meadows)	• Stake both boundaries of the construction ROW, staging and stockpile areas, and any extra temporary workspace. Do not allow brushing or grading beyond the stakes unless extra temporary workspace rights have been obtained. Clearly flag or stake the boundaries of temporary access roads and shoo-flies. Use short stakes/lath where cattle are present. Re-stake/flag the construction ROW boundaries, where warranted, following clearing and prior to the commencement of subsequent construction activities.	• Changes to composition of approximately 16.6 ha of native vegetation

Table 6.2.9-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Vegetation

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Loss or alteration to native vegetation composition (cont'd)	See above	• Do not seed marsh wetlands. Allow for natural revegetation, unless otherwise requested by a landowner. • Seed the disturbed areas of the construction ROW as per the Line List or as requested by the land authority as soon as practical after final clean-up and as weather and soil conditions permit. The goal is to reclaim all disturbed lands within one growing season following construction. • Restrict vehicle access over newly seeded areas. • During PCEM, vegetation monitoring will occur in the mid to late-summer when vegetation reaches its maximum size to allow for accurate identification and evaluation. Particular attention will be given to areas of terrain instability or soils that may be prone to erosion. If warranted, detailed vegetation assessments will be completed at sites where reclamation issues are identified on the Environmental Issues List (EIL).	See above
2.0 Loss or alteration to vegetation species of conservation concern	• LSA • Known populations of vegetation species of conservation concern	• Site-specific mitigation measures will be included in the Project-specific EPP[1] will be implemented to eliminate direct effects on vegetation species of conservation concern, if feasible, during pipeline construction and maintenance activities.	• Some alteration of vegetation species of conservation concern if avoidance is not practical and mitigation measures do not completely protect a site
3.0 Weed or pest introduction and/or spread	• RSA • Entire route	• Site-specific features of concern (e.g., rare plants and Noxious weeds) identified during biophysical surveys and will be signed, staked or flagged with suitable markings and/or fenced sufficiently (if approved by landowner) so that subsequent traffic can avoid these areas. • Ensure all equipment (e.g., vehicles, materials, and mats) arrives for work in a clean condition to reduce the risk of weed introduction. Prohibit any equipment which arrives in a dirty condition to work until it has been cleaned off at a suitable location.	• Weed or pest introduction and/or spread

Table 6.2.9-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Vegetation

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Weed or pest introduction and/or spread (cont'd)	See above	• Monitor topsoil windrows for weed growth during the course of construction during non-frozen soil conditions and direct the Contractor to implement corrective measures, if warranted or requested by the landowner. Corrective measures may include hand pulling, mowing, using selective, non-persistent herbicides (if necessary) or seeding with a cover crop. Additional information is presented in the Biosecurity Management Plan (to be appended to the EPP[1]). • Use an appropriate seed mix (in consultation with landowners, where applicable), for agronomic (i.e., non-native) seed mixes. Where possible, obtain seed from a local source and retain the Certificates of Analysis for future documentation. All seed mixes must have Certificates of Analysis for weed and undesirable species content, and germination tests for each lot of each species in the mix. Provide copies of all Certificates of Analysis to the Environmental Inspector or Enbridge designate. For native seed, obtain the highest seed grade available. Do not accept seed that contains any noxious weeds. • During the first year of the PCEM Program, the segments of the construction ROW will be monitored, where required, to identify areas where vegetation re-establishment has not progressed as expected. Vegetation parameters to be assessed include weed species, density and distribution present on all land uses. • Should monitoring indicate that further management measures are warranted (undesirable species remain above the threshold level) to prevent the spread of weed species, Enbridge will take appropriate action to address the issue in a timely manner.	See above
4.0 Removal of ornamental trees, windbreaks or shelterbelts	• Footprint • Entire route	• Ensure all site-specific landowner commitments and agreements are followed as per the Line List (e.g., narrowing down of the construction ROW, extending road bores, fencing off and/or salvaging trees with a tree spade may be required to avoid or minimize impacts on windbreaks, hedgerows, shelterbelts and yards). • Limit grubbing to areas where soil removal is necessary (e.g., trench line, areas to be graded).	• Removal or alteration of ornamental trees, windbreaks or shelterbelts

Table 6.2.9-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Vegetation

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0. Disturbance of vegetation due to a minor spill or drilling mud release and associated clean-up and reclamation activities	• RSA • Entire route	• Immediately implement the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]) in the event of a spill. • Report spills immediately to the Construction Manager and Environmental Inspector or Enbridge designate). The Environmental Inspector(s) will report spills to the Enbridge Environment Lead and, if warranted, appropriate government agencies in accordance with the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]).	• Disturbance of vegetation due to a minor spill and associated clean-up and reclamation activities • See Section 6.7 Accidents and Malfunctions for a discussion of pipeline releases and associated clean-up and reclamation activities during operations

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.9.3 Residual Effects Characterization and Significance Determination for Vegetation

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on vegetation, due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. This qualitative assessment relied on available research literature and the professional judgement of the assessment team.

Table 6.2.9-2 provides a summary of the significance evaluation of the potential residual effects of construction and operations of the replacement pipeline on vegetation. The rationale used to evaluate the significance of each of the potential residual effects is provided below, with the exception of the impact balance which is considered negative for all potential residual effects on vegetation. All assessment criteria were considered when determining the significance of changes to vegetation, however, the most influential assessment criteria are magnitude and reversibility.

Table 6.2.9-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Vegetation

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Changes to composition of approximately 16.6 ha of native vegetation	LSA	Short-term to extended-term	Isolated	Reversible	Low	High	High	Not significant

Table 6.2.9-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Vegetation

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(b) Some alteration of vegetation species of conservation concern if avoidance is not practical and mitigation measures do not completely protect a site	LSA	Medium-term to extended-term	Isolated to occasional	Reversible	Low	Moderate	Moderate	Not significant
(c) Weed or pest introduction and/or spread	RSA	Short-term	Occasional	Reversible	Low to medium	High	High	Not significant
(d) Removal or alteration of ornamental trees, windbreaks or shelterbelts	Footprint	Short-term to extended-term	Isolated	Reversible	Low	High	High	Not significant
(e) Disturbance of vegetation due to a minor spill and associated cleanup and reclamation activities	RSA	Immediate	Accidental	Reversible	Low to high	Low	Moderate	Not significant
(f) Combined effects on native vegetation	RSA	Short-term to extended-term	Isolated to occasional	Reversible	Medium	High	High	Not significant
(g) Combined effects on non-native vegetation	RSA	Short-term to extended-term	Isolated to occasional	Reversible	Low to medium	High	High	Not significant

Changes to Native Vegetation Composition

Approximately 16.6 ha of native vegetation (12% of the Footprint) will be disturbed or cleared during construction of the replacement pipeline (see Section 6.5 for an assessment of the potential change in composition of native vegetation associated with the construction of permanent facilities. Disturbed areas along the replacement pipeline route supporting native vegetation will be seeded with an appropriate seed mix (in consultation with landowners, where applicable) or allowed to naturally revegetate. No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation composition can be judged.

This residual effect is limited to the Footprint and is considered reversible. Due to the limited extent of native vegetation encountered by the replacement pipeline route and the success of past mitigation along adjacent existing Enbridge pipelines, the magnitude of change to native vegetation composition is considered to be low. Consequently, the potential changes to native vegetation composition due to construction and operation of the replacement pipeline are not significant (Table 6.2.9-2, point [a]).

Alteration of Vegetation Species of Conservation Concern

This discussion is confined to vegetation species of conservation concern in Ontario (i.e., listed by NHIC). An assessment of vegetation species at risk, including those listed as Endangered or Threatened federally or provincially (i.e., *SARA* Schedule 1, COSEWIC, Ontario *Endangered Species Act*), is provided in Section 7.10.

During the vegetation surveys conducted for the Project in May and September 2013, two species of conservation concern both ranked as S2 in Ontario, honey locust (*Gleditsia triacanthos*), and awned graceful sedge (*Carex davisii*), were observed. A discussion of these species and the locations where they occur near the Project is included in Appendix 2A. Site and species-specific mitigation measures for these occurrences are in Table 6.2.9-1 and will be included in the Project-specific EPP along with detailed applicable contingency and/or management plans. The species of conservation concern known to occur in the Footprint inhabit lands supporting native vegetation. Some alteration of vegetation species of conservation concern may occur if mitigation measures do not completely protect a site during construction or operations of the replacement pipeline. Disturbed areas along the replacement pipeline route supporting vegetation species of concern will be seeded with an appropriate seed mix (in consultation with landowners, where applicable) or allowed to naturally revegetate. No locally or regionally adopted threshold or standard exists against which the incremental change in vegetation species of conservation concern can be judged.

This residual effect may extend to the LSA if a population extends into that spatial boundary and if a disturbance on the Footprint has effects that extend beyond the disturbance (e.g., changes to hydrology or light regime). Due to the limited extent of species of conservation concern encountered by the replacement pipeline route and the success of past mitigation along adjacent existing Enbridge pipelines, the magnitude of change to species of conservation concern is considered to be low. Consequently, the potential changes to species of conservation concern due to construction and operation of the replacement pipeline are not significant (Table 6.2.9-2, point [b]).

Weed or Pest Introduction and/or Spread

In general, invasive species and pests (e.g., soybean cyst nematode) tend to inhabit areas where the seedbank has been disturbed by anthropogenic activity. Identification of weed species was conducted along select portions of the replacement pipeline route as part of the vegetation surveys in 2013. All weed species encountered during the 2013 vegetation surveys were recorded and their density/distribution was noted. The information collected during the vegetation surveys allows for an understanding of baseline weed conditions and the magnitude of weed infestations encountered along the replacement pipeline route.

Mitigation measures outlined in Table 6.2.9-1 are proven and effective industry standards to reduce the introduction and/or spread of weeds. These measures will be implemented during both construction and maintenance activities. Experience during past pipeline construction programs revealed that the implementation of appropriate mitigation measures during construction resulted in limited weed issues (Alliance 2002, Inter Pipelines 1995, TERA Environmental Consultants [Alta.] 2000, TERA Environmental Consultants 2002, 2011b, 2012a,b). Consequently, the residual effect is considered to be reversible and of low to medium magnitude. Therefore, the potential for weed introduction and spread due to construction and operation of the replacement pipeline is not significant (Table 6.2.9-2, point [c]).

Removal or Alteration of Ornamental Trees, Windbreaks and Shelterbelts

Ornamental trees, windbreaks and shelterbelts (i.e., agricultural vegetation features) contribute to productivity and sustainability of agricultural land uses by reducing wind erosion and wind-affected crop damage in addition to promoting snow catchment (United States Department of Agriculture 2006). The alteration of agricultural vegetation features may be necessary for construction activities, but will be of limited areal extent in relation to the total amount of these features in the LSA. If a landowner requests that an agricultural vegetation feature not be disturbed, other options will be explored where feasible, such as: narrowing down the construction ROW; extending road bores beneath the feature; limiting grubbing; transplanting with a tree spade; or planting new trees/shrubs in another area. This residual effect is reversible and is considered to be of low magnitude since landowner requests will influence mitigation. Consequently, the potential for removal or alteration of ornamental trees, windbreaks and shelterbelts due to construction and operation of the replacement pipeline is not significant (Table 6.2.9-2, point [d]).

Disturbance of Vegetation Due to a Minor Spill and Associated Clean-Up and Reclamation Activities

Despite best intentions, a small-scale spill is possible during construction and maintenance activities when there are multiple vehicles and equipment onsite. See Section 6.7 for further discussions of accidents and malfunctions.

Depending upon the location and volume, disturbance of vegetation could occur as a result of a spill and associated clean-up and reclamation activities. The magnitude of this effect would vary depending upon the severity of the spill, the location of the event and the vegetation species affected (e.g., the magnitude would be higher if a rare plant population is disturbed). Due to the unpredictability of a spill, mitigation typically implemented to prevent disturbance of vegetation would not be practical. Therefore, the magnitude of the residual effect associated with a spill that would result in vegetation disturbance is considered to be low to high. However, the probability of such an event occurring is low. Consequently, the potential for disturbance to vegetation due to a spill and from associated cleanup and reclamation activities during construction and operations of the replacement pipeline is not significant (Table 6.2.9-2, point [e]).

Combined Effects on Vegetation

When the combined effects of construction and operations of the replacement pipeline on vegetation are considered, two combined residual effects are identified:

- combined effects of the pipeline on native vegetation; and
- combined effects of the pipeline on non-native vegetation (i.e., cultivated, hay, tame pasture, ornamental trees, windbreaks and shelterbelts).

The combined effects evaluation considers the individual potential residual effects evaluated in Table 6.2.9-2 that are likely to occur and could act in combination on either native vegetation or non-native vegetation. The disturbance of vegetation due to spills is not considered in the combined effects on vegetation since the probability of a spill occurring is low.

Combined Effects on Native Vegetation

The following potential residual effects are likely to act in combination to result in overall effects on native vegetation during construction and operations of the replacement pipeline:

- changes to composition of approximately 16.6 ha of native vegetation;
- alteration of vegetation species of conservation concern; and
- weed or pest introduction and/or spread.

The individual effects identified above have the potential to act in combination on native vegetation crossed by the replacement pipeline route. Although the probability of these residual effects acting in combination along the route is high, given the low to medium magnitude of these effects, the combined effects of construction and operations of the replacement pipeline on native vegetation will be not significant following implementation of mitigation measures. Consequently, the potential combined effects on native vegetation are not significant (Table 6.2.9-2, point [f]).

Combined Effects on Non-Native Vegetation

The following potential residual effects are likely to act in combination to result in overall effects on non-native vegetation:

- weed introduction and/or spread; and
- removal or alteration of ornamental trees, windbreaks or shelterbelts.

These effects have the potential to act in combination to affect non-native vegetation crossed by the replacement pipeline route. Although the probability of these two residual effects acting in combination along the replacement pipeline route is high, given the low to medium magnitude of these effects, the combined effects of construction and operations of the replacement pipeline on non-native vegetation will be not significant following the implementation of the recommended mitigation measures. Consequently, the potential combined effects on non-native vegetation are not significant (Table 6.2.9-2, point [g]).

6.2.9.4 Summary

As identified in Table 6.2.9-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on vegetation of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of pipeline construction and operation on vegetation will be not significant.

6.2.10 Wildlife and Wildlife Habitat

6.2.10.1 Context

The effects assessment of wildlife and wildlife habitat is comprised of an analysis of the wildlife community and habitat types present within the RSA for the replacement pipeline (see Table 6.1.7-1). Wildlife species with federal or provincial conservation status are considered in this overall assessment of wildlife and wildlife habitat as well as more common and abundant species that occur in the RSA, including those that are important for cultural and tourism reasons (e.g., white-tailed deer, beaver and waterfowl). Key species groups of wildlife with conservation status were selected as indicators for the Species at Risk assessment in Section 6.2.11 to provide a focused assessment.

Land use in the LSA and RSA includes agricultural, industrial development, residential, recreational (e.g., golf course) and oil and gas activities. These developments and resource uses have resulted in habitat loss and alteration. Clearing of vegetation for agricultural activities, the creation of facilities and infrastructure, and sensory disturbance associated with development and resource use have affected the historical distribution and movement of wildlife.

The Hayesland-Christie, Sheffield-Rockton, and the Big Creek Headwaters PSW complexes are identified as areas providing winter cover for wildlife (e.g., white-tailed deer, ruffed grouse, ring-necked pheasant). Large Deer Wintering Areas have been identified within the Big Creek Headwaters PSW complex serving as important winter habitat for white-tailed deer in Ontario and providing vital protection and browse resources during severe conditions (Voigt et al. 1997).

Management objectives and guidelines related to wildlife in the RSA are set out by the OMNRF in their Significant Wildlife Technical Guide (Ontario Ministry of Natural Resources 2000). This document includes recommendations related to limiting access, protective buffer zones and sensitive periods associated with sensitive species as well as guidelines for working in the vicinity of sensitive species habitat (e.g., osprey). Where applicable, the recommendations in this document are referenced throughout the assessment and mitigation measures. In addition to the provincial objectives in Ontario, the CAs of Hamilton, Niagara Peninsula and Grand River have identified wildlife-related objectives to ensure that local resource management needs within their jurisdiction such as environmentally sensitive features (including waterbodies, lakes, drainage areas, wildlife areas and special habitat features) are protected (GRCA 2012, Halton-Hamilton Source Protection Committee 2015, NPCA 2013).

6.2.10.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

Approximately 24 km (69%) of the replacement pipeline will be constructed alongside and contiguous to an existing Enbridge pipeline ROW and other linear disturbances, with 11 km (31%) requiring new non-contiguous ROW. The pipeline will be placed in the existing ROW, with the exception of planned deviations to avoid features such golf clubs and residences.

The potential effects associated with the construction and operation of the replacement pipeline on wildlife and wildlife habitat were identified through consultation and engagement with government agencies, municipalities, CAs and landowners along the replacement pipeline route and are listed in Table 6.2.10-1. Aboriginal groups have not raised any concerns regarding wildlife and wildlife habitat.

Landowners along the replacement pipeline route have expressed concern about nuisance noise on livestock which is assessed under changes to wildlife habitat in Table 6.2.10-1. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

Mitigation measures to reduce the severity of the potential effects of construction and operations of the replacement pipeline on wildlife and wildlife habitat are provided in Table 6.2.10-1.

Mitigation measures (Table 6.2.10-1) were developed in accordance with Enbridge standards and provincial and federal regulatory guidelines including, however, not limited to the following:

- Assessment Report for the Hamilton Region Source Protection Area (Halton-Hamilton Source Protection Region 2015);
- Draft Source Protection Plan for the Grand River Source Protection Area within the Lake Erie Source Protection Region (GRCA 2012);
- Source Protection Plan for the Niagara Peninsula South Protection Area (NPCA 2014a);
- Greenbelt Plan (OMMAH 2005);
- Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario (Ontario Energy Board 2011); and
- Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources 2000).

Table 6.2.10-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wildlife and Wildlife Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Changes to wildlife habitat	• LSA • Tame pasture, treed areas, riparian areas, wetland areas	• In the event that clearing or construction activities occur within the migratory bird nesting period (April 4 to August 12), Wildlife Resource Specialists will use non-intrusive methods to conduct an area search for evidence of nesting (e.g., presence of territorial males, alarm calls, distraction displays, adults carrying nesting material/food) a maximum of 7 days prior to construction activity to identify active nests. In the event that an active nest is found, it will be subject to site-specific mitigation measures (e.g., clearly marked species-specific buffer are the nest or non-intrusive monitoring). • Suspend the work activity in the event that an area to be cleared is found to contain an active bird nest, burrow or den. Report sightings of wildlife species of concern to the Environmental Inspector or Enbridge designate. Implement applicable contingency measures associated with the discovery of species of concern during construction (e.g., seasonal timing constraints within the recommended set back distances) (see the Wildlife Species of Concern Discovery Contingency Plan in the EPP[1]). • Suspend ROW preparation in the event that an active nest or amphibian or reptile habitat is discovered during ROW preparation. Sign, fence or flag off an appropriate buffer area and contact the Environmental Inspector or Enbridge designate (see Wildlife Species of Concern Discovery Contingency Plan in the EPP[1]). • Contact the Environmental Inspector or Enbridge designate to request permission to remove muskrat lodges, where necessary. Ensure that the required approvals from the Ontario MNRF and/or the Local Conservation Authority are in place prior to commencing any activities that may cause disturbance to a muskrat lodge. Request the Environmental Inspector or Enbridge designate to arrange the removal of the muskrats prior to disturbance of the lodges. • Extend road bores to avoid clearing of adjacent shelterbelts, ornamental trees or windbreaks, where practical. Where shelterbelts, ornamental trees or windbreaks will be cleared for construction, reduce the width of the construction ROW, where practical (e.g., avoid extra temporary workspace) or as identified in the Line List.	• Changes to wildlife habitat

Table 6.2.10-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wildlife and Wildlife Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Changes to wildlife habitat (cont'd)	See above	• Complete final clean-up along the portions of the construction ROW constructed during non-frozen soil conditions as quickly as practical after backfilling and prior to freeze-up. Where completion of final clean-up prior to freeze-up is not feasible, complete final clean-up prior to spring breakup on all areas inaccessible due to the spring/early summer migratory bird nesting period or schedule final clean-up after the migratory bird nesting period. • Review RAPs applicable to construction-related activities prior to scheduling clean-up activities. • Do not seed marsh wetlands. Allow for natural revegetation, unless otherwise requested by a landowner.	See above
2.0 Changes to wildlife movement	• LSA • Entire route	• See mitigation measures regarding migratory birds in point 1 of this table. • Maintain a tight construction spread (i.e., interval between front-end activities such as brushing and grading, and back-end activities such as clean-up) to reduce the duration of activities and effects of the Project on land use, livestock and wildlife. • Ensure that noise abatement equipment (e.g., mufflers) on machinery is in good working order. Where practical, turn off equipment when not in use. Enclose noisy equipment, as needed, to limit the transmission of noise beyond the construction-site. Locate stationary equipment, such as compressors and generators, away from noise receptors. Replace or repair equipment parts generating excessive noise, if practical. • Limit the length of open trench and reduce the time the trench will be left open to lessen the amount of trench sloughing, frost penetration and interference with wildlife, landowners and livestock. The length of open trench may vary based on an evaluation of the stability of the trench, weather forecast (i.e., likelihood of precipitation), safety issues, potential for disruption of land use and risk to wildlife/livestock. • Leave gaps in the spoil pile and trench line, where requested, to allow farm equipment and livestock to cross the construction ROW. If required, gaps should be coincident with gaps in topsoil, spoil and snow (if present) windrows.	• Changes to wildlife movement

Table 6.2.10-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wildlife and Wildlife Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Changes to wildlife movement (cont'd)	See above	• Complete final clean-up along the portions of the construction ROW constructed during non-frozen soil conditions as quickly as practical after backfilling and prior to freeze-up. • Seed the disturbed areas of the construction ROW as per the Line List, or as requested by the land authority as soon as practical after final clean-up and as weather and soil conditions permit. The goal is to reclaim all disturbed lands within one growing season following construction.	See above
3.0 Changes to wildlife mortality risk	• RSA • Entire route	• See mitigation measures regarding migratory birds in point 1 of this table. • Do not harass or feed wildlife. • Do not allow pets on the construction ROW or at Project temporary facility sites. • Prohibit Project personnel from having firearms on the ROW, at temporary facility sites or in Project vehicles. • Prohibit Project personnel from hunting or fishing on the construction ROW or Project facility sites or access trails. • Establish construction traffic speed limits on access roads to reduce the risk of collisions with wildlife (refer to the Traffic Control Plan). • Use multi-passenger vehicles for the transport of crews to and from the job sites, to the extent practical, to reduce noise and air emissions during construction. • Implement the Wildlife Encounter Contingency Plan (to be appended to the EPP[1]) in the event of aggressive or nuisance wildlife, or in the event of a collision. • Suspend ROW preparation in the event that an active nest or amphibian or reptile habitat is discovered during ROW preparation. Sign, fence or flag off an appropriate buffer area and contact the Environmental Inspector or Enbridge designate (see Wildlife Species of Concern Discovery Contingency Plan, to be appended to the EPP[1]).	• Changes to wildlife mortality risk

Table 6.2.10-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Wildlife and Wildlife Habitat

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Changes to wildlife mortality risk (cont'd)	See above	• Report any incidents (e.g., aggressive behaviour, nuisance behaviour) or collisions with wildlife on the construction ROW to the Environmental Inspector or Enbridge designate who will assess the incident and determine if it is safe to continue/resume work. If necessary, the Environmental Inspector(s) will notify the Enbridge Environment Project Lead, the OMNRF, and if appropriate, the local police detachment. • Examine the trench on a regular basis for wildlife that may have become trapped overnight. Report the location and species of wildlife or livestock trapped in the trench/excavation, if present, to the Environmental Inspector or Enbridge designate prior to commencing any construction activities. The Environmental Inspector or Enbridge designate will contact the applicable provincial authority or the land agent, who in turn will contact the landowner, if necessary.	See above
4.0 Spill of hazardous materials on wildlife and wildlife habitat	• LSA • Entire route	• Implement the measures outlined in the Fuels and Hazardous Materials Contingency Plan in the event of a spill (to be appended to the EPP[1]). • Report spills immediately to the Construction Manager and Environmental Inspector who will report spills to the Enbridge Environment Lead and, if warranted, appropriate government agencies in accordance with the Fuels and Hazardous Materials Contingency Plan, to be appended to the EPP[1].	• Inadvertent spills could result in contamination or alteration of wildlife and/or wildlife habitat
5.0 Combined effects on wildlife and wildlife habitat	• RSA • Entire route	• See mitigation measures for alteration of wildlife habitat in point 1. • See mitigation measures for changes of wildlife movement in point 2. • See mitigation measures for changes to wildlife mortality in point 3. • See mitigation measures for effects of accidents and malfunctions on wildlife in point 4.	• Combined effect on wildlife and wildlife habitat

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.10.3 Residual Effects Characterization and Significance Determination for Wildlife and Wildlife Habitat

Table 6.2.10-2 provides a summary of the significance evaluation of potential residual environmental effects of the construction and operation of the replacement pipeline on wildlife and wildlife habitat. All assessment criteria were considered when determining the significance of each residual adverse effect. The most influential assessment criteria for wildlife and wildlife habitat are magnitude and reversibility. The determinations of significance for the potential residual effects on wildlife and wildlife habitat are also strongly influenced by ecological context, including relevant conservation, recovery, and land use planning objectives and strategies, which is reflected in the criteria ratings for magnitude. Qualitative significance determinations incorporate professional judgement, which allows for integration of all effects criteria ratings to provide relevant significance conclusions that are sensitive to context and facilitate decision-making (Lawrence 2007).

There are three primary effect pathways that have potential to affect wildlife and wildlife habitat including changes in habitat, movement and mortality risk. The following subsections describe these effect pathways (e.g., cause-effect relationships), as well as the potential effects associated with accidents and malfunctions. Table 6.2.10-2 summarizes the characterization and significance determination of potential residual environmental effects of the construction and operation of the Project on wildlife and wildlife habitat, with the exception of impact balance which is considered negative for all potential residual effects.

Table 6.2.10-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Wildlife and Wildlife Habitat

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Changes to wildlife habitat	LSA	Medium to extended-term	Isolated	Reversible	Low to medium	High	High	Not significant
(b) Changes to wildlife movement	LSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(c) Changes to wildlife mortality risk	RSA	Short-term	Occasional	Reversible	Low	High	High	Not significant
(d) Inadvertent spills could result in contamination or alteration of wildlife and/or wildlife habitat	LSA	Immediate to short-term	Rare	Reversible	Low	Low	Moderate	Not significant
(e) Combined effects of the Project on wildlife and wildlife habitat (points [a-c])	LSA	Medium to extended-term	Isolated to occasional	Reversible	Low to medium	High	High	Not significant

Changes to Wildlife Habitat

Changes in wildlife habitat will result from construction and operation of the replacement pipeline. Clearing of vegetation, soil removal and grading activities will result in direct habitat loss or alteration. Indirect habitat alteration occurs when habitat is available, however, the quality or effectiveness of the habitat is changed such that wildlife avoid the habitat or reduce their use of it. Reduced habitat effectiveness can occur as a result of fragmentation, creation of edges, or sensory disturbance (e.g., noise, artificial light, proximity to facilities and infrastructure, human activity and traffic). Habitat fragmentation can cause habitat to become unsuitable for species with large territories or home ranges (i.e., patch sizes become too small), alter predator-prey dynamics (Gehring and Swihart 2003) and allow for increased invasive or parasitic species abundance (e.g., cowbird parasitism of songbird nests near forest edges).

Changes in habitat suitability may also result from changes in vegetation communities due to increased light penetration at clearing edges, or from changes in water quality (e.g., siltation, deposition of airborne contaminants). Habitat loss and reduced habitat effectiveness can cause displacement of wildlife, and potentially result in use of less suitable habitat, reduced foraging ability (Bird et al. 2004), increased energy expenditure (Jalkotzy et al. 1997), and lower reproductive success (Habib et al. 2007).

Harper et al. (2001) identifies pipeline projects as having an adverse effect on vegetation and, therefore, wildlife habitat, due to the removal or modification of the pre-construction vegetation on the footprint and subsequent change in ecosystem dynamics (i.e., changes in microclimate, ground cover, soil compaction). The adverse habitat effects for most wildlife species are considered minor unless a substantial portion or critical element of the habitat is rendered unsuitable by the development (Harper et al. 2001).

Approximately 88% of the replacement pipeline route crosses previously cleared land (e.g., disturbed land, tame pasture, and cultivated land). Construction of the replacement pipeline will result in disturbance of approximately 14.9 ha of treed land and 5.9 ha of wetland areas. The area of new habitat disturbance will be reduced through routing through agricultural lands, the alignment of the replacement pipeline adjacent to existing disturbances to the extent practical, through shared workspace where pipeline ROWs are paralleled and implementation of mitigation to reduce disturbance (e.g., planned HDD activities; extending road bores to avoid shelterbelts). Approximately 24 km (69%) of the replacement pipeline will be constructed alongside and contiguous to an existing Enbridge pipeline ROW and other linear disturbances, with 11 km (31%) requiring new non-contiguous ROW. Routing through agricultural lands and paralleling existing linear disturbances meets provincial and industry guidelines relating to routing (Ontario Energy Board 2011). By paralleling existing disturbances, the fragmentation and isolation of habitat patches are also reduced. Appropriate reclamation measures will be applied to disturbed areas along the construction ROW as outlined in Table 6.2.10-1 (e.g., natural regeneration and/or seeding).

In addition to clearing of natural vegetation communities, the pipeline has the potential to alter aquatic habitat by changing wetland habitat function or water quality. Four PSW complexes and one locally significant wetland are traversed by the replacement pipeline. An HDD will be conducted at the PSW Sheffield-Rockton complex located south of the Westover Terminal, which will reduce distance to wildlife habitat. Amphibians and reptiles (e.g., turtles) are particularly sensitive to changes in water quality or increased siltation that may result from construction in and adjacent to wetlands. The most important considerations for limiting disturbances to hydrologic functions are ensuring that pre-construction elevations and contours are achieved (Gartman 1991), and ensuring that there will be no unnatural impedance to water flow. Re-establishing pre-construction contours within the wetland boundary during reclamation is expected to reduce the effects of construction on water quality due to siltation and wetland function, respectively. Additional measures to reduce water quality effects in wetlands and wetland habitat function are discussed in Sections 6.2.3 and 6.2.8, and Tables 6.2.3-1 and 6.2.8-1, respectively.

Habitat effectiveness may be affected by noise, light and activity associated with replacement pipeline construction and operations (e.g., maintenance activities). Sensory effects on wildlife can potentially include habitat loss or reduced habitat effectiveness through avoidance, increased energy expenditure, changes in normal behaviours (e.g., feeding) and impaired communication between individuals. Bayne et al. (2005) determined that the abundance of passerines is up to 1.5 times greater near noiseless energy facilities than areas in the vicinity of noise-producing facilities. However, different species and even individuals of a given species are expected to respond differently to sensory disturbances. Various factors affect an animal's response to sensory disturbances, such as noise level, frequency distribution, duration, number of events, rate of onset, level of existing ambient noise, time of year or day, animal activity and location, animal age and gender.

The residual effect of construction and operations of the replacement pipeline on wildlife habitat is reduced by limiting the area of disturbance (i.e., by routing adjacent to existing disturbances). As noted, the replacement pipeline crosses 88% previously cleared land. Additional mitigation listed in Table 6.2.10-1 will reduce the residual effects of the replacement pipeline on changes in wildlife habitat and will be included in the Project-specific EPP. Since the replacement pipeline route encounters woodlands, which are very limited in distribution and identified areas with high potential habitat value (e.g., PSW complexes, deer wintering areas, turtle overwintering areas, turtle nesting areas, amphibian woodland breeding habitats), the magnitude of effects on changes to wildlife habitat is considered low (in areas where agricultural lands are traversed) to medium. With mitigation, the residual effect of construction and operations of the replacement pipeline on wildlife habitat is expected to be reversible and of medium to extended-term duration, extending until re-establishment of vegetation has occurred within the construction ROW once the pipeline has been abandoned or decommissioned (Table 6.2.10-2, point [a]).

Changes to Wildlife Movement

Wildlife movement patterns vary between species, with species-specific attributes such as size and life stage, and other factors such as time of day and season. Most species will alter their movement to avoid construction areas however, some species may be less affected by human activity and noise during construction.

Miller et al. (2001) found that grassland (i.e., meadowlarks and vesper sparrows) and woodland birds (i.e., American robins) respond negatively to disturbance through increased flushing distance and overall distance moved, thereby increasing energetic costs. In southern Ontario, Eigenbrod et al. (2008) determined that amphibians avoided linear landscape elements, resulting in changes in movement patterns restricting the quantity of suitable habitat used. Shine et al. 2004 determined that not all linear features (e.g., gravel roads) induce road-basking behavior in snakes which would benefit thermoregulation, but rather snakes avoided open areas and changed movement patterns at linear features likely in response to increased risk of predation. Coyotes and bobcats have been found to persist in urban and fragmented habitat with unaltered home range sizes when compared to those individuals in fragmented habitat, however adjustments in temporal and spatial movement patterns suggesting avoidance where evident (Tigas et al. 2002). Raccoons have been found to use linear landscape features such as forest edges and maintained trail during nocturnal foraging (Barding and Nelson 2009). Changes in movement patterns during operations may also occur where the replacement pipeline route is adjacent to existing linear corridors, since the increased corridor width may cause an incremental barrier effect for some wildlife species.

Habitat fragmentation results when barriers to movement cause functional separation of habitats into smaller, isolated habitat patches (Andrén 1994, Jalkotzy et al. 1997). Some species are less affected by anthropogenic disturbance generated during construction activities and may continue to use or exploit established trails or activity patterns. Conversely, some species (e.g., deer) may exhibit little to no effect to the presence or activity of humans (Miller et al. 2001).

To mitigate or reduce changes to wildlife movement from both direct and indirect factors, measures such as maintaining a tight construction spread, leaving gaps in pipe and soil windrows, limiting the length of open trench and completing reclamation as soon as practical will be implemented. Direct changes to wildlife movements (i.e., physical barriers) are not expected during operation because the replacement pipeline will be primarily constructed in an agricultural landscape that is generally open habitat and, therefore, there will be no linear corridor to filter or restrict wildlife movement.

The potential residual effects associated with temporary changes to wildlife movement patterns during construction due to barriers are considered to have a negative impact balance. With the application of the recommended mitigation to prevent attraction of wildlife to the construction site and reduce barrier effects associated with construction materials, windrows and open trench, the potential residual effect is reduced to low magnitude, reversible and of short-term duration, extending until construction activities are completed. Consequently, the Project's contribution to potential incremental residual effects to changes in wildlife movement patterns is not significant (Table 6.2.10-2, point [b]).

Change in Wildlife Mortality Risk

The level of mortality risk that will occur due to replacement pipeline construction activities will depend on the species guild and can be mitigated in part by scheduling outside the migratory bird nesting periods or conducting pre-construction areas searches for evidence of nesting will prevent mortality of nesting birds and young. Grubbing, topsoil salvage and grading activities may affect small mammals, amphibians and reptiles that inhabit woody debris, litter and soil. Any amphibians or reptiles encountered on the construction ROW will be relocated to the closest suitable habitat to avoid injury or mortality caused by construction activities. However, there is potential during ROW preparation and construction activities for direct mortality of amphibians and small mammal species within the Footprint.

In less frequent situations, collisions with construction vehicles may result in mortality for a wide range of species including ungulate species. Deer are known to be attracted to recently cleared linear disturbances (Lyon and Jensen 1980) given the increased production of forage (Wallmo et al. 1972) and can easily habituate to disturbance corridors (Scott-Brown 1984). Although multi-passenger vehicles will generally be used to transport crews, and vehicle speed will be limited on Project access roads, a slight increase in the potential for vehicle/wildlife collisions during construction and, to a lesser extent, during the operations of the pipeline, does exist. The mitigation measures (Table 6.2.10-2) to be implemented during construction to reduce the potential for wildlife mortality (e.g., removing trapped animals from the trench and preventing wildlife encounters by appropriate waste handling) will also reduce the risk for wildlife mortality associated with pipeline construction.

There is a potential for an increase in wildlife mortality risk as a result of ROW preparation and construction activities, which results in a negative impact balance. However, the magnitude of this residual effect is low, reversible and of short-term duration, extending until construction activities are completed. Consequently, the Project's contribution to potential incremental residual effects to changes in wildlife mortality risk is not significant (Table 6.2.10-2. point [c]).

Effects of Spills on Wildlife

Potential wildlife mortality or injury and reduced habitat quality (i.e., water quality and vegetation alteration) could occur in the event of a spill construction or operations. Toxic substances that are accidentally released or are not properly contained can create exposure pathways for wildlife, and vegetation. The scale of the effect is dependent on the exposure pathway (e.g., ingestion from contaminated vegetation, mineral soil or water; inhalation of contaminated air), as well as the size, type and location of spill.

Several contingency plans and emergency response plans will be in place to direct response measures in the event there is a spill or hazardous substance release (Section 6.7 Accidents and Malfunctions). Depending on the severity and location, and the wildlife species affected, the magnitude of the impact of an accident or malfunction on wildlife either directly or through environmental pathways (e.g., contaminated water) could be high. With implementation of prevention measures, the probability of wildlife mortality or injury and reduced habitat quality due to an accident or malfunction is low and, consequently, the potential residual effect of accidents and malfunctions on wildlife is not significant (Table 6.2.10-2, point [d]).

Combined Effects on Wildlife and Wildlife Habitat

The evaluation of combined effects on wildlife considers all of the potential residual effects evaluated in Table 6.2-10-2 that are likely to occur as a result of construction and operations of the pipeline, and that could act in combination on wildlife in the Wildlife RSA. Effects that are considered unlikely (e.g., effects of accidents and malfunctions on wildlife) are not included in the combined effects analysis. The residual effects on wildlife and wildlife habitat are expected to act in combination differently during the construction and operation phases of the pipeline.

The residual effects that are likely to act in combination to affect wildlife during construction and operation include:

- changes to wildlife habitat;
- changes to wildlife movement; and
- changes to wildlife mortality risk.

Combined effects during construction activities associated with wildlife movement and wildlife mortality risk will be alleviated in the short-term following completion of construction. However, residual effects related to changes to wildlife habitat will carry forward into the operation phase (i.e., effect is reversible and of medium to extended-term duration, extending until native vegetation has been re-established within the construction ROW). Effects arising from habitat alteration are reduced by: routing approximately 88% of the replacement pipeline through previously cleared land (e.g., disturbed land, tame pasture, and cultivated land); alignment of the replacement pipeline route parallel to existing linear disturbances for approximately 69% of its length; the HDD of the Sheffield-Rockton PSW; reducing clearing requirements by sharing workspace on existing adjacent disturbances; reclaiming the ROW; and implementing remedial measures to address any issues identified during PCEM (e.g., weed control). Individually, the magnitude of the residual effects is low to medium. When considered in combination, the magnitude of the combined residual effect is low (in areas where agricultural lands are traversed) to medium given the sensitivity of some wildlife habitats and species occurring along the replacement pipeline route, and since some wildlife species will potentially experience all of the potential effects. Consequently, the Project's contribution to potential combined incremental residual effects to wildlife and wildlife habitat is not significant (Table 6.2.10-2 point [e]).

6.2.10.4 Summary

As identified in Table 6.2.10-2, there are no situations where there is a high probability of occurrence of a long or extended-term residual environmental effect on wildlife and wildlife habitat of high magnitude, or a high probability of occurrence of an irreversible residual effect of high magnitude. Consequently, it is concluded that the potential residual environmental effects of pipeline construction and operation on wildlife and wildlife habitat will be not significant.

6.2.11 Species at Risk or Species of Special Conservation Status

6.2.11.1 Context

Fish and Fish Habitat

Within the Aquatics RSA, seven fish species at risk that are listed either provincially (i.e., Ontario *Endangered Species Act*) and/or federally (i.e., COSEWIC and/or *SARA* Schedule 1 designation) have been documented in the watersheds or subwatersheds crossed by the replacement pipeline route: grass pickerel; redside dace; American eel; river redhorse; black redhorse; eastern sand darter; and silver shiner. Grass pickerel, redside dace and American eel have reasonable potential to interact with the Project.

Two federally and provincially listed mussel species have been documented within the watersheds or subwatersheds crossed by the replacement pipeline route: eastern pondmussel and rainbow mussel. Although the presence of these species has not been confirmed for the watercourses crossed by the replacement pipeline route, they have been conservatively included in the assessment as having potential to interact with the Project.

Fish Species at Risk Recovery Strategies and Management Plans

Fish species at risk recovery strategies and management plans have been developed for grass pickerel, redside dace and American eel. The species at risk recovery strategies and management plans presented in detail in Appendix 2Bregarding the objectives or goals directly relating to these fish species at risk. At the time of writing, recovery strategies or management plans had not been developed for eastern pondmussel or rainbow mussel. Recovery Strategies and Management plans considered include:

- Management Plan for the Grass Pickerel (*Esox americanus vermiculatus*) in Canada (Beauchamp et al. 2012);
- Redside Dace (*Clinostomus elongatus*) in Ontario. Ontario Recovery Strategy Series (Redside Dace Recovery Team 2010); and
- American Eel (*Anguilla rostrata*) in Ontario. Ontario Recovery Strategy Series (MacGregor et al. 2013).

With the successful implementation of the mitigation measures (Table 6.2.11-1), it is anticipated that the Project's environmental protection efforts are aligned with the goals or objectives of the plans outlined above and detailed in Appendix 2B related to protection, management, and recovery efforts pertaining to fish species at risk.

Vegetation

There are ten vegetation species at risk (i.e., *SARA* Schedule 1, Ontario *Endangered Species Act*) identified as having the potential to occur in the RSA for the replacement pipeline (based on known ranges and preferred habitat availability), and include: American chestnut; American columbo; American ginseng; broad beech fern; butternut; eastern flowering dogwood; green dragon; hoary mountain mint; red mulberry; and white wood aster. No vegetation species at risk occurrence records were identified in the NHIC online database as occurring within 5 km of the replacement pipeline route (NHIC 2015).

One vegetation species at risk was observed during field work in 2013: butternut (*Juglans cinerea*) (Appendix 2A). Butternut is listed as Endangered both federally and provincially, and was observed within section 1 north of Concession 4, west of the existing line, and directly south of Concession 2 within 50 m of the existing line. The results of the 2016 supplemental vegetation surveys will confirm the distribution and abundance of butternut in relation to the replacement pipeline route (see Section 10.0).

Butternut is a protected species under the *Endangered Species Act* of Ontario. This species is impacted by butternut canker, a fungal disease that has spread across its range throughout Ontario. In an effort to maintain a healthy population of butternut, the removal of these species is regulated by the OMNRF. Individuals or organizations wishing to remove individual trees must have them appraised by a butternut health assessor, defined as a person designated by the Minister for the purpose of assessing the extent to which butternut trees are affected by the canker. Depending on the health of the individuals and the results of the assessment, additional actions may be required. Planting younger trees in the vicinity of the removed trees may be required based on the size of the individuals. If the individuals are healthy and exhibit resistance to butternut canker, the butternut health assessor may restrict the removal of the individuals entirely.

Wildlife

Wildlife species with special conservation status that are federally listed on Schedule 1 of *SARA* and/or by COSEWIC or provincially listed under the Ontario *Endangered Species Act* that have the potential to occur within the LSA based on known ranges and preferred habitat availability include: little brown myotis; northern myotis; tri-colored bat; woodland vole; Acadian flycatcher; bald eagle; barn owl; barn swallow; black tern; bobolink; Canada warbler; cerulean warbler; chimney swift; common nighthawk; eastern meadowlark; eastern whip-poor-will; eastern wood-pewee; golden-winged warbler; Henslow's sparrow; grasshopper sparrow; hooded warbler; king rail; least bittern; Louisiana waterthrush; northern bobwhite; peregrine falcon; prothonotary warbler; red-headed woodpecker; short-eared owl; wood thrush; yellow-breasted chat; Jefferson salamander; Blanding's turtle; common snapping turtle; eastern hog-nosed snake; eastern musk turtle; eastern milksnake; eastern ribbonsnake; gray ratsnake; and wood turtle. Table 5.1-1 in Section 5 provides details regarding each species designation.

Eleven *SARA* Schedule 1 and/or COSEWIC species occurrence records were identified in the NHIC online database as being observed within 1 km of the replacement pipeline route, including: woodland vole; Acadian flycatcher; bobolink; eastern meadowlark; eastern whip-poor-will; Henslow's sparrow; Louisiana waterthrush; northern bobwhite; yellow-breasted chat; eastern milksnake; and Jefferson salamander (NHIC 2015). The following species with federal and provincial conservation status (i.e., *SARA*, COSEWIC, Ontario *Endangered Species Act*) were observed during previous field work: barn swallow; bobolink; chimney swift; eastern meadowlark; eastern wood-pewee; grasshopper sparrow; least bittern; red-headed woodpecker; wood thrush; common snapping turtle; eastern milksnake; monarch and West Virginia white.

6.2.11.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

Fish and Fish Habitat

The potential effects associated with construction and operations of the replacement pipeline on fish species at risk were identified by the assessment team, based on past experience, relevant fisheries management plans and watershed plans, and from consultation with stakeholders including Aboriginal groups, landowners, government agencies, CAs and municipalities along the replacement pipeline route.

There were no concerns specific to fish species at risk identified by landowners or Aboriginal groups along the replacement pipeline route during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

River redhorse, black redhorse, eastern sand darter and silver shiner are not expected to be present in any of the watercourses at locations crossed by the replacement pipeline route. If any individuals of these species are present, the mitigation measures outlined in Table 6.2.11-1 will address the potential effects, and potential residual effects will be similar to those for fish and fish habitat.

The mussel species round pigtoe, mapleleaf mussel, salamander mussel, northern riffleshell, snuffbox, wavyrayed lampmussel, threehorn wartyback, hickorynut, round hickorynut, kidneyshell, lilliput, and rayed bean are typically present in Southwestern Ontario (Metcalfe-Smith et al. 2005), however, their presence in the watercourses at locations crossed by the replacement pipeline route has not been confirmed. If any of these species is present, the potential residual effects are expected to be similar to those for freshwater mussels in general, and mitigation measures outlined in Table 6.2.11-1 will address the potential effects.

There is the potential for construction and operations of the replacement pipeline to interact with three fish species at risk (i.e., grass pickerel, redside dace and American eel) and two mussel species at risk (i.e., eastern pondmussel and rainbow mussel). The potential effects, mitigation measures and potential residual effects related to fish and fish habitat and freshwater mussels in general are outlined in

Table 6.2.11-1. Additional mitigation measures to reduce the potential effects of construction and operations of the replacement pipeline on the fish and freshwater mussel species at risk are summarized in Table 6.2.7-1.

Vegetation

There were no concerns regarding vegetation species at risk identified by landowners or Aboriginal groups along the replacement pipeline route during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

In order to determine appropriate mitigation for butternut, trees within the Footprint must be appraised by a butternut health assessor, defined as a person designated by the Minister of the OMNRF. Actions required by the assessor, may include planting younger trees in the vicinity of the removed trees or the removal of individuals may be restricted entirely.

Construction-related effects to occurrences of butternut observed along the construction ROW will be reduced, where feasible. Measures may include narrowing down the proposed area of disturbance, flagging the area for access restriction, extending road or watercourse/wetland bores and realigning the route. These recommended mitigation measures have been previously used on other major pipeline construction projects with success including the following example.

- During pre-construction surveys, small-flowered sand verbena (*Tripterocalyx micranthus*) was located adjacent to a proposed ROW and was avoided during construction (TERA Environmental Consultants 2011b). Small-flowered sand verbena is listed as Endangered by COSEWIC and is protected under *SARA*.

Mitigation suggested by the butternut health assessor will be followed and further mitigation will be used to reduce effects on the butternut populations where feasible. The potential for effects on butternut is evaluated in Table 6.2.11-1.

Wildlife

There were no concerns regarding wildlife species at risk identified by landowners or Aboriginal groups along the replacement pipeline route during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

Three effect pathways are identified as the primary mechanism for construction and operation of the replacement pipeline to affect wildlife species at risk: changes in habitat; changes in movement; and changes in mortality risk (Table 6.2.11-1).

Mitigation measures to reduce the potential effects of the Project on wildlife species at risk are summarized in Table 6.2.11-2 and were developed in accordance with the following references:

- Greenbelt Plan (OMMAH 2005);
- Environmental Guidelines for the Location, Construction and Operation of Hydrocarbon Pipelines and Facilities in Ontario (Ontario Energy Board 2011); and
- Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources 2000).

The results of field surveys are used to inform the development of mitigation to reduce the potential residual effects of the Project on wildlife species at risk.

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Combined effects on grass pickerel	• Footprint • Watercourse crossings	• Implement the applicable measures from the Fish Species of Concern Discovery Contingency Plan (to be included in the EPP[1)] should fish and mussel species of concern be discovered during construction. • See Table 6.2.7-1.	• Combined effects on grass pickerel
2.0 Combined effects on redside dace	• Footprint • Watercourse crossings	• Implement the applicable measures from the Fish Species of Concern Discovery Contingency Plan (to be included in the EPP[1)] should fish and mussel species of concern be discovered during construction. • See Table 6.2.7-1.	• Combined effects on redside dace
3.0 Combined effects on American eel	• Footprint • Watercourse crossings	• Implement the applicable measures from the Fish Species of Concern Discovery Contingency Plan (to be included in the EPP[1)] should fish and mussel species of concern be discovered during construction. • See Table 6.2.7-1.	• Combined effects on American eel
4.0 Combined effects on eastern pondmussel	• Footprint • Watercourse crossings	• Implement the applicable measures from the Fish Species of Concern Discovery Contingency Plan (to be included in the EPP[1)] should fish and mussel species of concern be discovered during construction. • See Table 6.2.7-1.	• Combined effects on eastern pondmussel
5.0 Combined effects on rainbow mussel	• Footprint • Watercourse crossings	• Implement the applicable measures from the Fish Species of Concern Discovery Contingency Plan (to be included in the EPP[1)] should fish and mussel species of concern be discovered during construction. • See Table 6.2.7-1.	• Combined effects on rainbow mussel
6.0 Effects on butternut	• Vegetation LSA • Lands supporting known butternut populations	• Control construction-related road dust as advised by the Environmental Inspector or Enbridge designate. Apply water to the construction ROW and access roads if traffic and wind conditions result in pulverized soils and dust problems. Alternatively, control dust emissions by applying dust suppressants, if warranted. Ensure dust suppressants are approved by the municipal district/rural municipality, Enbridge and landowners. • Recontour the construction ROW and restore the pre-construction grades and drainage channels. Where restoration of the pre-construction grade is not feasible due to the risk of the failure of fill on slopes, recontour to grades as directed by Enbridge. Typical diversion berm spacing is indicated in the EGC.	• Effects on butternut

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
6.0 Effects on butternut (cont'd)	See above	• Restrict weed management methods to handpicking within areas containing butternut. • During the first year of PCEM, the construction ROW will be monitored to identify areas where vegetation re-establishment has not progressed as expected. Vegetation parameters to be assessed. • Should monitoring indicate that further management measures are warranted (undesirable species remain above the threshold level) to prevent the spread of weed species, Enbridge will take appropriate action to address the issue in a timely manner.	See above
7.0. Changes in habitat, movement and mortality risk for bat species at risk (little brown myotis, northern myotis and tri-colored bat)	• LSA • Treed land	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement (e.g., ensuring that noise abatement equipment is in good working order) in Table 6.2.10-1 (point 2). • Seed disturbed soil on treed lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be included in the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	• Project effects on bat species at risk (little brown myotis, northern myotis and tri-colored bat) resulting from changes in habitat, mortality risk and combined effects
8.0. Changes in habitat, movement and mortality risk for woodland vole	• LSA • Treed land	• Implement the measures to reduce changes to wildlife habitat 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement in Table 6.2.10-1 (point 2). • Implement the measures to reduce changes to wildlife mortality risk (e.g., examining the trench on a regular basis) in Table 6.2.10-1 (point 3). • Examine the trench on a regular basis for wildlife that may have become trapped overnight. Report the location and species of wildlife or livestock trapped in the trench/excavation, if present, to the Environmental Inspector or Enbridge designate prior to commencing any construction activities. The Environmental Inspector or Enbridge designate will contact the applicable provincial authority or the land agent, who in turn will contact the landowner, if necessary.	• Project effects on woodland voles resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
8.0. Changes in habitat, movement and mortality risk for woodland vole (cont'd)	See above	• Seed disturbed soil on treed lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion. • Implement the Wildlife Species of Concern Discovery Contingency Plan (will be included in the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	See above
9.0 Changes in habitat, movement and mortality risk for barn owl, barn swallow, chimney swift and peregrine falcon	• LSA • Building, bridges	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement (e.g., ensuring that noise abatement equipment on machinery is in good working order) in Table 6.2.10-1 (point 2). • Implement the measures to reduce changes to wildlife mortality risk (e.g., suspending construction in the even that an active nest is discovered) in Table 6.2.10-1 (point 3). • Implement the Wildlife Species of Concern Discovery Contingency Plan (will be included in the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	• Project effects on barn owl and chimney swift resulting from changes in movement, mortality risk and combined effects
10.0. Changes in habitat, movement and mortality risk for common nighthawk	• LSA • Tame pasture, barren land	• Implement the measures to reduce changes to wildlife habitat 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement in Table 6.2.10-1 (point 2), including, however, not limited to: maintain a tight construction spread. • Implement the measures to reduce changes to wildlife mortality risk in Table 6.2.10-1 (point 3), including however, not limited to: using multi-passenger vehicles; and adhering to construction traffic speed limits to reduce the risk of collisions with wildlife. • Allow the ROW to naturally recover or requested by the land authority and where erodible soils or steep slopes do not create an erosion risk. Seed locations where a wider than anticipated area of disturbance has occurred (e.g., grading was necessary) and where directed by Environmental Inspector or Enbridge designate. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	• Project effects on common nighthawks resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
11.0. Changes in habitat, movement and mortality risk for eastern whip-poor-will	• LSA • Tame pasture, forest edges, open woodland areas	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement in Table 6.2.10-1 (point 2), including, however, not limited to: maintain a tight construction spread, ensuring that noise abatement equipment on machinery is in good working order. • Implement the measures to reduce changes to wildlife mortality risk in Table 6.2.10-1 (point 3), including however, not limited to: using multi-passenger vehicles; and adhering to construction traffic speed limits to reduce the risk of collisions with wildlife. • HDD activities are planned at the Sheffield-Rockton PSW Complex from KP 0.22 to KP 0.77. • Seed disturbed soil on level and gently sloping tame pasture lands as well as treed lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	• Project effects on eastern whip-poor-wills resulting from changes in habitat, movement, mortality risk and combined effects
12.0. Changes in habitat, movement and mortality risk for pasture bird species at risk (bobolink, eastern meadowlark, grasshopper sparrow, Henslow's sparrow, northern bobwhite, and short-eared owl)	• LSA • Tame pasture	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement (e.g., ensuring that noise abatement equipment on machinery is in good working order) in Table 6.2.10-1 (point 2). • Clearing activities are currently scheduled to commence outside the migratory bird nesting period of April 4 to August 12. In the event that clearing or construction activities begin within the migratory bird primary nesting period, Wildlife Resource Specialists will use non-intrusive methods to conduct an area search for evidence of nesting (e.g., presence of territorial males, alarm calls, distraction displays, adults carrying nesting material/food). In the event that an active nest is found, site-specific mitigation measures will be implemented (e.g., clearly marked species-specific buffer around the nest or non-intrusive monitoring).	• Project effects on pasture bird species at risk (bobolink, eastern meadowlark, grasshopper sparrow, Henslow's sparrow, northern bobwhite, short-eared owl resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
12.0. Changes in habitat, movement and mortality risk for pasture bird species at risk (bobolink, eastern meadowlark, grasshopper sparrow, Henslow's sparrow, northern bobwhite, and short-eared owl) (cont'd)	See above	• In the event that a species with a nesting period that extends past August 12 (i.e., golden-winged warbler, barn swallow, bobolink, bald eagle, and eastern meadowlark) is identified prior to or during ROW preparation, construction and/or reclamation activities, the appropriate protective buffer will be applied until the nest is confirmed to be no longer active. • Seed disturbed soil on level and gently sloping tame pasture lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion, unless otherwise requested by landowner. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	See above
13.0. Changes in habitat, movement and mortality risk for wetland bird species at risk (black tern, king rail, least bittern, Louisiana waterthrush)	• LSA • Wetlands	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1) including however, not limited to: reducing grubbing near riparian areas and wetlands; implement natural recovery method for reclamation; seeding riparian and erosion prone areas. • Implement the measures to reduce changes to wildlife movement (e.g., ensuring that noise abatement equipment on machinery is in good working order) in Table 6.2.10-1 (point 2). • Clearing activities are currently scheduled to commence outside the migratory bird nesting period of April 4 to August 12. In the event that clearing or construction activities begin within the migratory bird primary nesting period, Wildlife Resource Specialists will use non-intrusive methods to conduct an area search for evidence of nesting (e.g., presence of territorial males, alarm calls, distraction displays, adults carrying nesting material/food). In the event that an active nest is found, site-specific mitigation measures will be implemented (e.g., clearly marked species-specific buffer around the nest or non-intrusive monitoring). • Follow the measures for fish and fish habitat identified in Table 6.2.7-1 to reduce effects on riparian habitat in Table (point 1), and the measures for wetlands in Tables 6.2.3-1 and 6.2.8-1 to reduce effects on water quality and wetland habitat function.	• Project effects on wetland bird species at risk (black tern, king rail, least bittern, Louisiana waterthrush) resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
13.0. Changes in habitat, movement and mortality risk for wetland bird species at risk (black tern, king rail, least bittern, Louisiana waterthrush) (cont'd)	See above	• Prohibit the clearing of extra temporary workspace within the riparian buffer. • Limit vegetation removal and limit equipment disturbance adjacent to watercourses and/or wetlands to that which is absolutely necessary and in accordance with Project-specific plans and approvals. • Postpone clearing of wetland margins, watercourse approach slopes and banks until immediately prior to crossing construction, except, if necessary to install vehicle crossing structures. Where pre-clearing is approved by the Environmental Inspector or Enbridge designate, leave the vegetative ground mat and root structure intact. • Limit brushing in the vicinity of watercourse and wetland crossings to the removal of trees and shrubs along the trench line and work side area needed for the vehicle crossing to protect riparian areas. Following brushing, the low-lying understory vegetation is to remain intact. Reduce disturbance of soil adjacent to wetlands. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	See above

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
14.0 Changes in habitat, movement and mortality risk for woodland bird species at risk (Acadian flycatcher, bald eagle, Canada warbler, cerulean warbler, eastern wood-pewee, golden-winged warbler, hooded warbler, prothonotary warbler, red-headed woodpecker, wood thrush and yellow-breasted chat)	• LSA • Shrub, treed land	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Allow disturbed areas on the construction ROW to naturally recover where requested by the land authority and where erodible soils or steep slopes do not create an erosion risk. Seed as directed by Environmental Inspector or Enbridge designate. • Seed disturbed soil on treed lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	• Project effects on woodland bird species at risk (Acadian flycatcher, bald eagle, Canada warbler, cerulean warbler, eastern wood-pewee; golden-winged warbler, hooded warbler, prothonotary warbler, red-headed woodpecker, wood thrush, yellow-breasted chat) resulting from changes in habitat, movement, mortality risk and combined
15.0 Changes in habitat, movement and mortality risk for Jefferson salamander	• LSA • Wetlands	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1), when applicable. • Implement the measures to reduce changes to wildlife movement in Table 6.2.10-1 (point 2), when applicable. • Implement the measures to reduce changes to wildlife mortality risk in Table 6.2.10-1 (point 3), where applicable. • HDD activities are planned at the Sheffield-Rockton PSW Complex from KP 0.22 to KP 0.77. • Conduct amphibian salvages prior to the commencement of heavy equipment activity at known locations of breeding amphibians with special conservation status in accordance with amphibian salvage approval conditions. Ensure those conducting the amphibian salvage have the experience/training to meet the approval conditions. • Clearing and construction activities are scheduled to commence along the pipeline route in Q3 2017, which is outside the breeding period for amphibian species.	• Project effects on Jefferson salamander resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
15.0 Changes in habitat, movement and mortality risk for Jefferson salamander (cont'd)	See above	• Limit brushing in the vicinity of watercourse and wetland crossings to the removal of trees and shrubs along the trench line and work side area needed for the vehicle crossing to protect riparian areas. Following brushing, the low-lying understory vegetation is to remain intact. Reduce disturbance of soil adjacent to wetlands. • Replace trench material as soon as possible, and re-establish pre-construction contours within wetland boundary to ensure cross ROW drainage. • Do not seed marsh wetlands. Allow for natural revegetation. Follow the measures for Fish and Fish Habitat identified in Table 6.2.7-1 to reduce effects on riparian habitat (point 1), and the measures for wetlands in Tables 6.2.3-1 and 6.2.8-1 to reduce effects on wetland habitat function and water quality in wetlands (e.g., natural recovery, no seeding, re-establish pre-construction contours). • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	See above
16.0 Changes in habitat, movement and mortality risk for turtle species at risk (Blanding's turtle, common snapping turtle, eastern musk turtle, wood turtle)	• LSA • Wetlands	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement in Table 6.2.10-1 (point 2). • Implement the measures to reduce changes to wildlife mortality risk in Table 6.2.10-1 (point 3). • HDD activities are planned at the Sheffield-Rockton PSW Complex from KP 0.22 to KP 0.77. • Clearing and construction activities are scheduled to commence along the pipeline route outside the breeding period for turtle species. • Limit brushing in the vicinity of watercourse and wetland crossings to the removal of trees and shrubs along the trench line and work side area needed for the vehicle crossing to protect riparian areas. Following brushing, the low-lying understory vegetation is to remain intact. Reduce disturbance of soil adjacent to wetlands.	• Project effects on turtle species at risk (Blanding's turtle, common snapping turtle, eastern musk turtle, wood turtle) resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
16.0 Changes in habitat, movement and mortality risk for turtle species at risk (Blanding's turtle, common snapping turtle, eastern musk turtle, wood turtle) (cont'd)	See above	• Replace trench material as soon as possible, and re-establish pre-construction contours within wetland boundary to ensure cross ROW drainage. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	See above
17.0 Changes in habitat, movement and mortality risk for snake species at risk (eastern hog-nosed snake, eastern milksnake, eastern ribbonsnake)	• LSA • Tame pasture, shrub, treed land, riparian areas, wetlands, rock outcrops and fissures	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Implement the measures to reduce changes to wildlife movement in Table 6.2.10-1 (point 2). • Implement the measures to reduce changes to wildlife mortality risk in Table 6.2.10-1 (point 3). • Limit brushing in the vicinity of watercourse and wetland crossings to the removal of trees and shrubs along the trench line and work side area needed for the vehicle crossing to protect riparian areas. Following brushing, the low-lying understory vegetation is to remain intact. Reduce disturbance of soil adjacent to wetlands. • Replace trench material as soon as possible, and re-establish pre-construction contours within wetland boundary to ensure cross ROW drainage. • Do not seed marsh wetlands. Allow for natural revegetation. • Follow the measures for Fish and Fish Habitat identified in Table 6.2.6-1 to reduce effects on riparian habitat and the measures for wetlands in Tables 6.2.7-1 reduce effects on wetland habitat function and water quality in wetlands (e.g., natural recovery, no seeding, re-establish pre-construction contours). • Allow disturbed areas on the construction ROW to naturally recover where requested by the land authority and where erodible soils or steep slopes do not create an erosion risk. Seed as directed by Environmental Inspector or Enbridge designate. • Seed disturbed soil on treed lands as well as level and gently sloping tame pasture lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion.	• Project effects on snake species at risk (eastern hog-nosed snake, eastern milksnake, eastern ribbonsnake) resulting from changes in habitat, movement, mortality risk and combined effects

Table 6.2.11-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Species at Risk or Species of Special Conservation Status

Potential Effect	Spatial Boundary/Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
17.0 Changes in habitat, movement and mortality risk for snake species at risk (eastern hog-nosed snake, eastern milksnake, eastern ribbonsnake, gray ratsnake) (cont'd)	See above	• Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	See above
18.0 Changes in habitat, movement and mortality risk for monarch and West Virginia white	• LSA • Tame pasture, treed land	• Implement the measures to reduce changes to wildlife habitat in Table 6.2.10-1 (point 1). • Clearing and construction activities are currently scheduled to commence after monarchs have started migrating south in early August and outside of the West Virginia white adult flight period in Ontario. • Seed disturbed soil on treed lands as well as level and gently sloping tame pasture lands with an appropriate seed mix (in consultation with landowners, where applicable), based on Ecoregion. • Implement the Wildlife Species of Concern Discovery Contingency Plan (to be appended to the EPP[1]) in the event that wildlife species with special conservation status are identified during construction.	• Project effects on monarch and West Virginia white resulting from changes in habitat, movement, mortality risk and combined effects

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.11.3 Residual Effects Characterization and Significance Determination

Fish and Fish Habitat

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on aquatic species at risk, due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. This qualitative assessment relied on available research literature and the professional judgement of the assessment team.

A summary of the significance evaluation of the potential residual environmental effects of construction and operations of the replacement pipeline on aquatic species at risk is provided in Table 6.2.11-2. The rationale used to evaluate the significance of each of the potential residual environmental effects is provided below, with the exception of impact balance which is considered negative for all potential residual effects. All assessment criteria were considered but the most influential were magnitude, reversibility and probability.

Table 6.2.11-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Aquatic Species at Risk

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Combined effects on grass pickerel	Footprint Watercourse crossings	Short-term	Isolated to occasional	Reversible	Low to medium	High	Moderate	Not significant
(b) Combined effects on redside dace	Footprint Watercourse crossings	Short-term	Isolated to occasional	Reversible	Low to medium	Low	Moderate	Not significant
(c) Combined effects on American eel	Footprint Watercourse crossings	Short- term	Isolated to occasional	Reversible	Low to medium	Low	Moderate	Not significant
(d) Combined effects on eastern pondmussel	Footprint Watercourse crossings	Short- term	Isolated to occasional	Reversible	Low to medium	High	Moderate	Not significant
(e) Combined effects on rainbow mussel	Footprint Watercourse crossings	Short- term	Isolated to occasional	Reversible	Low to medium	High	Moderate	Not significant

Combined Effects on Grass Pickerel

The replacement pipeline route lies within the documented distribution of grass pickerel. The Welland River and tributaries, as well as tributaries to Twenty Mile Creek, are known to have habitat for the grass pickerel at or near the proposed watercourse crossings (DFO 2015, Morrison Hershfield 2012, NPCA 2011).

A trenched crossing method is proposed for these watercourses and appropriate mitigation for trenched crossings as outlined in the Table 6.2.7-2 will be implemented at all crossings. The potential residual effects will be similar to those for fish and fish habitat in general, as outlined in Section 6.2.7.

The combined effects of construction and operations of the replacement pipeline on grass pickerel are of high probability, however, are reversible and of low to medium magnitude, and therefore, are not significant (Table 6.2.11-2 point [a]).

Combined Effects on Redside Dace

The replacement pipeline route lies within the documented distribution of redside dace. A small portion of the species habitat, the Sheffield-Rockton Complex, drains to Westover Creek and may be affected by construction and operations of the replacement pipeline. Redside dace are found in coolwater systems within the Spencer Creek watershed (Bowlby et al. 2009). Given the known temperature preferences for redside dace, they are unlikely to occur within the watercourses crossed by the replacement pipeline route, which are typically warmwater systems. However, the proposed crossing of West Spencer Creek is approximately 750 m upstream from Spencer Creek, therefore due to the proximity of this crossing, there may be potential, though limited, for them to occur in West Spencer Creek.

A trenched crossing method is proposed for all watercourses and appropriate mitigation for trenched crossings as outlined in Table 6.2.7-2 will be implemented at all crossings. Redside dace are known to be present in the Sheffield-Rockton complex, however, the portion of this wetland that is crossed by the replacement pipeline route is proposed to be directionally drilled, which will avoid impacts to redside dace that may be present in the wetland. The potential residual effects on redside dace will be similar to those for fish and fish habitat in general, as outlined in Section 6.2.7. The combined effects of the construction and operation of the replacement pipeline on redside dace are of low probability, reversible and of low to medium magnitude, and therefore, not significant (Table 6.2.11-2 point [b]).

Combined Effects on American Eel

The replacement pipeline route lies within the documented distribution of American eel. American eel may occur within the Grand River within the Aquatics RSA. Although they have not been documented within the watercourses crossed by the replacement pipeline route, they have the potential to occur if suitable habitat and connectivity exists.

A trenched crossing method is proposed for all watercourses and appropriate mitigation for trenched crossings as outlined in Table 6.2.7-2 will be implemented at all crossings. The potential residual effects on American eel will be similar to those for fish and fish habitat in general, as outlined in Section 6.2.7.

The combined effects of construction and operations of the replacement pipeline on American eel are of low probability, low to medium magnitude, reversible and, therefore, not significant (Table 6.2.11-2 point [c]).

Combined Effects on Eastern Pondmussel

The replacement pipeline route lies within the potential distribution of eastern pondmussel. The eastern pondmussel may occur in watercourses crossed by the replacement pipeline route (Pickett pers. comm.).

A trenched crossing method is proposed for all watercourses and appropriate mitigation for trenched crossings as outlined in Table 6.2.7-2 will be implemented at all crossings. The potential residual effects on eastern pondmussel will be similar to those for fish and fish habitat in general, as outlined in Section 6.2.7.

The combined effects of construction and operations of the replacement pipeline on eastern pondmussel are of high probability, low to medium magnitude, reversible, and therefore, not significant (Table 6.2.11-2 point [d]).

Combined Effects on Rainbow Mussel

The replacement pipeline route lies within the potential distribution of rainbow mussel. The rainbow mussel may occur in watercourses crossed by the replacement pipeline route (Pickett pers. comm.).

A trenched crossing method is proposed for all watercourses and appropriate mitigation for trenched crossings as outlined in Table 6.2.7-2 will be implemented at all crossings. The potential residual effects on rainbow mussel will be similar to those for fish and fish habitat in general, as outlined in Section 6.2.7.

The combined effects of the construction and operation of the replacement pipeline on rainbow mussel are of high probability, low to medium magnitude, reversible, and therefore, not significant (Table 6.2.11-2 point [e]).

Vegetation

All assessment criteria were considered when determining the significance of the potential effects on vegetation species at risk, but the most influential assessment criteria were reversibility and magnitude.

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects on vegetation species at risk, due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. This qualitative assessment relied on available research literature and the professional judgement of the assessment team.

Table 6.2.11-3 provides a summary of the significance evaluation of the potential residual effects of construction and operations of the replacement pipeline on vegetation species at risk. The rationale used to evaluate the significance of each of the potential residual effects is provided below, with the exception of the impact balance which is considered negative for all potential residual effects.

Table 6.2.11-3. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Vegetation Species at Risk

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Effects on butternut	LSA	Extended-term	Isolated	Reversible	Medium	High	Moderate	Not significant

Effects on Butternut

Butternut was observed near the replacement pipeline route and may occur within the Footprint. The abundance distribution of butternut on the Footprint will be confirmed in 2016. According to the Ontario *Endangered Species Act*, butternut trees must be evaluated by a butternut health assessor who will determine what actions are necessary based on the health of the trees. Where feasible, effects on this species at risk will be avoided. Effects on butternut which may occur due to construction activities of the replacement pipeline have been evaluated in Table 6.2.11-3.

The mitigation suggested by the OMNRF butternut health assessor will be implemented, thus reducing the effects on butternut. The success of mitigation will be monitored during the PCEM program. The potential effects on butternut are considered to be extended-term as planting trees may be required which require a long time span to grow, however, the effects are considered reversible since new trees would replace old ones. The effects are considered to have high probability since it is expected that there are some butternut trees on the Footprint. The magnitude is considered to be medium since though, this is a *SARA*-listed species, this species is governed mainly by the regulations in the Ontario *Endangered Species Act* which will be followed (Table 6.2.11-3 point [a]). Consequently, this effect is not significant.

Wildlife

The residual effects characterization and detailed significance evaluation is provided in Appendix 2B for each wildlife species at risk identified in Table 6.2.11-4.

The potential residual environmental effects on wildlife and wildlife habitat associated with construction and operations of the replacement pipeline (Table 6.2.11-1) are:

- Project effects on bat species at risk (little brown myotis, northern myotis and tri-colored bat) resulting from changes in habitat, mortality risk and combined effects;
- Project effects on woodland voles resulting from changes in habitat, movement, mortality risk and combined effects;

- Project effects on barn owl, chimney swift and peregrine falcon resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on common nighthawks resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on eastern whip-poor-wills resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on pasture bird species at risk (bobolink, eastern meadowlark, grasshopper sparrow, Henslow's sparrow, northern bobwhite, and short-eared owl) resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on wetland birds (black tern, king rail, least bittern and Louisiana waterthrush) resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on woodland bird species at risk (Acadian flycatcher, bald eagle, Canada warbler, cerulean warbler, eastern wood-pewee, golden-winged warbler, hooded warbler, prothonotary warbler, red-headed woodpecker, wood thrush and yellow-breasted chat) resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on Jefferson salamanders resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on turtle species at risk (Blanding`s turtle, common snapping turtle, eastern musk turtle, and wood turtle) resulting from changes in habitat, movement, mortality risk and combined effects;
- Project effects on snake species at risk (eastern hog-nosed snake, eastern milksnake, and eastern ribbonsnake) resulting from changes in habitat, movement, mortality risk and combined effects; and
- Project effects on monarch and West Virginia white resulting from changes in habitat, movement, mortality risk and combined effects.

A residual effect is not expected for some effect pathways for some wildlife species at risk, as described below.

A residual effect of the Project related to a change in movement for little brown myotis, northern myotis and tri-colored bat is not expected given that bats are nocturnal and construction activities will occur during daylight hours.

Construction and operations of the replacement pipeline will not directly affect any potential barn swallow nesting habitat (i.e., no barns, buildings, bridges or infrastructure will be directly affected by the replacement pipeline). In the event that an active barn swallow nest is discovered within its setback distance from the construction ROW, the appropriate protective buffer will be applied until the nest is no longer active, which will mitigate for potential sensory disturbance (i.e., change in movement) and an increase in mortality risk. Therefore, no residual effects related to a change in habitat, change in movement or increased mortality risk for these species are expected.

The replacement pipeline will not directly affect any potential peregrine falcon nesting habitat (i.e., cliffs, bridges). No suitable nesting habitat was observed in the vicinity of the replacement pipeline route, however a peregrine falcon was observed during field work. In the event that an active peregrine falcon nest is discovered during ROW preparation or construction activities, the appropriate protective buffer will be applied until the nest is no longer active, which will mitigate for potential sensory disturbance (i.e., change in movement) or an increase in mortality risk. Therefore, no residual effects related to a change in habitat, change in movement or increased mortality risk for peregrine falcons is expected.

No residual effect related to change in mortality risk for bald eagle is expected because bald eagle stick nests are very visible and mitigation is in place to avoid nests (i.e., in the event that an active bald eagle nest is discovered during ROW preparation or construction activities, the nest will be subject to an appropriate buffer until the nest is no longer active).

As noted, there are three primary effect pathways that have potential to affect wildlife species at risk: changes in habitat, movement and mortality risk. After the mitigation is applied, the combined suite of potential adverse effects of the replacement pipeline on habitat, movement, mortality risk and their interactions constitute the potential residual effect for the wildlife species at risk.

Potential effects on wildlife and wildlife habitat related to accidents and malfunctions are assessed in Section 6.2.10.3 which also applies to wildlife species at risk. Table 6.2.11-4 summarizes the significance evaluation of potential residual environmental effects of construction and operations of the replacement pipeline on wildlife species at risk. The residual effects characterization and detailed significance evaluation is provided in Appendix 2B for each wildlife species at risk identified in Table 6.2.11-4.

The qualitative assessment method was adopted for the characterization and significance determination of residual adverse effects on wildlife species at risk. All assessment criteria were considered when determining the significance of each residual adverse effect. The most influential assessment criteria for wildlife species at risk are magnitude and reversibility. Quantitative metrics (e.g., length of woodlands, wetlands traversed) were calculated to inform the characterization of the magnitude of residual effects.

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species		Potential Residual Effects	Impact Balance	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance
BAT SPECIES AT RISK											
(a)	Little brown myotis	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	Moderate	Not significant
		No residual effect related to change in movement is expected.									
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	Moderate	Not significant
		Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**Moderate**	**Not significant**
(b)	Northern myotis	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	Moderate	Not significant
		No residual effect related to change in movement is expected.									
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	Moderate	Not significant
		Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**Moderate**	**Not significant**
(c)	Tri-colored bat	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	Moderate	Not significant
		No residual effect related to change in movement is expected.									
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	Moderate	Not significant
		Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**Moderate**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

				Temporal Context						
Species	**Potential Residual Effects**	**Impact Balance**	**Spatial Boundary**	**Duration**	**Frequency**	**Reversibility**	**Magnitude**	**Probability**	**Confidence**	**Significance**
WOODLAND VOLE										
(d) Woodland vole	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
BARN OWL AND CHIMNEY SWIFT										
(e) Barn owl	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species		Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context			Magnitude	Probability	Confidence	Significance[2]
					Duration	Frequency	Reversibility				
(f)	Chimney swift	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
COMMON NIGHTHAWK											
(g)	Common nighthawk	Change in habitat	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Combined	**Negative**	**LSA**	**Short-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
EASTERN WHIP-POOR-WILL										
(h) Eastern whip-poor-will	Change in habitat	Negative	LSA	Short to extended -term	Isolated to occasional	Reversible	Medium	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to Extended-term**	**Isolated to occasional**	**Reversible**	**Medium**	**High**	**High**	**Not significant**
PASTURE BIRD SPECIES AT RISK										
(i) Bobolink	Change in habitat	Negative	LSA	Short-term to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short-term to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

	Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(j)	Eastern meadowlark	Change in habitat	Negative	LSA	Short-term to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Combined	**Negative**	**LSA**	**Short-term to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(k)	Grasshopper sparrow	Change in habitat	Negative	LSA	Short-term to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Combined	**Negative**	**LSA**	**Short-term to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(l)	Henslow's sparrow	Change in habitat	Negative	LSA	Short-term to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Combined	**Negative**	**LSA**	**Short-term to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(m) Northern bobwhite	Change in habitat	Negative	LSA	Short-term to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short-term to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(n) Short-eared owl	Change in habitat	Negative	LSA	Short-term to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short-term to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
WETLAND BIRD SPECIES AT RISK										
(o) Black tern	Change in habitat	Negative	LSA	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(p) Least bittern	Change in habitat	Negative	LSA	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

				Temporal Context						
Species	**Potential Residual Effects**	**Impact Balance**	**Spatial Boundary[1]**	**Duration**	**Frequency**	**Reversibility**	**Magnitude**	**Probability**	**Confidence**	**Significance[2]**
(q) King rail	Change in habitat	Negative	LSA	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(r) Louisiana waterthrush	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species		Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
WOODLAND BIRD SPECIES AT RISK											
(s)	Acadian flycatcher	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(t)	Bald eagle	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
		Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
		No residual effect related to change in mortality risk is expected.									
		Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(u) Canada warbler	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(v) Cerulean warbler	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(w) Eastern wood-pewee	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(x) Golden-winged warbler	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(y) Hooded warbler	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated** to occasional	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(z) Prothonotary warbler	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(aa) Red-headed woodpecker	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(ab) Wood thrush	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(ac) Yellow-breasted chat	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Negligible	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
JEFERSON SALAMANDER										
(ad) Jefferson salamander	Change in habitat	Negative	LSA	Medium-term to extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short-term to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
TURTLE SPECIES AT RISK										
(ae) Blanding's turtle	Change in habitat	Negative	LSA	Medium-term to extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short-term to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(af) Common snapping turtle	Change in habitat	Negative	LSA	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(ag) Eastern musk turtle	Change in habitat	Negative	LSA	Medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(ah) Wood turtle	Change in habitat	Negative	LSA	Medium-term to extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
SNAKE SPECIES AT RISK										
(ai) Eastern hog-nosed snake	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	Moderate	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
(aj) Eastern milksnake	Change in habitat	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	Moderate	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short-term**	**Isolated to occasional**	**Reversible**	**Low**	**Low**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

Species	Potential Residual Effects	Impact Balance	Spatial Boundary[1]	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance[2]
(ak) Eastern ribbonsnake	Change in habitat	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	Moderate	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Combined	**Negative**	**LSA**	**Short--term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**
BUTTERFLY SPECIES AT RISK										
(al) Monarch	Change in habitat	Negative	LSA	Short to medium-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to medium-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

Table 6.2.11-4. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Species at Risk

				Temporal Context						
Species	**Potential Residual Effects**	**Impact Balance**	**Spatial Boundary[1]**	**Duration**	**Frequency**	**Reversibility**	**Magnitude**	**Probability**	**Confidence**	**Significance[2]**
(am) West Virginia white	Change in habitat	Negative	LSA	Extended-term	Isolated to occasional	Reversible	Low	High	High	Not significant
	Change in movement	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	High	Not significant
	Increased mortality risk	Negative	LSA	Short-term	Isolated to occasional	Reversible	Low	Low	High	Not significant
	Combined	**Negative**	**LSA**	**Short to extended-term**	**Isolated to occasional**	**Reversible**	**Low**	**High**	**High**	**Not significant**

6.2.11.1 Summary

As identified in Tables 6.2.11-2, 6.2.11-3 and 6.2.11-4, there are no situations where there is a high probability of occurrence of a permanent or extended-term duration of residual environmental effect on aquatic, vegetation or wildlife species at risk of high magnitude cannot be technically mitigated. Consequently, it is concluded that the residual environmental effect of pipeline construction and operations on species at risk will be not significant.

6.2.12 Human Occupancy and Resource Use

6.2.12.1 Context

Land use in the LSA is primarily rural/agricultural interspersed with farmhouses and natural features (e.g., woodlots, watercourses, wetlands and open space). There is a mix of agricultural fields that are both actively farmed and dormant. Infrastructure located in the LSA includes hydro transmission corridors, rail lines, existing pipelines, roads and highways. Recreational features located in the LSA include open spaces, trails, golf courses, the Ancaster Fairgrounds and the HAHA (see Section 5.0). Most of the LSA is located on lands designated as Protected Countryside in the Ontario Greenbelt Plan (OMMAH 2005).

The lands located in the LSA are primarily designated as Agriculture, Rural and Open Space with two areas identified as Urban (City of Hamilton 2013). However, the PPS (OMMAH 2014) focuses on the efficient use of land and infrastructure, environmental protection, and opportunities for mixed housing and employment growth. In the PPS, the Project would be considered as “infrastructure” and the PPS indicates that infrastructure should be provided in a coordinated, efficient and cost-effective manner to accommodate projected needs.

6.2.12.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on HORU associated with construction and operations of the replacement pipeline were identified by the assessment team supplemented with information gathered from Aboriginal groups, business owners (e.g., golf course owners/operators), government agencies and landowners and are listed in Table 6.2.12-1. Concerns regarding human occupancy and resource use that were identified by landowners during the consultation process include:

- timing of new pipeline construction affecting farming activities; and
- limitations to future development of lands crossed by the pipeline.

Any unique effects specific to individual properties, including limitations on future planned development, will be managed through case-by-case discussions with Enbridge and affected landowners. These potential effects are acknowledged but are anticipated to be resolved prior to construction and therefore no residual effects are identified.

Concerns regarding HORU that were identified by Aboriginal groups during the engagement process include a reduction of trees for resource use (e.g., fire wood) which is considered in the assessment for the potential effect regarding the physical disturbance to natural features in Table 6.2.12-1.

Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of mitigation measures to reduce the severity of potential effects of the Project on HORU are presented in Table 6.2.12-1. These measures have been considered acceptable by the NEB for past Enbridge pipeline projects (NEB 2008a,b,c).

Table 6.2.12-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Human Occupancy and Resource Use

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Physical disturbance of outdoor recreation use areas	• LSA • Entire route	• Reduce the amount of disturbance by using previously disturbed areas and existing ROW for stockpiles. • Implement the Traffic Control Plan for vehicular use on the construction ROW and associated access roads. The Traffic Control Plan is intended to protect the environment along the construction ROW and access roads. Confine all motorized vehicles to the construction ROW and approved access roads, shoo-flies or trails. This restriction also applies to all biophysical inventory and land surveying activities. • Ensure all identified cross-country ski trails, snowmobile trails, hiking trails, equestrian trails or obvious wildlife trails are not blocked by clearing debris or slash windrows. • Restore recreation trails and use areas disturbed by the replacement pipeline route to the extent feasible. • Continue consultation with affected stakeholders, including Aboriginal groups, throughout the life of the replacement pipeline.	• Decrease in quality of outdoor recreational experience of resource users during construction and site-specific maintenance
2.0 Physical disturbance to natural or built features	• Footprint • Entire route	• Reduce disturbance of valued natural features with a non-traditional human use (e.g., recreational trails, recreational use areas, key use areas) during final route refinement to the extent practical. • Reduce the amount of land disturbed by using previously disturbed areas for stockpiles and staging areas where possible. • Place signage on access roads in the vicinity of the construction activities to ensure users are aware that construction activities are taking place. • Develop a communication plan for activities that impact normal traffic flow, such as road closures and detours. • Notify local snowmobile/recreational club(s) prior to the commencement of construction of the construction details, including timing and location of Project activities and potential hazards. • Continue consultation with affected stakeholders, including Aboriginal groups, throughout the life of the replacement pipeline.	• Physical disturbance to natural and built features

Table 6.2.12-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Human Occupancy and Resource Use

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Change to access of recreation use areas	• LSA • Entire route	• Maintain access to established recreation features, through the clearing, construction and reclamation period, where practical. • Place signage on access roads in the vicinity of the construction activities to ensure users are aware that construction activities are taking place. • Develop a communication plan for activities that impact normal traffic flow, such as road closures and detours. • Notify local snowmobile/recreational club(s) prior to the commencement of construction of the construction details, including timing and location of Project activities and potential hazards. • Develop a Traffic Management Strategy and implement measures to ensure public safety at road and highway crossings. • Implement measures in the Traffic Control Plan. • Continue consultation with affected stakeholders, including Aboriginal groups, throughout the life of the replacement pipeline.	• Decrease in quality of outdoor recreational experience of resource users during construction and site-specific maintenance (refer to potential effect 1.0 of this table)
4.0 Sensory disturbance for land and resource users	• LSA • Entire route	• Safety measures to be incorporated into the Traffic Management Strategy prepared by the Contractor may include: – fencing off all road and trail entrances to the work site to avoid potential interactions with local traffic and pedestrians; – posting warning signs at approaches to the construction site from both directions; – keeping the construction spread tight (i.e., limiting the length between trenching and backfilling activities) in close proximity to residences to reduce the duration of open trench, as much as practical; – allowing space for safe crossing by pedestrians and cyclist; – plans for access through/around environmentally sensitive areas (e.g., wetlands, the drainage, rare plant sites, etc.) on the construction ROW; and – implementing 24 hour security, where warranted.	• Decrease in quality of outdoor recreational experience of resource users during construction and site-specific maintenance (refer to potential effect 1.0 of this table) • Increase in air emissions during construction, maintenance and operations (Section 6.2.4) • Increase in nuisance noise during construction and maintenance (Section 6.2.6) • Disruption of daily activities of local residents and land users during construction (Section 6.2.16)

Table 6.2.12-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Human Occupancy and Resource Use

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
4.0 Sensory disturbance for land and resource users (cont'd)	See above	• Establish construction traffic speed limits on access roads to reduce the risk of collisions with wildlife (see Environmental Traffic Control Plan to be appended to the EPP[1]). • See Section 6.2.4 Air Emissions, Section 6.2.5 Greenhouse Gas Emissions and Section 6.2.6 Acoustic Environment for measures pertaining to nuisance air and noise emissions, respectively.	See above
5.0 Alteration of viewsheds	• Entire route	• Leave ornamental trees, windbreaks or shelterbelts in place, to the extent practical, as identified in the Line List. • Extend road bores to avoid clearing of adjacent shelterbelts, ornamental trees or windbreaks, where practical. Where shelterbelts, ornamental trees or windbreaks will be cleared for construction, reduce the width of the construction ROW, where practical (e.g., avoid extra temporary workspace) or as identified in the Line List.	• Alteration of viewsheds
6.0 Disturbance or, encroachment on affected properties or limits to future development	• Entire route	• Conduct a pre-construction survey and narrow the construction ROW, if warranted, to avoid encroaching on farmsteads, residences, granaries, dugouts or sheds. • Consult with affected landowners.	• No residual effect identified
7.0 Disruption of farming activities	• Entire route	• Notify affected landowners, lessees and occupants prior to the commencement of construction of the construction details, including the route alignment and construction schedule. • Where practical, incorporate mitigation requests from landowners into the construction procedures, as indicated on the Line List. • Notify landowners of the proposed construction schedule so livestock can be shifted to adjacent fields. • Delay final staking until immediately prior to the commencement of clearing and construction. • Install temporary gates and fencing prior to construction, where reasonably requested by the landowner or deemed necessary, to prevent livestock from entering or leaving the property and from entering or accidentally falling into the trench/excavation.	• Disruption of farming activities

Table 6.2.12-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Human Occupancy and Resource Use

Potential Effect		Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
7.0	Disruption of farming activities (cont'd)	See above	• Confine all motorized vehicles to the construction ROW and approved access roads, shoo-flies or trails. This restriction also applies to all biophysical inventory and land surveying activities. • Employ weed control measures listed in Section 6.2.9 Vegetation. • Complete clean-up of disturbed areas immediately following completion of construction activities. • Employ all above measures to reduce the severity of disruption to farming activities during maintenance activities (e.g., preventative maintenance digs).	See above
8.0	Alteration of surface water supply and quality for downstream water users	• Watercourse crossings	• Notify appropriate authorities and licensees, if required by applicable regulations or legislation, prior to commencement of water crossing construction and prior to withdrawing water for hydrostatic testing. • Refer to Section 6.2.3 Water Quality and Quantity.	• No residual effect identified
9.0	Alteration of well water flow and quality	• Entire route	• Provide well replacement and, if warranted, the replacement of water of equal or better quality and quantity until replaced, in the event that construction activities result in a reduction of well water quality and quantity.	• No residual effect identified

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.12.3 Residual Effects Characterization and Significance Determination for Human Occupancy and Resource Use

Table 6.2.12-2 provides a summary of the significance evaluation of potential residual socio-economic effects of construction and operations of the replacement pipeline on HORU. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below, with the exception of impact balance which is considered negative for each potential residual effect on HORU. An evaluation of significance is not required for those potential effects where no residual effect is identified (i.e., alteration of well water flow). Refer to Section 6.2.16 Human Health for a discussion of disruption of activities of land users.

Table 6.2.12-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Human Occupancy and Resource Use

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Decrease in quality of outdoor recreational experience of resource users during construction and site-specific maintenance	LSA	Short-term	Isolated to occasional	Reversible	Low	High	High	Not significant
(b) Physical disturbance to natural and built features	Footprint	Short-term	Isolated to occasional	Reversible	Medium	High	Moderate	Not significant
(c) Alteration of viewsheds	RSA	Extended-term	Isolated	Reversible	Low	High	High	Not significant
(d) Disruption of farming activities	LSA	Short-term	Isolated	Reversible	Medium	High	High	Not significant
(e) Combined effects of the Project on human occupancy and resource use (points [a-d])	RSA	Short-term	Isolated to occasional	Reversible	Medium	High	High	Not significant

Decrease in Quality of Outdoor Recreational Experience

Decrease in quality of outdoor recreational experience of resource users, including Aboriginal groups, may be caused by construction and site-specific maintenance. Activities such as hiking, camping, wildlife viewing, paddling (canoeing and kayaking), boating, hunting, fishing, and golfing may be affected by the physical disturbance of outdoor recreation areas during construction of the replacement pipeline. Recreational features located in the LSA include open spaces, trails, and golf courses. The Chippewa Trail is located approximately 1 km west of the replacement pipeline end point, and the Hamilton-Brantford (Highway 52) Rail Trail is located southwest of Power Line Road West and Highway 52 (Trinity Road), and both are crossed by the existing pipeline ROW. Golf courses located in the area include the Copetown Woods Golf Club, Flamborough Hills Golf Club, Mystic Golf Club, Knollwood Golf Club and the Southern Pines Golf and Country Club. Nuisance air emissions, noise and visual effects may also occur during the construction of the replacement pipeline and affect all land users living, working or recreating in the vicinity of the final ROW. Aesthetic disturbances are assessed below under the alteration of viewsheds effect.

Mitigation measures designed to communicate construction locations and scheduling to the users of the lands in the vicinity of the replacement pipeline route will lessen the effect, since it is expected that users will choose an alternate location for their recreation during times when construction activities take place. The winter construction schedule is anticipated to mitigate potential sensory disturbances related to construction activities on summer recreationalists, such as golfers. The residual effect is considered to be reversible and of low magnitude and is therefore, not significant (Table 6.2.12-2, point [a]).

Physical Disturbance to Natural and Built Features

Natural and built features – such as interpretive signs, parking lots, picnic areas, trees, rocks, watercourses and trails – may have intrinsic, interpretive and recreational value, which could be disturbed as a result of construction of the replacement pipeline. Lands designated as Open Space in the Rural Hamilton Official Plan include public and private areas where land is used predominately for recreational activities, conservation management and other open space uses. These uses include parks, resource-based recreational and tourism uses, recreation/community centres, pedestrian pathways, trail, bikeways, walkways, campgrounds, woodlots, and wildlife management areas, fishing reserves and cemeteries.

Mitigation measures included in Table 6.2.12-1 will be implemented during construction activities. The residual effect of construction activities on natural and built features is considered to be reversible and of medium magnitude and is therefore, not significant (Table 6.2.12-2, point [b]).

Alteration of Viewsheds

Construction of the replacement pipeline will result in the presence and operation of equipment and the activity of construction workers. The visual quality of the landscape, adjacent to the construction ROW, may be adversely affected by the construction of the replacement pipeline. The impact balance of this residual effect is considered negative. The potential visual effects will be reduced by paralleling the existing Enbridge pipeline ROW, to the extent feasible and sharing workspace on the existing ROWs. Maintenance of existing vegetation buffers and reseeding of the construction ROW and temporary workspaces will also reduce the visual intrusion of the replacement pipeline. Ornamental trees, windbreaks or shelterbelts that have been fenced or flagged as indicated on the Line List will not be cleared. Boring underneath ornamental trees or replacing them by transplanting with a tree spade may be considered to mitigate this residual effect, where practical. However, some of these features may be removed as a result of the construction of the pipeline. The residual effect of construction activities on viewsheds is considered to be reversible and of low magnitude and is therefore, not significant (Table 6.2.12-2, point [c]).

Disruption of Farming Activities

Land use in the LSA is primarily rural/agricultural interspersed with farmhouses and natural features (e.g., woodlots, watercourses, wetlands and open space). There is a mix of agricultural fields that are both actively farmed and dormant. The lands located in the LSA are primarily designated as Agriculture, Rural and Open Space in the Rural Hamilton Official Plan (Schedule D: Rural Land Use Designations) (City of Hamilton 2012a). The primary intent of lands designated as Agriculture in the Rural Hamilton Official Plan is to protect prime agricultural areas for agriculture use. Permitted uses are limited to agricultural uses, agricultural-related commercial and agricultural-related industrial uses, and on-farm secondary uses. Agricultural land uses along the pipeline route include crop production and the rearing of livestock.

Farmers along the replacement pipeline ROW may experience disruptions to their activities during construction. The scheduling of construction outside the peak agricultural activity period, where feasible, will lessen the effects on farmers. Furthermore, advanced notification of the pipeline activity schedule to all affected farmers, and compensation for disrupted activities and crop loss will further reduce these potential effects. The pipeline will be buried with an adequate depth of cover to allow traffic associated with current land use to cross the ROW during normal conditions and, consequently, will not hinder the ability of the landowners to maintain their current agricultural or other operation. The residual effect is reversible in the short-term and is of medium magnitude and is therefore not significant (Table 6.2.12-2, point [d]).

Combined Effects on Human Occupancy and Resource Use

The following potential residual effects are likely to occur and may act in combination to result in overall effects on HORU use during construction and operations of the replacement pipeline:

- decrease in quality of outdoor recreational experience of resource users;
- physical disturbance to natural and built features;
- alteration of viewsheds; and
- disruption of farming activities.

With the implementation of the applicable mitigation presented in Table 6.2.12-2, combined effects on human occupancy and resource are considered reversible in the short-term, medium in magnitude, high in probability and not significant (Table 6.2.12-2, point [e]).

6.2.12.4 Summary

As identified in Table 6.2.12-2, there are no situations that would result in a significant socio-economic residual effect on human occupancy and resource use. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operation on human health will be not significant.

6.2.13 Heritage Resources

6.2.13.1 Context

The potential for encountering heritage resources is reduced by aligning the replacement pipeline route to parallel existing linear disturbances to the extent possible.

A Stage I Archaeological Assessment was conducted by D.R. Poulton in accordance with the provisions of the *Ontario Heritage Act* and the Standards and Guidelines for Consultant Archaeologists formulated by the MTCS (2011). The spatial boundary used for the Stage 1 Archaeological Assessment was a 1 km radius around the Project, as per the Guidelines. Results of the Stage I Archaeological Assessment are included in Section 5.0. A Stage 2 Archaeological Assessment is planned for winter 2015 to confirm the presence or absence of archaeological sites along the replacement pipeline route, including the existing segments of Line 10 that are to be replaced.

Correspondence with the Ontario Heritage Trust and the MTCS Heritage Registrar in July 2015 confirmed that the following are not within or immediately adjacent to the replacement pipeline route:

- provincial heritage properties (managed by MTCS);
- lands designated as protected under Section 29 of the *Ontario Heritage Act*; and
- lands with a notice of intention to designate under Section 41 of the *Ontario Heritage Act*.

Further research also indicated that the following do not occur within or immediately adjacent to the replacement pipeline route:

- National Historic Sites as indicated by Parks Canada;
- plaques designated provincially by the Ontario Heritage Trust; and
- protected properties present on the City of Hamilton's register.

6.2.13.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on heritage resources associated with construction and operations of the replacement pipeline were identified by the assessment team based on past experience and are listed in Table 6.2.13-1. There were no concerns regarding heritage resources identified by landowners or

Aboriginal groups along the replacement pipeline route during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

No interaction between the operations of the replacement pipeline and heritage resources was identified and, consequently, no potential effects have been included in Table 6.2.13-1.

Mitigation measures to reduce the severity of potential effects of the Project on heritage resources have been incorporated into Table 6.2.13-1.

Table 6.2.13-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Heritage Resources

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1. Disturbance of previously unidentified heritage resource sites during construction	• Footprint • Entire Route	• Follow all site-specific resource protection measures resulting from the heritage resource assessment. • Suspend work in proximity to archaeological, palaeontological or heritage sites (e.g., arrow heads, modified bone, pottery fragments, and fossils) discovered during construction. No work at that particular location shall continue until permission is granted by the applicable provincial authority or the consultant archaeologist. Follow the contingency measures identified in the Heritage Resource Discovery Contingency Plan (to be appended to the EPP[1]). • Prohibit the collection of any heritage, archaeological or palaeontological resources by Project personnel.	• No residual effect identified

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

Heritage resources provide a window into past human experiences and the geological record, and by their very nature, are non-renewable. Once disturbed, the resource may be altered or even lost. Consequently, the primary mitigation measure in protecting heritage resources is avoidance, and secondarily, site-specific mitigation developed in consultation with appropriate provincial regulatory authorities and approved by these authorities in fulfillment of permit obligations may also be used. In order to better understand heritage resources and the historical information associated with these resources, disturbing the resource through excavations is an acceptable practice and, in many cases, the only method to collect in situ information to add to the archaeological record. Regardless of whether the excavation of the site is for academic or development purposes, the loss of heritage resource sites is offset by the recovery of knowledge about the site gained through identifying, cataloguing and preserving artifacts and features in compliance with provincial guidelines.

In the unlikely event that an archaeological, historical or palaeontological site is discovered during construction, the Heritage Resource Discovery Contingency Plan will be implemented (i.e., construction at that location is to stop immediately, notify the Environmental Inspector or Enbridge designate and consult with a heritage resource specialist). Construction activities may resume only with the permission of the provincial regulatory authority.

Given that disturbances to heritage resources by the replacement pipeline are effectively offset by knowledge gained through the mitigation approved by the provincial regulatory authorities, no residual effects on heritage resource indicators have been identified and, consequently, no further evaluation of the effects of the Project on heritage resources is warranted.

6.2.13.3 Summary

As identified in Table 6.2.13-2, there are no potential scenarios for heritage resources that meet the criteria of a significant socio-economic residual effect. Consequently, no further evaluation of the replacement pipeline segments on heritage resources is warranted.

6.2.14 Traditional Land and Resource Use

6.2.14.1 Context

Enbridge has initiated consultation with Aboriginal groups with traditional territory in the vicinity of the replacement pipeline route. Enbridge also consulted with landowners in the Project area to determine current use of the land for traditional purposes. Enbridge will continue to work with Aboriginal groups and landowners to identify and address any TLRU issues and concerns with the objective of resolving these issues and concerns in a manner that meets the interests of all parties. Key concerns identified during the initial stages of consultation with Aboriginal groups include: water and source water protection, emergency response measures and plans, fish and fish habitat, and native vegetation used for traditional medicinal purposes.

6.2.14.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on TLRU associated with construction and operations of the replacement pipeline were identified by the assessment team, supported by the initial interests raised by Aboriginal groups. These potential effects are listed in Table 6.2.14-1 along with a summary of measures recommended to mitigate the potential effects.

Table 6.2.14-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Traditional Land and Resource Use

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Disruption of use of trails and travelways during construction	• LSA • Pipeline ROW	• Notify representatives of Aboriginal groups involved in the Enbridge Aboriginal Engagement Program of the proposed construction schedule and pipeline route prior to the commencement of construction. Where appropriate, install signs notifying groups of construction activities in the vicinity. • See section 6.2.18 Navigation and Navigation Safety for measures regarding navigable watercourses.	• Site-specific TLRU identified during ongoing engagement may be affected during construction and operation
2.0. Disturbance of hunting or trapping activities during construction	• Footprint, LSA and RSA • Pipeline ROW	• Notify representatives of Aboriginal groups involved in the Enbridge Aboriginal Engagement Program of the proposed construction schedule and pipeline route prior to the commencement of construction. Where appropriate, install signs notifying groups of construction activities in the vicinity. • See Table 6.2.10-1 for mitigation relevant to sensory disturbance, loss or alteration of wildlife habitat, and wildlife mortality.	• Site-specific TLRU identified during ongoing engagement may be affected during construction and operation • Disruption of subsistence hunting or trapping during construction

Table 6.2.14-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Traditional Land and Resource Use

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0. Disturbance of hunting or trapping activities during construction (cont'd)	See above	• See Section 6.2.6 Acoustic Environment for additional mitigation. • Should hunting sites be identified during supplemental engagement with Aboriginal groups, implement the following applicable measures: – adhere to species-specific timing constraints or provide suitable mitigation prepared by a professional biologist; – leave breaks in the pipeline trench, as needed, to allow animals to cross; – limit the use of chemical applications; and – alternative site-specific mitigation strategies recommended by participating Aboriginal groups. • Implement measure in Enbridge's Traditional Land and Resource Use Sites Discovery Contingency Plan (to be included in the EPP[1]), if warranted.	See above
3.0 Alteration of plant harvesting sites	• LSA • Pipeline ROW	• Notify representatives of Aboriginal groups involved in the Enbridge Aboriginal Engagement Program of the proposed construction schedule and pipeline route prior to the commencement of construction. Where appropriate, install signs notifying groups of construction activities in the vicinity. • Ensure all equipment (e.g., vehicles, materials, mats) arrives for work in a clean condition to reduce the risk of weed introduction. Prohibit any equipment which arrives in a dirty condition to work until it has been cleaned off at a suitable location • Implement measure in Enbridge's Traditional Land and Resource Use Sites Discovery Contingency Plan (to be included in the EPP[1)], if warranted.	• Site-specific TLRU identified during ongoing engagement may be affected during construction • Disruption of subsistence during plant gathering
4.0 Disturbance of fishing activities during construction	• LSA • Watercourses	• Notify representatives of Aboriginal groups involved in the Enbridge Aboriginal Engagement Program of the proposed construction schedule and pipeline route prior to the commencement of construction. Where appropriate, install signs notifying groups of construction activities in the vicinity. • See Section 6.2.7 Fish and Fish Habitat for mitigation relevant to potential effects on fish and fish habitat. • See Section 6.2.3 Water Quality and Quantity for mitigation relevant to potential effects on water quality and quantity.	• Site-specific TLRU identified during ongoing engagement may be affected during construction • Disruption of subsistence fishing during construction

Table 6.2.14-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Traditional Land and Resource Use

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
4.0 Disturbance of fishing activities during construction (cont'd)	See above	• Should fishing sites be identified during supplemental engagement with Aboriginal groups, implement the following applicable measures: – record and map fishing locales; – strict adherence to the regulations, standards and guidelines set by provincial and federal regulatory agencies for watercourse crossings; and – alternative site-specific mitigation strategies recommended by participating Aboriginal groups. • Implement measure in Enbridge's Traditional Land and Resource Use Sites Discovery Contingency Plan (to be included in the EPP1), if warranted.	See above
5.0 Disturbance of sacred areas during construction	• Footprint • Pipeline ROW	• Should sacred sites be identified during supplemental engagement with Aboriginal groups, implement the following applicable measures: – detailed recording, mapping and avoidance; – visual impact will be assessed; – additional mitigation measures will be refined and optimized through community discussions; and – alternative site-specific mitigation strategies recommended by participating Aboriginal groups. • Implement the contingency measures identified in the Traditional Land and Resource Use Sites Discovery Contingency Plan (to be appended to the EPP[1]) in the event that localized, important TLRU sites are identified during construction or during ongoing consultation.	• Site-specific TLRU identified during on-going engagement may be affected during construction and operation

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.14.3 Residual Effects Characterization and Significance Determination for Traditional Land and Resource Use

Table 6.2.41-2 provides a summary of the significance evaluation of potential residual socio-economic effects of the construction and operation of the replacement pipeline on TLRU. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below, with the exception of impact balance which is considered negative for each potential residual effect.

Table 6.2.14-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Traditional Land and Resource Use

Potential Residual Effects	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance [2]
(a) Site-specific TLRU identified during ongoing engagement may be affected during construction and operation	LSA	Short-term	Isolated to occasional	Reversible	Medium	Low	Moderate	Not significant
(b) Disruption of subsistence hunting, fishing and plant harvesting during construction	LSA	Short-term	Isolated	Reversible	Low	Low	Moderate	Not significant

Site-Specific Traditional Land and Resource Use

Should sites be identified during ongoing engagement with participating Aboriginal groups, the mitigation measures outlined in Table 6.2.14-1 and the TLRU Sites Discovery Contingency Plan (to be appended to the EPP) will be implemented. The impact balance of this residual effect is considered negative since TLRU may be affected as a result of construction and operation activities (i.e., during preventative maintenance digs). The potential residual effects arising from construction and operation on site-specific TLRU identified during ongoing engagement are reversible, of short-term duration since the potential effect is limited to the construction phase or to occasional, short-term site-specific maintenance activities during the operations phase, and of medium magnitude; consequently, the potential residual effects are not significant (Table 6.2.14-2, point [a]). The confidence is considered to be moderate for both residual effects in light of the ongoing engagement with Aboriginal groups.

Subsistence Hunting, Trapping, Fishing and Plant Harvesting

The entire replacement pipeline route is located in an agricultural setting on privately-owned and fee simple lands where hunting or trapping is only allowed with the permission of the landowner. This assessment considers that TLRU activities including fishing, hunting, trapping and plant harvesting are potentially practiced at these locations, where permission is granted. At the time of writing, no issues or concerns specific to subsistence activities were raised. The impact balance of this residual effect would be considered negative since the replacement pipeline may disrupt normal subsistence activities in the replacement pipeline area. However, due to the limited availability of land suitable for subsistence activities along the replacement pipeline route segments, including Crown lands, the residual effect is considered to be of low magnitude. The residual effect of disruption of subsistence hunting, fishing and plant harvesting during construction is reversible in the short-term (i.e., limited to the construction phase) and, consequently, the potential residual effects are not significant (Table 6.2.14-2, point [b]).

Combined Effects on Traditional Land and Resource Use

The probability of the replacement pipeline affecting either site-specific TLRU or subsistence hunting, fishing and plant harvesting is low and, consequently, an evaluation of the combined effects on TLRU is not warranted.

6.2.14.4 Summary

As identified in Table 6.2.14-2, there are no situations for TLRU that would result in a significant socio-economic residual effect. Consequently, it is concluded that the potential residual socio-economic effects of pipeline construction and operation on TLRU will be not significant.

6.2.15 Social and Cultural Well-Being

6.2.15.1 Context

As of 2011, Hamilton has a total population of 519,949 people. The median age of the population is 40.9 years old and 83.5% of the population is 15 years or older. Of the total population, the portion identifying as Aboriginal included 10,320 individuals. Hamilton had a total labour force of 424,055 individuals including 205, 210 males and 218,840 females (Statistics Canada 2012b).

6.2.15.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on social and cultural well-being use associated with the construction and operation of the replacement pipeline were identified by the assessment team supplemented with information gathered during the consultation process. No element specific concerns have been raised to date. Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of mitigation measures to reduce the severity of potential effects of the replacement pipeline on social and cultural well-being are presented in Table 6.2.15-1. These measures have been considered acceptable by the NEB for past Enbridge pipeline projects (NEB 2008a,b,c).

Table 6.2.15-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Social and Cultural Well-Being

Potential Effect		Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0	Disruption of community life by transient workers	• RSA • Entire route	• Communicate Enbridge's Contractor Alcohol and Drug Policy to all Project workers. • No worker shall distribute, possess, consume or use alcohol or illegal drugs on any Enbridge work site (including parking lots) or in any vehicle, or any other equipment. • Those who show careless or wanton neglect of the environment or disregard the EPP during construction shall be subject to disciplinary measures.	• Disruption of community life by transient workers • Disruption of normal, daily living activities of local residents and land users (see Section 6.2.16 Human Health)
2.0	Restriction of farming operations	• LSA • Entire route	• Input from landowners on the alignment of the proposed route has been sought and, where practical, their requests related to routing have been documented and addressed. • Where practical, incorporate mitigation requests from landowners into the construction procedures, as indicated on the Line List.	• No residual effect identified

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.15.3 Residual Effects Characterization and Significance Determination for Social and Cultural Well-Being

Table 6.2.15-2 provides a summary of the significance evaluation of potential residual socio-economic effects of the construction and operation of the replacement pipeline on social and cultural well-being. The rationale used to evaluate the significance of each of the residual socio-economic effect is provided below, with the exception of impact balance, which is considered negative for the potential residual effect on social and cultural well-being. An evaluation of significance is not required for those potential effects where no residual effect is identified (i.e., restrictions to farming operations).

Table 6.2.15-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Social and Cultural Well-Being

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance [2]
		Duration	Frequency	Reversibility				
(a) Disruption of community life by transient workers	RSA	Short-term	Isolated	Reversible	Low	High	Low	Not significant

Disruption of Community Life

Enbridge will not tolerate drug and alcohol use by its workforce and is committed to maintaining a safe and healthy workplace. The Project workforce will be required to adhere to Enbridge's Contractor Alcohol and Drug Policy.

It is expected that the Project construction workforce will not have a substantial amount of time for recreational activities after work hours. It is also expected that some of the workforce will be local and would, therefore, not be transient. However, regardless of the work hours and the implementation of Enbridge's Health and Safety Policy with respect to the health and safety of the employees, Contractors and the general public, it is not always feasible to prevent adults from engaging in certain behaviours when they are on their time off and not on the job. As such, the degree of confidence is low due to the difficulty in predicting human behavior. The adverse residual effect of disruption of community life by transient workers is anticipated to be of low magnitude and short-term in duration and is therefore, not significant (Table 6.2.15-2, point [a]).

6.2.15.4 Summary

As identified in Table 6.2.15-2, there are no situations that would result in a significant socio-economic residual effect on social and cultural well-being. Consequently, it is concluded that the residual socio-economic effects of replacement pipeline construction and operation on social and cultural well-being will be not significant.

6.2.16 Human Health

6.2.16.1 Context

Human health is defined as "*a state of complete physical, mental and social well-being, and the ability to adapt to the stresses of daily life; it is not merely the absence of disease or infirmity*" (NEB 2015a). This widely accepted interpretation of health recognizes the interrelationships between social, economic, political and cultural health determinants and the biophysical environment (Health Canada 2004).

These interrelationships change depending upon the nature of the project and its location. This Project is required to replace a segment of pipeline approximately 35 km in length along an existing Enbridge pipeline corridor that has been in use by Enbridge since the early 1960s, with the exception of necessary deviations for approximately 37% of the route. Pipeline facilities within the corridor have been subject to routine maintenance programs over the course of this time period.

6.2.16.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The environmental elements associated with the replacement pipeline that may be related to human health include soil and soil productivity, water quality, air emissions, acoustic environment, fish and fish habitat, and wildlife and wildlife habitat. Socio-economic elements that may be related to human health include HORU, TLRU, social and cultural well-being, and infrastructure and services, in particular, health services.

These environmental and socio-economic elements, as described in Section 5.0, have been assessed, considered and reviewed to identify components that could potentially be sources of adverse human health effects and the potential human receptors of these effects. With the implementation of best industry practices and regulatory requirements, routine construction and operation activities associated with pipeline projects are not likely to result in any potential residual effect for any of these elements that would pose a risk to human health. However:

- Local residents and land users, including the Aboriginal groups, may be affected by increases in nuisance air emissions, noise and traffic, alteration of viewsheds and disruption of activities of local residents and land users. Further assessment of human health due to disruption of normal daily living activities is warranted (see Tables 6.2.16-1 and 6.2.16-2).
- In the event of an accident or malfunction during construction or operation of the replacement pipeline, the potential exists for humans to be exposed to Project-related contaminants. This may occur from intentional or accidental immersion in natural waters during recreational activities or if contaminants within the soil are mobilized for uptake by vegetation which, in turn, are directly or indirectly ingested by humans or if fish or wildlife exposed to contaminants are directly ingested by humans (i.e., contamination of country foods). Further assessment of human health in the event of an accident or malfunction is warranted (see Section 6.7).

The potential human receptors are local residents and land users, including members of the Aboriginal groups, within the LSA or RSA.

The potential effects on human health associated with the construction and operation of the replacement pipeline were identified by the assessment team supplemented with information gathered during the consultation process, where applicable. The potential effects are listed in Table 6.2.16-1. There were no concerns specific to human health identified by landowners along the replacement pipeline route during the consultation process. Element-specific concerns, if applicable, are outlined in the respective section (e.g., concerns regarding soil and soil productivity are listed in Section 6.2.2.2). Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of mitigation measures to reduce the severity of potential effects of the replacement pipeline on human health related to the disruption of normal daily living activities are presented in Table 6.2.16-1.

Table 6.2.16-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Human Health

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures	Potential Residual Effect(s)
1.0 Disruption of normal, daily living activities	• RSA • Entire route	• Employ measures outlined in Section 6.2.3 Water Quality and Quantity related to water wells. • Employ measures outlined in Section 6.2.4 Air Emissions related to increased emissions during construction and site-specific maintenance of the activities.	• The pipeline may disrupt normal, daily living activities of local residents and land users

Table 6.2.16-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Human Health

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures	Potential Residual Effect(s)
1.0 Disruption of normal, daily living activities (cont'd)	See above	• Employ measures outlined in Section 6.2.6 Acoustic Environment related to increased noise during construction and site-specific maintenance. • Employ measures outlined in Section 6.2.7 Fish and Fish Habitat related to the alteration of habitat function. • Employ measures outlined in Section 6.2.9 Vegetation related to the alteration of native vegetation. • Employ measures outlined in Section 6.2.12 Human Occupancy and Resource Use regarding changes to existing land use activity including farming, outdoor recreation, hunting and visual aesthetics. • Employ measures outlined in Section 6.2.14 Traditional Land and Resource Use regarding traditional use activities. • Employ measures outlined in Section 6.2.17 Infrastructure and Services regarding construction traffic. • Communication with all communities and Aboriginal groups will continue to identify the areas of concern and interest and to find mutually acceptable solutions and benefits.	See above

6.2.16.3 Residual Effects Characterization and Significance Determination for Human Health

Table 6.2.16-2 provides a summary of the significance evaluation of the potential residual socio-economic effect of the construction and operation of the replacement pipeline on human health. The rationale used to evaluate the significance of the residual socio-economic effect is provided below, with the exception of impact balance, which is considered negative.

Table 6.2.16-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Human Health

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) The Project may disrupt normal, daily living activities of local residents and land users	RSA	Short-term	Periodic	Reversible	Medium	High	Moderate	Not significant

Daily Living Activities

Project effects that have been identified as potentially disrupting normal daily living activities of local residents and land users during construction include: potential minor decrease in surface water quality; increased nuisance air emissions; increased nuisance noise; disruption of land use activities (e.g., farming, outdoor recreation and hunting); and associated inconvenience, potential changes to visual aesthetics and increased traffic volumes. These effects also may be disruptive during some site-specific maintenance activities. The disruption of normal daily living activities may cause stress to local residents and land users. As a result, the impact balance of this potential residual effect is considered to be negative.

Enbridge has a variety of procedures, plans and protocols pertaining to the planning, construction and operation of the replacement pipeline. It is anticipated that for most local residents and land users in the vicinity of the replacement pipeline route, these strategies will aid in limiting the disruption that is experienced as a result of construction and site-specific maintenance. Given mitigation measures and the proposed fall and winter construction schedule, the residual effect is reversible, short-term in duration and of medium magnitude (Table 6.2.16-2, point [a]).

6.2.16.4 Summary

As identified in Table 6.2.16-2 and Section 6.7, there are no situations that are likely to result in a significant socio-economic residual effect on human health. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operation on human health will be not significant.

6.2.17 Infrastructure and Services

6.2.17.1 Context

The Project is serviced by local roads and highways, including Highway 403, and the Hamilton Airport. The Hamilton Police Department, Hamilton Fire Department, Hamilton EMS services and Hamilton Health Sciences offer protective and emergency services for the communities within the LSA. Hamilton collects and treats both sanitary and combined sewage (wastewater) and currently owns and operates two wastewater treatment plants. Hamilton offers a wide range of hospitality services including hotels, motels, campgrounds, and bed and breakfast venues. Hamilton manages many recreational facilities including pools, community centres, and arenas, in addition to an extensive network of parks and trails (City of Hamilton 2015a).

6.2.17.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on infrastructure and services associated with the construction and operation of the replacement pipeline were identified by the assessment team based on previous experience. No concerns regarding infrastructure and services have been raised during the consultation process to date. Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

A summary of mitigation measures to reduce the severity of potential effects of the Project on infrastructure and services are presented in Table 6.2.17-1. These measures have been considered acceptable by the NEB for past Enbridge pipeline projects (NEB 2008a,b,c).

Through the implementation of these mitigation measures, no conflicts regarding infrastructure and services were identified since the replacement pipeline will be constructed alongside and contiguous to existing linear infrastructure for approximately 69% of its length.

Table 6.2.17-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Infrastructure and Services

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
INFRASTRUCTURE			
1.1 Transportation of workers, supplies and equipment	• RSA • Entire route	• Routine access to the construction ROW for operations, maintenance and monitoring activities will be by way of pre-existing roads and trails, wherever practical (see the Traffic Control Plan). • Control construction-related road dust near residential areas and other areas as advised by the Environmental Inspector or Enbridge designate. Apply water to the construction ROW and access roads if traffic and wind conditions result in pulverized soils and dust problems. Alternatively, control dust emissions by applying dust suppressants, if warranted. Ensure dust suppressants are approved by the municipal district/rural municipality, Enbridge and landowners. • Implement measures outlined in the Traffic Control Plan to ensure public safety at road and highway crossings.	• Increased traffic on highways and local roads used to access the ROW will occur during construction
1.2 Disruption of transmission lines and pipelines	• RSA • Entire route	• Locate and flag utility lines (buried, laying on the ground or overhead) prior to the commencement of ground disturbance activities. • In accordance with Enbridge's Ground Disturbance Procedure, expose buried foreign lines prior to installing the pipeline in their vicinity to ensure the safety and protection of other existing infrastructure. • Clearly post signs prohibiting workers and equipment from entering staked, flagged and/or fenced environmentally sensitive areas. In the event that staking, flagging, fencing and/or signage is damaged or in disrepair during construction, notify the Construction Manager and/or Environmental Inspector or Enbridge designate and repair as soon as feasible.	• See Section 6.7 Accidents and Malfunctions
1.3 Waste management during construction	• RSA • Entire route	• Follow Enbridge's Waste Management Plan (Enbridge 2014). • Collect waste generated from the work site (e.g. construction garbage, food, industrial waste, etc.) on a regular basis and dispose of at an approved facility to avoid the attraction of animals. Waste containers shall accompany each working unit. No waste shall be disposed of in the trench.	• Temporary increase in waste flow to regional landfill sites will occur during construction

Table 6.2.17-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Infrastructure and Services

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.3 Waste management during construction (cont'd)	See above	• Ensure waste receptacles for recyclable materials are available at the construction office. • Locate temporary toilets at convenient and frequent locations on and along the construction ROW. Ensure temporary toilets are well anchored to prevent being blown over by winds and that they are cleaned and inspected to ensure they are in good working order on a regular basis. Provide sufficient toilets and personal washing facilities for all Contractor personnel in accordance with federal, provincial, municipal acts, regulations and codes. • Ensure good house-keeping practices are employed along the ROW. • Transport and dispose of all waste, including hazardous waste, in accordance with provincial and federal regulatory requirements and local guidelines. Ensure wastes are recycled where practical. • Follow criteria and regulations set out by Workplace Hazardous Materials Information System and Transportation of Dangerous Goods legislation.	See above
1.4 Influx of temporary construction workers	• RSA • Local accommodations	• Liaise with hotel owners far in advance of Project construction to secure the needed Project accommodation. • If some of the reserved commercial hotels and motels are not needed, request the Contractor to release the rooms for use by other potential commercial accommodation.	• No residual effect identified
SERVICES			
2.1 Provision of emergency services	• RSA • Entire route	• Provide key community contact numbers, pipeline route maps and the construction schedule to the Ontario Provincial Police, fire departments, hospitals/medical facilities and ambulance services. • Ensure that adequate numbers of approved safety and medical personnel are present during construction as per Occupational Health and Safety requirements. • Implement Enbridge's Construction Safety Manual (includes responses to environmental emergencies and contact numbers for health care services) if warranted.	• Increased demand on existing emergency services • See Section 6.7 for potential effects of accidents or malfunctions

Table 6.2.17-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Infrastructure and Services

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.1 Provision of emergency services (cont'd)	See above	• The Project-specific Emergency Response Plan will be reviewed with all personnel so they are familiar with its contents and copies of the plan shall be readily available at the work site. • Ensure continued consultation with emergency responders throughout the life of the pipeline.	See above

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.17.3 Residual Effects Characterization and Significance Determination for Infrastructure and Services

Table 6.2.17-2 provides a summary of the significance evaluation of potential residual socio-economic effects of the construction and operation of the replacement pipeline on infrastructure and services. The rationale used to evaluate the significance of each of the residual socio-economic effects is provided below, with the exception of impact balance which is considered to be negative for all potential residual effects. An evaluation of significance is not required for those potential effects where no residual effect is identified (i.e., influx of temporary construction workers).

Table 6.2.17-2. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Infrastructure and Services

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Increased traffic on highways and local roads used to access the proposed ROW during construction	RSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(b) Temporary increase in waste flow to regional landfill sites during construction	RSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(c) Change in availability of local accommodation during construction	RSA	Short-term	Isolated	Reversible	Low	Low	High	Not significant
(d) Increased demand on existing emergency services	RSA	Short-term	Accidental	Reversible	Low	Low	Low	Not significant

Table 6.2.17-2. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Infrastructure and Services

Potential Residual Effects		Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
			Duration	Frequency	Reversibility				
(e)	Combined effects of the Project on infrastructure and services (points [a] and [b])	RSA	Short-term	Isolated	Reversible	Low	High	High	Not significant

Increased Traffic on Highways and Local Roads

Alteration of traffic patterns, movements and volumes during construction along major highways and local roads are an unavoidable negative residual effect. There will only be an increase in traffic during construction. Construction-related traffic will also be associated with the transportation of workers to and from construction sites and the movement of equipment and supplies. A Traffic Control Plan will be implemented and speed limits on all roads, accesses and ROWs used will be strictly enforced.

Mitigation measures such as using multi-passenger vehicles and directing construction personnel to obey traffic, road use and safety laws will be implemented during construction activities. The residual effect of construction activities on traffic movements is considered to be reversible and of low magnitude and is therefore, not significant (Table 6.2.17-2, point [a]).

Temporary Increase in Waste Flow

Enbridge will reduce waste quantities to the lowest levels through Project design. All waste generated from the Project during construction will be hauled to the appropriate landfill sites in the region depending on the type of waste. Receptacles for recycling various products (e.g., paper, cardboard, glass, aluminum cans) will be available at the construction offices and will be hauled to appropriate recycling depots. The impact balance of this potential residual effect is considered to be negative due to increasing levels of waste at landfill sites and associated traffic. This residual effect is considered to be short-term in duration and low magnitude and is therefore, not significant (Table 6.2.17-2, point [b]).

Accommodation Availability during Construction

Regardless that sufficient accommodation exists in the RSA, early coordination of the commercial accommodation needs is recommended to ensure necessary rooms are available for any construction personnel that do not live in Hamilton. The impact balance of this potential residual effect is considered to be negative since the availability of accommodations for non-Project-related clients may decrease during construction, however, the number of workers anticipated to require short-term housing are expected to be readily accommodated in Hamilton. This residual effect is reversible and of low magnitude and is therefore, not significant (Table 6.2.17-2, point [c]).

Capacity of Existing Emergency Services

Enbridge is committed to constructing the replacement pipeline in a safe and responsible manner. There are several contingency plans, management plans and systems either in place or that will be in place to prevent accidents and reduce risk of injury to workers during construction. The plans include an ERP, Traffic Control Plan and Fire Contingency Plan. Enbridge’s Emergency Response Plan can be modified in consultation with local emergency providers to ensure that roles and responsibilities are understood and that the necessary resources required to respond are in place. All workers and visitors to the job site will have to participate in an environmental and safety orientation and, upon successful completion, display the valid safety hard hat decal before permission to access the job site is granted. Safety issues will be discussed during daily onsite tailgate meetings.

Despite these measures and best intentions, incidents during the construction phase may arise in which emergency services are required (e.g., ambulance, fire, police and hospital). The Project is located near services that would respond to emergency situations should they arise during construction of the pipeline. Given the proximity of the replacement pipeline to these communities and local roads and highways, it is anticipated that response to an emergency would occur in a timely manner (City of Hamilton 2015a) from any point along the route. If an incident does occur, in view of the extensive implementation of safety and mitigation measures, it is expected to be localized or of low relative intensity.

The impact balance of this potential residual effect is considered to be negative and the degree of confidence is low since it is difficult to predict whether an emergency event will occur or not. The residual effect of potentially using emergency services during the construction period is of low magnitude and low probability and is therefore, not significant (Table 6.2.17-2, point [d]).

Combined Effects on Infrastructure and Services

The following likely three potential residual effects may likely occur simultaneously during construction: increased traffic; increased waste flow; and change in availability of local accommodation. Change in the capacity of existing emergency services during construction due to an emergency situation is not considered in the combined effects on infrastructure since the probability of such a situation occurring is low. The combined effects of the Project on infrastructure and services are reversible, short-term in duration and of low magnitude. Consequently, it is concluded that the combined effects of the Project on infrastructure and services will be not significant (Table 6.2-17-2, point [e]).

6.2.17.4 Summary

As identified in Table 6.2.17-2, there are no situations for infrastructure and services that would result in a significant socio-economic residual effect. Consequently, it is concluded that the residual socio-economic effects of pipeline construction and operation on infrastructure and services will be not significant.

6.2.18 Navigation and Navigation Safety

6.2.18.1 Context

The replacement pipeline route crosses 69 watercourses. There are no designated Canadian Heritage Rivers are crossed by the replacement pipeline route (Canadian Heritage Rivers System 2011), nor any navigable waterways identified within the LSA that are listed by the *Navigable Protection Act.* However, based on a desktop review and field reconnaissance along the replacement pipeline route, West Spencer Creek has attributes (e.g., deep wet depth and wide wet width) that could make it suitable for recreational navigation. There is also a possibility that recreational boats could access West Spencer Creek through one of its tributaries during peak runoff seasons and has therefore been considered in this effects assessment.

The types of activities and use on watercourses crossed by the replacement pipeline route may include activities such as fishing, canoeing and kayaking. Vessels and craft used on watercourses crossed by the pipeline route may include boats, canoes and kayaks.

Project activities are anticipated to occur in fall and winter when the waterways are seasonally dry or frozen; however, this assessment is included in the event that construction or site-specific maintenance occurs during non-frozen conditions.

6.2.18.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on navigation and navigation safety associated with the construction and operation of the replacement pipeline were identified by the assessment team based on previous experience and are listed in Table 6.2.18-1. There were no concerns regarding navigation and navigation safety identified during the consultation process. Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

Table 6.2.18-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Navigation and Navigation Safety

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Disruption of watercourse users on navigable watercourses	• LSA • Navigable water-courses (e.g., West Spencer Creek)	• Notify appropriate authorities and licensees, if required by the MOECC, prior to commencement of watercourse crossing construction and prior to withdrawing water for testing. • Post warning signs upstream and downstream of crossings of navigable watercourses. Maintain these signs during all periods of open water when work is in progress and/or obstructions to navigation are in place, ensure they are legible and display them using black lettering on a yellow background. • Ensure the following warning systems are in place, if required by the NEB, until navigational hazards are removed: – install amber lights for instream work from dusk to dawn or during periods of restricted visibility; – mark any temporary water intakes in a navigable waterway with a yellow cautionary buoy; and – mark any isolation dam structures with yellow flashing lights from dawn to dusk and in periods of restricted visibility. • Allow navigation through the crossing construction site at all times or assist if necessary (e.g., pickup trucks to move people and vessels around). • Implement mitigation measures in the EPP to avoid or reduce the effects of instream construction.	• No residual effect identified
2.0 Concern for safety of users on navigable watercourses	• Navigable water-courses (e.g., West Spencer Creek)	• See mitigation measures in 1.0 of this table. • Follow all safety precautions and regulations required for hydrostatic testing. Consider posting warning signs at crossings in populated areas to advise the public of the danger.	• No residual effect identified

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

As a result of the construction schedule (Section 2.0) and the mitigation measures provided in Table 6.2.18-1, there are no residual effects identified during Project construction and operation on navigation and navigation safety.

6.2.18.3 Summary

As identified in Table 6.2.18-1, there are no situations for navigation and navigation safety that would result in a significant socio-economic residual effect.

6.2.19 Employment and Economy

6.2.19.1 Context

In 2014, Hamilton had a labour participation rate of 64% (compared with 62.8% in 2011) and an unemployment rate of 5.8% (compared with 8.7% in 2011). Of the total population aged 15 years and over by labour force status, approximately 407,000 individuals identified themselves as an employee (Statistics Canada 2015). The top three occupations in Hamilton in 2011 were sales and service occupations; business, finance and administration; and trades, transport and equipment operators. The top three industries residents were employed in over the same timeframe included health care and social assistance; manufacturing; and retail trade (Statistics Canada 2012b).

Contracting and employment opportunities and the need for local benefits have been identified as an important interest by communities. However, the greatest number of contracting and employment opportunities in the oil and gas industry is in the upstream sector (e.g., exploration and processing). Construction of the replacement pipeline will require skilled and unskilled labourers with a peak workforce of approximately 250 workers.

Enbridge has an Aboriginal and Native American Policy which focuses on recognizing the history, uniqueness and diversity of Aboriginal and Native American peoples. Enbridge has invested in building positive relationships with municipalities and Aboriginal and Native American Peoples, based on mutual respect and trust to help them realize their aspirations, and to help Enbridge reach their strategic business objectives. The policy is a responsibility shared between Enbridge and its subsidiaries, employees and Contractors. Enbridge has committed to providing on-going leadership and resources to ensure the effective implementation of the principles and commitments above, including the development of other implementation strategies and action plans (Enbridge 2015).

6.2.19.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential effects on employment and economy associated with the construction and operation of the replacement pipeline were identified by the assessment team supplemented with information gathered from landowners and government agencies. The potential effects are listed in Table 6.2.19-1. Concerns regarding employment and economy that were identified by landowners during the consultation process include:

- short-term and long-term financial impacts on businesses; and
- potential impacts to property values.

It is understood that property values are affected by numerous market forces and there is not a known or widely accepted cause and effect relationship between the presence of oil pipelines and property values. It is acknowledged that some homes were built after the existing Line 10 pipeline was in place and the easement would have been disclosed to the buyer at the time of purchase. Any unique effects on individual properties will be managed through case-by-case discussions and arrangements with Enbridge and no residual effects have been identified. The potential effect regarding financial impacts to personal businesses is addressed below.

Refer to the "Consultation Filing Requirements" chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

Additionally, a summary of measures to encourage the positive effects of the Project on employment and economy are provided in Table 6.2.19-1.

Table 6.2.19-1. Potential Effects, Mitigation Measures and Residual Effects of Construction and Operation of the Project on Employment and Economy

Potential Effect	Spatial Boundary/ Location	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Contracting and procurement opportunities	• RSA • Entire Route	• Prepare a database of Aboriginal Contractors and businesses that can provide services related to construction and provide these contacts to prime Contractors to use during the tendering process. • Provide the opportunity for qualified local Contractors to participate in the contracting process. • Where Aboriginal Contractor capacity exists (e.g., clearing, site security) Enbridge will competitively bid those contracts to qualified and capable Aboriginal Contractors.	• Increased contract procurement opportunities
2.0 Employment opportunities	• RSA • Entire Route	• Local motels, gas stations, hardware stores and restaurants will receive increased business during the construction season. Some of the construction subcontractors may be local or employ local labourers. • No increase or decrease in local business opportunities or employment is anticipated during the operational phase. • Enbridge is committed to their Aboriginal and Native American Policy to work with Aboriginal peoples to achieve sustainable benefits including opportunities in training and education, employment, procurement, business development and community investment (Enbridge 2015).	• Local businesses and residents will benefit from the Project through employment opportunities
3.0 Revenue	• National • Entire route	• Tax revenues from Enbridge are considered beneficial by governments.	• The Project will generate revenue for local, provincial and federal governments
4.0 Disruption to business	• Footprint • Privately-owned land	• Enbridge will manage any disruption to privately-owned businesses through consultation with affected parties. • Implement any approved mitigation measures resulting from ongoing consultation with landowners.	• No residual effect identified

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.2.19.3 Residual Effects Characterization and Significance Determination for Employment and Economy

A qualitative assessment was considered the most appropriate method to evaluate the significance of potential residual effects on employment and economy given the scope of the Project and the limited employment and economic benefits. This qualitative assessment relied on available research literature and the professional judgement of the assessment team.

Table 6.2-19-2 provides the rationale used to evaluate the significance of each of the potential residual socio-economic effects of the Project on employment and economy, with the exception of impact balance which is considered positive for all remaining potential residual effects. All assessment criteria were considered when determining the significance of each residual effect, but the most influential criteria were reversibility, magnitude and probability.

Table 6.2.19-2. Significance Evaluation of Potential Residual Effects of Pipeline Construction and Operation on Employment and Economy

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Increased contract procurement opportunities	RSA	Short-term	Isolated	N/A	Low	High	High	Not significant
(b) Local businesses and residents will benefit from the Project through employment opportunities	RSA	Short-term	Isolated	N/A	Low	High	High	Not significant
(c) The Project will generate revenue for local, provincial and federal governments	National	Long-term	Continuous	N/A	Low	High	High	Not significant
(d) Combined effects of the Project on employment and economy (points [a-c])	National	Short to long-term	Isolated to continuous	N/A	Low	High	High	Not significant

Contracting Procurement and Job Opportunities

Construction of the replacement pipeline will generate a demand for goods, services and workers. There will be direct and indirect business and employment opportunities, as well as direct and indirect income and employment effects.

Enbridge is committed to providing work opportunities for Aboriginal groups in proximity to the pipeline route according to their Aboriginal and Native American Policy. Where possible, these communities will be given an opportunity to provide labour, material, equipment and services to the Project. Enbridge will work with and expect that the successful Contractor(s) support Enbridge’s commitment that Aboriginal groups and businesses are provided full and fair opportunity to participate in the Project, where possible.

During preconstruction, positive residual effects have already been realized related to employment and economy (e.g., through the use of local services by field crews). During construction, the residual effect on contract procurement and job opportunities is considered to be positive, as is the residual effect of the Project on employment and economy during operation (Table 6.2.19-2, points [a] and [b]).

Revenue

Construction of the replacement pipeline will generate a demand for goods, services and workers. There will be direct and indirect business income and direct and indirect employment income. There will also be increased tax revenues during operations.

During all phases of the Project, the residual effects related to local, provincial and national revenues are considered to be positive and of low magnitude (Table 6.2.19-2, point [c]).

Combined Effects on Employment and Economy

The combined effects evaluation considers the individual potential residual effects evaluated above (points [a] through [c] of Table 6.2.19-2) that could act in combination on employment and economy during construction and operation of the Project.

The construction of the replacement pipeline is expected to result in contract procurement opportunities for local businesses and job opportunities for local residents. The operation of the Project is expected to result in some contract procurement opportunities for local businesses and tax revenue generation for local, provincial and federal governments. The combined effect of the Project on employment and the economy during construction and operations, while positive, is considered to be of low magnitude, given there will be no permanent full-time positions and the anticipated amount of tax revenue generated will be comparatively small. Consequently, it is concluded that the combined effects of the Project on employment and economy during construction and operations will be not significant (Table 6.2.19-2, point [d]).

6.2.19.4 Summary

As identified in Table 6.2.19-2, all identified residual socio-economic effects for employment and economy are positive; however, there are no situations for employment and economy that would result in a significant residual socio-economic effect. Consequently, it is concluded that the residual socio-economic effects of construction and operation on employment and the economy will be not significant.

6.3 Effects Assessment – Permanent Facilities

Using the assessment methodology described in Section 6.1, the following subsection evaluates the potential environmental and socio-economic effects arising from the installation of permanent facilities associated with the Project as described in Section 2.5.

Table 6.3-1. Element Interaction with Permanent Facilities

Element	Interaction with Permanent Facilities Component	
	Construction	**Operations**[1]
Physical and Meteorological Environment	No – The permanent facilities are located on level and stable areas. Therefore, no interaction with the physical and meteorological environment is anticipated during construction or operations.	
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	No – Air Emissions are not expected to increase during operations.
GHG Emissions	Yes	No – GHG Emissions are not expected to increase during operations.
Acoustic Environment	Yes	No – No increase in ambient noise is expected during operations.
Fish and Fish Habitat	Yes	Yes
Wetlands	Yes	Yes
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes

Table 6.3-1. Element Interaction with Permanent Facilities

Element	Interaction with Permanent Facilities Component	
	Construction	**Operations**[1]
Species At Risk	Yes	Yes
Human Occupancy and Resource Use	Yes	Yes
Heritage Resources	Yes	No – Surface or buried heritage resources sites would have been disturbed as a result of construction activities, therefore, no interaction is anticipated during operation of the new permanent facilities.
Traditional Land and Resource Use	No – The permanent facilities are located on privately-owned lands that are already not accessible or suitable for traditional uses. Therefore, the new permanent facilities will not affect any traditional use of the lands at these sites during construction or operation. Potential effects of the Project as a whole have been taken into consideration in Section 6.2.14.	
Social and Cultural Well-Being	No – This component of the Project will require a comparatively small workforce using the services of local communities over a short period. Consequently, the following potential social and cultural well-being effects noted on Table A-3 of the NEB *Filing Manual* do not apply to these components of the Project: • stresses on community, family and household cohesion; • alcohol and substance abuse; or • illegal or other potentially disruptive activities.	
Human Health	No – Potential effects on human health associated with construction and operations of the permanent facilities are limited to a short-term increase in nuisance air emissions (i.e., vehicle exhaust) and nuisance noise during construction. Air emissions and nuisance noise during construction are assessed in Sections 6.2.4 to 6.2.6. No interaction with human health is anticipated during construction or operation of the permanent facilities. Potential effects of the Project as a whole have been taken into consideration in Section 6.2.16 Human Health.	
Infrastructure and Services	Yes	No – Operations will require a small workforce using the existing services in the region for limited periods of time. Therefore, no interaction with infrastructure and services is anticipated during operation activities associated with the permanent facilities.
Navigation and Navigation Safety	No – The activities related to the new permanent facilities will not be located in, on, over, under, through, across or within 30 m of a navigable waterway.	
Employment and Economy	No – Construction of the new permanent facilities will entail a small workforce for a short period of time; therefore, no interaction with employment and economy is anticipated during construction or operation activities associated with the facilities. Potential effects of the Project as a whole have been taken into consideration in Section 6.2.19 Employment and Economy.	

Note

1 Activities during operations include periodic site visits, transportation of maintenance crews to facility or site, vegetation/weed management and aerial patrols.

6.3.1.1 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

The potential environmental and socio-economic effects associated with the construction and operation of the permanent facilities were identified by the assessment team and are listed in Table 6.3.1-1.

Table 6.3.1-1. Potential Effects, Mitigation Measures and Residual Effects of Permanent Facility Construction and Operation

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 SOIL AND SOIL PRODUCTIVITY			
1.1 Topsoil/subsoil mixing during construction	• All permanent facilities • Footprint	• Implement the applicable mitigation measures outlined in Table 6.2.2-1 (point 1.1). • Salvage topsoil from the entire construction site during non-frozen conditions. Reduce the topsoil salvage width during frozen conditions, if practical. • Salvage all available topsoil (minimum 10 cm. If soils are not readily distinguishable by colour, salvage topsoil to the plow layer or to 10 cm, whichever is greatest. • Where practicable, avoid driving or setting equipment on portions of the facility site where unsalvaged and unprotected topsoil is present, in order to avoid rutting and subsequent topsoil/subsoil admixing.	• Mixing of topsoil and subsoil
1.2 Surface gravel/subsoil mixing during construction	• Westover Terminal • Footprint	• Keep surface gravels separate from topsoil and spoil material. • Replace the upper subsoil and then the topsoil evenly over the ungravelled areas of the facility sites where lands disturbed during construction are not to be gravelled or otherwise used during the operation of the facility. • Replace gravel at previously-disturbed and gravelled areas, or spread new gravel on disturbed areas as directed by Enbridge.	• No residual effect identified
1.3 Compaction and rutting during construction	• All permanent facilities • Footprint	• Implement the applicable mitigation measures outlined in Table 6.2.2-1 (point 1.3). • Restrict all construction activities to the approved, surveyed site boundaries to reduce the area subjected to potential soil compaction. • Where practicable, do not drive or set equipment on portions of the facility site where unsalvaged and unprotected topsoil is present, in order to avoid rutting and subsequent topsoil/subsoil admixing. • Postpone construction, suspend equipment travel or utilize construction alternatives in the event of wet/thawed soils in order to reduce terrain disturbance and soil structure damage.	• No residual effect identified
1.4 Erosion of topsoil pile during construction and operation	• All permanent facilities • Footprint	• Implement the applicable mitigation measures outlined in Table 6.2.2-1 (points 2 and 3). • Apply tackifier or water, or implement other measures directed by the Environmental Inspector or Enbridge designate in order to control erosion on temporary topsoil stockpiles, if warranted. • Implement the Soil Erosion Contingency Measures when wind or water erosion of the topsoil windrow is a concern.	• No residual effect identified

Table 6.3.1-1. Potential Effects, Mitigation Measures and Residual Effects of Permanent Facility Construction and Operation

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 WATER QUALITY AND QUANTITY			
2.1 Alteration of natural surface water flow patterns	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.3-1 (point 1). • Locate the topsoil stockpile sites in upslope positions to avoid disruption of drainage and drainage channels. • Regrade areas with vehicle ruts or erosion gullies. • Construct drainage channels and adequately-sized culverts to ensure that drainage is not impeded.	• Localized alteration of natural surface drainage patterns
2.2 Reduction of surface water quality	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.3-1 (point 3).	• See Section 6.2.3 Water Quality and Quantity and Section 6.7 Accidents and Malfunctions
2.3 Reduction of groundwater quality	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.3-1 (point 4). • Determine which existing groundwater monitoring wells will be disturbed or damaged as a result of the construction program, if any, prior to the commencement of construction activities at each facility. • Decommission groundwater monitoring wells that may or will be affected by construction and have them reinstalled at a suitable new location following construction if the hydrogeological assessment identifies existing groundwater monitoring wells will be disturbed or damaged by construction. Retain a Hydrogeological Resource Specialist to select the appropriate new location and depth for each new monitoring well, if warranted. Retain a licenced water well drilling company to complete the well decommissioning and reinstallation, under the direction of the Hydrogeological Resource Specialist.	• See Section 6.2.3 Water Quality and Quantity and Section 6.7 Accidents and Malfunctions
2.4 Changes to water quality or quantity from withdrawal and release of hydrostatic test water	• All permanent facilities • RSA	• Implement the applicable mitigation measures outlined in Table 6.2.3-1.	• No residual effect identified
3.0 AIR EMISSIONS			
3.1 Nuisance air emissions from equipment and vehicles during construction	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.4-1 (point 1).	• Increase in air emissions during construction and operations

Table 6.3.1-1. Potential Effects, Mitigation Measures and Residual Effects of Permanent Facility Construction and Operation

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.2 Dust during construction	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.4-1 (point 2).	• Increase in air emissions during construction
4.0 GHG EMISSIONS			
4.1 Nuisance GHG emissions from equipment and vehicles during construction	• All permanent facilities • International	• Implement the applicable mitigation measures outlined in Table 6.2.5-1.	• Increase in GHG emissions during construction, site-specific maintenance activities and operation
5.0 ACOUSTIC ENVIRONMENT			
5.1 Nuisance noise during construction	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.6-1 (point 1).	• Increase in nuisance noise during construction
6.0 FISH AND FISH HABITAT			
6.1 Alteration or loss of fish habitat function	• Westover Terminal • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.7-1.	• See Section 6.2.11
6.2 Fish and freshwater mussel mortality	• Westover Terminal • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.7-1.	• No residual effect identified
7.0 WETLANDS			
7.1 Temporary alteration of wetland function	• Westover Terminal • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.8-1.	• See Section 6.2.8 Wetlands
7.2 Permanent loss of wetland area	• Westover Terminal • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.8-1.	• Permanent loss of wetland area
7.3 Contamination of wetlands from spills during construction and maintenance activities	• Westover Terminal • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.8-1.	• See Section 6.2.8 Wetlands

Table 6.3.1-1. Potential Effects, Mitigation Measures and Residual Effects of Permanent Facility Construction and Operation

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
8.0 VEGETATION			
8.1 Loss or alteration of native vegetation during construction	• Westover Terminal • Footprint	• Implement the applicable mitigation measures outlined in Table 6.2.9-1 (point 1).	• Loss of approximately 0.07 ha of native vegetation
8.2 Weed introduction and spread during construction and operations	• All permanent facilities • RSA	• Ensure all equipment (e.g., vehicles, materials, and mats) arrives for work in a clean condition to reduce the risk of weed introduction. Prohibit any equipment which arrives in a dirty condition to work until it has been cleaned off at a suitable location. • Monitor topsoil windrows for weed growth during the course of construction during non-frozen soil conditions and direct the Contractor to implement corrective measures, if warranted or requested by the landowner. Corrective measures may include hand pulling, mowing, using selective, non-persistent herbicides (if necessary), or seeding with a cover crop. • Implement additional applicable mitigation measures outlined in Table 6.2.9-1 (point 3).	• Weed introduction and/or spread
9.0 WILDLIFE AND WILDLIFE HABITAT			
9.1 Loss or alteration of wildlife habitat	• All permanent facilities • Footprint	• Implement the applicable mitigation measures outlined in Table 6.2.10-1 (point 1).	• Changes to wildlife habitat
9.2 Movement of wildlife during construction	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.10-1 (point 2).	• Movement of wildlife
9.3 Wildlife mortality during construction	• All permanent facilities • RSA	• Implement the applicable mitigation measures outlined in Table 6.2.10-1 (point 3).	• Changes to wildlife mortality risk during construction
10.0 SPECIES AT RISK			
10.1 Changes in habitat, movement and mortality risk for identified species at risk	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.11-1.	• Combined Project effects on species at risk resulting from changes in habitat, movement and mortality risk

Table 6.3.1-1. Potential Effects, Mitigation Measures and Residual Effects of Permanent Facility Construction and Operation

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
11.0 HUMAN OCCUPANCY AND RESOURCE USE			
11.1 Disruption of land user activities	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.12-1.	• Disruption of land user activities • Effects related to soil and soil productivity are addressed in Potential Effect 1 of this table
11.2 Sensory disturbance of nearby residents and land and resource users including alteration of viewsheds	• All permanent facilities • LSA	• Implement the applicable mitigation measures outlined in Table 6.2.12-1 (point 4).	• Sensory disturbance for local residents and land and resource users (from nuisance air emissions, noise and visual effects)
12.0 HERITAGE RESOURCES			
12.1 Disturbance of previously unidentified surface and buried heritage resource sites during construction	• All permanent facilities • Footprint	• Implement the applicable mitigation measures outlined in Table 6.2.13-1.	• No residual effect identified
13.0 INFRASTRUCTURE AND SERVICES			
13.1 Provision of emergency services	• All permanent facilities • RSA	• Implement the applicable mitigation measures outlined in Table 6.2.17-1 (point 2.1).	• No residual effect identified
13.2 Waste management during construction	• All permanent facilities • RSA	• Implement the applicable mitigation measures outlined in Table 6.2.17-1 (point 1.3).	• Temporary increase in waste flow to regional landfill sites will occur during construction

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.3.1.2 Residual Effects Characterization and Significance Determination for the Permanent Facilities

A qualitative assessment was determined to be the most appropriate method to evaluate the significance of the potential residual environmental and socio-economic effects of construction and operation of the permanent facilities due to a lack of regulatory thresholds, standards or guidelines. Consequently, the evaluation of significance of each of the potential residual effects relied on the professional judgement of the assessment team.

Table 6.3.1-2 provides a summary of the significance evaluation of the potential residual environmental and socio-economic effects of construction and operation of the permanent facilities. The rationale used to evaluate the significance of each of the potential residual effects is provided below, with the exception of impact balance, which is considered negative for all potential residual effects. An evaluation of significance is not required for those potential effects where no residual effect is identified.

Table 6.3.1-2. Significance Evaluation of Potential Residual Effects of Permanent Facility Construction and Operation

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Topsoil/subsoil mixing during construction	Footprint	Short-term	Isolated	Reversible	Low	High	High	Not significant
(b) Localized alteration of natural surface drainage patterns	LSA	Short to medium-term	Isolated	Reversible	Low to medium	High	High	Not significant
(c) Increase in air emissions during construction and operations	LSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(d) Increase in GHG emissions during construction, site-specific maintenance activities and operation	International	Short-term	Periodic	Irreversible	Low	High	High	Not significant
(e) Increase in nuisance noise during construction activities	LSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(f) Permanent loss of wetland area	LSA	Medium to long-term	Isolated	Reversible to irreversible	Low to medium	Low	High	Not Significant
(g) Loss of approximately 0.07 ha of native vegetation	Footprint	Extended-term	Isolated	Reversible to irreversible	Low	High	High	Not significant
(h) Weed introduction and/or spread	RSA	Short-term	Periodic	Reversible	Low	High	High	Not significant
(i) Changes to wildlife habitat	Footprint	Extended-term	Isolated	Reversible to irreversible	Low	High	High	Not significant
(j) Movement of wildlife away from permanent facilities	LSA	Short to extended-term	Isolated	Reversible	Low	High	Moderate	Not significant

Table 6.3.1-2. Significance Evaluation of Potential Residual Effects of Permanent Facility Construction and Operation

Potential Residual Effects	Spatial Boundary	Temporal Context: Duration	Temporal Context: Frequency	Temporal Context: Reversibility	Magnitude	Probability	Confidence	Significance
(k) Changes to wildlife mortality risk during construction	RSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(l) Changes in habitat, movement and mortality risk for identified species at risk	Footprint to LSA	Short to extended-term	Isolated to occasional	Reversible to irreversible	Low	Low to high	Moderate to high	Not significant
(m) Disruption of land user activities	LSA	Short-term	Isolated	Reversible	Low	High	High	Not significant
(n) Sensory disturbance for local residents and land and resource users (from nuisance air emissions, noise and visual effects)	LSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
(o) Temporary increase in waste flow to regional landfill sites will occur during construction	RSA	Short-term	Isolated	Reversible	Low	High	High	Not significant

Minor Topsoil/Subsoil Mixing

During the construction at the permanent facilities it is likely that a minor amount of topsoil and subsoil mixing will occur at select locations where topsoil is present. The impact balance of this residual effect is considered negative since admixing could decrease soil productivity. Work at the facilities will require the conversion of land previously used to support vegetation growth, where present, to a gravelled industrial site. Where practical, topsoil salvaged from greenfield sites during the construction process will be given to the respective landowner and will not be stored on-site.

The residual effect on soil and soil productivity is of high probability, however, it is of low magnitude, short-term duration and reversible. Therefore, with the implementation of mitigation measures, the residual effect is considered not significant (Table 6.3.1-2, point [a]).

Localized Alteration of Natural Surface Drainage Patterns

Construction activities requiring ground disturbance or excavations may contribute to some localized alteration of natural surface drainage patterns until settlement is complete. Grading and stormwater management measures may result in changes to surface flow patterns at facilities but surface flow patterns are expected to be unaffected adjacent to facility sites.

In the event that construction or maintenance activities at facilities result in changes in surface water regimes, corrective action, in consultation with the appropriate authorities, will be taken to resolve the issue. The PCEM program will identify locations of altered drainage patterns and remedial work will be conducted, as required.

The residual effect is of short to medium-term duration and is considered reversible. Although the probability of this residual effect is high, the residual effect is considered to be within environmental standards and, as a result, is of low to medium magnitude. Therefore, with the implementation of mitigation measures, the residual effect is considered not significant (Table 6.3.1-2, point [b]).

Air Emissions during Construction, Site-Specific Maintenance Activities and Operations

Ambient air quality in the LSA is rated as good with rare occurrences of degraded air quality (see Section 5.0). Increases in CAC emissions as a result of the Project are anticipated however, are expected to be small compared to existing emissions in the LSA.

The CACs expected to be emitted during construction and maintenance include NOx, CO, PM, and VOCs. The primary source of CAC emissions during construction of the permanent facilities will be from vehicle and equipment operation. Equipment operations will be the largest source of NOx during construction. Fugitive dust from on on-road equipment travel and off-road equipment use and material handling will be the largest source of PM. This residual effect is confined to construction activities completed during frozen conditions.

As noted in Section 5.0, the Project does not include the construction or operation of any permanent facilities or any modifications to existing facilities that are known to emit substantial amounts of air emissions (e.g., large combustion engines). During operations, increases in CAC emission will be resultant of periodic equipment use during site-specific maintenance and operations. The amount of CAC emissions associated with construction, site-specific maintenance activities and operations will be reduced by using well-maintained vehicles, reduction of vehicle and equipment idling and dust control measures. The residual effects of increased air emissions during construction, site-specific maintenance activities and operations are considered to have a negative impact balance and are of high probability. Although air emissions will increase during construction activities, the magnitude of the potential residual effect is considered low since it is expected that air emission concentrations will quickly attenuate to below standards within the LSA boundary. The increase in air emissions is anticipated to be of short-term duration and is considered reversible. Confidence is considered moderate due to the inherent uncertainties involved in accurately predicting fugitive emissions of particulate matter, particularly for material handling and movement activities, and resuspension of dust due to on-road equipment and vehicle travel. Therefore, the potential residual effect is considered to be not significant (Table 6.3.1-2, point [c]).

Greenhouse Gas Emissions during Construction, Site-Specific Maintenance and Operations

As noted in Section 5.0, the Project does not include the construction or operation of any permanent facilities that are known to be a major source of GHG emissions during operations (e.g., compressor station). The primary source of GHG emissions during construction will be from vehicle exhaust associated with transport to/from the facilities and heavy-duty construction equipment. The amount of GHG emissions associated with the construction of the permanent facilities will be reduced by using multi-passenger vehicles for the transport of crews to and from job sites, to the extent practical, using well-maintained equipment, and reducing idling. GHG emissions are considered irreversible, however, they are of low magnitude and the event causing an increase in GHG emissions (i.e., construction) will occur for an isolated period with the emissions ceasing once construction is complete. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [d]).

Increase in Nuisance Noise during Construction

As noted in Section 5.0, the Project does not include the construction or operation of any permanent facilities anticipated to result in an increase in noise emissions during operations. The primary source of nuisance noise will be from the construction of the new permanent facilities. The impact balance of this residual effect is considered negative since nuisance noise could cause a sensory disturbance to nearby residences. The residual effect is reversible, low magnitude, and short-term in duration (i.e., limited to the construction of the permanent facilities). Therefore, with the implementation of mitigation measures, the residual effect is considered not significant (Table 6.3.1-2, point [e]).

Permanent Loss of Wetland Area

During construction activities at the Westover Terminal, there is the likelihood that a portion of a wetland will be permanently disturbed, although through the implementation of the proposed mitigation measures, wetland function in surrounding wetlands is anticipated to be maintained within the LSA.

Due to the size of the wetland directly affected by the construction at the Westover Terminal and the relative small amount of land required for activities at the Westover Terminal (20 m x 33 m), overall wetland function is not anticipated to be lost at the disturbance sites, however, a reduction in wetland area may occur. The permanent loss of wetlands is considered to be irreversible at the disturbance sites, however, it is considered to be of low (herbaceous and shrub-dominant wetlands) to medium (treed wetlands) magnitude and reversible with the implementation of compensatory measures.

As permanent disturbance of wetlands cannot be avoided, further consultation with applicable regulatory authorities (e.g., Environment Canada and the CA) will be required and implementation of additional measures (e.g., wetland compensation) may be necessary to ensure that potential residual effects of permanent disturbances on wetland function remain not significant (Table 6.3.1-2, point [f]).

Loss of Native Vegetation

Approximately 0.07 ha of native vegetation will be disturbed or cleared during construction at the Westover Terminal and is considered to have a negative impact balance. The area of native vegetation to be disturbed is considered low relative to the extent of previously disturbed lands (e.g., agricultural land uses and existing facilities) encountered in the Footprint. The extent of altered native vegetation communities will be limited by the implementation of mitigation measures and reclamation measures will speed up the recovery of vegetation on the disturbed Project Footprint. The probability for loss of native vegetation is high, however, given the limited reduction in native vegetation, the magnitude is low. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [g]).

Weed Introduction and/or Spread

Enbridge will implement a Biosecurity Management Plan (to be appended to the EPP) during facility construction and operation such that potential effects due to weeds are maintained well within regulatory standards and are within the requirements of the Ontario *Weed Control Act*. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [h]).

Wildlife and Wildlife Habitat

Loss of Wildlife Habitat

Disturbance during construction activities will be reduced through the implementation of the recommended mitigation in Table 6.3.1-1 (e.g., avoiding construction during the migratory bird nest period or conducting a wildlife nest sweep) which will be included in the EPP. The loss of suitable wildlife habitat due to construction activities at the Westover Terminal and valve sites are considered minimal, resulting in a low magnitude of residual effects. Based on the operational life of the facilities, it is expected that potential wildlife habitat will not be reclaimed until the facilities are decommissioned. However, depending upon the landowner’s desired end land use, decommissioned areas may be returned to an agricultural land use, in which case, the loss of wildlife habitat would be permanent. Given that the magnitude of this residual effect is considered to be low, the potential residual effect related to loss of wildlife habitat is considered not significant (Table 6.3.1-2, point [i]).

Movement of Wildlife

Changes in wildlife movement is considered to be reversible, low magnitude, and short-term in duration with the implementation of the recommended mitigation measures in Table 6.3.1-1 which will be included in the EPP. Some wildlife species may alter their movement around the Westover Terminal and valve sites due to noise during operation, but will likely become acclimated to the level of noise over time. Other species may be less affected by the slight increase in noise. All assessment criteria were considered when determining the significance of wildlife displacement, but the most influential assessment criteria was magnitude. Therefore, although the probability of this residual effect is high, it is considered not significant (Table 6.3.1-2, point [j]).

Wildlife Mortality Risk

During construction activities, there is potential for an increased risk of wildlife mortality to arise from disturbance of undiscovered habitat. This increased risk will be reduced by implementing measures to avoid disturbance of nesting birds (i.e., avoiding construction during the migratory bird nesting period). With the implementation of the recommended mitigation measures in Table 6.3.1-1, which will be included in the EPP, the residual effect is reversible, of low magnitude, and short-term in duration. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [k]).

Species at Risk

There are no anticipated interactions with vegetation species of concern at the permanent facilities, so the discussion is focused on wildlife and aquatic species. Potential interactions with wildlife and aquatic species at risk are assessed in Section 6.2.11. There was no aquatic or wildlife habitat identified at the Nanticoke Junction Facility. Changes in habitat, movement and mortality risk will be reduced by implementing the recommended mitigation in Table 6.3.1-1, which will be included in the EPP. The potential residual effect associated with potential changes of habitat, movement, and mortality risk of wildlife and fish species at risk during construction activities at the permanent facilities is considered low magnitude with the implementation of mitigation measures.

This residual effect is reversible and of short-term duration with respect to changes in movement and increased mortality risk for species at risk. However, Project activities may result in an irreversible effect on potential habitat for certain species at risk, depending on the desired end land use following decommissioning. The probability of this residual effect is high for wildlife species that may use the habitat at Westover Terminal, but low for aquatic species, and the magnitude is considered low. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [l]).

Disruption of Land User Activities

Farmers and other land users in the vicinity of new permanent facilities may experience disruptions of their activities during the short-term duration of the construction phase. The impact balance of this residual effect is considered negative.

Advanced notification to nearby landowners, residents, lessees and occupants prior to the start of construction of the construction details, including timing and location of Project activities, will lessen the potential effects on landowner activities. In addition, agreements for demonstrated economic losses with those landowners who are directly affected by Project activities will further reduce this potential residual effect.

Most of the work on the existing facilities will occur within the boundaries of existing Enbridge property and little interaction with landowners is anticipated for those components (i.e., Westover Terminal and Nanticoke Junction Facility). With the implementation of the recommended mitigation, this potential residual effect is considered to be low magnitude, short-term in duration and reversible. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [m]).

Sensory Disturbance for Local Residents and Land and Resource Users

Nuisance air emissions and noise will occur during the construction of permanent facilities and may at times affect local residents and land and resource users living or working in the vicinity of permanent facilities. Possible effects may include air emissions (including odours and dust) and noise from construction equipment and vehicles. In addition, equipment, areas of land disturbance, and the activities of construction workers will be visible to local residents and nearby land and resource users during periods of construction. There may also be periods of night lighting around construction sites. Consequently, the visual quality of the landscape adjacent to the facilities may be adversely affected by the Project over the short-term construction period.

When construction activities are taking place in close proximity to human receptors, more people have the potential to be affected. In rural, less populated areas, the effects will be less detectable due to fewer human receptors. The implementation of the recommended mitigation measures will reduce the effects of noise and air emissions (including odours) on land users and residents. Noise and air emissions levels will adhere to municipal bylaws and stay within regulated levels. The potential effects on the acoustic environment and air emissions are discussed in the relevant sections above.

With the implementation of the recommended mitigation measures, sensory disturbance for local residents and land and resources users (from nuisance air emissions, noise, and potential visual effects) is considered to be low magnitude, short-term in duration, and reversible. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [n]).

Temporary Increase in Waste Flow

During construction of the permanent facilities, an increase in construction and household waste produced at the work site is expected. Household waste is also expected to be produced as a result of the influx of workers in a community. Local landfill sites, transfer station sites and wastewater treatment facilities may receive a temporary increase in wastes during construction. The capacity of the waste facilities in the RSA may be affected.

Enbridge will reduce waste quantities through Project design. All waste generated during construction at the facilities will be hauled to the appropriate landfill sites in the region depending upon the type of waste. Receptacles for recycling various products (e.g., paper, cardboard, glass and aluminum cans) will be available at the construction offices and will be hauled to appropriate recycling depots. More information about waste management services in the RSA is provided in Table 5.1-1.

With the implementation of the recommended mitigation, the potential residual effect is considered low magnitude, short-term in duration, and reversible. Therefore, the residual effect is considered not significant (Table 6.3.1-2, point [o]).

6.3.1.3 Summary

As identified in Table 6.3.1-2, there are no situations arising from the construction and operation of the permanent facilities where there is a high probability of occurrence of a permanent or long-term residual environmental effect of high magnitude that cannot be technically or economically mitigated nor are there any situations that would result in a significant socio-economic residual effect. Consequently, it is concluded that the potential residual effects arising from the installation and operation of the permanent facilities will be not significant.

6.4 Effects Assessment – Temporary Infrastructure and Workspace

The following temporary facilities will or may be needed prior to or during the construction of the Project:

- stockpile sites;
- temporary construction offices;
- temporary bridges for watercourse crossings;
- new temporary access roads (shoo-flies); and
- material and equipment staging areas.

The need for and the respective general location of these sites are the responsibility of the pipeline construction contractor. However, all temporary facility site locations will require the approval of the Environmental Inspector or Enbridge Environment staff.

The evaluation of potential temporary facility sites will be conducted as far in advance of its intended use as practical in order to allow an adequate time to choose and evaluate any alternate sites. In the event that specific mitigation is warranted for the site, the measures developed will be documented in the first year PCEM report (Section 9.0). General provisions will be included in the contract documents that commit contractors to site protection/restoration measures at sites identified, evaluated and used during the construction program. Mitigation measures to be used at temporary facility sites will be as described in Section 6.2. All applicable landowner as well as municipal, provincial and federal government approvals for a temporary facility site will be acquired prior to use of the site or area. The level of mitigation applied will ensure that any adverse residual environmental effects associated with the temporary facilities for construction are reduced to a level that is not significant.

6.5 Effects Assessment – Decommissioning

Using the assessment methodology described in Section 6.1, the following subsection evaluates the potential environmental and socio-economic effects arising from the decommissioning of the existing Line 10 pipeline from the Westover Terminal at to the Nanticoke Junction Facility. Decommissioning activities considered in this assessment include those that entail ground disturbance and decommissioning in-place.

The spatial boundaries used in the effects assessment for decommissioning are the same as the description under the Pipeline Construction and Operation component (Section 6.2). The rationale for the determination of these boundaries is also described in Section 6.2.

The environmental and socio-economic elements potentially interacting with the decommissioning of the existing Line 10 pipeline are identified in Table 6.5-1. Decommissioning entailing ground disturbance (i.e., clearing, topsoil salvage, excavation, backfilling, topsoil replacement, revegetation, temporary access, spill prevention and clean-up) will interact with the elements differently than decommissioning the pipeline in-place (i.e., leaving the pipeline in the ground. Therefore, Table 6.5-1 provides the element interactions for both decommissioning activities entailing ground disturbance and decommissioning in-place. The table also describes the rationale for those environmental and socio-economic elements which are not considered to interact with decommissioning of the existing Line 10 pipeline beyond the construction ROW.

Table 6.5-1. Element Interaction with Decommissioning Activities

Element	Interaction with Decommissioning Component During Decommissioning Activities Entailing Ground Disturbance	Interaction with Decommissioning Component During Decommissioning In-Place
Physical and Meteorological Environment	No – Activities to decommission the existing pipeline will entail ground disturbance at small isolated areas, and will not affect the morphology of unique physical features.	Yes
Soil and Soil Productivity	Yes	Yes
Water Quality and Quantity	Yes	Yes
Air Emissions	Yes	No – Once the pipeline has been decommissioned, physical activities that might result in air emissions will be minimal to non-existent.
GHG Emissions	Yes	No – Once the pipeline has been decommissioned, physical activities that might result in GHG emissions will be minimal to non-existent.
Acoustic Environment	Yes	No – Once the pipeline has been decommissioned, physical activities that might result in increased noise levels will be minimal to non-existent.
Fish and Fish Habitat	Yes	Yes
Wetlands	Yes	Yes
Vegetation	Yes	Yes
Wildlife and Wildlife Habitat	Yes	Yes
Species At Risk	Yes	No – Following activities to decommission the existing Line 10 pipeline, residual effects associated with soil, and subsequently vegetation, wildlife and wildlife habitat, and also species at risk are expected to be minimal to non-existent.
Human Occupancy and Resource Use	Yes	Yes
Heritage Resources	No - All decommissioning works entailing ground disturbance are anticipated to be confined to previously disturbed facilities or construction ROW. Therefore, no interaction between heritage resources and decommissioning activities entailing ground disturbance is anticipated.	No – Ground disturbance activities are not anticipated once the pipeline has been decommissioned. Therefore, no interaction between heritage resources and decommissioning in-place are anticipated.
Traditional Land and Resource Use	Yes	No –The pipeline will be decommissioned in-place with little to no surface disturbances anticipated following the act of decommissioning.

Table 6.5-1. Element Interaction with Decommissioning Activities

Element	Interaction with Decommissioning Component During Decommissioning Activities Entailing Ground Disturbance	Interaction with Decommissioning Component During Decommissioning In-Place
Social and Cultural Well-Being	No - The decommissioning of the existing pipeline entailing ground disturbance will entail a small workforce that is expected to use the services of local communities over a short period of time. Consequently, the following potential social and cultural well-being sources of effects noted on Table A-3 of the NEB *Filing Manual* do not apply to these components of the Project: • an increase in temporary or permanent residents to an area; • location of construction camps within, beside or near local communities; • a significant increase to, or uneven distribution of, personal income at the community level; and • disruptions to cultural traditions and institutions.	No - Once the existing Line 10 pipeline is decommissioned, a workforce and services of local communities are not anticipated to be needed.
Human Health	Yes	Yes
Infrastructure and Services	Yes	Yes
Navigation and Navigation Safety	No - The activities related to the ground disturbance associated with decommissioning of the existing pipeline will not be located in, on, over, under, through, across or within 30 m of a navigable waterway.	Yes
Employment and Economy	No - The decommissioning of the existing pipeline entailing ground disturbance will consist of a small workforce for a short period of time; therefore, no interaction with employment and economy is anticipated during decommissioning activities. An economic analysis was not deemed necessary for the decommissioning of the pipeline.	

Note:

1 Activities during pipeline construction include engineering, construction surveys, clearing (only if applicable), disposal, topsoil/strippings handling, excavation, cleaning of the pipeline, welding, backfilling and clean-up (see Section 2.8).

6.5.1 Potential Effects, Mitigation Measures and Residual Effects

The potential environmental and socio-economic effects associated with the decommissioning the existing Line 10 pipeline are listed in Table 6.5.1-1 and were identified by the assessment team based on past experience and from consultation with stakeholders including government agencies, and landowners along the decommissioning pipeline route. There are no outstanding concerns raised by landowners or Aboriginal groups regarding the planned decommissioning of the existing Line10 segment.

Refer to the “Consultation Filing Requirements” chapter of the Project Application for further information regarding Project-specific consultation efforts and outcomes.

For some of the potential effects, the recommended mitigation measures will completely mitigate the potential adverse effects, in which case, no residual effect is identified. In other situations, the mitigation measures will lessen the effects, but do not entirely eliminate them. Elements for which no residual effects are predicted require no further analysis (i.e., significance evaluation).

The potential effects associated with the decommissioning of the existing Line 10 are identified in Table 6.5.1-1. The assessment of potential effects considers those that may result from decommissioning activities as well as any potential effects that may arise during the life of the decommissioned pipe (i.e., decommissioning in-place). Mitigation measures recommended in Table 6.5.1-1 to reduce the potential effects of the decommissioning will also been incorporated into the Project-specific EPP.

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

	Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0	***PHYSICAL AND METEOROLOGICAL ENVIRONMENT***				
1(a)	Ground subsidence may result from a void created by infilling of the decommissioned pipeline	Decommissioning in-place	Footprint	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning.	• No residual effect identified
2.0	***SOIL AND SOIL PRODUCTIVITY***				
2(a)	Topsoil/subsoil mixing during decommissioning	Decommissioning entailing ground disturbance	Footprint	• Salvage topsoil, to the extent feasible, to the plow layer, to the colour change or to 10 cm, whichever is greatest, at locations where there is little to no topsoil on hay and cultivated lands. • Salvage all available root zone material, to the extent feasible, to the colour change or to 10 cm, whichever is greatest, at locations where there is little to no topsoil on tame pasture, hay pasture, shrub pasture, treed pasture or treed lands. • Implement the Soil Handling Contingency Measures during topsoil salvaging if any of the following are encountered: little or no topsoil; poor colour separation or uneven boundary between topsoils and subsoils; stony soils; uneven surface on native prairie or tame pasture; high winds; or as per the Line List. • Decommissioning activities at these locations will be similar to those associated with the construction of the Line 10 replacement pipeline. For a discussion of key recommendations and mitigation measures, refer to Section 6.2.2.	• Topsoil/subsoil mixing may occur as a result of ground disturbance decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
2(b) Compaction and rutting during decommissioning	Decommissioning entailing ground disturbance	Footprint	• Implement the Wet/Thawed Soils Contingency Plan (to be appended to the EPP[1]) during wet/thawed conditions. Postpone construction, suspend equipment travel or utilize construction alternatives in the event of wet/thawed soils in order to reduce terrain disturbance and soil structure damage. • Suspend activities during wet soil conditions. Reduce the width of temporary workspace if necessary. Postpone topsoil salvage activities until immediately prior to trenching or excavation. • Refer to Section 6.2.2 for a discussion of key recommendations and mitigation measures along the Line 10 replacement pipeline ROW.	• No residual effect identified
2(c) Erosion of topsoil	Decommissioning entailing ground disturbance	Footprint	• Implement the Soil Erosion Contingency Measures when wind or water erosion is a concern.	• Surface erosion of topsoil at locations disturbed by decommissioning activities can be expected until a vegetative cover has been established
2(d) Soil contamination due to spot spills	Decommissioning entailing ground disturbance	Footprint	• Immediately implement the Fuels and Hazardous Materials Contingency Plan in the event of a spill (to be appended to the EPP[1]). • The procedures to be followed will be consistent with those described in Enbridge's O&MM Book 8: Environment.	• No residual effect identified
2(e) Disturbance of previously contaminated soil	Decommissioning entailing ground disturbance	Footprint	• Consider soils contaminated if free product is present, the soil is a notably different colour than the surrounding soil (black, shades of grey, blue and green), hydrocarbon odours are present or there is sheen on excavation water. Immediately notify the Environmental Inspector, Enbridge designate and/or Construction Manager.	• No residual effect identified

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
2(e) Disturbance of previously contaminated soil (cont'd)	See above	See above	• Implement the Contaminated Soils Discovery Contingency Plan (to be appended to the EPP[1]) in the event that contaminated or potentially contaminated soils are encountered.	See above
2(f) Soil contamination due to residual contaminants still present in the decommissioned pipeline	Decommissioning in-place	Footprint	• Clean the pipeline prior to decommissioning. • Immediately implement the Fuels and Hazardous Materials Contingency Plan in the event of a spill, during decommissioning activities.	• No residual effect identified
2(g) Decommissioned pipeline acting as a conduit	Decommissioning in-place	Footprint	• Segment the pipe at select locations to prevent water migration. • Maintain ongoing ROW surveillance and maintenance.	• Reduction in soil productivity due to the decommissioned pipeline acting as a conduit to transport materials and contaminants • Reduction in soil productivity due to the decommissioned pipeline acting as a preferred water conduit
2(h) Ground subsidence may result from a void created by the infilling of the decommissioned pipeline	Decommissioning in-place	Footprint	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning.	• No residual effect identified
3.0 WATER QUALITY AND QUANTITY				
3(a) Alteration of natural surface water flow patterns due to excavation subsidence	Decommissioning entailing ground disturbance	LSA	• Regrade areas with vehicle ruts or erosion gullies or where the trench or excavated area has settled. • See recommended mitigation measures regarding alteration of natural surface water flow patterns in point 1 of Table 6.2.3-1.	• Localized alteration of natural drainage patterns at locations disturbed by decommissioning activities may occur until settlement of excavations is complete

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
3(b) Alteration or contamination of surface water or groundwater in the event of a spill	Decommissioning entailing ground disturbance	LSA	• Maintain equipment in good working condition and ensure equipment and vehicles are free of leaks. • Implement measures to minimize the risk of fuel, lubricating fluids, hydraulic fluids, methanol, standard antifreeze, herbicides, biocides or other chemicals from being released onto the ground or into any watercourse or wetland. • Ensure that bulk fuel trucks, service vehicles and pickup trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency materials on bulk fuel and service vehicles that are suitable for use on land and water (i.e., sorbent pads, sorbent boom and rope). • Report spills immediately to the Construction Manager or Environmental Inspector who will report spills to the Enbridge Environment Lead, and, appropriate government agencies in accordance with the Fuels and Hazardous Materials Contingency Plan. • Do not wash equipment or machinery in watercourses or wetlands. Control wastewater from construction activities, such as equipment washing or concrete mixing, to avoid discharge directly into any body of water. • Employ the following measures to reduce the risk of fuel spills in water. Where equipment servicing/refueling is necessary within 100 m of the normal high watermark of a watercourse or wetland, ensure that: – all containers, hoses and nozzles are free of leaks; – all fuel nozzles are equipped with automatic shut-off valves;	• Contamination of surface water or groundwater due to a spill during ground disturbance decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
3(b) Alteration or contamination of surface water or groundwater in the event of a spill (cont'd)	See above	See above	– operators are stationed at both ends of the hose during fueling unless the ends are visible and readily accessible by one operator; – fuel remaining in the hose is returned to the storage facility; – secondary containment exceeds the total volume being transferred in the case of stationary equipment (i.e., pumps and generators); and – adequate spill response materials are available at the site of the transfer to control all volumes spilled. • See recommended mitigation measures regarding alteration or contamination of surface water in point 3 and point 4 of Table 6.2.3-1.	See above
3(c) Decommissioned pipeline acting as a water conduit	Decommissioning in-place	LSA	• Segment the pipe at select locations to prevent water migration. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Maintain ongoing ROW surveillance and maintenance.	• Contamination of surface water and/or groundwater due to the decommissioned pipeline acting as a conduit to transport materials and contaminants • Alteration of surface water and/or groundwater quantity due to the decommissioned pipeline acting as a preferred water conduit
3(d) Contamination due to the presence of residual contaminants associated with the decommissioned pipeline	Decommissioning in-place	LSA	• Clean the pipeline prior to decommissioning.	• Contamination of surface water and/or groundwater due to the presence of residual contaminants associated with the decommissioned pipeline

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

	Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
3(e)	Alteration of natural surface water flow patterns due to ground subsidence that may result from a void created by infilling of the decommissioned pipeline	Decommissioning in-place	LSA	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning.	• Localized alteration of natural drainage patterns may occur where the decommissioned pipeline has infilled
4.0	***AIR EMISSIONS***				
4(a)	Air emissions during decommissioning activities	Decommissioning entailing ground disturbance	RSA	• Use well-maintained equipment to reduce air pollution. • Restrict the duration that vehicles and equipment are allowed to sit and idle, unless air temperatures are less than 5°C. • Use multi-passenger vehicles for the transport of crews to and from the job sites, to the extent practical, to reduce noise and air emissions during construction.	• Increase in nuisance air emissions during ground disturbance decommissioning activities
5.0	***GREENHOUSE GAS EMISSIONS***				
5(a)	GHG emissions during decommissioning activities	Decommissioning entailing ground disturbance	International	• See recommended mitigation measures in point 4.0 Air Emissions element of this table.	• Increase in GHG emissions during ground disturbance decommissioning activities
6.0	***ACOUSTIC ENVIRONMENT***				
6(a)	Noise during decommissioning activities	Decommissioning entailing ground disturbance	LSA	• Ensure that noise abatement equipment (e.g., mufflers) on machinery is in good working order. Where practical, turn off off equipment when not in use. Enclose noisy equipment, as needed, to limit the transmission of noise beyond the construction site. Locate stationary equipment, such as compressors and generators, away from noise receptors. Replace or repair equipment parts generating excessive noise, if practical.	• Increase in nuisance noise during ground disturbance decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

	Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
6(a)	Noise during decommissioning activities (cont'd)	See above	See above	• Schedule construction activities near residences and recreational areas (e.g., golf courses, campgrounds or parks) during the period from 7 AM to 7 PM, or in accordance with applicable noise bylaws or approval conditions. In the event of after-hours noise during construction, Enbridge will ensure affected landowners are notified in advance of construction activities.	See above
7.0	***FISH AND FISH HABITAT***				
7(a)	Decommissioned pipeline acting as a water conduit	Decommissioning in-place	Footprint (riparian habitat) LSA (instream habitat)	• Segment the pipe at select locations to prevent water migration. • Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Clean the pipeline prior to decommissioning.	• Alteration of riparian or instream habitat due to the decommissioned pipeline acting as a conduit to transport materials and contaminants • Alteration of riparian or instream habitat due to changes in hydrology from the decommissioned pipeline acting as a preferred water conduit
7(b)	Contamination of riparian or instream habitat due to the presence of residual contaminants associated with the decommissioned pipeline	Decommissioning in-place	Footprint (riparian habitat) LSA (instream habitat)	• Clean the pipeline prior to decommissioning.	• Alteration of riparian or instream habitat due to the presence of residual contaminants associated with the decommissioned pipeline
7(c)	Alteration or loss of riparian or instream habitat due to exposed pipe	Decommissioning in-place	Footprint (riparian habitat) LSA (instream habitat)	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Assess the need to weigh down buried pipe at watercourse crossings and wetlands prior to decommissioning and implement mitigation where needed.	• Alteration of riparian or instream habitat due to exposed pipe

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

	Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
8.0	***WETLANDS***				
8(a)	Decommissioned pipeline acting as a water conduit	Decommissioning in-place	LSA	• Segment the pipe at select locations to prevent water migration. • Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Clean the pipeline prior to decommissioning.	• Alteration of wetland habitat, hydrological and biogeochemical functions due to the decommissioned pipeline acting as a conduit to transport materials and contaminants
8(b)	Contamination of wetland habitat and interference with wetland biogeochemical cycling due to the presence of residual contaminants associated with the decommissioned pipeline	Decommissioning in-place	LSA	• Clean the pipeline prior to decommissioning.	• Alteration of wetland habitat and biogeochemical functions due to the presence of residual contaminants associated with the decommissioned pipeline
8(c)	Alteration of wetland habitat and alteration of wetland hydrology due to exposed pipe	Decommissioning in-place	LSA	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Assess the need to weigh down buried pipe at watercourse crossings and wetlands prior to decommissioning and implement mitigation where needed.	• Alteration of wetland habitat function and alteration of wetland hydrological function due to exposed pipe
9.0	***VEGETATION***				
9(a)	Potential effect to native vegetation	Decommissioning entailing ground disturbance	Footprint	• See recommended mitigation measures regarding loss or alteration to native vegetation composition in point 1.0 of Table 6.2.9-1.	• Change in composition of native vegetation at locations disturbed by decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
9(b) Potential alteration to vegetation species of conservation concern or rare plant community	Decommissioning entailing ground disturbance	Footprint	• In the event that vegetation species of conservation concern or rare plant communities are identified or suspected along the construction ROW during decommissioning activities entailing ground disturbance, notify the Environmental Inspector and the Enbridge Environment Lead. Flag or fence the area until a plant or community can be confirmed by a vegetation ecologist. Implement protection measures based on site-specific conditions and species sensitivity criteria.	• Some alteration of a vegetation species of conservation concern or rare plant community if mitigation measures do not completely protect a site.
9(c) Weed introduction and spread	Decommissioning entailing ground disturbance	RSA	• See recommended mitigation measures regarding weed introduction and spread in point 3.0 of Table 6.2.9-1. • Before mobilizing to the Project area, all passenger vehicles, grade, access and topsoil handling equipment, and subsoil handling equipment must arrive clean and free of soil and debris. • Use only appropriate seed mixes (in consultation with landowners, where applicable) for agronomic (i.e., non-native) seed mixes. Where possible, obtain seed from a local source and retain the Certificates of Analysis for future documentation. All seed mixes must have Certificates of Analysis for weed and undesirable species content, and germination tests for each lot of each species in the mix. Provide copies of all Certificates of Analysis to the Environmental Inspector. For native seed, obtain the highest seed grade available. • Choose an appropriate management option (i.e., mechanical, biological, physical, botanical or chemical) or a combination of treatments that will provide cost-efficient and effective weed management based on the data collected at weed occurrence sites.	• Weed introduction and spread at locations disturbed by decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect		Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
9(d)	Disturbance of vegetation due to a spill from construction equipment associated clean-up and reclamation activities at decommissioning locations	Decommissioning entailing ground disturbance	RSA	• See recommended mitigation measures regarding disturbance of vegetation due to a spill in point 5.0 of Table 6.2.9-1. • Immediately implement the Fuels and Hazardous Materials Contingency Plan in the event of a spill. • Report spills immediately to the Construction Manager and Environmental Inspector. • The Construction Manager or Environmental Inspector will report spills to the Enbridge Environment Lead, local Enbridge Operations and, appropriate government agencies in accordance with the Fuels and Hazardous Materials Contingency Plan.	• Disturbance of vegetation due to a spill from construction equipment associated clean-up and reclamation activities at locations disturbed by decommissioning activities
9(e)	Decommissioned pipeline acting as a water conduit	Decommissioning in-place	Footprint	• Segment the pipe at select locations to prevent water migration. • Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Clean the pipeline prior to decommissioning.	• Disturbance or alteration of vegetation due to the decommissioned pipeline acting as a conduit to transport materials and contaminants • Disturbance or alteration of vegetation due to the decommissioned pipeline acting as a preferred water conduit
9(f)	Alteration of vegetation due to due to the presence of residual contaminants associated with the decommissioned pipeline	Decommissioning in-place	Footprint	• Clean the pipeline prior to decommissioning.	• Disturbance or alteration of vegetation due to the presence of residual contaminants associated with the decommissioned pipeline

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
10.0 WILDLIFE AND WILDLIFE HABITAT				
10(a) Alteration of wildlife habitat	Decommissioning entailing ground disturbance in areas of native prairie, tame pasture, shrub pasture, treed pasture, treed areas, watercourses, wetlands, drainages and riparian areas	LSA	• See recommended mitigation measures regarding alteration of wildlife habitat in point 1.0 of Table 6.2.10-1. • Implement the Wildlife Species of Concern Discovery Contingency Plan in the event that wildlife species with special conservation status are identified during construction.	• Alteration of wildlife habitat availability and effectiveness during ground disturbance decommissioning activities
10(b) Changes to wildlife movement	Decommissioning entailing ground disturbance	LSA	• See recommended mitigation measures regarding changes to wildlife movement in point 2.0 of Table 6.2.10-1. • Complete decommissioning activities in a timely manner.	• Temporary changes to wildlife movement during ground disturbance decommissioning activities
10(c) Wildlife mortality	Decommissioning entailing ground disturbance	RSA	• See recommended mitigation measures regarding changes to wildlife mortality risk in point 3.0 of Table 6.2.10-1. • Implement the Wildlife Species of Concern Discovery Contingency Plan in the event that wildlife species with special conservation status are identified during construction. • Report the location and species of wildlife or livestock trapped in the trench or excavation if present, to the Environmental Inspector prior to commencing any construction activities.	• Increased wildlife mortality risk during ground disturbance decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
10(c) Wildlife mortality (cont'd)	See above	See above	• Suspend the work activity and/or fence or flag off the area in the event that an area where ROW preparation is to be conducted contains an active bird nest or a burrow or den is discovered during ROW preparation. Immediately report sightings of wildlife species with special conservation status to the Environmental Inspector or Enbridge designate. Implement applicable contingency measures associated with the discovery of species with special conservation status during construction (e.g., seasonal timing constraints within the recommended setback distances).	See above
10(d) Effects of spills of hazardous materials on wildlife	Decommissioning entailing ground disturbance	LSA	• Implement spill prevention measures outlined in the Enbridge Waste Management Plan (Enbridge 2014) and the Fuels and Hazardous Materials Contingency Plan. • Implement the measure outlined in the Fuels and Hazardous Materials Contingency Plan in the event of a spill. • Report spills immediately to the Construction Manager, Environmental Inspector and/or Enbridge designate.	• Effects of spills of hazardous materials on wildlife at locations disturbed by decommissioning activities • See Accidents and Malfunctions in Section 6.7
10(e) Decommissioned pipeline acting as a water conduit	Decommissioning in-place	Footprint	• Segment the pipe at select locations to prevent water migration. • Maintain ongoing ROW surveillance and maintenance. • Clean the pipeline prior to decommissioning.	• Alteration of wildlife habitat due to the decommissioned pipeline acting as a conduit to transport materials and contaminants • Alteration of wildlife habitat due to the decommissioned pipeline acting as a preferred water conduit

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
10(f) Contamination of wildlife habitat due to the presence of residual contaminants associated with the decommissioned pipeline	Decommissioning in-place	Footprint	• Clean the pipeline prior to decommissioning.	• Alteration of wildlife habitat due to the presence of residual contaminants associated with the decommissioned pipeline
11.0 SPECIES AT RISK OR SPECIES OF SPECIAL CONSERVATION STATUS				
11(a) Effects of habitat, movement and mortality risk change on wildlife species at risk	Decommissioning entailing ground disturbance in areas of tame pasture, shrubs, treed areas, watercourses, wetlands, drainages and riparian areas	Footprint	• See recommended mitigation measures regarding alteration of wildlife habitat in point 10(a) of this table. • See recommended mitigation measures regarding changes in wildlife movement in point 10(b) of this table. • See recommended mitigation measures regarding wildlife mortality in point 10(c) of this table.	• Effects of habitat, movement and mortality risk change on wildlife species at risk during ground disturbance decommissioning activities
12.0 HUMAN OCCUPANCY AND RESOURCE USE				
12(a) Sensory disturbance of nearby residents and land and resource users	Decommissioning entailing ground disturbance	RSA	• Notify the City of Hamilton, municipalities, Aboriginal groups involved in the Enbridge Aboriginal Engagement Strategy, nearby landowners and residents, and local recreation groups of Project details and provide with schedules prior to the initiation of decommissioning activities to minimize sensory disturbances, minimize disturbances to outdoor recreation and, if warranted, install signs at recreational access points notifying users of decommissioning activities in the vicinity. • Ensure that schedule changes are communicated to these groups prior to decommissioning. • Incorporate landowners' special requests into the construction procedures, as agreed upon in specific easement agreements.	• Sensory disturbance of local residents and land and resource users (from nuisance air emissions, noise and visual effects) at locations disturbed by decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
12(a) Sensory disturbance of nearby residents and land and resource users (cont'd)	See above	See above	• Implement the Traffic Control Plan for vehicular use on the construction ROW and associated access roads. • See recommended mitigation measures regarding nuisance air emissions in point 4.0 Air Emissions element of this table. • See recommended mitigation measures regarding nuisance noise in point 6.0 Acoustic Environment element of this table. • See recommended mitigation measures regarding the disruption of normal, daily living activities of local residents and land users in point 14.0 Human Health element of this table. • Continue consultation with affected stakeholders, including Aboriginal groups, throughout the decommissioning process.	See above
12(b) Disruption of outdoor recreation experience and activities of land users, including Aboriginal groups	Decommissioning entailing ground disturbance	RSA	• Notify the City of Hamilton, municipalities, Aboriginal groups involved in the Enbridge Aboriginal Engagement Strategy, nearby landowners and residents, and local recreation groups of Project details and provide with schedules prior to the initiation of decommissioning activities to minimize sensory disturbances, minimize disturbances to outdoor recreation and, if warranted, install signs at recreational access points notifying users of decommissioning activities in the vicinity. • Ensure that signs are installed in a manner that does not interfere with farm machinery that need access to roads and trails. • Notify landowners /lessees/occupants so that if feasible, livestock can be shifted to adjacent pasture lands during the scheduled decommissioning period. • Incorporate landowners' special requests into the decommissioning procedures, as agreed upon in specific ROW agreements.	• Disruption of outdoor recreation experience and activities of land users, including Aboriginal groups at select locations disturbed by decommissioning activities

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
12(b) Disruption of outdoor recreation experience and activities of land users, including Aboriginal groups (cont'd)	See above	See above	• Implement the Traffic Control Plan for vehicular use on the construction ROW and associated access roads and confine all motorised vehicles to the construction ROW and approved access roads, shoo-flies or trails. • Reduce the amount of disturbance by using previously disturbed areas and existing ROW for stockpiles. Review and adhere to measures in the Biosecurity Plan (to be appended to the EPP[1]) to monitor and control weed growth. • Install temporary gates and fencing prior to decommissioning activities if requested by the landowner to prevent livestock from entering or leaving the property and from entering or accidentally falling into the trench or excavation. Close gates after use. Assign a watchman, if warranted, to ensure gate closure. • Develop agreements with directly affected land users for demonstrated economic losses related to ground disturbance associated with decommissioning the existing Line 10 pipeline.	See above
12(c) Ground subsidence may result from a void created by the infilling of the decommissioned pipeline	Decommissioning in-place	Footprint	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning.	• No residual effect identified
12(d) Decommissioned pipeline acting as a water conduit	Decommissioning in-place	Footprint	• See recommended mitigation measures regarding surface water and groundwater quality and quantity in point 3.0 of this table.	• Alteration of surface water supply and quality (see Water Quality and Quantity element in this table)

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
12(d) Decommissioned pipeline acting as a water conduit (cont'd)	See above	See above	See above	• Alteration of well water flow and quality due to an alteration of groundwater quality or quantity (see Water Quality and Quantity element in this table)
12(e) Exposure of the decommissioned pipeline	Decommissioning in-place	Footprint	• Maintain ongoing ROW surveillance and maintenance. • Assess the need to weigh down buried pipe at watercourse crossings and wetlands prior to decommissioning and implement mitigation where needed.	• Accidents resulting from exposed pipe (see Accidents and Malfunctions Section 6.7)
13.0 TRADITIONAL LAND AND RESOURCE USE				
13(a) Disturbance of previously unidentified traditional use sites and activities	Decommissioning entailing ground disturbance	LSA	• See recommended mitigation measures regarding traditional use sites in Table 6.2.14-1. • Should traditional use sites be identified during engagement with Aboriginal groups, implement the following applicable measures: – record and map fishing locales; – strict adherence to the regulations, standards and guidelines set by provincial and federal regulatory agencies for watercourse crossings; and – alternative site-specific mitigation strategies recommended by participating Aboriginal groups.	• No residual effect

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
14.0 HUMAN HEALTH				
14(a) Disruption of normal, daily living activities of local residents and resource users	Decommissioning entailing ground disturbance	RSA	• Notify the City of Hamilton, local municipalities, Aboriginal groups (where applicable), nearby landowners and residences, and local recreation groups. Provide Project details and schedules prior to the initiation of decommissioning activities to minimize sensory disturbances and; minimize disturbances to outdoor recreation. • If warranted, install signs at recreational access points notifying users of decommissioning activities and ensure signs are installed in a manner that does not interfere with the larger and wider farm machinery that need access to roads and trails. • Ensure that schedule changes are communicated to these groups prior to decommissioning. • See recommended mitigation measures regarding surface water and groundwater quality and quantity in point 3.0 Water Quality and Quantity element of this table. • See recommended mitigation measures regarding nuisance air emissions in points 4.0 Air Emissions element and 5.0 GHG Emissions element of this table. • See recommended mitigation measures regarding nuisance noise in point 6.0 Acoustic Environment element of this table. • See recommended mitigation measures regarding vegetation disturbance in point 9.0 Vegetation element of this table. • See recommended mitigation measures in point 12.0 HORU element of this table. • Continue consultation with affected stakeholders, including Aboriginal groups, throughout the decommissioning process.	• Disruption of normal, daily living activities of local residents and resource users at locations disturbed by decommissioning activities • See Accidents and Malfunctions Section 6.7

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
14(b) Disruption of water well and/or drinking water supply quality due to potential contamination associated with the decommissioned pipeline and the decommissioned pipeline acting as a water conduit	Decommissioning in-place	LSA	• See recommended mitigation measures regarding surface water and groundwater quality and quantity in point 3.0 of this table.	• Contamination of surface water and/or groundwater due to the decommissioned pipeline acting as a preferred conduit to transport water or contaminants (see Water Quality and Quantity element) • Contamination of surface water and/or groundwater due to the presence of residual contaminants associated with the decommissioned pipeline (see Water Quality and Quantity element) • See Accidents and Malfunctions Section 6.7
15.0 INFRASTRUCTURE AND SERVICES				
15(a) Increased traffic volumes as a result of transporting workers, supplies and equipment	Decommissioning entailing ground disturbance	RSA	• Notify the City of Hamilton, municipalities, Aboriginal groups, nearby landowners and residences of Project details and provide with schedules prior to the commencement of decommissioning activities. • Ensure that schedule changes are communicated to these groups prior to decommissioning. • Implement the Traffic Control Plan for vehicular use on the ROW and associated access roads. • Multi-passenger vehicles will be used for the transport of decommissioning crews to and from the ROW, where practical, to lessen the potential for accidents due to tiredness, excess speed and the volume of traffic on roads, as well as reduce air emissions and potential for wildlife mortality.	• Increased traffic on highways and local roads used to access the Line 10 decommissioning sites

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
15(a) Increased traffic volumes as a result of transporting workers, supplies and equipment (cont'd)	See above	See above	• Implement the Traffic Control Strategy including safety measures developed by the Contractor to: – ensure public safety at road and highway crossings; – fence off all road and trail entrances to the work site to avoid potential interactions with local traffic and pedestrians; – post warning signs at approaches to the decommissioning site from both directions; and – plan for access through/around environmentally sensitive areas (e.g., heritage resource sites, wetlands, watercourses, rare plant sites, etc.) on the construction ROW. • Confine all motorized vehicles to the ROW and approved access roads, shoo-flies or trails. Direct construction workers to park in designated areas. The Contractor will be responsible to arrange and provide off-site parking and multi-passenger transportation to and from work site. • Control construction-related road dust near residential areas and other areas as advised by the Environmental Inspector or Enbridge designate. Apply water or dust suppressants, if warranted, to the ROW and access roads if traffic and wind conditions result in pulverised soils and dust problems. Alternatively, control dust emissions by applying dust suppressants, if warranted. Ensure dust suppressants are approved by the municipal district/rural municipality, Enbridge and landowners. • See recommended mitigation measures regarding sensory disturbance of land users in point 12.0 HORU element of this table.	See above

Table 6.5.1-1. Potential Effects, Mitigation Measures and Residual Effects of Pipeline Decommissioning

Potential Effect	Decommissioning Activities	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
15(a) Increased traffic volumes as a result of transporting workers, supplies and equipment (cont'd)	See above	See above	• See recommended mitigation measures regarding the disruption of normal, daily living activities of local residents and land users in point 14.0 Human Health element of this table. • See recommended mitigation measures regarding Accidents and Malfunctions (Table 6.7.2-1). • Continue consultation with affected stakeholders, including Aboriginal groups, throughout the life of the Project.	See above
15(b) Disturbance of transportation corridors (highways and railways) due to decommissioned pipeline infilling	Decommissioning in-place	Footprint	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning.	• Disturbance of transportation corridors (highways and railways) due to decommissioned pipeline infilling
16.0 NAVIGATION AND NAVIGATION SAFETY				
16(a) Navigation hazards if pipeline becomes exposed at navigable waterbody crossings	Decommissioning in-place	Footprint	• Maintain ongoing ROW surveillance and maintenance. • Maintain cathodic protection of the existing Line 10 following decommissioning. • Assess the need to weigh down buried pipe at watercourse crossings and wetlands prior to decommissioning and implement mitigation where needed.	• The safety of users on navigable waterbodies may be affected in the event of an exposed pipeline

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.5.2 Residual Effects Characterization and Significance Determination

A qualitative assessment was considered the most appropriate method to evaluate the significance of the potential residual effects associated with the existing Line 10 decommissioning due to the lack of quantitative data and accepted standards, guidelines and ecological thresholds. All assessment criteria were considered when determining the significance of each potential residual effect, however, the most influential assessment criteria were magnitude, reversibility and probability.

The potential residual effects associated with decommissioning activities entailing ground disturbance are similar to those associated with the replacement pipeline.

The development of mitigation measures and prediction of residual effects associated with decommissioning in-place have taken into consideration learnings from both abandonment as well as decommissioning projects. There have been only a few examples of major pipeline decommissioning or abandonment projects. However, there has been substantial effort, dating back to 1996, by several industry associations together with federal and provincial regulators on pipeline abandonment which can inform the assessment of potential environmental effects associated with decommissioning in-place. For this reason, consideration of the effects of pipeline decommissioning or abandonment is largely based on professional judgement and industry and regulatory position papers (e.g., Environmental Issues Concerning Pipeline Abandonment [H.R. Heffler Consulting Ltd. and TERA Environmental Consultants {Alta.} 1995], Pipeline Abandonment, A Discussion Paper on Technical and Environmental Issues [Pipeline Abandonment Steering Committee 1996], Guidelines for Pipeline Abandonment [CAPP 2002] and Pipeline Abandonment Scoping Study [Det Norske Veritas {DNV} 2010]).

A comprehensive report on pipeline abandonment was completed for the NEB by DNV (2010) which included a worldwide literature review along with consultation with experienced pipeline specialists, to identify issues and suggested research projects to fill knowledge gaps as well as a summary of environmental considerations related to pipeline abandonment. Recently, DNV (2015) released a report on the susceptibility of buried onshore pipelines to collapse following pipeline abandonment and long-term corrosion degradation. In the context of this ESA, these references on abandonment are equally applicable to decommissioning. More details are available in DNV (2010, 2015) and CAPP (2002).

Table 6.5.2-1 provides a summary of the significance evaluation of the potential residual environmental and socio-economic effects from the existing Line 10 decommissioning. The potential effects associated with pipeline construction are similar in nature to the potential effects associated with the effects associated with the physical works needed to decommission a pipeline. The discussion of the evaluation of significance of all of the potential residual environmental and socio-economic effects associated with decommissioning activities entailing ground disturbance are as described in the applicable subsections of Section 6.2. Therefore, the evaluation of significance for decommissioning activities entailing ground disturbance for the construction and operation of the replacement pipeline are not repeated below. The evaluation of significance of all potential residual environmental and socio-economic effects associated with decommissioning of the existing pipeline are outlined in Table 6.5.2-1 with the exception of the impact balance rating which is considered to be negative for all potential residual effects.

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
1.0 SOIL AND SOIL PRODUCTIVITY								
(a) Topsoil/subsoil mixing may occur as a result of ground disturbance decommissioning activities	Footprint	Short-term	Isolated	Reversible	Low	High	High	Not significant
(b) Surface erosion of topsoil at locations disturbed by decommissioning activities can be expected until a vegetative cover has been established	Footprint	Short-term	Isolated	Reversible	Low	High	High	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(c) Reduction in soil productivity due to the decommissioned pipeline acting as a conduit to transport materials and contaminants	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(d) Reduction in soil productivity due to the decommissioned pipeline acting as a preferred water conduit	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(e) Localized areas of ground subsidence resulting in reduced soil productivity	Footprint	Long-term	Periodic	Reversible	Low	Low	Moderate	Not significant
2.0 WATER QUALITY AND QUANTITY								
(a) Localized alteration of natural drainage patterns at locations disturbed by decommissioning activities may occur until settlement of excavations is complete	LSA	Short-term	Isolated	Reversible	Low to medium	High	High	Not significant
(b) Contamination of surface water or groundwater due to a spill during ground disturbance decommissioning activities	LSA	Immediate	Rare	Reversible	Low to high	Low	Moderate	Not significant
(c) Contamination of surface water and/or groundwater due to the decommissioned pipeline acting as a conduit to transport materials and contaminants	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects		Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
			Duration	Frequency	Reversibility				
(d)	Alteration of surface water and/or groundwater quantity due to the decommissioned pipeline acting as a preferred water conduit	LSA	Long-term	Rare	Reversible to Irreversible	Low to medium	Low	Low to moderate	Not significant
(e)	Contamination of surface water and/or groundwater due to the presence of residual contaminants associated with the decommissioned pipeline	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(f)	Localized alteration of natural drainage patterns may occur where the decommissioned pipeline has infilled	LSA	Long-term	Periodic	Reversible	Negligible to low	Low	Moderate	Not significant
3.0	***AIR EMISSIONS***								
(a)	Increase in nuisance air emissions during ground disturbance decommissioning activities	LSA	Short-term	Isolated to periodic	Reversible	Low	High	Moderate	Not significant
4.0	***GREENHOUSE GAS EMISSIONS***								
(a)	Increase in GHG emissions during ground disturbance decommissioning activities	Inter-national	Long-term	Isolated to periodic	Irreversible	Low	High	High	Not significant
5.0	***ACOUSTIC ENVIRONMENT***								
(a)	Increase in nuisance noise during ground disturbance decommissioning activities	LSA	Short-term	Isolated	Reversible	Medium	High	High	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
6.0 FISH AND FISH HABITAT								
(a) Alteration of riparian or instream habitat due to the decommissioned pipeline acting as a conduit to transport materials and contaminants	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(b) Alteration of riparian or instream habitat due to changes in hydrology from the decommissioned pipeline acting as a preferred water conduit	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(c) Alteration of riparian or instream habitat due to the presence of residual contaminants associated with the decommissioned pipeline	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(d) Alteration of riparian or instream habitat due to exposed pipe	LSA	Short to long-term	Occasional	Reversible	Low	Low	Low to moderate	Not significant
7.0 WETLANDS								
(a) Alteration of wetland habitat and biogeochemical functions due to the decommissioned pipeline acting as a conduit to transport materials and contaminants	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects		Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
			Duration	Frequency	Reversibility				
(b)	Alteration of wetland hydrological function due to the decommissioned pipeline acting as a preferred water conduit	LSA	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(c)	Alteration of wetland habitat and biogeochemical functions due to the presence of residual contaminants associated with the decommissioned pipeline	LSA	Long-term	Rare	Reversible	Low to medium	Low	Low to moderate	Not significant
(d)	Alteration of wetland habitat function and alteration of wetland hydrological function due to exposed pipe	LSA	Short to long-term	Occasional	Reversible	Low	Low	Low to moderate	Not significant
8.0	***VEGETATION***								
(a)	Changes in composition of native vegetation at locations disturbed by decommissioning activities	Footprint	Short-term	Isolated	Reversible	Low	High	High	Not significant
(b)	Weed introduction and/or spreading at locations disturbed by decommissioning activities	RSA	Short-term	Isolated	Reversible	Low	High	High	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects		Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
			Duration	Frequency	Reversibility				
(c)	Disturbance of vegetation due to a spill from construction equipment and from associated clean up and reclamation activities decommissioning locations entailing ground disturbance	RSA	Immediate	Rare	Reversible	Low to high	Low	Moderate	Not significant
(d)	Disturbance or alteration of vegetation due to the decommissioned pipeline acting as a conduit to transport materials and contaminants	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(e)	Disturbance or alteration of vegetation due to the decommissioned pipeline acting as a preferred water conduit	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(f)	Disturbance or alteration of vegetation due to the presence of residual contaminants associated with the decommissioned pipeline	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
9.0	***WILDLIFE AND WILDLIFE HABITAT***								
(a)	Alteration of wildlife habitat availability and effectiveness during ground disturbance decommissioning activities	LSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(b) Temporary changes to wildlife movement during ground disturbance decommissioning activities	LSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
(c) Increased wildlife mortality risk during ground disturbance decommissioning activities	RSA	Short-term	Isolated	Reversible	Low	Low	High	Not significant
(d) Effects of a spill of hazardous materials on wildlife at locations disturbed by decommissioning activities	RSA	Immediate	Rare	Reversible	Low to high	Low	Moderate	Not significant
(e) Alteration of wildlife habitat due to the decommissioned pipeline acting as a conduit to transport materials and contaminants	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(f) Alteration of wildlife habitat due to the decommissioned pipeline acting as a preferred water conduit	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant
(g) Alteration of wildlife habitat due to the presence of residual contaminants associated with the decommissioned pipeline	Footprint	Long-term	Rare	Reversible	Low	Low	Low to moderate	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

	Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
			Duration	Frequency	Reversibility				
10.0	***SPECIES AT RISK AND SPECIES OF SPECIAL CONSERVATION STATUS***								
(a)	Effects of habitat, movement and mortality risk change on wildlife species at risk during ground disturbance decommissioning activities	Footprint	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
11.0	***HUMAN OCCUPANCY AND RESOURCE USE***								
(a)	Sensory disturbance of local residents and land and resource users (from nuisance air emissions, noise and visual effects) at locations disturbed by decommissioning activities	RSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
(b)	Disruption of outdoor recreation experience and activities of land users, including Aboriginal groups at select locations disturbed by decommissioning activities	RSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
(c)	Disruption of outdoor recreation experience and activities of land users, including Aboriginal groups where the decommissioned pipeline has infilled	Footprint	Long-term	Periodic	Reversible	Low	Low	Moderate	Not significant

Table 6.5.2-1. Significance Evaluation of Potential Residual Effects of Pipeline Decommissioning

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
12.0 TRADITIONAL LAND AND RESOURCE USE								
(a) Previously unidentified traditional use sites and activities may be disturbed at locations disturbed by decommissioning activities	LSA	Short-term	Isolated to periodic	Reversible	Low	Low	Moderate	Not significant
13.0 HUMAN HEALTH								
(a) Disruption of daily living activities of local residents and resource users at locations disturbed by decommissioning activities	RSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
14.0 INFRASTRUCTURE AND SERVICES								
(a) Increased traffic on highways and local roads used to access the Line 10 decommissioning sites	RSA	Short-term	Isolated	Reversible	Low	High	Moderate	Not significant
(b) Disturbance of transportation corridors (highways and railways) due to decommissioned pipeline infilling	Footprint	Short-term	Periodic	Reversible	Low	Low	Moderate	Not significant
15.0 NAVIGATION AND NAVIGATION SAFETY								
(a) The safety of users on navigable waterbodies may be affected in the event of an exposed pipeline	Footprint to RSA	Extended-term	Rare	Reversible	Low to high	Low	Moderate	Not significant

The potential residual effects of leaving the decommissioned pipeline in-place (i.e., below the ground surface) are discussed below. Many of the potential aspects associated with decommissioning a pipeline in-place are interrelated and cannot be considered in isolation. The factors considered in this ESA in relation to decommissioning in-place include:

- ground subsidence;
- exposed pipe;
- the creation of water conduits; and
- residual contamination.

6.5.2.1 Ground Subsidence

In order to responsibly decommission a pipeline, an operator must consider the risks of ground subsidence in the event that the pipeline becomes corroded over time and eventually perforates and fills with material. Corrosion occurs as a result of an electrochemical reaction, whereby metal ions flow from the anode (in this case the steel pipe) to the cathode (the surrounding soil/water matrix). Corrosion of steel pipelines is controlled by the application of coatings and the use of cathodic protection. Cathodic protection works by connecting the metal to be protected with another more easily corroded "sacrificial metal" which acts as the anode of the electrochemical cell. The rate of corrosion will vary depending upon surrounding soil conditions and will not uniformly occur over the length of the pipeline (CAPP *et al.* 1996). A geotechnical study prepared for the NEB indicates that possible subsidence magnitude related to a of 323.9 mm O.D. (NPS 12) pipeline is negligible, based on a review of multiple subsidence calculation methods presented for pipeline with a depth of cover of 0.6 m or greater. Published literature reviewed during the development of the decommissioning plan substantiates the assessment that possible subsidence magnitudes related to a 323.9 mm O.D. (NPS 12) pipeline are expected to be minimal or negligible (see the Engineering Decommissioning Technical Report for further details).

Although considered unlikely to have adverse effects, a conservative approach to the assessment has been taken and it has been assumed that adverse potential effects may occur that could potentially warrant implementation of mitigation. Mitigation measures pertaining to ground subsidence include:

- maintaining ongoing ROW surveillance and maintenance; and
- maintaining cathodic protection of Line 10 following decommissioning.

Additional mitigation measures are provided in the Decommissioning Environmental Technical Report (Appendix 3).

Ground subsidence resulting from the infilling or collapse of the pipe is considered for such elements as soil and soil productivity, water quality and quantity, HORU, and accidents and malfunctions.

Soil and Soil Productivity

Localized areas of ground subsidence may result in reduced soil productivity along the area above the Line 10 pipeline where the decommissioned pipeline has disintegrated and infilled. The impact balance of this residual effect is considered negative since excessive ground subsidence may reduce soil productivity through erosion and drainage issues. This effect is unlikely to adversely affect soil productivity due to the small size of the pipe. However, in the unlikely event that it occurs, the residual effect is considered long-term in duration since the length of time over which ground subsidence occurs and eventually becomes evident is variable and could extend beyond 10 years. However, once identified, areas of reduced soil productivity associated with ground subsidence would be remediated within 1 year. The magnitude of this residual effect is considered low (Table 6.5.2-1, point 1[e]).

Water Quality and Quantity

Localized alteration of natural surface drainage patterns may occur where the decommissioned pipeline has disintegrated and infilled and caused ground subsidence, although the probability is low. The impact balance of this residual effect is considered negative since the potential exists for flooding, erosion and pooling until the natural drainage patterns are restored. The residual effect is considered to be long-term in duration since the length of time over which ground subsidence occurs and eventually becomes evident is variable and could extend beyond 10 years. However, once identified, areas of reduced surface water quantity associated with altered drainage patterns caused by ground subsidence would be remediated within 1 year. The magnitude of this residual effect is considered to range from negligible (in subsided areas lacking defined drainages) to low (in subsided areas in the vicinity of a drainage) (Table 6.5.2-1, point 2[a]).

Human Occupancy and Resource Use

Local residents and land users along the decommissioned pipeline route may experience disruptions to their activities in localized areas of excessive ground subsidence along the area above the Line 10 pipeline where the decommissioned pipeline has disintegrated and infilled. The impact balance of this residual effect is considered negative. The potential residual effect is considered low probability and is anticipated to be low magnitude should it occur (Table 6.5.2-1 point 11[c]).

Infrastructure and Services

The effects on infrastructure and services can potentially occur as a result of excessive ground subsidence at transportation corridors (highways and railways) where the decommissioned pipeline has disintegrated and infilled. Excessive ground subsidence following decommissioning could potentially result in the subsidence of a transportation corridor where it crosses the pipeline. This effect is unlikely to impact transportation corridors due to the small size of the pipe. In the unlikely event that it occurs, the potential residual effect is considered to have a negative impact balance, and is of low magnitude and short-term duration, as the transportation corridor can be readily repaired once the issue is identified (Table 6.5.2-1, point 14[b]).

Accidents and Malfunctions

An accident resulting from motorized vehicles (e.g., agricultural equipment, off road vehicles) interacting with ground subsidence along the existing ROW where the decommissioned pipeline has disintegrated and infilled may impact people, wildlife, or the surrounding lands and water. Depending on the severity of the accident, the magnitude and reversibility is high and permanent (in the case of a debilitating accident) to low and reversible (in the case of minor accident resulting in no damage or injury). However, the probability of an accident resulting from ground subsidence is low. Accidents and Malfunctions are assessed in Section 6.7.

6.5.2.2 Exposed Pipe

The potential effects related to natural processes within a watercourse are the same for a decommissioned pipeline left in-place as for an operational pipeline. These include lateral channel migration or scour of the streambed that exposes the pipe and threatens the integrity of the pipe. Should pipeline integrity be compromised, the potential for contamination is substantially reduced as a result of cleaning the pipeline. The environmental effects on fish and fish habitat also include physical effects such as blockage of fish passage and introduction of sediment to the watercourse. Exposed pipe is vulnerable to accelerated corrosion, in addition to being a potential physical barrier to land use, navigable water use and wildlife migration, it may also present a safety hazard.

Mitigation measures pertaining to exposed pipe include:

- maintaining ongoing ROW surveillance and maintenance;
- maintaining cathodic protection of the existing Line 10 following decommissioning;
- cleaning of the pipeline prior to decommissioning; and
- assessing the need to weigh down the buried pipe at watercourse crossings and wetlands prior to decommissioning and implement mitigation where needed.

Additional mitigation measures are provided in the Decommissioning Environmental Technical Report (Appendix 3).

Exposed pipe is considered for such elements as fish and fish habitat, wetlands, HORU, navigation and navigation safety, and accidents and malfunctions.

Fish and Fish Habitat

The impact balance of an alteration of riparian or instream habitat due to an exposed pipe altering the structure, vegetation, and hydrology of the waterbody is considered negative. The existing ROW will continue to be routinely monitored and, should exposed pipe be observed within a watercourse or Enbridge is made aware of an exposed pipe, an appropriate course of action will be determined in consultation with the applicable regulatory authorities. With the implementation of mitigation measures, the potential residual effect of pipe becoming exposed within a watercourse and affecting fish and fish habitat is considered to be of low probability, low magnitude and reversible (Table 6.5.2-1, point 6[d]).

Wetlands

An exposed pipeline can alter the bed, shores, and hydrology of a wetland, and negatively affect the wetland habitat function. The existing ROW will continue to be routinely monitored and, should exposed pipe be observed within a wetland or Enbridge is made aware of an exposed pipe, an appropriate course of action will be determined in consultation with the applicable regulatory authorities. With the implementation of mitigation measures, the potential residual effect of pipe becoming exposed and adversely affecting a wetland is considered to be low probability, low magnitude, and reversible (Table 6.5.2-1, point 7[d]).

Navigation and Navigation Safety

Exposed pipeline in the vicinity of navigable waterbodies could pose a public safety risk to users of the waterbody. The impact balance of this potential residual effect is considered negative, however, the probability of the decommissioned pipeline becoming exposed at a navigable waterbody and causing an accident is low given the implementation of the recommended mitigation. This potential residual effect is considered low to high magnitude and reversible as the length of time to identify an exposed pipeline may extend into the decommissioning phase. However, an exposed pipeline would take less than 1 year to remediate (short-term) (Table 6.5.2-1, point 15[a]).

Accidents and Malfunctions

An accident resulting from a vehicle impacting an area of exposed pipe along the existing ROW may impact people, wildlife, or the surrounding lands and water. Depending on the severity of the accident, the magnitude and reversibility is high and permanent (in the case of a debilitating accident) to low and reversible (in the case of minor accident resulting in no damage or injury). Mitigation measures such as ongoing ROW surveillance and maintenance will identify areas exposed pipe or nearly exposed pipeline resulting in a low probability of an accident. Accidents and Malfunctions are assessed in Section 6.7

6.5.2.3 Creation of Water Conduits

A buried pipeline may function as a conduit to transport water, soil or residual contaminants in a downslope direction, due to pipeline corrosion or if the pipeline is perforated over time due to pipeline corrosion. If the pipe wall is perforated, water and soil will infiltrate and travel downslope, unimpeded, and then may exit the pipe at another location. The magnitude of the potential residual effects associated with the transport of contaminants will be primarily determined by the cleanliness of the pipeline following decommissioning and the soil conditions at the inflow and outflow points. Cleaning of the Line 10 pipeline is expected to be effective during decommissioning.

Mitigation measures pertaining to the creation of water conduits include:

- segment the pipe at select locations to prevent water migration;
- maintaining ongoing ROW surveillance and maintenance;
- maintaining cathodic protection of the existing pipeline; and
- cleaning the pipeline prior to decommissioning.

Additional mitigation measures are provided in the Decommissioning Environmental Technical Report (Appendix 3).

The creation of water conduits is considered for such elements as soil and soil productivity, water quality and quantity, fish and fish habitat, wetlands, vegetation, and wildlife and wildlife habitat.

Soil and Soil Productivity

By acting as a preferred water conduit, the decommissioned pipeline can potentially transfer contaminants and influence the soil moisture, both of which can affect soil productivity. The likelihood of the decommissioned pipeline acting as a preferred water conduit to the extent that soil productivity is affected is considered low given the recommended mitigation (e.g., segmenting the pipeline). The transfer of contaminants is also unlikely given the implementation of additional mitigation measures (i.e., cleaning of the pipeline). A discussion regarding cleaning of the pipeline and residual contamination is provided in Section 6.5.2.4. The magnitude is expected to be low since cleaning of the pipeline during decommissioning is expected to reduce residual contaminants to a level that will not affect soil productivity in a substantive manner in addition to the segmentation which will limit the ability of the pipeline to act as a conduit. Potential soil contamination or effects relating to soil moisture as a result of the transport of contaminants and materials is expected to be reversible and of low magnitude. The probability of the pipe acting as a conduit to transport water and contaminants to the surface and affect soil productivity is low (Table 6.5.2-1, point 1[d]).

Water Quality and Quantity

Soil, water and residual contaminants may reach an aquifer or the surface and flow into a waterbody if there are perforations in the pipe wall, and hydrologic conditions exist. A discussion regarding cleaning of the pipeline and residual contamination is provided in Section 6.5.2.4. The impact balance of this residual effect is considered negative, however, the probability that residual contaminants being present in concentrations that will negatively affect aquifers or surface waterbodies through the conduit effect is low. The magnitude is considered to be low since cleaning of the pipeline during decommissioning is expected to be effective. The residual effect is reversible (Table 6.5.2-1, point 2[c]).

A buried decommissioned pipeline acting as a preferred water conduit could also lead to the undesirable drainage of areas resulting in the alteration of surface water and/or groundwater quantity. The impact balance of this residual effect is considered negative, however, the probability that aquifers or surface waterbodies (e.g., wetlands and watercourses) will be altered as a result of the decommissioned pipeline acting as a water conduit is low. The residual effect ranges from reversible to irreversible, and the magnitude is considered low to medium (Table 6.5.2-1, point 2[d]).

Fish and Fish Habitat

Materials and residual contaminants from the decommissioned pipeline may reach the ground surface and flow into a waterbody resulting in the alteration of riparian or instream habitat. The impact balance of this residual effect is considered negative, however, the probability that materials and contaminants in concentrations that will negatively affect riparian or instream habitat will reach any surface waterbodies through the conduit effect is low. A discussion regarding cleaning of the pipeline and residual contamination is provided in Section 6.5.2.4. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 6[a]).

A buried decommissioned pipeline acting as a preferred water conduit could also lead to the undesirable alteration of surface water quantity, which could result in the alteration of riparian or instream habitat. The impact balance of this residual effect is considered negative, however, the probability of an alteration of surface water quantity is low. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 6[b]).

Wetlands

Materials or residual contaminants within the decommissioned pipeline may reach the surface and flow into a wetland resulting in the alteration of wetland habitat and biogeochemical cycling. The impact balance of this residual effect is considered negative, however, the probability that materials and contaminants will reach any wetlands is low. A discussion regarding cleaning of the pipeline and residual contamination is provided in Section 6.5.2.4. This residual effect is considered reversible and low magnitude. The existing ROW will continue to be routinely monitored and will be remediated, as needed (Table 6.5.2-1, point 7[a]).

Under some circumstances, such as under a wetland, if the buried decommissioned pipeline was to act as a conduit, water could be drained away from or be potentially introduced to a wetland. Either instance might result in harmful effects on wetland function. The impact balance of this residual effect is considered negative, however, the probability that a wetland will be drained is low. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 7[b]).

Vegetation

Materials and residual contaminants from the decommissioned pipeline may reach the ground surface and affect soil productivity, subsequently altering vegetation. The impact balance of this residual effect is considered negative, however, the probability that materials and contaminants in concentrations will reach the soil and affect the vegetation is low. A discussion regarding cleaning of the pipeline and residual contamination is provided in Section 6.5.2.4. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 8[d]).

A buried decommissioned pipeline acting as a preferred water conduit could also affect the soil moisture in the area above the decommissioned pipeline, subsequently affecting the vegetation. The impact balance of this residual effect is considered negative, however, the probability of an alteration of vegetation is low. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 8[e]).

Wildlife and Wildlife Habitat

Materials and residual contaminants from the decommissioned pipeline may reach the ground surface and affect soil productivity, subsequently altering vegetation and thereby wildlife and wildlife habitat. The impact balance of this residual effect is considered negative, however, the probability that materials and contaminants in concentrations of concern will affect wildlife and wildlife habitat given the number of pathways required in addition to the low likelihood of each pathway occurring, is low. A discussion regarding cleaning of the pipeline and residual contamination is provided in Section 6.5.2.4. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 9[e]).

A buried decommissioned pipeline acting as a preferred water conduit could also affect the soil moisture in the area above the decommissioned pipeline, subsequently affecting the vegetation and thereby wildlife and wildlife habitat. The impact balance of this residual effect is considered negative, however, the probability of an alteration of wildlife and wildlife habitat is low. This residual effect is considered reversible and low magnitude (Table 6.5.2-1, point 9[f]).

6.5.2.4 Residual Contamination

The potential contaminants that could arise from pipeline decommissioning include contaminants resulting from the operation of the pipeline (i.e., pipeline, product, treatment chemicals, leaks and lubricants) and those caused by the corrosion of the pipeline (i.e., pipeline coatings and their degradation products) (DNV 2010). Once the pipeline has been emptied of service fluids, cleaned and decommissioned, residual contaminants may still be present.

The types of contaminants that may be a concern from the operation and decommissioning of the Line 10 pipeline include:

- petroleum hydrocarbons, polychlorinated biphenyls and naturally occurring radioactive materials;
- metals from the degradation of the pipeline; and
- pipeline coatings and their degraded products.

While the presence of some of the identified contaminants of concern are not anticipated to be encountered during the Line 10 decommissioning, (e.g., polychlorinated biphenyls and naturally occurring radioactive materials) based on Enbridge's Line 10 Westover Replacement Project Engineering Decommissioning Report, the presence of petroleum hydrocarb is anticipated.

The development and implementation of an effective cleaning plan including fluids displacement and effective cleaning of the pipeline is considered the primary mitigation measure to reduce the effects associated with residual contamination remaining in the pipeline after initial decommissioning. Pipeline cleaning procedures include containment, disposal and storage procedures for all collected material and cleaning by-products to address concerns regarding soil and water contamination.

Pipelines may be comprised of a combination of metals (iron, copper, nickel, molybdenum, chromium, and other trace elements). Metals potentially released from the decommissioned pipeline as a result of corrosion are generally not considered a threat to the environment since they have a low environmental mobility (DNV 2010).

Pipeline synthetic coatings may be comprised of coal tar or enamel, polyethylene tape, asbestos, asphalt, fusion bonded epoxy, or bitumen and glass-fiber for older pipelines. Of these materials, only carcinogenic compounds such as asbestos and coal tar are considered a potential environmental or human health threat (DNV 2010). When constructed, the existing Line 10 pipeline's external coating was polyethylene based tape (Polyken Tape). Polyethylene based tape is generally considered a safe product to work with and does not produce toxic leachates, contains no asbestos or coal tar, and is not soluble in water.

With the successful implementation of the recommended mitigation measures and in consideration of each potential residual contaminant, the likelihood that potential residual contaminants related to the decommissioned pipeline will occur at concentrations that could cause a threat to the environment or human health is considered low. Full mitigation measures are provided in the Decommissioning Environmental Technical Report (Appendix 3).

The potential for residual contamination is considered for such elements as soil and soil productivity, water quality and quantity, fish and fish habitat and wetlands.

Soil and Soil Productivity

Soil contamination is considered to have a negative impact balance for soil and soil productivity. The probability and magnitude of soil contamination arising from a buried decommissioned steel pipe are considered to be low given that cleaning of the pipeline during decommissioning is expected to be effective. The residual effect is reversible. (Table 6.5.2-1, point 1[e]).

Water Quality and Quantity

Surface water and/or groundwater contamination is considered to have a negative impact balance on water quality. The probability of surface water and/or groundwater contamination arising from residual contaminants associated with a buried decommissioned steel pipe is considered to be low. The magnitude is considered to be low since cleaning of the pipeline during decommissioning is expected to be effective. The residual effect is reversible (Table 6.5.2-1, point 2[e]).

Fish and Fish Habitat

The probability of watercourse contamination arising from residual contaminants in a buried decommissioned steel pipe is considered to be low. In the event that a perforation developed in the pipeline near a watercourse where residual contaminants were present, the contaminants could potentially migrate into the watercourse and result in the alteration of fish habitat. The impact balance of the potential residual effects on fish and fish habitat is considered negative. The existing ROW will continue to be routinely monitored and will be remediated, as needed. Since cleaning of the pipeline during decommissioning is expected to be effective and any residual effects on fish and fish habitat will be remediated and restored, this potential residual effect is of low magnitude and reversible (Table 6.5.2-1, point 6[c]).

Wetlands

The probability of wetland contamination arising from residual contaminants within a buried decommissioned steel pipe is considered to be low. In the event that a perforation developed in the pipeline near a wetland where residual contaminants were present, the contaminants could potentially migrate into the wetland and result in the alteration of wetland habitat and biogeochemical cycling. The impact balance of the potential residual effects on wetlands is considered negative. The existing ROW will continue to be routinely monitored and will be remediated, as needed. Since any effects will be promptly repaired and cleaning of the pipeline during decommissioning is expected to be effective, this potential residual effect is of low magnitude and reversible (Table 6.5.2-1, point 7[c]).

Vegetation

The impact balance of residual contaminants from the decommissioned pipe affecting vegetation is considered negative. However, the probability of vegetation contamination arising from residual contaminants in a buried decommissioned steel pipe is considered to be low. In the event that a perforation developed in the pipeline, the contaminants could potentially migrate into the surrounding soil and be taken up in the roots of vegetation and result in an alteration of vegetation. The existing ROW will continue to be routinely monitored and will be remediated, as needed. Since cleaning of the pipeline during decommissioning is expected to be effective and any effects on vegetation will be remediated, this potential residual effect is of low magnitude and reversible (Table 6.5.2-1, point 8[f]).

Wildlife and Wildlife Habitat

The impact balance of residual contaminants from the decommissioned pipeline affecting wildlife and wildlife habitat is considered negative. However, the probability of wildlife and wildlife habitat being affected from contamination arising from residual contaminants within a buried decommissioned steel pipe is considered to be low. In the event that contaminants migrate into the soil and are taken up by vegetation, the subsequent result may be an alteration of wildlife and wildlife habitat. The existing ROW will continue to be routinely monitored and will be remediated, as needed. Since cleaning of the pipeline during decommissioning is expected to be effective and any effects on wildlife habitat will be promptly remediated, this potential residual effect is of low magnitude and reversible (Table 6.5.2-1, point 9[g]).

6.5.3 Summary

As identified in Table 6.5.2-1, there are no situations arising from the decommissioning of the existing Line 10 where there is a high probability of occurrence of a permanent or long-term residual environmental effect of high magnitude that cannot be technically or economically mitigated, nor are there any situations that would result in a significant socio-economic residual effect. Consequently, it is concluded that the potential residual effects arising from the decommissioning of the existing Line 10 will be not significant.

6.6 Effects Assessment – Final Decommissioning or Abandonment of the Line 10 Replacement Pipeline

The NEB defines decommissioning as the permanent cessation of the operation of a pipeline without discontinuance of service; abandonment as the permanent cessation of the operation of a pipeline which results in the discontinuance of service; and deactivation as temporary removal from service.

Enbridge filed physical plans for abandonment with the NEB as part of the NEB's Land Matters Consultation Initiative in May 2011. The document contains assumptions for the types of facilities that would be abandoned in-place, abandoned in-place with special treatment, or removed. The methods of abandonment that will ultimately be implemented for the replacement pipeline and associated permanent facilities will be determined at the time it is removed from operation; however, those determinations will be based on the most current sound scientific studies and accepted industry practice at that time.

The physical activities associated with decommissioning or abandonment would include: purging and cleaning the pipeline with pigs; physically separating the pipeline from any in-service piping, and segmenting; and reclaiming any land disturbance as a result of physical activities. An assessment would be conducted to determine if there is any contamination of the associated land, and if warranted, special soil handling and remediation procedures would be implemented. Any lands disturbed by physical activities would be reclaimed to the appropriate land use at that time.

The reclamation objectives or principles to be applied to decommissioning or abandonment of the replacement pipeline and associated permanent facilities will be in accordance with all legislative and regulatory requirements in place at that time. The methods for evaluating the success of reclamation would be based on the principle that the success of land reclamation is measured against the adjacent site conditions. Parameters such as vegetation, soil and landscape parameters would be used as criteria to measure the degree of reclamation success to ensure land productivity is equivalent to the adjacent site conditions. Where no known or visible limitations to normal management, access, soil productivity, and ecosystem function are evident during the evaluation, land reclamation would be determined to be successful.

Any decommissioning or abandonment activities will require prior approval by the NEB and other applicable agencies. Accordingly, neither decommissioning nor abandonment of the Line 10 replacement pipeline or associated permanent facilities were considered further.

6.7 Effects Assessment – Accidents and Malfunctions

Accidents and malfunctions are unplanned events that could result in adverse effects on human health, property, or the environment. Modern-day preventative maintenance and inspection technology make accidents, especially large events, highly unlikely. In the rare event that an accident or malfunction does occur, Enbridge's goal is always to reduce the adverse effects on people and the environment.

A key consideration in the assessment of accidents and malfunctions during operations and maintenance activities is the fact that the replacement pipeline will be replacing an existing pipeline. By replacing an older pipeline with new pipe and installing the new pipe with better technologies, the net potential effects associated with accidents and malfunctions are expected to decrease. While accidents and malfunctions are predicted to be unlikely for all Project activities, the potential consequences are evaluated so that emergency response and contingency planning can be identified to further mitigate risk.

6.7.1 Spatial Boundaries

The spatial boundaries considered for the following effects assessment considered the applicable environmental or socio-economic element LSA or RSA. These spatial boundaries are described in Section 6.1.2.

6.7.2 Potential Effects and Mitigation Measures

The potential effects associated with accidents and malfunctions during Project construction, operation and decommissioning activities were identified by the assessment team and are listed in Table 6.7.2-1. Concerns regarding accidents and malfunctions that were identified during the consultation process include:

- safety of oil pipelines;
- proximity of residences and effects on health and well-being;
- emergency response procedures for a pipeline spill; and
- environmental liability if an accident were to occur.

Preventing accidents and malfunctions is the most effective way to reduce risks to human health, property, or the environment. While substantial adverse effects could occur as a result of an accident during the construction, operation, or decommissioning of the pipeline, Enbridge will implement strategies to prevent accidents and malfunctions through the application of:

- project design;
- recognized engineering techniques;
- sufficient and appropriate mitigation;
- routine maintenance;
- training; and
- integrity assurance programs.

Due to their location and the products they carry, pipelines may come in contact with water, bacteria, and various chemicals, all of which can corrode or cause the steel to wear. Both the interior and exterior of the pipe are potentially subject to corrosion, which Enbridge combats by:

- using special coatings;
- using cathodic protection (an electrical current that is applied to the pipeline to prevent corrosion);
- scheduling regular monitoring of prevention systems;
- scheduling excavation and repair programs when in-line inspections show early signs of corrosion;
- stopping the early signs of corrosion by re-applying the coating or replacing sections of pipe;
- using inspection instruments to clean and inspect pipelines from the inside (in-line inspection); and

- ongoing research and development to investigate new methods to prevent or manage corrosion.

Enbridge's regular monitoring and inspection program identifies locations to be checked for corrosion, cracks, dents or other features. If in-line inspections identify a change in the pipeline, Enbridge conducts preventative maintenance digs (e.g., integrity dig). Each dig involves excavating a section of buried pipe such that it can be carefully cleaned and examined. If a feature is found, it is repaired, recoated and reburied. In some cases, old sections of pipe are cut out so that new pipe can be welded in. Enbridge conducts all preventative maintenance digs to the highest environmental standards; digs are conducted safely, calling ahead so that other underground utilities can be marked and protected prior to excavation. Enbridge trains workers, welders and inspectors, and requires that Contractors who are working near the pipeline have the appropriate qualifications.

Enbridge monitors pipeline conditions 24/7 every day of the year through the Supervisory Control and Data Acquisition system, which is designed to identify and raise an alarm in response to unexpected operational changes. Enbridge is responsible for damages directly resulting from its operations, including impacts from leaks, unless the damage is as a result of third party negligence. The NEB maintains a "Safety Zone" of 30 m on either side of a pipeline ROW, requiring company approval for activities in this area, with the exception of normal farming activity. Externally, Enbridge has implemented an educational outreach program for landowners and excavators regarding the locations of pipelines and the need for awareness and pipeline safety. Enbridge is an active and supportive member of Ontario One Call.

Pipelines are considered the safest and most efficient method of transporting large volumes of liquid products over long distances (CEPA 2013). While pipelines can provide economic benefit to businesses, communities and governments, incidents such as damage to the pipeline, corrosion, operator error and vandalism could occur. Enbridge's goal is zero leaks and company-wide leak reduction targets are set across their liquids pipelines systems. A portion of each annual employee and executive performance review is measured against this goal. The goal of zero incidents has not been achieved, however, Enbridge has achieved continuous improvement in Operations. In 2004, to reduce the number of small spills within existing stations and terminals, Enbridge added system integrity measures such as a leak reduction team and small-piping-integrity initiatives to the existing pipeline integrity program. Since 2006, a cross-functional team of 12 experts in engineering, operations and pipeline integrity has helped to guide a leak-reduction program for Enbridge's network of facilities, including pump stations and terminals. That team's efforts have resulted in a reduction in the number and magnitude of leaks at Enbridge facilities over the past 5 years.

According to the NEB (2011), external interference from unauthorized activities is a leading cause of pipeline ruptures. Unauthorized activities as defined in the NEB Pipeline Crossing Regulations are "*actions that have the potential to damage a pipeline or that may impede access to a pipeline for the purposes of maintenance or emergency response*" and can include movement of vehicles or equipment over pipelines as well as construction, landscaping or grading over pipelines. The total number of unauthorized activities on ROWs between 2005 and 2007 was relatively stable at approximately 70 occurrences per year, however, that number increased to 126 in 2008 and 146 in 2009 (NEB 2011). This is substantially greater than the 10 year average of 70 per year. The NEB believes the increased number of unauthorized activities is due to urban encroachment on pipeline ROWs as well as additional investment in landowner engagement and reinforcement of reporting criteria, which may have resulted in more accurate and complete reporting of unauthorized activity (NEB 2011).

Enbridge maintains comprehensive emergency response plans, developed in consultation with regulatory agencies, local communities and various groups. Enbridge has equipment and resources available along the existing Line 10 ROW at Westover Terminal. In addition, Enbridge employs and has access to key response Contractors and personnel in the region, including Quantum Murray and the

Eastern Canadian Response Corporation. Enbridge works closely with first responders to ensure they have the knowledge and training to enable them to support an incident response.

A summary of mitigation measures to reduce the severity of potential effects of the Project as a result of an accident or malfunction is provided in Table 6.7.2-1. These measures were developed in accordance with Enbridge's O&MM, as well as with industry and regulatory guidelines including CAPP (1999, 2004). Although some of these guidelines were written in the context of pipelining in Alberta, they are still relevant to pipeline construction, operation and decommissioning in Ontario. The methods, procedures and best practices would not change from province to province as they are generally industry-wide standards. In addition, these measures have been considered acceptable by the NEB for past Enbridge pipeline projects (NEB 2008a,b,c).

Industry best practice technology, safety measures and contingency plans will also be used to reduce the probability of accidents occurring and having significant adverse effects. However, if an accident or malfunction does occur, an effective response plan will reduce the effects and associated risks.

Enbridge will use adaptive management to incorporate improvements in design, construction and reclamation throughout all phases of the Project. Information gathered during construction, operation, monitoring and reclamation activities for similar projects will be used to improve future procedures and monitoring (adaptive management). Enbridge also plans to use adaptive management in adopting knowledge gained from other pipeline projects as the information becomes publicly available.

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Spill of hazardous materials during Project activities	• Construction, operation and decommissioning • Use of vehicles and equipment for Project along entire route	Footprint RSA	• Review and adhere to the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]) and the Enbridge Waste Management Plan (Enbridge 2014) to avoid contaminant introduction during construction. • Maintain equipment in good working condition and ensure that equipment and vehicles are free of leaks. • Ensure operators and on-site construction foremen have been trained to contain spills or leakage from equipment. Ensure that Contractor equipment operators and foremen are aware of the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]).	• Inadvertent spills could result in contamination or alteration of: soil and soil productivity (Section 6.2.2); surface or groundwater quality (Section 6.2.3); riparian and instream habitat (Section 6.2.7); wetland function (Section 6.2.8); plants and plant communities (Section 6.2.9); wildlife and wildlife habitat (Section 6.2.10); and human health (Section 6.2.16)

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Spill of hazardous materials during Project activities (cont'd)	See above	See above	• Do not store fuel tanks, containers or stationary equipment within the normal high water mark of a watercourse or wetland, unless otherwise indicated in regulatory authorizations. If this is not feasible, secondary containment must be provided regardless of container size. If the fuel tank is double-walled, tertiary containment must be provided. Fuel storage areas, pumps, generators and other sources of deleterious substances must be within a containment system of sufficient capacity to ensure that deleterious substances do not enter fish habitat. Appropriate spill kits will be kept at fuel or hazardous materials storage, refuelling and maintenance or refuelling service vehicles. • Ensure that during the course of the Project, no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides or other chemicals are released on the ground or into a drainage or wetland. In the event of a spill, implement the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]). • Transport, handle, use and dispose of hazardous materials in accordance with provincial and federal regulatory requirements, and as identified in the Enbridge Waste Management Plan (Enbridge 2014) and the Fuels and Hazardous Materials Contingency Plan.	See above

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Spill of hazardous materials during Project activities (cont'd)	See above	See above	• Report spills immediately to the Construction Manager and/or Environmental Inspector who will report spills to the Enbridge Environment Lead and, appropriate government agencies in accordance with the Fuels and Hazardous Materials Contingency Plan (to be appended to the EPP[1]). • Ensure that bulk fuel trucks, service vehicles and pick-up trucks equipped with box-mounted fuel tanks carry spill prevention, containment and clean-up materials that are suitable for the volume of fuels or oils carried. Carry spill contingency material on bulk fuel and service vehicles that is suitable for use on land and water (i.e., sorbent pads, sorbent boom and rope). • Monitor hydraulic, fuel and lubrication systems of equipment used in watercourse crossing construction to ensure that the systems are in good condition and free of leaks. Clean equipment to be used instream or adjacent to a watercourse/wetland, or otherwise. Ensure equipment is free of grease, oil or other fluids, mud, dirt and vegetation, both prior to entering the waterbody and upon completion of instream activity. Prevent the discharge of materials toxic to fish or other aquatic life into a watercourse or wetland. • Follow remediation procedures outlined Book 7: Emergency Response and Book 8: Environment, of Enbridge's O&MMs in the event of a spill.	See above

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Spill of hazardous materials during Project activities (cont'd)	See above	See above	• Remediate the site according to the NEB Remediation Process Guide in the event of a spill.	See above
2.0 Fire	• Construction, operation and decommissioning • Entire route	RSA	**Fire Prevention** • Obtain a Fire Permit from the OMNRF in the event that burning is conducted during the fire season (April 1 to October 31). • Ensure that all personnel shall be made aware of proper disposal methods for welding rods, cigarette butts and other hot or burning material. Do not burn when the fire hazard is high • Smoke only on Enbridge property or the construction ROW in outdoor areas that are posted and approved by Enbridge • Environmental Orientation will be provided to all construction personnel and visitors. **In the Event of a Fire** • Follow the fire suppression measures of the Fire Contingency Plan (to be appended to the EPP[1]). • Follow the measures identified within the Emergency Response Plan in the event of an accidental fire. A copy of the Emergency Response Plan will be available in the Enbridge and Contractor construction offices for reference during construction.	• Despite vigilance, fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
2.0 Fire (cont'd)	See above	See above	• Implement measures from the following Enbridge O&MM Books (on file with the NEB), as appropriate: – Book 2 (Safety); and – Book 7 (Emergency Response): Chapter 1 (Emergency Preparedness), Chapter 2 (Emergency Response Actions) and Chapter 3 (Hazard-specific Emergencies – Fire Response). **Fire During Operation** • Implement the above procedures, where applicable, during operation and maintenance activities.	See above
3.0 Damage to foreign utilities	• Construction, operation and decommissioning • Locations of ground disturbance along entire route	RSA	• Locate and mark all known buried or above ground utilities including foreign lines and cables by using "one call" services. • Ensure construction personnel are properly trained in ground disturbance techniques. • Carefully expose all known locations of underground facilities in accordance with prescribed, safe methods. • Use flagging and signage at overhead line crossings to alert equipment operators of hazards. • Conduct construction activities in the vicinity of adjacent pipelines in compliance with all requirements of CSA Z662-15 and the *NEB OPRs* for work close to an operating pipeline. • Conduct all ground disturbance activities in accordance with Enbridge's ground disturbance policies.	• Damage of foreign utility lines could lead to interruption of services as well as fire or contamination of soil or water, depending on the type of foreign line (e.g., electrical or gas), its location, and the severity of damage

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Damage to foreign utilities (cont'd)	See above	See above	• Environmental Orientation will be provided to all construction personnel and visitors. • Prior to any equipment working on or crossing over an adjacent pipeline, obtain a crossing permit from the operator for each specific location, detailing the conditions and limitations for each crossing, as well as a proximity agreement for parallel pipes. • During pipeline construction, maintain adequate separations between the pipe trench and adjacent pipes needed to protect the existing pipeline, and also to allow for future remedial excavation work on either pipeline without affecting the other pipeline.	See above
4.0 Transportation accidents	• Construction, operation and decommissioning • Use of vehicles and equipment for Project along entire route	RSA	• Require all Contractor personnel to participate in a safety and environmental training session that will include instruction on the expectation that all Project-related vehicles are required to follow applicable traffic, road-use and safety laws. • Follow recommendations in the Traffic Control Plan. • Implement measures in Enbridge's O&MM 'Book 2: Safety'. Transport workers to and from the work sites by multi-passenger vehicles, to the extent practical.	• A transportation accident may cause injury to people or wildlife, or may result in fire or contamination of lands and water, depending upon the location and severity of the accident

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Release of drilling mud during HDD	• Construction • Trenchless crossings	Footprint, LSA	• Implement the Directional Drilling Procedures and Drilling Mud Release Contingency Plan in the event of a drilling mud release. **General Measures** • Utilize an Enbridge approved drilling mud. The mud selected should be appropriate for use in fish habitat. Ensure that drilling mud composition is limited to bentonite and/or additives mud drilling systems, fresh water and, if warranted, other inert additives. • Develop a clean-up plan prior to drilling. The plan will be prepared by the Drilling Contractor in consultation with Enbridge Environment and Construction. • Ensure that supervisory personnel, environmental inspection personnel, drilling contractor and water quality monitoring staff are aware of this contingency plan prior to the commencement of drilling activity. • Arrange for access, if required, beyond the boundaries of the Project's surface rights agreement along the drill path to monitor, contain and clean up potential inadvertant releases.	• Release of drilling mud on land may affect soil productivity • Disturbance of vegetation/wildlife habitat could result during clean-up and reclamation efforts following a HDD mud release on land or riparian areas • Depending upon the volume and the location of the release, a release of HDD mud into a waterbody may affect aquatic ecosystems

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Release of drilling mud during HDD (cont'd)	See above	See above	• Excavate the entry and expected exit sites to provide for the containment of drilling mud and sediments during an HDD. Ensure the excavations are located above the high watermark, far enough from the watercourse and large enough to contain the anticipated maximum volume of drilling mud above the high watermark of the watercourse. • Use water from an approved source in accordance with applicable permits to mix drilling mud. **<u>Emergency Response Equipment</u>** • Refer to the Directional Drilling Procedures and Drilling Mud Release Contingency Plan. • Maintain the following equipment on-site in sufficient quantities during drilling operation to contain any inadvertent drilling mud releases: – sandbags; – filter cloth (e.g., silt fence); – T-bar posts and post pounders; – straw bales; – light towers; – floating sediment boom; – shovels; – 6 ml polyethylene sheeting; and – two trash pumps complete with sufficient lengths of leak free hose and suction heads.	See above

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Release of drilling mud during HDD (cont'd)	See above	See above	• Maintain vacuum truck(s) on site during pullback operations. • Maintain the appropriate equipment on-site during drilling operation to ensure that accurate water quality monitoring and sampling is conducted. On site equipment may include the following (the equipment that is required on-site should be confirmed prior to the onset of drilling operations): – turbidity meter; – sampling pole; – chest waders; – water sample bottles; – ice augers; – boat; – coolers; and – appropriate safety equipment for working near water or on ice (e.g., throw bags, boat safety kit, ice safety kit). • Ensure that the water quality sampling plan that has had input from a qualified fish biologist is in place prior to drilling and includes the following information: – sample locations (both an upstream control site as well as appropriate downstream sites); – frequency of sampling; and – sampling procedures.	See above

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Release of drilling mud during HDD (cont'd)	See above	See above	**Monitoring** • Develop and follow a site-specific water quality monitoring plan for all activities where drilling is occurring under or near the waterbody. The water quality monitoring plan should be used to guide construction activities and to inform decisions in the event of an inadvertent release of drilling fluid or sediment, in which case, additional mitigation will be required. Monitoring may be conducted visually or by measurement of turbidity and TSS, depending on the sensitivity of the waterbody and as directed by the Environmental Inspector. Turbidity levels and TSS concentrations should not exceed guidelines provided by the CCME (2007). A qualified fisheries biologist should be on-site during construction to ensure regulatory compliance and to provide environmental protection advice to an Environmental Inspector or Enbridge designate, as required. • Monitor and record the amount of fluid return to the mud tank/pit and the amount of make-up drilling fluid required in the mixing tanks during drilling of the pilot hole and hole opening (reaming). Maintain a detailed log of all drilling activities in order to correlate drilling status with potential inadvertent release events.	See above

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Release of drilling mud during HDD (cont'd)	See above	See above	• Monitor both onshore and instream portions of the drill path and surrounding area for signs of drilling mud release. The size of the area to be monitored will be determined by evaluating geotechnical conditions (i.e., amount of fracturing, type and depth of substrate) and drilling conditions (i.e., depth of drill path, distance between the watercourse, and entry and exit points). Monitoring will be on a continuous basis during drilling operations and will continue for at least 12 hours after shut-down. Personnel equipped with appropriate communication devices shall be positioned at the most advantageous locations to observe any sign of a release of drilling mud to the surface or in the watercourse. **Emergency Response** • Suspend drilling operations immediately if an excessive loss of drilling mud is noted and conduct a detailed examination of the drill path and surrounding area for evidence of a release to the surface. • If no surface or in-water release is noted, it may be necessary to increase monitoring (terrestrial frac detection and water quality sampling) to ensure early detection while the drill continues. Measures should be taken by the Construction Manager to establish cause and mitigate for the drilling mud loss (e.g., use of cement plugs to prevent further loss at release points along the drill path).	See above

Table 6.7.2-1. Potential Effects, Mitigation Measures and Residual Effects of Accidents and Malfunctions

Potential Effect	Activity/Location	Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
5.0 Release of drilling mud during HDD (cont'd)	See above	See above	• Immediately notify the Construction Manager and the Environmental Inspector or Enbridge designate if a drilling mud release is observed. • If the amount of mud released is not great enough to allow practical collection, the mud release will be allowed to dry and naturally dissipate. • Contain and further prevent drilling mud from entering the watercourse from nearshore areas by installing a berm of subsoil, sandbags or other material approved by the Environmental Inspector or Enbridge designate. • Conduct water quality sampling as directed by the Environmental Inspector or Enbridge designate. Instream and nearshore containment/clean-up procedures include the following.	See above
Pipeline failure caused by a line break	• Operation • Entire route	RSA	• Locate valves along the pipeline to control release volumes. • Implement measures in Enbridge's O&MM Book 7 for Emergency Response in the event of a pipeline failure including Chapter 2 (Emergency Response Actions), Chapter 3 (Hazard-Specific Emergencies) and Chapter 4 (Containment, Recovery and Cleanup).	• A pipeline failure could adversely affect soil and soil productivity, surface water quality, groundwater quality, air quality, fish and fish habitat, wetland function, vegetation, wildlife and wildlife habitat, species at risk, HORU, TLRU, human health, and infrastructure and services

Note:

1 Detailed mitigation measures will be included in the Project-specific EPP.

6.7.3 Significance Evaluation of Potential Residual Effects

Where there are no standards, guidelines, objectives or other established and accepted ecological thresholds to define quantitative rating criteria or where quantitative thresholds are not appropriate, the qualitative method is considered to be the appropriate method for determining the significance of the potential residual effects. Consequently, a qualitative assessment of accidents and malfunctions was determined to be the most appropriate method with the evaluation of significance of each of the potential residual effects relying on the professional judgment of the assessment team.

Table 6.7.4-1 provides a summary of the significance evaluation of the potential residual effects associated with accidents and malfunctions during Project activities. The rationale used to evaluate the significance of each of the potential residual effects is provided in Section 6.1.7 and is also provided below the table.

Table 6.7.4-1. Significance Evaluation of Potential Residual Effects of Accidents and Malfunctions

Potential Residual Effect	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
Despite vigilance, fires may adversely affect adjacent vegetation and, in very rare situations, affect wildlife and adjacent property	RSA	Short to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
Damage of foreign utility lines could lead to interruption of services as well as fire or contamination of soil or water, depending on the type of foreign line (e.g., electrical or gas), its location, and the severity of damage	RSA	Immediate to medium-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
A transportation accident may cause injury to people or wildlife, or may result in fire or contamination of lands and water, depending upon the location and severity of the accident	RSA	Immediate to extended-term	Rare	Irreversible to reversible	Negligible to high	Low	Moderate	Not significant
Release of drilling mud on land may affect soil productivity	Footprint to LSA	Immediate to medium-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant
Disturbance of vegetation/wildlife habitat could result during clean-up and reclamation efforts following a HDD mud release on land or riparian areas	Footprint to LSA	Medium to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant

Table 6.7.4-1. Significance Evaluation of Potential Residual Effects of Accidents and Malfunctions

Potential Residual Effect	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
Depending upon the volume and locations of the release, a release of HDD mud into a waterbody may affect aquatic ecosystems	Footprint to LSA	Immediate to medium-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
A pipeline failure could adversely affect soil and soil productivity	RSA	Short to medium-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant
A pipeline failure could adversely affect surface water quality	RSA	Immediate to short-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant
A pipeline failure could adversely affect groundwater quality	RSA	Medium to long-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant
A pipeline failure could adversely affect air quality	RSA	Immediate to short-term	Rare	Reversible	Low	Low	Moderate	Not significant
A pipeline failure could adversely affect fish and fish habitat	RSA	Short to long-term	Rare	Reversible	Low to High	Low	Moderate	Not significant
A pipeline failure could adversely affect wetland function	RSA	Medium to long-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant
A pipeline failure could adversely affect vegetation	RSA	Short to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
A pipeline failure could adversely affect wildlife and wildlife habitat	RSA	Short to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
A pipeline failure could adversely affect species at risk	RSA	Short to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
A pipeline failure could adversely affect HORU	RSA	Short to medium-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant
A pipeline failure could adversely affect TLRU	RSA	Short to long-term	Rare	Reversible	Low to high	Low	Moderate	Not significant
A pipeline failure could adversely affect human health	RSA	Immediate to medium-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant

Table 6.7.4-1. Significance Evaluation of Potential Residual Effects of Accidents and Malfunctions

Potential Residual Effect	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
A pipeline failure could adversely affect infrastructure and services	RSA	Immediate to short-term	Rare	Reversible	Low to medium	Low	Moderate	Not significant

6.7.3.1 Fire Affecting Vegetation, Wildlife and Adjacent Property

A fire could occur during Project activities and cause damage to rare vegetation species or rare plant communities, organic soils, historical resources, wildlife, or riparian aquatic habitat. Additionally, it could cause property damage, affect human health and public safety, or increase the demand on local emergency services.

A fire during Project activities would result in a negative impact balance on vegetation, wildlife and adjacent property, and depending upon the size and location of the fire, the duration of the residual effect would vary from short to long-term.

The magnitude of the residual effect is considered to be low to high depending on the location, (e.g., treed versus agricultural fields), size, and what it consumes. Since small fires within the Footprint and off of the Footprint are of minor and moderate concern, respectively, and can be extinguished quickly, they are not likely to cause an adverse effect of high magnitude. Large fires that spread off the Footprint and result in loss of resources and property are likely to be considered an adverse effect with high magnitude.

The probability of a fire developing during Project activities is considered low since a fire would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project, if at all. Therefore, with the implementation of mitigation measures (e.g., construction crews having firefighting equipment and training) and the development of a Fire Contingency Plan, the potential residual effect of fire on environmental and socio-economic elements is considered to be not significant.

6.7.3.2 Damage of Foreign Utility Lines

Damage to a water line, natural gas distribution line, buried cable or telephone line could occur during Project activities that require ground disturbance and could lead to an interruption of services or could result in adverse effects on human health, vegetation, and wildlife.

Damage to foreign utility lines would result in a negative impact balance on various environmental and socio-economic elements depending on the location, type of line, and severity of the damage. The duration of the residual effect would vary from immediate to medium-term. Damage to a cable or telephone line would be reversible within a few days. Major damage to an electrical utility line could cause a power outage in a nearby community, which could lead to an interruption of community utilities and services for days or even weeks, depending on the severity of the damage and the time required to restore services. The loss of power in a nearby community could also have an adverse effect on the local economy if power is not restored for multiple days, forcing local businesses to remain closed. Damage to a natural gas distribution line could result in an explosion or fire which could have severe consequences for human health as well as the surrounding vegetation and wildlife. If a gas line was ruptured and an explosion or fire subsequently occurred, the residual effect on the environment could last several years.

The magnitude of the residual effect is considered to be low to high. A high magnitude scenario would be the rupture of a gas line leading to adverse effects on human health, vegetation and wildlife. A low to medium magnitude scenario is more likely and would include damage of a minor cable or electrical line resulting in only a nuisance or inconvenience to affected individuals for a short period of time.

The probability of damage to foreign utility lines is considered low since Enbridge will be adhering to industry standards, regulations and company protocols. Therefore, with the implementation of mitigation measures, the potential residual effect of damage to foreign utility lines is considered to be not significant.

6.7.3.3 Transportation Accident

A transportation accident could occur during Project activities that require the use of vehicles and equipment and could cause injury to people or wildlife, or could result in a fire or contamination of lands and water.

A transportation accident during Project activities would result in a negative impact balance on environmental and socio-economic elements including damage to property, inconvenience to the public, injury to humans or wildlife, and contamination of land or water. The duration of the residual effect would vary from immediate to extended-term depending on the severity of the accident. If a minor accident were to occur during Project activities and did not involve serious property damage, injury or loss of life, fire, or contamination, it could be resolved immediately. However, if a major accident were to occur resulting in permanent injury or death of a person or multiple people, then the residual effect would be irreversible.

The magnitude of the residual effect is considered to be negligible to high. A minor traffic accident that amounts to a short-lived nuisance or inconvenience to those involved and has no noticeable environmental effects would be considered to have a negligible magnitude. A high magnitude scenario would be an accident that results in death to humans, irreparable damage to property, damage to critical habitat, or severe contamination of lands or water.

The probability of a transportation accident is considered low since Enbridge will be adhering to all applicable traffic and road regulations as well as measures for traffic control to be included in the Project-specific EPP. Therefore, with the implementation of mitigation measures, the potential residual effect of a transportation accident is considered to be not significant.

6.7.3.4 Release of Drilling Mud Affecting Soil Productivity

A release of drilling mud onto land during construction of an HDD or other trenchless crossing at roadways or other terrestrial features could result in a negative impact on soil productivity. The duration of the residual effect would vary from immediate to medium-term depending on the size and location of the release. Drilling mud is typically composed of bentonite clay which is inert and, as such, a release to land would be relatively benign depending on the land use where the release occurs. In the event that a drilling mud release on land occurs during a trenchless crossing, the Drilling Mud Release Contingency Plan will be implemented. In many cases, the bentonite clay could be cleaned up immediately with only a short-term effect on soil productivity. If a release were to occur on agricultural land or if a large area were to be disturbed by clean-up efforts, the effect could extend into the medium-term since residual clay may remain following clean-up and it may take more than one growing season for vegetation to re-establish and for the soil to return to its pre-release productivity level. There would be no long-term effects on soil productivity as a result of a drilling mud release on land.

The magnitude of the residual effect is considered to be low to medium. The effect on soil productivity of a release of drilling mud on land would be within environmental standards following the implementation of clean-up measures. The probability of a release of drilling mud affecting soil productivity is considered low since a drilling mud release would occur as a result of an accident or malfunction which would happen only rarely. Therefore, with the implementation of mitigation measures, the potential residual effect of a release of drilling mud on soil and soil productivity is considered to be not significant.

6.7.3.5 Release of Drilling Mud Affecting Vegetation and Wildlife Habitat

A release of drilling mud into a terrestrial (upland or riparian) environment during construction of an HDD or other trenchless crossing could result in loss or alteration of vegetation and wildlife habitat.

A release of drilling mud into a terrestrial environment would result in a negative impact balance on vegetation and wildlife habitat. The duration of the residual effect would vary from medium to long-term depending on the length of time it takes vegetation to recolonize the area disturbed by the drilling mud and clean-up activities. As noted previously, the inert nature of bentonite clay facilitates quick clean-up and reclamation. In the event that an overland drilling mud release occurs during a trenchless crossing, the Drilling Mud Release Contingency Plan will be implemented.
Schmidt et al. (2001) evaluated the effect of a release of drilling mud during construction of HDD crossings on wetlands at five sites and determined that affected vegetation and habitat did not display substantial adverse effects as a result of bentonite discharge. Schmidt et al. (2001) further noted that the level of observed effect was in part related to the nature of clean-up procedures.

The magnitude of the residual effect is considered to be low to high. The introduction of a clay-based drilling mud into a terrestrial (upland or riparian) environment would vary depending on the location, volume released, the level of clean-up required and the vegetation species or vegetation community affected (e.g., the magnitude is higher if vegetation species or communities of concern are disturbed).

The probability of a release of drilling mud affecting vegetation and wildlife habitat is considered low since a drilling mud release would occur as a result of an accident or malfunction which would happen only rarely. Therefore, with the implementation of mitigation measures, the potential residual effect of a release of drilling mud affecting vegetation and wildlife habitat is considered to be not significant.

6.7.3.6 Release of Drilling Mud Affecting Aquatic Ecosystems

Watercourse crossings will be constructed using trenched crossing techniques, however, a potentially fish-bearing wetland, the Sheffield-Rockton complex, will be crossed using a trenchless (HDD) technique. A release of drilling mud into an aquatic environment during construction of an HDD crossing of a waterbody could result in a temporary decrease in surface water quality, alteration of aquatic habitat, and potential mortality or injury to fish or mussels.

A release of drilling mud into an aquatic environment would result in a negative impact balance on surface water quality, aquatic habitat, or fish and mussel populations. The duration of the residual effect would vary from immediate to medium-term depending on the location, the volume released, and the level of clean-up that is appropriate. Suspended solids released as a result of a drilling mud release into a wetland would settle out and disperse at a slower rate relative to a flowing stream or river. A larger drilling mud release into a wetland could take longer to disperse and settle out. There could also be more obvious and longer lasting effects on aquatic habitat, especially if habitat is altered during clean-up efforts. The magnitude of a drilling mud release on surface water quality, aquatic habitat, and fish or mussel mortality or injury is considered to be low to high. Depending on the size of the release, the sensitivity of the aquatic habitat, the sensitivity of fish or mussel species that are present, and the availability of refugia, the release of a large quantity of drilling mud could cause mortality of fish or mussel population in the immediate area of release. In-water releases of drilling mud occur less frequently than terrestrial releases. This is primarily due to the layout of directional drill paths which are commonly much longer than the width of the waterbody and which have shallower depths of cover near the upland drill entry and exit locations. The depth of cover along an HDD path often reaches its maximum directly under the waterbody. Monitoring throughout an HDD program allows for quick detection of a release and aids in limiting the total volume of the drilling mud released.

The magnitude of the residual effect is considered to be low to high. The effects on surface water quality, aquatic habitat, and fish or mussel mortality would be within environmental standards following the implementation of clean-up measures. The probability of a release of drilling mud affecting aquatic ecosystems is considered low since a drilling mud release would occur as a result of an accident or malfunction which would happen only rarely. Therefore, with the implementation of mitigation measures, the potential residual effect of a release of drilling mud affecting aquatic ecosystems is considered to be not significant.

6.7.3.7 Pipeline Failure Affecting Soil and Soil Productivity

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. If a leak or spill occurs on land, or underground, it may have adverse effects on soil and soil productivity.

A pipeline failure would result in a negative impact balance on soil and soil productivity. The duration of the residual effect would vary from short to medium-term depending on the size of the spill and the types of remediation efforts that are employed. Removal of contaminated soils and replacement with clean fill would be the preferred option for remediation. This type of action would reduce the duration of acute toxicity following the spill and clean-up efforts (i.e., a few days to weeks). However, natural weathering processes (e.g., wind and water erosion) along with microbial action would also help reduce any residual hydrocarbon concentrations over the longer term (Stantec et al. 2015). Recovery of soil productivity is linked to the recovery of soil invertebrate communities and, based on studies of past pipeline failures, would be expected to occur within 2 to 5 years following the spill and associated remediation efforts (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to medium. The concentration of residual hydrocarbons in affected soil, if present, would be reduced during remediation efforts to meet applicable environmental guidelines. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on soil and soil productivity is considered to be not significant.

6.7.3.8 Pipeline Failure Affecting Surface Water Quality

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. If the leak occurs in or near a body of water, it may have adverse effects on surface water quality.

A pipeline failure would result in a negative impact balance on surface water quality. The duration of the residual effect would vary from immediate to short-term depending on the type of waterbody (e.g., a fast-flowing river versus a small lake) and the time of year. Oil entering a waterbody may behave in different ways depending on a variety of factors. Hydrocarbons may be dispersed by wave action relatively quickly if they enter a fast-flowing river or stream, or they may also be dissolved into the water column and become diluted and degraded by microbial action (Stantec et al. 2015). A spill in a river or stream with relatively fast flow will result in hydrocarbons becoming dispersed and weathered relatively quickly, which could result in recovery of surface water quality within days of the spill event. If the waterbody is relatively stagnant, some of the oil may pool on the surface of the water in the form of an oil slick. Oil spilled into a waterbody with limited water renewal (e.g., small lakes or small, slow-moving streams) may pool on the surface or become aggregated with sediment and residual hydrocarbons remaining after remediation may take more than a few days to degrade (Stantec et al. 2015). For example, following the Wabamun Lake, Alberta oil spill in 2005, the oil formed tar balls that accumulated in reed beds along the shore of the lake. Most of the tar balls were removed from the reed beds by mechanical means. Based on monitoring of water quality in the lake, there were few indications of hydrocarbon contamination in the water column within six weeks (Stantec et al. 2015). Therefore, the natural weathering of residual tar balls and any oil re-entrained in the water column following remediation would likely only result in localized areas of reduced surface water quality over a short period of time (i.e., a few weeks). Also, depending on the type of sediment present in the waterbody, some of the hydrocarbons may become aggregated with sediment or become entrained in the bedload or along the floor of the waterbody (Stantec et al. 2015). If sediment was to become heavily oiled, remediation efforts would involve removal of the contaminated sediment from the waterbody. Residual hydrocarbons may remain in the water column for a few weeks following remediation, but review of past pipeline failures indicates recovery of surface water quality to applicable guidelines (for the protection of aquatic life) would take no more than a few weeks to a couple of months. In addition, a spill that occurs in the winter could result in some hydrocarbons becoming trapped under ice. The residual oil would then become re-entrained in the water column once the ice breaks up or melts. If the spill were to occur in winter and residual oil was released as a fresh pulse upon spring break-up, it would still likely weather and degrade to acceptable hydrocarbon concentrations within a few weeks (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to medium depending on the amount of oil spilled and the type of waterbody. A more stagnant body of water will experience more acute toxicity than a fast-flowing river or stream, however, with the application of remedial measures, water quality would be within applicable environmental standards. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on surface water quality is considered to be not significant.

6.7.3.9 Pipeline Failure Affecting Groundwater Quality

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. If the leak occurs below ground level, or if oil seeps through surface soil, it may have adverse effects on groundwater quality.

A pipeline failure would result in a negative impact balance on groundwater quality. The duration of the residual effect would vary from medium to long-term, depending on a variety of factors including the permeability of the soil (e.g., coarse-grained soils will more readily absorb spilled oil) , the viscosity of the oil (e.g., lighter oils with lower viscosity have more potential to reach the water table), the concentration of water-soluble hydrocarbons in the oil, the hydraulic gradient, and seasonal factors (e.g., a spill in winter, on snow-covered or frozen ground is likely to be more inhibited from absorbing into the soil and reaching the water table) (Stantec et al. 2015). In addition, as hydrocarbons undergo biodegradation in groundwater, they can release substances such as arsenic and heavy metals from the surrounding soil or rock resulting in another pathway for groundwater contamination. Groundwater wells can be installed and used to monitor groundwater quality at the site of a spill and in areas along the perimeter. A review of studies on the behavior of hydrocarbons in groundwater indicates that, depending on the various factors noted above, residual contamination can persist in groundwater for many years after an oil spill while complete recovery can take decades (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to medium depending on what the groundwater is used for and the applicable groundwater quality thresholds. Based on groundwater monitoring conducted on past oil spills, groundwater quality can be returned to natural conditions or acceptable thresholds for drinking water quality (depending on the location and water use) with appropriate monitoring and remediation. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on groundwater quality is considered to be not significant.

6.7.3.10 Pipeline Failure Affecting Air Quality

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. Air quality can be temporarily impacted by the release of VOCs following an oil spill.

A pipeline failure would result in a negative impact balance on air quality. The duration of the residual effect would vary from immediate to short-term. Air quality would be adversely affected by the release of VOCs as some of the spilled oil evaporates, however, the effects on air quality would be short-lived once the oil is recovered during remediation. A review of studies on the effects of oil spills indicates that VOC emissions in areas surrounding a spill event are either below human health screening levels or not detectable within a few days to a few weeks following spill clean-up (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low. In the event of a spill, nearby residents would be evacuated until air quality is returned to acceptable levels. Emissions of VOCs would disperse in the atmosphere and become diluted relatively rapidly. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on air quality is considered to be not significant.

6.7.3.11 Pipeline Failure Affecting Fish and Fish Habitat

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill into a fish-bearing waterbody can have lethal and sub-lethal effects on fish and can indirectly affect fish mortality through the loss or alteration of habitat during clean-up activities. The assessment of the residual effect of a pipeline failure on fish and fish habitat presented here is also applicable to in-water amphibians.

A pipeline failure would result in a negative impact balance on fish and fish habitat. The duration of the residual effect would vary from short to long-term depending on the degree and duration of exposure. A spill can physically smother aquatic organisms as well as expose them to acute or chronic toxicity and clean-up efforts can result in alteration or loss of essential habitat. Effects on fish can generally be characterized as short to medium-term in duration while effects on fish habitat can extend into the long-term.

Based on studies of oil spills in freshwater environments, direct mortality of fish can occur at the site of the spill as well as downstream of the spill with the overall reach dependent on the flow rate of the waterbody. Immediately following remediation, hydrocarbon concentrations in surface water can be expected to decrease to levels that are within thresholds for the protection of aquatic life within a few days to a few weeks (Stantec et al. 2015). Effects on fish eggs and fish embryos could result in more chronic effects on fish communities, especially if hydrocarbons are trapped in sediments. However, even if a portion of the reproductive capacity of a single year-class of fish is lost, studies have shown that recovery would occur in subsequent years and full recovery of fish communities can be expected within 10 years or less of a spill event (Stantec et al. 2015).

Effects on fish habitat during clean-up efforts can result in changes to fish abundance and diversity due to changes in vegetation or river morphology. For example, removal of oiled woody debris and log jams during the Pine River (BC) spill recovery efforts in 2000 resulted in long-term effects on instream and riparian habitat. Replacement structures were built, however, the river shifted course and bank erosion resulted in a less complex river channel that was straighter and wider than before (Stantec et al. 2015).

Despite the more long-term effects on instream and riparian habitat, fish populations rebounded within 7 years of the spill to higher levels than historically recorded (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to high. The effects of acute toxicity on fish immediately after the spill would be high magnitude since it would result in fish mortality. After spill clean-up and natural degradation of the hydrocarbons, the effect would be reduced to a medium or low magnitude, depending on the extent and severity of the spill. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on fish and fish habitat is considered to be not significant.

6.7.3.12 Pipeline Failure Affecting Wetland Function

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill in or near a wetland can result in adverse effects on wetland habitat, hydrological, and biogeochemical functions through the contamination of vegetation and soils as well as indirectly through the removal of vegetation and soils during remediation.

A pipeline failure would result in a negative impact balance on wetland function. The duration of the residual effect would vary from medium to long-term depending on the extent of the exposure and the characteristics of the wetland. Concentrations of hydrocarbons in wetlands where a spill has occurred are often high just immediately after the spill. Breakdown or weathering of the hydrocarbons is dependent on temperature and time (National Research Council 2003). Oil spilled in wetlands tend to have a long residence time, can cause interior oiling and pooling, and may result in a slow rate of recovery in some wetlands. In many instances oil in wetlands is difficult to clean-up due to access constraints (DNV 2003). The time of year of a spill can also have an effect. During the wet season there is more surface area over which an oil spill can affect a wetland due to flooding. During the dry season, as water levels lower, more substrate may be affected by percolation, although, the overall surface area affected by the oil spill may be reduced (DNV 2003). Project construction through wetlands will take place during the winter and early spring when the amount of surface water encountered and the potential for spill migration through the wetland will be reduced.

Wetlands contaminated with oil can recover relatively quickly (i.e., within 5 to 10 years) depending on the microbial community that is present and the rate of biodegradation of any residual hydrocarbons that remain after the implementation of clean-up efforts. Disturbance of wetland substrate, especially in peatlands (e.g., bogs), can have a negative effect by creating more of a disruption than the spill itself. Removing wetland substrate in an attempt to physically remove the oil can result in the oil being forced further down into the substrate strata, open water areas would be created, and vegetation could be damaged or destroyed (Moore et al. 1997, Zoltai and Kershaw 1995). Therefore, for wetlands where a substantial amount of vegetation and soil have to be removed during remediation, the recovery time can extend into the long-term (i.e., 10 years or more) due to varying rates of vegetation regeneration and recovery of soil invertebrate communities, which can take several years to return to pre-spill conditions (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to medium. The implementation of clean-up efforts will ensure that surface water quality and soil quality in affected wetlands is returned to appropriate thresholds for hydrocarbon contamination. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on wetland function is considered to be not significant.

6.7.3.13 Pipeline Failure Affecting Vegetation

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill on land or near water can adversely affect terrestrial and riparian vegetation through contamination. During clean-up efforts, unoiled vegetation may also be affected as a result of emergency response to the spill site (i.e., vehicles, people and equipment may trample vegetation in order to access the spill).

A pipeline failure would result in a negative impact balance on vegetation. The duration of the residual effect would vary from short to long-term depending on site-specific factors including the type of vegetation present and the degree of exposure. Due to the wide variety of potential spill scenarios and the varying degrees of tolerance among different plant species, effects on vegetation could range from 1 year to more than 10 years.

Effect pathways include physical smothering, habitat modification, and acute toxicity, all of which could lead to changes in the ecosystem structure. Depending on the vegetation communities present at the spill site, a spill could result in loss of plant diversity and could potentially affect rare plants and rare plant communities (Stantec et al. 2015). Remediation measures such as the removal of oiled soils and vegetation as well as reseeding of disturbed areas can help promote vegetation recovery. However, these efforts could also lead to a loss or alteration of native vegetation and could lead to the introduction or spread of non-native species and weeds (Stantec et al. 2015). Studies have shown that moderately tolerant perennial and biennial plant species are able to regenerate from surviving root systems relatively rapidly (i.e., within 1 year in some cases). Native plant species that are less tolerant can generally begin to recolonize in a few years if there are nearby populations that were not affected by the spill (Stantec et al. 2015). Mosses are quite sensitive to oil contamination. Hutchinson and Freedman (1975) found that even after three years following an oil spill, mosses, along with lichens and liverworts, showed little recovery. If the spill were to affect a mature or late successional habitat, or if it were to affect agricultural land, complete recovery could take several years since there would be residual effects on soil and soil productivity.

The magnitude of the residual effect is considered to be low to high. The residual effect would likely be low to medium in magnitude, however, a high magnitude scenario could occur where a spill resulted in the loss of a native or rare plant community, or resulted in long-term changes to an ecosystem. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on vegetation is considered to be not significant.

6.7.3.14 Pipeline Failure Affecting Wildlife and Wildlife Habitat

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill could adversely affect terrestrial and semi-aquatic mammals as well as birds, reptiles, and air-breathing amphibians (e.g., adult frogs, toads and salamanders) and their habitats. The effects of an oil spill on in-water amphibians are similar to fish. The assessment conducted for the residual effect of pipeline failure on fish and fish habitat can be considered applicable to in-water amphibians which are not considered further in this subsection on wildlife and wildlife habitat.

A pipeline failure would result in a negative impact balance on wildlife and wildlife habitat. The duration of the residual effect would vary from short to long-term depending on the extent of the spill and the degree of exposure of various wildlife species. Recovery of wildlife species could take a few months to several years depending on the reproductive capacity of affected populations and whether there are chronic effects from oiling of avian, reptile or amphibian eggs. Direct effects (i.e., as a result of contamination) and indirect effects (i.e., as a result of recovery efforts) of a spill on wildlife habitat could take more than 10 years to resolve depending on the type of habitat affected. Studies indicate that spills in aquatic environments are more likely to affect a higher proportion and wider variety of wildlife species than an inland spill (Stantec et al. 2015).

Effect pathways on mammalian and avian wildlife include oiling of fur or feathers (reducing thermoregulatory capacity), inhalation of VOCs, dermal exposure, ingestion of hydrocarbons during preening, chronic exposure from ingestion of contaminated food, habitat loss, and decline in food availability through decreased food or prey abundance (Stantec et al. 2015). In addition, bird eggs may be affected by oiling from the feathers of parent birds. Similar pathways apply to amphibians and reptiles and include dermal exposure, chronic exposure from ingestion of contaminated food, external oiling of eggs, and decline in food availability through decreased food or prey abundance due to adverse effects on other ecosystem components (Stantec et al. 2015). Immediately after a spill, there is typically direct mortality on wildlife as a result of oiling or ingestion of contaminated food. Accurate counts of wildlife killed by oil spills are difficult to obtain due to wildlife mobility, however, it is expected that some degree of wildlife mortality will occur after any spill into the environment. Clean-up efforts would include recovery of oiled wildlife and attempts would be made to rehabilitate and release as many individuals as possible (Stantec et al. 2015).

Studies on the effects of oil spills on wildlife indicate that semi-aquatic mammals (e.g., beavers, otters and muskrats), waterfowl (e.g., ducks, geese and herons), and air-breathing amphibians are the most susceptible to acute toxicity and direct mortality as a result of oiling from a spill into an aquatic environment. Mitigation to prevent wildlife from entering aquatic environments affected by an oil spill can include deterrents and, for waterfowl and other birds, seasonal factors can also play a natural role in reduction of exposure (i.e., migratory behaviour). Effects on these types of wildlife can be expected to range from a few months to several years depending on the reproductive capacity of affected populations. For example, chronic effects as a result of external oiling of bird or amphibian eggs will take longer to resolve than loss of a few members of a population of beavers or otters (Stantec et al. 2015).

Terrestrial mammals such as deer are less likely to suffer serious harm from acute or chronic exposure due to their relatively large size and wider habitat range. Recovery of large terrestrial mammals can be expected to be similar to the length of time for the recovery of essential food sources and habitat, however, it is also naturally mitigated by the extent of the species' home range and availability of other food sources. Therefore, the residual effect on terrestrial mammals can be expected to last anywhere from a few months to a few years depending on the extent of alternative food sources and the extent of habitat loss or alteration (Stantec et al. 2015).

Reptiles, especially turtles, are generally less susceptible to acute toxicity from direct contact with oil due to their relatively impermeable skin or outer amour. Some turtles that were recovered during clean-up efforts for the Kalamazoo River (Michigan) oil spill in 2010 were cleaned and released more than once with some turtles being captured, cleaned and released more than five times over the course of a few months (Stantec et al. 2015). Effects on reptiles are more likely to occur as a result of ingestion of contaminated food, decline in prey abundance, or as a result of external oiling of eggs. Population-level effects on turtles could last 5 years or more, since many species of turtle are endangered and they have relatively lower reproductive potential. In comparison, most other reptiles and air-breathing amphibians typically have a high reproductive potential and population-level effects could be resolved in as little as one to two breeding cycles (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to high. Some oil spills may result in direct mortality of hundreds of wildlife species which would be a high magnitude scenario, while other spills, depending on the location and severity, may have very few noticeable effects on wildlife and wildlife habitat. For example, after the 2015 Yellowstone River oil spill, there were no reports of oiled, injured or dead wildlife (Stantec et al. 2015). The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on wildlife and wildlife habitat is considered to be not significant.

6.7.3.15 Pipeline Failure Affecting Species at Risk

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill could affect vegetation or wildlife species at risk depending on the spill location.

A pipeline failure would result in a negative impact balance on species at risk. The duration of the residual effect would vary from short to long-term depending on what species are affected and the degree of the exposure. As noted in the assessment of pipeline failure on vegetation, the residual effects of a spill on vegetation could range from 1 year to more than 10 years. If there are ecosystem-level changes as a result of the loss or alteration of a rare plant species or community, it could take many years for that community to become re-established. Similarly, as noted in the assessment of pipeline failure on wildlife and wildlife habitat, effects on wildlife may take up to 10 years to resolve and effects on habitat could take beyond 10 years depending on the extent of the damage. Therefore, residual effects of a spill on vegetation or wildlife species at risk would be expected to have similar durations.

The magnitude of the residual effect is considered to be low to high. If species at risk are present in a spill area, they may experience direct mortality which could negatively affect populations. Alternatively, if species at risk are in a neighbouring area but not directly affected by the spill or clean-up efforts, they may experience some mild adverse effects related to food availability or habitat alteration until the spill area has completely recovered. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on species at risk is considered to be not significant.

6.7.3.16 Pipeline Failure Affecting Human Occupancy and Resource Use

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill could have adverse effects on nearby occupants as well as land and resource users.

A pipeline failure would result in a negative impact balance on HORU. The duration of the residual effect would vary from short to medium-term. In the event of a spill near residences, the occupants would be evacuated, which can typically last anywhere from a few hours to a few days depending on their proximity to the spill. In the rare situation where a spill results in oiling of a home, the evacuation of the occupants may last a bit longer than a few days and could extend for over a week (Stantec et al. 2015). An oil spill near a recreational area (e.g., hiking trails or fishing holes) could result in that area being restricted for use for a number of months to more than a year depending on the extent of the spill and the success of remediation and restoration efforts. In the case of a spill that affects fish, fishing advisories may be put in place for up to 1 to 2 years to protect human health (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to medium. In many cases, the residual effect on the socio-economic environment is not likely to go beyond that of a nuisance or inconvenience to a small amount of affected individuals. There is the potential for the residual effect to result in a moderate modification to the socio-economic environment if it were to affect daily activities or routines for a large group of land users, or a whole community, in the spill area. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on HORU is considered to be not significant.

6.7.3.17 Pipeline Failure Affecting Traditional Land and Resource Use

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. An oil spill could have adverse effects on TLRU if it were to affect resources used by Aboriginal groups.

A pipeline failure would result in a negative impact balance on TLRU. The duration of the residual effect would vary from short to long-term depending on the resource that is affected. If recreational uses such as hunting or trapping are affected by a spill, the residual effect would be expected to last no more than 1 year at any given location. However, if medicinal plants or important fish species are affected, the residual effect could last more than 1 year and continue for over 10 years (e.g., in the case of loss or alteration of an ecosystem that requires a number of years to naturally recover or regenerate).

The magnitude of the residual effect is considered to be low to high depending on the type of resource that is affected and the value that is placed on that resource by Aboriginal groups. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on TLRU is considered to be not significant.

6.7.3.18 Pipeline Failure Affecting Human Health

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. The physical and mental health of nearby residents and land users as well as clean-up workers may be adversely affected by a spill.

A pipeline failure would result in a negative impact balance on human health. The duration of the residual effect would vary from immediate to medium-term. Direct physical health effects would only last for the acute spill phase (e.g., a few days to a couple of weeks) while adverse effects to mental health may persist or worsen over the years following an oil spill (Stantec et al. 2015).

The most likely pathway for direct physical health effects from a spill would be from inhalation of VOC emissions. Once the spill is cleaned up, there would no longer be high enough concentrations of VOC emissions to cause noticeable health effects. In the case of an oil spill occurring near residences, the occupants would be evacuated from the area and would be unlikely to experience more than mild symptoms of VOC exposure such as headaches, dizziness, nausea, or eye and throat irritation. The clean-up workers are the most at risk for health effects, however, with proper training and implementation of personal protective equipment, adverse health effects can be effectively mitigated (Stantec et al. 2015). Another, less likely pathway for direct physical health effects, would be ingestion of contaminated drinking water or country foods (e.g., plants or herbs gathered from the wild). However, the potential for this pathway is very low since access restrictions and advisories would be put in place to prevent consumptive and recreational use of affected natural resources in and around a spill area. Similarly, drinking water wells and intakes would be monitored and contamination would be promptly remediated below human health screening levels.

Adverse effects on mental health would occur in situations where a spill resulted in loss of income or financial uncertainty for affected individuals, or where a community faces cultural losses from effects on natural resources. Individuals in these types of situations may experience anxiety, depression, or even post-traumatic stress disorder (Stantec et al. 2015). These types of effects have the potential to last a few years, depending on the specific circumstances, however, they can be mitigated in many cases by the provision of social support and compensation (Stantec et al. 2015).

The magnitude of the residual effect is considered to be low to medium depending on the type of health effects experienced. The physical health effects of VOC inhalation would not result in more than a nuisance or inconvenience since they would be short-lived as individuals would be removed from exposure to the emissions. A moderate modification of the socio-economic environment may result from effects on mental health if they are experienced at the community-level or affect more than a few individuals. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on human health is considered to be not significant.

6.7.3.19 Pipeline Failure Affecting Infrastructure and Services

A leak or failure of the pipeline may occur during operations due to corrosion, external interference, material defect, weather-related failure, geotechnical failure, overpressure or pre-existing damage from construction. In the event of a spill, there would be increased demand on emergency response services and, depending on the location of the spill, there could be adverse effects to local traffic and roadways.

A pipeline failure would result in a negative impact balance on infrastructure and services. The duration of the residual effect would vary from immediate to short-term depending on the scale of the spill and the length of time required for clean-up and response. If the spill is small and easily accessible, the residual effect may only last a couple of days. A larger spill would require a proportionately larger response and could result in increased demand on emergency services as well as increased traffic along local roadways for a number of weeks. In any scenario, the residual effect would be resolved in less than 1 year.

The magnitude of the residual effect is considered to be low to medium depending on the scale of the spill and level of emergency response. For relatively small spills, requiring only a few days for clean-up and response, the residual effect would likely be considered a nuisance or inconvenience. However, a larger spill requiring more equipment and vehicles and a longer response effort, could result in a moderate modification of the socio-economic environment if a key traffic thoroughfare were to be affected by increased traffic to the spill site. The probability of a pipeline failure occurring is considered low since a failure would occur as a result of an accident or malfunction which would happen only rarely over the life of the Project. Therefore, with the implementation of mitigation measures, the potential residual effect of pipeline failure on infrastructure and services is considered to be not significant.

6.7.4 Summary

As identified in Table 6.7.4-1, there are no situations arising from accidents and malfunctions where there is a high probability of occurrence of an irreversible residual effect of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the potential residual effects arising from an accident or malfunction will be not significant.

6.8 Changes to the Project Caused by the Environment

Enbridge has been operating a pipeline system and associated facilities in Canada for over 60 years and is aware of the typical, as well as the range of atypical, environmental conditions experienced along their system. This knowledge is reflected in the engineering design and mitigation measures recommended to address these environmental conditions.

6.8.1 Environmental Conditions Not Considered

The following environmental conditions were not considered to have the potential to adversely affect the Project during construction or operations:

- slumping; and

- wildfires.

6.8.2 Identified Potential Effects, Mitigation Measures and Potential Residual Effects

As stated in Section 6.2, environmental conditions may have adverse effects on the Project. The following environmental conditions were identified by the assessment team as having the potential to adversely affect the Project during construction or operations:

- extreme precipitation, flooding and erosion;
- severe weather events including high wind speeds (e.g., from tornadoes), heavy/persistent precipitation (e.g., from storms), extreme temperatures, lightning and temperature inversions;
- changing weather trends; and
- seismic activity.

These potential environmental conditions and recommended mitigation measures to reduce the severity of the potential effects on the Project are summarized in Table 6.8.2-1.

Table 6.8.2-1. Potential Effects, Mitigation Measures and Residual Effects of Changes to the Project Caused by the Environment

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
1.0 Loss of depth of cover due to flooding and erosion	• Watercourses • LSA	• Ensure pipeline burial depths at watercourses have taken into consideration flood events and scouring of the bed so that risk to the integrity of the pipeline due to such events is minimal. • Monitor the pipeline depth of cover within watercourses, when warranted, throughout the life of the pipeline. Complete remedial work as needed to protect pipeline integrity. • Refer to the Adverse Weather Contingency Plan and/or Erosion Control Contingency Plan (to be appended to the EPP[1]) for additional mitigation measures related to flooding and erosion.	• Loss of cover over the pipeline in isolated areas as a result of an extreme flood event
2.0 Severe weather events	• Entire Route • LSA	• Enbridge pipelines and facilities are engineered and designed to withstand the severe weather including high wind speeds (e.g., from tornadoes), heavy/persistent precipitation (e.g., from storms), extreme temperatures, lightning and temperature inversion. • Implement measures in Chapter 2 (Severe Weather) of Enbridge's O&MM Book 2 for Emergency Response.	• No residual effect identified

Table 6.8.2-1. Potential Effects, Mitigation Measures and Residual Effects of Changes to the Project Caused by the Environment

Potential Effect	Location/ Spatial Boundary	Key Mitigation Measures[1]	Potential Residual Effect(s)
3.0 Changing weather trends	• Entire Route • LSA	• Consider the changes to weather trends (e.g., snow pack conditions, timing and intensity of runoff and discharge within watercourses, amount of rainfall) within the Project area when scheduling maintenance activities along the replacement pipeline. • Understand the relationship between climatic parameters and the spread of pests that may affect vegetation and implement appropriate protection.	• Depending upon the type and severity of the change in weather trends, the scheduling of maintenance activities may be affected
4.0 Seismic activity	• Entire Route • LSA	• Suspend work immediately in the event of a seismic event. Refer to for the Emergency Response Plan for further response measures to be taken in the event of seismic activity occurring during construction.	• Seismic activity may damage the pipeline or facilities

6.8.2.1 Residual Effects Characterization and Significance Determination for Changes to the Project Caused by the Environment

Table 6.8.3-1 provides a summary of the significance evaluation of potential residual effects of changes to the Project caused by the environment. The rationale used to evaluate the significance of each of the residual effects is provided below, with the exception of impact balance which is considered negative for all potential residual effects. An evaluation of significance is not required for those potential effects where no residual effect is identified (i.e., severe weather events).

Table 6.8.3-1. Significance Evaluation of Potential Residual Effects of the Changes to the Project Caused by the Environment

Potential Residual Effects	Spatial Boundary	Temporal Context			Magnitude	Probability	Confidence	Significance
		Duration	Frequency	Reversibility				
(a) Loss of cover over the pipeline in isolated areas as a result of an extreme flood event	LSA	Immediate	Rare	Reversible	Medium	Low	High	Not significant
(b) Depending upon the type and severity of the change in weather trends, the scheduling of maintenance activities may be affected	LSA	Immediate to short-term	Rare	Reversible	Low	Low	High	Not significant
(c) Seismic activity may damage the pipeline or facilities	LSA	Immediate	Rare	Reversible	Low to high	Low	Moderate	Not significant

Loss of Cover over the Pipeline due to Flooding

An extreme flood event, either during construction, operations or decommissioning activities, could result in a loss of cover over the pipeline along flood plains and in watercourses along the replacement pipeline, or the existing Line 10 pipeline. The potential effects of flooding and associated mitigation vary depending upon the timing, location and magnitude of the event. A flood event that occurs immediately prior to the commencement of instream construction at a water crossing could delay construction activities and, in extreme cases, threaten the integrity of the temporary vehicle crossing.

The Adverse Weather Contingency Plan for Watercourse Crossings will be included in the Project-specific EPP to reduce the severity of the effects of high water levels during instream construction. The risk of a flood occurring during instream construction is considered to be low since construction is scheduled to avoid peak flows. In addition, the weather forecast applicable to the watershed for the anticipated crossing construction period is reviewed immediately prior to the commencement of water crossing construction thereby enabling the timely implementation of measures to mitigate any concerns.

Watercourse crossing construction is proposed after peak flows and the replacement pipeline will be buried deep enough to reduce the severity of the potential effects of flooding, as well as associated erosion and scouring. Nevertheless, line patrols during operation will pay particular attention to the beds and banks of watercourse crossings following floods to further ensure the integrity of the replacement pipeline and reduce the severity of potential effects on the aquatic environment. The need for weights on the pipeline to be decommissioned will be assessed prior to decommissioning activities. Remedial measures will be implemented, as warranted, following receipt of applicable approvals. Consequently, the probability of a flood resulting in a significant adverse environmental effect is low. This residual effect is considered to be medium magnitude, immediate in duration, and reversible and, therefore, is considered not significant (Table 6.8.3-1, point [a]).

Changing Weather Trends

Changes to weather trends during operation of the pipeline may manifest in several ways. Increased snow pack in winter and extended warm temperatures in spring may intensify runoff and alter hydrologic regimes within watercourses, including the timing and duration of peak flows. During operation of the replacement pipeline and associated permanent infrastructure, it is expected that Enbridge will be adaptive in their management of the pipeline and schedule maintenance activities to accommodate local environmental conditions (e.g., conducting activities in riparian areas during periods of low flow and least risk) and implement the appropriate protection measures to suit local environmental conditions so as to reduce the severity of the potential environmental effect.

By using adaptive management practices that are responsive to changing conditions, this residual effect is considered to be reversible, immediate to short-term in duration, low magnitude and low probability and, therefore, is considered not significant (Table 6.8.3-1, point [b]).

Seismic Activity

The Project is located in the Southern Great Lakes Seismic Zone which generally has a low to moderate seismic rating. There have been three major earthquakes with a magnitude of 2.5 or larger recorded in the past 30 years in this Seismic Zone (NRCan 2012). Enbridge is aware of the effect of geologic processes on pipeline infrastructure through their extensive experience with managing pipelines across North America. The Emergency Response Plan will be implemented in the event of an accident resulting from seismic activity, whether during construction, operation of the replacement pipeline and associated permanent facilities, or decommissioning activities on the existing pipeline (see Section 6.7 Accidents and Malfunctions).

The probability of a seismic event affecting the Project and resulting in a significant adverse environmental effect is low. This residual effect is considered to be low to high magnitude, immediate in duration, and reversible and, therefore, is considered not significant (Table 6.8.3-1, point [c]).

6.8.2.2 Summary

As identified in Table 6.8.3-1, there are no situations arising from the residual effects of changes to the Project caused by the environment where there is a high probability of occurrence of a permanent or long-term residual environmental effect of high magnitude that cannot be technically or economically mitigated. Consequently, it is concluded that the residual effects of changes to the Project caused by the environment will be not significant.

6.9 Summary of the Environmental and Socio-Economic Effects Assessment

The potential environmental and socio-economic effects associated with the Project are not unlike those routinely encountered during pipeline and facility construction and decommissioning in an agricultural setting.

A key consideration in the assessment of the potential effects arising from the operation of the Project was that it is a replacement project. Therefore, the potential effects associated with operation and maintenance activities will not result in a net increase in those effects since the decommissioning of the Line 10 pipeline will eliminate the need for the presently ongoing operations and maintenance of the existing Line 10 pipeline. In some cases, due to the relatively high intensity of the maintenance activities (i.e., investigation digs) along the Line 10 pipeline, the overall effects arising from the replacement pipeline will be less than the effects presently experienced along the Line 10 pipeline.

The potential environmental and socio-economic effects associated with the Project were identified through: consultation with federal and provincial government representatives as well as local CAs; consultation with landowners; engagement with Aboriginal groups; review of existing literature; field studies; and the professional judgement of the assessment team. These potential effects were related to environmental and socio-economic elements including:

- physical elements such as soil and soil productivity, water quality and quantity, air emissions, GHG emissions and acoustic environment;
- biological elements such as fish and fish habitat, wetlands, vegetation, wildlife and wildlife habitat, and species at risk;
- socio-economic elements such as HORU, heritage resources, TLRU, social and cultural well-being, human health, infrastructure and services, navigation and navigation safety, and employment and economy; and
- accidents and malfunctions.

Several mitigation strategies will be employed to avoid or reduce the severity of the potential effects of the Project including: paralleling an existing ROW for most of the length of the replacement pipeline route; scheduling of activities to avoid sensitive periods; development of practical and effective mitigation measures to address numerous site-specific and general issues; inspection during construction to ensure that planned mitigation is implemented and effective; and conducting the maintenance and operation of the pipeline system with a high standard of environmental excellence.

Through the implementation of the mitigation strategies, the potential residual effects associated with the construction and operation of the Project on the environmental and socio-economic elements were considered, in each case, to be not significant.