TRANSPORTATION ENVIRONMENTAL STUDY REPORT

HIGHWAY 401 REHABILITATION AND LONG-TERM WIDENING NEEDS FROM BROCK ROAD TO COURTICE ROAD

CITY OF PICKERING, TOWN OF AJAX, TOWN OF WHITBY, CITY OF OSHAWA,
MUNICIPALITY OF CLARINGTON, REGIONAL MUNICIPALITY OF DURHAM

CLASS ENVIRONMENTAL ASSESSMENT & PRELIMINARY DESIGN STUDY (GROUP 'B')

BOOK 1 OF 2 (MAIN REPORT)

PREPARED FOR THE MINISTRY OF TRANSPORTATION
BY: AECOM

(G.W.P. 10-20011)

NOVEMBER 2015

TRANSPORTATION ENVIRONMENTAL STUDY REPORT

CLASS ENVIRONMENTAL ASSESSMENT FOR PROVINCIAL TRANSPORTATION FACILITIES (GROUP "B")

G.W.P. 10-20011

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CITY OF PICKERING, TOWN OF AJAX, TOWN OF WHITBY, CITY OF OSHAWA, MUNICIPALITY OF CLARINGTON, REGIONAL MUNICIPALITY OF DURHAM

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NOVEMBER 2015

The Public Record

This Transportation Environmental Study Report (TESR) has been prepared under the Ontario Ministry of Transportation *Class Environmental Assessment for Provincial Transportation Facilities* (2000), in compliance with the requirements of the Ontario *Environmental Assessment Act*.

A CD copy of this document has been submitted to the following office of the Ontario Ministry of the Environment and Climate Change (MOECC) to fulfill the requirements of the Ministry of Transportation *Class Environmental Assessment for Provincial Transportation Facilities (2000)*.

Ministry of the Environment and Climate Change
Central Region Office - York Durham District
5th Floor, 230 Westney Road South
Ajax, ON L1S 7J5

This report is available for review during regular business hours at the following review locations:

Ministry of Transportation
Central Region-Toronto
Planning and Environmental Office
159 Sir William Hearst Avenue, 3rd Floor,
Toronto, ON M3M 0B7

Municipality of Clarington
Administration Centre
40 Temperance Street
Bowmanville, ON L1C 3A6

City of Pickering
City Hall
One The Esplanade
Pickering, ON L1V 6K7

Town of Ajax
Town Hall
65 Harwood Avenue South
Ajax, ON L1S 2H9

Town of Whitby
Town Hall
575 Rossland Road East
Whitby, ON L1N 2M8

City of Oshawa
City Hall
50 Centre Street South
Oshawa, ON L1H 3Z7

Pickering Central Library
One The Esplanade
Pickering, ON L1V 6K7

Ajax Public Library
55 Harwood Avenue South
Ajax, ON L1S 2H9

Whitby Central Library
405 Dundas Street West
Whitby, ON L1N 6A1

Oshawa Public Library-McLaughlin Branch
65 Bagot Street
Oshawa, ON L1H 1N2

Clarington Public Library-Courtice Branch
2590 Courtice Road
Courtice, ON L1E 2H8

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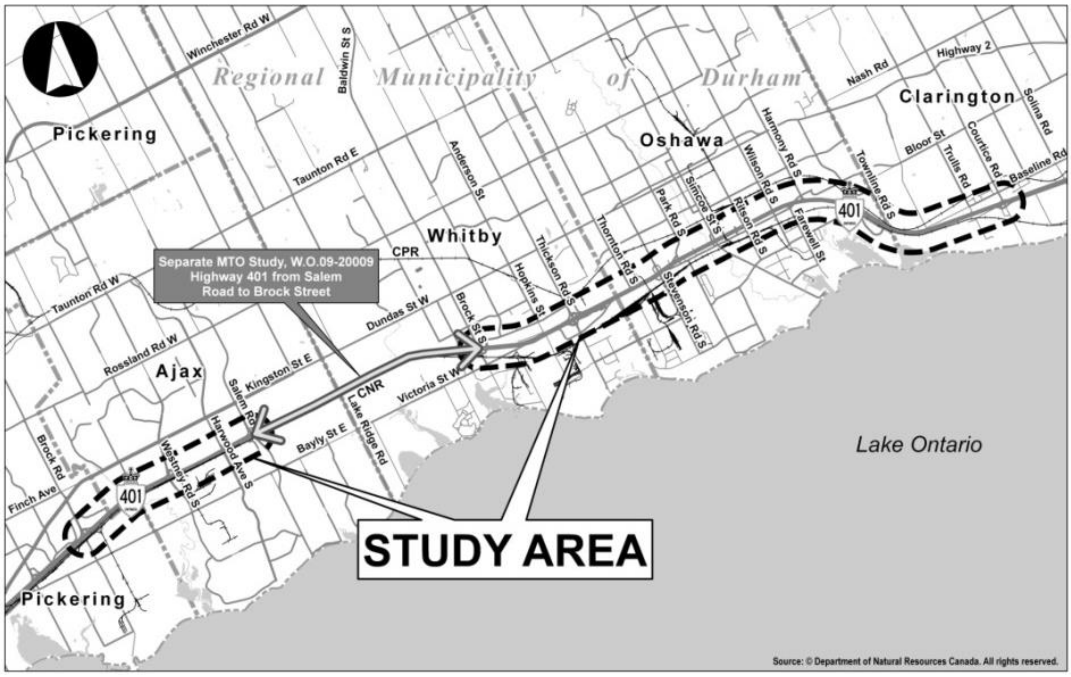
EXECUTIVE SUMMARY

The Ministry of Transportation Ontario (MTO) has retained AECOM (formerly URS Canada Inc.) to undertake a Preliminary Design and Class Environmental Assessment Study to determine the rehabilitation needs of Highway 401 from Brock Road to Courtice Road (25 km) in the City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa and the Municipality of Clarington in the Region of Durham (**Figure E-1**).

FIGURE E-1: STUDY AREA



The primary focus of this study has been to identify the rehabilitation needs of the Highway 401 corridor. In parallel, the Project Team has confirmed the long-term capacity and operational needs so that rehabilitation investments are made with knowledge of the long-term vision of the corridor. The Recommended Plan will allow the Ministry to construct interim improvements (general rehabilitation works) for Highway 401 from Brock Road to Courtice Road along with the proposed long-term widening. The long-term widening improvements may not take place for several years; therefore, MTO may proceed in advance with carrying out rehabilitation works subject to the MTO Class EA process (i.e. Detail Design).

The Recommended Plan (refer to **Chapter 8** and **Appendix C**) includes recommendations for the rehabilitation of the existing infrastructure within the Highway 401 corridor from Brock Road to Courtice Road, as well as to address the long-term capacity and operational requirements of the corridor. The section of Highway 401 from Salam Road to Brock Street was reviewed by MTO through a separate Environmental Assessment study (W.O. 09-20009) and does not form part of this TESR. In addition, the MTO's Highway 407 West Durham Link connection to Highway 401 and a new Lake Ridge Road interchange currently under

construction is also located within the limits of this project; although these Highway 407 works do not form part of this TESR. However, both of these projects have been taken into consideration as part of this study and the Recommended Plan for this study (G.W.P. 10-20011) incorporates the recommendations from the Salem Road to Brock Street study.

The following section provides an overview of the key components of the Recommended Plan.

Rehabilitation

Pavement Rehabilitation

The existing pavement throughout the Study Area consists of a combination of flexible and rigid pavement. Based on the results of the pavement condition survey, the existing pavement along this section of Highway 401 is considered to be in good condition and rehabilitation of the pavement is not required at this time. However, to address the long-term requirements for this section of Highway 401, the "Needs Year" has been identified based on the condition of the pavement and suitable rehabilitation strategies have been developed based on the results of the geotechnical investigation. The recommended Needs Year based solely on pavement requirements ranges from 2019 to 2023 depending on the section of Highway 401. The Needs Year for the existing pavement rehabilitation of Highway 401 mainline is identified in **Table E-1** below. Detailed pavement investigations will be completed during a subsequent Detail Design stage to confirm the pavement rehabilitation requirements, the timing of which is unknown at this time. Further details regarding the pavement recommendations along the corridor are provided in **Section 8.1.1.**

TABLE E-1: PRELIMINARY PAVEMENT REHABILITATION TIMING – HIGHWAY 401 MAINLINE

Road Section	Rehabilitation Timeline*
Brock Road to Salem Road	2022
Brock Street to Stevenson Road	2019
Stevenson Road to Harmony Road	2023
Harmony Road to Courtice Road	2023

**Based on pavement requirements only*

Bridge Rehabilitation

A total of 19 bridges are located within the Study Area, ranging in age from 11 to 78 years old (as of 2015). The majority of existing structures will require some form of rehabilitation within the next 20 years based on the condition and age of the structure, while a number of the structures are recommended for rehabilitation or replacement within the next 5 years. Further details regarding the structural rehabilitation requirements along the corridor are provided in **Section 8.1.2**. The recommended rehabilitation strategy for the existing structures includes:

- Rehabilitation of existing structures at Brock Road, Duffins Creek, Westney Road, Salem Road, Thickson Road, Oshawa Creek, and Bloor Street (over Harmony Creek);

- Replacement of existing structures at Park Road, Cubert Street, Simcoe Street, Albert Street, Ritson Road, Wilson Road, Bloor Street (over Highway 401), and Farewell Creek.

Additional structural improvements are required at the majority of locations to accommodate the recommended widening of Highway 401 and associated interchange modifications, described below.

In addition to the pavement and structural rehabilitation requirements, ongoing rehabilitation, repairs and general maintenance of other infrastructure along the corridor, such as existing signage, culverts, stormwater management ponds and electrical equipment will be completed as required.

Ultimate (Long-Term) Improvements

The Recommended Plan for Highway 401 within the Study Area is described in **Section 8.2** and includes the following:

Highway 401 Mainline

- Widen Highway 401 from the existing 10-lane cross-sections to a 12-lane cross-section (extend existing Express-Collector system to the east) from Brock Road to the future West Durham Link;
- Widen Highway 401 from the existing 6-lane cross-sections to a 10-lane cross-section (no Express-Collector system) from the future West Durham Link to Courtice Road.

Interchange Capacity and Operations

- Minor interchange modifications at Brock Road, Westney Road, Salem Road, Thickson Road, and Stevenson Road to accommodate the recommended widening of Highway 401;
- Major interchange reconfigurations at Simcoe Street / Ritson Road and Harmony Road interchanges including provision of new ramps to and from Highway 401;
- Closure of existing interchange ramps at Drew Street, west of Ritson Road.

Structures

In addition to the general structure rehabilitation and replacement requirements discussed previously, structural improvements to accommodate the recommended widening of Highway 401 and associated interchange modifications include:

- Widening of existing structures at Duffins Creek, Westney Road, Salem Road, Oshawa Creek and Bloor Street (over Harmony Creek);
- Modifications to existing structural embankments at Brock Road and Thickson Road including construction of retaining walls at structures;
- New structures at Simcoe Street westbound on-ramp over Oshawa Creek, Harmony Road / Highway 401, and Bloor Street realignment over Farewell Creek;
- Replacement of existing structures at Park Road, Cubert Street, Simcoe Street, Albert Street, Ritson Road, Wilson Road, Bloor Street (over Highway 401), and Farewell Creek

given both the age and condition of the structures and to accommodate the long-term widening of Highway 401.

Additional details of these recommendations are provided in **Section 8.2.3**.

Other Improvements

- Electrical work including upgraded or new illumination systems, new traffic signals and modifications and/or replacements to existing traffic signals (refer to **Section 8.2.4**).
- Drainage improvements, including culvert rehabilitation, replacement and extensions (to accommodate highway widening), replacement of existing storm sewers, new or improved ditching, and three new stormwater management ponds in the northeast quadrant of the Westney Road interchange (within the northbound to westbound on-ramp), south of Highway 401 west of Park Road, and south of Highway 401 east of Farewell Creek (refer to **Section 8.2.5**).
- New retaining walls at structures and throughout the Study Area to minimize or avoid property impacts;
- Implementation of Intelligent Transportation Systems (ITS) such as cameras, variable message signs and traffic detectors systems;
- Overhead signing upgrades and new or improved guiderail where required.

Utilities

- Utility relocation to accommodate the ultimate highway improvements (refer to **Section 9.4.4**).

Key Environmental Impacts & Proposed Mitigation Measures

Natural

The ultimate improvements to this section of the Highway 401 corridor will require extensions or replacement of watercourse culverts and bridges which will result in permanent impact to fish and fish habitat. Mitigation measures to address these impacts have been identified and restoration / enhancement / compensation to support future approvals under the Federal *Fisheries Act* will be addressed during future Detail Design stages. Minor vegetation removals (predominantly ornamental vegetation as well as some riparian vegetation) will also be required throughout the corridor to accommodate the Recommended Plan. Commitments for development of a Landscape Plan have been identified for subsequent Detail Design stages. Refer to **Section 9.1** and **Table 9-9** for additional details regarding impacts and proposed mitigation measures associated with the Natural Environment.

Socio-Economic

The Recommended Plan will result in impacts to residential and commercial properties as well as to various parks or other features adjacent to the corridor due to the proposed highway widening and interchange improvements. The Project Team also undertook an assessment of potential noise and air quality impacts as part of this study. Refer to **Section 9.2** and **Table 9-5** for

additional details regarding impacts and proposed mitigation measures associated with the Socio-Economic environment.

Cultural

Additional Stage 2 archaeological assessment investigations will be required during subsequent Detail Design stages. In addition, some impacts to built heritage features adjacent to the Highway 401 corridor are anticipated due to the proposed highway improvements.

Mitigation measures have been identified to eliminate or minimize the natural, socio-economic and cultural impacts resulting from implementation of the recommended highway improvements. Refer to **Chapter 4** for a description of existing conditions within the Study Area and **Section 9.3** and **Table 9-7** for additional details regarding impacts and proposed mitigation measures associated with the Cultural environment.

Consultation

Government agencies, Aboriginal Communities, municipalities, emergency services providers, interest groups and utility companies were notified of the commencement of this study by letter in October 2012. Stakeholders were also notified via newspaper advertisements and letters, informing them of the study and to solicit their comments. Two Public Information Centres were held for this study in March 2013 (to present the need for improvements and alternatives under consideration) and in November 2014 (to present the evaluation of alternatives, the Technically Preferred Plan and the proposed mitigation measures). Numerous meetings were held with GO Transit / Metrolinx, the Regional Municipality of Durham, City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa, Municipality of Clarington, City of Oshawa Development Services Committee, Toronto and Region Conservation Authority (TRCA), and Central Lake Ontario Conservation Authority (CLOCA) at key milestones and decision points throughout the study. An overview of consultation undertaken as part of this study is provided in **Chapter 3**.

BOOK 1 OF 2 – MAIN REPORT

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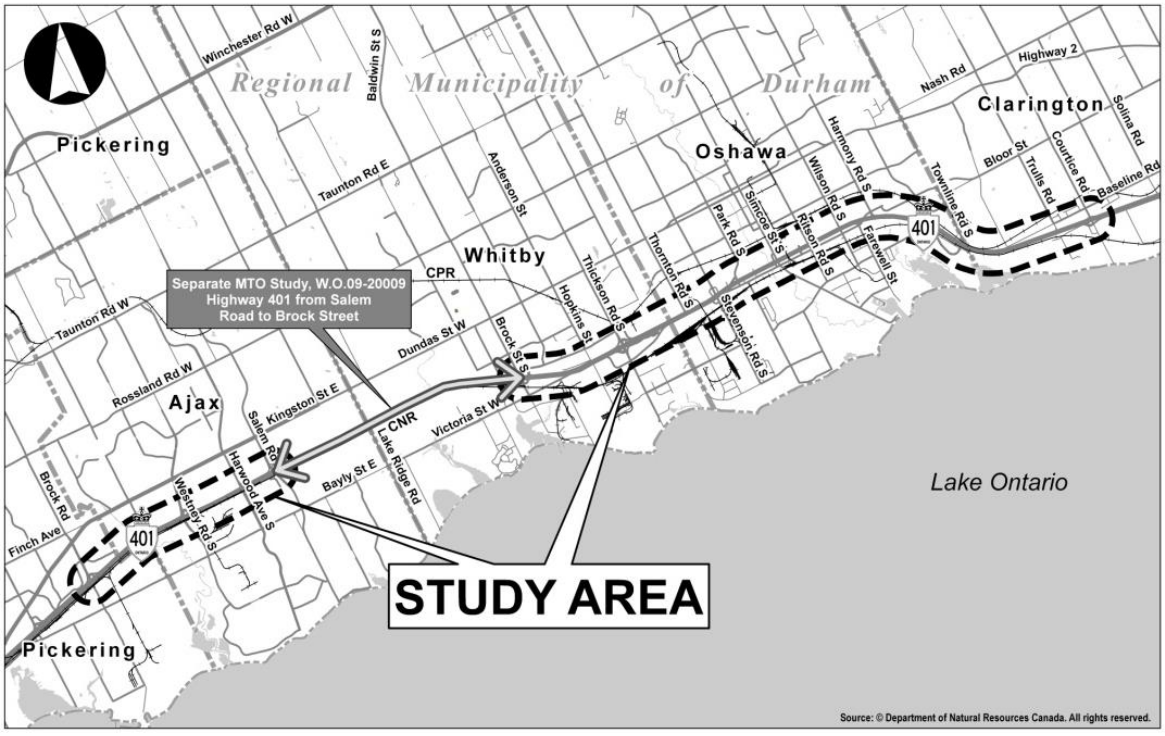
1.0 OVERVIEW OF THE PROJECT

1.1 STUDY BACKGROUND AND LOCATION

The Ontario Ministry of Transportation (MTO) retained AECOM (formerly URS Canada Inc.) to undertake a Class Environmental Assessment and Preliminary Design Study for the 25 km stretch of Highway 401 from Brock Road in the City of Pickering to Courtice Road in the Municipality of Clarington (**Figure 1-1**). The primary focus of this study was to confirm the rehabilitation needs of the corridor. In parallel, the Project Team has confirmed the long-term capacity and operational needs so that rehabilitation investments can be made with an understanding of the long-term vision for the corridor.

The Recommended Plan will allow the Ministry to construct interim improvements (general rehabilitation works) for Highway 401 from Brock Road to Courtice Road along with the proposed long-term widening. The long-term widening improvements may not take place for several years; therefore, MTO may proceed in advance with carrying out rehabilitation works subject to the MTO Class EA process (i.e. Detail Design).

FIGURE 1-1: STUDY AREA



The section of Highway 401 between Salem Road and Brock Street was excluded from this study as it was previously reviewed as part of a separate study (W.O. 09-20009) that considered the capacity, operational, and safety requirements of that section of Highway 401. That study also included the integration of the planned improvements for the Highway 407 West Durham Link connection to Highway 401 and a new Lake Ridge

Road interchange. The Recommended Plan for this study (G.W.P. 10-20011) incorporates the recommendations from the Salem Road to Brock Street study.

Highway 401 (also known as the MacDonald-Cartier Freeway) is an important freeway facility that extends across Southern, Central and Eastern Ontario. It is the longest 400-Series Highway in Ontario, beginning at Highway 3 in Windsor, 13 km from the Detroit River, and extending to the Quebec border, 818 km to the east.

Within the study limits, existing Highway 401 is an urban 10-lane divided freeway between Brock Road and Salem Road and 6-lane divided freeway east of Salem Road. It is a Controlled Access Highway with a design speed of 120 km/h and a posted speed of 100 km/h.

Growth Plan for the Greater Golden Horseshoe

In June 2006, the province of Ontario released the *Growth Plan for the Greater Golden Horseshoe* (the *Growth Plan*), which outlines a set of policies for managing growth, development and guiding planning decisions in the Greater Golden Horseshoe (GGH). As outlined in Section 1.1 of the *Growth Plan*, the plan provides a framework for implementing the Government of Ontario's vision for building stronger, prosperous communities by better managing growth in this region to 2031. The GGH extends around the west side of Lake Ontario from the Region of Niagara to the County of Northumberland, and includes the Region of Durham. The *Growth Plan* provides population and employment projections for each of the municipalities within the GGH for the ultimate 2031 planning horizon. In addition, it specifies land use intensification and density targets for each of the municipalities in order to provide for the efficient movement of people and goods. Within the current Study Area, the *Growth Plan* identifies the Urban Growth Centres of Downtown Pickering and Downtown Oshawa.

The rehabilitation and ultimate highway widening and interchange improvements identified in this Transportation Environmental Study Report (TESR) are consistent with the objectives of the *Growth Plan* as these improvements to Highway 401 form part of the infrastructure required to support the future population and employment growth.

Greenbelt Act / Greenbelt Plan

The *Greenbelt Act and Plan* came into effect in December 2004. The *Greenbelt Plan* includes 800,000 acres of land protected by the *Niagara Escarpment Plan* and the *Oak Ridges Moraine Conservation Plan*. The *Greenbelt* Plan identifies where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological features and functions occurring on this landscape. The *Greenbelt Plan* is a cornerstone of the *Growth Plan.*

The Study Area is not located within the area governed by the *Greenbelt Plan*. Highway 401 does cross lands designated as "Protected Countryside" at the boundary between the Town of Ajax and the Town of Whitby. However, that area was considered as part of the

previous Salem Road to Brock Street study and was not specifically reviewed as part of the current study.

1.2 STUDY PURPOSE, OBJECTIVES AND SCOPE

The purpose of this study was to examine all aspects of the existing Highway 401 corridor between Brock Road and Courtice Road to determine the rehabilitation needs within the corridor. This included a detailed examination of the existing condition and rehabilitation requirements along the corridor including existing pavement, structures, illumination and drainage.

In parallel, the Project Team undertook traffic analysis based on a planning horizon of 2031 to determine the long-term needs of the corridor from the perspective of the number of highway lanes required and the operation of the interchanges. Alternatives were developed, assessed and evaluated for the future widening of Highway 401, and for interchange improvements required to accommodate the future widening of the corridor and address existing and future safety and operational concerns.

In assessing the highway widening and interchange alternatives, a complete assessment of the potential impacts to the Natural, Social, Economic, and Cultural Environment was completed, along with Transportation Considerations and Cost. The assessment and evaluation of the alternatives included consultation with and input from municipal, agency and public stakeholders. Once a Recommended Plan was selected, a preliminary design was prepared and mitigation measures to minimize or avoid potential environmental impacts were developed. The study also included defining commitments to future work to be initiated during Detail Design and construction.

This study will form the basis for the follow-up Detail Design and preparation of contract packages for construction, the timing of which was unknown at the time of preparing this report.

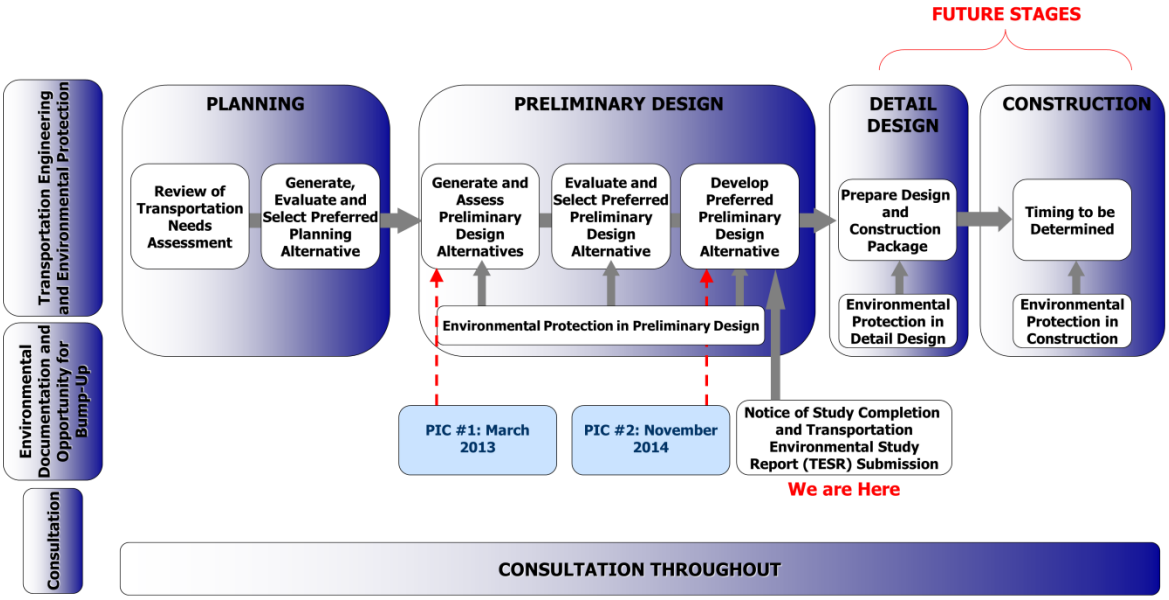
1.3 STUDY PROCESS

This study followed the approved planning process for a Group 'B' project under the *Class EA for Provincial Transportation Facilities (2000)*. **Figure 1-2** shows an overview of the Class EA process for Group 'B' projects. The study process provided opportunities for public and external agency review at key project milestones, as well as for a continuous, evolving approach to the technical work involved.

"Study Commencement" involved notifying government agencies, Aboriginal Communities, municipalities, interest groups and members of the public that the study was commencing. This involved placing advertisements in local newspapers and mailing notification letters to inform potentially interested and affected stakeholders of the study. Interested parties were asked to contact the Project Team for further information and/or to be placed on the project mailing list.

After documenting the existing conditions within the Study Area, the Project Team developed alternatives for improvements to this section of the Highway 401 corridor. Alternatives under consideration were presented at the first Public Information Centre (PIC) in March 2013. The next stage of the study process involved assessing and evaluating the various alternatives to arrive at the Recommended Plan. The assessment and evaluation of alternatives, the Recommended Plan and the proposed mitigation measures were presented to the public and external agencies during the second and final PIC held in November 2014. An overview of the consultation activities and input received is outlined in **Chapter 3**. Details of the Recommended Plan are documented in **Chapter 8**.

FIGURE 1-2: OVERALL STUDY PROCESS



This TESR documents the process that was followed leading to the selection of the Recommended Plan, and has been made available beginning **November 20, 2015** for a 30-day public review period. Interested persons are encouraged to review the TESR and provide written comments to the MTO during the 30-day review period (ending **December 19, 2015**).

During the 30-day review period, interested parties are encouraged to bring any potential concerns regarding the project to the attention of the project consultants (AECOM) and MTO. If, after consulting with MTO and Consultant staff, you still have serious unresolved concerns, you have the right to request the Minister of the Environment and Climate Change (in writing to: **77 Wellesley Street West, 11th Floor, Ferguson Block, Toronto, Ontario M7A 2T5**) to issue a Part II Order (i.e. "bump up") for the proposed changes to the improvements to this section of the Highway 401 corridor. A Part II Order may lead to the preparation of an Individual Environmental Assessment. A copy of the Part II Order request that is sent directly to the Minister of the Environment and Climate Change should also be forwarded to Ministry of Transportation and Consultant staff at the addresses listed below. If there are no outstanding concerns at the end of the

30-day review period (ending **December 19, 2015**) the project will be considered to have met the requirements of the Class EA.

The Ministry of Transportation and AECOM Project Team members are available to discuss details, refer to **Section 2.3** for contact information.

1.4 RELATED STUDIES / PROJECTS

The following provides a brief overview of related projects or studies completed within or adjacent to the study limits.

- **Highway 401 from Salem Road to Brock Street:** This Class Environmental Assessment and Preliminary Design Study was undertaken to address the capacity, operational, and safety requirements for Highway 401 within the study limits, including integration of the planned improvements for the Highway 407 West Durham Link connection to Highway 401 and a new Lake Ridge Road interchange. The study was completed in 2012.
- **Highway 407 East – West Durham Link**: Highway 407 will be extended from Brock Road to Highway 35/115 with two 10 km north-south links to Highway 401. One of the north-south links, the West Durham Link, will connect to Highway 401 between Salem Road and Brock Street. The 407 East Extension will be implemented in phases. Construction has started on Phase 1. At the end of Phase 1, approximately 22 km of new east-west highway from Brock Road in Pickering to Harmony Road in Oshawa, and the 10 km of north-south highway, West Durham Link, connecting Highway 407 East and Highway 401 will be opened to traffic. For more information, visit: www.highway407east.com.
- **Strategic Rehabilitation of Highway 401 from Warden Avenue to Brock Road:** This Class Environmental Assessment and Preliminary Design Study was undertaken to determine the long-term strategy for rehabilitation of the existing express / collector freeway section of Highway 401 between Warden Avenue and Brock Road. This study included the consideration of alternatives to improve the operational, geometric and safety conditions along this section of Highway 401, preliminary construction staging and contract sequencing for the recommended highway improvements, as well as the consideration of transit friendly initiatives. The study was completed in 2012.
- **Highway 401 Improvements from Courtice Road to East Townline Road:** This Class Environmental Assessment and Preliminary Design Study was completed to identify a rehabilitation strategy for this section of the Highway 401 corridor. The long-term need for widening Highway 401 and improving interchange capacity and operations was identified to support the development of a rehabilitation strategy and interim operational improvements, and to provide a long-term vision for the corridor. The Transportation Environmental Study Report for this study was filed in January 2014.
- **GO Transit Oshawa to Bowmanville Service Expansion and East Region Rail Maintenance Facility in Whitby:** An Environmental Assessment and Preliminary Design Study was completed in February 2011 recommending an

expansion of GO Train service from Oshawa to Bowmanville and the construction of a new rail maintenance facility in Whitby, south of Victoria Street and west of Hopkins Street. As part of this study, a new Highway 401 crossing is proposed east of Thickson Road and new GO Stations are proposed near Thornton Road, between Simcoe Street and Ritson Road, and Courtice Road.

A number of additional transit initiatives are planned or are being constructed in the Study Area, including the following:

- GO Transit study for a third track on the Lakeshore East corridor from Pickering to Whitby.
- Metrolinx / GO Transit electrification of the combined Kitchener and Lakeshore rail corridors.

A number of current and planned municipal initiatives in the vicinity of the Study Area were also reviewed and considered as part of the study process, including:

- Widening of Brock Road to 6-lane north and south of Highway 401 by Region of Durham (EA Study complete).
- Future Highway 401 crossing at Hopkins Street in Town of Whitby by Region of Durham (EA Study complete).
- Proposed realignment and widening of Victoria Street / Bloor Street by Region of Durham (EA Study complete);
- Planned re-construction and widening of Champlain Avenue by Region of Durham (Detail Design in progress);
- Future interchanges designated in Regional Official Plan at Colonel Sam Drive and Townline Road Extension / Prestonvale Road.

1.5 GENERAL DESCRIPTION OF THE RECOMMENDED PLAN

The Recommended Plan (refer to **Chapter 8** and **Appendix C**) includes recommendations for the rehabilitation of the existing infrastructure within the Highway 401 corridor, as well as to address the long-term capacity and operational requirements of the corridor. Key details of the Recommended Plan are outlined below.

Rehabilitation

Pavement Rehabilitation

The existing pavement throughout the Study Area consists of a combination of flexible and rigid pavement. Based on the results of the pavement condition survey, the existing pavement along this section of Highway 401 is considered to be in good condition and rehabilitation of the pavement is not required at this time. However, to address the long-term requirements for this section of Highway 401, the "Needs Year" has been identified based on the condition of the pavement and suitable rehabilitation strategies have been developed based on the results of the geotechnical investigation. The recommended Needs Year based solely on pavement requirements ranges from 2019 to 2023 depending

on the section of Highway 401. The Needs Year for the existing pavement rehabilitation of Highway 401 mainline is listed in **Table 1-1** below. Detailed pavement investigations will be completed during a subsequent Detail Design stage to confirm the pavement rehabilitation requirements. Further details regarding the pavement recommendations along the corridor are provided in **Section 8.1.1**.

TABLE 1-1: PRELIMINARY PAVEMENT REHABILITATION TIMING – HIGHWAY 401 MAINLINE

Road Section	Rehabilitation Timeline*
Brock Road to Salem Road	2022
Brock Street to Stevenson Road	2019
Stevenson Road to Harmony Road	2023
Harmony Road to Courtice Road	2023

**Based on pavement requirements only*

Bridge Rehabilitation

A total of 19 bridges are located within the Study Area, ranging in age from 11 to 78 years old (as of 2015). The majority of existing structures will require some form of rehabilitation within the next 20 years based on the condition and age of the structure, while a number of the structures are recommended for rehabilitation or replacement within the next 5 to 10 years. Further details regarding the structural rehabilitation requirements along the corridor are provided in Section 8.1.2. The recommended rehabilitation strategy for the existing structures includes:

- Rehabilitation of existing structures at Brock Road, Duffins Creek, Westney Road, Salem Road, Thickson Road, Oshawa Creek, and Bloor Street (over Harmony Creek);
- Replacement of existing structures at Park Road, Cubert Street, Simcoe Street, Albert Street, Ritson Road, Wilson Road, Bloor Street (over Highway 401), and Farewell Creek.

Additional structural improvements are required at the majority of locations to accommodate the recommended widening of Highway 401 and associated interchange modifications, described below.

In addition to the pavement and structural rehabilitation requirements, ongoing rehabilitation, repairs and general maintenance of other infrastructure along the corridor, such as existing signage, culverts, stormwater management ponds and electrical equipment will be completed as required.

Ultimate (Long-Term) Improvements

The Recommended Plan for Highway 401 within the Study Area is described in **Section 8.2** and includes the following:

Highway 401 Mainline

- Widen Highway 401 from the existing 10-lane cross-sections to a 12-lane cross-section (extend existing Express-Collector system to the east) from Brock Road to the future West Durham Link;
- Widen Highway 401 from the existing 6-lane cross-sections to a 10-lane cross-section (no Express-Collector system) from the future West Durham Link to Courtice Road.

Interchange Capacity and Operations

- Minor interchange modifications at Brock Road, Westney Road, Salem Road, Thickson Road, and Stevenson Road to accommodate the recommended widening of Highway 401;
- Major interchange reconfigurations at Simcoe Street / Ritson Road and Harmony Road interchanges including provision of new ramps to and from Highway 401;
- Closure of existing interchange ramps at Drew Street, west of Ritson Road.

Structures

In addition to the general structure rehabilitation and replacement requirements discussed previously, structural improvements to accommodate the recommended widening of Highway 401 and associated interchange modifications include:

- Widening of existing structures at Duffins Creek, Westney Road, Salem Road, Oshawa Creek and Bloor Street (over Harmony Creek);
- Modifications to existing structural embankments at Brock Road and Thickson Road including construction of retaining walls at structures;
- New structures at Simcoe Street westbound on-ramp over Oshawa Creek, Harmony Road / Highway 401, and Bloor Street realignment over Farewell Creek;
- Replacement of existing structures at Park Road, Cubert Street, Simcoe Street, Albert Street, Ritson Road, Wilson Road, Bloor Street (over Highway 401), and Farewell Creek given both the age and condition of the structures and to accommodate the long-term widening of Highway 401. Additional details of these recommendations are provided in **Section 8.2.3**.

Other Improvements

- Electrical work including upgraded or new illumination systems, new traffic signals and modifications and/or replacements to existing traffic signals.
- Drainage improvements, including culvert rehabilitation, replacement and extensions (to accommodate highway widening), replacement of existing stormsewers, new or improved ditching, and new stormwater management ponds in the northeast quadrant of the Westney Road interchange (within the northbound to westbound on-ramp), south of Highway 401 west of Park Road, and south of Highway 401 east of Farewell Creek (refer to **Section 8.2.5**).
- New retaining walls at structures and throughout the Study Area to minimize or avoid property impacts;

- Implementation of Intelligent Transportation Systems (ITS) such as cameras, variable message signs and traffic detectors systems;
- Overhead signing upgrades and new or improved guiderail where required.

Utilities

- Utility relocation to accommodate the ultimate highway improvements (refer to **Section 9.4.4**).

2.0 ENVIRONMENTAL ASSESSMENT PROCESS

2.1 THE ONTARIO ENVIRONMENTAL ASSESSMENT ACT

The purpose of *Ontario's Environmental Assessment Act* (*OEAA*) is to help protect and conserve Ontario's environment by ensuring that projects subject to the *EA Act* follow a planning process leading to environmentally sound decision-making. For projects subject to the *EA Act*, an environmental assessment involves identifying and planning for environmental issues and effects prior to implementing a project. The process allows reasonable opportunities for public involvement in the decision-making process of the project. An EA document is prepared by the proponent of the project and is subject to review by the public and government agencies before project approval is given.

The MTO *Class Environmental Assessment for Provincial Transportation Facilities* (2000) (*Class EA*) process is a planning process approved under the *EA Act* that provides a streamlined process that must be followed for projects or activities within a defined "class". When the *Class EA* planning process is adhered to for a project, the requirements of the *EA Act* are also fulfilled and formal approval under the *EA Act* is not required. The *Class EA* requirements must be met before a project can be implemented. Projects and activities that are defined within a "class" are generally ones that are recurring, carried out routinely and have predictable environmental impacts that can be mitigated to some extent.

The word "environment" in this context is defined as any aspect of life that may be impacted by an undertaking. Therefore, "the environment" can include aspects of the natural, social, economic and cultural environments depending on the project in question. Project groupings within the Class EA were established for the purposes of consultation, documentation and formal EA challenge (bump-up).

The groups are as follows:

- Group "A" – Projects involving new facilities;
- Group "B" – Projects involving major improvements to existing facilities;
- Group "C" – Projects involving minor improvements to existing facilities; and
- Group "D" – Activities that involve operation, maintenance, administration and miscellaneous work for provincial transportation facilities. These activities are approved under the OEAA subject to compliance with applicable environmental legislation other than the OEAA.

Provided MTO follows the principles and the planning process of the Class EA, no formal approval is required under the *EA Act*. This project has complied with the requirements of the MTO Class EA for a Group 'B' project.

Other aspects of the environmental assessment process applicable to these project types are contained in the Ministry's Class EA document. Readers interested in these matters

are encouraged to visit www.mto.gov.on.ca (Publications – Environmental Standards and Practices).

2.2 FEDERAL APPROVALS AND PERMITS

In July 2012, the Government of Canada released new regulations required to implement the *Canadian Environmental Assessment Act, 2012* (CEAA 2012). CEAA 2012 establishes a federal environmental assessment process focused on major projects that have a greater potential to have significant adverse effects on areas within federal jurisdiction. The types of activities to which CEAA 2012 applies ("designated projects") are identified in the regulations. CEAA 2012 requires the proponent of a designated project to submit a description of the project to the Canadian Environmental Assessment Agency (the Agency). Upon receipt of a project description, the Agency has 45 days, including a 20-day public comment period, to determine whether a federal environmental assessment is required.

The proposed improvements to this section of the Highway 401 corridor are not listed as "designated projects" under CEAA 2012 and therefore CEAA approvals are not required for this undertaking.

This project has been undertaken in accordance with the *2006 MTO / DFO* (Department of Fisheries and Oceans) */ MNRF* (Ministry of Natural Resources and Forestry) *Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings* (the Protocol). DFO is responsible for reviewing MTO projects, determining whether the Federal *Fisheries Act* applies and issuing a *Fisheries Ac*t authorization, if required.

Preliminary fisheries assessments were conducted on 18 crossings within the Study Area that provide direct and/or indirect fish habitat. Based on the results of the preliminary assessment, there are several crossings with moderate or low risks of resulting in serious harm to fish. As a result, MTO Project Notification forms will need to be prepared and submitted to DFO in Detail Design prior to construction. For further details on the fisheries assessment, refer to **Chapter 9**.

2.3 PURPOSE OF THE TRANSPORTATION ENVIRONMENTAL STUDY REPORT

This Highway 401 project (from Brock Road to Courtice Road) is classified as a Group "B" undertaking under the MTO *Class EA* due to the nature / scope of the undertaking. This Transportation Environmental Study Report (TESR) has been prepared and provides information on the environmental effects, proposed mitigation measures, and the process that has been followed leading to the selection of the Recommended Plan, as well as the technical findings of the study. This study will form the basis for the follow-up Detail Design and preparation of contract packages for construction, the timing of which was unknown at the time of preparing this report.

As required under the Class EA, this TESR is being made available to the public, other interested parties and external agencies for a 30-day review period at the following locations:

- Ministry of Transportation, Central Region
- City of Pickering, City Hall
- Town of Ajax, Town Hall
- Town of Whitby, Town Hall
- City of Oshawa, City Hall
- Municipality of Clarington, Administration Centre
- Pickering Central Library, Central Branch - One The Esplanade
- Ajax Public Library, Main Branch
- Whitby Central Library, Central Branch
- Oshawa Public Library, McLaughlin Branch
- Clarington Public Library, Courtice Branch
- AECOM, Richmond Hill

To notify interested parties of the opportunity to review this TESR, a *"Notice of Study Completion and Transportation Environmental Study Report Submission"* was placed in the *Ajax Pickering News Advertiser*, *Oshawa Whitby Clarington This Week*, and the *Toronto Star*, and is also available online at www.durhamregion.com/printeditions. Letters were also sent to individuals on the project mailing list the week of November 16, 2015.

During the 30-day review period, interested parties are encouraged to bring any potential concerns regarding the project to the attention of the project consultants (AECOM) and MTO. If, after consulting with MTO and AECOM staff, serious unresolved concerns are identified, individuals have the right to request the Minister of the Environment and Climate Change (in writing to: **77 Wellesley Street West, 11th Floor, Ferguson Block, Toronto, Ontario M7A 2T5**) to issue a Part II Order (i.e. "bump up") for this project. A Part II Order may lead to the preparation of an Individual Environmental Assessment. A copy of the Part II Order request that is sent directly to the Minister of the Environment and Climate Change should also be forwarded to Ministry of Transportation and Consultant staff at the addresses listed below. If there are no outstanding concerns at the end of the review period (ending **December 19, 2015**) the project will be considered to have met the requirements of the Class EA.

The MTO and consultant representatives named below may be contacted to further discuss this project.

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3.0 CONSULTATION

3.1 OVERVIEW

The Project Team developed a thorough and comprehensive consultation program for this project which provided opportunities for members of the public, municipal staff, Aboriginal Communities and external agency staff to engage in the study and provide meaningful input throughout the entire study process.

One of the primary objectives of this study, from the earliest planning stages, was to make decisions only after considering all of the potential impacts of the various improvements considered. Consultation with affected parties played an important role in this regard, in terms of identifying potential impacts as well as helping the Project Team to understand the relative advantages and disadvantages associated with the alternatives that were being considered. In this way, the project's stakeholders helped the Project Team to shape the outcome of this study.

Further to the above, members of the public, municipalities, government agencies, Aboriginal Communities and other stakeholders were provided the opportunity to review and comment on the existing condition information collected, the proposed alternatives, the evaluation methodology and evaluation of the alternatives, the identified impacts and the proposed mitigation measures along with the Recommended Plan.

A mailing list of interested individuals was established and continuously updated throughout the study. The purpose of this list was to ensure that individuals who had an interest in the study were kept informed of upcoming events and the progress of the project. The list included members of the public, the municipalities, government agencies, Aboriginal Communities, property owners within the Study Area, individuals who signed the visitor's register at the PIC and/or contacted the Project Team directly through the project website, phone, fax or email, and other stakeholders.

The public was formally invited to comment on the study and participate in the decision-making process through two PICs, which were held at key project milestones. The PICs were informal drop-in centres where information was provided on display boards. This information could be discussed with the Project Team at any time during the PIC events. A comment sheet was provided so attendees could submit written comments.

Additionally, a project website (www.highway401brocktocourtice.ca) was established to provide up-to-date information, including notices of upcoming events, PIC displays, FAQs, and a contact form for access to the Project Team.

Throughout the study and as described in **Section 3.4.1**, numerous meetings were held with municipal and agency staff to discuss the project and obtain input on key project decisions. In addition, Aboriginal Communities were consulted throughout the project including notification at study commencement and in advance of the two PICs.

The following sections provide more specifics about the consultation process that was followed for this undertaking.

3.2 PUBLIC CONSULTATION

3.2.1 Notice of Study Commencement

A "Notice of Study Commencement" was advertised in the following local newspapers: *Ajax Pickering News Advertiser* on Wednesday October 17, 2012, in the *Oshawa Whitby Clarington This Week* on Thursday October 18, 2012, and in the *Toronto Star* on Friday October 19, 2012 to inform area residents of the project. Interested parties were asked to contact the Project Team for further information and/or to be placed on the mailing list. The *French Language Service Act (FLSA)* requirements were not required for this study.

3.2.2 Notice of Public Information Centres

The first of two rounds of PICs was held in March 2013, and provided information on the existing Study Area conditions, the rehabilitation needs that had been identified, the existing and future transportation needs, and the mainline and interchange alternatives being considered. The second PIC was held in November 2014, and presented the final rehabilitation recommendations, as well as the evaluation of the alternatives and the Technically Preferred Plan for improvements to this section of the Highway 401 corridor.

Notification for each of the PICs was provided through:

- Advertisements in local newspapers:
  - Notice of the PIC # 1 was published in the *Ajax Pickering News Advertiser* on Wednesday March 6, 2013, the *Oshawa Whitby Clarington This Week* on Thursday March 7, 2013, the *Toronto Star* on Friday March 8, 2013, and in the online newspapers at www.durhamregion.com/printeditions.
  - Notice of the PIC # 2 was published in the *Ajax Pickering News Advertiser* on Thursday November 6, 2014, the *Oshawa Whitby Clarington This Week* on Thursday November 6, 2014, the *Toronto Star* on Friday November 7, 2014, and in the online newspapers at www.durhamregion.com/printeditions.
- Letters to individuals on the Project Team's study mailing list:
  - Invitation letters to PIC # 1, dated March 4, 2013, were distributed via Canada Post. This included individuals who requested to be added to the mailing list after receiving the Study Commencement notification, government agencies, ministries, municipalities and interest groups.
  - Invitation letters to PIC # 2, dated November 3, 2014, were distributed via Canada Post. In addition to those individuals already on the mailing list, this list included individuals who signed up at the first PIC.
- Brochures were hand delivered to property owners (second row from the existing MTO right-of-way) along Highway 401 between Park Road and Wilson Road.
- Details of PIC # 1 and PIC # 2 were posted on the project website's Home Page (www.highway401brocktocourtice.ca).

- In addition, the Ontario Government Notices were posted on the banner of the Home Page, on the Notices Page, and on the Public Information Centres Page of the project website. The PIC display material and Frequently Asked Questions (FAQs) related to each PIC were also uploaded for stakeholders who were unable to attend the event to access information.

- Prior to PIC # 2, letters were mailed to property owners directly impacted by the Recommended Plan encouraging them to attend PIC # 2 or call the Project Team to discuss the potential impacts and Recommended Plan.

3.2.3 Public Information Centre #1

The first PIC was held at two venues - Wednesday March 20, 2013 at the Quality Hotel and Conference Centre in the City of Oshawa and on Thursday March 21, 2013 at the Ajax Convention Centre in the Town of Ajax. Both events ran from 4:00 p.m. to 8:00 p.m.

The purpose of the PIC was to provide the opportunity for comment on the study purpose and process, schedule, existing conditions, need and justification, alternatives being considered, and next steps.

A total of 52 stakeholders chose to sign the visitor's register for this round of PICs (31 at the Oshawa location and 21 at the Ajax location). Staff from the City of Oshawa, Municipality of Clarington, Region of Durham, Town of Ajax, Central Lake Ontario Conservation Authority, and Rouge Valley Health Centre attended the PIC.

In addition to responding to verbal comments, the Project Team encouraged visitors to express, in writing, all comments and concerns they had regarding the study. In total, 32 written comments were received during this round of PICs - 4 comments at the Oshawa PIC location, 1 comment at the Ajax PIC location, and 27 written comments later submitted via mail, e-mail or the project website.

The following list summarizes some of the key comments provided at or subsequent to PIC #1. The complete *Public Information Centre #1 Summary Report* is available in **Appendix B**.

- Inquiry about construction timing.
- Questions regarding property impacts associated with the proposed mainline widening and interchange alternatives.
- Comments or preference for specific interchange alternatives (at Simcoe Road and Harmony Road).
- Concerns regarding noise impacts.
- Inquiry about how this project will impact future development.
- Comments regarding the need for widening Highway 401.
- Inquiry about when the Recommended Plan will be available for review.
- Inquiry about whether the possibility of adding capacity through transit was considered.

- Inquiry about whether the possibility of adding capacity through converting existing lanes to HOV lanes was considered.
- Inquiry about whether the effect of not adding capacity on Highway 401 was considered.
- Request to be added to the contact list.
- Request for copy of the PIC displays.

3.2.4 Public Information Centre #2

The second PIC was held on Thursday November 20th, 2014 at the Best Western Plus Durham Hotel and Conference Centre in the City of Oshawa from 4:00 p.m. to 8:00 p.m. The purpose of PIC #2 was to review the alternatives and the evaluation leading to the selection of the preferred alternative, present the preliminary design of the preferred alternative including recommendations for rehabilitation and construction sequencing, present recommended mitigation measures, and potential property impacts.

A total of 124 members of the public signed the visitor's register for the PIC. Representatives from the City of Pickering, City of Oshawa, Town of Ajax, Durham Region, Municipality of Clarington, Mississaugas of Scugog Island First Nation, and Central Lake Ontario Conservation Authority attended. In addition to responding to verbal comments, the Project Team encouraged visitors to express, in writing, all comments and concerns they had regarding the study. In total, 20 comment sheets were received.

The following list summarizes some of the key issues raised at PIC #2. The complete *Public Information Centre #2 Summary Report* is available in **Appendix B**.

- Inquiries regarding the timing of construction and property impacts.
- Questions / concerns regarding property impacts and the property acquisition process.
- Concerns regarding noise and the need for better noise barriers.
- Concerns regarding existing traffic conditions.
- Inquiries regarding the timing of other adjacent improvements, e.g. new Oshawa GO Station, Lakeshore East rail extension, etc.
- Concerns over the state of Durham's arterial road network and the additional traffic volume generated from highway widening compared to transit initiatives.
- Concerns regarding longer commute times due to construction.
- Request for an enlargement of a specific property being impacts.
- Inquiries regarding incorporation of recommendations from adjacent / related projects.
- Requests to be kept informed as the project proceeds and to be placed on the project mailing list.

3.3 TRANSPORTATION ENVIRONMENTAL STUDY REPORT

A "Notice of Study Completion and Transportation Environmental Study Report Submission" was placed in the *Ajax Pickering News Advertiser*, *Oshawa Whitby Clarington This Week*, and the *Toronto Star*, and is also available online at www.durhamregion.com/printeditions. The notice advertised that this TESR had been placed on the public record for a review period commencing on **November 20, 2015** and ending on **December 19, 2015**. In addition, notification letters were mailed to all individuals on the Project Team mailing list the week of November 16, 2015. The letters and the newspaper notices provided information about the locations where the TESR could be viewed, as well as contact information for individuals wishing to comment on the TESR.

3.4 EXTERNAL, GOVERNMENT, AGENCY AND FIRST NATIONS CONSULTATION

In addition to consultation with members of the public, the Project Team consulted with and held numerous meetings with external municipal and agency stakeholders at regular project milestones. A summary of key issues raised by external agencies, municipalities and aboriginal groups is provided in **Table 3-1**, and meetings held with these groups are summarized below. The Minutes of Meetings and key correspondence with these groups is available in **Appendix A**.

The External Team was comprised of municipal representatives, as well as provincial and federal government agencies, ministries and interest groups, including:

Provincial and Federal Government Agencies
- Infrastructure Ontario;
- Fisheries and Oceans Canada;
- Transport Canada;
- Ontario Ministry of the Environment and Climate Change;
- Ontario Ministry of Natural Resources and Forestry;
- Ontario Ministry of Agriculture, Food, and Rural Affairs;
- Ontario Ministry of Tourism, Culture and Sport; and
- Ontario Ministry of Municipal Affairs and Housing.

Conservation Authorities
- Toronto and Region Conservation Authority; and
- Central Lake Ontario Conservation Authority.

Municipalities and District School Boards
- City of Pickering;
- Town of Ajax;
- Town of Whitby;
- City of Oshawa;
- Municipality of Clarington;
- Region of Durham;
- Durham District School Board; and
- Durham Catholic District School Board.

Transportation Providers
- Metrolinx / GO Transit;
- CN Rail;
- CP Rail;
- Via Rail Canada Inc.; and
- Toronto Transit Commission

Emergency Services Providers
- Durham Regional Police;
- Durham Region EMS;
- City of Pickering EMS;
- City of Pickering Fire Services;
- Ajax Fire and Emergency Services;
- Town of Whitby Fire and Emergency Services;
- City of Oshawa Fire Services;
- Municipality of Clarington Emergency and Fire Services; and
- Ontario Provincial Police.

Interest Groups
- Ontario Parks;
- Durham Catholic District School Board Transportation Services;
- Durham Region Transit Specialized Services;
- Ontario Federation of All Terrain Vehicle Clubs;
- Ontario Federation of Snowmobile Clubs; and
- Canoe Ontario

Utilities
- Enbridge Gas Distribution Inc.;
- Enbridge Pipelines Inc.;
- Veridian Connections Inc.;
- Ontario One Call;
- Rogers Communications Inc. (Cable Lines);
- Whitby Hydro Energy Services;
- Oshawa Power and Utilities Corporation;
- HydroOne;
- Hydro One Real Estate Management;
- Union Gas Limited;
- Bell Canada ;
- GT Fiber Services Inc.;
- Allstream; and
- Cogeco Data Services.

At the start of the study, External Team members were contacted by mail and asked to return a questionnaire, which asked the following questions:

- Does your organization wish to participate in this study and continue to receive notices of project activities and information as this study progresses?
- If your organization wishes to participate in this study, please provide contact information below for the individual who will act as the Project Team's main point of contact.
- Please indicate if the above noted project will affect the delivery of your organization's programs or services, and/or any other relevant information in this regard.

Additionally, municipal stakeholders were contacted by mail and asked to return a questionnaire, which asked the following questions:

- Does your organization wish to participate in this study and continue to receive notices of project activities and information as this study progresses?
- If your organization wishes to participate in this study, please provide contact information below for the individual who will act as the Project Team's main point of contact.
- Please indicate if there are any adjacent road improvements currently being undertaken or are planned within the Study Area.

- Please indicate if there are any planned developments within the Study Area and the status of these applications.
- Please indicate if you have any comments regarding the existing interchanges (e.g. location, access, etc.).
- Are there any other municipal issues that the Project Team should be aware of?

3.4.1 Provincial and Federal Agency, and Municipal Consultation

The Project Team met with GO Transit, the Regional Municipality of Durham, City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa, and Municipality of Clarington on December 6, 2012. The purpose of the meeting was to engage municipal and agency staff at an early stage of the project to obtain feedback on mainline and interchange alternatives, as well as receive input on adjacent studies and relevant initiatives. Input was provided by the municipalities and agencies at the meeting regarding issues such as ongoing / adjacent studies, potential interchange locations and alternatives, active transportation initiatives, and requirements to accommodate transit friendly initiatives.

A second meeting was held with the Regional Municipality of Durham, City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa, and the Municipality of Clarington on March 1, 2013 to present and obtain input on the PIC #1 display material. This input was considered and incorporated into the PIC display material in advance of the PIC.

A third municipal meeting was held with the Regional Municipality of Durham and the City of Oshawa on October 30, 2013 to provide an overview of the Value Engineering (VE) workshop held in early June and to seek municipal input on the analysis of the VE alternatives prior to finalizing the evaluation of the interchange alternatives at Simcoe Street / Ritson Road and Harmony Road.

Two meetings were held with GO Transit / Metrolinx in April and June 2014. The purpose of the April 8, 2014 meeting was to:

- Provide an overview of the Highway 401 Brock Road to Courtice Road preliminary design and EA Study;
- Discuss the status of the GO Lakeshore East Rail Extension and Central Oshawa GO Station, and the potential implications of these initiatives on future interchange operations at Simcoe Street and Ritson Road;
- Provide an overview of the traffic analysis and assumptions undertaken to assess the potential impacts of the Central Oshawa GO Station on the proposed Simcoe Street / Ritson Road interchange.

The June 10, 2014 meeting with GO Transit / Metrolinx was held as follow-up to the April 8, 2014 meeting, and included discussion of the ridership projections associated with the Central Oshawa GO Station and the potential implications of these traffic volumes on the future interchange operations at Simcoe Street and Ritson Road.

The fourth municipal meeting was held with the Regional Municipality of Durham and the City of Oshawa on October 21, 2014. The primary purpose of the meeting was to review the updated analysis of the Simcoe Street / Ritson Road interchange alternatives and recommendations, and the recommended Harmony Road interchange alternative.

The fifth municipal meeting was held on November 5, 2014 to review the draft display material to be presented at PIC #2, and to provide an overview of the preliminary design of the Recommended Plan. Representatives from the Regional Municipality of Durham, City of Pickering, City of Oshawa, and Municipality of Clarington attended.

A meeting with the Toronto and Region Conservation Authority (TRCA) and the Central Lake Ontario Conservation Authority (CLOCA) was held on November 18, 2014 to provide an overview of the study, the Recommended Plan, and proposed impacts and mitigation measures. The Conservation Authorities had the opportunity to discuss any concerns with the Recommended Plan, impacts, and potential mitigation measures.

A meeting with the Town of Ajax was held on January 6, 2015 to provide a general overview / update of the study and key recommendations, with a focus on the Recommended Plan and impacts through the Town of Ajax as presented at PIC #2.

The meeting minutes of the above mentioned meetings can be found in **Appendix A**, along with a record of key correspondence with staff from external agencies and municipalities.

Councils

The Project Team provided a presentation to the Whitby Council on March 4, 2013 to review the PIC #1 displays. Comments were received on the project, as well as comments related to the Highway 401 Salem Road to Brock Street project, which were passed on to that Project Team.

The Project Team provided a presentation to the City of Oshawa Development Services Committee on June 17, 2013. The purpose of the presentation was to provide an overview of the study and the material presented at PIC #1, including the need and justification for improvements to Highway 401, and mainline and interchange alternatives.

A presentation was delivered to the Town of Ajax Community Affairs and Planning Committee on February 17, 2015 that provided a general project overview in addition to the Recommended Plan and potential impacts through the Town of Ajax. Members of the public were invited by the Town to attend this meeting, and provide input on the Recommended Plan.

No other requests for presentations to municipal councils were received by the Project Team.

3.4.2 Aboriginal Groups

The following Aboriginal Groups were notified of the project and asked to provide comments on any issues or concerns on the proposed improvements to this section of the Highway 401 corridor:

- Mississaugas of Scugog Island First Nation
- Chippewas of Georgina Island First Nation
- Chippewas of Mnjikaning First Nation
- Hiawatha First Nation
- Beausoleil First Nation
- Alderville First Nation
- Curve Lake First Nation
- Williams Treaties First Nations
- Kawartha Nishnawbe First Nation
- Huron Wendat Nation
- Peterborough and District Wapiti Métis Council

The Métis Nation of Ontario were also contacted regarding this project. Curve Lake First Nation, Chippewas of Rama First Nation, and Alderville First Nation requested to be kept informed of the study, but no representatives from any Aboriginal Group attended the PICs. During Detail Design, it is anticipated that meetings with these communities will be held to identify and discuss issues related to the specific design features of the Recommended Plan. Correspondence with Aboriginal Communities is documented in **Appendix A**.

TABLE 3-1: SUMMARY OF KEY ISSUES RAISED BY EXTERNAL AGENCIES AND ABORIGINAL COMMUNITIES

External Agency / Aboriginal Community	Comments / Issues / Concerns	Response
Regional Municipality of Durham	Pleased that long-term mainline widening requirements and interchange safety and operational improvements are being examined as part of this EA study. The Simcoe Street and Harmony Road interchanges are important gateways to the City of Oshawa, and it is imperative that the recommended design alternatives substantially improve the configuration, capacity and operational efficiency of these interchanges. Once implemented, these changes should accommodate traffic growth resulting, in part, from intensification and the proposed Central Oshawa GO Station, and last for many years into the future.	Comment noted.
	Public notification material seems to limit the scale of the improvements to be reviewed by this study, and the notification should be clear that the study includes review of the widening of Highway 401 and upgrades / improvements to existing interchanges.	The Ministry's direction at this time is generally to maintain existing infrastructure, and the focus of this study is therefore to review the rehabilitation needs of the corridor. The study is also being completed to review the long-term widening requirements of Highway 401, so that rehabilitation investments can be made with the knowledge of the long-term plans for the highway.
	Support for Simcoe Street interchange Alternative 4 to be carried forward in the study.	Comment noted.
	The Recommended Plan should include provision of a westbound off-ramp and eastbound on-ramp at Ritson Road to provide improved access, better traffic distribution and service any redevelopment / intensification in this area. The Central Oshawa GO Station is intended to be the eastern terminus for all day, two-way service when the Lakeshore East GO Rail line is extended to Bowmanville. GO riders who need to use the rail service outside of one or both peak periods will therefore have to access this station, which will increase the volumes of traffic accessing the station from the east via Highway 401. Specifically, the westbound off-ramp: • Provides a more direct route for traffic destined to the Central Oshawa GO station from the east via Highway 401, eliminating "backtracking;" and • Provides a direct route for commuter traffic to the eastern part of Downtown Oshawa and the central part of the city, taking some demand away from the already constrained Simcoe Street corridor.	The provision of a westbound off-ramp and eastbound on-ramp at Ritson Road was reviewed as part of a second stage of evaluation of Simcoe Street / Ritson Road interchange alternatives. Based on the completed traffic analysis, this ramp is not required to provide adequate operations along Highway 401, interchanges and ramp terminals. However, based on the second stage of evaluation these ramps have been incorporated into the Recommended Plan for the following primary reasons: • Improved overall traffic operations at the Simcoe Street interchange and remove some demand from the Simcoe Street corridor; • Improved overall access to and from the proposed Central Oshawa GO Station and planned Mobility Hub; • Provide a more direct access to and from downtown Oshawa and areas south of Highway 401; • Provide better overall traffic distribution between the two major north-south arterial roads (Simcoe Street and Ritson Road); and, • Identified by the Region of Durham and City of Oshawa as providing significant benefits to the municipalities.
	Concerned that the traffic analysis undertaken by GO Transit does not provide an accurate assessment of the longer term traffic impact the development will have on City and Regional roads, and believe that the traffic projections associated with the Central Oshawa GO Station and traveling to/from Highway 401 are low.	As part of this study, the Project Team engaged GO Transit in discussions regarding the Central Oshawa GO Station, and requested future ridership projections and traffic volumes. Following these discussions, GO Transit / Metrolinx completed additional analysis and provided updated ridership and traffic projections for the 2031 horizon year of the current study, given that the volumes originally provided by GO Transit and as included in the *Traffic Impact Study – Central Oshawa GO Station* had been based on a 2015 horizon year. The updated analysis provided anticipated traffic volume projections for the number of vehicles anticipated to utilize Highway 401 to access the Central Oshawa GO Station.
	Recommend that the Albert Street crossing be a right-in, right-out only intersection with Bloor Street since it is unlikely a traffic signal will be supported in the future.	The Recommended Plan includes provision of right-in / right-out access to/from westbound Bloor Street only. Traffic signals are not recommended at this location, and the southbound approach from Albert Street to Bloor Street will be stop-controlled. This configuration is recommended given the close spacing of this intersection to traffic signals at both Simcoe Street / Bloor Street and the new east ramp terminal intersection / Bloor Street, and the high projected future traffic

External Agency / Aboriginal Community	Comments / Issues / Concerns	Response
		volumes along Bloor Street which will make it difficult to turn both to/from eastbound Bloor Street at Albert Street.
	Preference for locating the proposed westbound off-ramp to Simcoe Street at the existing 1st Avenue intersection, rather than at the existing location of the westbound on-ramp to the south. Provision of a skewed intersection at Simcoe Street / 1st Avenue is not preferable, and 1st Avenue should be realigned beginning further to the east to intersect Simcoe Street at 90 degrees.	Comment noted. The Recommended Plan includes the westbound off-ramp located opposite 1st Avenue, resulting in improved traffic operations relative to the existing ramp intersection location.
	Appropriate turning lanes and storage should be provided to handle anticipated traffic queues.	Comment noted. Proposed storage lengths at turning lanes have been maximized to the extent possible, based on the anticipated traffic operations and volumes at each location and with consideration of the physical constraints in the area.
	Elimination of double left turn lane requirements at Harmony Road interchange (and split phasing of traffic signals) is preferable, notably at the Harmony Road / Bloor Street intersection. Preference is for Harmony Road interchange Alternative 4 to be carried forward in the study since it provides the best alignment for Bloor Street, eliminates the need for an additional crossing of Harmony Creek and creates larger development parcels along Bloor Street compared to other alternatives and has less encroachment on natural heritage areas than many of the other alternatives.	Comments noted.
	An additional EB off-ramp at Farewell Street should be considered in the Harmony Road interchange design, especially to help serve goods movement for the large employment area to the south.	Given the close spacing of a potential off-ramp to Farewell Street and the primary eastbound off-ramp destined to the Harmony Road / Bloor Street intersection, an off-ramp to Farewell Street would result in potential safety, operational and geometric concerns, with tight horizontal curvature approaching the Bloor Street / Farewell Street intersection and the potential for trucks to queue up from the intersection and block through traffic destined to the Harmony Road / Bloor Street intersection. This off-ramp would also result in additional weaving concerns along Highway 401 between the on-ramp from Ritson Road and an off-ramp to Farewell Street. Acceptable operations are anticipated at the proposed Bloor Street / Harmony Road intersection without the off-ramp connection at Farewell Street. As such, this study is not seeking approval for providing this access. The TESR will include discussion of a potential consideration for future access at this location, and that the review, design and approvals for any additional access at this location would be subject to a separate EA study by others if and when the need for this access is determined in the future.
	Entry to the Harmony Road / Bloor Street westbound on-ramp should be shifted slightly to the north of Harmony Road in order to separate the on-ramp traffic from the intersection of Harmony Road with Bloor Street and the eastbound ramps.	This configuration has been included in the Recommended Plan, and the design has considered the potential for queues along southbound Harmony Road backing up from Bloor Street to beyond the start of the dedicated channelized right to Highway 401.
	Consideration should be given to potentially reduce environmental / floodplain impacts and improve alignment by shifting the Harmony / Bloor intersection to the south and flattening the Bloor alignment, including shifting the reverse curves closer to Harmony provided the buttonhook ramps can be closer without operational issues (as keeping ramps close to Harmony as operationally possible for way finding makes sense).	The Recommended Plan includes a minor relocation of this intersection to the south. In general, the proposed location of the westbound ramp terminal intersection along Bloor Street has been maintained, in order to maximize spacing and available storage distance from the Harmony Road / Bloor Street intersection.
	Ensure minimum road widths meet relevant provincial and municipal standards.	Comment incorporated into Recommended Plan.
	The Michael Starr Trail is identified in the Regional Cycling Plan as a dedicated multi-use path. Also, the Joseph Kolodzie trail along the Oshawa Creek is part of the Regional Trail Network. As part of MTO's scope of work, provision should be made for cyclists and pedestrians along Albert Street, Simcoe Street and Bloor Street to connect to these trail systems as part of the interchange design.	In general, existing active transportation networks including trails, cycling routes and sidewalks on bridges will be maintained or replaced through the project limits. In particular, the existing structures at Simcoe Street and Albert Street include sidewalks on both sides of the structures, and the proposed future replacement structures will be designed to include replacement sidewalks and side clearance between the sidewalk and edge of travelled lane. The existing Bloor Street structure

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	Provision for the Harmony Creek Trail, which is part of the Regional Trail Network, to cross Highway 401 should be incorporated into the interchange design.	over Highway 401 includes a sidewalk on the north side of the structure only. The proposed interchange configuration at Harmony Road is not conducive to pedestrian movement on the south side of Bloor Street, and it is envisioned that the proposed replacement structure over Highway 401 will include a 1.5 m sidewalk on the north side of the structure only. However, further discussion will be held during Detail Design to confirm the need for sidewalks along both sides of the road. With regards to the Michael Starr Trail crossing over Albert Street, the existing connections to this trail at the north and south sides of the structure will be maintained and/or re-constructed as required to accommodate the future widening of Highway 401 to 10-lane. The existing Joseph Kolodzie trail along the Oshawa Creek will be generally unaffected by the Recommended Plan. The Recommended Plan includes a new structure to accommodate the proposed westbound on-ramp over Oshawa Creek. This structure will be designed to accommodate and minimize impacts to this existing trail. The existing Harmony Creek Trail presently terminates well north of Highway 401, and is not located in the vicinity of the Harmony Road interchange. Potential crossing opportunities for the trail of Highway 401 will be reviewed further during the Detail Design stage, through consultation with municipal staff.
	The provision of bike lanes and sidewalks along crossing roads should be considered throughout the corridor.	In general, existing active transportation networks including trails, cycling routes and sidewalks on bridges will be maintained or replaced through the project limits. Should the municipality wish to have sidewalks and/or bike lanes included at other locations, the Ministry will work cooperatively with the municipality to find the most suitable way to provide the facilities. Further discussions will be held during Detail Design regarding the location of these facilities, and the provision of these sidewalks will be subject to cost sharing agreements between the Ministry and the Region or municipality.
	Ramp modifications at interchanges should be designed to accommodate future widening of the crossing roads.	In general, only minor changes are proposed along the crossing roads as most modifications to ramps are at the connection to Highway 401. However, it is envisioned that future widening of crossing roads (e.g. from four to six lanes) could generally be accommodated.
	The study should review the potential for future interchanges at Colonel Sam Drive and Townline Road, which have been the subject of past studies, and are identified in the Region of Durham's Transportation Master Plan (TMP).	Although additional interchanges at these locations are not being pursued by MTO as part of this study, the study has included review of the general technical feasibility of potential interchanges at these locations at a concept level. The review has identified there are significant geometric concerns associated with interchanges at both locations.
	The Region is undertaking design for the proposed rehabilitation and widening of Champlain Avenue from the entrance at Durham College to east of Thornton Road which is planned for construction in 2016. The design of these works should be coordinated with the future Highway 401 widening to eliminate as much potential throwaway as possible when completing the Champlain Avenue work.	Comment noted. The Recommended Plan, profile and cross-sections for the Highway 401 widening have been provided to the Region so that the designs can be coordinated and future throwaway minimized.
	The Recommended Plan should identify a right-of-way need on the north side of Champlain Avenue to offset the encroachment into the Region's right-of-way, east of Thickson Road.	MTO is not able to identify property impacts that are not directly related to the improvements to Highway 401. The property requirements on the north side of Champlain Avenue should be confirmed and identified as part of the municipal design work for this widening. A note will be added to the Recommended Plan that the final property limit on the north side of Champlain Avenue will be determined at the Detail Design stage for the Champlain Avenue widenings.

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	Consideration should be given to incorporating channelized right-turns into the Recommended Plan at various locations, such as the Simcoe Street/Bloor Street and Harmony Road/Bloor Street intersections, and to consider other minor modifications to the Recommended Plan at the Simcoe Street interchange and vicinity such as restrictions to turning requirements.	The Recommended Plan has been designed to meet the future operational needs of the corridor from the Ministry's perspective, and the suggested enhancements are considered to be driven by a municipal need and not a provincial transportation need. A commitment can be included in the TESR for further discussions on the need for these improvements during the Detail Design stage, subject to the timing of the Highway 401 improvements relative to any future municipal initiatives in this area.
City of Pickering	The intensification of downtown Pickering has been identified as a key initiative.	Comment noted.
	Accommodation of cycling and pedestrians at overpasses is desirable, specifically at the Harwood Avenue, Westney Road and Salem Road crossings.	In general the recommendations of this study will not preclude the ability to provide sidewalks or bike lanes across structures. Such improvements could be considered as part of the rehabilitation (or replacement) of these bridges if requested by the municipalities, but the associated costs would likely be the responsibility of the municipality.
	A commercial development (Pickering-Brock Centre) is planned at the southwest corner of Notion Road and Pickering Parkway, and another consultant completed a study to review the impacts of a potential Highway 401 crossing at this location. The study assumed a Notion Road overpass and a stormwater management pond in the southwest corner.	Comment noted.
	Fire Services are interested in any closures, lane reductions, etc. that could impact response times.	Comment noted.
	Has the study considered the Pickering Live development proposed in the vicinity of Highway 401 and Church Street, and notably the potential interchange ramps at Church Street associated with this development?	The additional access to/from Highway 401 (west) proposed as part of the Pickering Live development is a separate initiative that is not being considered as part of the current study.
Town of Ajax	Complaints from pedestrians have been received regarding pedestrian access and safety at various interchange crossings (e.g. Westney Road, Harwood Road).	This study includes a collision analysis which takes into consideration pedestrian collisions and safety. The Recommended Plan will include consideration of potential improvements to address pedestrian safety (e.g. removal of channelized right-turns). With regard to provision of improved pedestrian access across Highway 401 (e.g. via sidewalks), it should be noted that where rehabilitation of existing bridges may be required, the Ministry would generally look to replace "like with like". In addition, these improvements would likely be subject to cost-sharing between MTO and the municipalities.
	Will the MTO only acquire residential properties in its entirety or will only the relevant portions of the properties be acquired?	The property impacts identified as part of this study are based on the portions of property actually required for the improvements. The full extent of property to be purchased will be determined on a case-by-case basis at a later date, through discussions and negotiations between the MTO Property Section and impacted property owners.
	The Town has recently put in significant efforts in improving the facilities at Cedar Park. The preferred plan indicates that MTO will require the southern portion of Cedar Park. Please provide clarification on how the MTO will reconfigure Cedar Park to maintain its current facilities and function and what mitigation measures would be provided to the Town for the loss of this parkland.	A potential concept for the re-configuration of Cedar Park has been prepared, which would include provision of additional parking on the east side of the park and removal of the south baseball diamond. Further discussions on the reconfiguration of Town properties such as Cedar Park that are impacted by the Recommended Plan will be undertaken at the Detail Design stage once the final property requirements are confirmed. The costs associated with this work will be subject to these future discussions and negotiations between the Town and MTO.
	Any proposed modifications to the Town of Ajax roads must conform to the Town's Engineering Design Criteria and Standard Drawings	Comment Noted. In general, the Recommended Plan has been prepared to minimize impacts to municipal right-of-ways (ROW) and meet municipal standards where possible, however in some areas it is not possible to meet these guidelines without resulting in significant additional property impacts, which is not considered desirable.

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	How does the MTO propose to manage stormwater runoff? Water quality control and treatment should be provided for all areas discharging into watercourses through Ajax. Water quantity control should be provided in all areas where specified by TRCA, including Millers Creek, Carruthers Creek and Lynde Creek.	Water quantity and quality control measures will be implemented at outlets where required to mitigate any potential impacts due to the highway widening. It is noted that the sections of Highway 401 that traverse the Carruthers Creek and Lynde Creek watersheds are outside of the study limits of this study. For watercourses located within the study limits (e.g. Miller Creek), the relevant hydraulic models have been received from TRCA. These models have been reviewed and updated as necessary to evaluate potential flooding impacts.
	How is the screening of trees and vegetation impacted? The Town will require the replacement of all trees removed. The replacement will be dependent on the caliper of the trees removed.	The tree removal requirements will be confirmed during the subsequent detailed design stage, and a commitment for the development of a Landscape Plan during detailed design will be included in the TESR.
	The Town of Ajax are not in favour of an interchange at Highway 401 and Church Street, which is being considered as part of the Pickering Live development, given the potential impacts to the existing road network and development in the area.	Comment noted.
Town of Whitby	Bridges and overpasses should include the provision of sidewalks on both sides at Provincial cost.	In general the recommendations of this study will not preclude the ability to provide sidewalks or bike lanes across structures. Such improvements could be considered as part of the rehabilitation (or replacement) of these bridges if requested by the municipalities, but the associated costs would likely be the responsibility of the municipality.
City of Oshawa	The Michael Star Trail crossing of Highway 401 at the Albert Street underpass is a key link between south Oshawa and the urban growth centre and should be maintained or enhanced. The City also seeks and opportunity to link the two disconnected sections of the Harmony Creek Trail System, north and south of Highway 401 via a new crossing at the planned Harmony Road interchange to accommodate a critical missing link in the City's active transportation network. It is anticipated that the preferred crossing location for the trail will be near Harmony Creek, rather than at Farewell Creek.	With regards to the Michael Starr Trail crossing over Albert Street, the existing connections to this trail at the north and south sides of the structure will be maintained and/or re-constructed as required to accommodate the future widening of Highway 401 to 10-lane. The existing Joseph Kolodzie trail along the Oshawa Creek will be generally unaffected by the Recommended Plan. The Recommended Plan includes a new structure to accommodate the proposed westbound on-ramp over Oshawa Creek. This structure will be designed to accommodate and minimize impacts to this existing trail. The existing Harmony Creek Trail presently terminates well north of Highway 401, and there are no existing designated trails in the vicinity of the Harmony Road interchange. Potential crossing opportunities for the trail of Highway 401 will be reviewed further during the Detail Design stage, through consultation with municipal staff.
	City staff request MTO to allow for future growth of the local roads and their associated existing and planned pedestrian / cycling requirements, both at the Ministry's cost.	In general, existing active transportation networks including trails, cycling routes and sidewalks on bridges will be maintained or replaced through the project limits. In particular, the existing structures at Simcoe Street and Albert Street include sidewalks on both sides of the structures, and the proposed future replacement structures will be designed to include replacement sidewalks and side clearance between the sidewalk and edge of travelled lane. The existing Bloor Street structure over Highway 401 includes a sidewalk on the north side of the structure only. Given the proposed interchange configuration at Harmony Road, which is not conducive to pedestrian movement on the south side of Bloor Street, the proposed replacement structure over Highway 401 will include a 1.5 m sidewalk on the north side of the structure only. Existing overpass structures at Park Road, Cubert Street, Ritson Road and Wilson Road are recommended for future replacement. The proposed replacement structures at these locations will be designed to accommodate sidewalks on both sides of the structures, however the provision of these sidewalks will be subject to cost sharing agreements between the Ministry and the Region or municipality. The existing sidewalks on both sides of Cubert Street and Wilson Road will be re-constructed beneath the replacement structures.

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		The Region of Durham's Transportation Master Plan identifies widening of Wilson Road from two to four lanes from Bloor Street to Bond Street. As such, the recommended replacement structure will be designed to accommodate 4-lane along Wilson Road. The incremental cost of the larger structure will be subject to cost sharing agreements between MTO and the Region or municipality. The current study will obtain Environmental Assessment approval for 2-lane of Wilson Road only.
	Concerned with the exclusion of the WB off-ramp to Ritson Road on the basis that it would facilitate improved access to the City of Oshawa from Highway 401 and may worsen overall operations by requiring all traffic destined to downtown Oshawa and the new Oshawa GO Station to utilize the off-ramp at Simcoe Street only. It is anticipated that traffic demand to and from the station via Highway. 401, for commuters living east of Ritson Road will be significant when the station opens and will continue to grow for many years Simcoe Street is the primary north-south spine in Oshawa for the future BRT / LRT service, the Central Oshawa Mobility Hub and a key Highway 401 crossover for the Regional Cycling Network. It also provides primary access to Downtown Oshawa and the University. Without the Ritson Road off ramp, all traffic will be required to use the Simcoe Street Interchange thereby increasing traffic to an already congested interchange and Simcoe Street. Does not believe the Simcoe / Ritson Interchange Analysis provides an accurate assessment of the longer term traffic impact the development of the new GO Station will have on the City and Regional Roads.	The provision of a westbound off-ramp and eastbound on-ramp at Ritson Road was reviewed as part of a second stage of evaluation of Simcoe Street / Ritson Road interchange alternatives. Based on this evaluation, these ramps have been incorporated into the Recommended Plan for the following primary reasons: • Improved overall traffic operations at the Simcoe Street interchange and remove some demand from the Simcoe Street corridor; • Improved overall access to and from the proposed Central Oshawa GO Station and planned Mobility Hub; • Provide a more direct access to and from downtown Oshawa and areas south of Highway 401; and, • Provide better overall traffic distribution between the two major north-south arterial roads (Simcoe Street and Ritson Road). As part of this study, the Project Team engaged GO Transit in discussions regarding the Central Oshawa GO Station, and requested future ridership projections and traffic volumes. Following these discussions, GO Transit / Metrolinx completed additional analysis and provided updated ridership and traffic projections for the 2031 horizon year of the current study, given that the volumes originally provided by GO Transit and as included in the *Traffic Impact Study – Central Oshawa GO Station* had been based on a 2015 horizon year. The updated analysis provided anticipated traffic volume projections for the number of vehicles anticipated to utilize Highway 401 to access the Central Oshawa GO Station.
	Construction of the dedicated connection from southbound Harmony Road to westbound Highway 401 should proceed as soon as possible, even if the other interchange improvements are delayed.	The timing of improvements and specific construction staging and sequencing recommendations will not be determined as part of this study. However, some components of the Recommended Plan (e.g. structures) may proceed in advance of the overall corridor improvements. The TESR will clearly note that advanced construction of the Recommended Plan could include individual ramp connections, in addition to structural and pavement works.
	Recommend the study consider an additional lane on the eastbound off-ramp to provide direct access to Farewell Street. City of Oshawa staff considers this to be beneficial for the following reasons: • A large amount of traffic, especially truck traffic uses Farewell Street to travel between Highway 401 and the southern areas of Oshawa. • A large amount of commuter traffic use Farewell Street to access General Motors Business Park which contains existing commercial developments and has the capacity for future developments. • Existing large industrial operations, including a growing number of industrial port users, generate a considerable about of this traffic and are looking to expand their facilities, thereby creating additional traffic south of Highway 401.	Given the close spacing of a potential off-ramp to Farewell Street and the primary eastbound off-ramp destined to the Harmony Road / Bloor Street intersection, an off-ramp to Farewell Street would result in potential safety, operational and geometric concerns, with tight horizontal curvature approaching the Bloor Street / Farewell Street intersection and the potential for trucks to queue up from the intersection and block through traffic destined to the Harmony Road / Bloor Street intersection. This off-ramp would also result in additional weaving concerns along Highway 401 between the on-ramp from Ritson Road and an off-ramp to Farewell Street. Acceptable operations are anticipated at the proposed Bloor Street / Harmony Road intersection without the off-ramp connection at Farewell Street. As such, this study is not seeking approval for providing this access. The TESR will include discussion of a potential consideration for future access at this location, and that the review, design and approvals for any additional access at this

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	• The Oshawa Port Authority (OPA) is actively seeking to expand its operations and develop its land holdings consistent with the OPA's approved Land Use Plan, resulting in increased traffic between Highway 401 and the port. • Farewell Street is the only direct north-south route linking Highway 401 to Oshawa's port lands and surrounding industrial area. Although Simcoe Street also provides access, it predominantly services residential neighbourhoods and would be in-conflict with industrial traffic. • Future industrial development, such as a potential container port will produce additional traffic, particularly truck traffic. • This additional lane will reduce the difficult turning movements for trucks exiting Highway 401 going directly to Farewell Street under the proposed design. A slotted right turn could also be added to the new lane to provide easy access to westbound Bloor Street. Left turns to eastbound Bloor Street could also be restricted.	location would be subject to a separate EA study by others if and when the need for this access is determined in the future.
	The Recommended Plan may have an adverse impact to the floodplain elevations in the vicinity of the Harmony Road interchange, and the City of Oshawa have no plans to move forward with improvements to the downstream culverts at the CN Rail. However, the improvements at this location should be undertaken based on a scenario (with or without improvements at the downstream CN Rail culvert) that will produce the least amount of flood elevation increase on the upstream lands.	The analysis of floodplain impacts in the vicinity of Harmony Creek and Farewell Creek was initially undertaken based on the assumption that the existing culvert at the CNR would be replaced. This analysis was subsequently revisited based on the assumption that the downstream culvert would remain in place. In either scenario, the analysis has identified that the Recommended Plan at the Harmony Road interchange will have minimal impacts to floodplain elevations at this location.
	The median should be designed to allow flow-through during major storm events, notably at flood prone areas such as near Harmony and Farewell Creeks.	This will be noted in the TESR, and will be considered further during the future Detail Design stage.
	Concerned that the Recommended Plan will have an adverse impact on floodplain elevations upstream of Highway 401 at Oshawa Creek.	The Recommended Plan is anticipated to result in relatively minor increase in regional flood level upstream of the Highway 401 crossing at Oshawa Creek, which is not anticipated to change the horizontal extents of the upstream floodplain or result in impacts to existing upstream properties. Additional hydraulic assessment will be undertaken during Detail Design to evaluate the use of a more open barrier system at the Oshawa Creek structure and increase weir flow capacity during overtopping events.
	The existing Albert Street crossing may not be required for vehicle access, but a crossing would be preferable to provide pedestrian / bike access between the new Oshawa GO Station and lands south of Highway 401. The crossing could also be used as part of the Michael Starr Trail (as per the existing condition). Given the proposed location of the Oshawa GO Station and Michael Starr Trail, a more preferable crossing location may be to the east of Albert Street in line with the former CN spur line crossing, although this would conflict with the location of the proposed eastbound buttonhook ramps.	The Recommended Plan includes replacement of the Albert Street structure at the existing location. As Albert Street is a City of Oshawa road, removal of a vehicular bridge at this location or replacing it with a pedestrian only bridge may be considered at a later date at the request of the City of Oshawa.
Municipality of Clarington	Analysis completed by CLOCA has identified floodwaters potentially backing up at the Highway 401 concrete median (e.g. at Harmony Creek and Tooley Creek). The Project Team should consider provision of concrete medians that can pass flood waters.	This will be noted in the TESR, and will be considered further during the future Detail Design stage.
	The Municipality will be interested in the economic development implications and how any proposed work ties in with other infrastructure projects.	Comment noted.
GO Transit / Metrolinx	GO Transit has plans for a new station (Central Oshawa GO Station) north of Highway 401 at Simcoe Street, and an alternative could be considered with a direct connection to the frontage street (western boundary of the station).	Comment noted.

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	GO Transit will be increasing rail and bus service over the next five years as needed, including Highway 2 Durham Transit Service and off-peak services on the Lakeshore rail line. Improvements are also planned in Pickering and Ajax as well as the East Rail Maintenance Facility.	Comment noted.
	GO Transit is generally seeking 7.4m vertical clearance at structures to accommodate future electrification. Other issues that should be considered by the Project Team as they move forward include appropriate column spacing to accommodate a potential third track, drainage modifications within the MTO ROW that may affect the rail ROW, provision of bus pass-through lanes at interchanges, bus priority measures to allow buses to get to stations on time.	Comment noted.
	Crossing agreements may need to be modified and construction staging should be designed to keep transit moving.	Comment noted.
	GO Transit recognize there is a need to take into account Metrolinx's proposed future plans in support of the assessment of improvements / modifications to the interchanges along Highway 401 in the Oshawa area. The traffic study completed in support of the GO Lakeshore East Rail Extension EA was focused on local roads and a projected timeframe that does not align with the projected timelines of the Highway 401 study. This analysis will likely not be re-visited until closer to the detailed design phase (for the GO Lakeshore East Rail Extension) and when funding / prioritization decisions are made (likely not for some time).	Subsequent discussions and meetings were held with GO Transit, which are documented in meeting minutes included in **Appendix A**. A technical memo was subsequently received which provided updated and expanded ridership and traffic projections for a future Central Oshawa GO Station, along an extended Lakeshore East rail corridor, based on a 2031 time horizon.
Toronto and Region Conservation Authority (TRCA)	Provided areas of interest and mapping, criteria for selecting alternatives, and requested opportunities for review at study commencement.	The Project Team will assess the potential impacts and opportunities for enhancement to the areas of interest highlighted by TRCA, and will document the findings in the Transportation Environmental Study Report (TESR). Additional discussions and a meeting will be arranged as the study progresses.
	There are several wetlands and watercourses that may be impacted as a result of the proposed work along Highway 401. TRCA lands are located on both sides of Highway 401 in various locations throughout the study limits. TRCA staff should remain involved with the review of materials and any discussions regarding impacts to the natural features and TRCA lands, if expected.	This input will be reviewed by the Project Team and incorporated into the team's assessment of the potential impacts and opportunities for enhancement to the areas of interest highlighted by TRCA.
	Duffins Creek is a very significant corridor for migratory fish from Lake Ontario and where we survey migratory salmonids and operate lamprey control weir for DFO. It is very, very popular angling location- in part open all year round, and has great significance as a hiking corridor - Trans Canada Trail and the NHS feature afford critical habitat and linkages to Duffins Marsh. Further it is a special policy area and has a flood control dike, and a long term streamflow gauge for the Duffins Watershed operated by Water Survey of Canada.	
	In general, TRCA requests that 1:1 habitat restoration compensation be provided for removal of lost cultural woodland. This compensation could be provided outside of the Ministry's Highway 401 ROW.	MTO does not typically provide compensation outside of their ROW, and there is minimal space available within the ROW to provide additional compensation. A commitment will be included in the TESR that a landscape plan be developed during future stages of the project (i.e. Detail Design).
	Request the use of enhanced swales for treatment based on additional impervious areas.	Comment noted. This will be considered comment as part of the drainage study.
	Do not want to see significant increase in flood level elevations as a result of the recommended improvements.	Comment noted.
	TRCA request to review the Drainage and Hydrology Report, Fisheries and Terrestrial reports prior to finalization of the reports / submission of the TESR.	The draft TESR will not be circulated for review in advance of filing on the public record as it will be made available for a 30-day review period. However, the Drainage and Hydrology, Fisheries and Terrestrial Impact Assessment reports will be made available for review by TRCA and CLOCA.

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	Various comments provided on the draft Fish and Fish Habitat Impact Assessment Report, draft Terrestrial Ecosystems Impact Assessment Report, and draft Drainage and Hydrology Report	The comments provided by TRCA on these reports have been reviewed, and the Project Team responses to the comments documented in a comment-response table. The comments are being incorporated into the final versions of these reports and TESR as appropriate.
Central Lake Ontario Conservation Authority (CLOCA)	CLOCA have recently completed a model update for the Oshawa Creek floodplain, and the current study should utilize this model in the assessment of impacts at this location.	Comment noted. The updated model has been utilized in the assessment of impacts at this location.
	CLOCA would like to see 1:1 habitat compensation for loss of vegetation within the Study Area, especially areas within the Oshawa Creek and Harmony Creek valleys.	MTO does not typically provide compensation outside of their ROW, and there is minimal space available within the ROW to provide additional compensation. A commitment will be included in the TESR that a landscape plan be developed during future stages of the project (i.e. Detail Design).
	CLOCA request to review the Drainage and Hydrology Report, Fisheries and Terrestrial reports prior to finalization of the reports / submission of the TESR.	The draft TESR will not be circulated for review in advance of filing on the public record as it will be made available for a 30-day review period. However, the Drainage and Hydrology, Fisheries and Terrestrial Impact Assessment reports will be made available for review by TRCA and CLOCA.
	Highway 401, in the current situation, will be impassable during a major flood. With traffic stopped from this major throughway, traffic will be forced onto regional and local roads, causing traffic mayhem. Generally, CLOCA recommends that MTO consider the following: 1) Close examination of highway profile changes, new ramps in floodprone areas, culvert lengthening, and barrier options that could negatively impact flooding conditions. 2) Review of options to reduce or relieve flooding conditions on the highway including: a. Work with CNR to review potential to significantly relieve flooding conditions by increasing the flood capacity of the CN railway embankment. b. Assess potential to increase conveyance capacity at culverts / bridges to relieve flooding on the highway. c. Where flooding will overtop the highway, permeable barriers should be implemented in place of solid concrete barriers to allow floodwaters to overtop the highway without building to the full height of the concrete barrier. 3) Submission of floodplain analysis to CLOCA for review (and approval).	The primary focus of this study has been to confirm the rehabilitation needs of the corridor, and to identify a long-term plan to address capacity and operational needs so that rehabilitation investments are made with knowledge of the long-term vision for the corridor. The study has included a review of the impacts on existing flooding and floodplains in the area as a result of the future widening of Highway 401 and associated interchange improvements. The conveyance requirements of existing Highway 401 water crossings through the study area has been reviewed, and the Recommended Plan and proposed drainage strategies have been designed to address the hydraulic requirements and result in no net increase in floodplain elevations throughout this part of the Highway 401 corridor. We recognize that there are existing flooding concerns at some locations within the Study Area, such as the existing flooding issues in the vicinity of the Harmony Road interchange which are primarily a result of backwater effects from the downstream CN Rail embankment and undersized culvert crossings. As the CN Rail embankment is outside of MTO's ROW and not within the jurisdiction of the Ministry, we are not able to address this issue as part of the scope of this study. However, we have considered this issue as part of our assessment and evaluation of interchange alternatives at Harmony Road to determine whether each of the alternatives result in additional increases to flood plain elevations. Similarly, flooding concerns in other locations of the corridor are primarily a result of conditions outside of MTO's ROW and can therefore not be addressed as part of this study. With regards to the assumptions made with respect to the culvert crossings beneath the CN Rail embankment, our drainage analysis at this location was initially completed under the assumption that the culverts would be replaced and a large open span structure provided. However, based on input from the City of Oshawa indicating that there are no plans for replacement of these crossings, our analysis was subsequently revised based on maintaining the existing openings at the CN Rail embankment. In either scenario, the proposed interchange improvements at this location result in no significant increase in floodplain elevations. In addition, we note that the recommended Harmony Road interchange re-configuration was selected in part to minimize encroachment into the existing Harmony Creek / Farewell Creek floodplain. Further, the Recommended Plan includes replacement of the existing 12 m span structure carrying Highway

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		401 over Farewell Creek with an 18 m span structure. Other existing watercourse crossings throughout the Study Area are also recommended for replacement. For example, the 3.8 m span Harmony Creek tributary crossing of Highway 401 is recommended for removal and replacement with a 4.0 m span culvert, and the 3.8 m span Robinson Creek culvert crossing is recommended for removal and replacement with a 4.5 m span culvert. It is noted that the Recommended Plan includes no modifications to the existing Highway 401 profile. However, as part of the future widening of Highway 401, other options to address potential flooding concerns such as implementing permeable median barriers will be explored. A commitment to further review these measures will be documented in the TESR, and the details of these measures will be further reviewed during the subsequent Detail Design stage.
	CLOCA owns property along the Harmony Creek in the Bloor Street area. This property will be an island in access roads with the proposed Harmony Road ramping and Bloor Street realignment. Anticipate that CLOCA will not be granted access to this property under this plan, and request that MTO purchase the property from CLOCA.	Comment noted.
	Various comments provided on the draft Fish and Fish Habitat Impact Assessment Report, draft Terrestrial Ecosystems Impact Assessment Report, and draft Drainage and Hydrology Report	The comments provided by CLOCA on these reports have been reviewed, and the Project Team responses to the comments documented in a comment-response table. The comments are being incorporated into the final versions of these reports and TESR as appropriate.
Curve Lake First Nation	The area in which your project is proposed is situated within the Traditional Territory of Curve Lake First Nation. Our First Nation's Territory is incorporated within the Williams Treaty Territory and is the subject of a claim under Canada's Specific Claims Policy. Although we have not conducted exhaustive research nor have we the resources to do so, Curve Lake First Nation Council is not currently aware of any issues that would cause concern with respect to our Traditional, Aboriginal and Treaty rights. Should excavation unearth bones, remains or other such evidence of a native burial site or any Archaeological findings, we must be notified without delay. If any new, undisclosed or unforeseen issues should arise, that has potential for anticipated negative environmental impacts or anticipated impacts on our Treaty and Aboriginal rights we require that we be notified regarding these as well.	Noted.
Chippewas of Rama First Nation	A copy of your letter has been forwarded to Karry Sandy-McKenzie, Barrister & Solicitor, Coordinator for Williams Treaties First Nations for further review and response directly to you. Please direct all future correspondence and inquires, with a copy to Rama First Nation, to Ms. Sandy-McKenzie.	Project contact list updated.
Alderville First Nation	As per the Alderville First Nation Consultation Protocol, your proposed project is deemed a level 3, having minimal potential to impact our First Nations' rights, therefore, please keep Alderville apprised of any archaeological findings, burial sites or any environmental impacts, should any occur.	Noted.
Huron-Wendat First Nation	Please address future correspondence to Chief Line Gros-Louis who is responsible for our Ontario file.	Project contact list updated.
Mississaugas of Scugog Island	Expressed concerns over increased salt use on Highway 401 associated with widening of the highway and the impact on wetlands. Additional concerns over QC / QA during construction.	MTO employs the most up-to-date practices available for effective salt management. The Ministry continues to investigate ways to control and reduce salt usage, while ensuring highway safety. During the construction phase MTO salt management policy related to salt application, storage and stockpiling of salt-laden snow are implemented, as well as any new salt management

External Agency / Aboriginal Community	Comments / Issues / Concerns	Response
		initiatives in place at the time of operation. These measures will reduce salt use and waste with benefits to the natural environment. In terms of compliance monitoring during construction, construction is subject daily to general on-site inspection to ensure the execution of the environmental component of the work and to deal with environmental problems that develop during construction. Construction projects with significant mitigating measures / concerns are subject to periodic site visits by Construction Administration environmental staff. The timing and frequency of such site visits are determined by the schedule of construction operations, the sensitivity of environmental concerns and the development of any unforeseen environmental problems during construction.
Ministry of Aboriginal Affairs	MAA notes that the Peterborough and District Wapiti Metis Council may be interested in your project given the proximity of their community or reserve lands to the area of the proposed project or because of your project's potential environmental impacts. Any correspondence to the Peterborough and District Wapiti Metis Council should be copied to the Metis Nation of Ontario.	Noted. Project contact list updated.
Ministry of Natural Resources and Forestry (MNRF)	The Study Area should be assessed for any species at risk and any species found must be reported. The preferred alternative should ideally avoid disturbance to the natural features of the Study Area. If any disturbance is proposed to the features within the area mitigation will be required to ensure that impacts are minimized.	The Project Team is currently documenting existing conditions and the transportation issues through this section of Highway 401, including the existing and forecasted traffic volumes and operations. During the next step of this study, the Project Team will be developing alternatives to address the identified transportation issues. At this time, it is too early to determine the extent of impacts on the natural environment and species at risk. Once the impacts of this study have been identified, MNRF will be consulted regarding disturbances to natural features or species at risk.
Transport Canada	Transport Canada is responsible for the administration of the *Navigable Waters Protection Act* (NWPA), which prohibits the construction or placement of any "works" in navigable waters without first obtaining approval. If any of the related project undertakings cross or affect a potentially navigable waterway, the proponent should prepare and submit an application in accordance with the requirements as outlined in the attached Application Guide and Form.	Comment noted.
Infrastructure Ontario	Please refer to attached PDF that highlights next steps only if your project impacts lands owned by Infrastructure Ontario. If your project does not impact any lands owned by IO, please remove IO from the mailing list.	Noted. Removed from project mailing list.

4.0 OVERVIEW OF EXISTING CONDITIONS

To support the development and examination of a reasonable range of alternatives, significant features within the Study Area were identified to determine their sensitivity and potential for impacts associated with the proposed Highway 401 improvement alternatives. Identifying significant features involved the collection of primary and secondary source data derived from surveys, field investigation, published and unpublished literature, government sources and consultation with agencies and the public. The data collected was grouped in the following categories:

- Natural Environment
- Socio-Economic Environment
- Cultural Environment
- Transportation / Cost

Information about the existing environmental features within the Study Area was collected from the following sources:

- Toronto and Region Conservation Authority
- Central Lake Ontario Conservation Authority
- City of Toronto
- City of Pickering
- City of Ottawa
- Town of Ajax
- Municipality of Clarington
- Regional Municipality of Durham
- Ministry of Agricultural, Food and Rural Affairs – Land Canada Inventory;
- Statistics Canada
- Ministry of Natural Resources and Forestry (MNRF), Natural Heritage Information Centre (NHIC)
- Ministry of the Environment and Climate Change (MOECC)
- Field investigations
- Aerial photography

The following sections of this report provide an overview of the existing environmental conditions within the Study Area.

4.1 NATURAL ENVIRONMENT

4.1.1 Topography and Drainage

According to a topographic map for the area available on the Natural Resources Canada website (http://atlas.nrcan.gc.ca/site/english/maps/topo/index.html), the topography in the vicinity of the Study Area is undulating in nature, with a generally downward slope towards the west / southwest. The ground surface elevations between Brock Road and Salem Road range from approximately 80 to 110 m above mean sea level (amsl). The topography between Brock Road and Salem Road slopes slightly downwards from the central portion westerly and easterly towards the two ends. The ground surface elevations between Brock Street and Courtice Road range from approximately 75 m to 120 m amsl. Maximum elevations are present at the central portion between Stevenson Road South and Ritson Road South.

The area between Brock Road and Salem Road is located within Duffins Creek and Carruthers Creek watersheds, which fall under the jurisdiction of the Toronto and Region Conservation Authority (TRCA), while the area between Brock Street and Courtice Road is located within a number of watersheds, including Pringle Creek, Corbett Creek, Goodman Creek, Oshawa Creek, Harmony Creek, Farewell Creek, Robinson Creek and Tooley Creek watersheds, which all fall under the jurisdiction of the Central Lake Ontario Conservation Authority (CLOCA). The referenced creeks and their tributaries cross the Highway 401 corridor at several locations within the Study Area and drain southerly to Lake Ontario.

4.1.2 Physiography

According to the *Physiography of Southern Ontario* (Chapman and Putnam, 1984), the Study Area is located within the Iroquois Plain physiographic region, which is comprised mostly of permeable sands and situated along the shoreline of the current Lake Ontario. Lake Iroquois was a high-level glacially-dammed lake which formed during the regional deglaciation approximately 12,500 years ago. The ancestral lake stood up to 40 m above the present level of Lake Ontario and deposited an extensive lacustrine plain south of the Iroquois shoreline. The Study Area is dominated by fine-textured glacial till and glaciolacustrine deposits.

4.1.3 Geology and Hydrogeology

Geology and Hydrology

The quaternary deposits of the Study Area are comprised of two primary types of deposits: silt and clay with minor sand of glaciolacustrine origin and undifferentiated till of predominantly sandy silt to silt matrix. The overburden deposits are underlain by Middle Ordovician aged bedrock of black shale and/or limestone of the Blue Mountain Formation (between Brock Road and Salem Road) and Lindsay Formation (the majority

of the area between Brock Street and Courtice Road) at depths ranging from approximately 2.4 m to greater than 50 m within the Study Area.

Multiple quaternary aquifer systems are present within the Study Area. Based on a review of the quaternary aquifer thickness maps generated as part of the *Groundwater Modelling of the Regional Municipality of Durham (2010)*, a summary of the overburden aquifers that could be present with the Study Area is provided below:

- The surficial aquifers associated with the glaciolacustrine deposits (recent deposits), are thin and discontinuous within the Study Area.
- The Oak Ridges Aquifer is generally absent within the Study Area. The only area that the Oak Ridges Aquifer is present is a limited area on the north side of Highway 401 in the vicinity of Prestonvale Road and Baseline Road. The Oak Ridges Aquifer in this area is thin and has a very limited size.
- The Thorncliffe Aquifer is the predominant quaternary aquifer within the Study Area. The Thorncliffe aquifer system is generally thin between Brock Road and Salem Road. The aquifer system is of greater thickness between Brock Street and Courtice Road. The thickness of the Thorncliffe Aquifer between Brock Street and Courtice Road can reach 30 m to 40 m in the areas between Thickson Road and Thronton Road, and between Oshawa Creek and Farewell / Harmony Creeks.
- The Scarborough Aquifer is generally thin and only present in isolated areas within the Study Area. Greater thickness of this aquifer system (up to 30 m to 40 m) is observed in the vicinity of Farewell / Harmony Creeks.

There are no municipal wells located within the Study Area or in the vicinity. As such, it was determined that the underlying aquifers are not used for municipal water supply purposes. However, based on the MOECC water well records, there are a number of the private water wells located within the Study Area for domestic, public, commercial, industrial, or livestock purposes. Approximately 72% of the existing water wells draw water from the overburden aquifers. The bedrock aquifer is not used as significant drinking water source within the Study Area.

Groundwater

Regionally, the groundwater flow is inferred to be to the south towards Lake Ontario. Locally, the shallow groundwater flow is influenced by the surface topography; likely flowing into the areas of depressions and where creeks / streams are present. It should be noted that the groundwater flow pattern could be influenced by local drainage ditches, underground utilities and services in the area as well as seasonal changes.

Groundwater Recharge / Discharge Conditions

The study areas are dominated by fine-textured glacial till and glaciolacustrine deposits, which does not permit high rates of groundwater recharge. Based on the groundwater recharge maps generated as part of the *Assessment Reports* for the Toronto and Region

Source Protection Area (TRSPA) and Central Lake Ontario Source Protection Area (CLOSPA), the groundwater recharge rates within the study areas are considered low. There are no significant groundwater recharge areas identified within the study areas.

Groundwater discharges from the groundwater system to the surface as springs, seeps or upwellings. Groundwater discharge occurs along surface water bodies, streams and wetlands. Within the study areas, groundwater discharge likely occurs along the creeks that cross the study areas, their tributaries and associated wetlands.

Areas of Shallow Groundwater Table and Potential Springs / Upwelling

Areas of high water table are generally present in the vicinity of the numerous creeks that cross the Study Area, their tributaries and associated wetland. Actual areas of groundwater discharge or upwelling are expected to be confined to the referenced areas. According to the static water level information available from the water well records, shallow groundwater conditions are present throughout both studies areas. Approximately 50% of the existing water wells have static water levels with 5 m below ground (mbg).

It should be noted that the areas of high water table have been identified based on the MOECC well record review, topographic mapping, and visual observations. Groundwater level data should be collected during the future geotechnical / hydrogeological investigations to confirm the high groundwater table conditions.

Groundwater Susceptibility

Although the fine-textured overburden deposits within the study areas reduce the level of groundwater susceptibility to surficial contamination, the presence of shallow groundwater table and numerous creeks, tributaries and wetlands increase the groundwater susceptibility. According to the Highly Vulnerable Aquifers (HVAs) mapped as part of the *Assessment Reports* for the TRSPA and CLOSPA, the majority of the Study Area are rated as either having high or medium groundwater vulnerability. Limited areas of low vulnerable aquifers are present at the western end of the Study Area, between Thornton Road and Park Road, and at the eastern end of the Study Area.

Water Supply Wells and Wellhead Protection Areas

According to the MOECC well records, discussed in the previous section, and the wellhead protection areas delineated as part of the *Assessment Reports* for the TRSPA and CLOSPA, there are no municipal water supply wells or their associated wellhead protection areas (WHPAs) located within the study areas or in the vicinity (10 km from the study area limits).

Surface Water Intake Protection Zones

A limited area of Intake Protection Zone -2 (IPZ-2) associated with the Ajax Water Treatment Plant Intake is located on the south side of Highway 401 in the vicinity of Harwood Avenue. The IPZ-3 associated with this surface water intake runs along Duffins Creek, between Church Street and Westney Road.

A limited area of IPZ-2 associated with the Oshawa Water Treatment Plant Intakes (East and West) is located on the south side of Highway 401 in the vicinity of Stevenson Road. The IPZ-3 associated with this surface water intake runs along Oshawa Creek, which crosses on the west side of Simcoe Street.

4.1.4 Fish and Fish Habitat

The Study Area spans over 10 subwatersheds along the north shore of Lake Ontario, crossing two conservation authorities' jurisdictions: CLOCA and TRCA. Within the Study Area, the existing Highway 401 crosses 18 watercourses. Of these watercourses and their adjacent lands, 11 are associated with Environmentally Significant Areas (ESA) while five are contained in Areas of Natural and Scientific Interest (ANSIs). Five Provincial Significant Wetlands (PSW) are also present within the Study Area: Lower Duffins Creek, Carruthers Creek, Lynde Shores, Oshawa Second Marsh, and McLaughlin Wetland Complex. Refer to **Table 4-1** and **Figures 4-1** to **4-3** for the watercourse crossings within the Study Area.

TABLE 4-1: WATERCOURSE CROSSING LOCATIONS

Waterbody	Subwatershed	General Location
Duffins West - Tributary A	Duffins	860 m west of Church St.
Duffins West - Tributary B	Duffins	775 m west of Church St.
Duffins West - Tributary C	Duffins	660 m west of Church St.
Duffins West - Tributary D	Duffins	315 m west of Church St.
Duffins Creek West	Duffins	910 m west of Westney Rd.
Duffins Creek East	Duffins	350 m west of Westney Rd.
Tributary of Carruthers Creek	Carruthers	180 m west of Salem Rd.
Carruthers Creek	Carruthers	1.7 km west of Lake Ridge Rd.
Tributary of Lynde Creek West	Lynde	230 m west of Lake Ridge Rd.
Lynde West	Lynde	2.8 km west of Henry St.
Lynde East	Lynde	1.7 km west of Henry St.
Tributary of Lynde Creek East	Lynde	1 km west of Henry St.
Tributary of Pringle Creek	Pringle	2.3 km west of Thickson Rd. S.
Pringle Creek	Pringle	1.7 km west of Thickson Rd. S.
Corbett Creek West	Corbett	225 m west of Thickson Rd. S.
Tributary of Corbett Creek East	Corbett	1.9 km west of Stevenson Rd.
Corbett Creek East	Corbett	1.4 km west of Stevenson Rd.
Oshawa Creek	Oshawa	180 m west of Simcoe St. S.
Tributary of Harmony Creek	Oshawa	5.7 km west of Courtice Rd.
Harmony Creek	Harmony	5.2 km west of Courtice Rd.

Waterbody	Subwatershed	General Location
Farewell Creek	Farewell	4.9 km west of Courtice Rd.
Tributary of Farewell	Farewell	4.7 km west of Courtice Rd.
Discharge to McLaughlin Bay	McLaughlin Bay Wetland Coastal Complex	2.6 km west of Courtice Rd.
Robinson Creek	Robinson	1.5 km west of Courtice Rd.
Tooley Creek	Tooley	185 m west of Courtice Rd.

Outside current Study Limits

FIGURE 4-1: EXISTING WATERCOURSE CROSSING LOCATIONS

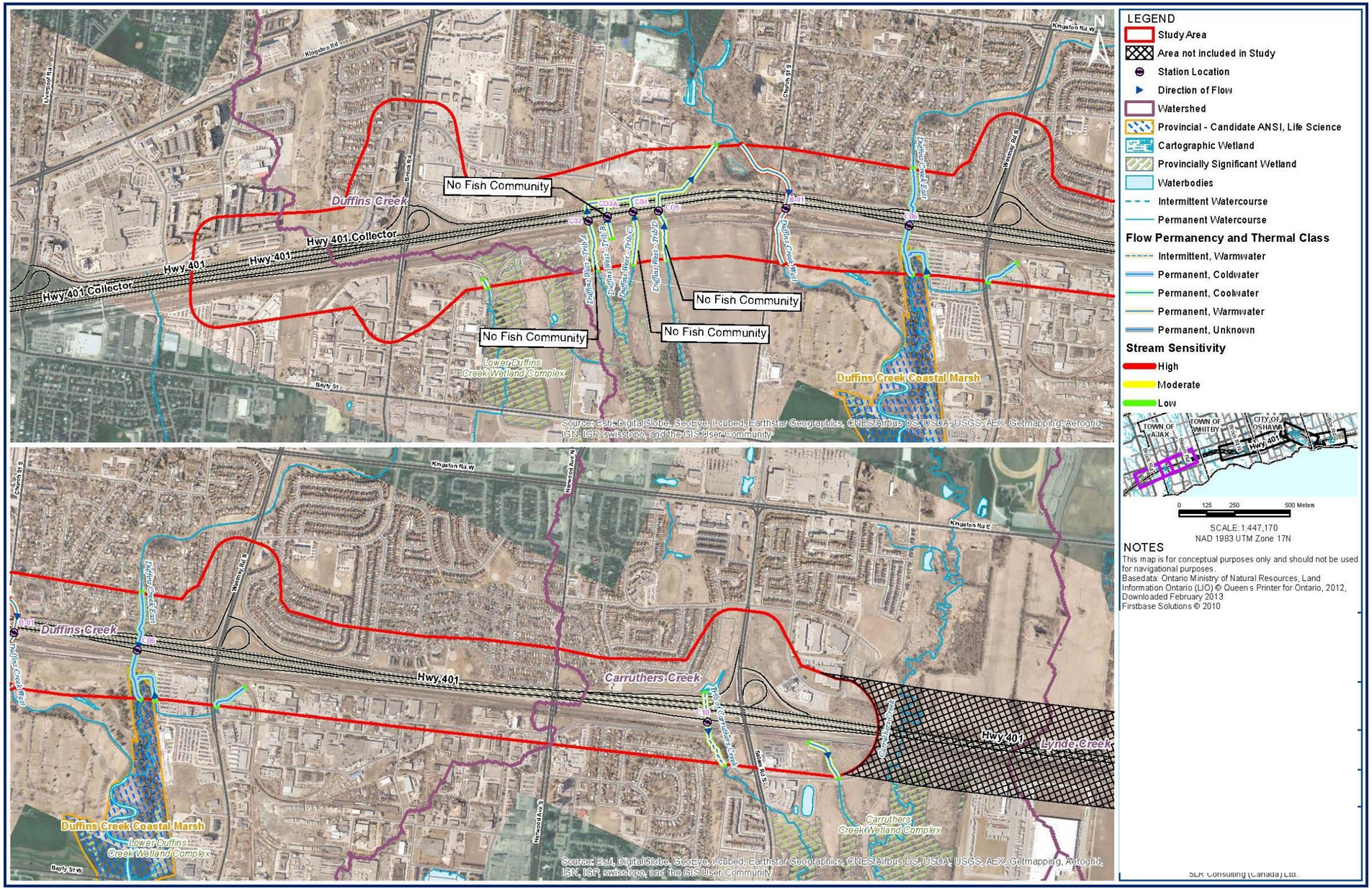


FIGURE 4-2: EXISTING WATERCOURSE CROSSING LOCATIONS

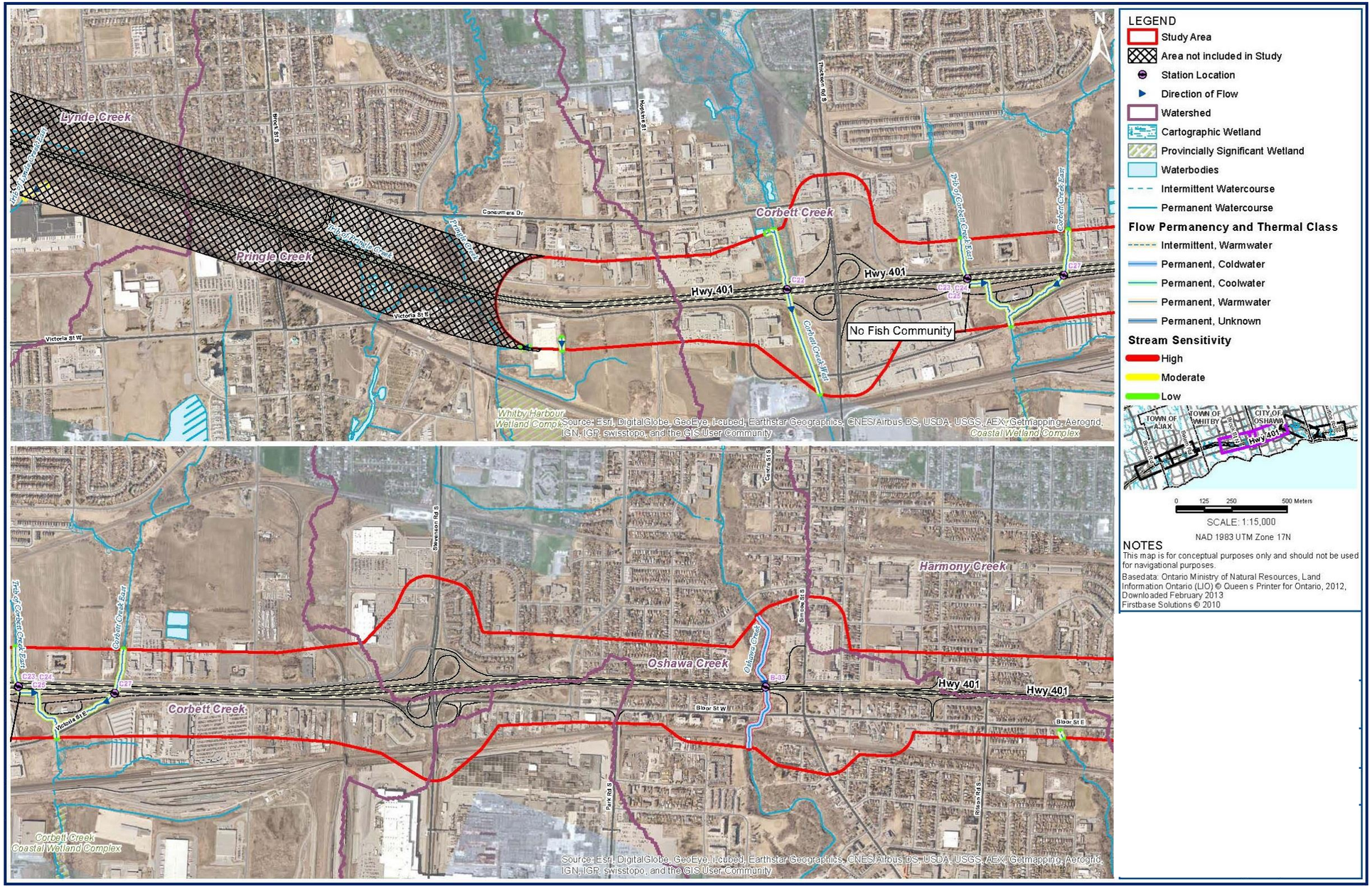
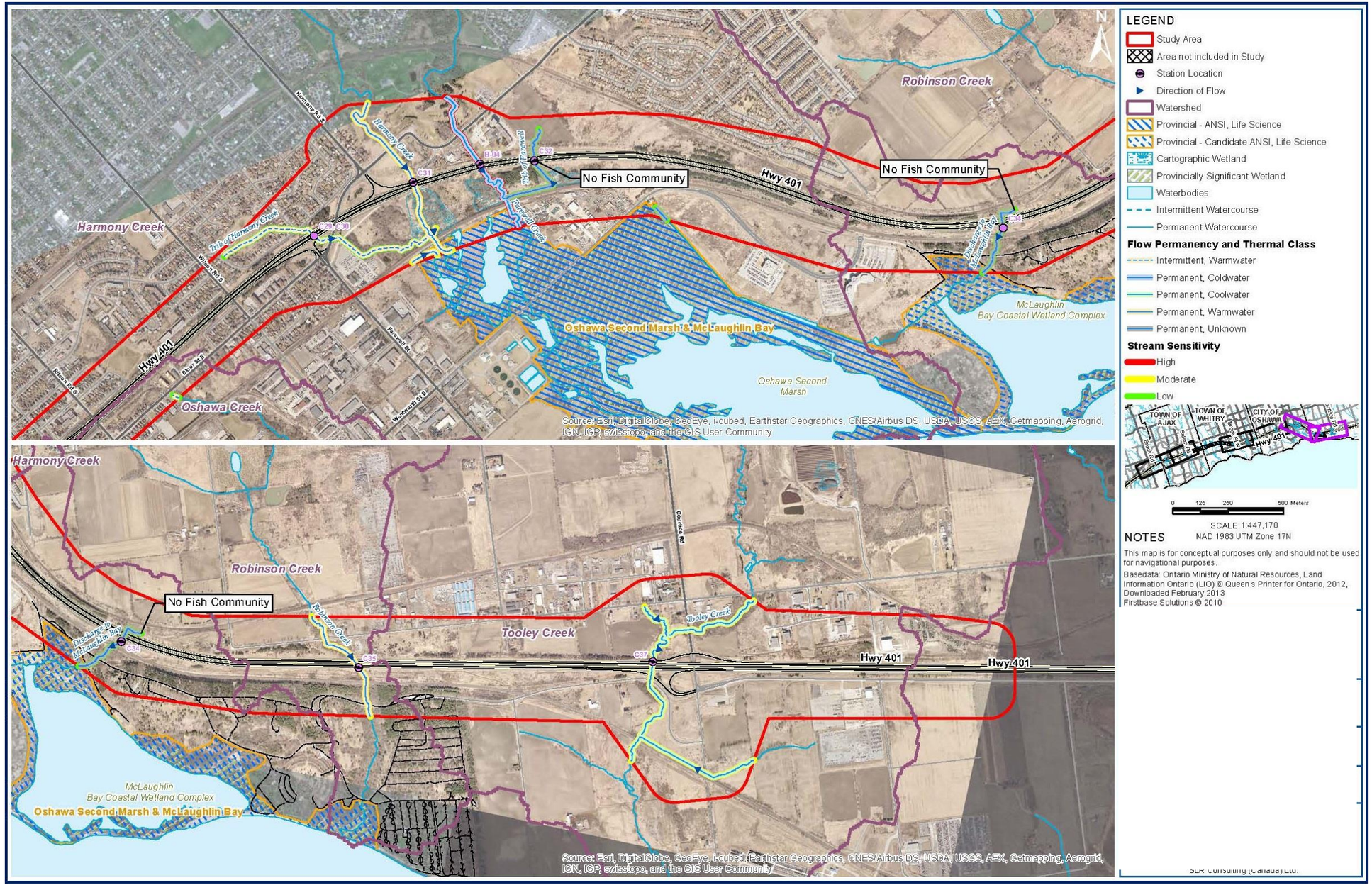


FIGURE 4-3: EXISTING WATERCOURSE CROSSING LOCATIONS



Overview of Watersheds and Fish and Fish Habitat Watercourses

Duffins Creek

The Duffins Creek watershed is the largest watershed in the Study Area with an area of approximately 28,800 ha. According to MNRF NRVIS mapping, the Duffins Creek watershed is 19.2% forested. Most of Duffins Creek is considered coldwater habitat, with a smaller portion classified as warmwater (MNRF NRVIS mapping). Six watercourse crossings of Duffins Creek occur within the Study Area. Many of the smaller Duffins Creek tributaries through the Highway 401 corridor are warmwater systems as they are predominately surface water fed.

In general, Duffins Creek supports a diverse fish community with 33 species recorded during the 2000 and 2002 fish community surveys (Cook and Clayton 2004). Fish community inventories identified: resident and migratory Salmonids (e.g., Brook Trout (Salvelinus fontinalis), Brown Trout (*Salmo trutta*), Chinook Salmon (*Oncorhynchus tshawytscha*), Rainbow Trout (*Oncorhynchus mykiss*), and the provincially Endangered Redside Dace (*Clinostomus elongatus*) among others (TRCA 2003) within the watershed. Redside Dace habitat, however, is not present in any portion of Duffins Creek within the Study Area. East Duffins Creek supports diverse migratory and spawning habitat used by Coho Salmon, Rainbow, Brown and Brook Trout, and re-introduced Atlantic Salmon (*Salmo salar*). An additional 18 species have historically been found in Duffins Creek watershed (Cook and Clayton 2004).

The following describes the fish habitat present in the watercourses of Duffins Creek within the Study Area:

- **Duffins Creek West - Tributary A -** This watercourse is classified as a permanent warmwater tributary to Duffins Creek by MNRF. The watercourse flows northward under Highway 401 through a 0.9 m by 0.6 m concrete box culvert. Information provided by MNRF indicates that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections conducted as part of this project confirmed that the watercourse does not directly support a fish community. There was evidence of benthic invertebrates in the area investigated suggesting a potential indirect contributing function to other watercourses in the subwatershed.
- **Duffins Creek West - Tributary B -** This watercourse is classified as a permanent warmwater tributary to Duffins Creek. The creek flows northward under Highway 401 through a concrete box culvert, 860 m west of Church Street. Information provided by MNRF indicates that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections conducted as part of this project confirmed that the watercourse does not directly support a fish community.

- **Duffins Creek West - Tributary C -** Downstream of the highway this watercourse is classified as a permanent warmwater tributary of Duffins Creek. This watercourse flows beneath Highway 401 through a concrete box culvert, with dimensions 1.8 m by 1.2 m. Information provided by MNRF indicates that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections conducted as part of this project confirmed that the watercourse does not directly support a fish community.
- **Duffins Creek West - Tributary D -** This watercourse is classified as a permanent warmwater tributary of Duffins Creek, that flows northward under Highway 401 through a concrete box culvert with dimensions 1.2 m by 1.2 m. Information provided by MNRF indicates that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections conducted as part of this project confirmed that the watercourse does not directly support a fish community.
- **Duffins Creek West -** Duffins Creek West is a fast flowing permanent warmwater watercourse. The creek flows southward under Highway 401 through a large 6-span bridge structure. Information provided by MNRF indicates the watercourse supports a diverse fish community. Fish known to be present in the watercourse include Lake Trout (*Salvelinus namaycush*), Rainbow Trout, Pumpkinseed (*Lepomis gibbosus*), Smallmouth Bass (*micropterus dolomieu*), Yellow Perch (*Perca flavescens*), White Sucker (*Catostomus commersonii*) and Cyprinid species.
- **Duffins Creek East (Miller Creek) -** This watercourse is a permanent coolwater watercourse that flows south under Highway 401 through three separate sections of culvert, including both concrete box culverts and corrugated steel pipe culverts (CSP). Information provided by MNRF indicates that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that cyprinid species are present in the watercourse. Upon further fish collection, Longnose Dace (*Rhinichthys cataractae*) and Blacknose Dace (*Rhinichthys atratulus*) were present in the upstream reach of watercourse.

Carruthers Creek

The Carruthers Creek watershed is approximately 3,830 ha and 20 km long and 3 km at its widest point (TRCA 2003). The watershed is 9.8% forested (OMNRF NRVIS mapping). The majority of Carruthers Creek (middle and upper reaches) is considered coldwater habitat, while the remainder of the watercourses, including that traversing through the Study Area are classified as warmwater (MNRF NRVIS mapping). The Carruthers Creek watershed includes multiple watercourse crossings of Highway 401, however only the Carruthers Creek tributary falls within the current project limits, as follows:

- **Tributary of Carruthers Creek -** This watercourse is classified as an intermittent, warmwater tributary. The upstream portion begins at the Danovilla stormwater management pond in the northwest quadrant of the Salem Road

interchange. The outlet of this pond flows south under Highway 401 through a concrete box culvert, with dimensions 1.4 m by 1.5 m. Downstream of Highway 401, the creek runs south and borders residential properties and a moderately dense riparian buffer exists on the east and west sides of the creek. MNRF identified that Cyprinid species are present in the watercourse. Fish collections conducted as part of this project identified that only young-of-year Cyprinid species occupy the watercourse.

Pringle Creek

The Pringle Creek watershed lies completely within Durham Region and crosses two municipal jurisdictions: the Town of Whitby and the City of Oshawa. Two watercourse crossings of Pringle Creek occur within the Study Area. The watershed is about 3,100 ha in size and the percentage of forest cover for the watershed is 10% (OMNRF NRVIS mapping). Approximately 50% of Pringle Creek is considered coldwater habitat. A small portion in the lower reaches is classified as coolwater, while the portion of the middle reach that extends through the Study Area is classified as warmwater (MNRF NRVIS mapping).

The fish community of the upper portions of the Pringle Creek watershed includes: Rainbow Trout, Chinook Salmon, White Sucker, Walleye (*Stizostedion vitreum*), Pumpkinseed (*Lepomis gibbosus*), and Largemouth Bass (*Micropterus salmoides*), among others (CLOCA 2005) while the lower reaches through the Study Area contain minnows and other forage fish. The following describes the fish habitat present in the watercourses of Pringle Creek within the Study Area:

- **Tributary of Pringle Creek -** This feature is classified as a permanent, warmwater tributary of Pringle Creek. The upstream portion of the channel is buried under commercial properties that boarder Highway 401. The outlet of the piped system flows south under Highway 401 through a concrete box culvert, with dimensions 1.9 m by 1.35 m. Downstream of Highway 401, the watercourse flows adjacent to a water treatment facility. Information provided by MNRF indicates that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections conducted as part of this project confirmed that the watercourse does not directly support a fish community.
- **Pringle Creek -** Pringle Creek is a permanent coolwater watercourse that flows south under Highway 401 through a concrete box culvert, with dimensions 6 m by 3 m. The upstream portion of the creek is surrounded by a dense riparian buffer and runs parallel to commercial buildings. The downstream portion of the Pringle Creek flows parallel to Highway 401 and then runs south adjacent to a water treatment facility. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that Cyprinid species are present in the watercourse. Fish collections conducted as part of this project confirmed that Longnose Dace and Johnny Darter (*Etheostoma nigrum*) present in the watercourse.

Corbett Creek

Corbett Creek is a small watershed, with an approximate area of approximately 1,500 ha. The watershed lies completely within Durham Region and crosses two municipal jurisdictions: the Town of Whitby and the City of Oshawa. This watershed is largely urbanized with a relatively small proportion (4.1%) of forest cover (OMNRF NRVIS mapping). Most of Corbett Creek, and that which is located in the Study Area, is considered warmwater habitat. A small portion of Corbett Creek, outside of the Study Area, is unclassified and approximately 400 m of the creek is classified as coldwater (OMNRF NRVIS mapping). The following describes the fish habitat present in the watercourses of Corbett Creek within the Study Area:

- **Corbett Creek West -** Corbett Creek West is a permanent warmwater creek that flows south under Highway 401 through a 5 m by 3 m concrete box culvert. Upstream of the Highway, channel morphology consisted of a straight, defined channel. The downstream portion of Corbett Creek West had poorly defined channel morphology that is adjacent to commercial properties. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that White Sucker, Brown Bullhead (*Ameiurus nebulosus*), Pumpkinseed, and Brook Stickleback (*Culaea inconstans*) are present in the watercourse. In addition, fish collections completed as part of this project found young-of-year Cyprinids in the creek.
- **Tributary of Corbett Creek East -** This is a permanent warmwater tributary of Corbett Creek East. The creek flows south under Highway 401 through a 2 m by 1.7 m concrete box culvert. The upstream portion of the creek enters the Study Area from agricultural fields. The downstream portion of the watercourse exits the Highway 401 culvert and then flows east along the Thickson Road on ramp. Flow then continues southward of Highway 401 through a 1.2 m by 0.8 m concrete box culvert. Information provided by MNRF indicates that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections conducted as part of this project indicated that the watercourse supports a small number of fish, as Creek Chub (*Semotilus atromaculatus*) were captured in this small channel.
- **Corbett Creek East -** Corbett Creek East is a permanent warmwater creek that flows south under Highway 401 through a 5 m by 3.2 m concrete box culvert. The creek is a channelized run approximately 2 m wide and 0.4 m deep. The downstream portion of the Corbett Creek East is channelized and runs parallel to Highway 401 adjacent to the MTO Truck Inspection Station. Information provided by MNRF indicated that fish are present at the watercourse crossing location and recent field investigations confirmed that the watercourse does support a fish community. MNRF identified that the creek supports Muskellunge (*Essox masquinongy*), Pumpkinseed, Brown Bullhead, and White Sucker. Furthermore, information provided by CLOCA indicates that this watercourse is known to support Northern Pike in the coastal wetland downstream of the study

area. Investigations indicated that White Sucker, Longnose Dace and Creek Chub are also present in this watercourse.

Oshawa Creek

The watershed is approximately 10,800 ha in size. Of this total area, approximately 14.8% of the watershed is forested (OMNRF NRVIS mapping). The Oshawa Creek watershed lies within CLOCA's jurisdiction and crosses four municipal jurisdictions: the Town of Whitby, City of Oshawa, Municipality of Clarington, and the Township of Scugog (CLOCA 2005). The majority of Oshawa Creek is considered coldwater habitat with a small portion classified as warmwater (lower reaches). Oshawa Creek Watershed Management Plan (OCWMP) (CLOCA 2002) reports that 20 native fish species, including Brook Trout, were captured in the Oshawa Creek system. In addition, four non-native species were also captured: Rainbow Trout, Brown Trout, Chinook Salmon and Goldfish (*Carassius auratus*).

Brown Trout have now become naturalized within the watershed. The OCWMP also indicates that Oshawa Creek East and West are "major salmonid migration routes". The following describes the fish habitat present within Oshawa Creek within the Study Area:

- **Oshawa Creek -** This is a permanent coldwater creek that flows south under Highway 401 through a large three span concrete arch culvert. The upstream portion of the creek meanders between residential and commercial properties. The downstream portion of the creek runs parallel to Oshawa Creek Park. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that American Brook Lamprey (*Lampetra appendix*), Sea Lamprey (*Petromyzon marinus*), Rainbow Trout, Chinook Salmon, Pumpkinseed, Bluegill (*Lepomis macrochirus*), Rock Bass (*Ambloplites rupestris*), Smallmouth Bass, White Sucker, Mottled Sculpin (*Cottus bairdii*), and Slimy Scuplin (*Cottus cognatus*) are present in the watercourse.

Farewell and Harmony Creek

The watershed is approximately 10,900 ha in size and has two major tributaries - Black and Harmony Creeks. The watershed is mostly located in the Municipality of Clarington. The main branches of Farewell and Harmony Creek are classified as coldwater streams in the mid and upper reaches although Harmony Creek is managed for warmwater fish through the Study Area. Farewell Creek supports Rainbow and Brown Trout, and Harmony Creek supports Rainbow Trout, in additional to a number of cyprinid species. The following describes the fish habitat present in the watercourses of Farewell and Harmony Creek within the Study Area:

- **Tributary of Harmony Creek -** This is a warmwater intermittent tributary that flows south under the Highway 401. The most upstream portion exits a 3.8 m by 2.2 m concrete box culvert into the MTO right-of-way (ROW). The downstream

portion of the Tributary of Harmony Creek exits into the MTO ROW into an approximately 3 m wide channel. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF reported that Goldfish and Cyprinid species are present in this watercourse. Fish collections identified that White Sucker is also present in this watercourse.

- **Harmony Creek -** Harmony Creek is a permanent warmwater tributary of Farewell Creek that flows south under Highway 401 through a 5 m by 2.6 m concrete box culvert. Upstream of the MTO ROW, the creek borders a golf course to the east, and residential homes to the west. The downstream portion of Harmony Creek is channelized and approximately 10 m wide. Information provided by MNRF indicated that fish are present at the watercourse crossing location and recent field investigations confirmed that the watercourse supports a fish community. Fish present in the watercourse include Rainbow Trout, Pumpkinseed, Brown Bullhead, White Sucker and Goldfish.
- **Farewell Creek -** Farewell Creek is a permanent coldwater creek that flows south under Highway 401 through a single span, concrete arch structure. Upstream of Highway 401, the creek crosses beneath Bloor Street and flows between commercial properties. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that American Brook Lamprey, Bluegill, Brown Bullhead, Rainbow Trout, Rock Bass, Sea Lamprey, White Sucker, Yellow Perch, Mottled Sculpin, and Cyprinid species are present in the watercourse.
- **Tributary of Farewell Creek -** This channel is classified as a permanent tributary and MNRF has not assigned a thermal regime to the watercourse. The creek flows south under the Highway 401 through a concrete box culvert, with dimensions 1.2 m by 0.9 m. Upstream of the culvert is a small linear channel approximately 2 m in width, while the downstream portion of the creek is approximately 2.70 m wide. Information provided by MNRF indicated that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections completed as part of this project confirmed that the watercourse does not support a fish community.

McLaughlin Bay Coastal Wetland Complex

The McLaughlin Bay Wetland Coastal Complex is provincially significant and is situated on Lake Ontario around the shores of McLaughlin Bay. The wetland complex is comprised of five wetlands, the majority of which are classified as marsh wetlands with a dominate substrate consisting of sand. The wetland complex provides direct fish habitat for as many as 18 fish species. One small surface tributary of the wetland complex occurs within the Study Area although it primarily contributes surface run-off and provided no fish habitat.

- **Discharge to McLaughlin Bay -** This is a permanent watercourse with unknown thermal regime that is diverted under Highway 401 through a 1.2 m by 1.2 m

concrete box culvert. During the time of investigation, it was noted that the downstream portion offers no direct fish habitat. Little water was observed during field investigations at the upstream and downstream portions of the watercourse. Information provided by MNRF indicated that the watercourse in the area of investigation is not known to provide fish habitat. Fish collections complete as part of this project confirmed that the watercourse does not support a fish community.

Robinson and Tooley Creek

- **Robinson Creek -** The headwaters of Robinson Creek originate just north of the Study Area, in the Regional Municipality of Clarington. The creek crosses Highway 401 east of Harmony Road, and outlets to Lake Ontario through a portion of the provincially significant McLaughlin Bay Wetland Complex. Within the Study Area, Robinson Creek is a permanent warmwater creek. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that fish present in the watercourse include: Rainbow Trout, Pumpkinseed, White Sucker, and Mottled Sculpin.
- **Tooley Creek -** The Tooley Creek watershed originates in the Lake Iroquois Shoreline in the Regional Municipality of Clarington. Tooley Creek crosses Highway 401 west of Courtice Road, and the watershed outlets to Lake Ontario through the Tooley Creek Coastal Marsh. Within the Study Area, Tooley Creek is a permanent coolwater creek. After leaving the Highway 401 culvert, the creek remains buried for approximately 130 m downstream of Highway 401. This portion of the creek flows adjacent to agriculture land use towards its outlet to Lake Ontario. Information provided by MNRF indicated that the watercourse in the area of investigation is known to provide fish habitat. MNRF identified that Rainbow Trout and Cyprinid species are present in the watercourse.

Assessment of Sensitivity

In addition to providing fish community records, MNRF was contacted to provide the habitat sensitivity status for all the watercourses within the Study Area. **Table 4-2** provides a summary of the sensitivity status as provided by the MNRF. The MNRF has classified 12 of the watercourses as Low Sensitivity, three as Moderate Sensitivity and three watercourses as High Sensitivity.

TABLE 4-2: SENSITIVITY RANKINGS OF THE AQUATIC HABITAT ALONG STUDY AREA

Waterbody Name	MNRF Interpretation of Fish and Fish Habitat Sensitivity	In-Water Timing Windows for Construction	Thermal Regime	Direct or Indirect Fish Habitat
Duffins West - Tributary A	Low	July 1 – March 31	Warmwater	Indirect

Waterbody Name	MNRF Interpretation of Fish and Fish Habitat Sensitivity	In-Water Timing Windows for Construction	Thermal Regime	Direct or Indirect Fish Habitat
Duffins West - Tributary B	Low	July 1 – March 31	Warmwater	Indirect
Duffins West - Tributary C	Low	July 1 – March 31	Warmwater	Indirect
Duffins West - Tributary D	Low	July 1 – March 31	Warmwater	Indirect
Duffins Creek West	High	July 1- September 15	Warmwater	Direct
Duffins Creek East (Miller Creek)	Low	June 15 – September 15	Coldwater	Direct
Tributary of Carruthers Creek	Low	July 1 – March 31	Warmwater	Direct
Corbett Creek West	Low	July 1 – March 31	Warmwater	Direct
Tributary of Corbett Creek East	Low	July 1 – March 31	Warmwater	Direct
Corbett Creek East	Low	July 1 – March 31	Warmwater	Direct
Oshawa Creek	High	June 15 – September 15	Coldwater	Direct
Tributary of Harmony Creek	Low	July 1 – March 31	Warmwater	Direct
Harmony Creek	Moderate	June 1 – Sept. 15	Warmwater	Direct
Farewell Creek	High	June 15 – September 15	Coldwater	Direct
Tributary of Farewell Creek	Low	July 1 – March 31	Unknown	Indirect
Discharge to McLaughlin Bay	Low	July 1 – March 31	Unknown	Indirect
Robinson Creek	Moderate	July 1 – March 31	Warmwater	Direct
Tooley Creek	Moderate	June 15 – September 15	Coolwater	Direct

The characterizations of fish and fish habitat sensitivity rankings are largely influenced by the thermal regime of a watercourse and the fish community and habitat functionality the watercourse supports or provides. The watercourses within the study area include 12 warmwater watercourses, 3 coldwater watercourses, and 1 coolwater watercourse. Of these watercourses, 12 provide direct fish habitat and 6 provide either no habitat or indirect fish habitat.

Due to the coldwater classification and the presence of salmonids, MNRF classified Duffins Creek West as Highly Sensitive. It was further determined that this portion of Duffins Creek West has functional habitat characteristics. The presence of cobble substrate and instream cover provides opportunities for refuge and feeding habitat. The

riffle, and pool sequencing present in the watercourse are ideal conditions for many functions including spawning refuge, and feeding. The Duffins Creek West is highly turbid and this may cause risk to some species intolerant of suspended solids.

Farewell Creek is also classified as Highly Sensitive. Similarly this classification is due to its diverse fish community, and to the presence of salmonid migration. Farewell Creek provides coldwater habitat and supports a fish community encompassing 10 species (refer to **Section 4.1.4** for more details). Farewell Creek has a great deal of cover provided by overhanging riparian vegetation and gravel substrates that are ideal for cyprinid spawning.

Moderately Sensitive watercourses include Harmony Creek, Robinson Creek and Tooley Creek. Harmony Creek has a fish community containing Rainbow Trout, Pumpkinseed, Brown Bullhead, White Sucker, and Goldfish. The presence of migratory Rainbow Trout is likely the major reason for a Moderate Sensitivity rating. Similarly, both Robinson Creek and Tooley Creek support populations of Rainbow Trout.

Existing Fish and Fish Habitat Summary

Table 4-3 provides a summary of the existing fish and fish habitat conditions observed by the Project Team or noted by resource agencies for watercourses along Highway 401 between Brock Road to Courtice Road.

TABLE 4-3: EXISTING FISH AND FISH HABITAT CONDITIONS SUMMARY

Waterbody Name	Watercourse Classification	Flow	Habitat Information/ Locations	Substrate Type	Vegetation (riparian and instream)	Fish Species Present	
						MNRF (2009, 2010)	SLR (2013)
Duffins West - Tributary A	Warmwater	Permanent		Gravel, sand, detritus	Emergent	None	No fish Captured
Duffins West - Tributary B	Warmwater	Permanent		Detritus, silt	Overhanging vegetation, instream grasses	None	No fish Captured
Duffins West - Tributary C	Warmwater	Permanent		Silt, detritus	Overhanging willow, instream phragmites	None	No fish Captured
Duffins West - Tributary D	Warmwater	Permanent		Silt/sand, muck	Instream Phragmites	None	No fish Captured
Duffins Creek West	Warmwater	Permanent	Salmonid migration	Cobble, boulder, some clay	Instream emergent and overhanging	Lake Trout, Rainbow Trout, Pumpkinseed, Smallmouth Bass, Yellow Perch, White Sucker, Cyprinid spc.	No fish Captured
Duffins Creek East (Miller Creek)	Coldwater	Permanent		Cobble, sand/silt	Overhanging riparian vegetation	Longnose Dace, Blacknose Dace	Longnose Dace, Blacknose Dace
Tributary of Carruthers Creek	Warmwater	Intermittent		Cobble, sand/silt, dispersed boulders	Overhanging riparian vegetation	Cyprinid spp.	YOY unknown
Tributary of Pringle Creek	Warmwater	Permanent		Cobble, gravel	Sparse instream vegetation, overhanging riparian vegetation	None	YOY unknown Brook Stickleback
Pringle Creek	Coolwater	Permanent		Sand, gravel with dispersed cobble/boulder	Riparian vegetation only	Cyprinid spc.	Creek Chub
Corbett Creek West	Warmwater	Permanent		Silt, cobble	Dense phragmites instream; Submergent instream-milfoil	White Sucker, Brown Bullhead, Pumpkinseed, Brook Stickleback	White Sucker, Longnose Dace, Creek Chub
Tributary of Corbett Creek East	Warmwater	Permanent		Silt/sand, cobble, gravel	Dense instream phragmites	None	
Corbett Creek East	Warmwater	Permanent		Sand/silt, gravel/cobble	Emergent grasses instream, overhanging riparian vegetation	Muskellunge, Pumpkinseed, Brown Bullhead, White Sucker	White Sucker

Waterbody Name	Watercourse Classification	Flow	Habitat Information/ Locations	Substrate Type	Vegetation (riparian and instream)	Fish Species Present	
						MNRF (2009, 2010)	SLR (2013)
Oshawa Creek	Coldwater	Permanent		Cobble, gravel, dispersed boulder	No instream vegetation, little riparian cover	American Brook Lamprey, Sea Lamprey, Rainbow Trout, Chinook Salmon, Pumpkinseed, Bluegill, Rock Bass, Smallmouth bass, White Sucker, Mottled Sculpin, Slimy Sculpin	
Tributary of Harmony Creek	Warmwater	Intermittent		Silt/sand, cobble	Sparse emergent vegetation	Goldfish, cyprinid spc.	
Harmony Creek	Warmwater	Permanent		Silt, organic debris	Overhanging riparian vegetation	Rainbow Trout, Pumpkinseed, Brown Bullhead, White Sucker, Goldfish	No fish Captured
Farewell Creek	Coldwater	Permanent	Salmonid migration	Silt/sand, cobble	Instream emergent grasses, overhanging riparian vegetation	American Brook Lamprey, Bluegill, Brown Bullhead, Rainbow Trout, Rock Bass, Sea Lamprey, White Sucker, Yellow Perch, Mottled Sculpin, Cyprinid spc.	No fish Captured
Tributary of Farewell Creek	Unknown	Permanent		Sand/silt, muck	Instream cattails, phragmites, grasses	None	
Discharge to McLaughlin Bay	Unknown	Permanent		Silt, cobble	Overhanging vegetation	None	
Robinson Creek	Warmwater	Permanent		Gravel, cobble, sand	Sparse instream, overhanging riparian vegetation	Rainbow Trout, Pumpkinseed, White Sucker, Mottled Sculpin	
Tooley Creek	Coolwater	Permanent		Boulder, cobble, gravel	Moderate overhanging riparian vegetation	Rainbow Trout, Cyprinid spc.	

Species at Risk

The MNRF Natural Heritage Information Centre (NHIC) species occurrence mapping does not indicate any fish Species at Risk (SAR) within the 1 km square grid across the Study Area. Similarly, the Department of Fisheries and Oceans (DFO's) Distribution of Fish Species at Risk mapping (2013) shows no fish or mussel SAR species located in the Highway 401 Study Area. Through direct discussions with MNRF, they noted that their records do not show any SAR fish species or regulated habitat in the immediate area of the Highway 401 watercourse crossings.

4.1.5 Drainage and Hydrology

Within the Study Area, Highway 401 traverses 10 watersheds that span across five municipalities, and two Conservation Authorities. There are 11 major watercourses and 19 minor crossings of tributaries and centreline culverts that function as part of the local highway drainage. **Table 4-4** below lists the watersheds and major watercourse crossings within the Study Area. It is noted that the Lynde Creek watershed and McLaughlin Bay Wetland Coastal Complex sub-watershed, as described in **Section 4.1.4**, are not identified below as they are either outside of the immediate study area (Lynde Creek) or do not contain any major watercourse crossings.

TABLE 4-4: SUMMARY OF MAJOR WATERCOURSE CROSSINGS

Watershed	Watercourse	Culvert ID	Locations	Conservation Authority
Duffins Creek	Duffins Creek	B01	City of Pickering	TRCA
	Miller Creek	C06	Town of Ajax	TRCA
Carruthers Creek	Carruthers Creek Tributary 'A'	C10	Town of Ajax	TRCA
Pringle Creek	Pringle Creek	C18	Town of Whitby	CLOCA
Corbett Creek	Corbett Creek West Branch	C22	Town of Whitby	CLOCA
	Corbett Creek East Branch	C27	Town of Whitby	CLOCA
Oshawa Creek	Oshawa Creek	B03	City of Oshawa	CLOCA
Black/Harmony/Farewell	Harmony Creek	C31	City of Oshawa	CLOCA
	Farewell Creek	B04	City of Oshawa	CLOCA
Robinson Creek	Robinson Creek	C35	Municipality of Clarington	CLOCA
Tooley Creek	Tooley Creek	C37	Municipality of Clarington	CLOCA

The western portion of the project limits is generally serviced by an existing median sewer that collects and conveys runoff from the two internal lanes and associated shoulders. The existing storm sewer systems outlet to either:

- An existing culvert crossing;
- The existing roadside ditches that parallel the roadway; or
- An existing municipal storm system at an interchange location.

There are nine outlet locations that discharge into a municipal storm sewer. The remaining highway outlet locations discharge to existing watercourses. Generally, the

existing storm sewer systems within the project limits have sufficient capacity to convey the 10 year design flow. There are several isolated sections of sewers that appear to be operating above capacity.

There are three existing MTO stormwater management (SWM) facilities located within the immediate study limits:

- Existing SWM facility located south of the Highway 401 and servicingthe existing commercial / industrial area, a portion of Salem Road, and a portion of Highway 401 (approximately 28 ha);
- Existing SWM facility located in northeast quadrant of Stevenson Road interchange, and services a portion of Stevenson Road interchange and portions of Highway 401 (approximately 9.5 ha); and
- Existing SWM facility located in southeast quadrant of Stevenson Road interchange, and services a portion of Stevenson Road interchange and portions of Highway 401 (approximately 7.7 ha).

A review of existing Regulatory floodplain mapping indicate that Highway 401 is overtopped at several locations, which pose a flood risk during extreme rainfall events. These locations include: Corbett Creek West Branch (Structure C22), Corbett Creek East Branch Tributary (Structures C23, C26), Oshawa Creek (Structure B03), Harmony Creek (Structures C29, C30, and C31), and Farewell Creek (Structures B04, C32).

Additional information regarding the existing drainage conditions within the Study Area is provided in the *Preliminary Drainage and Hydrology Report (October 2015),* available under separate cover.

4.1.6 Terrestrial Ecosystems

Vegetation & Vegetation Communities

Vegetation throughout the Study Area (except for a few locations that contain larger patches of naturalized habitat) is fairly uniform. This uniformity is due directly to the highly urbanized nature of the landscape, which makes it vulnerable to disturbance adapted species. This is particularly applicable to areas within the ROW along the entire length of the Study Area. The dominant ELC classifications are Cultural Community classes. These are a result of fragmented and managed lands where species diversity is limited and typically dominated by non-native species. Locations of all ELC communities can be found in **Appendix E**. The following describes the composition of ELC polygons identified during field investigations which occurred over the spring, summer and fall seasons.

MAS2-1 Cattail Mineral Shallow Marsh Type

For the MAS2-1 Cattail Mineral Shallow Marsh Type, two locations (polygons) dominated by Narrow-leaved Cattail (*Typha angustifolia*) are found on both sides of

Highway 401 west of Thickson Road. Other species present include Common Cattail (*Typha latifolia*) and patches of Common Reed (*Phragmites australis*).

MAS Shallow Marsh Ecosite

Numerous polygons of MAS Shallow Marsh Ecosite are found throughout the Study Area on both sides of Highway 401. Within the ROW, many are relatively small in size. All have very low species diversity. Species dominance varies between Common Reed and Cattail species.

MAM Meadow Marsh Ecosite

Several MAM Meadow Marsh Ecosite polygons are located throughout the Study Area. The two largest polygons are located east of Harmony Road. The dominant species within these polygons include Reed Canary Grass (*Phalaris arundinacea*), Lake Bank Sedge (*Carex lacustris*), and Purple Jewelweed (*Impatiens glandulifera*).

SWD4 – Mineral Deciduous Swamp Ecosite

Two SWDA Mineral Deciduous Swamp Ecosite polygons are located on the south side of Highway 401 east of Harmony Road. These polygons have a mix of species including Crack Willow (*Salix fragilis*), Green Ash (*Fraxinus pennsylvanica*), Manitoba Maple (*Acer negundo*), and White Elm (*Ulmus americana*). The understory varies between the two polygons. The polygon located further east is dominated by Cattail species and Reed Canary Grass. The polygon located closer to Harmony Road is dominated by Ostrich Fern (*Matteuccia struthiopteris*) with Wood Nettle (*Laportea canadensis*) as an associate.

The polygon located further east shows signs of the overstory species in significant decline. This, along with the dominant vegetation in the understory indicates that sufficient water is building up in the area and flooding out the overstory, creating conditions more suitable for a Shallow Marsh.

CU – Cultural Community Class

The CU Cultural Community Class Ecosite is the most dominant vegetation form / polygon in the Study Area. It has been used to identify and describe habitat lacking in structure and use. These areas are typically small, isolated by roads and structures, and in many cases manicured or influenced by other anthropogenic effects. Dominant species within these areas are almost entirely non-native, but adapted to these types of constantly disturbed or degraded habitats. Species found throughout these polygons within the entire Study Area include: Smooth Brome (Bromus inermis), Kentucky Blue Grass (*Poa pratensis*), Bird Vetch (*Vicia cracca*), Creeping Bent Grass (*Agrostis stolonifera*), Common Mallow (*Malva neglecta*), Black Medic (*Medicago lupulina*), Common Ragweed (*Ambrosia artemisiifolia*), and Chickory (*Cichorium intybus*). Many of the

areas along the ROW contain drainage features typically dominated by the highly invasive and non-native Common Reed.

CUM1 – Mineral Cultural Meadow

The CUM1 Mineral Cultural Meadow sites are located adjacent to Highway 401 for most of the Study Area; they are dominated by various species but primarily non-native. Species present include Smooth Brome, Timothy Grass (*Phleum pratense*), Queen Anne's Lace (*Daucus carota*), Common Milkweed (*Asclepias syriaca*), Sweet White Clover (*Trifolium repens*), Canada Goldenrod (*Solidago canadensis*), Teasel (*Dipsacus fullonum*) and Dog-strangling Vine (*Vincetoxicum rossicum*).

CUT1 – Mineral Cultural Thicket

Mineral Cultural Thicket (CUT1) polygons are typically found in the east end of the Study Area likely due to the reduced urbanization in a couple sections and old fields have been left to continue with natural succession processes. Species include Staghorn Sumac (*Rhus typhina*), Trembling Aspen (*Populus tremuloides*), Black Locust, Scots Pine, and Common Buckthorn.

CUW1 – Mineral Cultural Woodland

Mineral Cultural Woodlands are located throughout the Study Area. Species composition was relatively consistent. These polygons vary in size, but have more open canopies (35%-65% cover) than forest units. Dominant species are typically non-native and include Manitoba Maple, Norway Maple (*Acer platanoides*), Austrian Pine, Scots Pine, White Ash (*Fraxinus americana*), Hybrid Willow (*Salix x rubens*), Norway Spruce, Black Locust (*Robinia pseudoacacia*), White Elm, Silver Maple (*Acer saccharinum*), and Balsam Poplar (*Populus balsamifera*).

CUP – Cultural Plantation Ecosite

Three large CUP Cultural Plantation Ecosite polygons are located on the south side of Highway 401 at the east end of the Study Area (west of Courtice Road). They contain a mixed dominance of deciduous and coniferous species. The planted species include Austrian Pine (*Pinus nigra*) and Norway Spruce (*Picea abies*). Deciduous regenerating species that share co-dominance in many areas include Poplars (*Populus balsamifera*) and Sugar Maple (*Acer saccharum*).

Two distinct CUP3 Coniferous Plantations are found on the south side of Highway 401 east of Harmony Road. They are dominated by Scots Pine (*Pinus sylvestris*) and Austrian Pine (*Pinus nigra*). No understory is present within these polygons due to the dense overstory shading.

FOD – Deciduous Forest Community Series

Three FOD Deciduous Forest Community Series polygons are found in the west end of the Study Area adjacent to Church Street. They are dominated by Manitoba Maple, and Hybrid Willow. Understory species include Manitoba Maple and Common Buckthorn with insufficient definition to be classified to ecosite.

- FOD4 Dry – Fresh Deciduous Forest Ecosite: Six (6) FOD4 Dry – Fresh Deciduous Forest Ecosite polygons are located throughout the Study Area. They are typically associated with corridors where the landscape allows for forests to form. Species dominance varies and includes White Ash, Manitoba Maple, Balsam Poplar, Common Basswood (*Tilia americana*), and Hybrid Willow. The understory in many of these polygons have been invaded by non-native species including Garlic Mustard (*Alliaria petiolata*) and Common Buckthorn (*Rhamnus cathartica*).
- FOD5 Dry – Fresh Sugar Maple Deciduous Forest Ecosit - One Fresh Sugar Maple Deciduous Forest Ecosite polygon is located at the far east end of the Study Area adjacent to Courtice Road. It is dominated by Sugar Maple (*Acer saccharum)*, with Basswood, White Ash, and Manitoba Maple as associates.
- FOD7 Fresh – Moist Lowland Deciduous Forest Ecosite: Four FOD7 Fresh – Moist Lowland Deciduous Forest Ecosite polygons are located in the Study Area both north and south of Highway 401. They are dominated by Hybrid Willow with Manitoba Maple and White Elm as associates. Understory species in two of the polygons are almost completely dominated by Garlic Mustard other species present include Common Buckthorn.

OA – Open Aquatic

One Open Aquatic polygon occurs within the Study Area. This feature is a stormwater management pond at Salem Road. Vegetation diversity is low and the pond is surrounded by Common Reed or Narrow-leaved Cattail patches. This stormwater facility is not considered habitat for the purposes of this report.

4.1.7 Wildlife and Wildlife Habitat

The dominant vegetation within the Study Area is classified as "Cultural" due to the recent human disturbance including manicured lawns or open areas. Much of the ROW and Study Area towards the east end is active agricultural habitat. Forest units connected to larger habitat patches in the region are located around Church Street, Garden Street, Thickson Road, Simcoe Street, Harmony Road, and Courtice Road. Larger wetland communities are associated with the Provincially Significant Wetlands located along the Study Area.

Breeding Birds

A total of 76 species were recorded during breeding bird surveys completed as part of this study. These species reflect the habitat available for nesting which includes primarily urban habitat (cultural communities), some open country / grasslands, wetlands, riparian and agricultural lands with some larger forest patches associated with protected corridors / features on the landscape.

The only species documented listed under the Ontario *Endangered Species Act*, 2007 is Barn Swallow. Observations of multiple individuals were confirmed in 13 of the 26 survey sectors. Selected observations are believed to be individuals that nest outside of the Study Area. The only confirmed colony was located outside of the Study Area inside a barn situated north of the Highway 401 ROW, immediately west of Courtice Road on the south side of Baseline Road.

No other SAR identified by MNRF was encountered during breeding bird surveys.

Amphibians and Reptiles

As part of this study, amphibian calling counts were undertaken at 12 locations throughout the identified wetlands in the Study Area. Species recorded include American Toad (*Anaxyrus americanus*), Gray Tree Frog (*Hyla versicolor*), and Green Frog (*Lithobates clamitans*). Calling frogs were recorded at 3 of the 12 locations; at the larger wetlands adjacent to Thickson Road (Corbett Creek West), Simcoe Street (Oshawa Creek), and east of Harmony Road (Harmony-Farewell Creek). Gray Tree Frogs were recorded in the Marsh and Swamp habitat located south of Highway 401 east of Harmony Road.

There was no evidence that turtles are using the terrestrial area surrounding the ROW for breeding. While some potential nesting habitat does exist within the Study Area, no turtle nests or nesting attempts were encountered during field work throughout the fall, spring and summer seasons. Limited habitat exists within the Highway 401 MTO ROW.

One Eastern Gartersnake (*Thamnophis sirtalis*), a non-SAR species, was observed south of Highway 401 within the ROW east of Brock Road. Little-to-no habitat was observed for amphibian and reptile SAR in the Study Area.

Mammals

Incidental mammal species recorded during terrestrial field site visits include: Eastern Chipmunk (*Tamias striatus*), and Grey Squirrel (*Sciurus carolinensis*). Evidence of White-tailed Deer (*Odocoileus virginianus*) and Common Raccoon (*Procyon lotor*) were found during field investigations. No habitat for mammal SAR is known to exist in the Study Area.

Wildlife Passage

Expansion of the Highway 401 through the Study Area, while likely to remove potential wildlife habitat, is not anticipated to obstruct passage across the already fragmented landscape. The existing Highway 401 represents a significant barrier to movement with passage restricted to bridge openings and additional widening is unlikely to affect that existing impact.

Species at Risk

The MNRF provided a list identifying SAR and Provincially Rare Species on record for the Study Area (**Tables 4-5** and **4-6**). The list includes records for the section of Highway 401 between Salem Road and Brock Street that is excluded from this study, but could not be parsed out by MNRF.

TABLE 4-5: SPECIES AT RISK ON RECORD WITHIN THE STUDY AREA

Common Name	Scientific Name
Acadian Flycatcher	*Empidonax virescens*
Bald Eagle	*Haliaeetus leucocephalus*
Barn Swallow	*Hirundo rustica*
Black Tern	*Chlidonias niger*
Blandings Turtle	*Emydoidea blandingii*
Bobolink	*Dolichonyx oryzivorus*
Butternut	*Juglans cinerea*
Canada Warbler	*Wilsonia canadensis*
Cerulean Warbler	*Dendroica cerulea*
Chimney Swift	*Chaetura pelagica*
Crooked-stem Aster	Symphyotrichum prenanthoides
Dense Blazing Star	*Liatris spicata*
Eastern Meadowlark	*Sturnella magna*
Eastern Pondmussel	*Ligumia nasuta*
Henslow's Sparrow	*Ammodramus henslowii*
Hill's Thistle	*Cirsium pumilum*
Horned Grebe	*Podiceps auritus*
King Rail	*Rallus elegans*
Kirtland's Warbler	*Dendroica kirtlandii*
Least Bittern	*Ixobrychus exilis*
Loggerhead Shrike	*Lanius ludovicianus*

Common Name	Scientific Name
Louisiana Waterthrush	*Parkesia motacilla*
Milksnake	*Lampropeltis triangulum*
Northern Map Turtle	*Graptemys geographica*
Peregrine Falcon	*Falco peregrinus*
Piping Plover	*Charadrius melodus*
Prothonotary Warbler	*Protonotaria citrea*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Short-eared Owl	*Asio flammeus*
Snapping Turtle	*Chelydra serpentina*
Whip-poor-will	*Caprimulgus vociferus*
Yellow-breasted Chat	*Icteria virens*
Yellow Rail	*Yellow Rail*
Migratory Species	
American White Pelican	*Pelecanus erythrorhynchos*
Golden Eagle	*Aquila chrysaetos*

TABLE 4-6: PROVINCIALLY RARE SPECIES ON RECORD WITHIN THE STUDY AREA

Common Name	Scientific Name
American Golden-plover	*Pluvialis dominica*
Black-Crowned Night-heron	*Nycticorax nycticorax*
Bushy Cinquefoil	*Potentilla supina*
Bushy Seedbox	*Ludwigia alternifolia*
Canvasback	*Aythya valisineria*
Caspian Tern	*Hydroprogne caspia*
Forster's Tern	*Sterna forsteri*
Greater Black-backed Gull	*Larus marinus*
Great Egret	*Ardea alba*
Hairy-fruited Sedge	*Carex trichocarpa*
Hudsonian Godwit	*Limosa haemastica*
Little Gull	*Hydrocoloeus minutus*
Marbled Godwit	*Limosa fedoa*
Nuttall's Pondweed	*Potamogeton epihydrus*
Orange Coneflower	*Rudbeckia fulgida*

Common Name	Scientific Name
Pectoral Sandpiper	*Calidris melanotos*
Purple Milkweed	*Asclepias purpurascens*
Queen Devil	*Hieracium gronovii*
Red-necked Grebe	*Podiceps grisegena*
Red Throated Loon	*Gavia stellata*
Redhead	*Aythya americana*
Rough-legged Hawk	*Buteo lagopus*
Scarlet Beebalm	*Monarda didyma*
Short-billed Dowitcher	*Limnodromus griseus*
Whimbrel	*Numenius phaeopus*
White-eyed Vireo	*Vireo griseus*
Winged Loosestrife	*Lythrum alatum*
Wilson's Phalarope	*Phalaropus tricolor*
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*
Hairy Woodmint	*Blephilia hirsuta*

The only MNRF identified SAR found within the Study Area is Barn Swallow. No other SAR were encountered during field investigations.

No Butternut Trees were encountered during site investigations within the Study Area. No other SAR or Provincially Rare Species were encountered during field investigations over the course of three seasons (spring, summer, and fall).

4.1.8 Designated Areas

Important natural features and functions are identified by the province, lower tier municipalities and conservation authorities using a variety of instruments including Areas of Natural and Scientific Interest (ANSI), Provincially Significant Wetlands (PSWs) and Environmentally Significant Areas (ESA) that often overlap in area. Several are located within the Study Area and are identified below:

There are two ANSIs located at:

- Duffins Creek Coastal Marsh Provincial Life Science ANSI Candidate (located south of Highway 401 west of Westney Road)
- Life Science ANSI (located south of Highway 401 east of Harmony Road)

ESAs include:

- Lower Duffins Creek PSW (located south of Highway 401 east and west of Church Street)
- Oshawa Second Marsh and McLaughlin Bay PSW

PSWs include:

- Lower Duffins Creek Wetland Complex
- Duffins Creek Coastal Marsh
- Carruthers Creek Wetland Complex
- Oshawa Second Marsh

Other significant features located within the Study Area include the TRCA and CLOCA Natural Heritage Systems which exist throughout the natural corridor system from the City of Pickering to Clarington. These Natural Heritage Systems were created to protect, enhance and interconnect significant natural areas. They were developed at the regional scale with a primary focus of terrestrial biodiversity. Where possible, activities within lands included in these natural heritage system areas should seek to minimize disturbance, provide restoration towards enhancement of ecological function and improve landscape interconnectedness.

Portions of the Natural Heritage Systems that fall within the MTO ROW include:

- Lower Duffins Creek Wetland Complex
- Duffins Creek and Duffins Creek Coastal Marsh
- Carruthers Creek and Carruthers Wetland Complex
- Whitby Harbour Tributary
- West Corbett Creek
- East Corbett Creek
- Oshawa Creek
- Harmony and Farewell Creek and Oshawa Second Marsh
- Robinson Creek
- Tooley Creek

4.2 SOCIO-ECONOMIC ENVIRONMENT

The Study Area is located in the City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa and the Municipality of Clarington in the Region of Durham. **Tables 4-7** and **4-8** summarize the population and total private dwellings (based on 2011 Statistics Canada data) and the place of work status, mode of transportation to work, and the breakdown of industry within the Study Area (based on 2006 Statistics Canada data), respectively.

TABLE 4-7: POPULATION NUMBERS AND DWELLINGS IN THE STUDY AREA MUNICIPALITIES (2011)

Municipality	Population	Total Private Dwellings
Municipality of Clarington	84,548 (8.6% increase since 2006) (median age of 38.6)	30,797
City of Oshawa	149,607 (5.7% increase since 2006) (median age of 40.6)	61,306
Town of Whitby	122,022 (9.7% increase since 2006) (median age of 37.6)	41,931
Town of Ajax	109,600 (21.6% increase since 2006) (median age of 36.2)	35,593
City of Pickering	88,721 (1.0% increase since 2006) (median age of 40.7)	29,875
Region of Durham	608,124 (8.4% increase since 2006) (median age of 39.2)	220,598

TABLE 4-8: PLACE OF WORK STATUS, INDUSTRY, AND MODE OF TRANSPORTATION TO WORK (2011)

Municipality	Place of Work Status		Industry		Mode of Transportation to Work	
Municipality of Clarington	Worked at Home:	2,445	Agriculture and Other Resource Based Industries:	2,535	Car, Truck, Van as Driver:	31,940
	Worked Outside Canada:	80	Construction:	3,125	Car, Truck, Van as Passenger:	3,060
	No Fixed Workplace Address:	3,605	Manufacturing:	7,115	Public Transit:	1,340
	Worked at Usual Place:	33,980	Wholesale Trade:	1,865	Walked or Bicycled:	1,070
			Retail Trade:	4,640	All Other Modes:	170
			Finance and Real Estate:	1,970		
			Health Care and Social Services:	4,220		
			Educational Services:	2,665		
			Business Services:	6,650		
			Other:	7,105		
City of Oshawa	Worked at Home:	3,305	Agriculture and Other Resource Based Industries:	1,765	Car, Truck, Van as Driver:	51,280
	Worked Outside Canada:	160	Construction:	5,100	Car, Truck, Van as Passenger:	6,170
	No Fixed Workplace Address:	7,285	Manufacturing:	12,770	Public Transit:	5,590
	Worked at	59,775	Wholesale Trade:	3,175	Walked or Bicycled:	3,400
			Retail Trade:	9,200	All Other Modes:	605
			Finance and Real Estate:	3,855		

Municipality	Place of Work Status		Industry		Mode of Transportation to Work	
	Usual Place:		Health Care and Social Services:	7,175		
			Educational Services:	4,960		
			Business Services:	13,620		
			Other:	13,380		
Town of Whitby	Worked at Home:	3,810	Agriculture and Other Resource Based Industries:	2,355	Car, Truck, Van as Driver:	43,120
	Worked Outside Canada:	200	Construction:	3,495	Car, Truck, Van as Passenger:	4,570
	No Fixed Workplace Address:	5,280	Manufacturing:	6,540	Public Transit:	5,730
	Worked at Usual Place:	50,090	Wholesale Trade:	3,555	Walked or Bicycled:	1,610
			Retail Trade:	6,930	All Other Modes:	340
			Finance and Real Estate:	5,905		
			Health Care and Social Services:	5,745		
			Educational Services:	4,610		
			Business Services:	11,985		
			Other:	10,870		
Town of Ajax	Worked at Home:	2,585	Agriculture and Other Resource Based Industries:	1,255	Car, Truck, Van as Driver:	33,830
	Worked Outside Canada:	175	Construction:	2,895	Car, Truck, Van as Passenger:	3,860
	No Fixed Workplace Address:	4,275	Manufacturing:	5,860	Public Transit:	6,115
	Worked at Usual Place:	41,365	Wholesale Trade:	2,920	Walked or Bicycled:	1,460
			Retail Trade:	6,730	All Other Modes:	370
			Finance and Real Estate:	5,440		
			Health Care and Social Services:	4,315		
			Educational Services:	2,870		
			Business Services:	10,510		
			Other:	7,945		
City of Pickering	Worked at Home:	3,010	Agriculture and Other Resource Based Industries:	1,110	Car, Truck, Van as Driver:	33,365
	Worked Outside Canada:	170	Construction:	3,315	Car, Truck, Van as Passenger:	3,730
	No Fixed Workplace Address:	4,725	Manufacturing:	5,095	Public Transit:	5,790
	Worked at Usual Place:	39,755	Wholesale Trade:	3,010	Walked or Bicycled:	1,320
			Retail Trade:	5,915	All Other Modes:	280
			Finance and Real Estate:	5,775		
			Health Care and Social Services:	4,250		
			Educational Services:	3,005		

Municipality	Place of Work Status	Industry		Mode of Transportation to Work
		Business Services:	10,895	
		Other:	7,685	

4.2.1 Existing Land Use

The Study Area consists of a mix of land uses, including residential, institutional, commercial / industrial, waterfront gateway, and open spaces (including recreational areas, environmental protection areas and hazard lands). In general, where residences do not already exist, the municipalities have designated lands adjacent to Highway 401 as employment areas (i.e. commercial / industrial). There are also small pockets of agricultural lands within the more urbanized sections of the Study Area (e.g. between Squires Beach Road and Church Street South on the south side of Highway 401), and river valley connections cross Highway 401 at various locations. **Figures 4-4** to **4-10** illustrate existing land use designations (as identified in the Official Plans) within the Study Area.

FIGURE 4-4: LAND USE WITHIN THE STUDY AREA

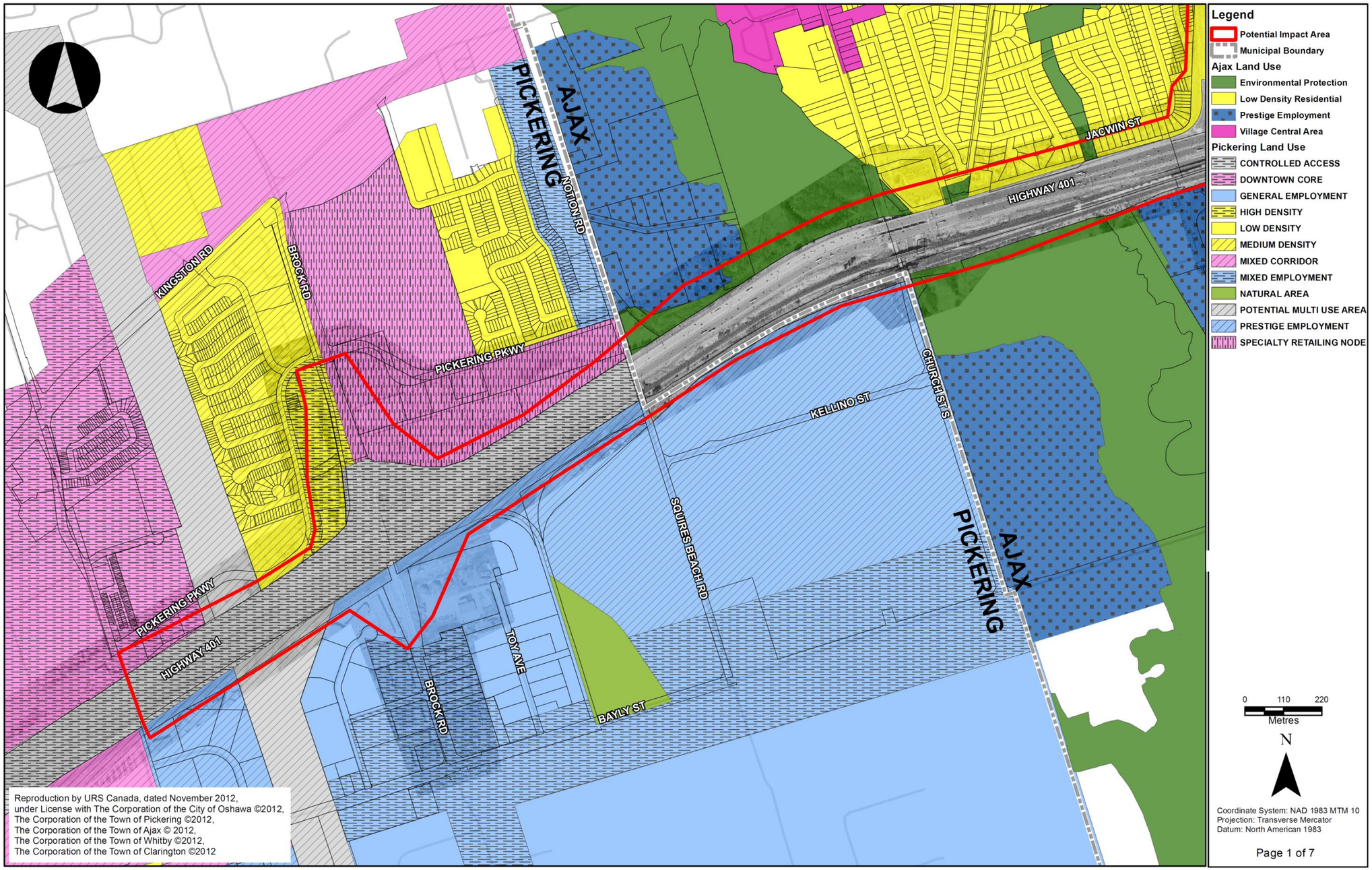


FIGURE 4-5: LAND USE WITHIN THE STUDY AREA

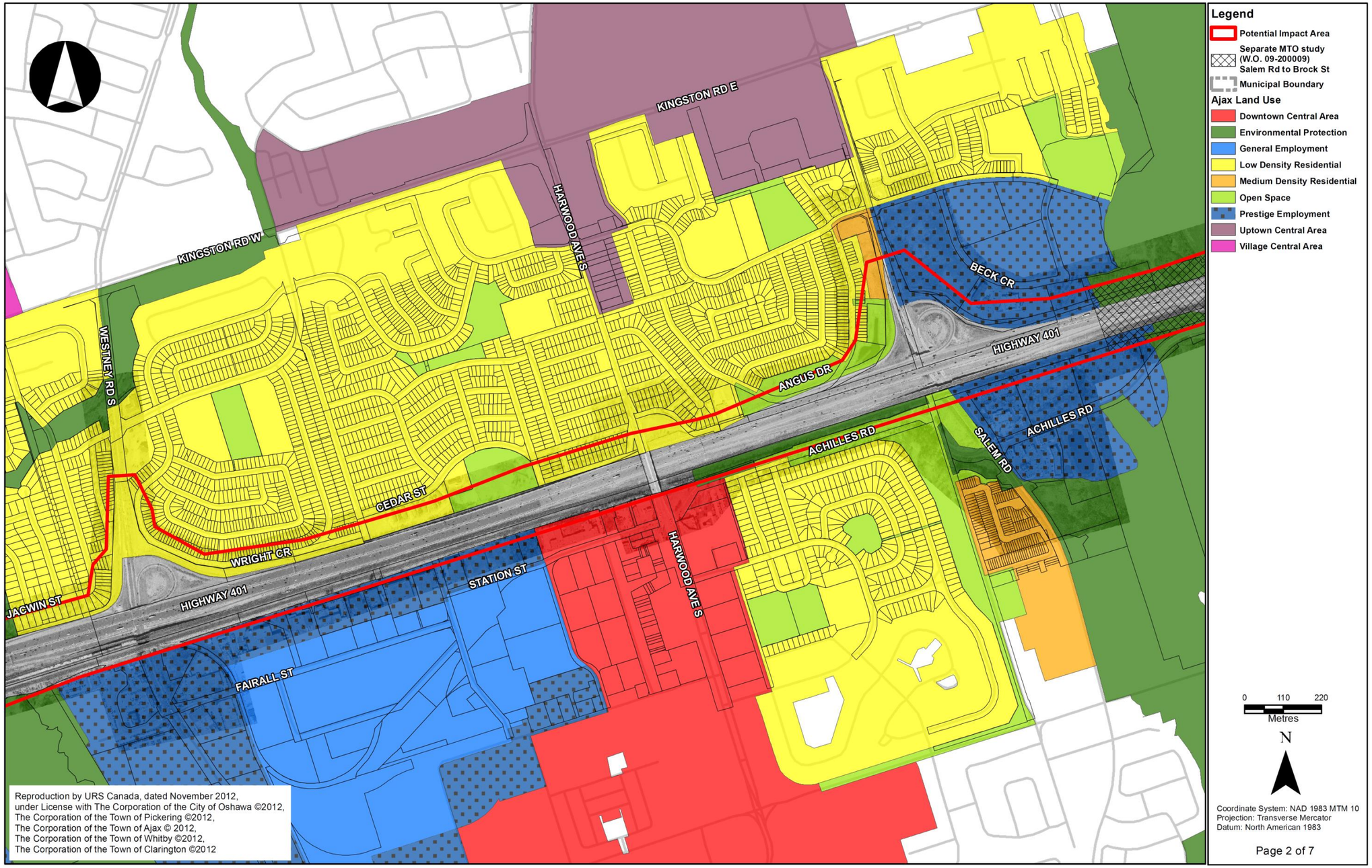


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FIGURE 4-6: LAND USE WITHIN THE STUDY AREA

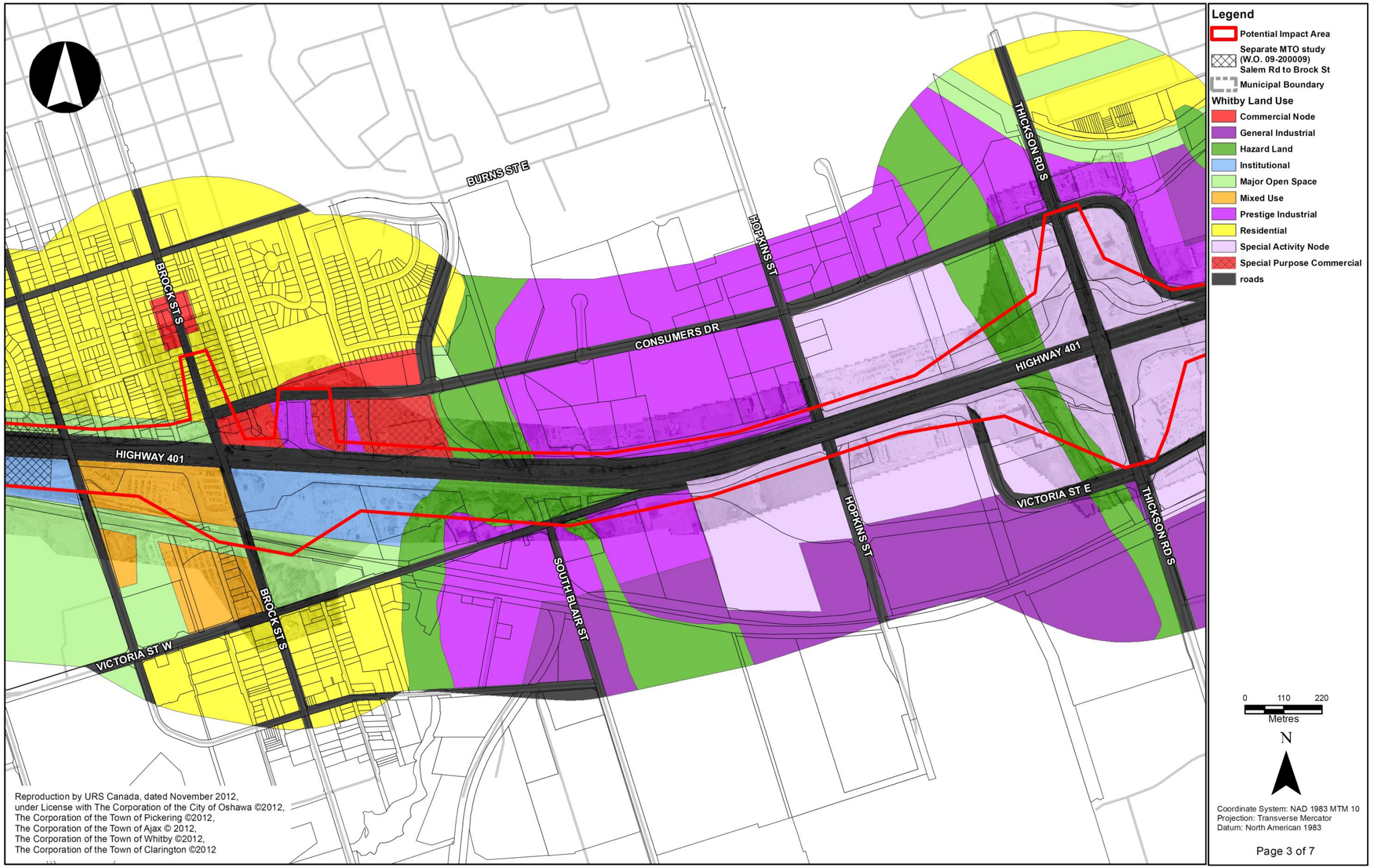


FIGURE 4-7: LAND USE WITHIN THE STUDY AREA

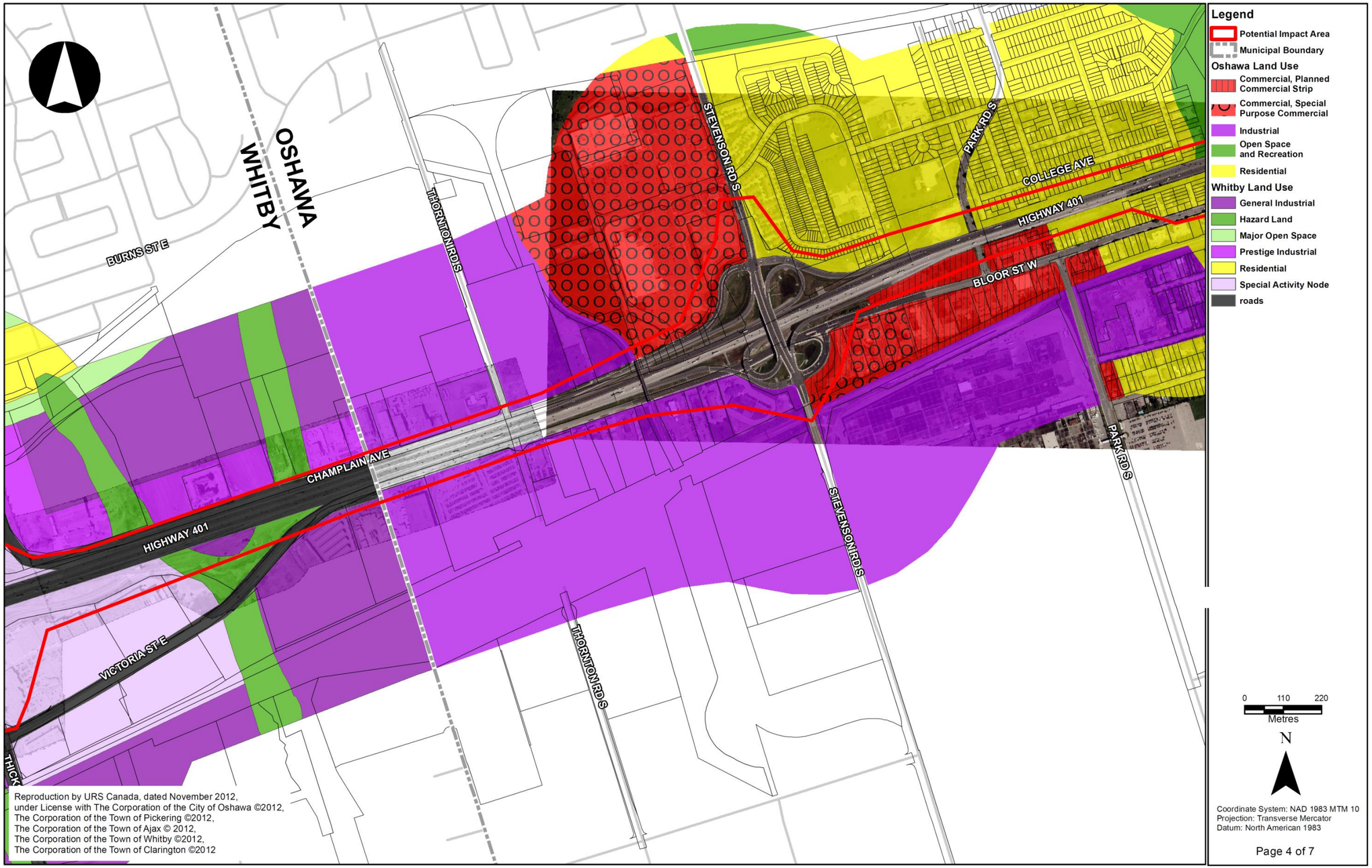


FIGURE 4-8: LAND USE WITHIN THE STUDY AREA

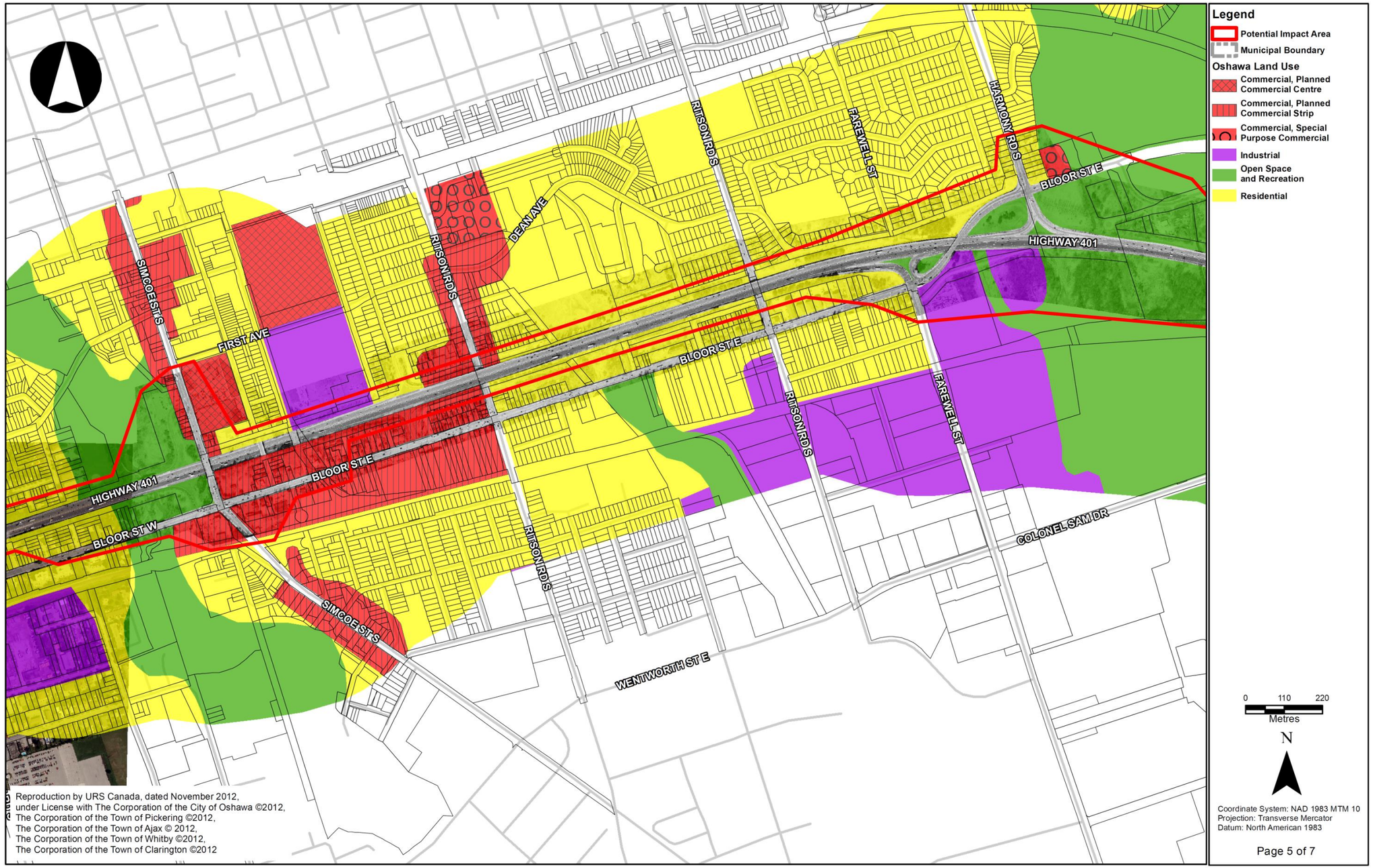


FIGURE 4-9: LAND USE WITHIN THE STUDY AREA

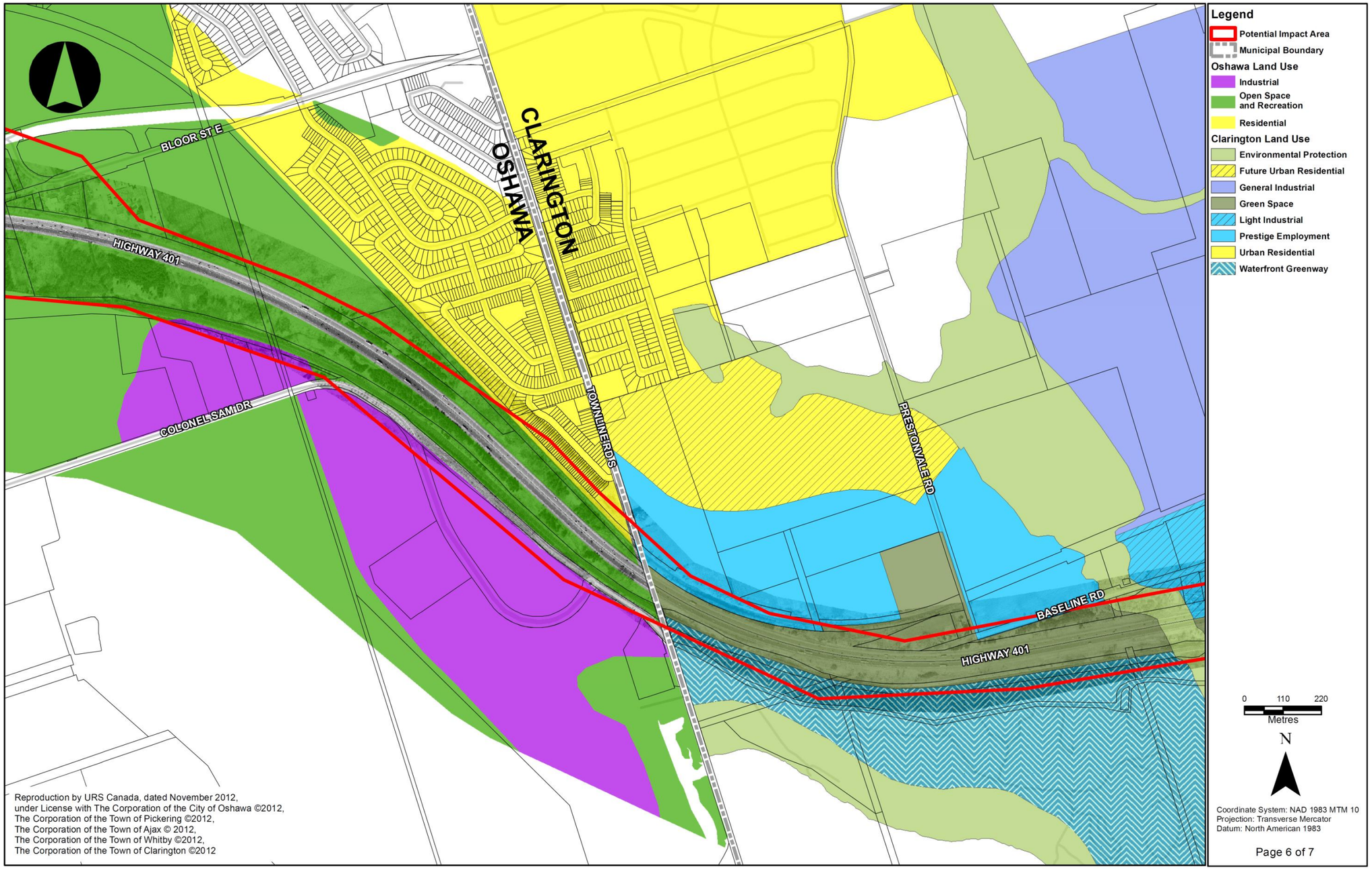
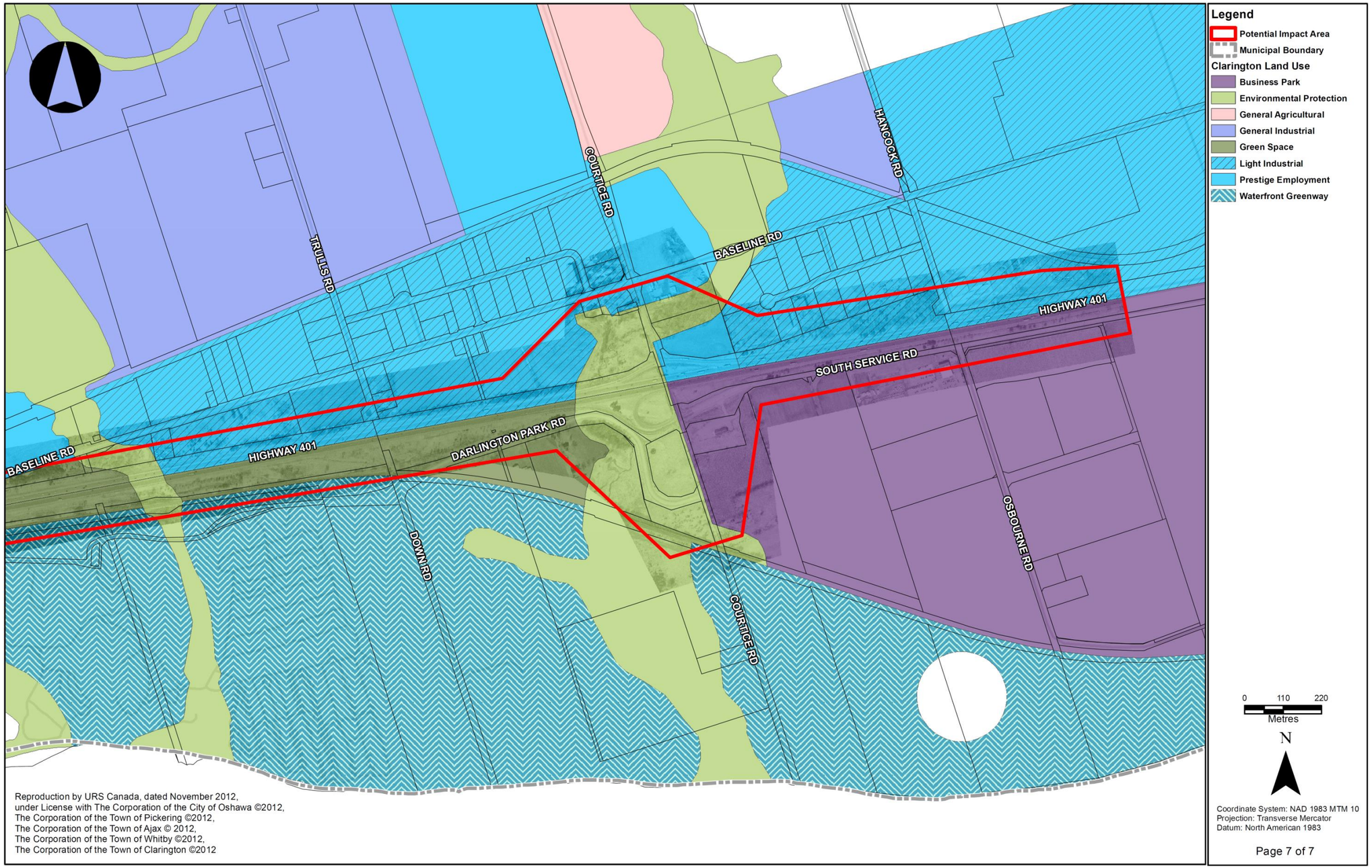


FIGURE 4-10: LAND USE WITHIN THE STUDY AREA



Residential and Secondary Plans

A number of existing residential areas are located adjacent to the Highway 401 corridor throughout the study limits. An overview of some of the existing neighbourhoods within the Study Area, as outlined in the various municipal Official Plans, is provided below.

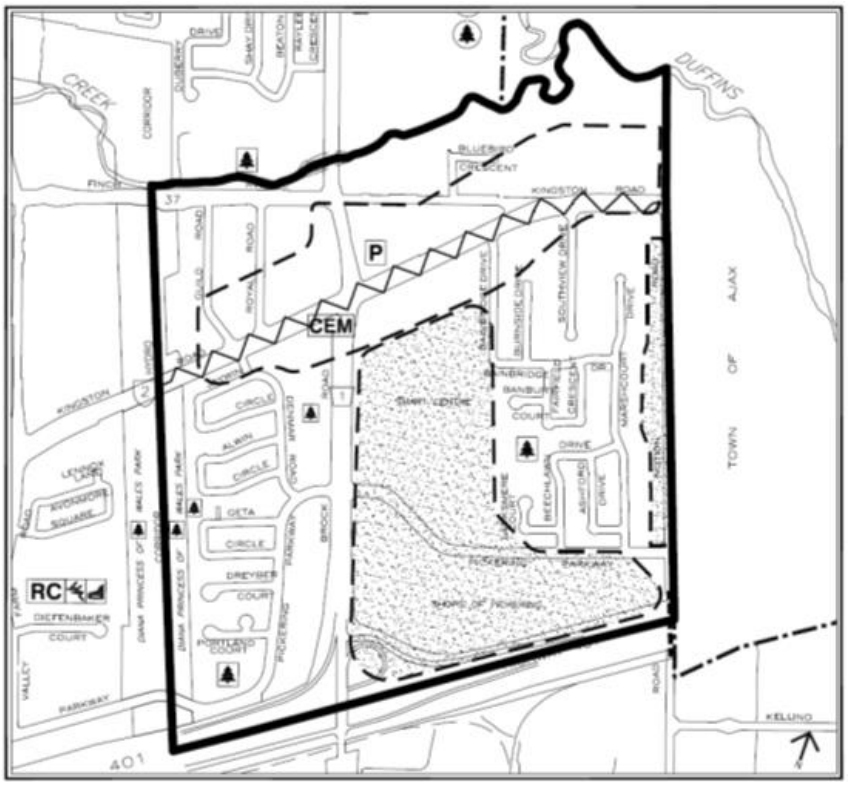
City of Pickering

Village East

The City of Pickering Official Plan identifies the Village East neighbourhood (**Figure 4-11**) within the west limits of the Study Area. This neighbourhood is bounded by the hydro transmission corridor west of Brock Road, West Duffins Creek, the Ajax-Pickering boundary, and Highway 401. The neighbourhood includes the following features:

- Established residential areas fronting Guild Road, Royal Road and Southview Drive; subdivision activity at the western and eastern ends of the neighbourhood has occurred since 1970s;
- Consists of a mix of detached, semi-detached, townhouse and apartment dwellings; also includes four neighbourhood parks plus part of the Diana Princess of Wales Park, a cemetery and a police station;
- Has neighbourhood and community shopping around the intersection of Brock and Kingston Roads, and the First Simcha Shopping Centre, located on the east side of Brock Road;
- Has environmentally sensitive areas associated with West Duffins Creek.

FIGURE 4-11: CITY OF PICKERING VILLAGE EAST NEIGHBOURHOOD



Source: City of Pickering Official Plan (2009), Map 19

Town of Ajax

The Town of Ajax Official Plan identifies residential land uses on the north side of Highway 401 between Church Street and Salem Road. Numerous residential streets are located directly adjacent to Highway 401 including Mill Street, Jacwin Drive, Wright Crescent, Reading Street, Cedar Street, Queen Street, Birch Crescent and Angus Drive. Residential development is also located south of the rail corridor between the Downtown Central Area along the Harwood Avenue corridor and Salem Road.

Town of Whitby

Residential land uses are located on the north side of Highway 401 between approximately Lynde Creek and Pringle Creek. In addition, the Town of Whitby Official Plan identifies two Secondary Plans on the south side of Highway 401, as follows:

Town of Whitby Secondary Plan – Port Whitby Community

The goal of the Port Whitby Secondary Plan (**Figure 4-12**) is to encourage the development and redevelopment of the Port Whitby Community through both private and public initiatives by maximizing its tourism opportunities, and promoting its potential as a unique small-craft recreational harbour and residential community, while also

protecting and enhancing the natural features of the harbour area. The objectives of the secondary plan are to:

- Maximize the potential for the utilization of the Whitby Harbour as a small craft harbour and the utilization of the adjoining public open space lands for active and passive recreational purposes;
- Provide for the reinforcement of a Port Whitby Community land-based residential community. It shall be the Municipality's policy to encourage infilling and/or intensification in order to provide affordable housing and to ensure that in areas of mixed use, redevelopment is compatible with existing development in terms of scale, traffic generated and demand on municipal services; and
- To permit the Port Whitby Community to develop to a population capacity of 7,000 persons.

Town of Whitby Secondary Plan – Lynde Shores

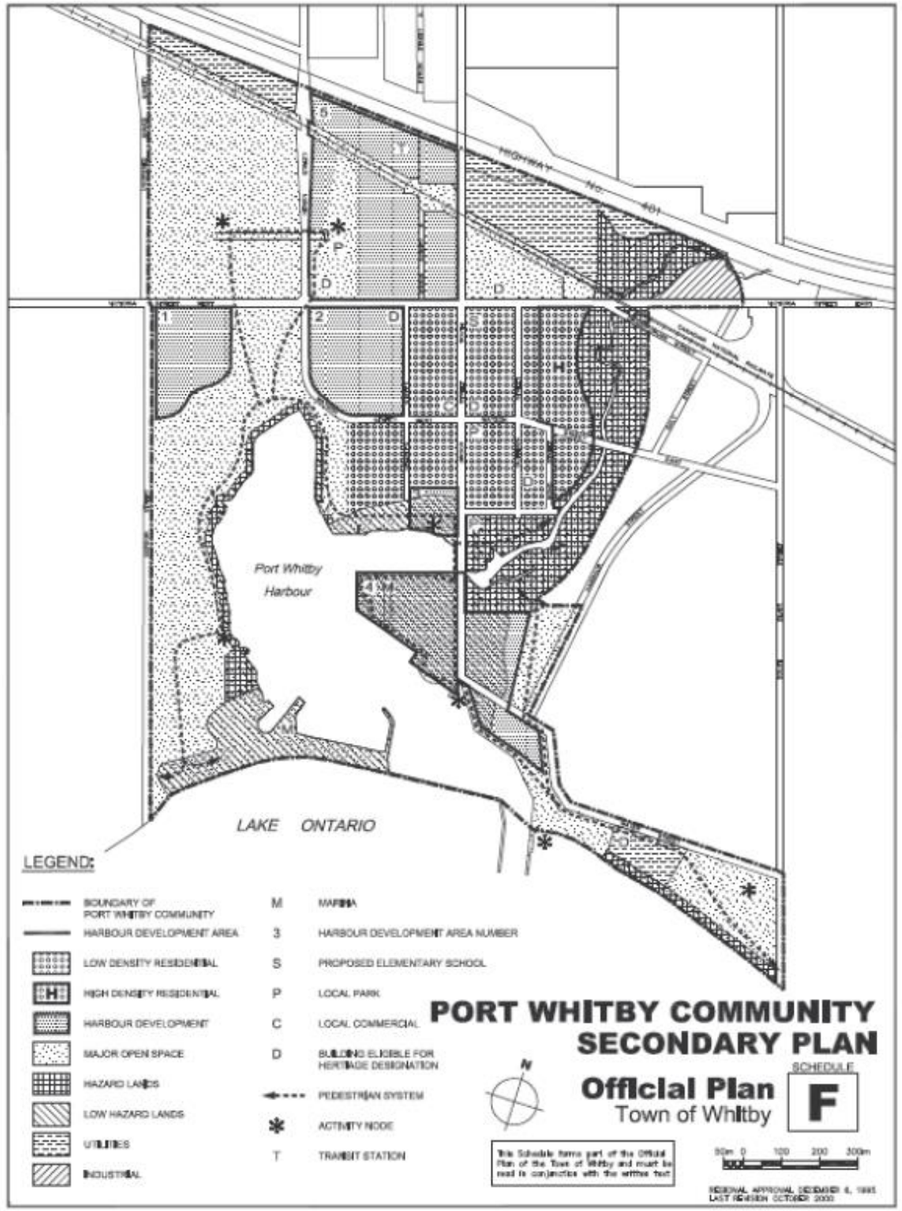
The goal of the Lynde Shores Secondary Plan (**Figure 4-13**) is to provide for the comprehensive development of the Lynde Shores Secondary Plan Area in a manner which protects and enhances the Lynde Creek wetland and integrates residential, commercial, institutional, industrial and community oriented uses. Additionally, the secondary plan aims to provide for the development of a Business Park area adjacent to Highway 401 that capitalizes on the advantages of the surrounding transportation facilities.

The objectives of the secondary plans are:

- To develop a fully integrated residential neighbourhood incorporating a range of residential densities and community facilities;
- To develop a neighbourhood which will integrate with, and shares various community facilities with, the adjacent Port Whitby area;
- To develop a neighbourhood which shall provide a full range of housing types to satisfy the social and economic needs of Whitby's population;
- To develop a strategically located Business Park taking advantage of the Highway 401 exposure and the surrounding transportation network;
- To provide for the ultimate needs of the two hospitals in a manner which is compatible and integrated with the adjacent recreational and residential development;
- To develop an open space system which provides recreational opportunities to the residents of Whitby utilizing the Lake Ontario waterfront while respecting the environmentally sensitive nature of the Class 1 wetlands on the western boundary of the area, and the sensitive nature of archaeological sites in the area; and
- To establish a focal point for the neighbourhood at the Gordon Street-Victoria Street intersection, incorporating a mixture of residential, retail commercial,

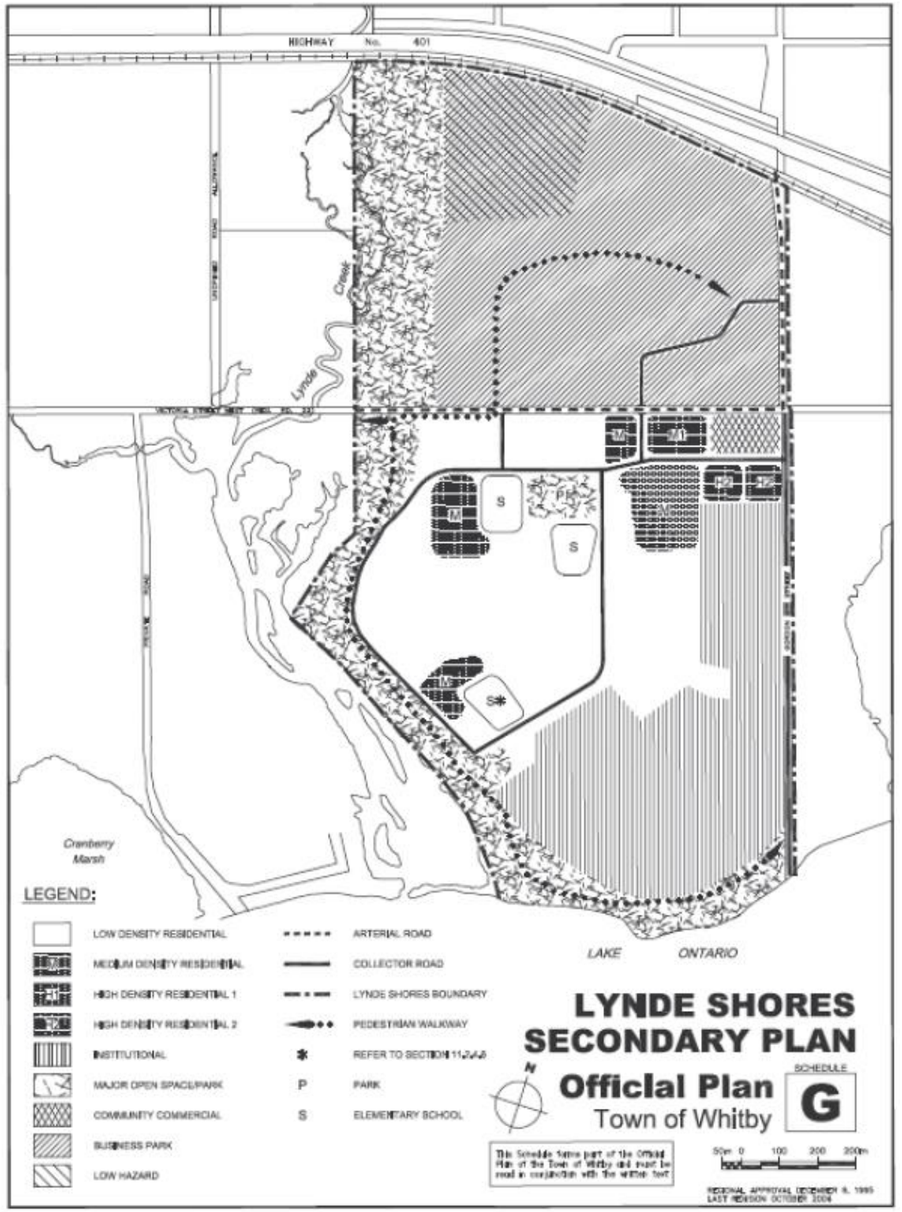
office and recreation uses while ensuring a high quality of design and visual appearance.

FIGURE 4-12: TOWN OF WHITBY – PORT WHITBY SECONDARY PLAN



Source: Town of Whitby Official Plan (2010), Schedule F

FIGURE 4-13: TOWN OF WHITBY – LYNDE SHORES SECONDARY PLAN



Source: Town of Whitby Official Plan (2010), Schedule G

City of Oshawa

Within the City of Oshawa, residential development is located in close proximity to the Highway 401 corridor on both the north and south sides of the highway. The City of Oshawa Official Plan identifies both Community Improvement Areas and Renaissance Community Improvement Area within the study limits, as follows:

Community Improvement Area

The delineation of the Community Improvement Areas shown on Schedule "C" (**Figure 4-14**) is based on the following criteria:

- Residential areas which require improvements to upgrade housing units, deficient neighbourhood parks and recreational facilities, deficient streets and sidewalks, deficient sewer and water services, and to alleviate land use conflicts;
- Commercial areas which require improvements to upgrade deteriorated buildings, aesthetic amenities, deficient streets and sidewalks, parking deficiencies, and deficient sewer and water services. Such areas may exhibit a large number of vacant buildings or other indicators of economic decline, and land use conflicts; and,
- Industrial areas which require improvements to upgrade deteriorated buildings, deficient streets and sidewalks, deficient sewer and water services, inadequate parking, access and loading facilities, landscaping and buffering, or to alleviate environmental problems such as noxious uses or pollution, vacant or obsolete industrial buildings and land use conflicts.

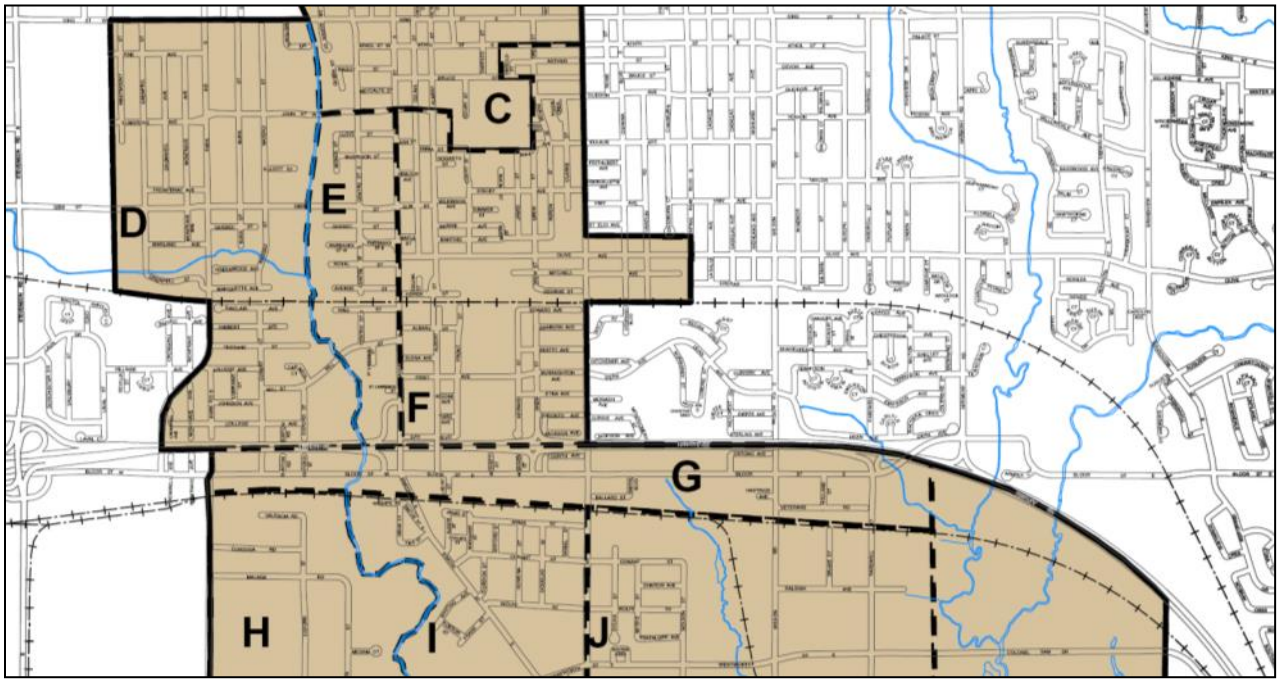
Subareas D, E, F, G, and I are adjacent to the Study Area, as follows:

- **Subarea D** – this area is located west of Oshawa Creek, between King Street West and Highway 401. Improvements are required to upgrade those buildings which require rehabilitation, to improve facilities and appearance of park and recreation areas and to upgrade deficient roads;
- **Subarea E** – this area is located south of the Central Business District between the Oshawa Creek and Simcoe Street. Improvements in this area are required to alleviate land use conflicts between residential and commercial uses. Improvements will also upgrade buildings which require rehabilitation, establish new recreational facilities in the existing parks, upgrade road deficiencies, alleviate a lack of off-street parking in the Simcoe Street commercial area, and establish community facilities in the high density residential sector;
- **Subarea F** – this area is generally located south of the Central Business District between Simcoe Street and Ritson Road. Although substantial improvements have been made in the area, improvements are required to alleviate land use conflicts among residential, commercial and industrial areas, and to upgrade buildings requiring rehabilitation, road deficiencies, a lack of off-street parking in

the Simcoe Street commercial area, economic decline in the commercial area, and to rehabilitate or remove obsolete or vacant industrial buildings;

- **Subarea G** – located between Highway 401 and the CN Rail line, this linear mixed use area comprises the Bloor Street corridor area. Improvements in this area are required to alleviate severe land use conflicts, to upgrade buildings requiring rehabilitation, deficiencies in parks and community facilities, and to alleviate economic decline and detrimental impacts from major road and rail transition facilities; and
- **Subarea I** - this area is generally bounded by the Oshawa Creek, the CN Rail line, Ritson Road and Wentworth Street. Although substantial improvements have been made in the area, improvements are required to alleviate land use conflicts between residential and industrial uses, and to upgrade buildings requiring rehabilitation, deficiencies in parks, deficient roads and vacant lots.

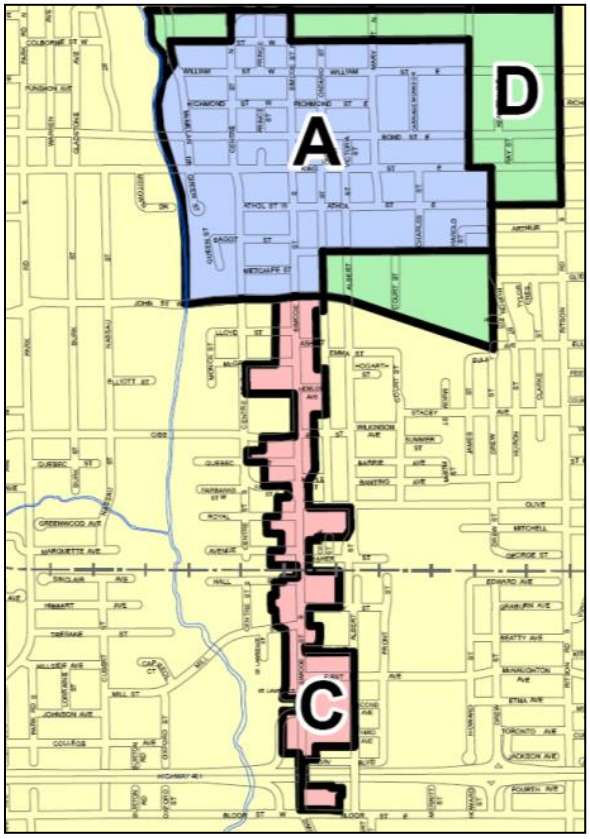
FIGURE 4-14: CITY OF OSHAWA COMMUNITY IMPROVEMENT AREA



Renaissance Community Improvement Area

The City of Oshawa Official Plan also identifies a Renaissance Community Improvement Area located within the study limits, as shown in **Figure 4-15**. Subarea C of this area is located adjacent to the Study Area and is comprised of certain lands generally fronting onto Simcoe Street South between John Street and Bloor Street.

FIGURE 4-15: CITY OF OSHAWA RENAISSANCE COMMUNITY IMPROVEMENT AREA SUBAREA C



Source: City of Oshawa Official Plan (2012), Schedule C-1

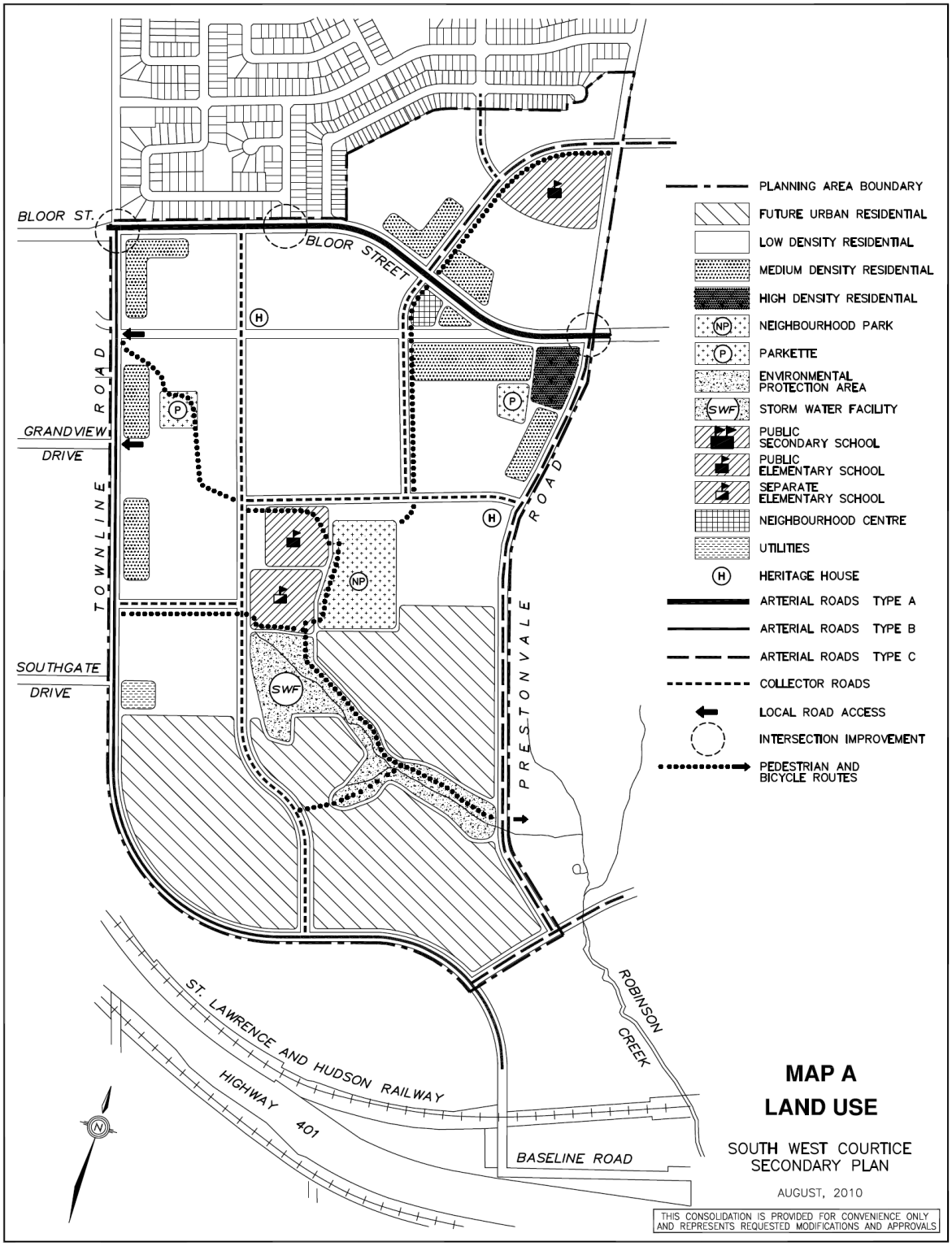
Municipality of Clarington

South West Courtice Secondary Plan

Within the Municipality of Clarington, the South-West Courtice Secondary Planning Area (**Figure 4-16**) comprises a portion of the Bayview Neighbourhood and the Penfound Neighbourhood as identified in the Clarington Official Plan. The Secondary Planning Area is approximately 148 hectares in size.

The goal of the plan is to provide a residential living environment that promotes a desirable quality of life and social interaction, and to provide a broad range of housing to meet the evolving housing needs of current and future residents. The ultimate planned population for the Secondary Planning Area is approximately 6,200 persons at an overall gross residential density of 17.3 units per gross hectare.

FIGURE 4-16: MUNICIPALITY OF CLARINGTON SECONDARY PLAN – SOUTH WEST COURTICE



Source: Municipality of Clarington Official Plan (2012), South West Courtice Secondary Plan

Commercial and Industrial

Major commercial and industrial areas are located at various locations along the corridor, including the vicinity of the Brock Road interchange, south of Highway 401 between Westney Road and Harwood Avenue, east of Salem Road, between Brock Street and Stevenson Road, along Simcoe Street, and south of the Harmony Road / Bloor Street interchange. Major industries and commerce within the Study Area include retail, manufacturing, servicing, construction, and hospitality.

Community / Recreational / Institutional / Park Features

Natural and Open Space Features

One of the most notable recreational features in the Study Area is the Waterfront Trail, opened in 1995 by the Waterfront Regeneration Trust in partnership with the Municipality of Clarington and a number of community groups. The Waterfront Trail follows the shores of Lake Ontario and the St. Lawrence River, connecting communities from Niagara-on-the-Lake to the Quebec border. For this study, the majority of the Waterfront Trail is located along the lakeshore, far from the Highway 401 corridor, with one exception. Within the Municipality of Clarington, the Waterfront Trail follows the southern edge of the CN Rail line, goes through Darlington Provincial Park, and crosses the rail line at Trullis Road. At this point, the Waterfront Trail is directly adjacent to Highway 401 eastbound and the Courtice Road interchange.

Darlington Provincial Park, which is part of the Ontario Provincial Parks system, is located to the south of Highway 401 west of Trulls Road. This park hosts camping, hiking, wildlife viewing, fishing, hunting, swimming, canoeing, and other boating opportunities.

Various other trails connect to the Waterfront Trail and extend north past the Highway 401 corridor. Major trails or cycling routes within the Study Area include:

- Duffins Creek trail system, a component of the Trans Canada Trail which crosses Highway 401 adjacent to Church Street / Duffins Creek;
- Joseph Kolodzie Oshawa Creek bike path, located in the Oshawa Creek valley and crossing beneath Highway 401 west of Simcoe Street;
- Michael Starr Trail, located east of Simcoe Street and crossing Highway 401 at Albert Street;
- Harmony Creek Trail, located north and south of Highway 401 near Harmony Road.

FIGURE 4-17: NATURAL AREAS AND TRAIL AT OSHAWA CREEK

Oshawa Creek

Oshawa Creek Bike Path

Park Lands

Five other public parks are located within or in close proximity to the Study Area, including:

- Cedar Park (west of Harwood Avenue on north side of Highway 401);
- Arbour Park (east of Harwood Avenue on south side of Highway 401);
- Storie Park (west of Simcoe Street on north side of Highway 401, adjacent to Oshawa Creek);
- Chopin Park (east of Ritson Road on north side of Highway 401); and
- Kingside Park (west of Harmony Road on north side of Highway 401).

Cemeteries

Three cemeteries are present within the Study Area, including:

- Saint Francis de Sales Catholic Cemetery, North of Highway 401 on Notion Road south of Pickering Parkway
- South of Highway 401 on Victoria Street and Brock Street South; and
- St. Wolodymyr and St. Olha Ukrainian Cemetery, north of Highway 401 on Prestonvale Road north of Baseline Road near the eastern end of the Study Area.

FIGURE 4-18: CEMETERIES WITHIN THE STUDY AREA

Saint Francis de Sales Catholic Cemetery

Cemetery - South of Highway 401 on Victoria Street and Brock Street South

Cemetery – St. Wolodymyr and St. Olha Ukrainian Cemetery

Institutions

The following municipal institutions are located within the Study Area:

- Community Development Council Durham (east of Westney Road on south side of Highway 401);
- Welcome Centre Immigrant Services (east of Westney Road on south side of Highway 401).

Churches

Nine churches are located within the Study Area, including:

- Church of Jesus Christ of Latter Day Saints (east of Church Street on north side of Highway 401);
- Church of the Living God (west of Harwood Avenue on north side of Highway 401);
- Ajax Baptist Church (east of Harwood Avenue on north side of Highway 401);
- Grace Lutheran Church (east of Stevenson Road on north side of Highway 401);
- New Apostolic Church (east of Stevenson Road on north side of Highway 401);
- St. John's Ukrainian Orthodox Church (east of Simcoe Street on south side of Highway 401;
- St. George's Ukrainian Catholic Church (east of Simcoe Street on north side of Highway 401);
- Greek Orthodox Church Evangel (Ritson Road on south side of Highway 401);
- Slavic Baptist Church (east of Ritson Road on south side of Highway 401);

Agricultural

There are few agricultural properties within the Study Area. **Table 4-9** presents the Ministry of Agriculture, Food and Rural Affairs (MAFRA's) definition of the capability classes found within the study area.

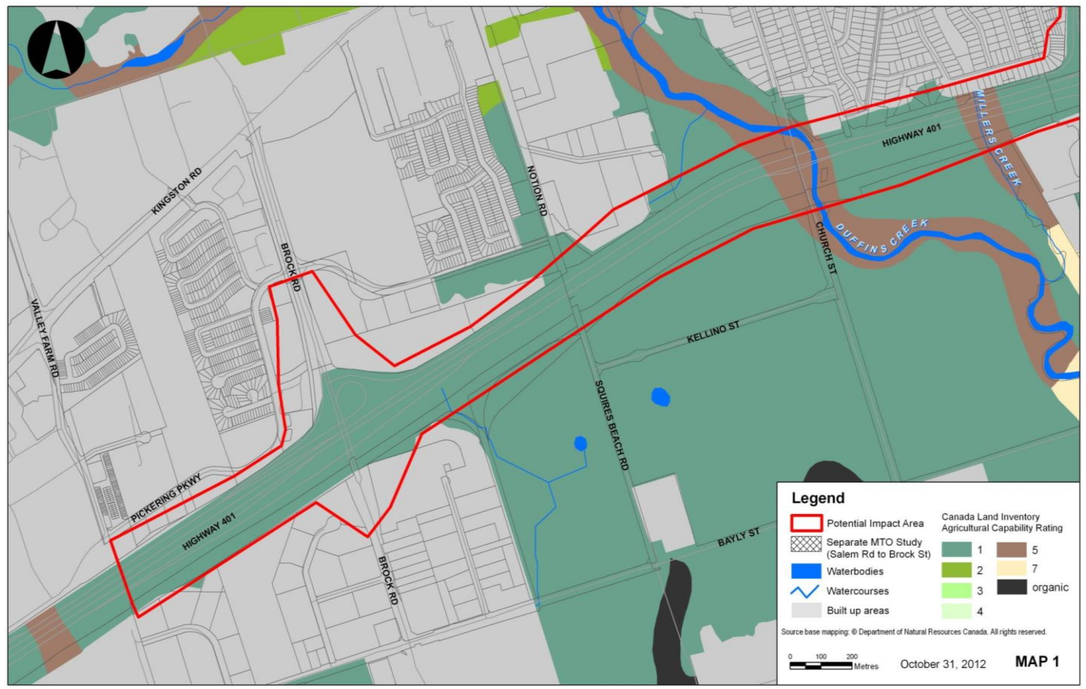
TABLE 4-9: DEFINITIONS OF CAPABILITY CLASSES

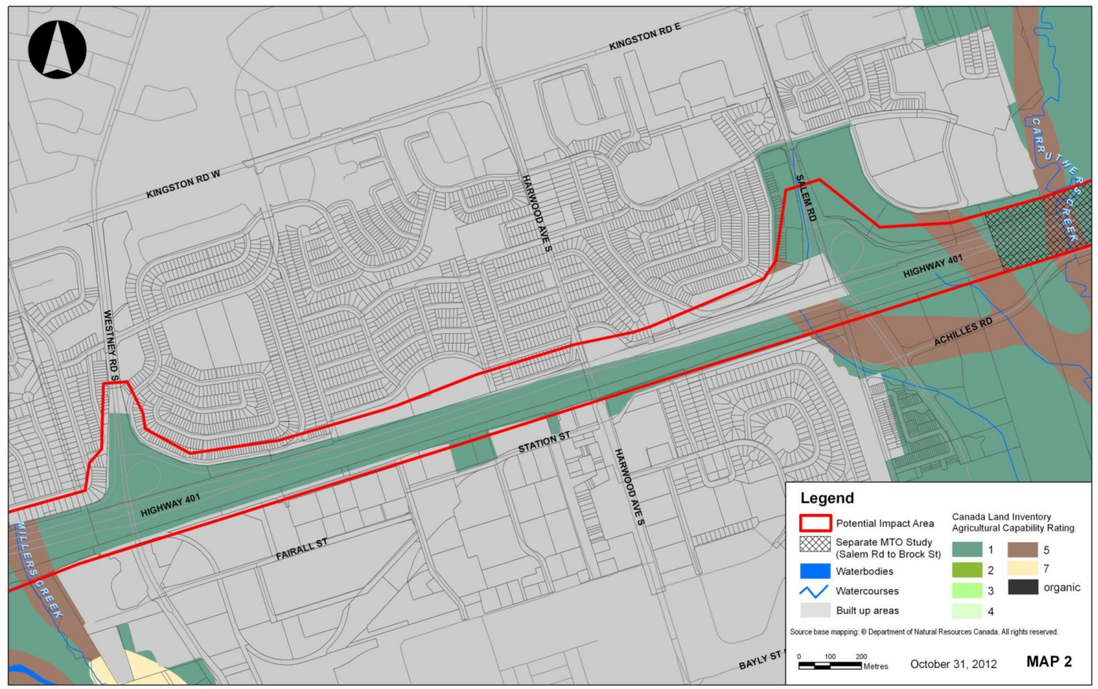
Soil Capability Class	Definition
Class 1	Soils have no significant limitations in use for crops. Soils are level to nearly level, deep, well to imperfectly drained, and have good nutrient and water holding capacity. They can be managed and cropped without difficulty. Under good management they are moderately high to high in productivity for the full range of common field crops.
Class 2	Soils have moderate limitations that reduce the choice of crops or require moderate conservation practices. These soils are deep and may not hold moisture and nutrients as well as Class 1 soils. The limitations are moderate and the soils can be managed and cropped with little difficulty. Under good management these soils are fair to moderately high in productivity for a wide range of field crops.
Class 3	Soils have moderately severe limitations that reduce the choice of crops or require special conservation practices. Limitations are more severe than Class 2 soils. They may affect the following practices: timing and ease of tillage; planting and harvesting; choice of crops; and methods of conservation. Under good management these soils are fair to moderately high in productivity for a wide range of common field crops.
Class 5	Soils have severe limitations that restrict capability to producing perennial forage crops. The limitations are so severe that the soils are not capable of use for sustained production of annual field crops. The soils are capable of producing native or tame species of perennial forage plants and may be improved through the use of farm machinery. Feasible improvement practices may include clearing of bush, cultivations, seeding, fertilization or water control.

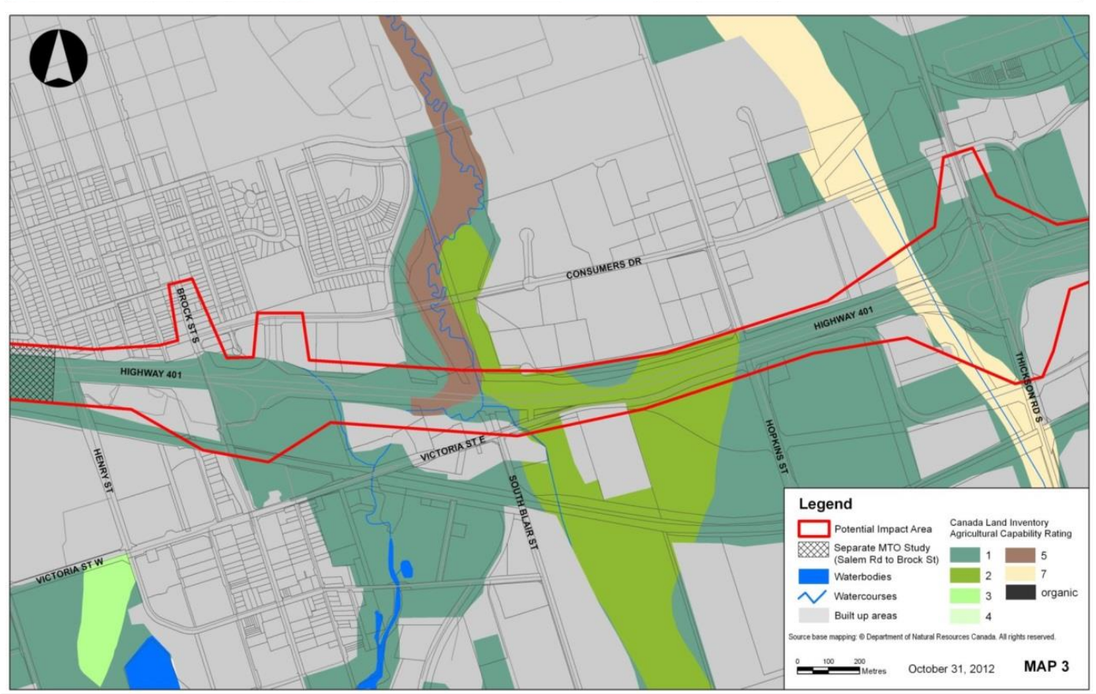
Agricultural uses become more prominent in the Municipality of Clarington, in the vicinity of Townline Road South. The majority of the Study Area, from Brock Road to Harmony Road, is urbanized. From Harmony Road to Courtice Road, where there are agricultural lands, the majority of the soils are considered Soil Capability Class 1; with Class 2 soils adjacent to Harmony Road (refer to **Figures 4-19** and **4-20**).

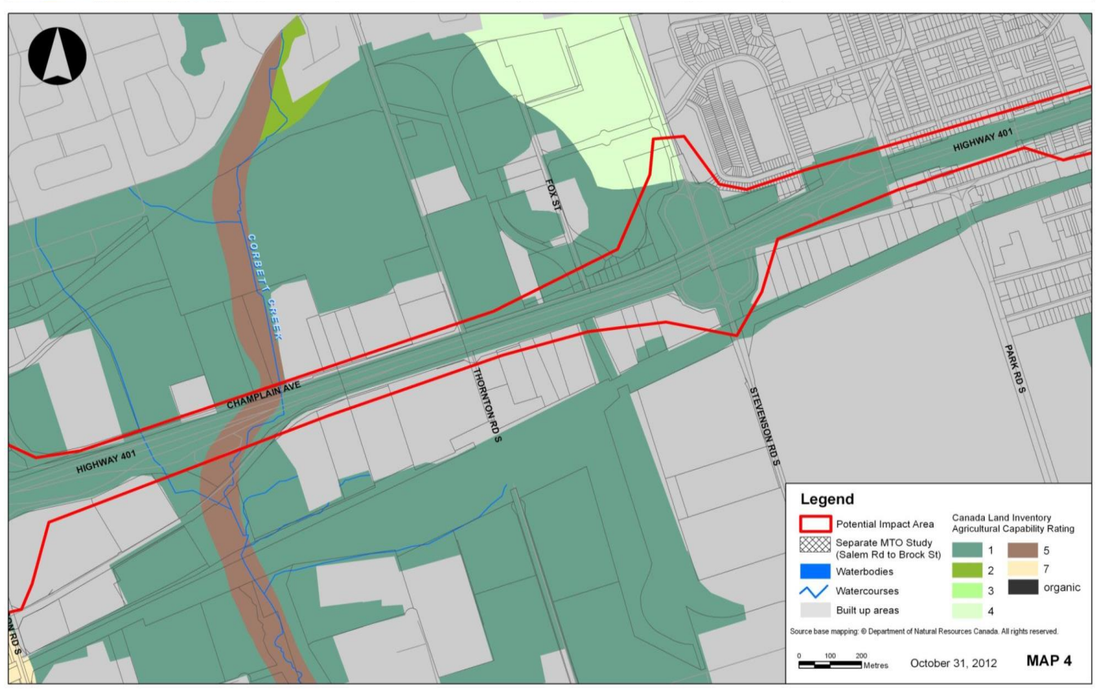
FIGURE 4-19: EXAMPLE OF AGRICULTURAL LANDS WITHIN THE STUDY AREA

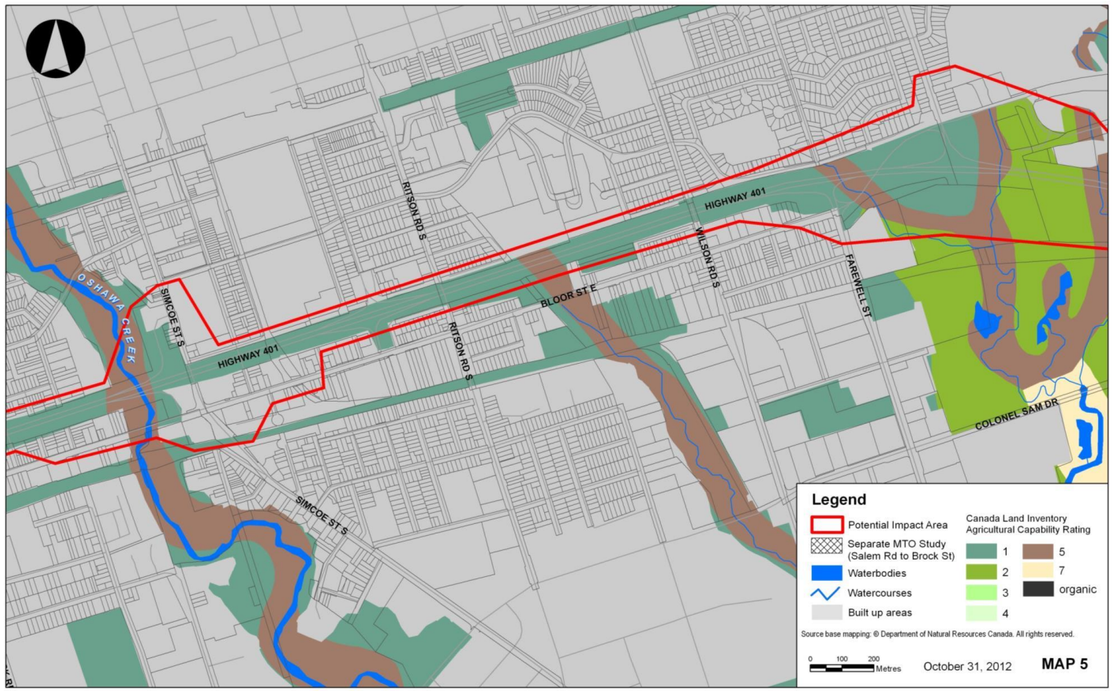
FIGURE 4-20: SOIL CLASSES WITHIN THE STUDY AREA (BROCK ROAD EASTERLY TO COURTICE ROAD)

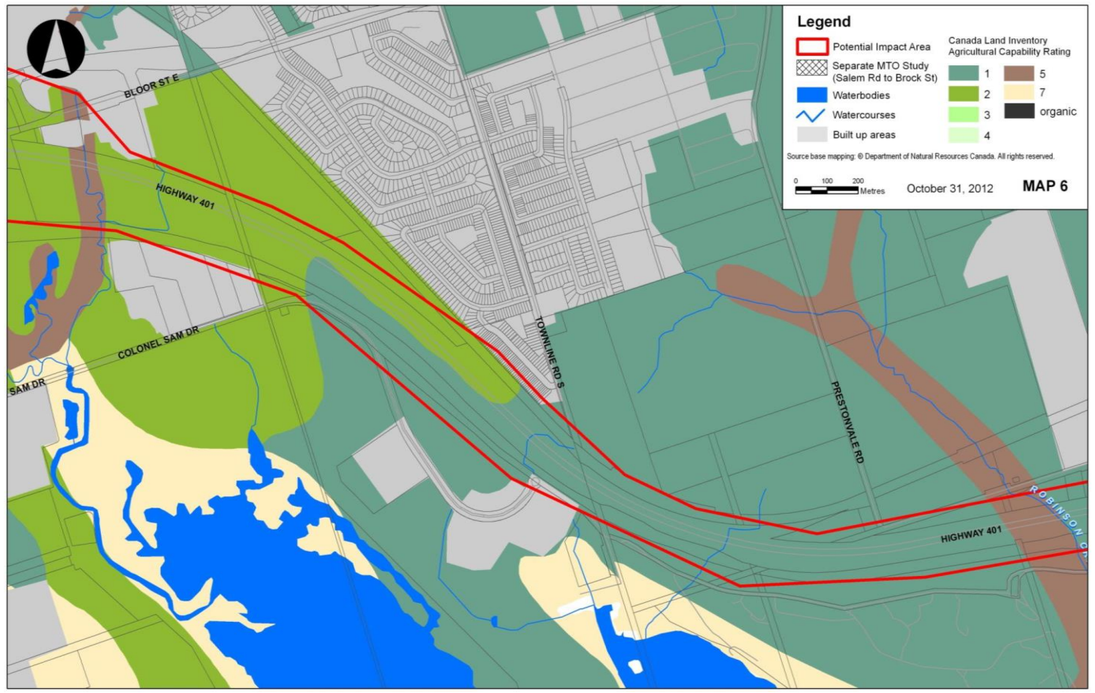









HIGHWAY 401
BLOOR ST E
RITSON RD S
WILSON RD S
FAREWELL ST
SIMCOE ST S
OSHAWA CREEK
COLONEL SAM DR
Legend
Potential Impact Area
Separate MTO Study (Salem Rd to Brock St)
Waterbodies
Watercourses
Built up areas
Canada Land Inventory Agricultural Capability Rating
1
2
3
4
5
7
organic
Source base mapping: © Department of Natural Resources Canada. All rights reserved.
0 100 200 Metres
October 31, 2012
MAP 5


BLOOR ST E
HIGHWAY 401
COLONEL SAM DR
SAM DR
TOWNLINE RD S
PRESTONVALE RD
ROBINSON C
HIGHWAY 401
Legend
Potential Impact Area
Separate MTO Study (Salem Rd to Brock St)
Waterbodies
Watercourses
Built up areas
Canada Land Inventory Agricultural Capability Rating
1
2
3
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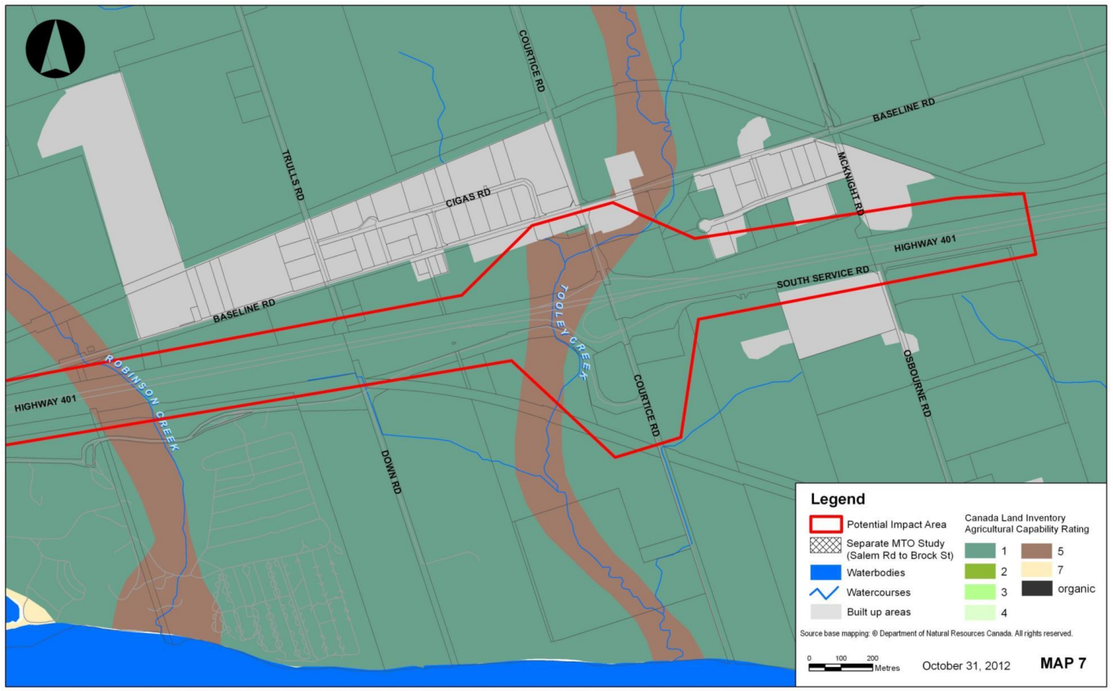
5
7
organic
Source base mapping: © Department of Natural Resources Canada. All rights reserved.
0 100 200 Metres
October 31, 2012
MAP 6


COURTICE RD
TRULLS RD
CIGAS RD
BASELINE RD
MCKNIGHT RD
HIGHWAY 401
SOUTH SERVICE RD
TOOLEY CREEK
OSBOURNE RD
BASELINE RD
ROBINSON CREEK
HIGHWAY 401
COURTICE RD
DOWN RD
Legend
Potential Impact Area
Separate MTO Study (Salem Rd to Brock St)
Waterbodies
Watercourses
Built up areas
Canada Land Inventory Agricultural Capability Rating
1
2
3
4
5
7
organic
Source base mapping: © Department of Natural Resources Canada. All rights reserved.
0 100 200 Metres
October 31, 2012
MAP 7

Future Planned Developments

Durham Live

Durham Live is a planned 220-acre, mega-entertainment tourist destination that could include a casino in the area near Bayly Street and Church Street. At the January 19th, 2015 council meeting, Town of Pickering councillors voted in favour to a zoning bylaw allowing Pickering Developments to proceed with its vision for Durham Live. The proposed Zoning By-Law Amendment application, if approved, would create a new zone category – "Major Tourist Destination" - on the entirety of the site that would permit a broad range of tourist destination related uses which include a casino and five-star hotel, convention centre, performing arts centre, outdoor amphitheatre, cinema entertainment, restaurant plaza, waterpark hotel and waterpark, a boutique hotel, tourist centre / botanical gardens, community recreation centre, fitness centre and spa and varying commercial office uses in the City of Pickering. The planned development includes potential new interchange access to and from Highway 401 west at Church Street. Given that planning of this development is still in the early stages and has not been approved, this potential access with Highway 401 was not considered as part of the current study.

4.2.2 Air Quality

An air quality assessment was undertaken as part of this study. The assessment considered existing and future air quality by predicting contaminant concentrations at sensitive land uses adjacent to the corridor. The study considered regularly assessed contaminants of interest for transportation assessments in Ontario, as determined by the MTO and MOECC. These contaminants are generally associated with motor vehicle emissions and included nitrogen dioxide, carbon monoxide and particulate matter, and key volatile organic compounds including benzene, 1,3-Butadiene, formaldehyde, acetaldehyde and acrolein.

Background (ambient) conditions are measured contaminant concentrations that are exclusive of emissions from the existing or proposed project infrastructure. These emissions are typically the result of trans-boundary (macro-scale), regional (meso-scale), and local (micro-scale) emission sources and result due to both primary and secondary formation. Primary contaminants are emitted directly by the source and secondary contaminants are formed by complex chemical reactions in the atmosphere. Secondary pollution is generally formed over great distances in the presence of sunlight and heat and most noticeably results in the formation of fine particulate matter ($PM_{2.5}$) and ground-level ozone (O_3), also considered smog.

In Ontario, a significant amount of smog originates from emission sources in the United States which is the major contributor during smog events which usually occur in the summer season (MOECC, 2005). During smog episodes, the U.S. contribution to $PM_{2.5}$ can be as much as 90% near the southwest U.S. border. Air quality is strongly influenced

by weather systems (i.e. meteorology) that typically move out of central Canada into the mid-west of the U.S. then eastward to the Atlantic coast. This weather system generally produces winds with a southerly component that travel over major emission sources in the U.S. and result in the transport of pollution into Ontario.

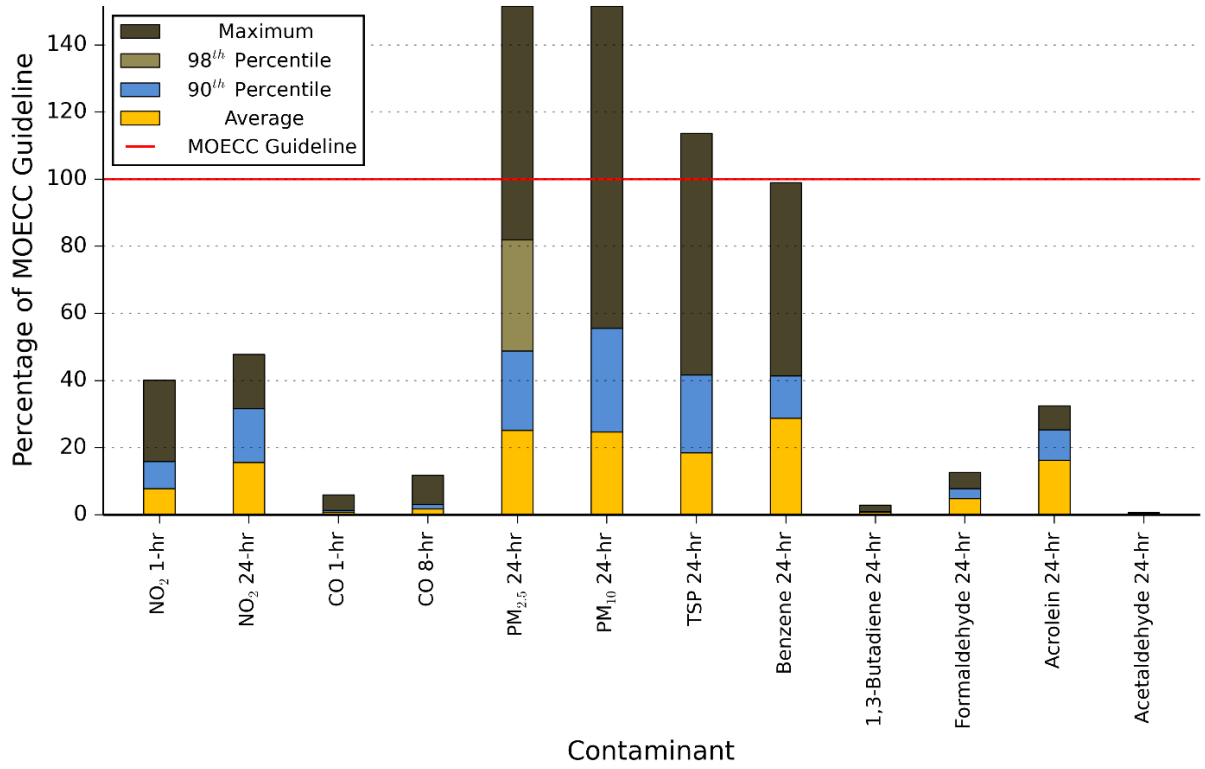
Understanding the composition of background air pollution and its influences is important in determining the potential impacts of a project, considering that the majority of the combined concentrations are typically due to existing elevated ambient background levels.

Based on a review of year 2007 to 2011 ambient monitoring dataset, all contaminants were below their respective MOECC criteria with the exception of PM_{10} (coarse particulate matter) and TSP (total suspended particulate matter). The PM_{10} and TSP concentrations were calculated based on their relationship to $PM_{2.5}$ (fine particulate matter). The guideline for $PM_{2.5}$ is based on an average annual 98^{th} percentile concentration, averaged over three consecutive years. Therefore, it was determined that the maximum rolling 98^{th} percentile average was 22.1 $\mu g/m^3$, which is less than the guideline.

From a review of the VOC (Volatile Organic Compounds) dataset, it was determined that due to the lack of monitoring data, the 90^{th} percentile value would be used to supplement monitored data when a greater than six day gap occurred between measurements. However, the summary of ambient monitoring data presented in this section provides the statistics for all available data.

A summary of the background concentrations as a percentage of their respective MOECC guidelines or CWS is presented in **Figure 4-21**.

FIGURE 4-21: SUMMARY OF AIR QUALITY BACKGROUND CONCENTRATIONS



Results of the air quality analysis including potential impacts as a result of the Recommended Plan and mitigation measures are outlined in **Section 9.2.4**. Additional details regarding the air quality assessment can be found in the *Air Quality Report (February 2015)*, available under separate cover.

4.2.3 Noise

A noise analysis was undertaken as part of this study to assess the potential noise impacts in noise sensitive areas and possible noise mitigation associated with the recommended plan for improvements to this section of the Highway 401 corridor.

The noise analysis was undertaken in accordance with Section 3.4 of the MTO Environmental Reference for Highway Design (ERHD) and MTO Environmental Guide for Noise. The Noise Guide policy requires the prediction and comparison of future ambient (do nothing) and future with undertaking sound levels in order to determine potential impacts and mitigation.

Traffic data and the preliminary design of the Recommended Plan containing study area data, modeled with Federal Highway Administration (FHWA) Traffic Noise Model

version 2.5 software (approved by MTO for use on this project), were implemented in order to predict future ambient and future with undertaking noise levels.

Under the Environmental Guide for Noise, Noise Sensitive Areas (NSAs) include the following land uses provided they have an Outdoor Living Area (OLA) associated with them:

- Private homes (such as single family residences and townhouses).
- Multiple unit buildings, such as apartments with OLAs for use by all occupants.
- Hospitals and nursing homes, where there are OLAs for use by patients.

A total of 19 NSAs were identified to represent the Study Area (**Table 4.10**), containing a total of approximately 1,015 modeled receptor units. The Study Area also has pre-existing noise barriers installed at most NSAs along the Highway 401 corridor, from Church Street in Ajax, through to the Harmony Road interchange in Oshawa. The 19 NSA are summarized in the table below.

TABLE 4-10: NOISE SENSITIVE AREAS WITHIN THE STUDY AREA

NSA ID	Description
NSA 1	Area north of Highway 401 and Pickering Parkway, east of Glenanna Road, and west of Brock Road. NSA is primarily SFRs* and MFRs* with a park. Existing commercial land uses between Highway 401 and some MFRs.
NSA 2	Area north of Highway 401 and Pickering Parkway, east of Brock Road, and west of Notion Road. NSA is primarily SFRs with a cemetery on the east side of Notion Road. Existing commercial land uses between Highway 401 and SFRs.
NSA 3	Area north of Highway 401 and mostly east of Church Street South and west of Westney Road South, with a few SFRs along the west side of Church Street South. NSA is primarily SFRs and a church. An existing noise barrier approximately 1,260 meters in length is already in place.
NSA 4	Area north of Highway 401, east of Westney Road South and west of Harwood Avenue South. NSA is primarily SFRs with a cluster of MFRs, Durham Secondary Academy and Middle School, Cedar Park, and a church. An existing noise barrier approximately 950 m in length is already in place.
NSA 5	Area north of Highway 401, east of Harwood Avenue South, and west of Salem Road South. NSA is primarily SFRs and a church. An existing noise barrier approximately 300 m in length is already in place on west side of NSA. Existing developer wall in place in the middle of the NSA.
NSA 6	Area south of Highway 401 and Achilles Road, east of Harwood Avenue South, and west of Salem Road South. NSA is primarily SFRs with a small cluster of MFRs, Ajax Public Library, and Arbour Park. An existing noise barrier approximately 530 m in length is already in place on the south side of the railroad tracks and north of Achilles Road.

NSA ID	Description
NSA 7	Area south of Highway 401, east of South Blair Street, and north of the South Blair Street and Victoria Street East / Highway 22 intersection. NSA consists of a couple of scattered SFRs.
NSA 8	Area north of Highway 401, east of Stevenson Road South, and west of Simcoe Road. NSA is primarily SFRs with a couple of MFR clusters, College Hill Public School, a church, and Stone Park. An existing discontinuous noise barrier is already in place. They are approximately 160 m, 258 m, and 755 m in length, going from the westernmost barrier to the easternmost barrier.
NSA 9	Area south of Highway 401, east of Park Road South, and west of Simcoe Street South. NSA is a mixed residential area consisting of SFRs and MFRs. An existing noise barrier approximately 838 m in length is already in place.
NSA 10	Area north of Highway 401, between the Highway 401 westbound onramp and Simcoe Street South. NSA consists of SFRs situated along Simcoe Road South.
NSA 11	Area south of Highway 401, west of Albert Street, east of Simcoe Street South, and just south of the railroad tracks. NSA consists of scattered SFRs with a church mixed with commercial land uses. An existing noise barrier approximately 245 m in length is already in place on the eastern portion of this NSA. An existing berm is also in place, but it is unclear if it is natural or specifically for mitigation.
NSA 12	Area north of Highway 401, east of Albert Street, and west of Front Street. NSA consists of SFRs and a church.
NSA 13	Area north of Highway 401, east of Howard Street, and west of Drew Street / Highway 401 westbound onramp. NSA consists of SFRs. An existing noise barrier approximately 216 m in length is already in place.
NSA 14	Area north of Highway 401, east of the Highway 401 westbound offramp to Drew Street, and west of Harmony Road South. NSA consists primarily of SFRs with a few MFR clusters, two parks (Chopin Park and Kingside Park), and some scattered commercial land uses. Three existing noise barriers approximately 1,690 m in total length are already in place.
NSA 15	Area south of Highway 401, east of the Highway 401 eastbound onramp from Bloor Street East, and west of Farewell Street. NSA consists primarily of SFRs and several MFRs, mixed with commercial land uses. Two existing noise barriers approximately 1,035 m in total length are already in place.
NSA 16	Area north of Highway 401, east of Harmony Road South, and west of Harmony Creek Golf Centre. NSA consists of SFRs along Harmony Road South and Armada Court.
NSA 17	Area north of Highway 401, east of the railroad tracks, and west of Townline Road South. NSA is primarily SFRs with a cluster of MFRs at the southern end and one SFR east of Townline Road South.

NSA ID	Description
NSA 18	Area south of Highway 401, running along Darlington Park Road, north of McLaughlin Bay, and west of Courtice Road. Area consists of scattered SFRs and Darlington Provincial Park.
NSA 19	Area north of Highway 401, just west of Prestonvale Road, and west of Courtice Road. Area consists of scattered SFRs mixed with commercial land uses.

*SFR = Single Family Residence, MFR = Multi-Family Residence, OLA = Outdoor Living Area

To view the locations of NSA refer to **Appendix F**. The results of the noise analysis including potential noise impacts as a result of the Recommended Plan and mitigation measures are outlined in **Section 9.2.5**. Additional details regarding the noise assessment can be found in the *Noise Study Report (February 2015)*, available under separate cover.

4.2.4 Aesthetics / Landscape Composition

Lands adjacent to Highway 401 within the Study Area are highly developed and urbanized. Residential and commercial developments are built adjacent to the Highway 401 ROW through the majority of the Study Area. The most notable views and vistas within the Study Area include the agricultural lands and Darlington National Park that abut the highway in Clarington, and the various waterways and greenspaces that cross the highway (Duffins Creek, Oshawa Creek). Other sites that have an aesthetic value include the various municipal parks and trails located adjacent to the highway (e.g. Cedar Park, Storie Park, Chopin Park, Joseph Kolodzie Trail, Michael Starr Trail, etc.), and built heritage features such as the St. George Ukrainian Catholic Church.

4.2.5 Property Waste and Contamination

A Contamination Overview Study (COS) was undertaken as part of this study. The COS involved a review of secondary source information to identify properties / areas within the Study Area with the potential for site contamination (i.e., soil and groundwater contamination). The COS involved research into the site history through the review of available aerial photographs, regulatory agency databases, municipal official plans, and available environmental reports / documents, as well as a visual assessment of the subject properties from publicly accessible lands.

The land use within the Study Area is a mixture of urban, agricultural and green spaces. Given the nature of their business, the industrial / commercial facilities observed may currently be or were historically involved in handling, storing and using various types of chemicals in their associated manufacturing or commercial operations.

In general, the COS identified the potential for contamination on residential properties as relatively low and mostly related to historic leaking from underground fuel storage tanks or on-site vehicle repair. The likelihood of contamination being present on industrial properties is relatively high and the extent of contamination is likely more severe due to

the industrial processes and materials involved. Commercial properties, which do not involve industrial processes or deal with large amount of chemicals or storage tanks, are given a relative moderate risk rating of "medium". Similarly, institutional facilities such as churches, public schools and community services are ranked as "medium", unless specifically indicated to be known for contamination, which are then ranked as "high".

The COS identified 174 individual properties along the Highway 401 corridor with "high" potential for environmental contamination, while 59 commercial and/or light industrial properties were identified as having "medium" potential for environmental contamination. The properties containing CNR tracks were also rated as having "medium" potential. Based on a database search, one property within the Study Area was found to have groundwater contamination. In addition, 37 significant spill locations were also identified within the Study Area.

Potential impacts and mitigation measures are outline in **Section 9.2.6**. Additional details regarding property waste and contamination can be found in the *Contamination Overview Study Report (February 2013)*, available under separate cover.

4.3 CULTURAL ENVIRONMENT

4.3.1 Archaeological Resources

A Stage 1 archaeological assessment was carried out in accordance with the *Ontario's Ministry of Culture's Standards and Guidelines for Consultant Archaeologists (2011).* A Stage 1 archaeological assessment involves background research to describe the known and potential archaeological resources in and adjacent to the study corridor. The assessment incorporates a review of previous archaeological research, and physiographic and land use history for the properties within the Study Area.

The results of the study suggest that most of the lands within this Highway 401 ROW have been previously disturbed by road construction and grading and therefore no longer contain archaeological potential. However, a number of parcels immediately adjacent to the existing ROW and within the proposed area of impact of the Highway 401 improvements are not visibly disturbed. Therefore, these lands exhibit moderate to high potential for containing archaeological sites.

Further, a total of 46 archaeological sites have previously been registered within a 2 km radius of the Study Area, including three within the immediate Study Area that may be impacted by the Recommended Plan. This, combined with the proximity to watercourses, historic roadways and mapped homestead locations, indicates that the Study Area exhibits moderate to high overall archaeological site potential.

4.3.2 Built Heritage Resources

A Built Heritage and Cultural Heritage Landscape Assessment was completed as part of this study, in accordance with the MTO *Environmental Guide for Built Heritage and Cultural Heritage Landscapes (February 2007).* The process of field review and consultation with municipalities identified a total of 23 Built Heritage Resources and Cultural Heritage Landscapes in or adjacent to the Study Area that have already been recognized or have the potential to be recognized for heritage significance. Of these properties, 3 are designated under Part IV of the *Ontario Heritage Act*; 12 are listed on Municipal Heritage Registers or Inventory Lists, and 8 are unrecognized at present but have potential for heritage significance. There are also five bridges that have been found to have local significance by the Heritage Bridge Committee.

Table 4-11 lists the municipally identified sites with potential heritage significance within the Study Area.

TABLE 4-11: MUNICIPALLY IDENTIFIED AND POTENTIAL BUILT HERITAGE RESOURCES (BHRS) AND CULTURAL HERITAGE LANDSCAPES (CHLS)

Site Number / Type	Municipality	Property Description	Heritage Status
01/CHL	Ajax	St. Francis de Sales Catholic Cemetery Notion Rd South	Listed
02/CHL	Ajax	Part of neighbourhood north of Highway 401 between Harwood Avenue and Cedar Park;	None at present, in process
03/CHL	Clarington	Trull Cemetery, west of 1558 Baseline Road	None at present, Cemeteries Act
04/BHR	Clarington	1558 Baseline Road	None at present
05/BHR	Clarington	Jesse Trull House, 1598 Baseline Road	Primary listing
06/CHL	Clarington	1711 Baseline Road	Primary listing
07/CHL	Clarington	1719 Darlington Park Road	Primary listing
08/BHR	Oshawa	St. George Ukrainian Catholic Church, 597 Albert St	“A” Listed Property
09/BHR	Oshawa	St John the Baptist Ukrainian Orthodox Church, 31 Bloor Street East	“A” Listed Property
10/BHR	Oshawa	Greek Orthodox Church Evangelismos Tis Theotokou, 261 Bloor Street East	None at present
11/BHR	Oshawa	213 College Ave.	“B” Listed Property
12/BHR	Oshawa	13 Knight’s Road	“B” Listed Property
13/BHR	Oshawa	566-68 Simcoe Street S.	“B” Listed Property
14/BHR	Oshawa	Railway underpass, Simcoe Street S.	None at present
15/BHR	Whitby	1100 Brock Street	None at present
16/BHR	Whitby	1124 Brock Street	Listed
17/BHR	Whitby	1132 Brock Street	Listed
18/BHR	Whitby	1200 Brock Street	Designated OHA pt IV
19/BHR	Whitby	1207 Brock Street	Listed
20/BHR	Whitby	1601 Hopkins Street South	Designated OHA pt IV

Site Number / Type	Municipality	Property Description	Heritage Status
21/BHR	Whitby	1119 King Street	None at present
22/BHR	Whitby	600 Victoria Street East	None at present
23/BHR	Whitby	601 Victoria Street East	Designated OHA pt IV

The five locally significant MTO bridges in the Study Area have been evaluated by the Heritage Bridge Committee. Two of these structures, including Brock Street and Henry Street, were reviewed as part of the Highway 401 Salem Road to Brock Street Environmental Assessment Study and are considered outside the scope of this study. The remaining three sites are summarized in **Table 4-12**.

TABLE 4-12: MTO BRIDGE SITES WITHIN STUDY AREA WITH HERITAGE SIGNIFICANCE

Name	MTO Site No.	Year Built	Comments
Oshawa Creek	22-175	1939	CHER completed score of 77, Locally significant 9/06
Albert Street	22-177	1939	CHER completed score of 66, Locally significant 9/06
Simcoe Street	22-176	1941	CHER completed score of 62, Locally significant 9/06

Potential impacts and mitigation measures are outline in **Section 9.3.2**. Additional details regarding Built Heritage and Cultural Landscape features can be found in the *Built Heritage Assessment Report (April 2013)*, available under separate cover.

4.4 TRANSPORTATION INFRASTRUCTURE

4.4.1 Highway 401

Highway 401 (also known as the MacDonald-Cartier Freeway) is the primary transportation route across Southwestern, Central and Eastern Ontario. It is the longest 400-Series Highway in Ontario, beginning at Highway 3 in the City of Windsor and extending easterly to the Quebec border. It serves as the primary goods movement corridor in the GTA and in Ontario.

Through the City of Toronto, Highway 401 is generally a 12 to 14-lane Express / Collector system. The Express / Collector system transitions to a 10-lane simple freeway in the vicinity of Brock Road at the western boundary of the study limits, and a 10-lane cross-section is provided between Brock Road and Salem Road. Between Salem Road and Courtice Road at the eastern portion of the study limits, Highway 401 is a 6-lane simple freeway. Within the Study Area, there are 10 interchanges, and an additional 9 municipal crossing roads which maintain the connectivity of the municipal road system across Highway 401, but do not have highway access.

4.4.2 Interchanges

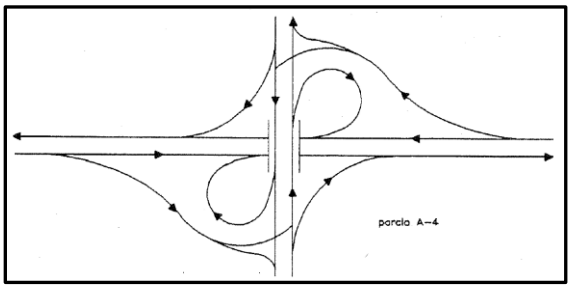
Ten interchanges are located along the section of Highway 401 from Brock Road to Courtice Road, of which nine are considered within the scope of this project. The Brock Street interchange is located within the study limits for the Highway 401 Salem Road to Brock Street Environmental Assessment study, and was not reviewed as part of the current study. The following section provides a brief overview of the interchange types and interchanges providing access to Highway 401 within the scope of this project.

Interchange Types

Existing interchanges or ramps within the study area include three main types, as follows:

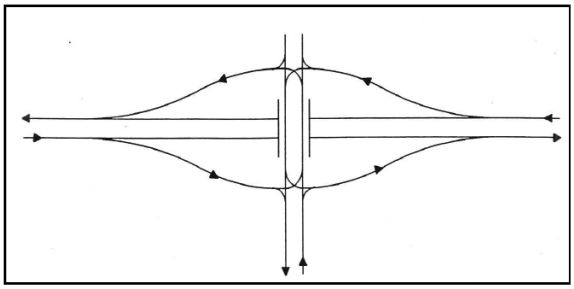
Parclo A – A Parclo A interchange configuration includes exit ramps in advance of the crossing road, and entrance ramps from the crossing road to the highway via a right-side exit loop ramp. With this configuration, no left-turn lanes are required along the crossing road. A Parclo A-4 configuration refers to an interchange with a Parclo configuration provided for both directions of traffic along the highway, and ramps in all four quadrants of the interchange. A typical Parclo A-4 configuration is illustrated in Figure 4-22.

FIGURE 4-22: TYPICAL PARCLO A-4 INTERCHANGE CONFIGURATION



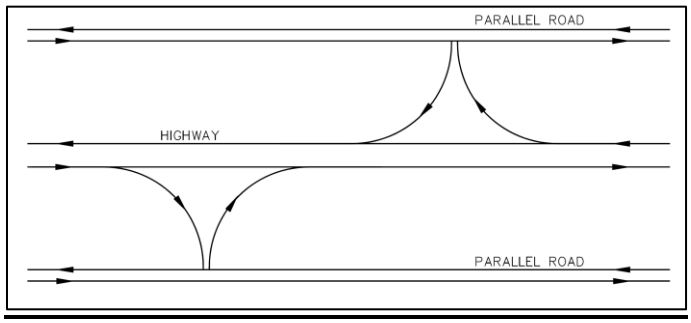
Diamond – A diamond-type interchange configuration includes exit ramps in advance of the structure, and entrance ramps beyond the structure, suggesting the shape of a diamond. Left-turn movements are required from the crossing road to access the entrance ramp to the highway. A typical Diamond configuration is illustrated in Figure 4-23.

FIGURE 4-23: TYPICAL DIAMOND INTERCHANGE CONFIGURATION



Buttonhook – A buttonhook-type interchange or ramp configuration includes J-shaped ramps which generally provide direct access between the highway and a closely spaced parallel road. Left-turn movements are required from the parallel road to access a buttonhook entrance on-ramp to the highway. A typical Buttonhook ramp configuration is illustrated in Figure 4-24.

FIGURE 4-24: TYPICAL BUTTONHOOK INTERCHANGE CONFIGURATION



Brock Road

The Highway 401 / Brock Road interchange has a Parclo A configuration on the north side of Highway 401 and a diamond configuration on the south, and an underpass structure (Brock Road crossing over Highway 401). In the vicinity of Highway 401, Brock Road is a 4-lane urban arterial road with a posted speed limit of 50 km/h. Residential and commercial development is in close proximity to the interchange. CN Rail lines located directly south and parallel to Highway 401 restrict construction of a standard Parclo A4 interchange at this location.

Westney Road

The Highway 401 / Westney Road interchange has a Parclo A configuration on the north side of Highway 401 and a diamond configuration on the south, and an overpass structure (Highway 401 crossing over Westney Road). Westney Road is a 4-lane urban arterial road with a posted speed limit of 60 km/h. Residential development is located in close proximity to the interchange ramps in the northeast and northwest quadrants of the interchange, while the CN Rail lines located directly south and parallel to Highway 401 restrict construction of a standard Parclo A4 interchange.

Salem Road

The Highway 401 / Salem Road interchange has a Parclo A configuration on the north side of Highway 401 and a diamond configuration on the south, and an overpass structure (Highway 401 crossing over Salem Road). Salem Road is a 4-lane arterial road with a posted speed limit of 60 km/h. Residential and commercial development is located in close proximity to the interchange ramps in the northeast and northwest quadrants of the

interchange, while the CN Rail lines located directly south and parallel to Highway 401 restrict construction of a standard Parclo A4 interchange.

Thickson Road

The Highway 401 / Thickson Road interchange has a Parclo A-4 configuration, and an underpass structure (Thickson Road crossing over Highway 401). A truck inspection station is located in the southeast quadrant of the interchange, with the off-ramp from eastbound Highway 401 to the truck inspection station exit located beneath the Thickson Road structure. The eastbound on-ramps from Thickson Road merge in advance of the connection to Highway 401 and cross beneath the off-ramp to the truck inspection station at a structure east of Thickson Road. Thickson Road is a 6-lane arterial road with a posted speed limit of 60 km/h. The interchange is adjacent to commercial development and the Durham College – Whitby Campus, along with intersections with Champlain Avenue and Victoria Street.

Stevenson Road

The Highway 401 / Stevenson Road interchange has a Parclo A-4 configuration, and an underpass structure with Stevenson Road over Highway 401. Bloor Street is located directly south and parallel to Highway 401 at the interchange, and crosses beneath the eastbound off-ramp, southbound to eastbound on-ramp, and northbound to eastbound on-ramp. A 4-lane connecting road is located opposite the eastbound off-ramp intersection with Stevenson Road and provides a direct connection to Bloor Street, while Champlain Avenue is located opposite the westbound off-ramp intersection with Stevenson Road. Stevenson Road is a four-lane arterial road with a posted speed limit of 60 km/h. Development in the immediate vicinity of the interchange includes a mixture of residential, commercial and industrial land uses.

Simcoe Street

The Highway 401 / Simcoe Street interchange is a partial interchange with access to and from the west only. The eastbound off-ramp is a buttonhook configuration which intersects with Bloor Street approximately 60 m west of Simcoe Street. The westbound on-ramp intersects Simcoe Street approximately 180 m north of Highway 401. Simcoe Street is a 4-lane arterial road with a posted speed limit of 60 km/h, and crosses over Highway 401. Provision of a standard interchange configuration is generally limited by existing residential and commercial development in the area, two churches in close proximity to the interchange, and by Bloor Street which is located 100 m south of and parallel to Highway 401.

Ritson Road (Drew Street)

The Highway 401 / Ritson Road (Drew Street) interchange has a buttonhook configuration, with eastbound off and on-ramps connecting to Bloor Street approximately

220 m west of Ritson Road. Westbound off and on-ramps connect directly to Drew Street, 200 m west of Ritson Road. Provision of a standard interchange configuration is generally limited by existing residential and commercial development in the area, and by Bloor Street which is located 100 m south of and parallel to Highway 401.

Harmony Road / Bloor Street

The Highway 401 / Harmony Road / Bloor Street interchange has a buttonhook configuration, with eastbound off and on-ramps connecting to Bloor Street opposite Farewell Street, and westbound off and on-ramps connecting to Bloor Street opposite Harmony Road. Between the west and east ramp terminal intersections, Bloor Street is a three lane urban arterial road with a posted speed limit of 50 km/h which crosses over Highway 401. Farewell Street and Harmony Street are both four-lane arterial roads with posted speed limits of 60 km/h and 50 km/h, respectively. The interchange is located in close proximity to residential development, as well as environmental features including crossings of Harmony Creek and Farewell Creek.

Courtice Road

The Highway 401 / Courtice Road interchange has a Parclo A configuration on the south side of Highway 401 and a diamond configuration on the north side, and includes an overpass structure (Highway 401 crossing over Courtice Road). Courtice Road is a 2-lane urban arterial road with a posted speed of 80 km/h. Improvements to this interchange were reviewed as part of the Highway 407 East Environmental Assessment Study.

4.4.3 Crossing Roads

In addition to the 10 interchange locations along Highway 401, there are 9 municipal road crossings without access to Highway 401 between Brock Road and Courtice Road, of which 7 of these roads are considered within the scope of this project. The Lake Ridge Road and Henry Street crossings are located within the study limits for the Highway 401 Salem Road to Brock Street Environmental Assessment study, and were not reviewed as part of the current study. The following section provides a brief overview of each of these locations.

Church Street

Church Street South is a 2-lane collector road which crosses beneath Highway 401, directly adjacent to Duffins Creek. Agricultural land and a golf course are located to the south of Highway 401 near Church Street and residential development is located on the north side of Highway 401, east of Church Street.

Harwood Avenue

Harwood Avenue South is a 4-lane collector road with an underpass structure carrying Harwood Avenue over Highway 401 and CN Rail lines. Residential development is located adjacent and directly north and south of Highway 401, with commercial development southwest of the crossing.

Park Road

Park Road is a 4-lane collector road with an overpass structure carrying Highway 401 over Park Road. Park Road intersects Bloor Street West at a signalized T-intersection immediately south of Highway 401. Park Road at Highway 401 is surrounded by a mixture of residential and commercial development.

Cubert Street

Cubert Street is a 2-lane collector road with an overpass structure carrying Highway 401 over Cubert Street. Cubert Street intersects Bloor Street West at a signalized T-intersection immediately south of Highway 401. Cubert Street at this location is primarily surrounded by residential development.

Albert Street

Albert Street is a 2-lane local road with an underpass structure carrying Albert Street over Highway 401. Albert Street intersects Bloor Street West at an unsignalized T-intersection immediately south of Highway 401, and with Lviv Boulevard immediately to the north. Albert Street at this location is surrounded primarily by residential and commercial development, with the St. George Ukrainian Catholic Church located immediately north of Highway 401.

Ritson Road

Ritson Road South is a 4-lane collector road with an overpass structure carrying Highway 401 over Ritson Road. Access to Ritson Road from Highway 401 is provided through a buttonhook off and on-ramp configuration at Drew Street, immediately west of Ritson Road. Ritson Road intersects Bloor Street West at a signalized intersection immediately south of Highway 401. The roadway is surrounded by residential development on both the north and the south sides of Highway 401.

Wilson Road

Wilson Road is a 4-lane collector road with an overpass structure carrying Highway 401 over Wilson Road. Wilson Road intersects Bloor Street West at a signalized intersection immediately south of Highway 401. The roadway is surrounded by residential development on both the north and the south sides of Highway 401.

4.4.4 Additional Roads within the Study Area

In addition to the crossing roads outlined in **Sections 4.4.2** and **4.4.3**, numerous municipal roadways are located in close proximity to Highway 401 within the Study Area. Notable adjacent roads include:

- Pickering Parkway, located directly north of and parallel to Highway 401, from Brock Road to Notion Road
- Victoria Street, located directly south of and parallel to Highway 401, from Lake Ridge Road to east of Thickson Road where it becomes Bloor Street;
- Consumers Drive, located directly north of and parallel to Highway 401 between Brock Street and Thickson Road;
- Champlain Avenue, located directly north of and parallel to Highway 401 between Thickson Road and Stevenson Road; and
- Baseline Road West, located directly north of and parallel to Highway 401 between Prestonvale Road to the east of Courtice Road.

4.4.5 Truck Inspection Station

There is one Truck Inspection Station (TIS) within the Study Area, located south of Highway 401 and east of Thickson Road. Access to the TIS is via an eastbound off-ramp from Highway 401, and a separate eastbound on-ramp is provided from the TIS to Highway 401.

4.4.6 Transit Services

A number of transit-related structures and associated infrastructure are located in the Study Area, including:

- CP rail overhead structure, west of Stevenson Road;
- CN rail line along the south side of Highway 401 throughout the Study Area;
- CP rail line along the north side of Highway 401 from Harmony Road to Courtice Road;
- GO Transit Ajax Train Station, south side of Highway 401, west of Westney Road;
- GO Transit Whitby Train Station, south side of Highway 401, west of Brock Street;
- GO Transit Oshawa / VIA Rail Train Station, south side of Highway 401, west of Thornton Road South;
- Proposed GO East Rail Maintenance Facility (ERMF), south side of 401, west of Thickson Road South; and
- MTO Brock Road Patrol Yard - south of Highway 401, east of Brock Road.

Durham Region Transit

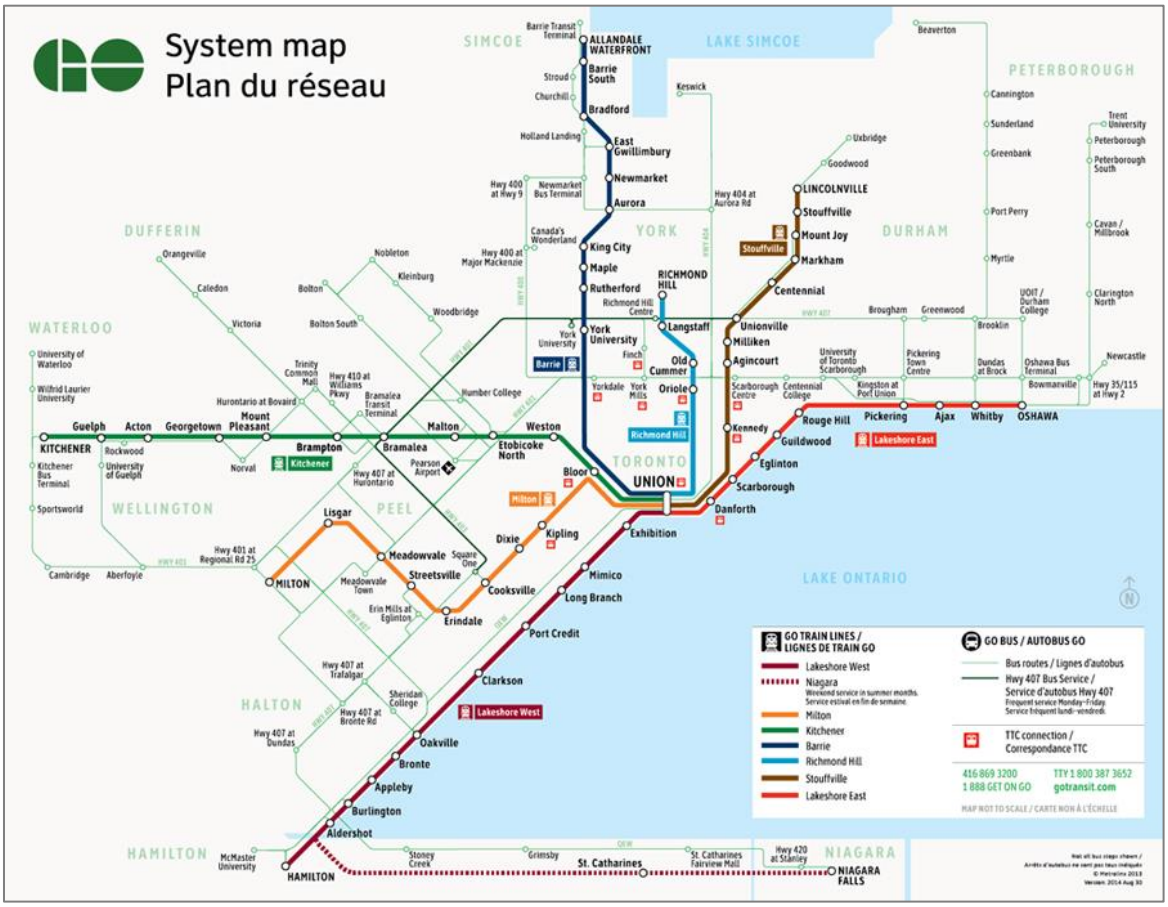
In 2006, local transit in Durham combined to become a region-wide service called Durham Region Transit. The amalgamation brings together Oshawa Transit, Ajax-Pickering Transit, Whitby Transit, Clarington Transit, and Handi Transit. Numerous Durham Region transit routes run through the Study Area and cross Highway 401.

GO Transit

GO Transit operates the Lakeshore East rail line through the Study Area. Highway 401 is also a GO bus route, with GO stations in Ajax, Whitby, and Oshawa. Refer to **Figure 4-25** for the GO Transit Systems Map.

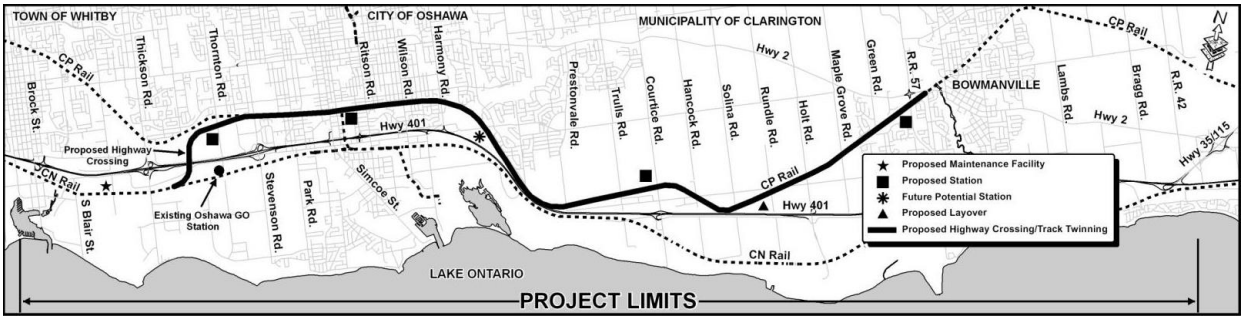
In 2011, GO Transit completed a study that would increase rail service through Durham Region. This study included a new maintenance facility, Highway 401 crossing and two additional GO stations. The proposed maintenance facility will be located within the Town of Whitby between South Blair Street and Thickson Road. The proposed Highway crossing will cross west of Thornton Road. The additional GO stations are proposed in the City of Oshawa between Simcoe Street and Ritson Road to the north of First Street, and in the Municipality of Clarington west of Courtice Road north of the CP Rail line. An additional potential future station is located in the City of Oshawa east of Harmony Road on the south side of Bloor Street. Refer to **Figure 4-26** for the proposed GO Rail expansion through Durham Region.

FIGURE 4-25: GO TRANSIT SYSTEM MAP



Source: GO Transit, http://www.gotransit.com/timetables/en/schedules/maps.aspx#

FIGURE 4-26: PROPOSED GO RAIL EXPANSION



4.4.7 Freight Rail Transport

Between approximately Brock Road and Brock Street, CN and CP Rail lines are located directly adjacent to the south side of Highway 401. Both lines diverge slightly south of Highway 401 beginning at Brock Street, and the CP Rail line terminates directly west of Thornton Road at the existing Oshawa GO Station. The CP Rail line is utilized by GO

Transit, which operates stations in the southwest quadrants of Highway 401 / Westney Road (Ajax GO Station), Highway 401 / Brock Street (Whitby GO Station), and Highway 401 / Thornton Road (Oshawa GO Station).

A CP Rail crossing over Highway 401 is located directly west of Stevenson Road and connects with an existing CP line located approximately 500 m parallel to the north side of Highway 401. East of Harmony Road to Courtice Road, this line is located directly adjacent to the north side of Highway 401. The CN Rail line runs parallel to Highway 401 approximately 300 m south of the highway from Stevenson Road to Harmony Road. From Harmony Road to Courtice Road, the CN Rail line is located directly adjacent to the south side of Highway 401.

A former CN Rail spur line structure over Highway 401, located directly east of Albert Street, was demolished in 2011.

4.4.8 Transportation Master Plans

Town of Ajax Master Plan

The Town of Ajax Transportation Master Plan (TMP) was last updated in 2013 due to a 22% growth in population from the previous TMP update completed in 2007. The primary purpose of this update was to define a comprehensive, fully integrated and sustainable transportation network to accommodate population and employment growth to the year 2031. Refer to http://www.ajax.ca/en/doingbusinessinajax/tmp.asp for additional details.

Town of Whitby Master Plan

The Town of Whitby Transportation Master Plan (TMP) is a study of the integrated transportation network required to meet anticipated growth in a cost-effective, efficient, balanced and environmentally sensitive manner. The Whitby TMP was completed in 2010 with the goal to: Establish, at a strategic level, an integrated and diversified transportation system and policy framework to support long-term growth and provide for efficient movement of people and goods to areas within and to/from the Town. Refer to http://www.whitby.ca/en/townhall/transportationmasterplanstudy.asp for additional details.

City of Oshawa Integrated Transportation Master Plan

The City of Oshawa Integrated Transportation Master Plan (I.T.M.P.) is being developed to define a City-wide transportation vision that supports the City's Strategic Plan and Official Plan in addition to provincial transportation requirements and objectives. The master plan will integrate elements of land use planning, policy support and development, multi-modal personal and freight travel and public and stakeholder participation to prepare a master plan, which addresses existing, as well as, future transportation

challenges within the City including its urban as well as rural areas. Refer to http://www.oshawaitmp.ca/ for additional details.

Municipality of Clarington Master Plan

The Clarington Transportation Master Plan is a strategic document that will guide the renewal and improvement of Clarington's transportation network over the next twenty years and beyond. The purpose of the plan is to create a coordinated, integrated, realistic and accessible multi modal transportation system. The vision is to provide healthy, safe and convenient travel choices for the efficient movement of people and goods as they travel within, arrive, depart, or pass through the Municipality of Clarington. Refer to http://www.clarington.net/en/live-here/transportation-master-plan.asp for additional details.

Region of Durham Master Plan

The Region of Durham Transportation Master Plan is a strategic planning document designed to define the policies, programs and infrastructure improvements required to plan for Durham's future transportation needs. The transportation system for the Region of Durham is integrated and balanced, using a range of transportation strategies to address the mobility and goods movement requirements of the entire community, to sustain investment in industry, agriculture and tourism, to maintain community "wellness", and to integrate with the environment. A *Transportation Master Plan Update* study was initiated by the Region in 2014 and is expected to be completed in early 2016. Refer to http://durhamtmp.ca/ for additional details.

4.5 OTHER INFRASTRUCTURE

The primary purpose of this study was to determine the long-term strategy and requirements for the rehabilitation of Highway 401 between Brock Road and Courtice Road. The project therefore examined the existing conditions and rehabilitation requirements relating to pavement, structures, electrical equipment, and other infrastructure along the corridor, in addition to consideration of the widening requirements along the corridor.

The following sections provide an overview of the existing conditions of the various components of Highway 401 infrastructure. Additional information pertaining to the requirements for each component is provided in the various technical reports prepared for each discipline, which are available under separate cover. An overview of the recommendations for each of these components of the existing infrastructure is provided in **Chapter 8**.

4.5.1 Pavement

Highway 401 was originally constructed as a 4-lane rural highway from Brock Road to Ritson Road in the late 1940's using a concrete (rigid) pavement structure and from Ritson Road to Courtice Road in 1952 using a flexible (asphalt) pavement structure. The rigid pavement section was then overlayed with hot mix asphalt in the late 1950's and the flexible pavement section was overlayed with hot mix asphalt in the late 1960's. Widening of the entire section to a 6-lane cross section (three lanes in each direction) using a flexible pavement structure was carried out in the mid to late 1970's. Highway 401 from Brock Road to east of Salem Road was further widened to an 8 to 10 lane cross section in the late 1990's / early 2000's with flexible pavement. Highway 401 was resurfaced with a mill and pave strategy from Brock Street to Courtice Road in 1998, 2000 and 2005.

A visual pavement condition survey was completed as part of this study, along with a limited pavement coring program and borehole investigation. The visual condition survey included noting the occurrence, severity and frequency of cracking and other distress manifestations, such as loss of coarse aggregate and/or ravelling, rutting, transverse and longitudinal cracks, and distortions. Laboratory tests / examinations were carried out on representative soil, asphalt, granular and concrete samples obtained during the course of the investigation.

The assessment of the existing pavement structure and rehabilitation requirements was based on the Highway 401 segments included in MTO's Pavement Management System (PMS), as shown below in **Table 4-13**:

TABLE 4-13: PAVEMENT MANAGEMENT SYSTEM SECTIONS WITHIN STUDY AREA

PMS Section	From	To
PMS-1	Brock Road	Harwood Avenue
PMS-2	Harwood Avenue	Salem Road
PMS-3	Brock Street	Stevenson Road
PMS-4	Stevenson Road	Courtice Road

In general, at the time of undertaking the pavement investigations the pavement along the Highway 401 corridor was considered in good condition with the exception of the westbound lanes from Stevenson Road to Lake Ridge Road, which were in fair to good condition. It is noted that at the time of preparing this report, the section of Highway 401 between Salem Road and Brock Street was being partially re-constructed to the north to accommodate construction of the West Durham Link interchange.

The existing pavement on the interchange ramps and cross roads within the project limits were generally found to be in good condition, with the exception of Brock Road, the northbound to westbound on-ramp at the Thickson Road interchange, and the southbound to westbound on-ramp at the Ritson Road / Drew Street interchange which were in fair

condition. The predominant distresses on Brock Road was moderate rutting, while the two ramps exhibited slight to moderate longitudinal and transverse cracking.

The current pavement condition of each PMS segment on the Highway 401 mainline is summarized in **Table 4-14**.

TABLE 4-14: SUMMARY OF CURRENT PAVEMENT CONDITION

PMS Section	Highway 401 Westbound	Highway 401 Eastbound
PMS-1	Good	Good
PMS-2	Good	Good
PMS-3	Fairly Good	Good
PMS-4	Good	Good

More comprehensive investigations will be required during Detail Design to confirm existing pavement conditions and rehabilitation requirements.

Additional information regarding the existing pavement structure including conditions and rehabilitation requirements are provided in the *Preliminary Pavement Design Report (December 2014)*, available under separate cover.

4.5.2 Structures

A total of 19 bridges and 7 structural culverts are located along Highway 401 within the immediate Study Area, excluding the structures located between Salem Road and Brock Street which were reviewed as part of a separate study. As part of this study, the existing structures along the highway were inspected to identify structural issues and to determine the need for repair, rehabilitation, modification, strengthening or replacement required to address the safety and operational improvements recommended for Highway 401 within the project limits. It should be noted that detailed bridge conditions surveys were not included within the scope of this assignment, and will be completed at Detail Design to confirm the existing conditions of the structure and the full extent of necessary rehabilitation.

The structures at the west end of the Study Area (from Brock Road to Salem Road) are between 11 to 78 years old, with an average age of 35 years (as of 2015). Structures at the east end (from Thickson Road to Courtice Road) are generally older, ranging from between 10 to 76 years old, with an average age of 56 years (as of 2015).

The existing structures within the Study Area are summarized in **Table 4-15**, including age, type, and rehabilitation history.

TABLE 4-15: EXISTING STRUCTURES WITHIN STUDY LIMITS

Structure	Structure Type	Year Built	No of Spans	Year of Previous Rehab	General Comments
Brock Road Underpass	Prestressed AASHTO III girder	1973	5	None	Structure is 42 years old*. Structure is in overall fair to good condition. *(Note: Rehabilitation of this structure commenced in 2015 and was ongoing at the time of preparing this report).*
Duffins Creek Bridge	CPCI girder	1937	6	1992	Structure is 78 years old*. Rehabilitated and widened in 1975. Rehabilitated in 1992. Superstructure replaced in 1998.
Duffins Creek East Culvert (Miller Creek)	Concrete box culvert adjacent to CSP culvert	Varies *(Refer to Note 1 below)*	N/A	1986 (Rehab and Widening)	Concrete box culvert in fair condition, CSP culvert component in poor condition. *(Refer to Note 1 below)*
Westney Road Overpass	Concrete slab	1985	1	None	Structure is 30 years old*. Structure is in overall good condition.
Harwood Road Underpass	Steel box girder	2004	3	None	Structure is 11 years old*. Structure is in overall excellent to good condition.
Salem Road Overpass	CPCI girder	2002	1	None	Structure is 13 years old*. Abutments were constructed wider and can accommodate future widening of Highway 401 on the north side. Structure is in excellent to good condition.
Corbett Creek West Culvert	Concrete box culvert	1958	N/A	1982 (Rehab and Widening)	Structural culvert is 57 years old*. Culvert is in overall fair condition.
Thickson Road Underpass	Post-tensioned voided slab	1983	2	None	Structure is 32 years old*, and is in overall good condition. Structure was previously modified to accommodate off-ramp to truck inspection station on south side.
Corbett Creek East Culvert	Concrete box culvert	1961	N/A	1977 (Rehab and Widening)	Structural culvert is 54 years old*. Culvert is in overall good condition.
Thickson Road Ramp S-E	Concrete rigid frame	1985	1	None	Structure is 30 years old*. Structure is in overall fair to good condition.

Structure	Structure Type	Year Built	No of Spans	Year of Previous Rehab	General Comments
CPR-GM Spur Line	Steel plate girder	2004	4	None	Structure is 11 years old*. Structure is in overall excellent to good condition.
Stevenson Road Underpass	CPCI girder	2005	3	None	Structure is 10 years old*. Structure is in overall excellent to good condition.
Park Road Overpass	Concrete rigid frame	1939	1	1976	Structure is 76 years old*. Structure widened and rehabilitated 39 years ago*. Abutment wall and repairs to soffit carried out 13* years ago. Structure is in overall fair condition.
Cubert Street Overpass	Concrete rigid frame	1941	1	1974	Structure is 74 years old*. Structure widened and rehabilitated 41 years ago*. Abutment wall and soffit repairs 12 years ago*. Structure is in overall fair condition.
Oshawa Creek Bridge	Concrete arch	1939	3	1978	Structure is 76 years old*. Structure widened and rehabilitated 38 years ago*. Structure is in overall good to fair condition.
Simcoe Street Underpass	Concrete rigid frame	1941	2	1990	Structure is 74 years old*. Structure was rehabilitated 25 years ago*. Structure is in overall poor to fair condition.
Albert Street Underpass	Concrete rigid frame.	1939	1	1995	Structure is 76 years old*. Structure was rehabilitated 20 years ago*. Structure in in overall poor to fair condition.
Ritson Road Overpass	Concrete rigid frame	1941	1	1974	Structure is 74 years old*. Structure widened and rehabilitated 41 years ago*. Repairs to soffit and substructure 13 years ago*. Structure is in overall fair condition.
Wilson Road Overpass	Concrete rigid frame	1955	1	1974	Structure is 60 years old*. Structure widened and rehabilitated 41 years ago*. Concrete patch repairs to abutment walls and soffit 12 years ago*. Structure in overall fair condition.
Tributary of Harmony Creek Culvert	Concrete box culvert	Unknown	N/A	Unknown	Culvert is in overall good condition.

Structure	Structure Type	Year Built	No of Spans	Year of Previous Rehab	General Comments
(Hwy 401)					
Tributary of Harmony Creek Culvert (Bloor Street)	Concrete box culvert	Unknown	N/A	Unknown	Culvert is in overall good condition.
Bloor Street Underpass	Concrete rigid frame	1952	2	1993	Structure is 63 years old*. Structure was rehabilitated 22 years ago*.
Harmony Creek Culvert	Concrete arch	1952	1	1977	Structure is 63 years old*. Structure was widened and rehabilitated 38 years ago*. Structure is in overall good condition.
Bloor Street (over Harmony Creek)	Concrete rigid frame	1977	1	None	Structure is 37 years old*. Structures in overall good condition.
Farewell Creek Bridge	Concrete rigid frame	1952	1	1977	Structure is 63 years old*. Bridges widened and rehabilitated 38 years ago*. Structure in overall good to fair condition.
Robinson Creek Culvert	Concrete box culvert	Unknown	N/A	Unknown	Culvert is in overall good condition

*As of 2015

Note 1: The Duffins Creek East (Miller Creek) culvert includes three distinct portions with different ages: the north portion extends beneath Highway 401 and includes a concrete box culvert adjacent to a CSP culvert. A middle portion consists of a single concrete box culvert and is located beneath the northern set of rail tracks directly south of Highway 401. A southern portion consists of three CSP culverts and crosses beneath the southern-most rail tracks south of Highway 401. The details in the table above refer to the north portion only, which is the section located beneath Highway 401.

Additional information regarding the various structural alternatives and recommendations at these locations is provided in **Sections 5.4.2** and **8.1.2**, and in the individual *Preliminary Structural Design Reports* prepared for the structures, available under separate cover.

4.5.3 Electrical

Highway 401 and Interchange Illumination

A combination of conventional illumination and high mast lighting (HML) is provided in the Study Area (refer to **Figure 4-27** for typical conventional and high mast lighting). Existing mainline illumination is provided along the median of Highway 401 as follows:

- Full HML from Brock Road to Salem Road, and East of Thickson Road to Park Road.
- Full conventional illumination from Park Road to Harmony Road.

Existing interchange illumination is provided at the following locations:

- Combination of high mast and conventional illumination – Brock Road, Westney Road, Salem Road, and Stevenson Road; and
- Conventional illumination – Thickson Road, Simcoe Street, Ritson Road, Harmony Road / Bloor Street, and Courtice Road.

Existing electrical / illumination conditions are generally good, however minor deficiencies / rehabilitation considerations that have been noted include reduced light distribution at some locations along the corridor due to old luminaries and glare, deterioration of internal electrical equipment due to salt spray / build-up in HML poles, and damaged pole bases.

FIGURE 4-27: TYPICAL CONVENTIONAL (LEFT) AND HIGH MAST (RIGHT) ILLUMINATION

Crossing Road Illumination

Existing lighting systems are provided along all municipal crossing roads within the Study Area. Crossing roadway illumination systems are owned and maintained by the municipalities and are generally in fair to good condition. The systems were observed to be fully operational with few deficiencies. These deficiencies include damaged pole bases, aged brackets, restricted maintenance access due to growing bushes, missing / damaged handhole covers, and unmetered power supply cabinets.

Traffic Signals

Within the interchange limits of the Study Area, there are signalized intersections at the following locations:

- Brock Road north and south ramp terminal intersections;

- Westney Road north and south ramp terminal intersections;
- Salem Road north and south ramp terminal intersections;
- Thickson Road north and south ramp terminal intersections;
- Stevenson Road north and south ramp terminal intersections ;
- Eastbound off/on-ramps at Bloor Street (west of Ritson Road);
- Eastbound off/on-ramps at Bloor Street / Farewell Street (west of Harmony Road); and,
- Harmony Road / Bloor Street / Highway 401 Westbound ramps.

The signals are owned by MTO, but the municipalities are currently responsible for the maintenance and associated costs of the traffic signals, as well as signal timing and monitoring. Based on visual assessment of above grade installations, the equipment was generally in good to fair conditions. The systems are between 5 and 42 years old (as of 2015).

Additional details regarding the existing conditions and rehabilitation requirements of the electrical system within the Study Area is provided in the *Electrical Systems Report Existing Conditions (September 2013)*, available under separate cover.

4.5.4 Utilities

Numerous underground and aerial utilities are located along the Highway 401 corridor within the Study Area, including gas pipelines, cable, watermains, sewers and hydro. The following agencies were contacted in order to acquire information on existing utilities within the Study Area:

- Enbridge Gas
- Veridian Connections Inc. (Electricity)
- Rogers Communications Inc. (Cable Lines)
- Whitby Hydro Energy Services
- Oshawa Power and Utilities Corporation
- HydroOne
- Union Gas Limited
- Bell Canada
- GT Fiber Services Inc.
- Allstream
- Cogeco Data Services
- City of Pickering
- Town of Ajax
- Town of Whitby
- City of Oshawa
- Municipality of Clarington
- Region of Durham

Notable utilities within the Study Area include:

- Hydroelectric transmission corridor (Hydro One) - from the Pickering Nuclear Generating Station which crosses Highway 401 west of the Brock Road interchange;
- Multiple Hydro One, Veridian Connections, and Oshawa Power and Utilities Corp. overhead crossings of Highway 401, including the vicinities of Squires

Beach Road, Westney Road, Knapton Avenue, west of Harwood Avenue, Salem Road, Thornton Road, east and west of Stevenson Road, and east of Ritson Road;

- Watermain crossings beneath Highway 401 at Brock Road, east of Westney Road, at Salem Road, east of Thickson Road, at Stevenson Road, Park Road, Cubert Street, Simcoe Street, Albert Street, Drew Street, Ritson Road, west of and at Wilson Road and between Harmony Road and Courtice Road; and
- Enbridge gas crossings beneath Highway 401 at Brock Road, east and west of Thickson Road, and east of Stevenson Road.

5.0 TRANSPORTATION PROBLEMS AND OPPORTUNITIES

Commuter traffic on Highway 401 from Pickering to Clarington is currently experiencing delays during weekday peak periods. Based on the 2031 population and employment forecasts in the provincial Growth Plan for the surrounding municipalities and the GTA, traffic volumes on Highway 401 are expected to continue to grow even with the implementation of transportation initiatives currently being pursued by the Province, including the Highway 407 East Extension from Brock Road to Highway 35/115, the GO Lakeshore East Extension, and planned and committed road improvements by local municipalities.

An analysis of existing and projected future traffic operations on this section of Highway 401 demonstrated further deterioration in the level of operations along the corridor by 2031, and the need to provide additional capacity to accommodate the anticipated increase in travel demand. The following sections summarize the key elements of the traffic analysis undertaken for existing and future conditions including the capacity and operation needs, as well as the rehabilitation needs for this section of the Highway 401 corridor.

5.1 EXISTING TRAFFIC OPERATIONS

At the outset of this study, a traffic operational analysis was undertaken to assess existing and future projected traffic conditions along the section of Highway 401 from Brock Road to Courtice Road. The Ministry's *Greater Golden Horseshoe (GGH) Transportation Model* was used to model the existing and future traffic demands on Highway 401, and along adjacent roads and crossing roads at interchanges. This model utilizes the future population and employment growth projections that are identified in the province's *Growth Plan for the Greater Golden Horseshoe (2006)* to forecast the future growth in passenger vehicle, commercial vehicle and transit trips within the GGH to 2031. The results of this analysis were used to define the transportation problems and opportunities for this section of Highway 401.

5.1.1 Highway 401 Operations

Level of Service (LOS) is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level-of-service definition generally describes these conditions in terms of such factors as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety. Levels of Service 'A' through 'D' typically reflect adequate operations, while LOS 'E' reflects increasing congestion and operations at capacity, and LOS 'F' reflects unstable traffic flows, long delays and, in some cases, severe traffic congestion.

Existing Highway 401 volumes are at or approaching capacity in the AM and PM peak hours, with Average Annual Daily Traffic (AADT) volumes ranging from between

100,000 vehicles per day in the east end of the Study Area to 170,000 vehicles per day in the west end of the Study Area, and traffic volumes ranging from 3,500 to 10,000 during peak periods. In particular, significant congestion in the afternoon (PM) peak period is present along eastbound Highway 401 approaching Salem Road, where existing Highway 401 transitions from a 5-lane to 3-lane cross-section in each direction. Additional congestion in the PM peak period is present between approximately Brock Street and Stevenson Road. Significant congestion is also apparent during the morning (AM) peak period in the westbound direction, generally beginning in the vicinity of Brock Street and extending eastward towards Stevenson Road. Existing peak hour traffic operations along Highway 401 are illustrated graphically in **Figure 5-1** and **5-2**.

FIGURE 5-1: EXISTING (2011) AM PEAK HOUR HIGHWAY 401 TRAFFIC OPERATIONS

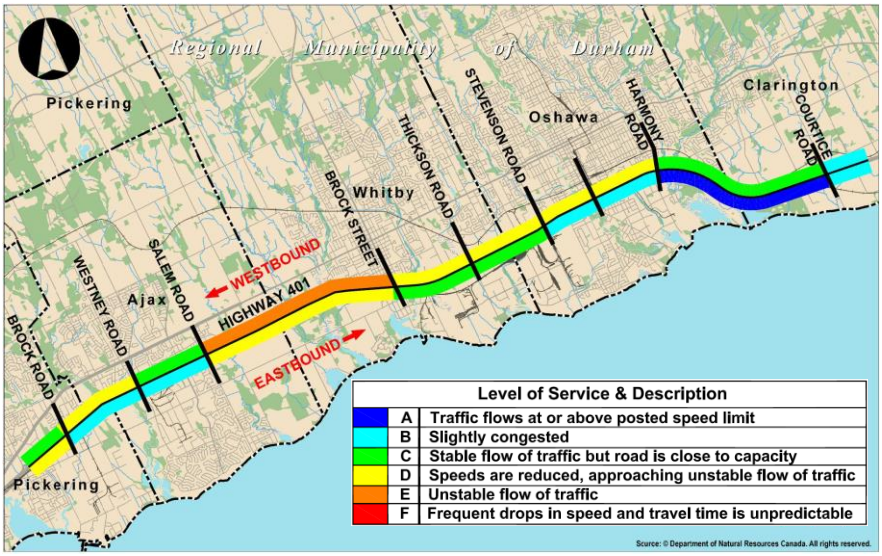
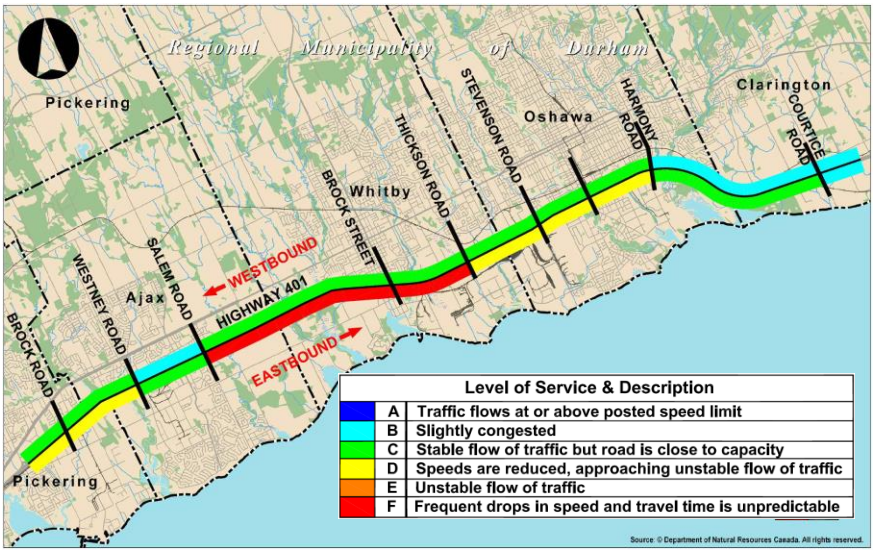


FIGURE 5-2: EXISTING (2011) PM PEAK HOUR HIGHWAY 401 TRAFFIC OPERATIONS



5.1.2 Interchange Operations

Existing traffic operations at interchanges were assessed at the ramp terminals (which are the intersections between the interchange ramp and the corresponding municipal crossing road). The majority of the ramp terminal intersections are currently operating at acceptable levels-of-service (LOS 'D' or above) during both AM and PM peak hours. Notable intersections where LOS 'E' or 'F' traffic operations were identified during the AM peak hours include the eastbound off-ramp to Bloor Street at the Simcoe Street interchange, and the Harmony Road / Bloor Street / East ramp terminal intersection (westbound on-ramp and off-ramp intersection with Bloor Street and Harmony Road). In the PM peak hour, LOS 'E' or 'F' operations were identified at the Brock Road, Westney Road, Salem Road and Stevenson Road south ramp terminal intersections, the eastbound off-ramps to Bloor Street at the Simcoe Street and Harmony Road / Bloor Street interchanges, and the Harmony Road / Bloor Street / East ramp terminal intersection

5.2 FUTURE TRAFFIC DEMAND

A Travel Demand Forecast was completed to determine projected traffic volumes and future lane requirements along Highway 401 within the Study Area. This analysis was undertaken based on data obtained from the Ministry's *Greater Golden Horseshoe Transportation Model* for the 2021 and 2031 AM and PM Peak hours. This model was developed based on existing and planned land uses in Durham Region, municipal road network assumptions based on Transportation Master Plans and Capital Programs, existing and planned transit initiatives, and peak hour traffic / vehicle occupancy data. Historical traffic data for Highway 401 mainline, ramps and ramp terminal intersections were obtained from the MTO and local municipalities.

The analysis found that projected 2031 volumes are anticipated to exceed available capacity on Highway 401 throughout the study limits and will result in congested conditions based on the existing lane configuration, even with the planned extension of Highway 407 East to Highway 35/115 and other planned transit and road improvements. The 2031 traffic forecast revealed a need to widen Highway 401 to 12 lanes between Brock Road and the future West Durham Link by extending the existing Express-Collector system, and to ten lanes from the West Durham Link to Courtice Road.

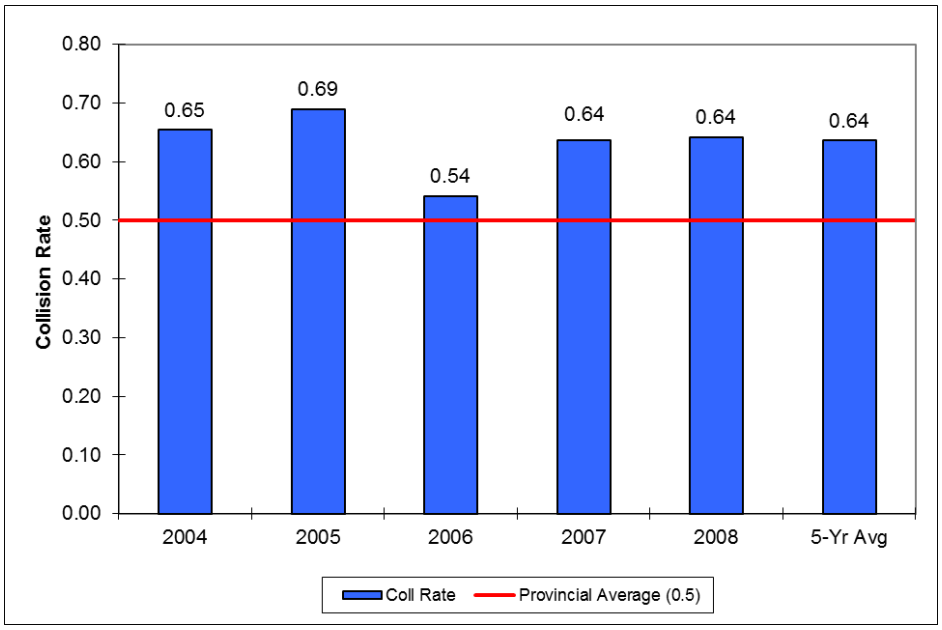
5.3 COLLISION HISTORY

The collision history review included a comprehensive assessment of all reported collisions that occurred on Highway 401 from Brock Road to Courtice Road, between 2004 and 2008 (5-year history), which represented the most recent data set available at that time. The collision history review involved identifying collision-prone locations and potential contributing factors and possible improvements to address deficiencies along the Highway 401 mainline, as well as ramps and ramp terminal intersections.

Collision rates were calculated for the Highway 401 mainline corridor based on the number of collisions recorded per million vehicle kilometres (MVK). Over the 5-year period between 2004 and 2008, there were 4,752 collisions recorded on Highway 401 between 1.0 km west of Brock Road and 1.0 km east of Courtice Road (approximately 950 collisions per year). Of these, 3,638 collisions were determined to be mainline-related, which were used to calculate Highway 401 collision rates.

The overall collision rate for the section of Highway 401 within the study limits was calculated at 0.64 collisions per million vehicle kilometres (MVK) over five years, which is higher than the provincial average for freeways of 0.5 MVK. The most notable sections with high collision rates were found to be in close proximity to the interchanges at Brock Road, Westney Road, Salem Road, Brock Street, and Thickson Road. **Figure 5-3** summarizes the annual collision rates on Highway 401 between 2004 and 2008.

FIGURE 5-3: MAINLINE HIGHWAY 401 COLLISION RATES



**Collision Rates per Million Vehicle Kilometres (MVK)*

5.4 REHABILITATION NEEDS

5.4.1 Pavement

As outlined in **Section 4.5.1**, a visual pavement condition survey was completed as part of this study, along with a limited pavement coring program and borehole investigation. In general, at the time of undertaking the pavement investigations the pavement along the Highway 401 corridor was considered in good condition with the exception of the westbound lanes from Stevenson Road to Lake Ridge Road, which was in fair to good condition. The last major pavement rehabilitation occurred between 1999 and 2008. The typical timeframe for major pavement rehabilitation is between 12 and 15 years, and

between 8 and 10 years for pavement resurfacing. Major pavement rehabilitation is therefore required along the corridor within the next 5 to 10 years for the Highway 401 mainline, and for the majority of interchange ramps. Refer to **Section 8.1.1** for details regarding the pavement recommendations for the corridor.

5.4.2 Structures

As outlined in **Section 4.5.2**, a total of 19 bridges and 7 structural culverts are located along Highway 401 within the Study Area. Structures in the east end of the Study Area (Oshawa) are generally older and require a greater level of rehabilitation (or potentially replacement). Some structures have been recently replaced, and can accommodate a future widening of Highway 401 with minor rehabilitation required. The majority of existing structures will require some form of rehabilitation or replacement within the next 20 years based on the condition and age of the structure, regardless of whether Highway 401 is widened. Refer to **Section 8.1.2** for details regarding the structural recommendations.

5.4.3 Electrical

Existing electrical / illumination conditions are generally good, however minor deficiencies exist within the study limits. Ongoing rehabilitation, upgrading or replacement of existing lighting equipment is required throughout the corridor to maintain appropriate lighting levels. Additional lighting improvements will be required to accommodate a future widening of Highway 401 and associated interchange improvements. The existing electrical conditions are discussed further in **Section 4.5.3**, while the overall recommendations are summarized in **Section 8.1.3**.

5.5 SUMMARY OF TRANSPORTATION PROBLEMS AND OPPORTUNITIES

Highway 401 is currently a 10-lane controlled access freeway in the west end of the Study Area transitioning to a 6-lane freeway at Salem Road and easterly to the east end of the Study Area. Within the study limits, existing Highway 401 traffic volumes are currently at or approaching capacity in the AM and PM peak hours. Traffic volumes along Highway 401 are expected to continue to grow even with the implementation of transit and other highway initiatives currently being pursued by the Province, and planned and committed road improvements by local municipalities. As traffic volumes increase, congestion may lead to further operational issues, driver frustration, and potential for collisions and trip delays.

Given the increased traffic volumes and the anticipated level of congestion, transportation improvements to these sections of Highway 401 are required by 2031 to support the projected growth in the area. In recognition of these transportation needs, a recommended plan for highway widening and interchange improvements along this section of Highway 401 has been developed to define and protect the property / highway ROW that will be required. Rehabilitation of the existing infrastructure (such as bridges

and pavement) is also required throughout the corridor, and will be implemented in advance of, or in conjunction with, the longer-term highway widening and interchange improvements. With a future vision in place for this section of the Highway 401 corridor, the rehabilitation improvements can be implemented efficiently and in a cost effective manner with the knowledge of the long-term plan.

6.0 ALTERNATIVES TO THE UNDERTAKING

Transportation planning alternatives (also referred to as "Alternatives to the Undertaking") are broad-based alternatives that represent fundamentally different ways of addressing the identified transportation problems and opportunities. Consistent with the *Class EA for Provincial Transportation Facilities (amended 2000)*, the Alternatives to the Undertaking were examined at an early stage of this study, and reviewed based on their ability to satisfy the key objectives of the study:

- Address the current and future rehabilitation needs along Highway 401 between Brock Road and Courtice Road;
- Address future capacity and operational issues along Highway 401 between Brock Road and Courtice Road;
- Improve safety conditions on Highway 401 between Brock Road and Courtice Road; and
- Reduce or minimize impacts to the natural, social, economic and cultural environments.

The Project Team considered a range of transportation planning alternatives, as well as the "Do Nothing" alternative, which was used as a baseline for comparison purposes. A brief description of these alternatives, as well as an overview of the evaluation of the Alternatives to the Undertaking is provided in the following sections.

6.1 DO NOTHING

The Do Nothing alternative maintains the status quo with regard to transportation infrastructure and services, with no significant changes or actions being taken to either manage demand, expand infrastructure, or improve operations. Traffic volumes in this section of the Highway 401 corridor are expected to continue to increase. The "Do Nothing" alternative would result in further deterioration of level of service, resulting in an increase in travel time, congestion, potential for collisions, driver frustration and increased fuel consumption. Further, this option would not resolve the short or long-term rehabilitation needs of the corridor, nor does it address the existing and future operational and geometric concerns along Highway 401. Although the "Do Nothing" alternative does not address the objectives of this study, it was carried forward and used as a baseline for comparison with the Highway 401 improvement alternatives.

6.2 TRANSPORTATION DEMAND MANAGEMENT AND TRANSPORTATION SYSTEMS MANAGEMENT

Transportation Demand Management includes the implementation of measures to sufficiently reduce, shift, or eliminate transportation demand. These measures include flexible work hours, telecommuting, and promoting carpooling. Transportation Systems Management includes system improvement alternatives such as Intelligent Transportation

Systems (ITS) like the Ministry's COMPASS system, and enhanced signage (including changeable message signs) along the highway to improve driver awareness, to provide real-time information to drivers to aid in their decision making process, and to separate traffic streams, i.e. local versus long distance.

6.3 ENCOURAGE THE USE OF OTHER TRANSPORTATION MODES

There are a number of initiatives planned in the Study Area by Metrolinx that may result in a shift to transit. These include the GO Train service expansion from Oshawa to Bowmanville, GO Transit study for a third track on the Lakeshore East corridor from Pickering to Whitby, and provision of Bus Rapid Transit along Highway 2. In addition to increased transit options, provision of carpool lots and bus bypass shoulders may assist in encouraging the use of other modes of transportation.

6.4 IMPROVEMENTS TO HIGHWAY 401

Improvements to Highway 401 include measures such as extending the Express-Collector system, improving geometrics at interchanges, and rehabilitating or replacing structures and pavement.

6.5 ENCOURAGE GREATER USE OF LOCAL ROADS

Encouraging greater use of local roads was considered as an Alternative to the Undertaking in order to potentially reduce traffic volumes on Highway 401. This option may include measures such as road widenings of parallel roads, geometric improvements and modifications to signal timings.

6.6 ASSESSMENT OF ALTERNATIVES TO THE UNDERTAKING

Table 6-1 summarizes the assessment of the Alternatives to the Undertaking.

While encouraging greater use of local roads may result in a minor reduction of traffic on Highway 401, the latent travel demands are so significant in this corridor that this shift would not be large enough to ease the existing traffic congestion or address the other study objectives. In addition, the parallel roads adjacent to Highway 401 within the study limits are generally arterial roads designed to provide local access, and are not intended to provide transportation service for longer-distance traffic that utilizes the provincial roadway network. As such, this alternative was not considered further.

The benefits of Transportation Demand Management (TDM) and Intelligent Transportation Systems (ITS) from a traffic operation and capacity perspective are recognized. While these measures may be useful in conjunction with other improvement alternatives, they cannot solely address the overall study objectives in terms of relieving congestion, improving safety conditions or address rehabilitation needs. Similarly, encouraging the use of other modes of transportation through provision of additional or

improved transit options, carpool lots and bus bypass shoulders will assist in reducing the travel demand along the Highway 401 corridor, however the shift would not be enough to significantly address the existing or future traffic congestion or address the other study objectives.

While there are benefits associated with both TDM / ITS and encouraging the use of other transportation modes in terms of improving operations along Highway 401, the implementation of these alternatives (individually or as a combination alternative) will not fully address the projected future capacity needs on this section of Highway 401, and they will not address the existing and future rehabilitation requirements of the corridor which is the primary focus of the study. Improvements to this section of the Highway 401 corridor is the only alternative that can fully address the objectives of this study on its own, and this option was therefore carried forward for further study as the recommended Alternative to the Undertaking.

Improvements to ITS will be incorporated along the Highway 401 corridor as part of the overall recommended improvements. Various measures to encourage the use of other transportation modes, such as provision of carpool lots, will be considered as part of this study in conjunction with improvements to Highway 401. A number of transit initiatives that will further encourage the use of other modes of transportation are planned within the Study Area by Metrolinx and other municipal transit agencies, and these options were therefore not considered further as part of the current study.

TABLE 6-1: ALTERNATIVES TO THE UNDERTAKING

ALTERNATIVES TO THE UNDERTAKING	STUDY OBJECTIVES				PRELIMINARY ASSESSMENT	SUMMARY
	1 Address future capacity and operational issues along Highway 401	2 Improve safety conditions on Highway 401	3 Address the future rehabilitation needs along Highway 401	4 Reduce or minimize impacts to the natural, social, economic and cultural environments		
Do Nothing	○	○	○	◕	The status quo does not address the main operational and geometric deficiencies (e.g. weaving, congestion, limited moves at interchanges). Increased congestion will result in greater travel delay which will impact industry, tourism and community quality of life. This alternative is only being brought forward in this study for comparison purposes.	**Does not address the study objectives. Carried forward for comparison purposes only.**
Transportation Demand Management (TDM) and Intelligent Transportation Systems (ITS)	◔	◔	○	◕	Influencing travel choices (e.g. carpooling, telecommuting, etc.) and implementing low-cost measures to improve the efficiency of the existing transportation system (e.g. automated message systems, etc.) cannot solely address the study objectives, but may be considered along with other alternatives.	✓
Encourage the use of other modes of transportation (e.g. rail, bus, etc.)	◔	◔	○	◐	There are a number of initiatives planned in the study area by Metrolinx that may result in a shift to transit. While encouraging the use of other modes of transportation (via provision of additional transit options, carpool lots, bus bypass shoulders, etc.) may result in a an additional shift from passenger vehicles to transit, the shift would not be enough to significantly ease the existing or future traffic congestion or address the other study objectives. As such, this alternative may be considered along with other alternatives.	✓
Improvements to Highway 401	●	●	●	◔	Improvements to Highway 401 such as improving geometrics at interchanges, rehabilitating or replacing structures and pavement, widening of Highway 401, etc., has the potential to resolve the majority of the main operational and geometric deficiencies and rehabilitation needs along this section of Highway 401. This alternative is being carried forward for further study.	✓
Encourage Greater Use of Local Roads	◔	○	○	◕	While encouraging greater use of local roads may result in a minor reduction of traffic on Highway 401, the shift would not be enough to ease the existing traffic congestion or address the other study objectives. As such, this alternative is not being carried forward for further study.	✗

LEGEND				
Most Preferred →				Least Preferred
●	◕	◐	◔	○

7.0 GENERATION AND EVALUATION OF HIGHWAY 401 IMPROVEMENT ALTERNATIVES

Following the assessment of the Alternatives to the Undertaking, the Project Team developed preliminary design alternatives corresponding to the recommended Alternative to the Undertaking that was carried forward, "Improvements to Highway 401". Based on the existing traffic conditions and projected traffic growth, mainline widening alternatives were examined. Interchange design alternatives were also considered at Simcoe Street, Ritson Road and Harmony Road, and minor interchange improvements to accommodate the proposed widening of Highway 401 were reviewed at Brock Road, Westney Road, Salem Road, Thickson Road and Stevenson Road. Improvements to the Lake Ridge Road, Brock Street and Courtice Road interchanges have been considered as part of separate studies for the section of Highway 401 between Salem Road and Brock Street, and as part of the Highway 407 East Extension project and were not re-visited as part of the current study. However, the recommendations from these studies have been incorporated into the recommended plan for this study.

In addition to the alternatives noted above to address the future capacity and operational issues along Highway 401, alternatives to address the rehabilitation needs of the corridor such as the existing pavement, structures and illumination were also considered. Additional details of the rehabilitation recommendations are presented in **Chapter 8**, and in the various technical reports prepared for each discipline, available under separate cover.

7.1 HIGHWAY 401 MAINLINE ALTERNATIVES

Alternatives along mainline Highway 401 were developed to address the identified long-term capacity and operational needs. As discussed in **Chapter 5**, the traffic forecasting and operational analysis identified that in order to meet the long-term capacity and operational requirements of the corridor, Highway 401 would require a widening to 12 lanes between Brock Road and the future West Durham Link by extending the existing Express-Collector system, and to ten lanes east of the future West Durham Link.

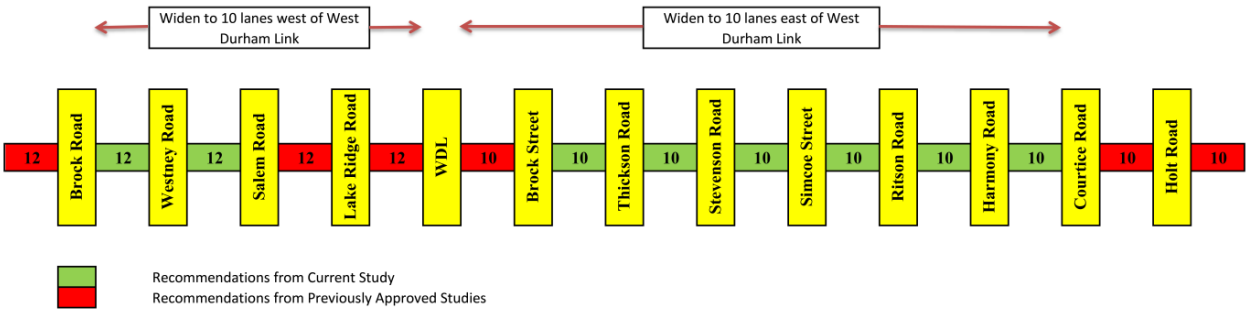
Although the above noted widening will generally provide adequate capacity and acceptable traffic operations within the Study Area, the traffic analysis identified that some sections to the east of the future West Durham Link may still experience some levels of congestion by 2031. Extension of the 12-lane Express-Collector system further to the east was subsequently considered, including to both the Thickson Road interchange and to the future East Durham Link, located approximately 1 km east of Courtice Road. While these improvements would result in improvement in overall traffic operations relative to providing a 10-lane cross-section, the analysis indicated that additional capacity through this section of Highway 401 would further attract additional traffic to the highway from the adjacent local road network, resulting in only minor incremental transportation benefits. In addition, a further extension of the 12-lane Express-Collector

system to the East Durham Link would result in a significant increase in property impacts and displacements, most notably through the constrained section in the City of Oshawa between the Stevenson Road and Harmony Road interchanges. Extension of the 12-lane Express-Collector system would also result in major impacts to existing infrastructure such as the recently constructed Stevenson Road interchange (including the replacement of structures at the interchange), the CPR overhead crossing west of Stevenson Road, and at Thickson Road. In addition, the re-construction or removal of numerous local roads parallel to Highway 401 would also be required. Given the significant incremental impacts and costs associated with extending the Express-Collector system beyond the West Durham link, and the relatively minor incremental transportation benefits, the recommendation to extend the 12-lane Express-Collector system to the West Durham Link only was maintained.

In addition to the recommended Highway 401 widening noted above, the traffic analysis identified that with a 10-lane cross-section some congestion may be present in the westbound direction in the AM peak hour between Brock Street and the future West Durham Link. While this section of Highway 401 was reviewed as part of the Highway 401 Salem Road to Brock Street Environmental Assessment Study and is therefore not considered part of the current study, an alternative lane configuration was reviewed to understand potential traffic operations in the network and the impacts of these operations on other sections of Highway 401. Provision of a continuous auxiliary lane between the Brock Street westbound on-ramp (from the north), and the westbound off-ramp to the West Durham Link was subsequently considered. Although this configuration was found to decrease congestion levels through this section of Highway 401 in the 2031 horizon year, it would also result in significant additional property and environmental impacts. While the current study is not seeking EA Approval for the section of Highway 401 between Salem Road and Brock Street, the provision of the continuous auxiliary lane through this section of Highway 401 will be considered further during the subsequent Detail Design stage for the widening of Highway 401.

The recommended widening and lane requirements along Highway 401 within the Study Area are identified in **Figure 7-1**.

FIGURE 7-1: HIGHWAY 401 SUMMARY OF LANE WIDENING RECOMMENDATIONS



7.1.1 Screening Analysis of Mainline Widening Alternatives

After determining the recommended lane requirements of Highway 401, alternatives to accommodate the recommended widening were reviewed along the entire corridor, including:

- Widening about the Centreline (generally maintain the existing centreline, with relatively equal impacts on the north and south side of Highway 401);
- Widening to the North (generally maintain the existing Highway 401 eastbound edge of pavement, and avoid impacts on the south side of Highway 401); and
- Widening to the South (generally maintain the existing Highway 401 westbound edge of pavement, and avoid impacts on the north side of Highway 401).

Prior to undertaking the detailed evaluation of the alternatives, a screening-level assessment was undertaken for the three widening options for various segments of the Highway 401 corridor. In particular, it was recognized that the "Widen about Centreline" alternative would generally balance property impacts on the north and south sides of Highway 401. This option would also minimize the extent of Highway 401 and interchange re-construction that would be required, minimizing construction staging requirements and traffic impacts as well as total construction cost. As such, in locations where widening about the centreline could generally be accommodated within the existing MTO ROW, the centreline option was considered preferred and a complete evaluation of the three alternatives was not completed. Further, in locations where a major constraint such as a rail corridor would preclude one or more of the widening alternatives, this widening option was not included within the detailed evaluation of alternatives.

In summary, the three widening alternatives were reviewed and evaluated along the entire corridor, except where:

- Widening about the Centreline can generally be accommodated within the existing ROW or results in lower property impacts than the other widening alternatives; and
- A major constraint (e.g. a rail corridor that would require relocation) precludes a widening alternative.

For the purpose of completing the assessment and evaluation of widening alternatives, the Highway 401 mainline was split into eight segments between Brock Road and Courtice Road. The screening level assessment of the alternatives is summarized as follows:

<u>Segment 1 - West of Brock Road to 400 m east of Church Street</u>

- **Widening about the Centreline** – widening can be accommodated with only minor property impacts on the north side of Highway 401, and existing Brock Road underpass can be salvaged. **PREFERRED**

- **Widening to the South** – significant impacts to existing railway.
- **Widening to the North** – greater property impacts on the north side of Highway 401 (relative to widening about the centreline alternative), replacement of existing Brock Road underpass required.

Segment 2 - 400 m east of Church Street to 500 m west of Harwood Avenue

- **Widening about the Centreline** – significant impacts to railway and retaining walls, and requires rail structure replacements.
- **Widening to the South** – significant impacts to railway and retaining walls, and requires rail structure replacements.
- **Widening to the North** – avoids significant impacts to the existing railway, and is therefore considered the only feasible alternative. **PREFERRED**

Segment 3 - 500 m west of Harwood Avenue to 500 m east of Salem Road

- **Widening about the Centreline** – some property impacts on the north side of Highway 401 (but less than the Widening to North alternative), and avoids impacts to the existing railway on the south side of Highway 401. **PREFERRED**
- **Widening to the South** – requires rail structure replacements, and possibly the replacement of the Harwood Avenue structure.
- **Widening to the North** – greater property impacts on the north side of Highway 401 (relative to widening about the centreline alternative), and possibly requires the replacement of the Harwood Avenue structure.

Segment 4 - 500 m east of Salem Road to 800 m east of Brock Street

- The mainline alignment through this section was reviewed as part of the Salem Road to Brock Street and 407 East – West Durham Link Environmental Assessment studies, and was not considered further as part of the current study.

Segment 5 - 800 m east of Brock Street to Thornton Road

- **Widening about the Centreline** – impacts on both north and south sides of Highway 401 including road realignments, but no impacts to the Thickson Road structure.
- **Widening to the South** – impacts the south side of Highway 401, potential Thickson Road structure replacement, but avoids property impacts to the north side and the Champlain Court realignment.
- **Widening to the North** – impacts the north side of Highway 401, potential Thickson Road structure replacement, but avoids property impacts on the south side and the Victoria Street realignment.

Since the screening assessment did not identify a clearly preferred alternative for this section of Highway 401, a more detailed evaluation was completed that considered the

Natural, Socio-Economic and Cultural Environments, as well as Transportation Considerations and Cost. Additional details of this evaluation are provided in **Section 7.1.2**, and summarized in **Table 7-2**.

Segment 6 - Thornton Road to Park Road (through Stevenson Road Interchange)

- **Widening about the centreline** – potential widening can be accommodated with no property impacts or significant interchange reconstruction. **PREFERRED**
- **Widening to the North or South** – would result in major impacts to Stevenson Road interchange including replacement of a number of recently constructed structures.

Segment 7 - Park Road to Harmony Road

- **Widening about the centreline** – impacts to both the north and south sides of Highway 401.
- **Widening to the South** – potentially significant property impacts on the south side of Highway 401 and reduced separation to Bloor Street, but avoids property impacts on the north side.
- **Widening to the north** – potentially significant property impacts on the north side of Highway 401, but avoids property impacts on the south side.

Since the screening assessment did not identify a clearly preferred alternative for this section of Highway 401, a more detailed evaluation was completed that considered the Natural, Socio-Economic and Cultural Environments, as well as Transportation Considerations and Cost. Additional details of this evaluation are provided in **Section 7.1.2**, and summarized in **Table 7-3**.

Segment 8 - Harmony Road to Courtice Road

- **Widening about the Centreline** – widening can be accommodated with only minor property impacts on both sides of Highway 401. **PREFERRED**
- **Widening to the North or South** – results in additional property impacts relative to Widen about Centreline, as well as rail realignment on either side of Highway 401.

7.1.2 Evaluation of Mainline Widening Alternatives

For the two segments of the corridor where the screening assessment did not identify a clearly preferred alternative to accommodate the widening of Highway 401, a more detailed evaluation was completed that considered the Natural, Socio-Economic and Cultural Environments, as well as Transportation Considerations and Cost. A reasoned argument (trade-off) method of evaluation was used to select a preferred alternative. The Reasoned Argument Method considers the advantages and disadvantages of each alternative and the relative significance of the impacts. The Reasoned Argument Method presents a clear and thorough evaluation of the trade-offs between various categories /

factors / indicators, and the reasons why one alternative is preferred over another. The alternatives under consideration were assessed and evaluated based on the criteria listed in **Table 7-1**.

TABLE 7-1: EVALUATION CRITERIA

ENVIRONMENTAL COMPONENT	CRITERIA
Natural Environment	Effect on drainage and hydrology > e.g. creeks, rivers, groundwater Effect on fish and fish habitat > e.g. surface water features with fish and fish habitat Effect on terrestrial habitat and wildlife > e.g. vegetation communities, wetlands, designated natural areas, conservation areas Effect on Species At Risk (SAR) > e.g. listed species and their habitat
Socio-Economic Environment	Effect on residential properties > e.g. disruption, displacement, out-of-way travel Effect on community and institutional features > e.g. disruption, displacement, out-of-way travel Noise impacts > note: a noise assessment will be completed as part of this study Air quality impacts > note: an air quality assessment will be completed as part of this study Effect on agricultural operations > e.g. disruption, displacement, out-of-way travel Effect on commercial / industrial properties > e.g. disruption, displacement, out-of-way travel Effect of areas of waste and contamination
Cultural Environment	Effect on archaeological resources > e.g. disruption or displacement Effect on built heritage resources > e.g. disruption or displacement
Transportation and Cost	Traffic operations and capacity Traffic safety Rehabilitation needs Construction staging Emergency access Utilities Cost

The three widening alternatives considered for each segment are shown in **Figures 7-2** and **7-3** for the sections from east of Brock Street to Thornton Road, and from Park Road to Harmony Road, respectively.

Segment 5: 800 m East of Brock Street to Thornton Road

For the section of Highway 401 from east of Brock Street to Thornton Road, it was found that all of the widening alternatives are equally preferred from a natural environment perspective since they all result in similar potential impacts to water features and fish and fish habitat, terrestrial habitat and vegetation, and groundwater features. All of the alternatives are also equally preferred from a cultural environment perspective since they

all have low potential to impact areas of archaeological significance and have similar impacts to built heritage features and cultural heritage landscapes.

Widen about the Centreline (Alternative 1) is preferred from a transportation and cost perspective since it minimizes impacts to existing infrastructure and utilities, has the lowest level of complexity of construction staging, and has the lowest capital cost. This alternative is also preferred from a socio-economic perspective since it minimizes impacts to aesthetics, noise, community effects, agricultural operations, and commercial and industrial operations. As such, Widen about the Centreline (Alternative 1) is preferred overall. Additional details of the evaluation are provided in **Table 7-2**.

Segment 7: Park Road to Harmony Road

For the section of Highway 401 from Park Road to Harmony Road, the evaluation identified that all of the alternatives are equally preferred from a transportation and cost perspective since they are all relatively similar in terms of safety and operations, impacts to existing transportation infrastructure, complexity of construction staging, impacts to utilities, and cost. All of the alternatives are also equally preferred from a natural environment perspective since they all result in similar potential impacts to water features and fish and fish habitat, terrestrial habitat and vegetation, and groundwater features.

Although the Widen to South option (Alternative 3) is preferred from a cultural environment perspective, it is the least preferred alternative overall as it displaces significantly more residential, commercial and industrial properties than the other alternatives. The Widen about Centreline (Alternative 1) and Widen to North (Alternative 2) options are comparable in terms of impacts to commercial and industrial properties, however Alternative 1 avoids displacement of any institutional, recreational or community features and results in significantly less impacts to residential properties relative to Alternative 2. As such, Widen about the Centreline (Alternative 1) is preferred overall. Additional details of the evaluation are provided in **Table 7-3**.

FIGURE 7-2: HIGHWAY 401 WIDENING ALTERNATIVES FROM EAST OF BROCK STREET TO THORNTON ROAD

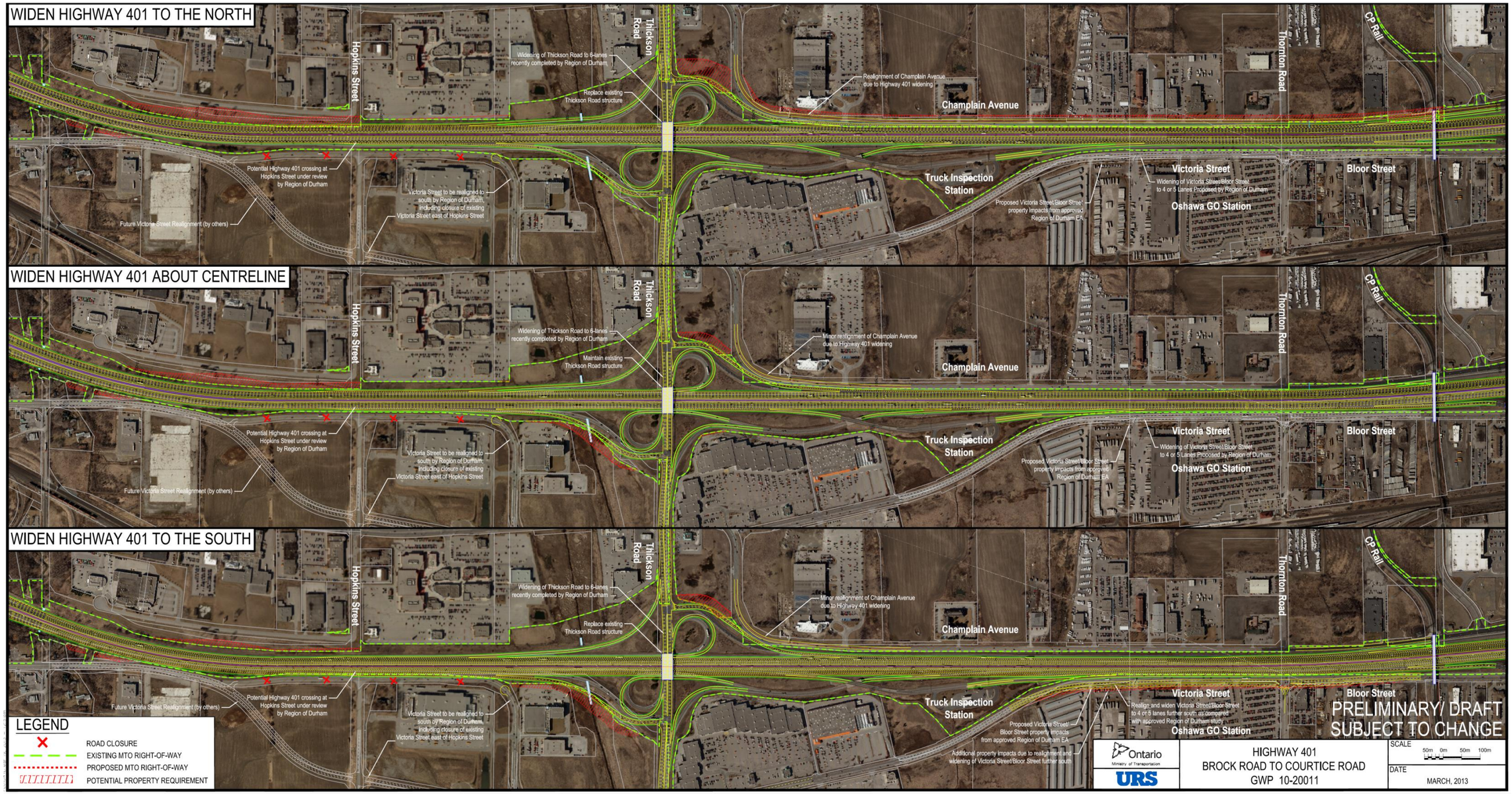


TABLE 7-2: HIGHWAY 401 WIDENING FROM BROCK STREET TO THORNTON ROAD – SUMMARY OF EVALUATION

Category	Relative Level of Significance	Alternative			Summary
		Alternative 1 - Widen About Centre	Alternative 2 - Widen to the North	Alternative 3 - Widen to the South	
Transportation and Cost	High	●	◔	◔	Alternative 1 is not anticipated to adversely affect interchange operations, as the location of the ramp terminal intersections along Thickson Road remains unchanged. Alternatives 2 and 3 may result in minor adverse effects to operations along Thickson Road due to the reduction in separation distance between ramp terminals and the adjacent side street intersections along Thickson Road. Alternative 1 can also accommodate the widening of Highway 401 at the Thickson Road underpass, whereas Alternatives 2 and 3 require the replacement of the Thickson Road underpass. In addition, Alternative 2 requires a significant realignment of Champlain Avenue and Alternative 3 requires a realignment of Victoria Street / Bloor Street (in addition to that required for the approved Victoria Street / Bloor Street EA undertaken by Durham Region). As Alternative 1 minimizes impacts to existing infrastructure and utilities, has the lowest level of complexity of construction staging (given that the Thickson Road structure can be maintained), and has the lowest capital cost, **Alternative 1 (widen about the centreline) is preferred from a transportation and cost perspective.**
Natural Environment	Medium	◐	◐	◐	All of the alternatives result in similar minor potential impacts to water features and fish and fish habitat, terrestrial habitat and vegetation, and groundwater features. It is anticipated that impacts to Species at Risk can be avoided. **As such, all of the alternatives are equally preferred from a natural environment perspective.**
Socio-Economic Environment	High	●	◔	◐	None of the alternatives impact any residential properties and are anticipated to have no/minimal aesthetic and noise impacts to adjacent sensitive viewers. Alternative 1 does not impact any residential, commercial or industrial properties, while Alternatives 2 and 3 disrupt 14 and 11 commercial and industrial properties, respectively. **As such, Alternative 1 (widen about the centreline) is preferred from a socio-economic environment perspective.**
Cultural Environment	Medium	◐	◐	◐	Widening about the centreline, to the north and to the south all have low potential to impact areas of archaeological significance. All of the alternatives may potentially disrupt a heritage home along Hopkins Street, however this impact is primarily a result of the potential Hopkins Street grade separation that is being studied by the Region of Durham. **As such, all of the alternatives are equally preferred from a cultural environment perspective.**
SUMMARY		●	◔	◐	All of the alternatives are equally preferred from a natural environment perspective since they all result in similar potential impacts to water features and fish and fish habitat, terrestrial habitat and vegetation, and groundwater features. All of the alternatives are also equally preferred from a cultural environment perspective since they all have low potential to impact areas of archaeological significance and have similar impacts to built heritage features and cultural heritage landscapes. Alternative 1 is preferred from a transportation and cost perspective since it minimizes impacts to existing infrastructure and utilities, has the lowest level of complexity of construction staging, and has the lowest capital cost. Alternative 1 is also preferred from a socio-economic perspective since it minimizes impacts to aesthetics, noise, community effects, agricultural operations, and commercial and industrial operations. **As such, Alternative 1 (widen about the centreline) is preferred overall.**

LEGEND				
Most Preferred →				Least Preferred
●	◕	◐	◔	○

FIGURE 7-3: HIGHWAY 401 WIDENING ALTERNATIVES FROM PARK ROAD TO HARMONY ROAD

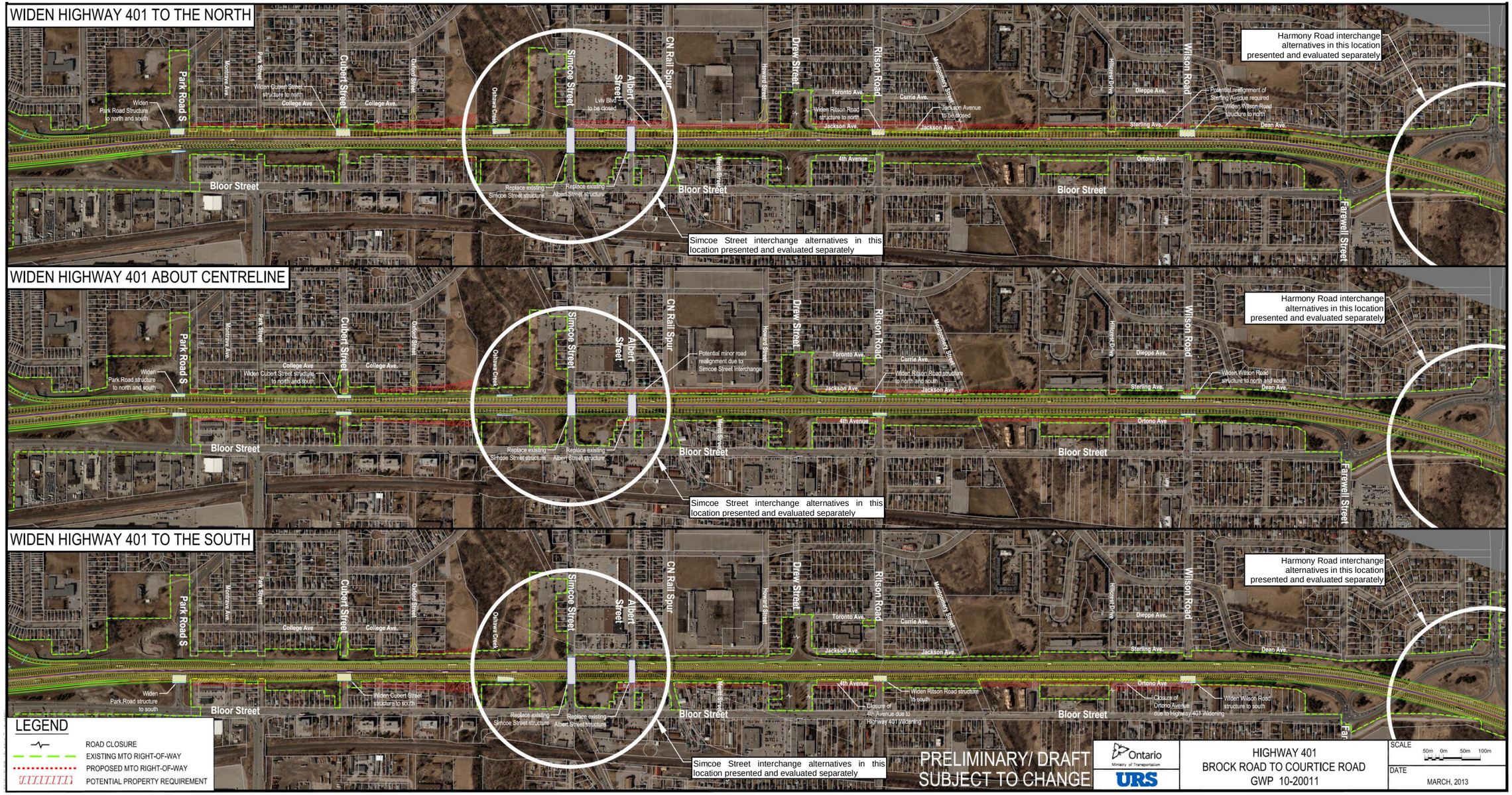


TABLE 7-3: HIGHWAY 401 WIDENING FROM PARK ROAD TO HARMONY ROAD – SUMMARY OF EVALUATION

Category	Relative Level of Significance	Alternative			Summary
		Alternative 1 - Widen About Centre	Alternative 2 - Widen to the North	Alternative 3 - Widen to the South	
Transportation and Cost	**High**	●	●	●	All of the alternatives are relatively similar in terms of impacts to existing transportation infrastructure (roads and bridges), safety and operations, complexity of construction staging, impacts to utilities, and cost. **As such, all of the alternatives are equally preferred from a transporation and cost perspective.**
Natural Environment	**Medium**	◐	◐	◐	All of the alternatives result in similar potential impacts to water features and fish and fish habitat (at Oshawa Creek), terrestrial habitat and vegetation (particularly adjacent to Oshawa Creek), and groundwater features. Impacts to species at risk can likely be avoided. **As such, all of the alternatives are equally preferred from a natural environment perspective.**
Socio-Economic Environment	**High**	●	◐	○	All of the alternatives have similar potential to affect local air quality conditions, to result in incremental noise level increases at some receptors, and to result in aesthetic impacts to sensitive viewers adjacent to Highway 401. However, Alternative 1 displaces and disrupts significantly fewer residential, commercial and industrial properties relative to Alternatives 2 and 3, and avoids displacement of any institutional, recreational or community features. **As such, Alternative 1 (widen about the centreline) is preferred from a socio-economic environment perspective.**
Cultural Environment	**Medium**	◐	○	●	All of the alternatives may impact areas of archaeological potential due to the encroachment adjacent to Oshawa Creek and the relatively high overall property impacts. All of the alternatives also likely displace 1 heritage home due to the Simcoe Street interchange reconfiguration, however Alternative 1 also potentially results in frontage property impacts to the St. George Ukranium Catholic Church and Alternative 2 potentially displaces the St. George Ukranium Catholic Church. **As such, Alternative 3 (widen to the south) is preferred from a cultural environment perspective.**
SUMMARY		●	◐	○	All of the alternatives are equally preferred from a transportation and cost perspective since they are all relatively similar in terms of safety and operations, impacts to existing transportation infrastructure, complexity of construction staging, impacts to utilities, and cost. All of the alternatives are also equally preferred from a natural environment perspective since they all result in similar potential impacts to water features and fish and fish habitat, terrestrial habitat and vegetation, and groundwater features. Although Alternative 3 is preferred from a cultural environment perspective, it is the least preferred alternative overall as it displaces significantly more residential, commercial and industrial properties than Alternatives 1 and 2. Alternatives 1 and 2 are comparable in terms of impacts to commercial and industrial properties, however Alternative 1 avoids displacement of any institutional, recreational or community features and results in significantly less impacts to residential properties relative to Alternative 2. Further, it is anticipated that significant impacts to the St. George Ukrainian Catholic Church can be avoided with Alternative 1 through construction of a retaining wall. **As such, Alternative 1 (widen about the centreline) is preferred overall.**

LEGEND				
Most Preferred →				Least Preferred
●	◕	◐	◔	○

7.1.3 Highway 401 Transfer Location Alternatives

Extending the Express-Collector system to the West Durham Link requires the introduction of transfer lanes between the Express and Collector lanes, to allow for the distribution of traffic between the two streams of traffic. An Express to Collector and Collector to Express transfer was considered in each direction from west of Brock Road to the future West Durham Link to optimize traffic operations along Highway 401 through this section.

In reviewing the potential location for the new transfers, consideration was given to the location and resulting operations of the existing transfers in the Express-Collector system west of Brock Road. Other key criteria considered in the development and assessment of potential transfer locations included:

- Adequate spacing of transfers between interchanges, including the number of interchanges located between each set of transfers and corresponding traffic volumes and operations at each transfer;
- Proximity of transfers to the upstream or downstream interchanges, and associated traffic / weaving operations; and
- Environmental and property impacts.

Eastbound Highway 401

West of Brock Road, an existing Express to Collector transfer is located in the eastbound lanes of Highway 401, east of Whites Road. In the present condition, this transfer is primarily utilized by vehicles in the eastbound Express lanes exiting at Brock Road. The nearest upstream Collector to Express transfer is located east of the Sheppard Avenue / Port Union Road interchange.

Based on consideration of the existing transfer locations and the criteria noted above, a new eastbound Express to Collector transfer alternative was developed for just west of Salem Road. This transfer would be primarily utilized by vehicles in the eastbound Express lanes and exiting to the proposed West Durham Link or Lake Ridge Road interchanges. Based on this proposed transfer location, the existing Express to Collector transfer east of Whites Road would be primarily utilized by vehicles exiting eastbound Highway 401 at Brock Road, Westney Road and Salem Road. The proposed transfer was located to maximize available weaving distance from the transfer to the future Lake Ridge Road interchange, and to minimize environmental and property impacts.

An eastbound Collector to Express transfer alternative was developed for west of Church Street. This transfer would serve as the first possible access point to the Express lanes for vehicles entering Highway 401 from interchanges at Sheppard Avenue / Port Union Road (northbound), Whites Road and Brock Road. In addition, this location would minimize potential weaving concerns between vehicles entering eastbound Highway 401 from

Brock Road and utilizing the transfer, and through traffic remaining in the Collector lanes. However, this transfer location would also require construction of a new structure for the eastbound Collector lanes over Duffins Creek, resulting in significant environmental impacts and associated construction cost.

Given the potential environmental impacts and high cost of a new structure over Duffins Creek, a refinement to this transfer location was subsequently developed, relocating the transfer to just east of Brock Road. This location would restrict access to the eastbound Express lanes for vehicles entering Highway 401 from Brock Road, and those vehicles would remain in the Collector lanes until the end of the Express-Collector system at the West Durham Link. However, this configuration would also avoid the need to construct a new structure over Church Street / Duffins Creek, and would make use of the widened Duffins Creek sub-structure that was constructed in 1999. Traffic analysis completed for the refined transfer location found that this modification would improve overall traffic operations in the eastbound Express lanes, with some minor traffic slow-downs anticipated in the eastbound Collector lanes given that traffic from Brock Road remains in the Collector lanes. However, good overall operations are still anticipated, and given the reduced environmental impacts and cost associated with this option the revised transfer location just east of Brock Road was incorporated into the Recommended Plan.

Westbound Highway 401

West of Brock Road, an existing Express to Collector transfer is located in the westbound lanes of Highway 401 just east of Whites Road. In the present condition, this transfer is primarily utilized by vehicles in the westbound Express lanes exiting to Kingston Road / Highway 2, near Sheppard Avenue. The nearest downstream Collector to Express transfer is located west of the Whites Road interchange, providing the first opportunity for vehicles entering Highway 401 from Brock Road, Liverpool Road and Whites Road to access the westbound Express lanes.

Based on consideration of the existing transfer locations and the transfer location criteria noted above, a new westbound Express to Collector transfer alternative was developed in the vicinity of Church Street / Duffins Creek. This transfer would be primarily utilized by and signed for vehicles in the westbound Express lanes and exiting to the Brock Road, Liverpool Road or Whites Road interchanges. A refinement to this transfer location was subsequently considered, shifting the transfer slightly to the west of Duffins Creek / Church Street. This location reduces the separation between the transfer and the westbound off-ramp to Brock Road by approximately 200 m. However, this refinement avoids the need to construct a new structure for the westbound Collector lanes over Duffins Creek, which would have been required with the original location. With the refined location, the widening of Highway 401 could be accommodated on the existing Duffins Creek sub-structure, which was previously widened in 1999, thereby avoiding any additional environmental impacts to the creek and adjacent lands. Traffic analysis identified no significant operational concerns with the reduced separation between the

transfer and off-ramp to Brock Road, and therefore the revised transfer location was incorporated into the Recommended Plan.

A westbound Collector to Express transfer alternative was developed for west of Salem Road. This transfer would serve as the first potential access point to the Express lanes for vehicles entering westbound Highway 401 from Salem Road and the future Lake Ridge Road and West Durham Link interchanges. This location would result in good overall traffic operations and distribution between the Express and Collector lanes. A potential transfer location west of Westney Road, which would allow traffic entering from Westney Road to access the Express lanes, was not considered given the potential property impacts and weaving concerns between this transfer and the recommended Express to Collector transfer west of Church Street. As such, the transfer location west of Salem Road was incorporated into the Recommended Plan.

7.2 HIGHWAY 401 INTERCHANGE ALTERNATIVES

Alternatives to address existing or future operational, capacity or safety concerns at interchanges along the Study Area were reviewed. Major interchange design alternatives were developed where the following criteria were met:

- The alternative will provide significant transportation benefits.
- The alternative does not significantly impact a major constraint (e.g. rail corridor).
- The existing interchange configuration cannot accommodate the recommended widening of Highway 401.

Based on the criteria above, major interchange design alternatives were reviewed for the Simcoe Street / Ritson Road and Harmony Road interchanges, given that the new alternatives would provide a significant transportation benefit and as the existing interchange configuration cannot accommodate the recommended widening of Highway 401. For the remaining interchanges, minor refinements only to accommodate the proposed widening of Highway 401 and to address operational or safety concerns were reviewed, as the existing configurations are generally considered acceptable. The minor interchange improvements that were considered for the remaining interchanges generally maintain the existing configuration of the interchange and include:

- Modifications to ramp tie-ins with Highway 401 to accommodate additional lanes;
- Extension of turning lanes or speed change lanes; and,
- Improved geometry, such as increased ramp radii.

Minor interchange improvements were reviewed at Brock Road, Westney Road, Salem Road, Thickson Road and Stevenson Road. Improvements to the Lake Ridge interchange Road, Brock Street and Courtice Road interchanges were previously reviewed as part of separate studies and were not re-visited as part of the current study.

7.2.1 Simcoe Street / Ritson Road Interchange

The existing Highway 401 / Simcoe Street interchange is a partial interchange with access to and from the west only. As described in **Section 4.4.2**, the eastbound off-ramp is a "buttonhook" configuration with access to Bloor Street, west of Simcoe Street. The westbound on-ramp intersects with Simcoe Street approximately 200 m to the north of Highway 401. The area in the immediate vicinity of the interchange includes residential and commercial development in the southwest, southeast and northeast quadrants of the interchange, along with Oshawa Creek directly west of Simcoe Street. In addition, Bloor Street is located approximately 100 m south of and parallel to Highway 401.

The existing Highway 401 / Ritson Road (Drew Street) interchange has a buttonhook configuration, with eastbound off and on-ramps connecting to Bloor Street, west of Ritson Road. Westbound off and on-ramps connect directly to Drew Street, west of Ritson Road. Provision of a standard interchange configuration at these locations is generally limited by existing residential and commercial development in all four quadrants of the interchange, and by Bloor Street which is located 100 m south of and parallel to Highway 401. The interchange is located in close proximity to both the Simcoe Street and Harmony Road interchanges resulting in potential weaving concerns along Highway 401.

The existing Simcoe Street and Ritson Road interchanges are illustrated in **Figure 7-4**.

FIGURE 7-4: EXISTING SIMCOE STREET / RITSON ROAD INTERCHANGE

Given the identified operational and geometric concerns at these two interchange locations, and as the existing configurations cannot adequately accommodate the recommended widening of Highway 401 to 10 lanes, alternatives to re-configure the existing interchanges were reviewed. Alternatives for the Simcoe Street and Ritson Road interchanges were considered together given the close proximity of the interchanges and the associated interaction between traffic operations along both Highway 401 and the adjacent road network.

Based on the geometry of the existing interchange ramps located just west of Ritson Road, these ramps cannot safely accommodate the future widening of Highway 401 without major re-construction and associated property impacts. Further, the westbound on and off-ramps connect to an existing local road (Drew Street), which is considered undesirable for access to and from a major freeway facility. The existing ramps west of Ritson Road were therefore all recommended for closure. In addition, given the existing land uses and road network connections along Simcoe Street, along with the existing property constraints in all four quadrants at Ritson Road and Highway 401, Simcoe Street was considered the preferable location for providing full access to Highway 401. As such, alternatives for providing a full-moves interchange with access in all directions was reviewed at Simcoe Street. Alternatives which included partial access to Highway 401 at Ritson Road, in addition to full access at Simcoe Street, were also considered.

The development of interchange alternatives at these locations was completed in two stages. The initial alternatives considered at these locations were presented for public review at PIC #1 and are illustrated in **Figures 7-5** to **7-11**. As noted above, all alternatives included closure of the existing interchange ramps located just west of Ritson Road.

FIGURE 7-5: ALTERNATIVE 1: SIMCOE STREET INTERCHANGE – PARCLO / DIAMOND

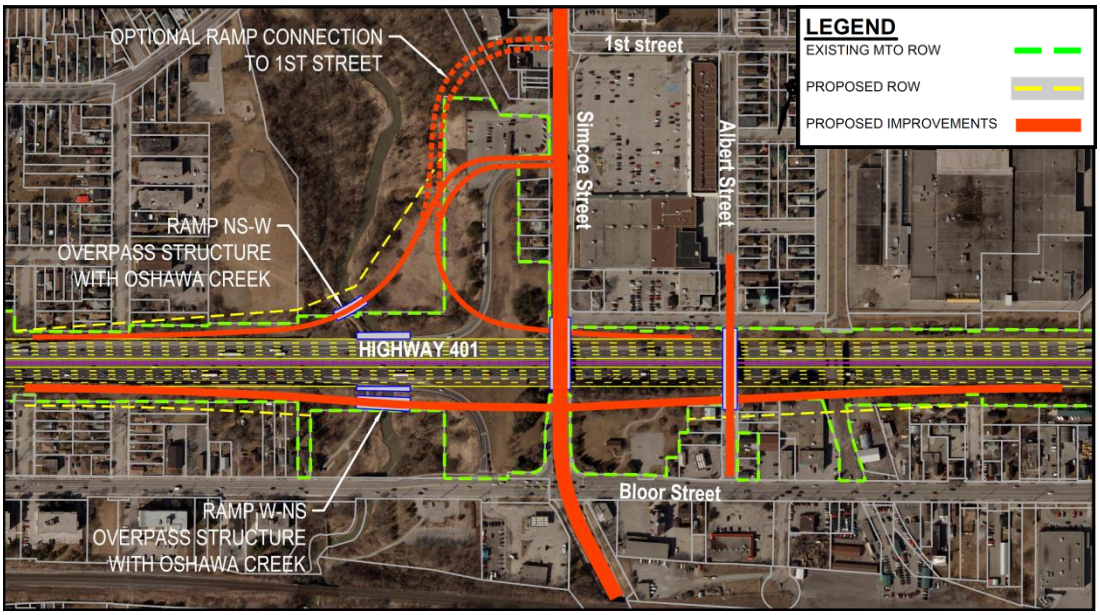


FIGURE 7-6: ALTERNATIVE 2: SIMCOE STREET INTERCHANGE – PARCLO / DIAMOND WITH BLOOR STREET GRADE SEPARATION

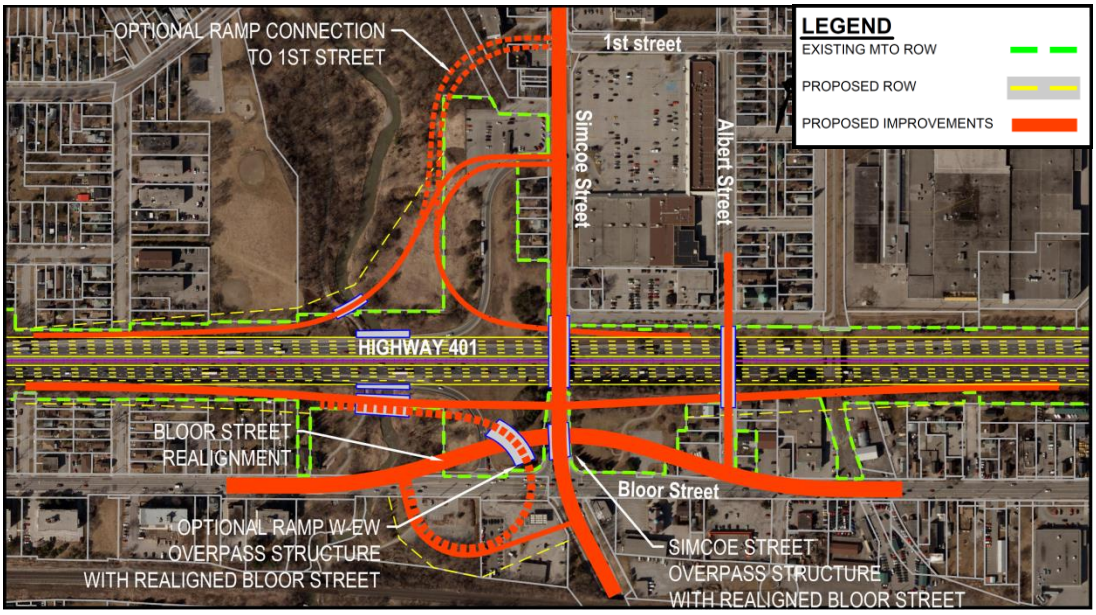


FIGURE 7-7: ALTERNATIVE 3: SIMCOE STREET INTERCHANGE – PARCLO B WITH BUTTONHOOKS WEST OF BLOOR STREET

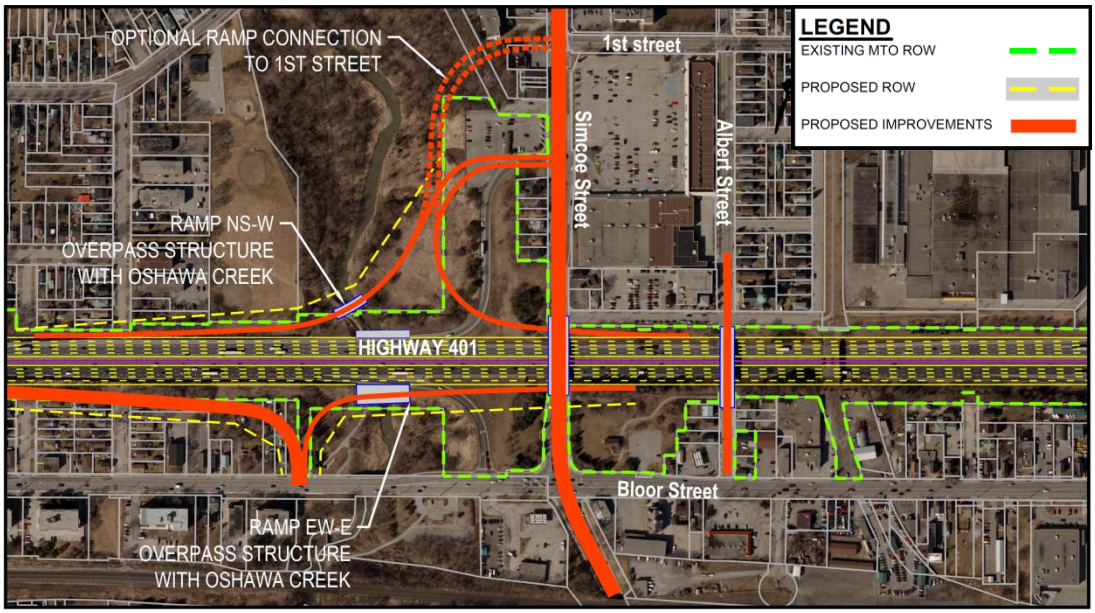


FIGURE 7-8: ALTERNATIVE 4: SIMCOE STREET INTERCHANGE – PARCLO B WITH BUTTONHOOKS EAST OF BLOOR STREET

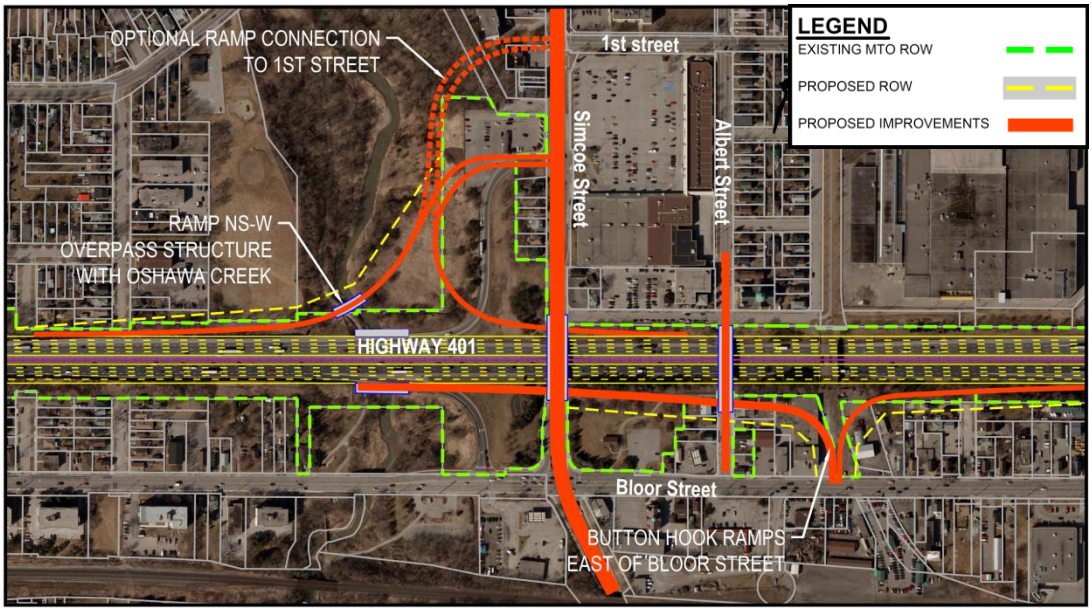


FIGURE 7-9: ALTERNATIVE 4A: SIMCOE STREET INTERCHANGE – DIAMOND WITH BUTTONHOOKS EAST OF BLOOR STREET

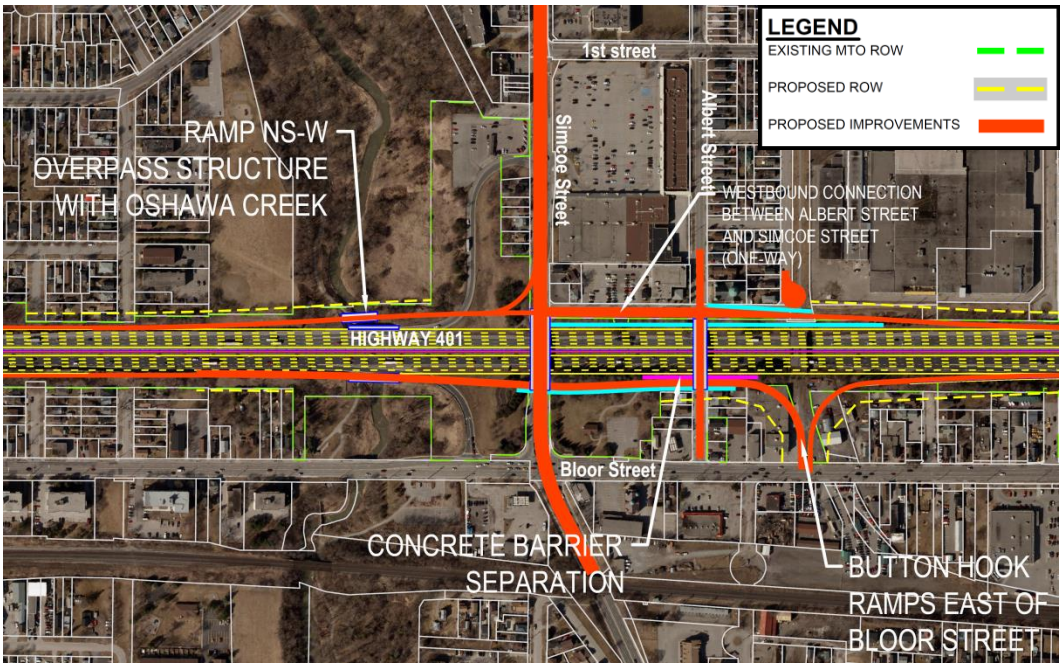


FIGURE 7-10: ALTERNATIVE 5: SIMCOE STREET INTERCHANGE – SPLIT DIAMOND WITH RAMPS AT FORMER RAIL CORRIDOR

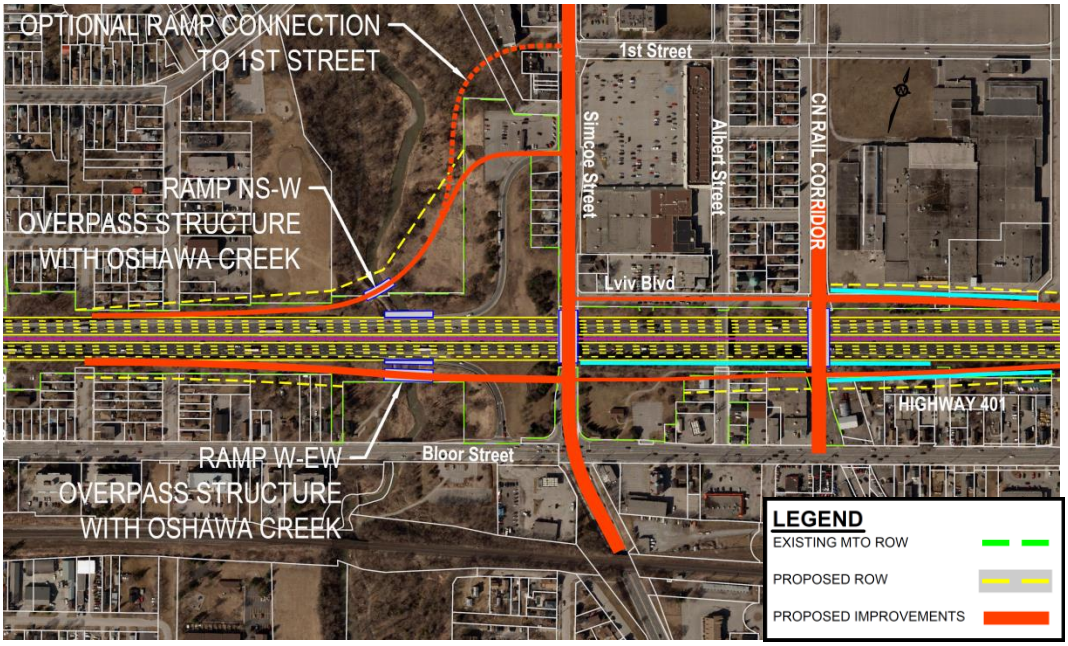


FIGURE 7-11: ALTERNATIVE 6: SIMCOE STREET INTERCHANGE – SPLIT DIAMOND WITH RAMPS AT RITSON ROAD

A screening level assessment was initially completed on the alternatives based on anticipated overall traffic operations. Based on this initial assessment, Alternatives 1, 5 and 6 were screened out as a result of significant operational and safety concerns associated with closely spaced intersections along Simcoe Street. More specifically, the closely spaced intersections along Simcoe Street between Bloor Street and the south ramp terminal intersections were found to result in traffic backups (queuing) and conflicting traffic movements (weaving) between intersections. The other alternatives were carried forward for further assessment and evaluation based on the criteria outlined in **Table 7-1**. The full evaluation of alternatives is provided in **Table 7-4**, and summarized below:

<u>Alternative 2: Parclo B / Diamond with Bloor Street Grade Separation</u>

- Provides improved geometrics, safety, and intersection operations relative to existing condition;
- Increased intersection spacing along Simcoe Street reduces potential weaving concerns;
- High impact to adjacent properties and utilities, and highest construction cost and staging complexity.

<u>Alternative 3: Parclo B with Buttonhooks west of Bloor Street</u>

- Lower impact to terrestrial habitat, vegetation and fish habitat (relative to Alternative 2);
- Weaving concerns along Highway 401 due to proximity of eastbound on-ramp at Stevenson Road and eastbound off-ramp at Bloor Street;
- High impact to properties adjacent to Highway 401.

Alternative 4: Parclo B with Buttonhooks east of Bloor Street

- Good overall traffic operations anticipated;
- Increased intersection spacing along Simcoe Street (relative to Alternative 4A) reduces weaving concerns;
- Lower overall impacts to natural environment and adjacent residential and commercial properties relative to Alternatives 2 and 3.

Alternative 4A: Diamond with Buttonhooks east of Bloor Street

- Lowest impacts to natural environment and adjacent residential and commercial properties;
- Potential operational concerns / traffic queuing along Simcoe Street;
- Undesirable safety conditions associated with introduction of freeway traffic on local road network, and potential for wrong-way travel on westbound off-ramp.

Based on the initial evaluation of alternatives, Alternative 4 was selected as the preferred configuration.

TABLE 7-4: INITIAL EVALUATION OF SIMCOE STREET INTERCHANGE ALTERNATIVES

Category	Relative Level of Significance	Alternative				Summary
		Alternative 2 - Parclo B / Diamond with Bloor Street Grade Separation	Alternative 3 - Parclo B with Buttonhooks West of Simcoe Street	Alternative 4 - Parclo B with Buttonhooks East of Simcoe Street	Alternative 4A - Partial Diamond with Buttonhooks East of Simcoe Street	
Transportation and Cost	High	◕	◐	●	◔	All of the alternatives result in acceptable overall interchange operations. Although Alternative 4A eliminates the westbound B-loop off-ramp and is associated with the lowest construction cost, the high southbound left turning volumes at this intersection are anticipated to result in potential queuing between intersections along Simcoe Street. This option also has a higher complexity of construction staging and introduces highway-related traffic on the local road network (Albert Street and Lviv Boulevard), resulting in undesirable safety operations and potential for wrong-way travel along the westbound off-ramp. As such, Alternative 4A is least preferred from a transportation and cost perspective. The high eastbound left turning volumes at the Bloor Street / Simcoe Street intersection with Alternative 3 are also anticipated to result in a greater number of critical movements and potential for eastbound queues to extend to the south ramp terminal intersection in the PM peak hour. Alternative 3 has the shortest distance between the eastbound on-ramp from Stevenson Road and off-ramp to Simcoe Street, which is anticipated to result in potential weaving concerns and speed reductions along Highway 401. Geometrically, the eastbound buttonhook off-ramp and reduced deceleration length on the off-ramp with Alternative 3 is associated with less than desirable ramp geometrics. Between Alternatives 2 and 4, Alternative 2 is associated with a high level of complexity of construction staging and utility impacts, given the realignment of Bloor Street and grade separation with Simcoe Street. In addition, Alternative 2 has a significantly higher construction cost than Alternatives 4. As such, **Alternative 4 is preferred from a transportation and cost perspective.**
Natural Environment	Medium	◔	◐	◕	●	Alternative 2 results in the greatest impacts to water features, fish and fish habitat at Oshawa Creek, and terrestrial habitat and vegetation, given the realignment of Bloor Street and the eastbound off-ramp which requires a new structure and fill into the Oshawa Creek floodplain. Alternative 2 also has the greatest potential to impact groundwater features given the realignment and lowering of Bloor Street, and is therefore least preferred from a Natural Environment perspective. Between Alternatives 3, 4 and 4A, Alternative 4A has the lowest impact to terrestrial habitat and vegetation and to fish and fish habitat at Oshawa Creek. Impacts to species at risk are not anticipated for any alternatives. **As such, Alternative 4A is preferred from a natural environment perspective.**
Socio-Economic Environment	Medium-High	◔	◐	◕	●	All of the alternatives have similar potential to affect local air quality conditions and to result in incremental noise level increases at some receptors. In terms of community effects, Alternative 4A is anticipated to displace the lowest number of residential properties (7) followed by Alternatives 4, 2 and 3 (8, 10 and 17, respectively). Alternatives 3, 4 and 4A are not anticipated to displace any institutional, recreational or community features, whereas Alternative 2 may displace the BRODIE Community & Residential Services Centre, Oshawa Community Centre and New Ark-Opportunity Learning Centre. Alternative 2 also displaces the highest number of commercial or industrial properties (9) while Alternative 4 displaces 6 commercial/industrial properties and Alternatives 3 and 4A have 3 displacements. Alternative 2 also has the greatest impacts to properties with potential for medium or high waste/contamination. Given the high number and extent of impacts, Alternative 2 is least preferred from a socio-economic perspective. Of the remaining options, Alternative 3 results in the next highest total number of displacements, and is not preferred. Between Alternatives 4 and 4A, Alternative 4A results in slightly higher out-of-way travel to/from existing businesses given conversion of Lviv Street to a one-way street. However, it results in significantly less displacements and lower disruption than the other alternatives. **As such, Alternative 4A is preferred from a socio-economic environment perspective, followed by Alternative 4.**
Cultural Environment	Low-Medium	◕	◕	◕	●	All of the alternatives have the potential to result in frontage property impacts to the Ukrainian Catholic Church of St. George. All of the alternatives may impact areas of archaeological potential in the vicinity of Oshawa Creek, although Alternative 4A has the lowest potential due to reduced encroachment into the creek. As such, Alternative 4A is slightly preferred **from a cultural environment perspective.**
SUMMARY		◔	◔	●	◕	Between Alternatives 2, 3 and 4, Alternative 4 results in slightly lower environmental impacts, the lowest number of overall property displacements, and the best overall operations and safety conditions. Alternative 4 is therefore preferred or equally preferred over Alternative 2 and 3 in all categories, and Alternatives 2 and 3 are not preferred. Between Alternative 4 and 4A, Alternative 4A results in a lower overall number of residential, commercial/industrial and institutional/recreational displacements, and is therefore preferred from a socio-economic perspective. Alternative 4A is also preferred from both a natural and cultural environment perspective, as it results in lower impacts to terrestrial habitat and vegetation, and fish and fish habitat at Oshawa Creek, which minimizes potential for archaeological impacts. Both alternatives are anticipated to result in good overall traffic operations. Although Alternative 4A eliminates the westbound B-loop off-ramp and is associated with a lower construction cost, the high southbound left turning volumes at the Bloor Street/Simcoe Street intersection is anticipated to result in potential queuing between closely-spaced intersections along Simcoe Street. Further, Alternative 4A has a higher complexity of construction staging and introduces highway-related traffic on the local road network (Albert Street and Lviv Boulevard), resulting in undesirable safety operations and potential for wrong-way travel along the westbound off-ramp. While Alternative 4A is preferred in the other criteria, these operational and safety concerns are considered to outweigh the other benefits of this option. **As such, Alternative 4 (Parclo B with Buttonhooks East of Simcoe Street) is preferred overall.**

LEGEND				
Most Preferred →				Least Preferred
●	◕	◐	◔	○

Following completion of the initial evaluation of Simcoe Street interchange alternatives, the preferred configuration (Alternative 4) was further reviewed with options providing additional ramps at Ritson Road to and from the east. The additional ramps at Ritson Road were reviewed with consideration of the anticipated traffic growth associated with the proposed future Central Oshawa GO Station. The two additional alternatives that were considered are illustrated in **Figures 7-12** and **7-13**.

FIGURE 7-12: ALTERNATIVE 4B: ALTERNATIVE 4 WITH EASTBOUND ON-RAMP AT RITSON ROAD

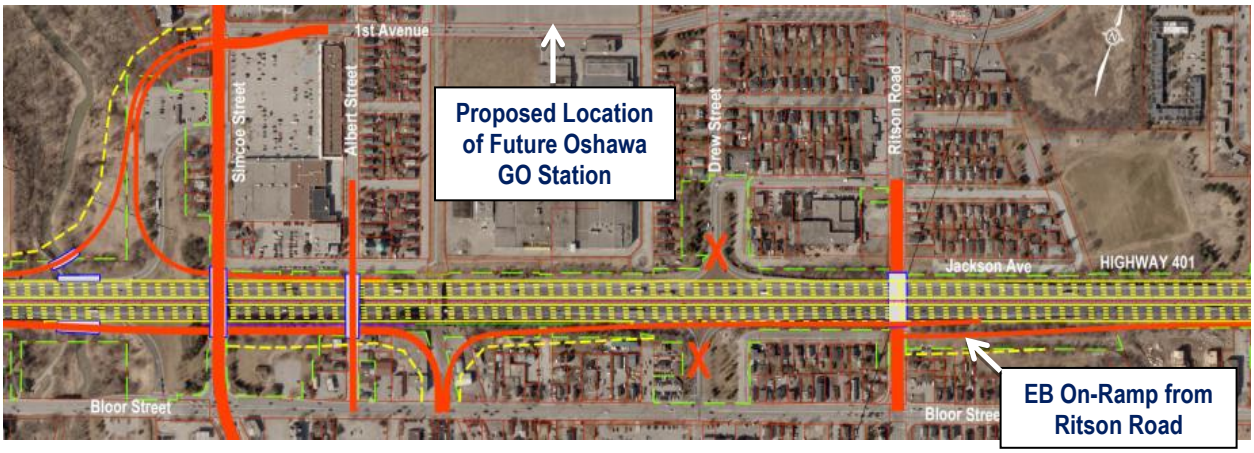
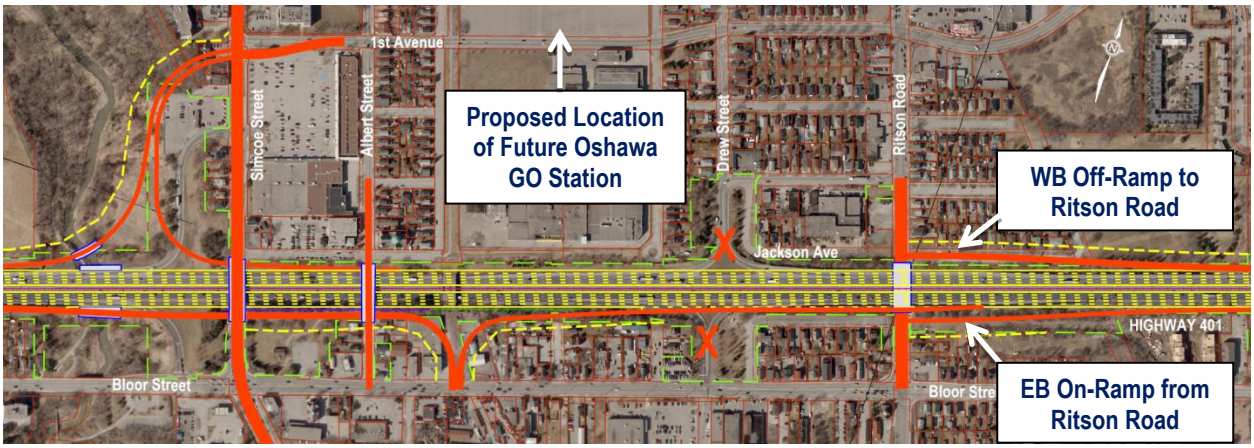


FIGURE 7-13: ALTERNATIVE 4C: ALTERNATIVE 4 WITH EASTBOUND ON-RAMP AND WESTBOUND OFF-RAMP AT RITSON ROAD



The final evaluation of Alternative 4 and the additional alternatives (Alternative 4B and 4C) was undertaken based on the criteria outlined in **Table 7-1**, and is summarized in **Table 7-5**.

<u>Alternative 4B: Eastbound On-Ramp at Ritson Road</u>

- Overall improvement in operations (relative to Alt 4);

- Elimination of double left turn lanes at:
  - Westbound First Avenue at Simcoe Street
  - Southbound Simcoe Street at Bloor Street
- Improved / enhanced access from the proposed Central Oshawa GO Station to eastbound Highway 401 via Ritson Road;
- Access to/from Highway 401 westbound via ramps at Simcoe Street.

Alternative 4C: Eastbound On-Ramp and Westbound Off-Ramp at Ritson Road

- Overall improvement in operations including elimination of double left turn lanes at Simcoe Street;
- Improved / enhanced access from proposed Central Oshawa GO Station to eastbound Highway 401 via Ritson Road;
- Westbound off-ramp to Ritson Road provides:
  - Improved distribution of traffic and utilization of two major north-south arterial roads (Simcoe Street and Ritson Road)
  - More direct access to downtown Oshawa, new Oshawa GO Station (and planned Mobility Hub) and areas south of Highway 401.

Overall Summary

In summary, all three alternatives result in acceptable intersection operations (overall intersection Level of Service 'A' to 'D' in both peak periods). Alternatives 4B and 4C are preferred to Alternative 4 on the basis of the improvements to PM peak operations at the Bloor Street / east ramp terminal intersection from LOS 'D' to LOS 'C'. Both options also eliminate the requirement for the southbound double left turn from Simcoe Street to Bloor Street, and at both the eastbound and westbound approaches to the Simcoe Street / North Ramp Terminal / 1st Avenue intersection. The westbound off-ramp at Ritson Road included in Alternative 4C also improves overall operations at the Simcoe Street / North Ramp Terminal intersection.

Between Alternatives 4B and 4C, Alternative 4C results in the displacement of a number of residential properties along Jackson Avenue, and is also the highest cost option. However, the provision of both a westbound off-ramp to Ritson Road and on-ramp from Ritson Road has been identified by the Region of Durham and City of Oshawa as providing significant benefits to the municipalities. These ramps provide better distribution of traffic through the local road network, reducing traffic volumes along the Simcoe Street corridor. In addition, the provision of these additional ramps will reduce out-of-way travel to and from downtown Oshawa, the proposed Central Oshawa GO Station and planned Mobility Hub, which will provide a benefit to existing commercial / industrial operations and the Oshawa Designated Growth Area. While Alternatives 4B and 4C provide similar traffic operations along Highway 401 and the Simcoe Street interchange, the additional benefits associated with Alternative 4C noted above are

considered to outweigh the additional impacts to properties along Jackson Avenue, additional cost and slightly higher natural environment impacts, making it the preferred alternative. As such, Alternative 4C is the preferred overall configuration. It is noted that the proponency for the Ritson Road off-ramp will be determined in the future based on further discussions with municipal staff and other relevant parties.

TABLE 7-5: FINAL EVALUATION OF SIMCOE STREET INTERCHANGE ALTERNATIVES

Category	Relative Level of Significance	Alternative			Summary
		Alternative 4 - Parclo B with Buttonhooks East of Simcoe Street	Alternative 4B - Parclo B with Buttonhooks East of Simcoe Street and EB on-ramp at Ritson Road	Alternative 4C - Parclo B with Buttonhooks East of Simcoe Street and EB and WB Ramps at Ritson Road	
Transportation and Cost	High	◐	◕	●	All three alternatives result in acceptable intersection operations (overall intersection Level of Service A to D in both peak periods). Alternatives 4B and 4C improve PM peak operations at the Bloor Street/east ramp terminal intersection from LOS 'D' to LOS 'C'. Both options also eliminate the requirement for the southbound double left turn from Simcoe Street to Bloor Street, and at both the eastbound and westbound approaches to the Simcoe Street/North Ramp Terminal/1st Street intersection. The westbound off-ramp at Ritson Road included in Alternative 4C also improves overall operations at the Simcoe Street / North Ramp Terminal intersection. Both Alternatives 4B and 4C result in some potential speed reductions and weaving between the ramps at Ritson Road and Harmony Road, however these impacts are considered minor. While both alternatives are more expensive than Alternative 4, given that they both eliminate the requirement for double left-turns, slightly improve overall intersection operations, and better distribute traffic through the local road network, they are preferable to Alternative 4 from a Transportation and Cost perspective. Between Alternatives 4B and 4C, Alternative 4C provides improved traffic distribution between Simcoe Street and Ritson Road, and the additional off-ramp to Ritson Road improves overall operations along Simcoe Street and results in slightly improved traffic operations at the north ramp terminal intersection and to the future Oshawa GO Station. Although this alternative is approximately $1 million more expensive than Alternative 4B, the improved traffic distribution and operations are considered to outweigh the incremental cost. As such, Alternative 4C is preferred from a Transportation and Cost perspective.
Natural Environment	Medium	●	◕	◐	All three alternatives result in the same degree of impact to Oshawa Creek and the valley west of Simcoe Street, and have the same potential for impacts to Species at Risk. Alternatives 4B and 4C each result in greater terrestrial impacts given the additional ramps at Ritson Road. As such, Alternative 4 is slightly preferred from a Natural Environment perspective, followed by Alternative 4B and 4C.
Socio-Economic Environment	High	◕	◕	◕	All three alternatives have similar potential to affect local air quality conditions, do not impact any agricultural operations, and result in the likely displacement of 6 commercial properties. Alternatives 4 and 4B are each anticipated to displace 7 residential properties, while Alternative 4C will displace an additional 11 residential properties along Jackson Avenue, east of Ritson Road. The displacement of homes will change the existing view (i.e. aesthetic impacts) for the second row of homes along Jackson Avenue, and may also result in a minor increase in noise levels. However, the provision of an additional westbound off-ramp to Ritson Road and on-ramp from Ritson Road will reduce out-of-way travel to and from downtown Oshawa, the proposed Central Oshawa GO Station and planned Mobility Hub, which will provide a benefit to existing commercial/industrial operations and the Oshawa Designated Growth Area. These benefits are considered to offset the additional impacts to properties along Jackson Avenue. As such, all three alternatives are considered equally preferred from a Socio-Economic perspective.
Cultural Environment	Medium	●	●	●	All three alternatives may impact areas of archaeological potential in the vicinity of Oshawa Creek. All of the alternatives also have the same potential to result in frontage property impacts to the St. George's Ukrainian Catholic Church. As such, all three alternatives are equally preferred from the cultural environment perspective.
SUMMARY		◐	◕	●	All three alternatives result in acceptable intersection operations (overall intersection Level of Service A to D in both peak periods). Alternatives 4B and 4C improve PM peak operations at the Bloor Street/east ramp terminal intersection from LOS 'D' to LOS 'C'. Both options also eliminate the requirement for the southbound double left turn from Simcoe Street to Bloor Street, and at both the eastbound and westbound approaches to the Simcoe Street/North Ramp Terminal/1st Street intersection. The westbound off-ramp at Ritson Road included in Alternative 4C also improves overall operations at the Simcoe Street / North Ramp Terminal intersection. Alternative 4C results in the displacement of a number of additional residential properties along Jackson Avenue, and is also the most expensive option. However, the provision of both a westbound off-ramp to Ritson Road and on-ramp from Ritson Road provides better distribution of traffic through the local road network, reducing future traffic volumes from the Simcoe Street corridor. In addition, the provision of these additional ramps will reduce out-of-way travel to and from downtown Oshawa, the proposed Central Oshawa GO Station and planned Mobility Hub, which will provide a benefit to existing commercial/industrial operations and the Oshawa Designated Growth Area. These benefits are considered to outweigh the additional impacts to properties along Jackson Avenue and slightly higher natural environment impacts. **As such, Alternative 4C is the preferred overall configuration.**

LEGEND				
Most Preferred →				Least Preferred
●	◕	◐	◔	○

7.2.2 Harmony Road Interchange

As described in **Section 4.4.2,** the existing Harmony Road interchange has a buttonhook configuration, with eastbound off and on-ramps connecting to Bloor Street opposite Farewell Street, and westbound off and on-ramps connecting to Bloor Street opposite Harmony Road. The Bloor Street / Harmony Road ramp terminal intersections were found to operate at capacity with LOS 'E' operations during peak hours under existing traffic conditions. The interchange is located in close proximity to residential development and other environmental features. The existing interchange is illustrated in **Figure 7-14**.

FIGURE 7-14: ALTERNATIVE 1: EXISTING HARMONY ROAD INTERCHANGE

Given the identified operational and geometric concerns at this interchange, and as the existing configuration cannot adequately accommodate the recommended widening of Highway 401 to 10 lanes, alternatives to re-configure this interchange were reviewed.

The alternatives considered for this interchange are illustrated in **Figures 7-15** to **7-20**.

FIGURE 7-15: ALTERNATIVE 1: HARMONY ROAD INTERCHANGE – PARTIAL 'TRUMPET' WITH BUTTONHOOK EAST OF HARMONY ROAD

FIGURE 7-16: ALTERNATIVE 2: HARMONY ROAD INTERCHANGE – PARTIAL 'TRUMPET' WITH BUTTONHOOKS AND BLOOR STREET REALIGNMENT

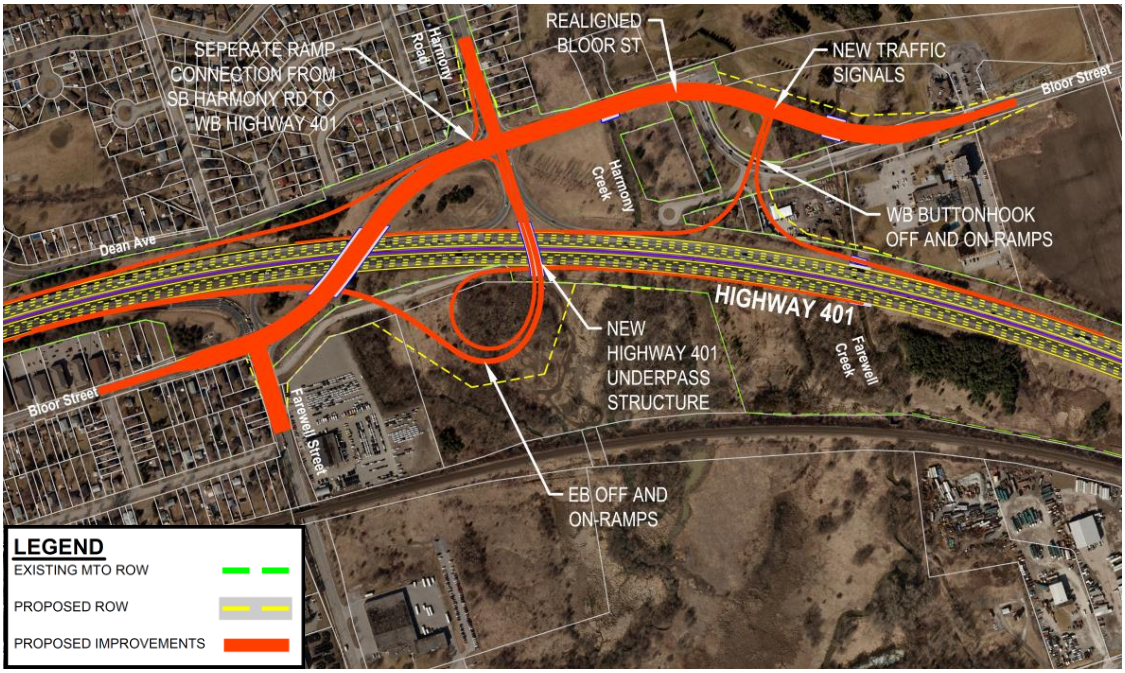


FIGURE 7-17: ALTERNATIVE 3: HARMONY ROAD INTERCHANGE – PARCLO A/ DIAMOND CONFIGURATION WITH SOUTHERLY BLOOR STREET REALIGNMENT

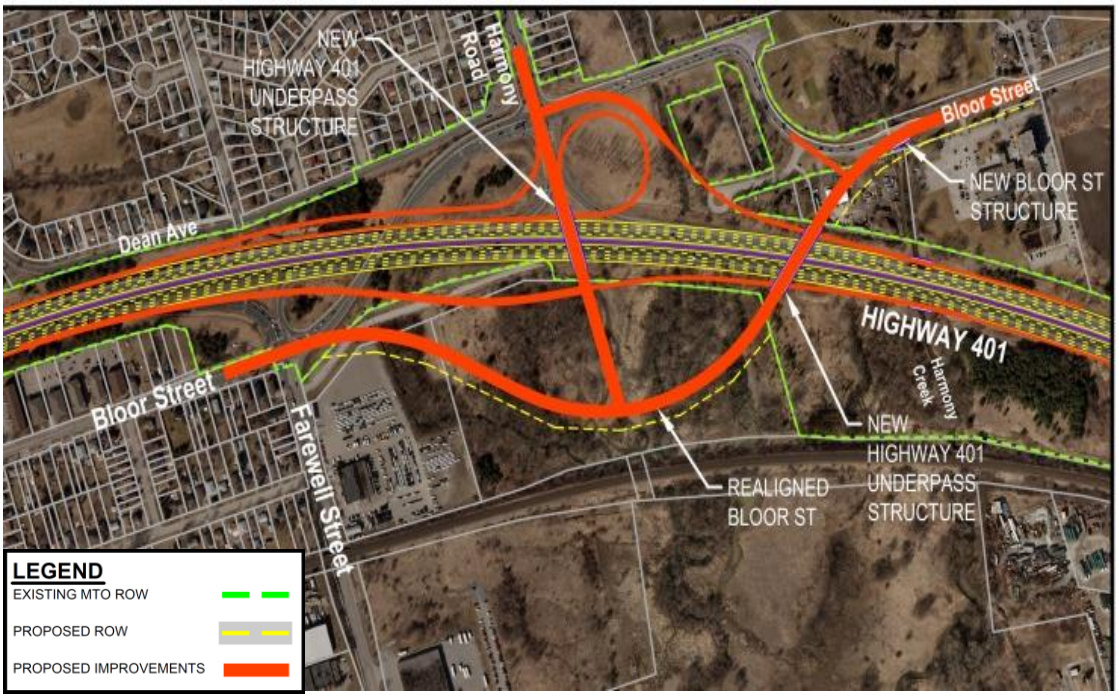
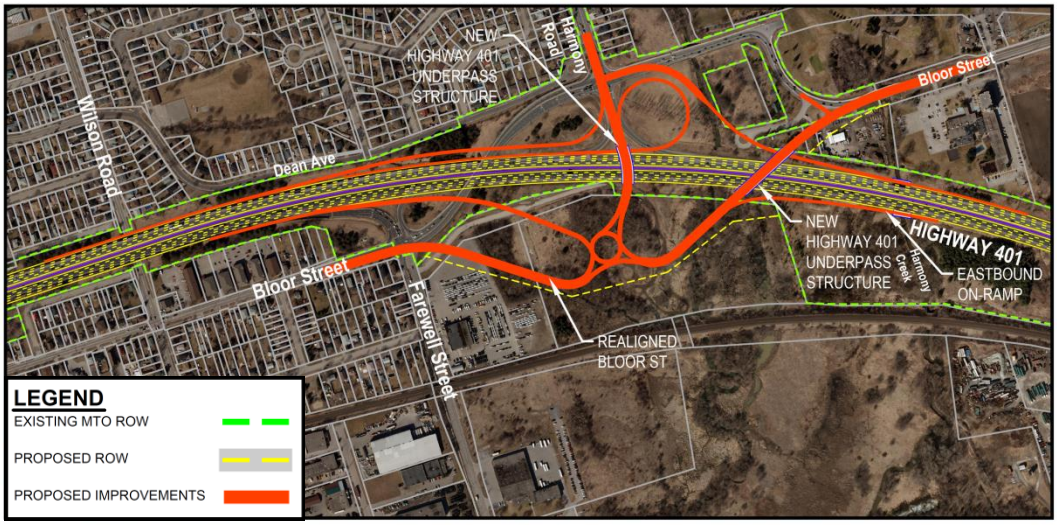


FIGURE 7-18: ALTERNATIVE 4: HARMONY ROAD INTERCHANGE – PARCLO A/ PARTIAL 'TRUMPET' WITH SOUTHERLY BLOOR STREET REALIGNMENT

FIGURE 7-19: ALTERNATIVE 5: HARMONY ROAD INTERCHANGE – PARCLO A/ ROUNDABOUT CONFIGURATION WITH EASTBOUND BUTTONHOOK OFF-RAMP

FIGURE 7-20: ALTERNATIVE 6: HARMONY ROAD INTERCHANGE – PARCLO A/ ROUNDABOUT CONFIGURATION WITH EASTBOUND OFF-RAMP TO ROUNDABOUT



A screening level assessment was initially completed on the alternatives based on anticipated overall traffic operations. Based on this screening assessment, two of the six interchange alternatives were initially screened out. Alternative 1 was screened out due to the close intersection spacing along Bloor Street which would result in conflicting traffic movements (weaving) and traffic back up (queuing) between intersections. Alternative 5 was screened out due to significant operational concerns associated with high traffic volumes through the roundabout causing weaving and queuing. The four remaining alternatives were carried forward for further assessment and evaluation based

on the criteria outlined in **Table 7-1**. The full evaluation of alternatives is provided in **Table 7-6** and summarized below.

Alternative 6 is associated with the lowest overall construction cost and is equally preferred with Alternatives 3 and 4 from a socio-economic environment perspective. However, this option has less desirable traffic operations than the other alternatives, and is also not preferred in any of the other major categories. As such, Alternative 6 is not preferred.

Alternative 4 results in acceptable traffic operations, however it is also associated with a greater number of critical movements including some LOS 'F' movements. This option also has a significantly higher construction cost than the other alternatives while not providing other major benefits, and is therefore not preferred.

Between the remaining two alternatives, Alternative 2 is less preferred from a Socio-Economic perspective given that it displaces two additional residences, impacts the Harmony Creek Golf Course and has greater aesthetic and noise impacts due to the encroachment of the direct westbound on-ramp from Harmony Road into the northwest quadrant of the interchange. While overall interchange operations are anticipated to be similar for either option, Alternative 3 has higher potential for queuing between adjacent intersections along Harmony Road. Alternative 2 also has significantly lower impacts to terrestrial habitat and vegetation, to fisheries and aquatic habitat, and to the Harmony Creek and Farewell Creek floodplains and is therefore preferred from both a Natural Environment and Cultural Environment perspective (given the slightly lower potential for archaeological impacts). Further, Alternative 2 is approximately $3.6 million less expensive than Alternative 3.

As such, Alternative 2 is the preferred overall configuration for the Harmony Road interchange.

TABLE 7-6: EVALUATION OF HARMONY ROAD INTERCHANGE ALTERNATIVES

Category	Relative Level of Significance	Alternative				Summary
		Alternative 2-Trumpet with Buttonhooks Further East of Harmony Road	Alternative 3 - Parclo A / Partial Diamond with Southerly Bloor Street Realignment	Alternative 4 - Parclo A/Partial 'Trumpet' with Southerly Bloor Street Realignment	Alternative 6 - Parclo A with Roundabout at South Ramp Terminal (EB Off-Ramp to Roundabout)	
Transportation and Cost	High	●	◕	◐	◔	Alternatives 2 and 3 result in good overall interchange operations. Alternative 4 results in acceptable operations, however is associated with a greater number of critical movements including some LOS 'F' movements. Alternative 6 results in numerous critical movements through and at the approaches to the roundabout and along Bloor Street, including significant queuing and delay along the eastbound off-ramp. Although this option results in the best overall staging and geometrics (along with Alternative 4), these benefits do not outweigh the significant operational and associated safety concerns, and as such Alternative 6 is least preferred. Alternative 4 results in the best overall geometrics and is equally preferred with Alternative 3 in terms of safety and signage. However, the alternative is less desirable than Alternative 3 from an operational perspective given the higher number of critical movements. Further, Alternative 4 is significantly more costly than the other configurations, and is not preferred. Alternative 3 is preferable to Alternative 3 on the basis of lower complexity of construction staging and simplified signage. However, Alternative 2 has lower anticipated impacts to existing utilities and lower overall property requirements. While overall interchange operations are anticipated to be similar for either option, Alternative 3 has higher potential for queuing between adjacent intersections along Harmony Road. Further, Alternative 3 is approximately $3.6 million more expensive than Alternative 2. **For these reasons, Alternative 2 is preferred from a Transportation and Cost perspective.**
Natural Environment	Moderate-High	●	◐	◐	◐	length of impacts to fisheries and aquatic habitat, however Alternative 4 may require a realignment of Farewell Creek at the westbound off-ramp to Bloor Street, while Alternative 6 results in a slightly greater impact than Alternative 3. All alternatives have some potential to impact Species at Risk due to encroachment in the natural area south of Highway 401, although these impacts are lowest for Alternative 2 given it has the lowest overall encroachment. In terms of impacts to terrestrial habitat and vegetation, Alternative 2 results in the least area of impact, followed by Alternatives 4 and 6. While Alternative 3 has a slightly greater impact to terrestrial habitat and vegetation, it is anticipated that a portion of these impacts located between the Highway 401 interchange ramps and Bloor Street can be minimized or avoided. Alternative 4 has the greatest potential to impact groundwater features given the additional grade separations and profile adjustments along Bloor Street. Given that Alternative 2 has the lowest impacts to both terrestrial habitat and to fisheries and aquatic habitat, as well as the lowest flood plain impacts, **it is preferred from a natural environment perspective.**
Socio-Economic Environment	Moderate-High	◐	●	◕	◕	All of the alternatives have similar potential to affect local air quality conditions, and result in no impacts to existing agricultural operations. Alternative 2 results in slightly greater aesthetic and noise impacts to sensitive properties than the other alternatives due to the encroachment of the direct N-W on-ramp from Harmony Road into the northwest quadrant of the interchange. In terms of community effects, Alternative 2 results in 4 residential displacements while Alternatives 3, 4 and 6 each result in 2 residential displacements. Alternative 2 also results in the greatest impact to commercial or industrial properties, given the realignment of Bloor Street through the Harmony Creek Golf Course. Further, Alternative 2 results in a slightly greater increase in out-of-way travel to and from existing businesses and industries along Farewell Street. Alternative 2 is therefore least preferred. Alternative 3 results in slightly less commercial property impacts relative to Alternatives 4 and 6. **As such, Alternative 3 is preferred from a socio-economic environment perspective, followed by Alternatives 4 and 6.**
Cultural Environment	Low	●	◕	◕	◕	All of the alternatives have potential for archaeological impacts given the encroachment into the natural area south of Highway 401, although Alternative 2 has the lowest encroachment and therefore has a slightly lower potential for archaeological impacts. None of the alternatives are anticipated to impact any built heritage or cultural landscape features. **As such, Alternative 2 is slightly preferred from a cultural environment perspective.**
SUMMARY		●	◕	◐	◔	Alternative 6 is associated with the lowest overall construction cost and is equally preferred with Alternatives 3 and 4 from a socio-economic environment perspective. However, this option is associated with numerous critical movements through and at the approaches to the roundabout and along Bloor Street, including significant queuing and delay along the eastbound off-ramp and along Bloor Street. This option is also not preferred in any of the other major categories, and as such Alternative 6 is not preferred. Alternative 4 results in acceptable traffic operations, however it is also associated with a greater number of critical movements including some LOS 'F' movements. This option also has a significantly higher construction cost than the other alternatives while not providing other major benefits. Between the remaining two alternatives, Alternative 2 is less preferred from a Socio-Economic perspective given that it displaces 2 additional residences, impacts the Harmony Creek Golf Course and has greater aesthetic and noise impacts to sensitive receivers due to the encroachment of the direct westbound on-ramp from Harmony Road into the northwest quadrant of the interchange. While overall interchange operations are anticipated to be similar for either option, Alternative 3 has higher potential for queuing between adjacent intersections along Harmony Road. Alternative 2 also has significantly lower impacts to terrestrial habitat and vegetation, to fisheries and aquatic habitat, and to the Harmony Creek and Farewell Creek floodplains and is therefore preferred from both a Natural Environment and Cultural Environment perspective (given the slightly lower potential for archaeological impacts). Further, Alternative 2 is approximately $3.6 million less expensive than Alternative 3. **As such, Alternative 2 is preferred overall.**

LEGEND				
Most Preferred →				Least Preferred
●	◕	◐	◔	○

7.3 OTHER TRANSPORTATION INITIATIVES

7.3.1 Carpool Lot Alternatives

The Ministry of Transportation has a commitment to build, operate and maintain carpool lots. As such, the Project Team reviewed the Study Area for potential carpool lot locations which could be provided within existing MTO-owned property. Three potential locations for carpool lots were identified along the corridor. These include the northwest quadrant of the Thickson Road interchange (opposite the westbound off-ramp), the northwest quadrant of the Stevenson Road interchange (with access off of Champlain Avenue), and within the proposed w\

estbound inner-loop off-ramp at Simcoe Street. Carpool lot alternatives are presented in **Figures 7-21** to **7-23**. Given existing property constraints and access restrictions, no other reasonable locations were identified along the corridor.

Of the three identified locations, it is anticipated that the carpool lot locations at the Thickson Road and Simcoe Street interchanges will result in adverse impacts to traffic operations along both the crossing road and at the interchange. In particular, each location would require provision of new or expanded northbound left-turn lanes along the crossing road to enter the carpool lot. The primary access to the lot near the Stevenson Road interchange would be from Champlain Avenue, which would minimize operational impacts along Stevenson Road and at the interchange. As such, the carpool lot location near the Stevenson Road interchange is considered the most desirable location.

It is noted that a detailed assessment and evaluation of carpool lot alternatives was not undertaken as part of this study, and further analysis and potential implementation of carpool lots at these or other locations within the Study Area will be completed at the discretion of MTO based on provincial priorities during future stages of design. Alternatives will be evaluated with consideration to impacts to the natural environment, social environment, economic environment and cultural environment, as well as transportation considerations such as accessibility and anticipated utilization.

FIGURE 7-21: POTENTIAL CARPOOL LOT AT STEVENSON ROAD INTERCHANGE

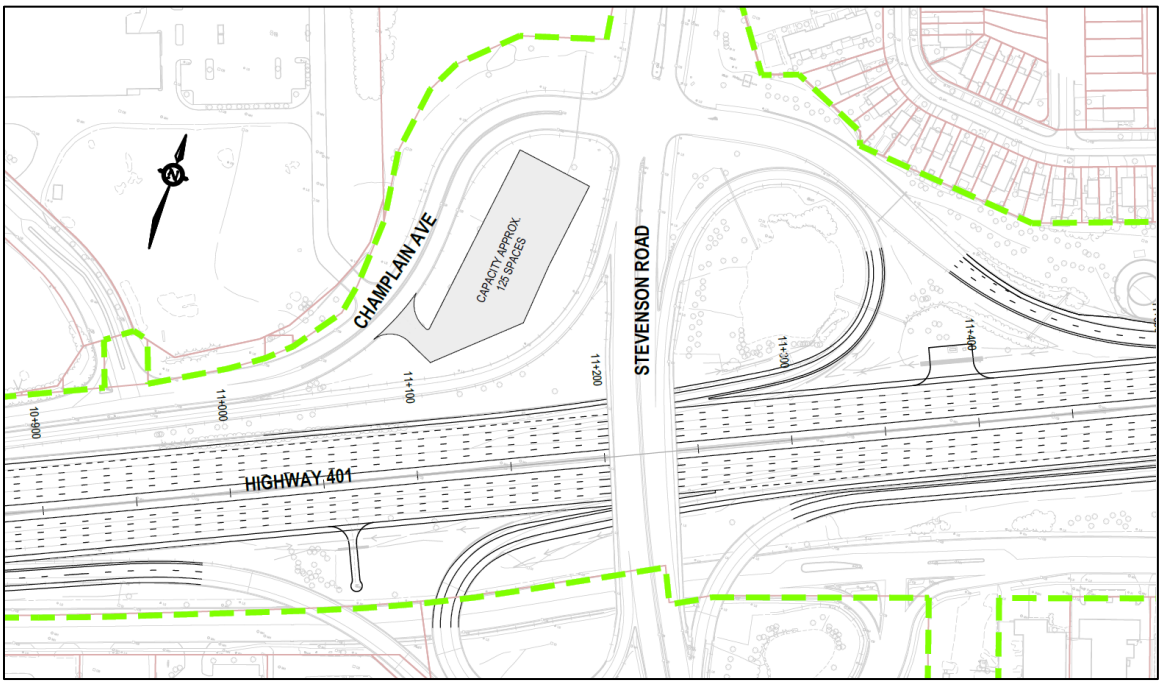


FIGURE 7-22: POTENTIAL CARPOOL LOT AT THICKSON ROAD INTERCHANGE

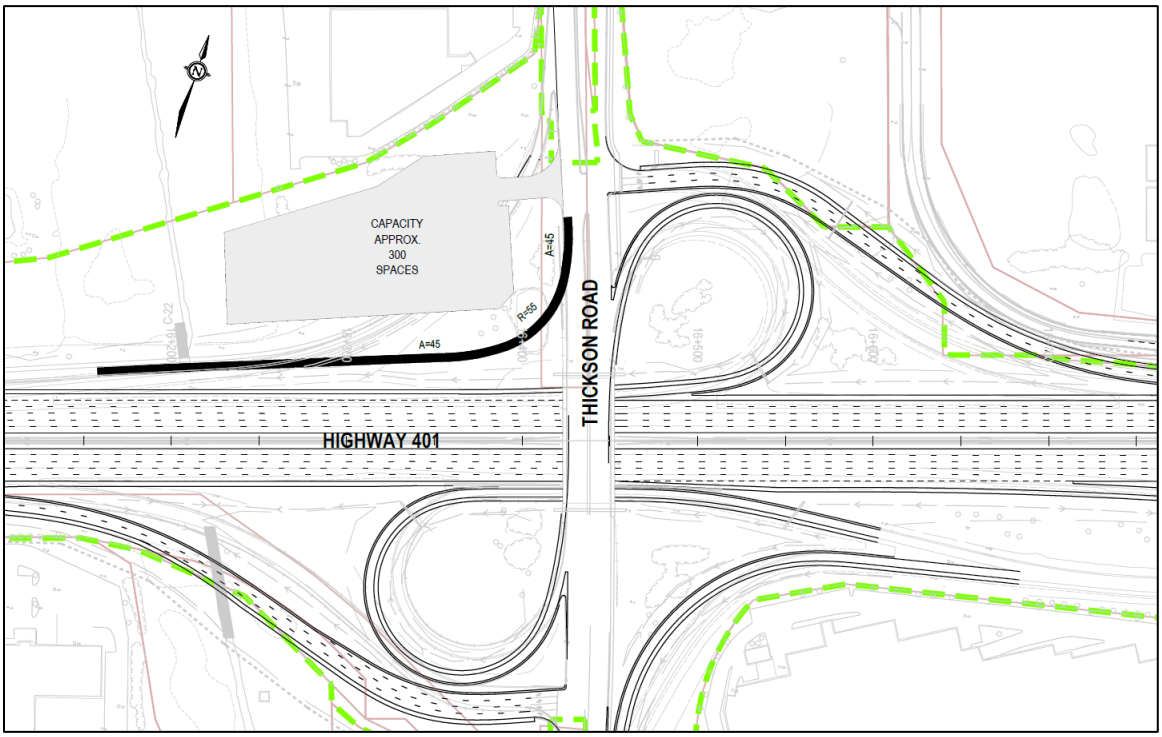
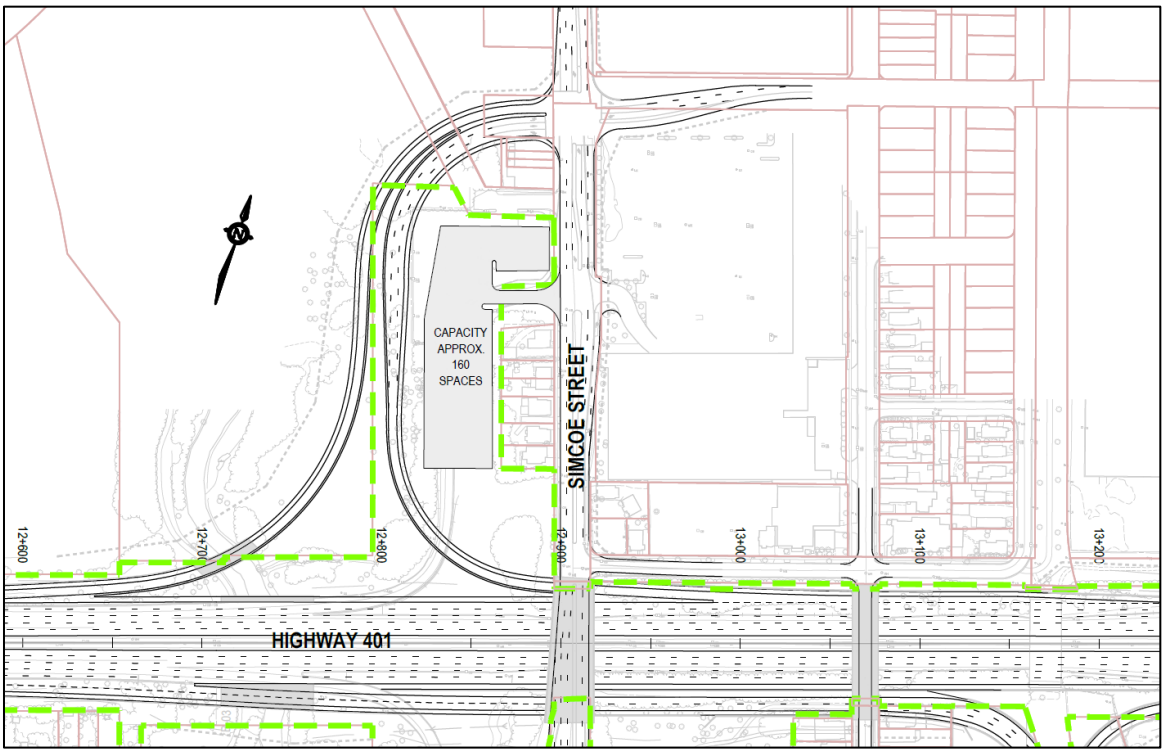


FIGURE 7-23: POTENTIAL CARPOOL LOT AT SIMCOE STREET INTERCHANGE



7.3.2 High Occupancy Vehicle (HOV) Lanes

The provision of HOV lanes through this stretch of Highway 401 has been identified as part of MTO's long-term HOV network plans (*Ontario's High Occupancy Vehicle Lane Network Plan for the 400-series Highways in the Greater Golden Horseshoe (2007)*). The current study has reviewed the general feasibility of providing HOV lanes along the corridor as part of the ultimate widening of Highway 401, and the Recommended Plan will not preclude the provision of HOV lanes. However, the decision as to whether HOV lanes are ultimately provided will be made at a later date, closer to the construction of the actual widening of Highway 401. Development of a full HOV system design, including consideration of potential access / egress locations to the HOV lanes, was not undertaken as part of this study.

8.0 THE RECOMMENDED PLAN

The following sections summarize the proposed improvements to the Highway 401 corridor within the project limits, including the recommendations for the rehabilitation of the existing infrastructure within the Highway 401 corridor, and the recommended long-term capacity and operational improvements. The Recommended Plan for the long-term capacity and operational improvements along the corridor is illustrated in the Preliminary Design plates provided in **Appendix C**, and additional details regarding the recommended improvements and rehabilitation needs are provided in the various technical reports prepared as part of this study, which are available under separate cover.

8.1 REHABILITATION REQUIREMENTS

As discussed in **Chapter 1**, this study has been completed to identify the long-term capacity and operational requirements of the corridor, in order that rehabilitation investments to existing infrastructure such as structures and pavement are made with knowledge of the long-term vision for the corridor.

8.1.1 Pavement Rehabilitation

An overview of the existing pavement conditions along the corridor is provided in **Section 4.5.1**. Based on the results of the pavement condition survey, the existing pavement along this section of Highway 401 is considered in good condition and rehabilitation of the pavement is not required at this time. However, to address the long-term requirements for this section of Highway 401, the "Needs Year" has been identified based on the condition of the pavement and suitable rehabilitation strategies have been provided based on the results of the geotechnical investigation.

The recommended Needs Year based solely on pavement requirements ranges from 2019 to 2023 depending on the section of Highway 401. The Needs Year for the existing pavement rehabilitation of Highway 401 mainline is listed in **Table 8-1**.

TABLE 8-1: PRELIMINARY PAVEMENT REHABILITATION TIMING – HIGHWAY 401 MAINLINE

Road Section	Rehabilitation Timeline*
Brock Road to Salem Road	2022
Brock Street to Stevenson Road	2019
Stevenson Road to Harmony Road	2023
Harmony Road to Courtice Road	2023

*based on pavement condition only

It should be noted that detailed pavement investigations will be required during Detail Design to confirm the pavement rehabilitation requirements. Additional information regarding the pavement recommendations and strategic rehabilitation requirements are

provided in the *Preliminary Pavement Design Report (December 2014)*, available under separate cover.

8.1.2 Structure Rehabilitation and Replacement

An overview of the existing structures through the Study Area is provided in **Section 4.5.2**. In general, the structures at the west end of the Study Area (from Brock Road to Salem Road) are newer, ranging in age from between 11 to 78 years old, with an average age of 35 years (as of 2015). Structures at the east end (from Thickson Road to Courtice Road) are generally older, ranging from between 10 to 76 years old, with an average age of 56 years (as of 2015).

The majority of existing structures will require some form of rehabilitation within the next 20 years based on the condition and age of the structure, while a number of the structures are recommended for rehabilitation or replacement within the next five years. The specific details of the rehabilitation requirements for all structures will be confirmed during Detail Design subject to the findings of the detailed bridge conditions surveys to be undertaken at that stage.

Given both the age and condition of some of the structures within the Study Area, and specifically through the City of Oshawa, a number of structures are recommended for replacement. These include the Highway 401 structures at Park Road, Cubert Street, Simcoe Street, Albert Street, Ritson Road, Wilson Road, Bloor Street and Farewell Creek. These structures will be replaced to accommodate the recommended future widening of Highway 401 and associated interchange improvements.

Depending on the anticipated timing of the future Highway 401 widening, consideration will be given to replacing some of the structures in advance of the future widening as part of an advance construction contract. The details regarding timing of construction and rehabilitation / replacement of all structures within the Study Area will be confirmed by the Ministry as part of their annual capital planning program. Additional information regarding the structural recommendations from this study is available in the individual Structural Design Reports prepared for each existing and proposed structure within the Study Area, available under separate cover.

In addition to the general rehabilitation or replacement requirements for each structure, the structural recommendations to accommodate the recommended long-term Highway 401 widening and associated improvements are summarized in **Section 8.2.3**.

8.1.3 Electrical Rehabilitation

The existing electrical equipment along the corridor is summarized in **Section 4.5.3**. Existing illumination along the corridor is generally considered to be in good condition overall, however minor deficiencies / rehabilitation considerations include reduced light distribution at some locations along the corridor due to old luminaires and glare,

deterioration of internal electrical equipment due to salt spray / build-up in some high mast light poles, and damaged pole bases that will require replacement.

Given the age and condition of various components of the electrical system, ongoing rehabilitation and repairs to this equipment will be completed as required. Recommendations to improve the electrical system and lighting along the corridor based on the future long-term widening of Highway 401 and associated interchange improvements are documented in **Section 8.2.4**. Additional details regarding the recommended rehabilitation requirements of the electrical system within the Study Area is provided in the *Electrical Preliminary Design Report (April 2015)*, available under separate cover.

8.2 ULTIMATE (LONG-TERM) HIGHWAY IMPROVEMENTS

The Recommended Plan for Highway 401 within the Study Area from a transportation and operational perspective includes mainline improvements, major interchange reconfigurations at Simcoe Street and Harmony Road / Bloor Street, and minor improvements at other interchanges to accommodate the recommended mainline widening. The recommended transportation improvements are summarized in the following sections.

8.2.1 Highway 401 Mainline

The recommended improvements for mainline Highway 401 include:

- **Brock Road to future West Durham Link** - Widen from 10 lanes to 12 lanes including extension of the existing Express-Collector system.
- **Future West Durham Link to Courtice Road** – Widen from 6 lanes to 10 lanes and maintain the simple freeway configuration (i.e. no Express-Collector system).

The widening of Highway 401 will generally be completed about the centerline of Highway 401, with the exception of a section in the vicinity of Westney Road where Highway 401 will be widened to the north to avoid significant impacts to the existing rail corridor and related infrastructure on the south side of Highway 401.

As part of the Express-Collector system between Brock Road and the future West Durham Link, the Recommended Plan includes an eastbound Collector to Express transfer immediately east of Brock Road, and an eastbound Express to Collector transfer between Harwood Avenue and Salem Road. In the westbound direction, a new Express to Collector transfer will be provided to the west of Church Street and a Collector to Express transfer west of Harwood Avenue.

8.2.2 Interchanges and Intersections

In addition to the recommended mainline improvements, modifications to existing interchanges along the corridor are recommended to accommodate the proposed

widening and to address existing or future operational, capacity or safety concerns at interchanges. Minor interchange modifications are recommended at the majority of interchanges, while major reconfigurations are recommended at the Simcoe Street / Ritson Road and Harmony Road interchanges. The recommended improvements to the interchanges within the Study Area include:

Brock Road Interchange

- Minor reconstruction to interchange ramps to accommodate the 12-lane Express-Collector system.

Westney Road Interchange

- Minor reconstruction to interchange ramps to accommodate the 12-lane Express-Collector system;
- Widen westbound off ramp to provide four turning lanes (two right and two left turn lanes) at Westney Road and eliminate the shared left-right turning center lane;

Salem Road Interchange

- Minor reconstruction to interchange ramps to accommodate the 12-lane Express-Collector system.

Thickson Road Interchange

- Minor reconstruction to interchange ramps to accommodate Highway 401 widening to 10 lanes;
- Widen eastbound off ramp to accommodate an additional right turn lane such that four turning lanes (two right and two left turn lanes) are provided at Thickson Road.

Stevenson Road Interchange

- Minor reconstruction to interchange ramps to accommodate Highway 401 widening to 10 lanes;
- Minor lane reconfiguration at the north ramp terminal to include a shared through / right turn movement from the westbound off-ramp;
- Convert the centre left turn lane from the eastbound off-ramp to a shared left / right turn lane at the south ramp terminal.

Simcoe Street / Ritson Road (Drew Street) Interchange

- Reconfiguration of Simcoe Street interchange to include a westbound B-loop off-ramp and westbound on-ramp connection at 1st Avenue, and eastbound buttonhook ramp connections to Bloor Street, east of Simcoe Street;
- Provision of new diamond-style eastbound on-ramp and westbound off-ramp along Ritson Road;

- Closure of existing eastbound off-ramp to Bloor Street, west of Simcoe Street;
- Closure of existing eastbound and westbound buttonhook ramps west of Ritson Road at Drew Street;

Harmony Road / Bloor Street Interchange

- Reconfiguration of the interchange to include eastbound off and on-ramps with a 'Trumpet' configuration connecting to Harmony Road / Bloor Street, and westbound buttonhook off and on-ramps to Bloor Street, east of Harmony Road;
- Additional westbound on-ramp connection from southbound Bloor Street
- Partial realignment of Bloor Street east of Harmony Road;

8.2.3 Structures

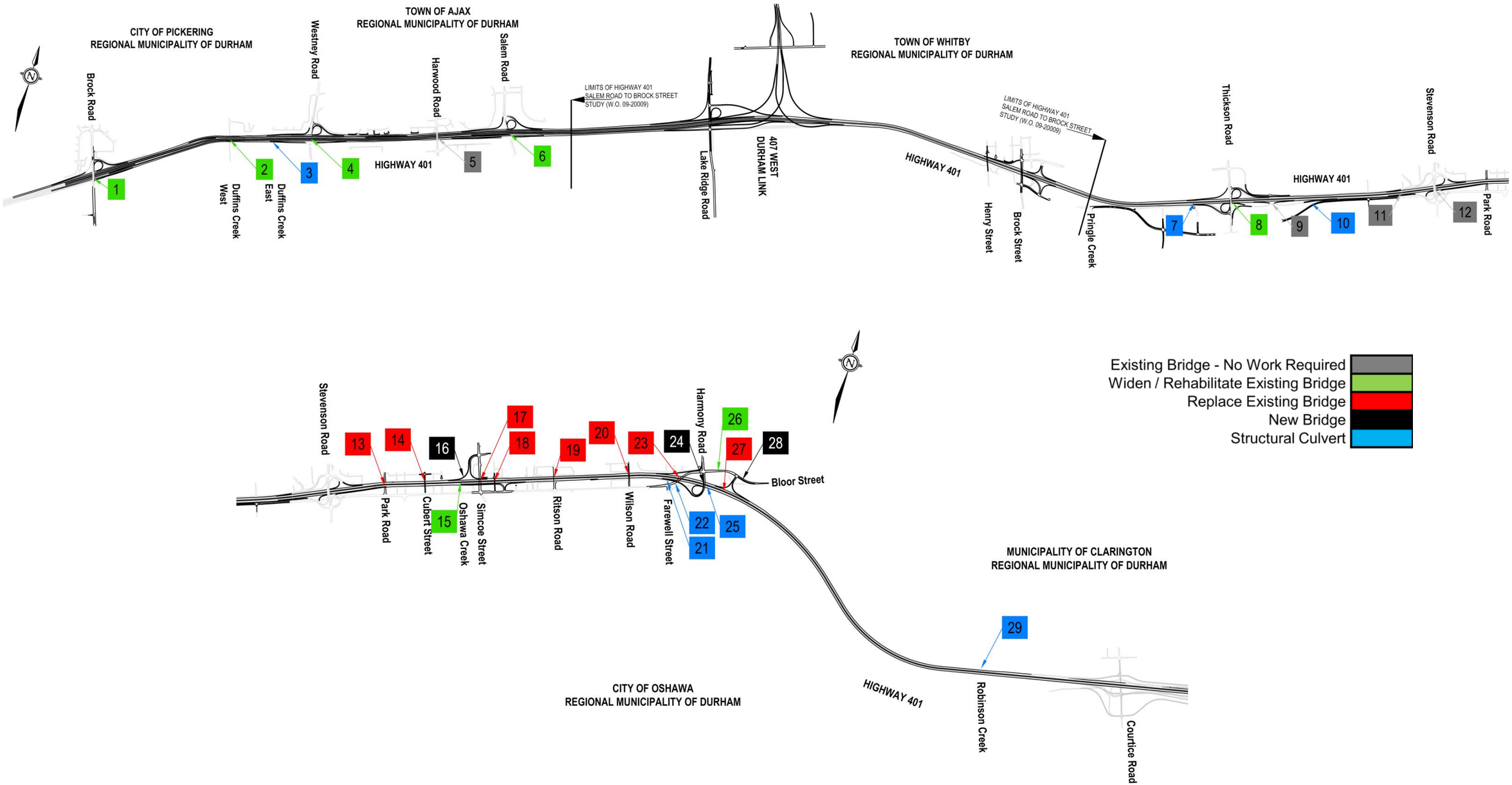
As noted in **Section 8.1.2**, based on the condition and age of the existing structures in the Study Area, the majority of the structures will require some form of rehabilitation or replacement within the next 20 years while a number of the structures are recommended for rehabilitation or replacement within the next five years. Additional structural improvements are required at the majority of locations to accommodate the recommended widening of Highway 401 and associated interchange modifications. As noted, depending on the anticipated timing of the future Highway 401 widening, consideration will be given to replacing some of the structures in advance of the future widening as part of an advance construction contract. These recommendations are summarized in **Table 8-2**, and illustrated on the key plan in **Figure 8-1**.

TABLE 8-2: STRUCTURAL RECOMMENDATIONS TO ACCOMMODATE ULTIMATE HIGHWAY 401 CONFIGURATION

ID #	Structure	Recommendation
1	Brock Road Underpass	Rehabilitation and remove existing structure embankments
2	Duffins Creek Bridge	Rehabilitate and widen deck on existing piers
3	Duffins Creek East / Miller Creek Structural Culvert	Culvert extension to the north (Replacement of CSP component only recommended based on existing condition).
4	Westney Road Overpass	Rehabilitate and replace existing superstructure and construct new WB Collector structure
5	Harwood Avenue Underpass	No work required
6	Salem Road Overpass	Rehabilitate and widen existing structure
7	Corbett Creek West Structural Culvert	Culvert extension to north and south
8	Thickson Road Underpass	Rehabilitate and remove existing north structure embankment
9	Truck Inspection Station Ramp Bridge	No work required

ID #	Structure	Recommendation
10	Corbett Creek East Structural Culvert	No work required
11	CPR-GM Spur Line	No work required
12	Stevenson Road Underpass	No work required
13	Park Road Underpass	Replace existing structure with wider structure
14	Cubert Street Underpass	Replace existing structure with wider structure
15	Oshawa Creek Bridge	Rehabilitate and widen existing structure
16	Simcoe Street WB on-ramp (Oshawa Creek)	New structure required
17	Simcoe Street Underpass	Replace existing structure with longer span structure
18	Albert Street Underpass	Replace existing structure with longer span structure
19	Ritson Road Overpass	Replace existing structure with wider structure
20	Wilson Road Overpass	Replace existing structure with wider structure
21	Tributary of Harmony Creek Culvert (Highway 401)	Relocate / replace culvert
22	Tributary of Harmony Creek Culvert (Bloor Street)	Relocate / replace culvert
23	Bloor Street Underpass (Highway 401)	Replace existing structure with longer span structure
24	Harmony Road / EB Ramps (Highway 401)	New structure required
25	Harmony Creek Culvert	Culvert extension to north and south
26	Bloor Street Structure (Harmony Creek)	Widen existing structure
27	Farewell Creek Bridge	Replace existing structure with wider structure
28	Bloor Street Realignment Structure (Farewell Creek)	New structure required
29	Robinson Creek Culvert	Replace culvert

FIGURE 8-1: STRUCTURAL KEY PLAN AND RECOMMENDATIONS



8.2.4 Electrical

The recommended electrical improvements associated with the long-term highway widening improvements are summarized in **Table 8-3**. Additional details regarding the recommended electrical improvement within the Study Area is provided in the *Electrical Preliminary Design Report (April 2015)*, available under separate cover.

TABLE 8-3: SUMMARY OF ELECTRICAL WORK

Location	Recommended Highway Improvement	Impact on Electrical System	Electrical Work
Brock Road	Realignment of E-N/S Ramp	Traffic Signals, ducts, lighting	Temporary and permanent traffic signals and lighting
Hwy 401 east of Brock Road	Hwy 401 widening and median realignment	Highmast lighting	Upgrade existing highmast lighting and new highmast lighting
Westney Road Interchange	Hwy 401 widening and median realignment	Traffic signals, ducts, ramp lighting, highmast lighting, municipal lighting	Temporary and permanent traffic signals, replace highmast lighting, ramp lighting and municipal lighting
Hwy 401 east of Westney Road	Hwy 401 widening and median realignment	Highmast lighting	Replace highmast lighting
Salem Road Interchange	Hwy 401 and structure widening and E-N/S ramp realignment	Municipal overpass illumination and MTO lighting	Extend municipal overpass lighting and remove MTO light
Hwy 401 east of Brock Street	Hwy 401 widening	None	Optional new highmast lighting
Thickson Road Interchange	Hwy 401 widening and ramps realignment	Traffic signals, ducts, decision point lighting and ramp lighting	Temporary and permanent traffic signals, ramp lighting, underpass lighting, optional new highmast lighting and distribution assembly
Hwy 401 east of Thickson Road	Hwy 401 widening	None	Optional new highmast lighting and ramp lighting
Stevenson Road Interchange	Hwy 401 widening and median realignment	Highmast lighting	Replace existing highmast pole
Hwy 401 east of Stevenson Road	Hwy 401 widening and median realignment	Conventional mainline lighting and municipal lighting	Highmast lighting and municipal underpass lighting
Hwy 401-	Hwy 401 widening,	Traffic signals, ducts,	Temporary and permanent traffic

Location	Recommended Highway Improvement	Impact on Electrical System	Electrical Work
Simcoe Street Interchange	ramps realignment and structures	conventional mainline lighting, ramp lighting, municipal lighting	signals, highmast lighting, underpass lighting and municipal lighting
Hwy 401-Ritson Road to Wilson Road	Hwy 401 widening and structures	Conventional mainline lighting and municipal underpass lighting	Permanent traffic signals, highmast lighting, ramp lighting and municipal under / overpass lighting
Hwy 401-Harmony Road Interchange	Hwy 401 widening, Bloor Street realignment and ramps realignment	Traffic signals, ducts, conventional lighting, ramp lighting, municipal lighting	Temporary and permanent traffic signals, highmast lighting, underpass lighting, conventional and municipal lighting
Hwy 401-Bloor Street E. Ramp Terminal	Hwy 401 widening, Bloor Street E. ramps	Conventional lighting, ramp lighting, municipal lighting	Permanent traffic signals, highmast lighting, conventional and municipal lighting
Hwy 401 east of Harmony Road	Hwy 401 widening	None	Optional highmast lighting and distribution assembly
Hwy 401 west of Courtice Road	Hwy 401 widening	None	Optional highmast lighting

8.2.5 Drainage

The recommended drainage improvements include the following:

- Three new stormwater management ponds, including:
  - Northeast quadrant of the Westney Road interchange (within the northbound Westney Road to westbound Highway 401 inner loop on-ramp). The pond will provide quantity and quality control prior to discharge into the existing Westney Road storm sewer.
  - Dry pond located on south side of Highway 401, west of Park Road within the existing MTO right-of-way.
  - Dry pond located on south side of Highway 401 between the highway and rail corridor, east of Farewell Creek within the existing MTO right-of-way.
- Two existing MTO stormwater management ponds within the Stevenson Road interchange will be maintained and will service additional flow from the proposed Highway 401 widening and interchange improvements;
- Culvert extensions, relocations, rehabilitations and upsizing at various locations to accommodate the proposed highway improvements.
- New culverts to accommodate the proposed interchange improvements at Harmony Road and Simcoe Street.

- New or improved ditching to provide conveyance of proposed Highway 401 overland runoff, including enhanced grass swales throughout the corridor for quality control and pipe storage for quantity control.
- The combination of ponds and enhanced swales designed to treat an area equivalent to 136% of the new pavement area.

A more comprehensive assessment of the condition of the existing storm sewers, stormwater ponds, and other stormwater management features will be undertaken during Detail Design. Additional details regarding the drainage and hydrology analysis and recommendations within the Study Area is provided in the *Drainage and Hydrology Report (October 2015)*, available under separate cover.

8.2.6 Other Improvements

Other components of the Recommended Plan include:

- Overhead signing upgrades, including new overhead signage through the Express-Collector system extension between Brock Road the future West Durham Link;
- Utility relocations to accommodate the ultimate highway improvements;
- Extension of the existing ATMS system from Brock Road to Courtice Road, including provision of CCTV cameras and poles, Variable Message Signs (VMS), Vehicle Detector Stations (VDS), Road Weather Information Stations (RWIS), electrical chambers, cabinets and pedestals.
- New retaining walls throughout the corridor including at Brock Road, Westney Road, Salem Road, Thickson Road, Stevenson Road, Park Road, Simcoe Street, Ritson Road, and Harmony Road interchanges, as well as adjacent to the Highway 401 mainline.
- Provision of new or upgraded guiderail as required.

8.3 CONTRACT SEQUENCING AND CONSTRUCTION STAGING

It is anticipated that some smaller components of the overall recommended improvements or rehabilitation assignments will be constructed in advance of the main rehabilitation or widening contracts, such as individual structural rehabilitations or localized pavement improvements. The details of these contracts including construction staging requirements and contract sequencing will be determined by MTO at a later date subject to the following:

- Extent of rehabilitation requirements;
- Availability of funding; and
- Other provincial priorities.

As part of this study, conceptual construction staging plans were developed for the overall long-term mainline improvements and at key locations such as at the

Simcoe Street and Harmony Road interchanges to illustrate the general feasibility and concept for construction of the Recommended Plan. Typical staging cross-sections were developed at critical locations along the corridor, particularly at structures, to confirm the general feasibility of the recommended approach.

The conceptual staging strategy was based on the assumption that the existing number of lanes along Highway 401 will generally be maintained during construction, including five lanes in each direction throughout the west section (Brock Road to Salem Road) and three lanes in each direction throughout the east section (Salem Road to Courtice Road). The final construction staging strategy will be determined during Detail Design subject to:

- The overall scope of the construction contract including timing of the contract relative to the long-term widening of Highway 401.
- Confirmation of pavement and structure rehabilitation requirements based on additional investigations including additional boreholes and detailed condition surveys at all structures;
- Further traffic analysis based on updated traffic volume forecasts to define a detailed staging plan and understand lane closure implications; and
- Consideration of other closure options, e.g. weekend or long-term closures of individual ramps or interchanges, etc.

It is anticipated that replacement of various bridge structures along the corridor, and notably through the City of Oshawa, will require temporary or long-term road closures along municipal roads. In particular, full road closures of Park Road, Cubert Street, Albert Street, Ritson Road and Wilson Road are anticipated to facilitate replacement of the structures at these locations.

It is anticipated that the timing of the replacement of these structures will be coordinated to avoid closure of adjacent municipal road crossings at the same time, and additional traffic analysis will be undertaken during Detail Design to review the traffic implications of these closures.

Lane reductions are also anticipated along Westney Road, Simcoe Street and Bloor Street (at Harmony Road) to facilitate rehabilitation or replacement activities at these structures. Details of these lane or road closures will be confirmed during the Detail Design stage, in consultation with the local municipalities.

9.0 ENVIRONMENTAL ISSUES, EFFECTS, MITIGATION MEASURES AND COMMITMENTS

This section presents an overview of the potential temporary and permanent impacts to the natural, socio-economic and cultural environments, as well as transportation effects, associated with the Recommended Plan. This section also identifies mitigation measures that will be implemented to avoid or minimize these impacts prior to, during and post construction impacts associated with the Recommended Plan. Commitments to future work are also presented herein. Mitigation measures include planning decisions, design features, and construction requirements and constraints. Commitments to future work are also presented herein. A summary of the mitigation, protection, and future commitments is presented in **Table 9-9**.

9.1 NATURAL ENVIRONMENT

The potential environmental impacts on fish and fish habitat, terrestrial ecosystems, wildlife and wildlife habitat, and groundwater areas associated with the Recommended Plan as well as proposed mitigation measures have been assessed and are described in the following sections.

9.1.1 Soils

Potentials Impacts

Soil disturbance associated with construction activities may result in erosion.

Recommended Mitigation Measures

An erosion and sediment control plan will be implemented during construction of proposed works. Measures to be incorporated can include but are not limited to: catchbasin sediment traps, silt fences, rock check dams, erosion control blankets, etc. Erosion and sediment control structures will be designed, installed, maintained, and removed according to Ontario Provincial Standard Specifications (OPSS).

9.1.2 Fish and Fish Habitat

Potential Impacts

Data collected through the desktop analysis and field investigations was used to provide a description of the fish and fish habitat associated with identified watercourses within the upstream and downstream reaches of the MTO ROW.

In general, potential impacts from highway improvements including widening of Highway 401 could include: site erosion and release of sediment laden water into the creek; temporary avoidance by fish of the in-water areas adjacent to the bridge due to vibration; fuel spills from storage and refuelling of equipment; removal of riparian vegetation; temporary isolation / encroachment of creek habitat due to mitigation techniques (coffer dams, silt curtains, etc.), and permanent bank alteration and channel infill resulting from highway geometry improvements requiring an adjustment in crossing location.

The risk to fish habitat from these and other potential impacts is often controlled or eliminated through the use of: timing windows for in-water construction; standard best management practices for erosion and sediment control; construction access, site controls and operational constraints; and construction monitoring and inspection.

The fish assessment was based on the following DFO's Self-Assessment criteria:

1. No aquatic species at risk occur with the project area

2. Mitigation and design modification will prevent potential impacts from causing serious harm to fish and fish habitat

- No increased footprint below the high water mark;
- No addition of new fill below the high water mark;
- No significant removal of woody riparian vegetation;
- Effective control of sediment and/or debris;
- All in-water work completed within in-water timing window; and
- No reduction in fish passage.

There is potential for the watercourses within the Study Area to undergo indirect impacts as a result of works, due to the construction of additional traffic lanes and highway paving. These short duration works may involve the introduction of sediment and other deleterious substances into the aquatic environment, and/or riparian vegetation disturbance. It is anticipated that these watercourses can be sufficiently protected through the proper design and implementation of mitigation strategies, such as Erosion and Sediment Control, completing works in-the-dry, and maintaining channel connectivity and downstream flow.

1. Low sensitivity of fish and fish habitat (MNRF characterization)

2. No to low potential for impacts to fish and fish habitat passage

As a result of this Self-Assessment process, potential impacts of the Recommended Plan were considered at the following culvert crossings which are all considered Low sensitivity: C01, C02, C03, C04, C05, C06, C07, C08, C09,

C10, C11, C19, C20, C21, C24, C25, C26, C27, C28, C32, C33, and C34 (refer to **Figures 4-1** to **4-3** to view the watercourse crossings). There is low risk of the proposed work resulting in serious harm to fish at these locations; therefore, no further fish and fish habitat assessment was needed for the watercourse crossings.

The Recommended Plan will result in permanent occupancy of the creek bed in Oshawa Creek (B-03) and Harmony Creek (C31) which are considered as High and Moderate sensitive systems, respectively. As a result there is a moderate risk of resulting in serious harm to fish and an MTO Project Notification "Moderate / High Risk" Form 2 should be prepared and submitted to DFO in Detail Design prior to construction.

The proposed works at Duffins Creek West (B-01), Corbett Creek West (C22), Tributary of Corbett Creek East (C23), two Tributaries of Harmony Creek (C29 and C30), Farewell Creek (B-04) and Robinson Creek (C35) represent a low risk of resulting in serious harm to fish. An MTO Project Notification "Low Risk" form should be prepared and submitted to DFO in Detail Design prior to construction.

Due to the nature of works proposed at B-01, C22, C23, B-03, C29, C30, C31, B-04, and C35 and the sensitivity of fish and fish habitat within these watercourses, further assessment of impacts as per *MTO's Environmental Guide for Fish and Fish Habitat (2013; the Guide)* is required. A Fisheries Assessment was completed at a Preliminary Design level to determine the risk of causing serious harm to fish and fish habitat at the nine locations listed above.

The following discussion provides an evaluation of potential impacts, while a high-level summary of the impacts is provided in **Table 9-1**. The extent, duration and intensity of the potential impacts were considered specifically in relation to the sensitivity of the fish and fish habitat. In general, these potential effects fall into two broad categories of site preparation and construction (generally short to moderate duration) and the longer term effects from channel modifications and structures that remain post construction. Each of these categories has elements that can potentially put fish and fish habitat at risk.

Duffins Creek West (B-01) – Impacts

The Recommended Plan includes widening the existing bridge deck to both the north and south side of the existing structures. The piers of the existing structure have been identified as structurally sound to support a wider deck in order to facilitate additional traffic lanes. In maintaining the existing piers, the Recommended Plan will avoid any increase in permanent footprint within the waterbody. As a result, the creek functions are anticipated to remain unharmed. There will be no direct discharge of deck drainage outlets (deck drains) into the

watercourses, and the majority of deck drainage will be conveyed off the bridge deck and away from watercourses to reduce altered water quality.

The widening of the bridge is not expected to alter light penetration or affect instream vegetative growth and thermal properties of the watercourse. It is currently envisioned that the majority of the proposed construction will be conducted from above the valley as existing piers can accommodate the additional decks. Therefore, it is not anticipated that significant portions of riparian vegetation will be removed as a result of the construction of the new deck. During construction the introduction of sediment and other deleterious substance into Duffins Creek could occur. These impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due the nature of this work, and the ability to control impacts through mitigation, the potential for residual impacts is anticipated to be low.

Corbett Creek West (C22) – Impacts

The existing concrete box culvert which conveys the creek under Highway 401 will be extended to the north by 7.75 m and to the south by 43.75 m to accommodate the Recommended Plan. This extension, particularly to the south, will result in a lengthened segment of the watercourse shaded by artificial material. The culvert extension design will be a box culvert structure, and embedded approximately 300 mm to maintain fish passage and provide opportunities for natural establishment of fish habitat through the culvert. This design eliminates the occurrence of a permanent footprint within the water. This design is not expected to cause any passage issues, and will maintain fluvial functions. The design incorporates a smooth transition from existing culvert to extension to match the existing channel bed at the inlet and outlet locations. The majority of impacts to fish and fish habitat are likely to occur in the short term at the construction phase of the project.

These impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due the nature of this work, and the ability to control impacts through mitigation, the potential for the occurrence of residual impacts is anticipated to be low.

Tributary of Corbett Creek East (C23) - Impacts

The proposed works at this watercourse crossing include the replacement of the existing concrete box culvert by a 108.5 m long structure, with a slight realignment of the creek. The upstream portion of the culvert, located north of Highway 401, will be maintained in its current position. The downstream end of the culvert, located to the south of Highway 401, will be realigned to the east. The affected reach provides low quality habitat and lacks attributes suitable for

functions such as spawning or rearing. The realignment provides an opportunity to utilize natural channel design and enhance existing habitat conditions.

The new culvert will be closed bottom and embedded approximately 300 mm to maintain fish passage and provide opportunities for natural establishment of fish habitat through the culvert. During construction, downstream flow and connection to the upstream reaches will be maintained and where possible, works will be completed in the dry. This strategy will reduce potential adverse effects to fish and fish habitat.

Creek realignments have the potential to cause serious harm to fish and fish habitat through improper design, simplification of habitat type, and increased sediment loading. Mitigation measures such as erosion and sediment controls, isolation of work area, and timing restrictions commonly negate any harm. The culvert replacement and channel realignment is not expected to alter the function of this watercourse or cause serious harm to fish and fish habitat.

These impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due the nature of this work, and the ability to control impacts through mitigation, the potential for residual impacts is anticipated to be low.

Oshawa Creek (B-03) - Impacts

The Recommended Plan recommends that the Oshawa Creek crossing structure be widened at both the upstream and downstream sides of the existing structure. The Recommended Plan also includes the construction of a new bridge which will span an upstream portion of Oshawa Creek (north of Highway 401), at the realigned westbound on-ramp of the Simcoe Street interchange.

During construction, there is potential for temporary impacts such as disruption to instream habitat, and the introduction of sediment and other deleterious substances. It is currently envisioned that the majority of the proposed construction will be conducted within the valley and that valley access by large machinery will be required. These works are anticipated to require vegetation disturbance or removal both within the valley and on adjacent table lands.

Due to the original design of the existing Oshawa Creek three-span arch culvert, encroachment into and permanent occupancy of the creek bed will occur, resulting in a permanent reduction in existing fish habitat. The culvert arches will have open footings and this encroachment is not expected to affect the integrity of the upstream or downstream reaches of Oshawa Creek. The lengthened culvert will not affect fish passage as the design incorporates an open bottom and smooth transition from existing culvert to extension to match the existing channel bed at the inlet and outlet locations.

The new bridge design will be a clear span structure avoiding any infill or encroachment into or near the existing creek channels. It is recommended that no direct discharge from deck drainage outlets (deck drains) into the watercourses, and as much of the deck drainage as possible will be conveyed off the bridge deck and away from watercourses for application of the recommended stormwater management measures. If scour / rock protection is required for the areas around the bridge abutments or piers, it will be designed and installed so as to avoid any encroachment into the channel. Hardening / armouring of the channel banks will also be avoided, unless otherwise required for channel stability, and designed in consultation with a fluvial geomorphologist. In the event that rock protection is required in the water, it will be designed to provide fish habitat opportunities (e.g., rounded river stone (cobble stone)).

Some of these impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due to the nature of the design plan and the value of existing conditions in Oshawa Creek, there is potential for residual impacts to occur.

Tributary of Harmony Creek (C29, C30) - Impacts

The culvert which conveys this watercourse under Highway 401 eastbound and westbound traffic lanes will be replaced and slightly realigned to the west. A second culvert which conveys the downstream portion of the creek under Bloor Street will be replaced and realigned west to east under Bloor Street near the reconstructed intersection at Farewell Street (total length of creek realignment is approximately 75 m). The creek realignments are localized; however, the realignment will result in a decrease in total channel length and an increase in culvert length.

The new concrete box culverts will be embedded approximately 300 mm to maintain fish passage and provide opportunities for natural establishment of fish habitat through the culvert. During construction, downstream flow and connection to the upstream reaches will be maintained and where possible, works will be completed in the dry. This strategy will reduce potential adverse effects to fish and fish habitat.

Creek realignments have the potential to cause serious harm to fish and fish habitat through improper design, simplification of habitat type, and increased sediment loading. Mitigation measures such as erosion and sediment controls, isolation of work area, and timing restrictions commonly negate any harm. The new channel will apply natural channel design measures that will provide channel stability and ensure that the potential habitat and function of the existing channel sections (example; refuge pools) will be re-instated and potentially enhanced in the newly created reaches.

These impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due to the intermittent flow and low habitat value in this tributary, the culvert replacement and channel realignment is not expected to alter the function of this watercourse or cause serious harm to fish and fish habitat.

During Detail Design, opportunities to improve the existing structure will be further discussed and consideration of maintaining the current alignment of the creek and replacing the structure with one continuous culvert. Although a continuous culvert will eliminate daylighting the creek in the ROW, a continuous culvert will decrease the introduction of highway runoff, and limit the occurrence of erosion. These design features would further reduce the potential for residual effects.

Harmony Creek (C31) - Impacts

Harmony Creek is a permanent warmwater system that supports a diverse fish community. Within the watercourse there is a high width to depth ratio and the substrates comprise course material including cobbles, gravels and sand. This habitat is suitable for functions including spawning, rearing and feeding for a range of species. The creek is characterized as a Moderate sensitivity watercourse by MNRF.

The Recommended Plan for Harmony Creek includes the extension of both the upstream and downstream ends of the culvert. The upstream end will be extended 7.75 m and the downstream end will be extended 11.5 m. The wings walls, located on both creek banks, will be widened to the width of the creek.

The widening of wing walls will reduce any narrowing of the channel that currently exists, and allow natural form and function to re-establish within the watercourse. The proposed works also involve the downstream extension of the Bloor Street East bridge located upstream of Highway 401. The existing structure spans the wetted width of Harmony Creek and the new structure will mimic this design, therefore no encroachment into the watercourse is anticipated.

Short-term impacts, such as temporary avoidance of the area by fish, are likely to occur at the construction phase of the project. The culvert extension work will result in a lengthened segment of the watercourse shaded by artificial material. It is anticipated that the design of the culvert will be an open bottom structure. The culvert extension is not expected to cause any passage issues, and will maintain fluvial functions. Either of these designs will help eliminate potential impacts to fish and fish habitat. However, due to the widening of wingwalls, permanent encroachment into the watercourse is expected.

Some of these impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due to the nature of the design plan and the value of existing conditions in Harmony Creek, there is potential for residual impacts to occur.

Farewell Creek (B-04) - Impacts

Farewell Creek is conveyed through a single span concrete arch bridge under Highway 401. Upstream of Highway 401, the creek flows under a second clear span bridge which supports Bloor Street. Farewell Creek is classified as a highly sensitive watercourse by MNRF. This watercourse is a permanent coldwater feature that supports a diverse community of fish inclusive of sensitive species like Rainbow Trout.

The Recommended Plan for Farewell Creek includes replacement of the Highway 401 bridge over Farewell Creek with a wider structure at both the upstream and downstream ends under Highway 401. Additionally, works will involve the removal of and upstream relocation of the Bloor Street bridge (north of Highway 401), to permit a realignment of Bloor Street associated with re-construction of the Harmony Road interchange.

The Highway 401 Farewell Creek bridge will span the wetted width of the creek and avoid encroachment into the watercourse. The span of the bridge will be increased from 11.5 m to 18 m. The bridge will have a 1.5 m buffer on both sides of the top of creek embankment. The new Bloor Street bridge will have a clear span of 13 m and provide a 1.5 m buffer on either side of the creek embankment.

It is recommended that no direct discharge of deck drainage outlets (deck drains) into the watercourses, and as much of the deck drainage as possible should be conveyed off the bridge deck and away from watercourses. If scour / rock protection is required at the Bloor Street bridge for the areas around the bridge abutments, it should be designed and installed so as to avoid any encroachment into the channel. Hardening / armouring of the channel banks should also be avoided, unless otherwise required for channel stability, and designed in consultation with a fluvial geomorphologist. In the event that rock protection is required in the water, it should be designed to provide fish habitat opportunities (e.g., rounded river stone).

It is currently envisioned that the majority of the proposed construction will be conducted within the valley and that valley access by large machinery will be required. These works are anticipated to require vegetation disturbance or removal both within the valley and on adjacent table lands. During this construction, there is potential for temporary impacts such as disruption to instream habitat, and the introduction of sediment and other deleterious substances. These impacts can be controlled for through the application of

mitigation strategies such as sediment and erosion controls and re-vegetation of disturbed area.

The majority of these impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due to the nature of the design plan, the potential for residual impacts to occur is unlikely.

Robinson Creek (C35) - Impacts

The proposed works involve a replacement of the existing culvert with a larger span culvert. The existing culvert (3.8 m x 3.05 m) will be replaced with a new culvert (4.5 m x 3.05 m) to accommodate increased flow and address increased floodplain elevations associated with highway widening. The culvert replacement will result in a lengthened segment of the watercourse shaded by artificial material. It is anticipated that the culvert replacement design will be a concrete box culvert, and embedded approximately 300 mm. This embedded design will create a smooth transition from the existing culvert to the extension and will match the existing channel bed at the inlet and outlet locations. This design is not expected to cause any passage issues, and will maintain fluvial functions. The majority of impacts to fish and fish habitat are likely to occur in the short term at the construction phase of the project.

Some of these impacts can be mitigated through using strategies such as sediment and erosion control practices and re-vegetation of disturbed areas. Due to the nature of the design plan, the potential for residual impacts to occur is unlikely.

If the proposed design details change from an open bottom box culvert extension to a closed box culvert, the assessment of impacts at Robinson Creek will need to be re-assessed. Robinson Creek is considered a moderately sensitive watercourse, and occupation of the channel bed will result in residual impacts.

TABLE 9-1: FISH AND FISH HABITAT RESIDUAL EFFECTS TABLE

Location	Waterbody	Type of Fishery Directly Supported	Type of Work/ Undertaking	Description	Scale (L,M,H)	Comments (rationale for scale)
B-01	Duffins Creek West	Permanent warmwater forage and sport fish	Bridge deck widening	Short term impact on flows within timing appropriate window.	Low	With proper mitigation and widening of bridge deck only, the scale of residual impacts is considered low
C22	Corbett Creek West	Permanent warmwater forage fish	Culvert extension- upstream and downstream	Short term impact on flows within timing	Low	With proper mitigation and extension of open bottom culvert structures, the scale of

Location	Waterbody	Type of Fishery Directly Supported	Type of Work/ Undertaking	Description	Scale (L,M,H)	Comments (rationale for scale)
				appropriate window.		residual impacts is considered low
C23	Tributary of Corbett Creek East	Permanent warmwater, few forage species only	Culvert replacement and creek realignment	Short term impact on flows within timing appropriate window.	Low	With proper mitigation and replacement of open bottom culvert structures, the scale of residual impacts is considered low
B-03	Oshawa Creek	Permanent coldwater forage and sport fish	3 span arch concrete culvert extension at upstream and downstream ends. Construction of new bridge located upstream	Short term impact on flows, permanent occupation of creek channel.	Moderate	Due to permanent occupation of the creek bed, the scale of residual impacts is considered moderate
C29	Tributary of Harmony Creek	Intermittent warmwater forage fish	Culvert replacement and realignment	Short term impact on flows within timing appropriate window.	Low	With proper mitigation and replacement of open bottom culvert structures, the scale of residual impacts is considered low
C30	Tributary of Harmony Creek	Intermittent warmwater forage fish	Culvert replacement and realignment	Short term impact on flows within timing appropriate window.	Low	With proper mitigation and replacement of open bottom culvert structures, the scale of residual impacts is considered low
C31	Harmony Creek	Permanent warmwater forage and sport fish	Culvert extension at upstream and downstream ends	Short term impact on flows within timing appropriate window.	Moderate	Due to permanent occupation of the creek bed, the scale of residual impacts is considered moderate
B-04	Farewell Creek	Permanent coldwater forage and sport fish	Bridge replacement (with a wider deck)	Short term impact on flows within timing appropriate window.	Low	With proper mitigation and clear span bridge design, the scale of residual impacts is considered low
C35	Robinson Creek	Permanent warmwater forage and sport fish	Culvert replacement	Short term impact on flows within timing appropriate	Low	With proper mitigation and replacement of open bottom culvert structures, the scale of residual impacts is

Location	Waterbody	Type of Fishery Directly Supported	Type of Work/ Undertaking	Description	Scale (L,M,H)	Comments (rationale for scale)
				window.		considered low

Recommended Mitigation Measures

The *Fisheries Protection Policy Statement (DFO 2013)* requires proponents to demonstrate that measures and standards have been applied to avoid, then mitigate and finally offset residual serious harm to fish that are part of or support commercial, recreational or Aboriginal fisheries.

The proper implementation of appropriate mitigation strategies outlined below will assist in the avoidance of serious harm to fish as a result of project related works. The risk to fish habitat during construction is often controlled or eliminated through the use of: timing windows for in-water construction; standard best management practices for erosion and sediment control; construction access, site controls and operational constraints; and construction monitoring and inspection.

During construction, mitigation encompasses implementation of all relevant standard and nonstandard / site-specific protection measures and management practices embodied in MTO's Operational Constraints and Construction Specifications. These measures and all the site specific measures will continue to be refined and detailed as the design evolves through subsequent design phases. The mitigation measures will be finalized based on the final design, and its effects on fish and fish habitat. In addition, comprehensive construction mitigation involves recognition and implementation of additional control measures that may be identified through good construction practices and environmental inspection.

Fish Protection Mitigation Measures

All in-water and near-water activities will be conducted within the applicable in-water construction timing windows, as identified by MNRF, to protect the resident fishery life functions as outlined below. Fish protection measures include:

- The MNRF classifies the majority of watercourses in the Study Area as warmwater and therefore, in-water work in many of watercourses will only occur between the months of July 1 to March 31.
    - Where salmonid migration occurs, in-water work will only occur between July 1 and September 15 (more restrictive timing window to allow for construction works).
    - In the coldwater / coolwater watercourses, in-water work is only to occur between the months of June 1 to September 15.

- All in-water activities shall be performed in the dry. This will require construction to occur behind water tight isolation barriers (coffer dam, Aqua-Dam, sheet piling, etc.).
- The water tight work zones shall not occupy more than one third of the active channel at any point in time to maintain downstream flow and fish passage.
- Any fish stranded within the temporary in-water work zones will be removed and relocated using appropriate techniques by a qualified fisheries specialist possessing a valid Scientific Collector's Permit.

Erosion and Sediment Control Mitigation Measures

A comprehensive erosion and sediment control (ESC) plan will be developed in subsequent design phases and implemented to prevent migration of sediment laden runoff (or other contaminants) from the construction zone to the creek. This plan will include inspection and maintenance of the measures until final cover is established. Specific aspects include:

- Perimeter silt fence installed between the work areas and along the banks of watercourses within the area of construction (where feasible).
- Temporary silt fence placed around inlets and outlets of existing culverts in the drainage system (where feasible).
- Silt fence properly installed and regularly inspected and maintained. It will be left in place and maintained until all surfaces contributing drainage to these watercourses are fully stabilized.
- All exposed and newly constructed surfaces will be stabilized using appropriate means in accordance with the characteristics of the soil material. These surfaces will be fully stabilized and re-vegetated as quickly as possible following completion of the proposed works.
- Contingency procedures, materials and notification procedures will be readily available for use in the event of a silt release and for general application in regular maintenance and repair.
- Grassed swales to be enhanced with rock check dams to provide storage and additional treatment capacity, where necessary. Rock protection is to be provided for swales with velocities greater than 1.5 m/s (where feasible)
- During construction, erosion and sedimentation controls (ESC) (rip-rap, silt fence etc.) are to be installed to intercept drainage from external areas and direct it away from exposed surfaces.
- Straw bale and rock flow checks to be provided in roadside ditches as required.

Construction Access, Site Controls and Operational Constraints

- The construction access and work areas to be confined to the extent required for the construction activities, and these areas are to be defined in the field using appropriately installed protective fencing or other suitable barriers.
- Removal of riparian vegetation, particularly woody vegetation, will be kept to the minimum necessary for the project works. The woody vegetation that will likely require removal will be replaced with appropriate native species.
- Any temporarily stockpiled material, construction or related materials will be properly contained (e.g. within silt fencing) in areas separated a minimum of 30 m from any waterbody.
- All construction materials and debris will be removed and appropriately disposed of following construction.
- Every effort will be made to retain as much of the natural vegetation as reasonably possible to help ensure bank stability, control erosion and expedite the re-colonization of vegetative cover.
- Removal of natural vegetation will take place outside of the breeding bird window (April 15 to July 31) in order to avoid disturbance of migratory breeding birds protected by the *Migratory Birds Convention Act (1994).*
- Removed shoreline vegetation from watercourses is to be replaced using native vegetation along the newly created shoreline at a ratio that exceeds the removal of woody stock.
- All activity will be controlled so as to prevent entry of any petroleum products, debris or other potential contaminants / deleterious substances, in addition to sediment as outlined above, to any waterbody. No storage, maintenance or refuelling of equipment will be conducted near any waterbody. A Spills Prevention and Response Plan will be developed and kept on site at all times.

Protection during Removal and Extension of the Existing Bridges and Culverts

- Appropriate containment systems (e.g. coffer dams, Aqua-Dam, sheet piling, etc.) will be designed and implemented during the removal of the existing structures to prevent entry of debris into watercourses. This system(s) will address large materials and fine particulates, and will be regularly monitored to remove and appropriately dispose of accumulated material.
- Materials that fall in the water will be carefully retrieved to minimize disturbance.

- All excavated material shall be removed and deposited in an area above the high water mark of the shoreline and be contained behind properly installed and maintained sediment barriers or devices.

Rehabilitation Following Construction

- All of the areas disturbed during construction will be restored, stabilized and re-vegetated as soon as the works are completed to prevent migration of fine material to watercourses during runoff events, as well as minimizing the opportunity for colonization of the area by invasive species.
- To reduce the potential impact of this activity on fish, rounded river stone (cobble stone) to be applied to areas of disturbance as a means of stabilizing and naturalizing the creek banks (where feasible).
- Only native plants, compatible with site conditions will be used.

Site Inspection and Monitoring

- A qualified Fisheries Contracts Specialist will be responsible for conducting regular inspections of the environmental protection measures (ESCs, containment measures, etc.) and identifying deficiencies. The inspector will ensure all environmental mitigation and design measures are properly installed / constructed and maintained, and appropriate contingency and response plans are in place and implemented if required.

Impact Off-Setting Measures

Typically, a project strives to minimize impact to fish and fish habitat through relocating works, the evaluation of alternatives, the application of redesign of particular components, and effective selection of both construction materials and techniques. In some instances, these approaches and the application of sound mitigation techniques are insufficient to entirely reduce the impacts to fish habitat. In such cases, alternatives are often selected that create unavoidable harmful effects on fish habitat and offsets for habitat loss is required.

The outcome of this Impact Assessment Process has identified that offset measures may be required to account for impacts to fish and fish habitat at Oshawa Creek and Harmony Creek. The following habitat enhancement opportunities within the ROW have been identified:

- Plant woody vegetation along a narrow riparian area along the downstream banks
- Restore active erosion areas
- Remove existing pollution from watercourses
- Removal of identified migratory barriers (e.g. Tributary of Harmony Creek and Tooley Creek). CLOCA has identified that the Highway 401

culvert at Tooley Creek is the main migration corridor to upstream habitat. Furthermore, this location should be prioritized over other candidate locations for habitat restoration works within the study area.

- Invasive species management (phragmites) in newly disturbed riparian areas at Tributary of Corbett Creek East (C23) to prevent re-establishment;
- Monitor and remove obstructions in culverts.

Fish and Fish Habitat Summary

The fish and fish habitat identified within the Study Area associated with the Recommended Plan represents cool, cold, and warmwater communities. No aquatic species at risk are known to occur with the study area. The Recommended Plan includes both the widening of existing bridges and construction of new clear span bridges over watercourses, culvert extensions, replacements, and introduction of new culverts including slight realignments of watercourses. These works will require no temporary obstruction to fish passage. In-water work will be completed in the dry, while maintaining downstream flow. These project elements coupled with the use of mitigation measures discussed above should prevent the majority of potential impacts to fish and fish habitat.

9.1.3 Groundwater

Potential Impacts

The potential impacts from the Highway 401 improvement work to the local groundwater system include, but are not limited to, the following:

- Changes to recharge / discharge regimes resulting from the disturbance of the ground surface, ground clearing, compaction, road cuttings, placement of fill and the presence of the completed impervious layers of road surface;
- Potential dewatering impacts that include a reduction in groundwater level and reduced flow to the nearby private wells and groundwater-dependent water bodies;
- Application of commercial fertilizers during seeding activities to re-establish vegetative cover;
- Potential spills of hydrocarbons and other chemicals used during construction activities that could impact the groundwater aquifer and groundwater-dependant water bodies; and
- The future use of salt for road de-icing in winter seasons.

High potential for groundwater impacts are present in the following areas:

- Areas along the creeks, tributaries, and wetland areas where high groundwater tables are present; and

- Areas of Highly Vulnerable Aquifers and Intake Protection Zones.

Recommended Mitigation Measures

The following mitigation measures are recommended to manage the potential impacts:

- Limit the depth of excavation and minimize the need for dewatering during construction, particularly in HVAs and IPZs;
- If dewatering is required, dewatering activities will be conducted in accordance with control procedures as specified in OPSS 518 Control of Water from Dewatering Operations. A Permit to Take Water (PTTW) must be obtained from the Ministry of the Environment and Climate Change (MOECC) if the amount of water taken exceeds 50,000 litres/day (50 m^3/day) as per Ontario's Water Taking Regulation (Ontario Regulation 387/04 made under the *Ontario Water Resources Act*).
- In the areas where deep excavations are expected, a pre-construction water well survey will be conducted to confirm the presence or absence of active water wells, and if any are present, a well monitoring program will be established to monitor the wells that could be potentially affected, prior to, during and after the construction activities; any wells to be removed during the highway improvement activities will have to be decommissioned properly as per the Ontario Wells Regulation (R.R.O. 1990, Reg. 903);
- Minimize disturbance to existing vegetation and grassed slopes where re-grading is required (disturbed areas will be re-vegetated as quickly as possible after completion of construction activities);
- Prepare and implement a stormwater management plan to protect the quality of surface runoff that may infiltrate groundwater resources;
- Prepare and implement a spill prevention and control management plan;
- Minimize commercial fertilizer usage and runoff by following the MTO prescribed best management practices and Ontario Provincial Standard Specification (OPSS 0804); and
- Minimize salt usage and runoff during road de-icing applications by following best practices consistent with those used across North America and employ the latest winter maintenance technologies.

9.1.4 Drainage and Hydrology

Overview

The Preliminary Drainage and Hydrology study investigated a total of 30 crossings along the Highway 401 mainline, including new watercourse crossings

upstream of the highway at Oshawa Creek and Farewell Creek. A summary of the results of the study are outlined below.

From the approved watershed hydrology models from the Conservation Authorities, the design and regulatory flows for each crossing were identified and used to assess hydraulics. A separate hydrology model was developed using VO2 for catchments not covered by the watershed model. Additionally, from the existing conditions hydraulic assessment, there are 11 existing structures that do not achieve the MTO design freeboard criterion, including three bridge structures / open footing culvert that do not meet the design clearance (i.e. structures B03, B04, and C21). Refer to **Figures 4-1** to **4-3** for the watercourse crossings and the location of these structures. From these 11 structures, the roadway at 6 structures is overtopped during the design storm event.

From the existing conditions hydraulic assessment, there are ten structures where the highway is overtopped during the regulatory storm event (i.e. flow from the greater of 100 year design storm or Hurricane Hazel) or check flow (i.e. 130% of the 100 year design flow).

A hydraulic assessment was completed for all crossings under proposed conditions to identify potential upstream impacts with respect to increased water levels. Potentially impacted structures resulting from the highway improvements include structures C02, C05, C06, C10, C33, C34, C35, and C36. Culverts C03, C09, C20, C21, and C24 are proposed for removal and therefore were excluded from the impact assessment. The proposed highway improvements will not affect the alignment of existing Culverts C26, C27, and C28, and these were therefore also excluded from this assessment.

For the impacted crossings, the structure flow conveyance area size was increased until proposed water levels matched existing levels for the design flow. Although the highway widening at structures C02 and C10 would result in a minor increase in upstream water levels, it was determined that the increase would not impact existing upstream properties or the highway.

The existing highway storm sewer network within the project limits was assessed and found to be generally sufficient to convey the 10 year design storm flows. New storm sewers will be required to service the highway widening and will include connections into existing storm networks within the highway right-of-way and into municipal storm networks. The proposed sewer connections within the highway right-of-way were determined to be sufficient to convey the additional highway drainage. There was insufficient information to confirm the available conveyance capacity of the existing receiving municipal storm networks.

There are four municipal road crossings under Highway 401 (Park Road South, Cubert Street, Ritson Road South and Wilson Road South) that require significant

road works. The proposed lowering of the road sag will essentially eliminate the existing storm sewer outlet.

The proposed stormwater management plan for the highway improvements will include the use of SWM ponds (both existing and proposed) for quality and quantity control, pipe storage for quantity control, and enhanced swales for quality control.

Potential Impacts

Highway 401 traverses 10 watersheds that span across five municipalities, and two Conservation Authorities. There are 11 major watercourses and 19 minor crossings of tributaries and centreline culverts that function as part of the local highway drainage. While the Pringle Creek watercourse (C18) was reviewed as part of the existing conditions analysis, it is located within the limits of the Salem Road to Brock Street Environmental Assessment study (G.W.P. 10-20011) and the impacts to this watercourse were therefore not considered as part of the current study. Existing drainage and hydrology impacts are summarized as follows:

- A review of existing Regulatory floodplain mapping indicate that Highway 401 is overtopped at several locations, which pose a flood risk during extreme rainfall events. These locations include: Corbett Creek West Branch (Structure C22), Corbett Creek East Branch Tributary (Structures C23, C26), Oshawa Creek (Structure B03), Harmony Creek (Structures C29, C30, and C31), and Farewell Creek (Structures B04, C32).
- For the majority of the watercourse crossings, the existing structure will have to be lengthened to accommodate the proposed highway widening.
- Results of the analysis confirmed that the proposed highway improvements will not result in a significant increase to the upstream water level for the majority of crossings within the project limits for the design and regulatory / check flows. Potentially impacted structures resulting from the highway improvements however include structures C02, C05, C06, C10, C33, C34, C35, and C36.
- For the impacted structures (except for structures C02, C06, and C10), the culvert dimensions were adjusted until proposed water levels matched or were lower than existing conditions. The increase in upstream design and check water levels at structures C02 and C10 were confirmed as being relatively minor. For structure C06, it is recommended that the existing CSP section of the culvert be replaced with a concrete box culvert given the age and condition of the existing structure and to mitigate the headwater increase.

- At the Highway 401/Harmony Road interchange, the proposed improvements include new ramps and realignment of Bloor Street, resulting in new watercourse crossings and lengthening of existing crossings. The proposed interchange improvements have been developed to minimize potential impacts to the Regulatory floodplain.
- At the Highway 401/Simcoe Street interchange, the proposed improvements include new ramps to and from Simcoe Street and widening of Highway 401. This results in a new watercourse crossing of Oshawa Creek upstream of the highway for the construction of the westbound on-ramp from Simcoe Street, and lengthening of the existing Oshawa Creek bridge along Highway 401. In terms of grading considerations, the new ramps will have minimal impact on the available floodplain storage west of Simcoe Street during the regulatory flood event.
- The majority of the crossings will not be impacted upon as a result of the proposed highway improvements. That is, the lengthening of most culverts / bridges will not result in an increase to the upstream regulatory or design flood elevation.
- The relatively minor increase in water levels at some structures will not impact existing upstream properties nor change the flood risks for the highway.
- Several municipal roads that cross under Highway 401 are proposed for improvements to accommodate the recommended improvements. In particular, the four municipal roads crossing beneath Highway 401 within the City of Oshawa will require a partial re-construction and lowering of the roads, including Park Road South, Cubert Street, Ritson Road South, and Wilson Road South. The proposed road profile will be lowered by more than 1 m at each sag location. This would essentially eliminate the possibility of utilizing the existing storm sewer at the sag location to service each of the roadways.
- The highway widening will add approximately 63 ha of impervious area and increase the overall percent imperviousness from 35% to 49%.

Recommended Mitigation Measures

- Where there are proposed storm connections into an existing municipal storm network, flow controls will be implemented to prevent surcharging the receiving system.
- The proposed stormwater management plan (SWM) includes the use of both existing and proposed SWM ponds. Three new SWM ponds are proposed as follows:
  - Northeast quadrant of the Westney Road interchange (within the northbound Westney Road to westbound Highway 401 inner loop on-

ramp). The pond will provide quantity and quality control prior to discharge into Miller Creek.

- Dry pond located on south side of Highway 401, west of Park Road within the existing MTO ROW.
- Dry pond located on south side of Highway 401 between the highway and rail corridor, east of Farewell Creek within the existing MTO ROW.

Existing SWM ponds in the vicinity of the Salem Road interchange and within the Stevenson Road interchange have sufficient capacity to service the proposed Highway 401 widening.

From a fisheries perspective, the three new proposed SWM ponds will not directly outlet into watercourses with direct fish and fish habitat.

- During the subsequent Detail Design stage, the existing servicing along the subject municipal roads and the associated drainage impacts of lowering the road profiles will be confirmed. In the event that the existing storm outlet in the sag locations cannot be used to service the proposed road profile, the following servicing options will be considered in the final design stage:
  - Create a parallel storm sewer to service the sag location and outlet further downstream; and
  - Implement a mechanical drainage system, such as a pumping station unit, to drain the sag.
- A review of additional municipal data and other relevant information should be collected prior to Detail Design to assess the full extent of potential servicing improvements to achieve a gravity outlet. This will include review of more detailed as-built records or sub-surface utility investigations of the existing municipal services, which were unavailable at the time of this study.
- Provide both quality and quantity control where required at existing outlet locations.
- Generally, the existing road drainage patterns have been maintained under proposed conditions to the extent possible to minimize the potential impacts to existing outlets.
- Constraint outlets should be assessed during Detail Design stage to determine the residual conveyance capacity of the receiving storm sewer network.
- Additional coordination with municipalities will be required at the final design stage to confirm whether more stringent water quantity controls are necessary.
- Quantity control (post-to-pre peak flow controls up to and including the 10 year design flow) should be implemented for the new highway drainage

prior to connecting into the municipal system to avoid potential surcharging of the receiving system.

- Pipe storage is proposed within the highway corridor to achieve the required storage volumes.
- Construction of enhanced ditches. In order to improve the effectiveness of enhanced ditches in the treatment of water consideration should be given during Detail Design for the inclusion of additional treatment features spaced along the enhanced ditches where feasible.
- The combination of ponds and enhanced swales will treat a total of 86.4 ha of highway impervious area or the equivalent to 136% of the new pavement area.
- Additional information is required from municipalities to confirm available conveyance capacities in receiving storm systems. This assessment will also confirm the necessity for using more stringent quantity control criteria for outlets that discharge into municipal storm systems.
- Details for erosion and sediment control measures will be established during Detail Design.

Additional details on each of these measures are available in the *Drainage and Hydrology Report (October 2015)*, available under separate cover.

9.1.5 Terrestrial Ecosystems

Secondary source information and consultation with the MNRF together with field studies was used to determine the significance of the existing natural features within the Study Area. Additionally, the selection of the Recommended Plan has been undertaken with consideration of the sensitivity of terrestrial ecosystems occurring throughout the Study Area.

Potential Impacts

Due to the nature of the proposed undertaking and the existing conditions within the Study Area, significant impacts to terrestrial features are not anticipated to occur as result of this project. Proposed highway improvements and related construction activities will occur outside the limit of all designated features identified within the Study Area such as ANSIs, ESAs and PSWs. The majority of vegetation throughout the Study Area today has been culturally influenced by both the past construction of the existing Highway 401, its subsequent improvements, and on-going maintenance activities, in addition to the adjacent urbanized landscape throughout the Study Area. The vegetation units being affected by the Recommended Plan are generally not part of larger habitat

patches, are isolated on the landscape through the highway corridor, and contain low species diversity with many non-native species.

Vegetation and Vegetation Community Impacts

As a result of the Recommended Plan, which includes Highway 401 widening and interchange improvements, encroachment into existing roadside vegetation (including upland communities and roadside ditches) will be required. The majority of the vegetation communities affected throughout the Study Area have been identified as Cultural Communities which have a low species diversity comprised of common, tolerant, and often invasive species. Such communities are typical of previously disturbed roadside communities and are common throughout southern Ontario.

The following discussion addresses the potential impacts to vegetation and vegetation communities due to construction of the Recommended Plan. The Recommended Plan has been divided into three primary components of the proposed works when discussing vegetation and vegetation community impacts:

- Highway widening
- Bridge work within valley systems
- Interchange improvements

Highway Widening

The following three vegetation communities (Cultural Community Class, Forest Community Class, and Wetland Community Classes) will be affected within the ROW:

Cultural Community Class (CU)

The largest area (243,757 m^2) of vegetation removal will occur within the Cultural Community Class (CU) which includes: meadow, thicket and woodland that have succeeded from previous highway stabilization and enhancement programs. This community class is the most dominant vegetation form / polygon in the Study Area and very common along highways in southern Ontario. It occurs throughout the Study Area in roadside ditches and other low lying features. Dominant species within these areas are almost entirely non-native, adapted to constantly disturbed or degraded areas. Many of the areas along the MTO ROW contain minor drainage features typically dominated by the highly invasive and non-native Common Reed. Removal of portions of these community polygons, especially those dominated by the aggressive Common Reed is not considered a negative impact. Furthermore, many of the species within this type of community will naturally re-establish along the new margin of the new highway following construction.

CUT1 – Mineral Cultural Thicket

Mineral Cultural Thicket (CUT1) polygons primarily occur along the margin of the highway in the east end of the Study Area. Encroachment of 63,820 m^2 will occur into numerous CUT1 polygons as a result of road widening east of Farewell Creek.

CUW1 – Mineral Cultural Woodland

Mineral Cultural Woodlands are located throughout the Study Area but appear more often east of Harmony Road. Encroachment of 66,100 m^2 into several of these units will occur as a result of highway widening. The remaining portions of the units are anticipated to survive and continued establishment of these units in adjacent cultural vegetation units will occur naturally.

CUM1 - Mineral Cultural Meadow

The CUM1 Mineral Cultural Meadow sites are located in the Study Area adjacent to Highway 401 primarily east of Harmony Road. Encroachment into several of these units will occur as a result of highway widening. Approximately, 26,680 m^2 of CUM1 will be impacted as a result of the Recommended Plan. This type of community will naturally re-establish along the margin of the new highway following construction.

CUP – Cultural Plantation Ecosite

CUP Cultural Plantation Ecosite polygons are located within the Study Area east of Farewell Creek. Three relatively large linear polygons occur along the highway margin, although portions of these units are separated from the proposed encroachment area by other cultural units. Encroachment into portions of some of these units totaling 9,400 m^2 will occur as a result of highway widening. The remaining portions of the units are anticipated to survive and continue to establish naturally.

Forest Community Class

Removal of small wooded communities with closed canopy will occur associated with the floodplains of Pringle Creek (excluded from this study), Oshawa Creek, and West Corbett Creek.

FOD4 - Dry – Fresh Deciduous Forest Ecosite

A small area (14 m^2) will be removed between the railroad and the highway as a result of the new interchange loop at Harmony Road as well as a small corner at Oshawa Creek.

FOD7 - Fresh – Moist Lowland Deciduous Forest Ecosite

A relatively small portion (3,012 m^2) of the FOD7 polygon at Robinson Creek will be removed due to both highway widening and the northward culvert extension / replacement at this location.

Based on the presence of many non-native tree species and the dominance of Garlic Mustard in the understory, the impact to this FOD7 unit is considered to be of low significance to the local terrestrial system. Restoration of the riparian area adjacent to Robinson Creek is recommended following disturbance from construction. The goal will be to establish native species in this area.

Wetland Community Classes

Small meadow and shallow marshes have formed in the swales adjacent to Highway 401 that unavoidably will be removed. Approximately 3,830 m^2 of small meadow and shallow marsh will be impacted by the Recommended Plan.

MAS Shallow Marsh Ecosite

MAS Shallow Marsh Ecosite polygons occur sporadically throughout the Study Area on both sides of Highway 401. Removal of two small units occurs between Brock Road and Church Street. Encroachment on a unit on the north side of ROW west of Thickson Road can be avoided however the enhancements to the interchange necessitate partial removal of the southern unit.

These units have very low species diversity and species dominance varies between Common Reed and cattail species. Removal of portions of these small community polygons, especially those dominated by the aggressive Common Reed is not considered a negative impact. Many of the species within this type of community will naturally re-establish along the new margin of the new highway in low lying areas following construction.

<u>Bridge Work within the Valley System</u>

The following section provides a discussion of the potential impacts to vegetation and vegetation communities due to the proposed bridge works throughout the corridor. There are three bridge locations along Highway 401 within the Study Area that require rehabilitation, widening, or replacement and which will result in potential impacts to vegetation and vegetation communities:

- Duffins Creek Bridge Widening
- Oshawa Creek Bridge Rehabilitation and Widening
- Farewell Creek Bridge Replacement

These larger structures cross the three major valleys of Duffins Creek, Oshawa Creek and Farewell Creek. The existing bridges at Duffins Creek and Oshawa Creek are proposed to be rehabilitated and widened to accommodate the highway platform while the Farewell Creek Bridge at Highway 401 is recommended for replacement.

The Recommended Plan at the Simcoe Street and Harmony Road interchanges also includes additional structures or modifications to existing structures for access ramps and the realignment of adjacent roads that are required to facilitate the proposed interchange improvements. Such ancillary works include a new bridge to span an upstream portion of Oshawa Creek (north of Highway 401) at the new Simcoe Street interchange and the removal and relocation of the Bloor Street Bridge (north of Highway 401) over Farewell Creek as part of the Harmony Road interchange improvements. The proposed works at the Harmony Road interchange also involve the southerly extension of the Bloor Street East bridge located upstream of Highway 401.

Duffins Creek Bridge Widening

This Recommended Plan proposes that the Duffins Creek Bridge be widened by constructing additional decks on both the north and south side of the existing structures. It is currently envisioned that the majority of the proposed construction will be conducted from above the valley as existing piers can accommodate the additional decks. For this reason, it is assumed that valley access by large machinery will not be required. Rock slope protection will be added to the new slopes under the additional decks.

Potential impacts associated with improvements to this bridge include permanent removal of existing valley slope vegetation from the area under the new deck and disturbance of roadside vegetation within the staging areas beside the valley during construction. The area (m^2) of vegetation removals anticipated to occur at this bridge has been accounted for in the Highway Widening results described above. Vegetation within the valley and its slopes is comprised of the cultural community CUW1 – Mineral Cultural Woodland. Similarly, the table lands adjacent to this bridge, where construction staging is anticipated to occur, are comprised of CUW1 and the Cultural Community Class (CU) polygons. The vegetation species that have been captured in the both of these communities are very common in the local and regional landscape. The composition of these communities includes many non-native vegetation species and their presence in this area indicates prior disturbance. The remaining portions of both the CUW-1

and CU units are urban tolerant and anticipated to survive and naturally re-establish along the margin of the new highway following construction. For this reason, the removal of potions of these vegetation units under the new bridge decks and from adjacent table land is not considered a significant impact.

Oshawa Creek Bridge Rehabilitation and Widening

The Recommended Plan includes rehabilitation and widening of the Oshawa Creek Bridge on both the north and south side of the existing structure. This crossing is comprised of three large con-span arches. Extensions are required at each con-span arch. Additional works and bridges within this valley are required to improve the Simcoe Street interchange. The Recommended Plan includes the construction of a new bridge which will span an upstream portion of Oshawa Creek (north of Highway 401) at the new Simcoe Street interchange. Potential impacts associated with this interchange improvement are also discussed below.

The majority of the proposed construction is anticipated to be conducted within the valley. Additionally access by large machinery will be required down in the valley. These works are anticipated to result in vegetation disturbance or removal both within the valley and on adjacent table lands. Access roads and construction methods are to be defined during subsequent Detail Design phases.

Removals are anticipated to include portions of cultural woodlands (CUW1), Mineral Cultural Meadow (CUM1) and Dry – Fresh Deciduous Forest (FOD4). The table lands adjacent to this crossing, where construction staging and access is anticipated to occur, are comprised of CUW1, Cultural Community Class (CU) polygons.

Polygons CUW-1, CUM-1 and CU are indicative of previously disturbed areas and are typical dominated non-native species. FOD4 Dry – Fresh Deciduous Forest Ecosite polygons are typically associated with the floodplain. Native tree species often dominate the overstory in these units although non-native species such as Manitoba Maple are also present. The understory in many of these polygons is often invaded by non-native species including Garlic Mustard (*Alliaria petiolata*) and Common Buckthorn (*Rhamnus cathartica*). The Recommended Plan removes approximately 100 m^2 of the FOD4 unit by encroaching into the polygon that extends southward along the valley. This encroachment, although reducing the area of the unit, leaves the majority of this FOD4 community intact.

Ultimately, impacts from vegetation removal in this area as a result of improvements to the Oshawa Creek crossing structure are anticipated to be reduced off-set by restoration landscaping along the valley corridor using desirable native species.

Farewell Creek Bridge Replacement

The Recommended Plan includes the replacement of the Highway 401 bridge over Farewell Creek. Works will involve the removal of and upstream relocation of the Bloor Street bridge (north of Highway 401), to permit a realignment of Bloor Street associated with re-construction of the Harmony Road interchange.

The proposed Highway 401 Farewell Creek bridge replacement will span the wetted width of the creek and avoid encroachment into the watercourse. The span of the bridge will be increased from 13 m to 18 m. The bridge will have a 1.5 m buffer on both sides of the top of creek embankment. The new Bloor Street bridge will have a clear span of 13 m and provide a 1.5 m buffer on either side of the creek embankment.

It is currently envisioned that the majority of the proposed construction associated with this bridge will be conducted within the valley and that valley access by large machinery will be required. These works are anticipated to require vegetation disturbance or removal both within the valley and on adjacent table lands. The vegetation units in the work area consist of cultural communities CUW1 – Mineral Cultural Woodland and Cultural Community Class (CU) polygons. Adjacent tablelands, where construction staging and access may occur, also contain CUM1 Mineral Cultural Meadow. All of these vegetation units are indicative of previously disturbed areas and are typical dominated non-native species.

A SWD4 Mineral Deciduous Swamp Ecosite polygon occurs south of the existing bridge. This wetland unit is positioned outside and north of the Oshawa Second Marsh boundary. Although dominated by a mix of wetland tree species, they are in significant decline. A dominance of cattail species and Reed Canary Grass in the understory indicates that the unit is transitioning into a Shallow Marsh. While a small portion along the north side of this unit is anticipated to be removed as part of this bridge replacement and associated highway widening, the proposed encroachment will remove less than 10% of the area, leaving a substantial portion of the swamp community intact.

Disturbance and removal of portions of these communities are not anticipated to affect the integrity on the surrounding valley corridor provided adequate erosion and sediment controls and restoration landscaping, using desirable native species, are provided.

<u>Interchange Improvements</u>

The Recommended Plan includes interchange improvements at many locations across the Study Area. Many of these improvements will require only minor encroachments into existing vegetation, all of which consists of cultural

communities that are very common in the local and regional landscape and tolerant of disturbance. The relatively minor disturbances to these vegetation units are similar in effect and significance as the highway widening activities discussed earlier.

The following three highway interchanges merit further discussion due to their reconfiguration and encroachment into adjacent vegetation communities as discussed below:

- Thickson Road Interchange Improvements
- Simcoe Street Interchange Improvements
- Harmony Road Interchange Improvements

Thickson Road Interchange Improvements

The proposed improvements to the Thickson Road interchange include alignment adjustments to most of the existing ramps that will require reworking and removal of most of the Cultural Community vegetation within the existing interchange. Encroachment into the CUW1 / CUT1 polygon positioned in the northeast quadrant and the MAS2-1 cattail dominated unit in the southwest quadrant within the floodplain of the West Corbett Creek will occur. These Narrow-leaved Cattail dominated units also contain Common Cattail and patches of Common Reed.

The majority of vegetation units being disturbed, including the CU and CUW1 / CUT1 units, are not part of larger habitat patches and they provide low species diversity with many non-native species. These vegetation units are common throughout southern Ontario. Many of the species within these communities will naturally re-establish within and adjacent to the interchange following construction.

The Recommended Plan encroaches into the Cattail Mineral Shallow Marsh (MAS2-1) in the southwest quadrant and removes nearly one third of this unit. The proposed encroachment into this unit not anticipated to affect the integrity of the remaining habitat provided adequate erosion and sediment controls are provided and hydrology of the marsh (which is controlled by West Corbett Creek) is not altered. Where possible, consideration will be given to tightening up of the proposed Highway 401 grading at this location during Detail Design to minimize or avoid impact to this feature.

Simcoe Street Interchange Improvements

The Simcoe Street interchange improvements include the introduction of a new westbound off-ramp and on-ramp connection at 1st Avenue in addition to the proposed extension of the Oshawa Creek Bridge. These new features require

disturbance and displacement of several vegetation units within and adjacent to the Oshawa Creek Valley.

Six different vegetation units occur within the Recommended Plan footprint of this interchange improvement including: Cultural Community Class (CU); Mineral Cultural Woodland (CUW1); Mineral Cultural Meadow (CUM1); Meadow Marsh Ecosite (MAM); Shallow Marsh Ecosite (MAS); and, Dry – Fresh Deciduous Forest Ecosite (FOD4) within the Natural Heritage System. The reconfiguration of this interchange will require the removal of portions of these six vegetation units. Cultural units (CU, CUW1 and CUM1) are common throughout the local and regional landscape and contain or are dominated by non-native species. The small marsh MAS / MAM community contains low species diversity with species dominance of Common Reed and cattail species. Removal of this unit within the valley will reduce local habitat variability but is not considered a major impact due its relatively small area and composition of dominant plant species. The Recommended Plan removes approximately 4,480 m^2 of the FOD4 unit by encroaching into the polygon that extends northward along the valley. This encroachment, although reducing the area of the unit, leaves the majority of this FOD4 community intact. It is recommended that construction access and staging within the valley avoid the FOD4 forest unit along the western valley wall.

The Recommended Plan will have the effect of narrowing the valley corridor north of Highway 401 within the Oshawa Creek Valley. The additional crossing of the creek by the westbound off ramp may further constrain terrestrial connectivity below the Highway 401 off ramp although the contiguous forest along the west side of the valley through this section will continue to provide an unobstructed valley corridor for wildlife.

Although the narrowing of the valley corridor and additional bridge span are permanent removals, ecological restoration of areas disturbed by project construction activities along the eastern side of the valley as well as the meadow (CUM1) on the western valley wall would assist vegetation recovery and replacement of the removed habitat. As works within this valley represent the project's most intensive valley alteration, re-vegetation and habitat restoration efforts will be given a high priority in this area during Detail Design and include an aggressive restoration landscaping plan, that uses desirable native species and elevated quantities of calliper material. Restoration with native species of mixed sizes to initiate recovery of mixed age class forest is also recommended. Newly created edges along the FOD4 unit may require the preparation of an edge management plan. Where feasible, a reduction of required valley infill and in the disturbance of the six vegetation units will be considered during subsequent design phases.

Harmony Road Interchange Improvements

The proposed improvements to the Harmony Road interchange include the construction of new eastbound off ramp and on ramp south of Highway 401 at Harmony Road, the construction of a westbound on ramp and off ramp to Bloor Street, as well as improvements to Bloor Street between Farewell Street to east of Farewell Creek.

Eight different vegetation types occur within the proposed Recommended Plan footprint of this interchange improvement including: Cultural Community Class (CU); Mineral Cultural Meadow (CUM1); Mineral Cultural Woodland (CUW1); Mineral Cultural Thicket (CUT1); Meadow Marsh Ecosite (MAM); Shallow Marsh Ecosite (MAS); Dry – Fresh Deciduous Forest Ecosite (FOD4); and Mineral Deciduous Swamp Ecosite (SWD4). The vegetation in this location tends to be patchy and fragmented due to past disturbance. All of these units are very common in the local and regional landscape. Potential impacts from the proposed interchange improvements include the permanent removal of several small polygons of cultural meadows interspersed with patches of cultural woodland. Being tolerant of disturbance, the remaining portions of the CUT1, CUM1 and MAS units are anticipated to survive and naturally re-establish along the margin of the new highway following construction.

Two units of SWD4 located at the north end of Oshawa Second Marsh within the floodplain of the Harmony-Farewell Creeks will be encroached upon, removing small portions that extend into the MTO ROW.

The deciduous forest (FOD4) located south of Highway 401 and east of Harmony Creek will be entirely removed as a result of the new interchange. Native tree species dominant the overstory in this unit although non-native species such as Manitoba Maple are also present. The proposed footprint will also expose the northern edge in the adjacent FOD7 unit which lies beyond the area of direct disturbance. This unit is dominated by Hybrid Willow, Manitoba Maple and White Elm with an understory dominated by non-native invasive species. Given the dominance of non-native species in this unit indicates the presence of a degraded community, edge effects along newly established boundaries with this FOD7 unit are not anticipated to be a concern.

Re-vegetation and habitat restoration efforts will be given a high priority in this area during Detail Design. The restoration landscaping plan will strive to replace a portion of the FOD4 community using native species and elevated quantities of calliper material.

Wildlife and Wildlife Habitat

This section includes a description of Wildlife and Wildlife Habitat impacts to the following:

- Amphibians and Reptiles
- Species at Risk
- Provincially Significant Wetlands and Designated Areas
- Linkages and Corridors

General recommended mitigation measures for all four components of Wildlife and Wildlife Habitat are discussed together following the discussion on impacts as the mitigation measures can be applied to all features listed if applicable.

No uncommon or at risk wildlife species were identified in the Study Area aside from occasional observations of Barn Swallow (Species-at-Risk (SAR)) in flight. Much of the Study Area beyond the MTO Highway 401 ROW towards the east end is active agricultural habitat, whereas lands to the east are highly urbanized and result in limited wildlife habitat. Vegetation communities to which an impact may be created are mostly Cultural Communities, wetlands and lowland forests with low species diversity comprised of common, tolerant and often invasive plants subject to continuous noise from the highway traffic. In general, these areas afford marginal wildlife habitat for common urban tolerant species. For these reasons, the majority of the proposed vegetation removal within the Study Area is not anticipated to create a measurable impact on individual wildlife species or habitat use.

Amphibians and Reptiles – Potential Impact

Breeding amphibian surveys were performed at 12 locations throughout the identified wetlands in the study area. Some species recorded include: American Toad (*Anaxyrus americanus*), Gray Treefrog (*Hyla versicolor*), and Green Frog (*Lithobates clamitans*). Only three of the 12 sites had recorded frog calls. The locations where frog calls were heard occurred at the larger wetlands associated with West Corbett Creek (Green Frog), Oshawa Creek (American Toad), and Harmony/Farewell Creek (Gray Treefrog, Green Frog).

No basking turtles or nesting sites / attempts were encountered during terrestrial and fish and fish habitat field site visits over the course of the spring and summer months. An Eastern Gartersnake (*Thamnophis sirtalis*), a non-SAR species was observed south of Highway 401 within the MTO ROW east of Brock Road.

The proposed works are not anticipated to significantly impact individual amphibians and reptile species or their habitat given the limited presence of existing species or populations.

Species at Risk – Potential Impact

Barn Swallow (SAR) was observed flying through the Study Area. A colony of Barn Swallow was located inside a barn situated north of the Highway 401 ROW, immediately west of Courtice Road on the south side of Baseline Road outside of the Study Area. No anticipated effects to Barn Swallow or any other at risk species is anticipated as a result of the construction of the Recommended Plan. However, if Barn Swallow is identified within the Study Area during Detail Design, MNRF is to be consulted to determine activity registration and/or permitting requirements under ESA.

Provincially Significant Wetlands and Designated Areas – Potential Impact

The Recommended Plan improvements and related construction activities occur outside the limit of PSWs, ANSIs and ESAs identified within the Study Area. As such, no direct impacts to designated areas are anticipated as a result of project activities. However, indirect impacts may occur as a result of encroachment into adjacent lands and areas providing buffer functions. The significant areas and description of proposed works at the locations where this indirect impact may occur are described below:

- Duffins Creek Coastal Marsh Provincial Life Science ANSI Candidate (located south of Highway 401 west of Westney Road)
- Lower Duffins Creek PSW (located south of Highway 401 east and west of Church Street)
- Oshawa Second Marsh and McLaughlin Bay PSW

Crossings of Natural Heritage Systems occur at:

- Duffins Creek
- Carruthers Creek
- Whitby Harbour Tributary
- West Corbett Creek
- East Corbett Creek
- Oshawa Creek
- Harmony and Farewell Creek and Oshawa Second Marsh
- Robinson Creek
- Tooley Creek

Linkages and Corridors – Potential Impact

Wildlife passage within the Study Area is not anticipated to be significantly altered by the Recommended Plan given the influence of existing urban residential, commercial and industrial developments and road infrastructure. The

existing Highway 401 already presents a barrier to wildlife movement with passage restricted to bridge openings and large culverts. The majority of the existing culverts are likely too small and/or long (low openness ratio) to provide passage for most wildlife species common to the Study Area. The proposed lengthening of larger culverts and widening of valley bridge structures is not anticipated to reduce wildlife passage given the relatively small incremental addition in length and the large height of the valley bridges. Where feasible, the additional new crossings over Harmony and Farewell Creek valley systems will be sized to accommodate wildlife passage that matches or exceeds existing highway structures. Appropriate openness ratios for wildlife species common to the study area, such as small mammals and herpotofaunal will be used during subsequent design phases at these new crossings to influence the design of the structure so that target wildlife species are afforded passage. At Detail Design additional opportunities to integrate techniques from the Wildlife Corridor Protection and Enhancement Plan (CLOCA, 2015) should be explored.

Recommended Mitigation Measures

The following discussion provides a summary of the suite of mitigation measure and operational constraints recommended for incorporation into future contract documents during the subsequent Detail Design phase of this project, for the protection of terrestrial ecosystems (species and habitat including: Amphibians and Reptiles, SAR, Provincially Significant Wetland and Designated Areas, and Linkages and Corridors). These mitigation measures range from Best Management Practices (BMPs) to site specific strategies, which may be superseded by refined measures or techniques as time passes. Current measures and BMPs available at the time of construction will be implemented. Relevant Ontario Provincial Standards Specifications (OPSS) are to be followed.

Clearing and Grubbing

Mitigation measures will be applied during clearing and grubbing activities to minimize removal of native vegetation; minimize impact to retained features, maintain water balance and avoid native soil disturbance. Mitigation measures that should be applied where applicable include:

- Removal of natural vegetation will take place outside of the breeding bird window (April 1- to August 31) in order to avoid disturbance of migratory breeding birds protected by the *Migratory Birds Convention Act (1994).*
- Further screening for Barn Swallow (SAR) nesting activity at structures requiring replacement or rehabilitation will be performed during subsequent Detail Design phases given the confirmed presence of this species within the Study Area.
- Tree removal will be restricted to the working area and minimized were possible.

- Trees will be felled into the ROW to avoid damaging other standing vegetation. Trees will be felled away from any watercourse where it is safe to do so.
- Tree grubbing will be restricted to the required construction activity zone. Where possible, tree stumps will be cut flush to the ground and grubbing avoided to minimize soil disturbance, particularly in erosion prone areas adjacent to Duffins Creek Bridge, Oshawa Creek Bridge and interchange, Harmony Road interchange and Farewell Creek Bridge.
- Trees along newly created edges of forests will be flush cut (not grubbed) to stimulate suckering regeneration along remaining forest edge. This is particularly relevant in FOD units associated with the Simcoe Street and Harmony Road interchanges.
- Tree hording fence (i.e. tree protection fence) will be established along the edge of disturbance to prevent intrusion and stockpiling of materials into adjacent forest and swamp areas etc.

Sediment and Erosion Control

Mitigation measures should be used for erosion and sediment control to prohibit sediment from entering adjacent water bodies, wetlands and forested areas. The primary principles associated with erosion and sediment control (ESC) protection measures are to a) minimize soil mobilization; b) minimize the duration of soil exposure; c) retain existing vegetation where feasible; d) keep runoff velocities low; and, e) trap sediment as close to the source as possible. Mitigation measures that should be applied where applicable include:

- Silt fence will be established adjacent to sensitive features at the limit of construction throughout the Study Area to prevent sediment laden water from entering these features. Specific locations requiring silt fence and other erosion and sediment control structures will be determined at Detail Design.
- Erosion and sediment control structures will be designed, installed, maintained, and removed according to *Erosion and Sediment Control Guideline for Urban Construction (2006),* applicable *OPSS Guidelines,* and/or established MTO procedures.
- Exposed soils will be stabilized and/or re-vegetated as soon as possible (within 45 days) with native seed mixes to reduce erosion. If stabilization is not possible by plantings, then other appropriate erosion controls (e.g. coir mats) will be applied in the interim.
- Sediment control structures will be regularly inspected and checked after storms and repaired as required. The structures will be cleaned out when accumulated sediment reaches half the design height.

Grading

Mitigation measures that should be applied where applicable include:

- Grading impacts will be minimized where possible during Detail Design within and adjacent to all natural areas with particular attention given to the following locations: west of Carruthers Creek adjacent to the Salem Road westbound off-ramp, West Corbett Creek, Oshawa Creek (Simcoe Street interchange), and Harmony Road interchange.
- Mitigation measures will be used during grading to minimize the overall grading footprint and keep gradients low.

Equipment Maintenance and Materials Management and Disposal

Mitigation measures that should be applied where applicable include:

- Refueling will not be permitted within 30 m of any woodland, wetland or watercourse, or the top of bank areas.
- Stockpiling of materials and staging will be located outside of woodlands and thickets to the extent possible.
- Soil from vegetation communities containing invasive plant species will not be transported or used in adjacent areas unless it is placed in an area that will be actively managed (e.g., mowed park) or buried below an impervious surface (e.g., road).

Restoration

Mitigation measures that should be applied where applicable include:

- Restoration of land will be designed toward enhancement of ecological function and improvement of landscape interconnectedness at all valley creek crossings. This is of particular importance at the following locations: Duffins Creek Bridge, Oshawa Creek Bridge and interchange, Harmony Road interchange, and Farewell Creek Bridge.
- Restoration of vegetation within stockpiles and staging areas used within the MTO ROW will be restored with native vegetation. Use of non-native species will be avoided.
- Restoration and landscaping plans will use only native species, and ideally those found within the watersheds of TRCA and CLOCA. Vegetation will be sourced from appropriate local genetic stock where possible.
- Use a variety of seeding and planting methods, multiple species and relatively high planting densities for woody species to build natural redundancy into the restoration plans.

Design and Operations

Mitigation measures that should be applied where applicable include:

- Terrestrial passage for small mammals will be considered during Detail Design of new ramps, bridges and culverts where feasible. This is of particular importance at Oshawa Creek (Simcoe Street) and Farewell Creek bridges.
- MTO salt management policy related to salt application, storage and stockpiling of salt-laden snow will be implemented, as well as any new salt management initiatives in place at the time of operation. These measures will reduce salt use and wastage with benefits to the natural environment.

Terrestrial Ecosystems Summary

As a result of the highway widening and bridge and interchange improvements associated with the Highway 401 Recommended Plan, a total disturbance and/or removal of approximately 62 ha of vegetation will be required. The Recommended Plan is anticipated to result in both direct and indirect impacts to the terrestrial ecosystem. Proposed mitigation measures to avoid, minimize or offset impacts to terrestrial ecosystems are summarized in **Table 9-2** below.

TABLE 9-2: SUMMARY OF TERRESTRIAL ECOSYSTEMS IMPACTS AND MITIGATION

Feature	Effect	Mitigation
Cultural Upland Vegetation (meadow, thicket and woodland)	Removal and encroachment of predominantly non-native species and occasional early successional species such as Balsam Poplar	Refinements to grading limit and silt fence during Detail Design and construction phases may limit removals of the plantation east of Harmony Creek.
Lowland Deciduous Forest (FOD7)	Three (3) small areas removed in floodplain at Oshawa Creek, Harmony Creek and Robinson Creek CUW is present on slopes in the existing condition	Consider reducing the requirement for grading and disturbance adjacent to these features during Detail Design. Install tree hoarding (i.e. tree protection fence) and enhance the area with restoration plantings where feasible as part of the Landscape Plan.
Wetland Vegetation (Shallow Marsh)	Three small areas removed between Brock Street and Church Street and west of Thickson Road MAM / MAS exists west of Simcoe Street and is present in the floodplain	Consider reducing the requirement for grading and disturbance at the property limit on north side of ROW west of Thickson during Detail Design to avoid impacts to the wetland in West Corbett Creek Corridor.
Wetland Vegetation	Removal of edges that	Delineation of retained wetland and

Feature	Effect	Mitigation
(Deciduous Swamp) contiguous but not part of Oshawa Second Marsh	extend into the ROW	protection of water quality by installing silt fence.
Forest Units (FOD4)	Potential disturbance to FOD4 at Harmony Creek Potential disturbance to FOD4 at Oshawa Creek	No alternative due to location at Harmony Road. Mitigate via forest restoration (if feasible and within MTO's ROW) on the meadow to the east within Natural Heritage System Locate staging areas, stockpiles, fuelling areas etc. outside of Natural Heritage System; Reforest available meadow habitat where feasible within MTO's ROW and manage edge effects to remaining forest vegetation
Indirect Effects to Designated Features	Potential effects of uncontrolled discharge of contaminated water and/or sediments	Aggressive stormwater control; planting of *Populus* species to control water where stormwater facilities' may not be accommodated. Mitigation to take place where feasible within MTO's ROW
Wildlife Habitat	Removals of habitat for urban tolerant species	Will recover with restoration of where feasible within MTO's ROW
Linkages and Corridors	Potential to constrict corridor at Oshawa Creek	Provide terrestrial passage under new access ramp and maintain openness ratio for small to medium sized wildlife common to watershed. Where feasible within MTO's ROW

Small portions of the project occur within sensitive valley lands such as Oshawa Creek and Harmony Creek.

Efforts have been made to minimize and avoid effects to the valley corridors. In order to off-set the residual effects of vegetation clearing and removal, vegetation restoration and enhancement should be used throughout the project limits with particular attention given to the following areas: Duffins Creek bridge, Oshawa Creek bridge and interchange, Harmony Road interchange, and Farewell Creek bridge.

The application of appropriate mitigation strategies and implementation of vegetation restoration and landscaping during the construction phase of the project will further reduce the magnitude of impacts posed to by this project.

9.2 SOCIO-ECONOMIC ENVIRONMENT

9.2.1 Property Impacts

The Recommended Plan will require approximately 21.2 ha of permanent property from a total of 261 property parcels. Efforts have been made, where appropriate at key locations, to minimize the extent of additional property that is required to accommodate the proposed Highway 401 improvements by including retaining walls, curb and gutter and other measures in the Recommended Plan. MTO will negotiate the transfer of all necessary properties prior to construction.

Property impacts will be confirmed during the subsequent Detail Design phase, and once they are confirmed representatives from the MTO Property Section will contact affected property owners to discuss the proposed impacts to their property and begin negotiations to acquire the required property. Stakeholders will also be contacted with respect to temporary property requirements that may be required constructed for construction of the recommended improvements (i.e. temporary limited interest). Upon completion of construction, temporary property will be returned to the owner. All reasonable attempts will be made to restore the land to its original condition.

Residential Properties

Approximately 3.4 ha of residential property from 127 properties will be impacted by the Recommended Plan.

Commercial and Industrial Properties

Approximately 4.4 ha of property will be required from 47 different commercial or industrial properties as a result of the Recommended Plan.

Agricultural

No agricultural property will be impacted or required by the Recommended Plan.

Park Lands

The Recommended Plan will result in impacts to the following park lands:

Cedar Park – the Recommended Plan will result in an encroachment of between 19 and 24 m into the south edge of Cedar Park. The total area is anticipated to be approximately 0.54 ha, including a portion of an existing baseball diamond, basketball court and parking area. A potential concept for the re-configuration of Cedar Park was prepared as part of this study, which would include provision of additional parking on the east side of the park and removal of the south baseball

diamond. Further discussions on the reconfiguration of this park will be undertaken with the Town of Ajax at the Detail Design stage once the final property requirements are confirmed.

Storie Park – the Recommended Plan will result in an encroachment of up to 9 m into the south edge of Storie Park, located adjacent to Oshawa Creek on the west side of Simcoe Street and north of Highway 401, in the City of Oshawa. The total area of impact to the park is approximately 0.03 ha.

Chopin Park – the Recommended Plan will result in an encroachment of between approximately 20 and 30 m into the south edge of Chopin Park, located on the north side of Highway 401 between Ritson Road and Wilson Road in the City of Oshawa. The total area of impact to the park is approximately 0.13 ha.

Other Property Features

Additional properties directly impacted by the Recommended Plan include:

- The Church of Jesus Christ of Latter Day Saints, Ajax Baptist Church, and St Johns Ukrainian Greek Orthodox Church of Canada;
- CN and CP Railway ROW through the Municipality of Clarington; and;
- Various municipal ROWs adjacent to the highway corridor.

Recommended Mitigation Measures

- Efforts have been made, where appropriate at key locations, to minimize the extent of additional property that is required to accommodate the proposed highway improvements by including retaining walls, curb and gutter and other measures in the Recommended Plan. Property impacts will be confirmed during the subsequent Detail Design stage, and once they are confirmed representatives from the MTO Property Section will contact affected property owners to discuss the proposed impacts to their property and begin negotiations to acquire the required property.
- For permanent property taking, compensation will be provided at fair market value. Compensation will also be provided with respect to temporary property requirements that may be constructed for construction of the recommended improvements (i.e. temporary limited interest). Upon completion of construction, temporary property will be returned to the owner.

9.2.2 Landscape Composition

The Recommended Plan will result in minor edge impacts to natural / open space features adjacent to Highway 401 including: Oshawa Creek and Harmony Creek and municipal parks including Cedar Park, Storie Park, and Chopin Park. The

recommended improvements will be constructed generally along the existing Highway 401 corridor and will result in a minor change to existing views and vistas. Landscaping plans will be developed during Detail Design to re-vegetate disturbed areas. Refer to **Appendix D** to view the conceptual Landscape Opportunities Plan for the corridor.

9.2.3 Active Transportation

Where works to crossing roads are required to accommodate the proposed improvements, existing active transportation networks including trails, cycling routes and sidewalks on bridges will be maintained or replaced in kind.

The provision of additional trails, cycling routes and sidewalks on or beneath bridges where they are not currently provided is the responsibility of the municipality. In particular, the existing structures at Park Road, Ritson Road and Bloor Street (over Highway 401) include sidewalks on one side of the bridge only. Each of these structures will be replaced as part of the Recommended Plan. Should the municipality wish to have sidewalks and/or bike lanes included on both sides of the road as part of the current study, the Ministry will work cooperatively with the municipality to find the most suitable way to provide the facilities. However, the provision of these sidewalks will be subject to cost sharing agreements between the Ministry and the Region or municipality.

The existing connections to the Michael Starr Trail crossing at the Albert Street structure will be maintained and/or re-constructed as required to accommodate the future widening of Highway 401 and re-configuration of the Simcoe Street interchange, and the existing Albert Street structure will be replaced to maintain the existing trail crossing on the bridge.

The existing Joseph Kolodzie trail along the Oshawa Creek will be generally unaffected by the Recommended Plan. The Recommended Plan includes a new structure to accommodate the proposed westbound on-ramp over Oshawa Creek. This structure will be constructed to accommodate and minimize impacts to this existing trail.

The City of Oshawa has future plans for providing a Harmony Creek Trail crossing of Highway 401, in the vicinity of the Harmony Road interchange. Potential crossing locations for this trail could include along the proposed eastbound ramp structure over Highway 401, at the Harmony Creek culvert or Farewell Creek structure, or on a separate structure. Further discussions will be required during future stages of design to confirm the recommended crossing location and design requirements. Provision of this trail crossing will be subject to cost sharing agreements between the Ministry and the City of Oshawa.

9.2.4 Air Quality

As discussed in **Section 4.2.2** of this TESR, an air quality assessment was undertaken as part of this study. The purpose of this assessment was to assess the impacts of the increase in traffic volume and the widening of Highway 401 on local and regional air quality, by predicting contaminant concentrations at sensitive land uses adjacent to the highway for the existing, future no-build and future build scenarios. The study considered regularly assessed contaminants of interest for transportation assessments in Ontario, as determined by the MTO and MOECC. These contaminants are generally associated with motor vehicle emissions and included nitrogen dioxide, carbon monoxide and particulate matter, and key volatile organic compounds including benzene, 1,3-Butadiene, formaldehyde, acetaldehyde and acrolein.

Potential Impacts

The results of the analysis indicated that, for most contaminants, the predicted maximum emissions at sensitive receptors near Highway 401 are within applicable air quality thresholds. The exceptions are PM_{10} (coarse particulate matter) and TSP (total suspended particulate matter) and benzene.

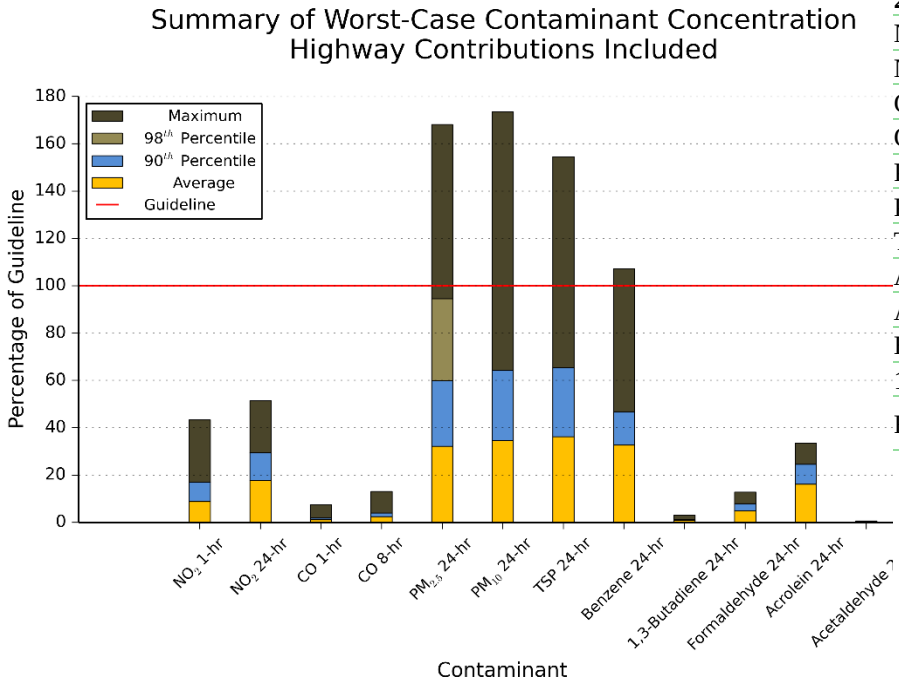
The following outlines the key conclusions from the air quality assessment:

- The maximum combined concentrations for the future build scenario were all below their respective MOECC guidelines or Canada Wide Standards (CWS), with the exception of PM_{10}, TSP and benzene;
- Frequency Analysis determined that with the proposed improvements, the project exceeded PM_{10} guideline six additional days over the 5-year period. The TSP guideline was exceeded 22 additional days over the 5-year period. The benzene guideline was exceeded no additional days over the 5-year period. For all contaminants this equates to additional exceedances less than 2% of the time;
- The maximum change in O_3 (ground-level ozone) and $PM_{2.5}$ (fine particulate matter) concentrations on a regional air quality basis was very small; and,
- Mitigation measures are not warranted, due to the small number of additional days which are expected to exceed the guideline.

Table 9-3 provides a summary of the analysis for the future 2031 build condition.

TABLE 9-3: SUMMARY OF 2031 FUTURE BUILD RESULTS

5 Year Statistical Summary	% of Guideline	
	2031 Future Build	
	NO2 (1-hr)	43%
	NO2 (24-hr)	51%
	CO (1-hr)	8%
	CO (8-hr)	13%
	$PM_{2.5}$ (See Note)	95%
	PM_{10}	173%
	TSP	154%
	Acetaldehyde	1%
	Acrolein	33%
	Benzene	107%
	1,3-Butadiene	3%
	Formaldehyde	13%



Note: The $PM_{2.5}$ results are in compliance with the CWS. The highest three year rolling average of the yearly 98th percentile combined concentrations was calculated to be 25.5 µg/m^3 (years 2007 to 2009) or 95% of the CWS.

Recommended Mitigation Measures for Air Quality during Construction

Air quality during construction may be affected with dust impacts from construction activities and from heavy construction equipment. These impacts will be limited to the construction period and are not considered a recurring activity.

With respect to the potential for temporary air quality impacts during construction of the proposed project, it is recommended that an emissions management strategy based on established best practices be implemented that includes the following:

- Use of dust suppressants, reduced travel speeds for heavy vehicles, efficient staging of activities and minimization of haul distances, covering stockpiles, and periodic watering (as required).
- Regular cleaning of construction sites and access roads to remove construction-caused debris and dust.

- Dust suppression on unpaved haul roads and other traffic areas susceptible to dust, subject to the area being free of sensitive plant, water or other ecosystems that may be affected by dust suppression chemicals.
- Covered loads when hauling fine-grained materials.
- Use of enclosures, wet sandblasting and/or other techniques to minimize dust during any sandblasting operations.
- Prompt cleaning of paved streets / roads where tracking of soil, mud or dust has occurred.
- Tire washes and other methods to prevent trucks and other vehicles from tracking soil, mud or dust onto paved streets or roads.
- Covered stockpiles of soil, sand and aggregate as necessary.
- Compliance with posted speed limits and, as appropriate, further reductions in speeds when travelling at sites with unpaved surfaces.

In order to minimize potential air quality impacts during construction, the contract package prepared in Detail Design will include requirements for implementing best management practices for control of dust and other emissions.

Additional details of this assessment are documented in the report *Air Quality Assessment – Highway 401 Improvements from Brock Road to Courtice Road (February 2015)*, available under separate cover.

9.2.5 Noise

A Noise Analysis was undertaken as part of this study in accordance with MTO and Ministry of the Environment and Climate Change (MOECC) policy. Requirements for the noise assessment and mitigation relating to the construction of new or the expansion of existing Provincial Highways are outlined in the *MTO Environmental Guide for Noise*. These guidelines require that potential noise impacts be investigated where a highway construction project is proposed through or adjacent to a Noise Sensitive Area (NSA).

Potential Impacts

In order to determine a noise impact, a comparison is made for future sound levels with and without the proposed improvements for the Outdoor Living Area (OLA) of properties along the corridor, which generally correspond to an area at ground level where outdoor living activities would take place (i.e. the back yard of a residence or a pool). The objective for outdoor sound levels is to achieve the future ambient noise level that would occur without the proposed improvements. The significance of the noise impact is quantified by comparing the future sound level without the project to the future sound level with the proposed improvements. Additional details regarding the Noise Analysis undertaken as

part of this study can be found in the *Noise Study Report (February 2015)*, available under separate cover.

A total of 19 Noise Sensitive Areas (NSAs) were identified within the Study Area. A description of these NSAs is provided in **Section 4.2.3**, and **Table 4-9**. All 19 NSA's were found to have receivers with noise impacts, which fall under two categories:

- The relative change in sound level at a given receptor of greater than or equal to 5 dBA over the predicted future ambient level
- The absolute sound level at a given receptor of greater than or equal to 65 dBA for the predicted future with undertaking condition

Table 9-4 provides an overview of predicted noise level ranges for the future ambient and future with undertaking conditions, and the number of noise impacted receptors in each identified NSA location. It is noted that where an existing noise barrier adjacent to the highway will be impacted by the proposed widening of Highway 401, it is assumed that these barriers will be relocated adjacent to the new lanes at a similar height as the existing barriers.

TABLE 9-4: PREDICTED NOISE LEVELS AND IMPACT SUMMARY

NSA	Land Use	Future Ambient		Future with Undertaking	
		Range (dBA)	# of Impacted Dwelling Units	Range (dBA)	# of Impacted Dwelling Units
NSA-1	SFR, MFR	52-74	57	51-74	53
NSA-2	SFR, Cemetery	55-70	0	56-73	0
NSA-3	SFR	55-66	5	55-69	29
NSA-4	SFR, MFR	52-74	51	54-76	47
NSA-5	SFR	51-73	45	52-74	53
NSA-6	SFR	51-68	12	51-68	26
NSA-7	SFR	70-75	2	69-75	2
NSA-8	SFR, MFR, School, Athletic Field	50-75	12	52-78	61
NSA-9	SFR, MFR	54-67	8	57-69	15
NSA-10	SFR	69-71	4	70-72	4
NSA-11	SFR	56-64	3	58-74	10
NSA-12	SFR, MFR, Church	55-72	4	56-75	4
NSA-13	SFR	58-67	3	60-65	1
NSA-14	SFR, MFR, Athletic Field	53-76	85	53-77	53
NSA-15	SFR, MFR	55-70	59	56-70	99
NSA-16	SFR	60-71	7	64-70	8

NSA	Land Use	Future Ambient		Future with Undertaking	
		Range (dBA)	# of Impacted Dwelling Units	Range (dBA)	# of Impacted Dwelling Units
NSA-17	SFR, MFR	52-72	58	53-71	59
NSA-18	SFR, Park	60-70	1	60-69	1
NSA-19	SFR	62-75	13	62-75	10

SFR = Single Family Residence, MFR = Multi-Family Residence, OLA = Outdoor Living Area

Each NSA with impacted receptors was assessed for mitigation using MTO guidelines for feasibility. The technical, economic, and administrative feasibility of providing mitigation is as follows:

- **Technical Feasibility** - Review the constructability of the noise mitigation (i.e. design of the noise barrier, roadside safety, shadow effect, topography, ability to achieve a 5 dBA reduction, ability to provide a continuous barrier, etc.)
- **Economic Feasibility** - Based on a cost / benefit assessment of the noise mitigation (i.e. determine cost per benefited receiver)
- **Administrative Feasibility** - Confirm the ability to locate the noise mitigation on the lands within the public ownership (i.e., provincial or municipal ROW)

Table 9-5 provides a summary of all NSAs determined to have noise impacts under the future with undertaking scenario, along with a summary of the noise mitigation analysis.

TABLE 9-5: NOISE MITIGATION ANALYSIS SUMMARY

NSA	Mitigation Recommended?	Comment
NSA-1	Yes	The majority of impacted receivers on the west end of this NSA either do not feature an OLA, or, the OLA is not located on the first floor of the impacted receiver. However, in the eastern portion of this NSA, along the southbound Brock Road - Highway 401 Westbound on ramp, there are several impacted OLAs which qualify for barrier analysis. A new noise barrier in this area is recommended, extending along the ramp alignment to benefit approximately 31 MFR dwelling units.
NSA-2	No	According to MTO policy, cemeteries by themselves do not qualify as noise sensitive, thus the impacted receiver does not qualify for barrier analysis.
NSA-3	No (Existing and Relocated Barrier)	This NSA features an existing noise barrier that is expected to be moved or replaced in-kind along the new widened highway/on-ramp edge of pavement. The replaced portion will be approximately 710m in length and will provide 5-12 dB reduction at impacted receptors.
NSA-4	No	Though the Most Exposed Side (MES) of SFRs along Wright Crescent are

NSA	Mitigation Recommended?	Comment
	(Relocated Barrier)	experiencing impacts, this neighborhood was analyzed for mitigation at the receiver OLAs, which resulted in no further impacts at these receivers. The remainder of the NSA features an existing noise barrier that is expected to be moved or replaced in-kind along the new widened highway/on-ramp edge of pavement. The replaced portion will be approximately 950m in length and will provide 7-14 dB reduction at impacted receptors.
NSA-5	No (Existing and Relocated Barrier)	This NSA features an existing noise barrier that is expected to be moved or replaced in-kind along the new widened highway / on-ramp edge of pavement. The replaced portion will be approximately 180m in length and will provide 5-11 dB reduction at impacted receptors.
NSA-6	No (Existing Barrier)	Though impacts exist at this location, a noise barrier has already been installed at this NSA and will not require displacement.
NSA-7	No	A noise barrier located on the highway ROW was analyzed using the 4:1 rule for the impacted receptors. However, the cost of this noise barrier was found to exceed the MTO typical cost allowance per benefitting dwelling unit (two units), and mitigation is therefore not recommended.
NSA-8	No (Existing and Relocated Barrier)	Barriers on west side of NSA-8 will remain in place after improvements. The east side of this NSA features an existing noise barrier that is expected to be moved or replaced in-kind along the new widened highway / on-ramp edge of pavement. The replaced portion will be approximately 390m in length and will provide 8-11 dB reduction at impacted receptors.
NSA-9	No (Existing and Relocated Barrier)	This NSA features an existing noise barrier that is expected to be moved or replaced in-kind along the new widened highway / on-ramp edge of pavement. The replaced portion will be approximately 450m in length and will provide 5-6 dB reduction at impacted receptors.
NSA-10	No (Existing and Relocated Barrier)	A noise barrier located on the highway and off-ramp ROW was analyzed using the 4:1 rule for the impacted receptors. However, the cost of this noise barrier was found to exceed the MTO typical cost allowance per benefitting dwelling unit (four units), and mitigation is therefore not recommended.
NSA-11	No (Existing and Relocated Barrier)	This NSA features an existing noise barrier on the eastern portion that is expected to be moved or replaced in-kind along the new on-ramp edge of pavement. The replaced portion will be approximately 450m in length and will provide 5-9 dB reduction at impacted receptors. A noise barrier located on the highway off-ramp ROW was analyzed for the impacted receivers on the western portion using the 4:1 rule. However, the cost of this noise barrier was found to exceed the MTO typical cost allowance per benefitting dwelling unit (four units), and mitigation is therefore not recommended.
NSA-12	No	A noise barrier located on the highway and off-ramp ROW was analyzed using the 4:1 rule for the impacted receptors. However, the cost of this noise barrier was found to exceed the MTO typical cost allowance per benefitting dwelling unit (four units), and mitigation is therefore not recommended.

NSA	Mitigation Recommended?	Comment
NSA-13	No (Existing Barrier)	This NSA features an existing noise barrier that will not be impacted.
NSA-14	No (Relocated and Existing Barrier)	This NSA features three existing noise barriers that are expected to be moved or replaced in-kind along the new widened highway / on-ramp edge of pavement. The replaced portion will be approximately 1,550m in length and will provide 5-11 dB reduction at impacted receivers.
NSA-15	No (Relocated and Existing Barrier)	This NSA features two existing noise barriers that are expected to be moved or replaced in-kind along the new widened highway / on-ramp edge of pavement. The replaced portion will be approximately 990m in length and will provide 5-13 dB reduction at impacted receivers. Additionally, it is recommended that the relocated barrier on the western portion of this NSA be extended eastward approximately 120m along the new highway on-ramp. Approximately five impacted dwelling units will be benefitted by this extension, representing OLAs (a playground and row of patios) associated with a multi-family residential complex that are currently not receiving any shielding from existing barrier geometries.
NSA-16	No	A noise barrier located on the highway ROW was analyzed using the 4:1 rule for the single impacted receptor. However, the cost of this noise barrier was found to exceed the MTO typical cost allowance per benefitting dwelling unit (one unit), and mitigation is therefore not recommended.
NSA-17	Yes	There are several impacted OLAs which all qualify for barrier analysis. A new noise barrier in this area is recommended, extending along the Highway 401 alignment to benefit approximately 49 MFR dwelling units.
NSA-18	No	A noise barrier located on the highway ROW was analyzed using the 4:1 rule for the single impacted receptor. However, the cost of this noise barrier was found to exceed the MTO typical cost allowance per benefitting dwelling unit (one unit), and mitigation is therefore not recommended.
NSA-19	No	A noise barrier located on the highway ROW was analyzed using the 4:1 rule for the impacted receptors. However, due to the vast dispersion of impacted receivers, the significant cost of this noise was found to exceed the MTO typical cost allowance per benefitting dwelling unit (10 units). Therefore, mitigation is not recommended.

Recommended Mitigation Measures

The locations where new noise barriers are recommended are summarized in **Table 9-6** below. As noted, where existing noise barriers will be displaced by the recommended widening of Highway 401, these barriers are assumed to be replaced adjacent to the new edge of pavement.

The following details the mitigation evaluation for those NSAs (1 and 17) where mitigation is recommended. A more detailed analysis of the proposed noise barriers will be carried out as part of Detail Design.

TABLE 9-6: RECOMMENDED NOISE BARRIER SUMMARY

NSA	Description
NSA 1	The recommended barrier is approximately 330 m in length and 3.5 to 4 m in height. This noise barrier will be located adjacent to the edge of pavement of the southbound Brock Road to westbound Highway 401 on-ramp. Thirty-one (31) dwelling units would be benefitted according to MTO guidelines (achieving mitigation of > 5 dBA average over the first row). This noise barrier is illustrated in **Figure 9-1**.
NSA 17	The recommended barrier is approximately 800 m in length and 4 to 5.5 m in height. The noise barrier will be located adjacent to the westbound lanes of Highway 401, east of the Harmony Road interchange. This noise barrier will provide noise protection for the residential neighbourhood of multi-family residences northeast of Highway 401, bounded on the southwest by Highway 401, on the east by Townline Road, and on the northwest by approximately Bloor Street. Forty-nine (49) dwelling units would be benefitted according to MTO guidelines (achieving mitigation of > 5 dBA average over the first row). During the Detail Design stage, further investigation for barrier placement and analysis should be carried out due to possible variations in topography along the MTO ROW. This noise barrier is illustrated in **Figure 9-2**.

FIGURE 9-1: PROPOSED MITIGATION FOR NSA-1

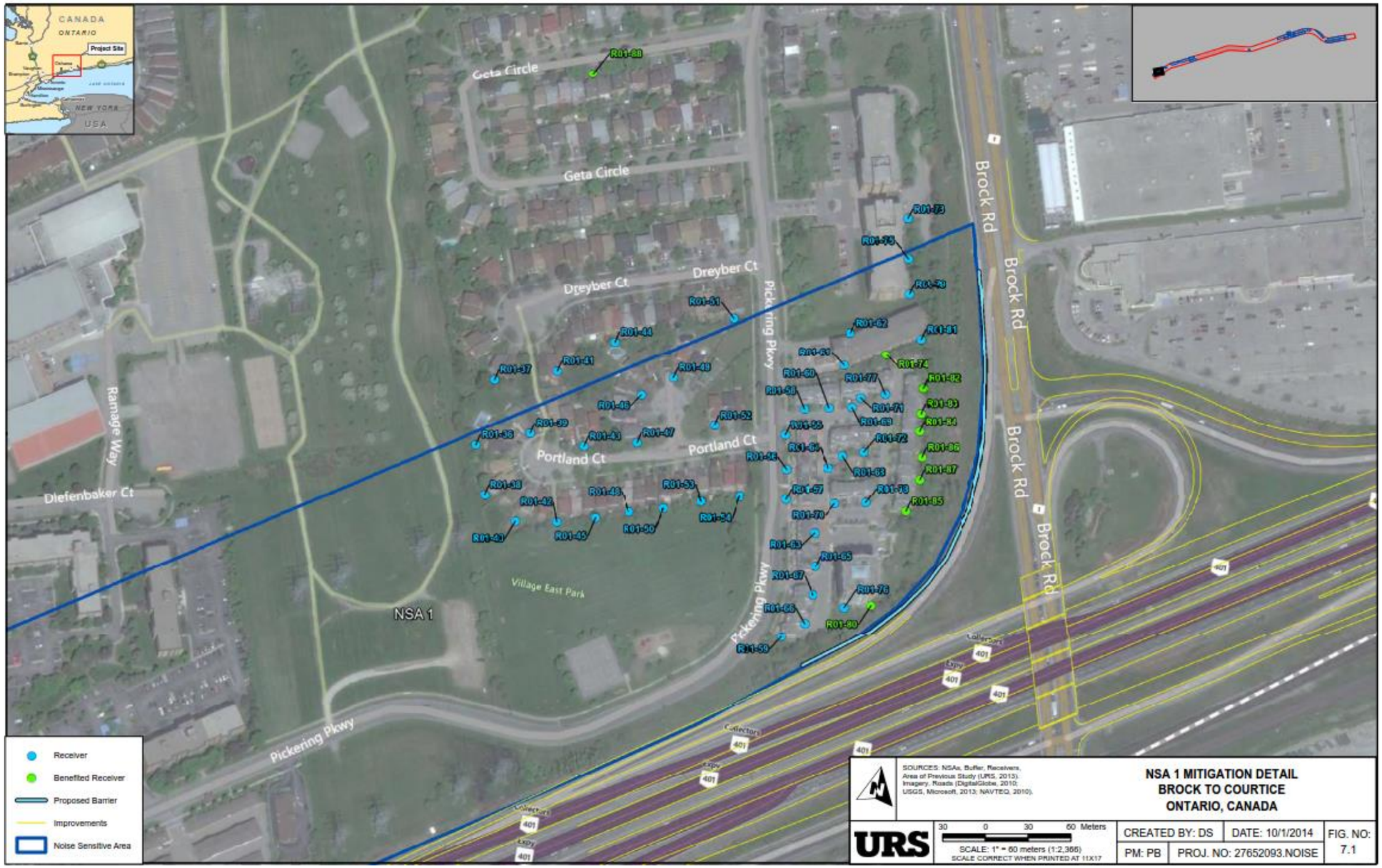
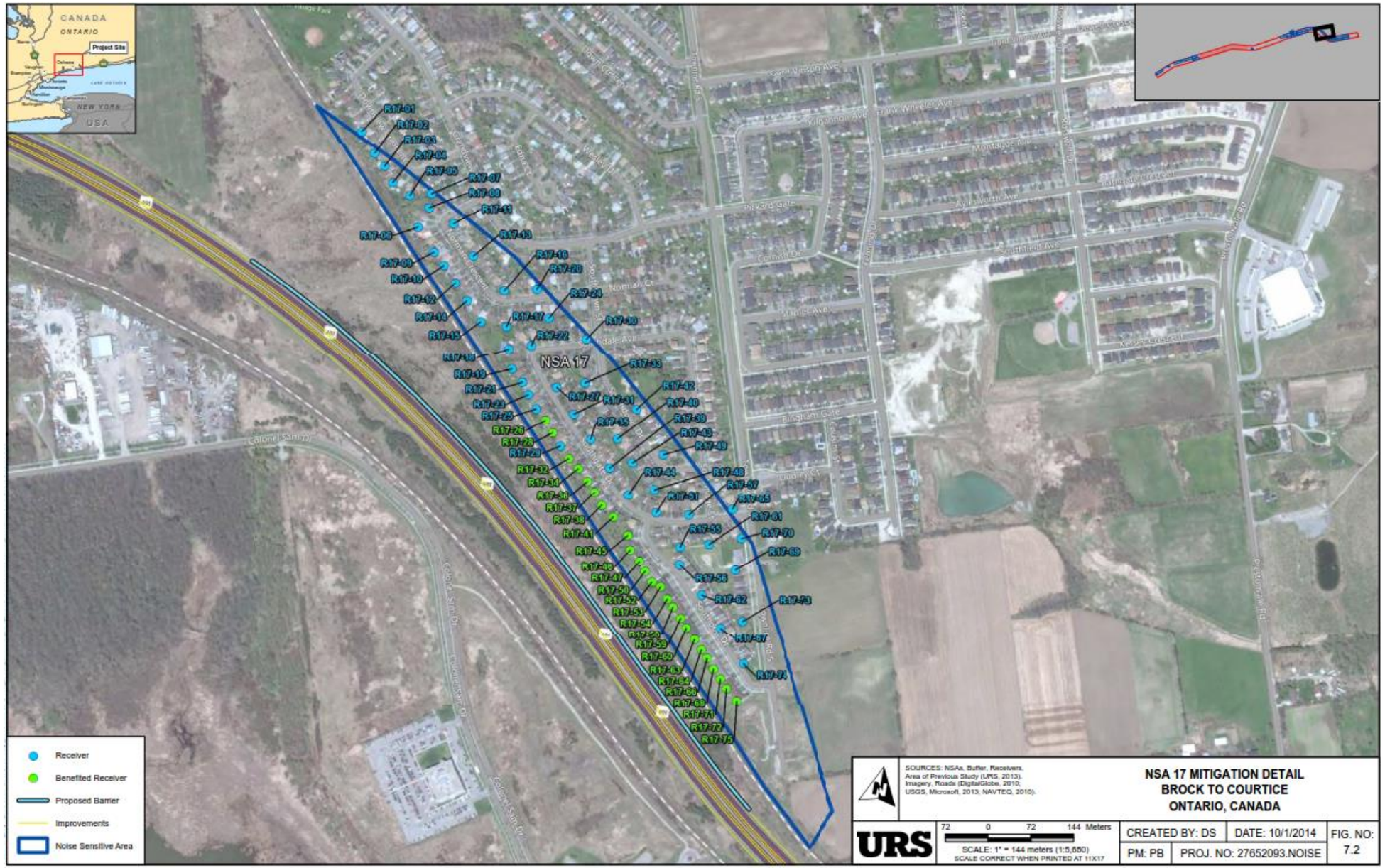


FIGURE 9-2: PROPOSED MITIGATION FOR NSA-17



Construction Noise

In addition to traffic noise produced by the operation of vehicles on Highway 401, interchanges and crossing roads, noise during the construction phase of the study was considered. Unlike operational traffic noise, construction noise is temporary, lasting from a few weeks to several months at any particular location, and is dependent upon the type of construction equipment and processes used, and the time of day that the construction will take place.

Potential Impacts

Construction noise for this project may be expected to produce potential noise impacts at nearby NSAs. In general, the same NSAs identified for potential operational traffic noise impacts may also experience potential construction noise impacts. The potential for construction noise impacts will depend on the number and type of construction equipment and processes to be used and the time of day that they may occur. Construction activities that are expected to occur to implement the Recommended Plan that generate noise include but are not limited to removing pavement, construction of the road base, addition of new lanes, paving, and construction of structures (including pile driving).

Recommended Mitigation Measures

- During construction, the Contractor will be required to abide by any municipal noise control bylaws, keep idling of construction equipment to a minimum, maintain equipment in good working order to reduce noise from construction activities and be available to address any concerns that may arise with respect to noise during construction. Furthermore, complaints will be investigated according to the provisions of the *MTO Environmental Guide for Noise (October 2006).* Any initial complaint from the public requires verification by MTO that the general noise control measures agreed to are in effect. If not, MTO will advise the Contractor of any problems, and enforce its contract.
- To mitigate impacts of any noise barrier replacements within the project limits noise barriers should be planned to be replaced on a staggered basis (i.e. only removed and replace in approximately 100m lengths, leaving an approximate 300m section of existing noise barrier in place between replacement areas in an attempt to keep increased noise levels during construction to a minimum). Any open gaps in the noise barrier walls during construction are to be temporarily fenced off to prevent trespassing onto the highway.
- A noise by-law exemption permit will be pursued from municipalities as appropriate to facilitate night time and weekend construction which may be required in order to minimize impacts to traffic operations.

- Construction equipment should be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts.
- Idling of equipment should be restricted to the minimum necessary to perform the specified work.
- During construction noise complaints will be investigated according to the provisions of the *MTO Environmental Guide for Noise (October 2006)*. Any initial complaint from the public requires verification by MTO that the general noise control measures agreed to are in effect. If not, MTO will advise the Contractor of any problems, and enforce its contract.

A variety of construction noise mitigation strategies can be employed, depending on a variety of conditions. During the Detail Design process, when construction activities and processes are better defined, potential noise impacts and mitigation measures may be re-visited.

9.2.6 Property Waste and Contamination

Potential Impacts

A *Contamination Overview Study* (COS) was undertaken as part of this study. An analysis of the key findings collected during the COS was undertaken to determine the relative potential (highf, moderate and low potential) for soil and groundwater contamination in the Study Area. The analysis was generally based on current and historical land use (sources of contamination), and on surficial geology, hydrology and topography (contaminant migration and sensitive receptors).

The potential for contamination on residential and agricultural properties, except for orchards, are relatively low and mostly related to historic leaking from underground fuel storage tanks or on-site vehicle repair. Properties which had historical or present use of orchards are rated as having high potential of contamination due to the extensive use of pesticides. The likelihood of contamination being present on industrial properties is also relatively high and the extent of contamination is likely more severe due to the industrial processes and materials involved. Commercial properties, which do not involve industrial processes or deal with large amount of chemicals or storage tanks, are given a relative moderate risk rating of “medium”. Similarly, institutional facilities such as churches, public schools and community services are ranked as “medium”, unless specifically indicated to be known for contamination, which will then be ranked as “high”. Properties which were never developed or were developed but only used for agriculture or residential or parkland uses were rated as having a “low” potential for contamination.

The COS identified 174 individual properties along the Highway 401 corridor with "high" potential for environmental contamination, while 59 commercial and/or light industrial properties were identified as having "medium" potential for environmental contamination. The properties containing CNR tracks were also rated as having "medium" potential. Based on a database search, one property within the Study Area was found to have groundwater contamination. In addition, 37 significant spill locations were also identified within the Study Area.

Recommended Mitigation Measures

The following recommendations should be carried out during the Detail Design phase:

- As per the *MTO's Environmental Standards and Practices User Guide dated December 2006*, a more detailed review including a site visit, an interview and completion of a Preliminary Site Screening (PSS) will be undertaken for the properties that are rated as having "high" or "medium" potential for contamination and which will be required to accommodate the proposed improvements to this section of the Highway 401 corridor.
- Based on the nature of the land uses in the Study Area, it is expected that Phase One Environmental Site Assessments (ESAs) will also be required for selected on-site industrial and/or commercial properties that are required for the highway improvements. Since the responsibility for any contamination that is discovered after a property transaction generally rests with the new owner of the property, PSS, Phase One and Phase Two ESA are often conducted prior to any property transactions.
- In addition, 37 significant spill locations were identified within the Study Areas. If highway improvement work (i.e. excavation) is conducted in the vicinity of the spill locations, special attention should be paid to the soil and groundwater in the area for any visual evidence of contamination (i.e. discoloration, odour or free product); if visual evidence of contamination is noted, further investigation work of the soil and/or groundwater quality in the area will be required.
- Excess material will be generated during construction and require proper management (removal, storage and disposal). Materials will be managed in accordance with *Ontario Provincial Standard Specification (OPSS) 180 – General Specification for the Management of Excess Materials.* Should any contaminated materials be encountered during the undertaking, caution will be exercised while handling and disposing of contaminated materials and will be managed in accordance with provincial regulations.
- There is the potential that the structures (bridges, retaining walls etc.) may have asbestos containing materials (ACM). If ACMs are identified and determined to require abatement as a result of the proposed works, appropriate handling, health and safety, abatement and waste disposal

protocols will be followed according to the *Ontario Environmental Protection Act – R.R.O. 1990 Regulation 347: General – Waste Management* and the *Ontario Occupational Health and Safety Act – O. Regulation 278/05: Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations.* Information on the management of asbestos is to be included in the contract documents as a precautionary measure.

Additional details regarding property waste and contamination can be found in the *Contamination Overview Study Report (February 2013),* available under separate cover.

9.2.7 Navigable Protection Act

Transport Canada is responsible for the administration of the *Navigable Protection Act (NPA),* which prohibits the construction or placement of any "works" in navigable waters without first obtaining approval. Appropriate consultation and paperwork is to be submitted to Transport Canada during Detail Design relating to any bridges that cross or affect a potentially navigable waterway.

9.3 CULTURAL ENVIRONMENT

9.3.1 Archaeological Resources

Potential Impacts

The Stage 1 archaeological assessment determined that 46 archaeological sites have been registered within a 2 km radius of the Study Area, including three within the immediate Study Area that may be impacted by the Recommended Plan and will have to be re-located during the Stage 2 archaeological assessment. This, combined with the proximity to watercourses, historic roadways and mapped homestead locations, indicates that the Study Area exhibits moderate to high archaeological site potential.

The results of the field review indicate that much of the lands within the Preliminary Design have been disturbed by previous road construction and grading and therefore no longer contain archaeological potential. While the disturbance visibly extends to the limits of the ROWs throughout much of the Recommended Plan, a number of areas are not visibly disturbed and will require Stage 2 archaeological assessments.

Recommended Mitigation Measures

- For lands assessed during this Stage 1, should the proposed improvements to Highway 401 from Brock Road to Courtice Road result in the

encroachment upon previously undisturbed lands determined to have archaeological site potential, a Stage 2 archaeological assessment should be conducted by a licensed consultant archaeologist in accordance with the MTCS *Standards and Guidelines for Consultant Archaeologists* (2011) prior to any land disturbing activities.

  - Notable areas where Stage 2 investigations are recommended include the lands adjacent to Duffins Creek on the north side of Highway 401, the vicinity of the Thickson Road interchange, the lands adjacent to Oshawa Creek, and the lands adjacent to Harmony Creek and Farewell Creek near the Harmony Road / Bloor Street interchange.

- The condition of the three previously registered three sites which are within the immediate Study Area is presently not known due to lack of reporting information. Therefore, it is recommended that an attempt be made to re-locate these sites during the Stage 2 archaeological assessment in order to determine their presence.
- No archaeological assessment is required in those portions of the Study Corridor that are deemed to have had all archaeological potential removed through past disturbances. Additional details can be found in the *Stage 1 Archaeological Assessment (September 2013)*, available under separate cover.

The above recommendations are subject to MTCS approval, and it is an offence to alter any archaeological site without MTCS concurrence. No grading or other activities that may result in the destruction or disturbance of an archaeological site are permitted until notice of MTCS approval has been received.

Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*.

The *Cemeteries Act*, R.S.O. 1990, c.C.4 and the *Funeral, Burial and Cremation Services Act*, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or corner and the Registrar of Cemeteries at the Ministry of Consumer Services.

9.3.2 Built Heritage Resources

Potential Impacts

As noted in **Chapter 4**, a Built Heritage and Cultural Heritage Landscape Assessment was completed as part of this study, in accordance with the MTO *Environmental Guide for Built Heritage and Cultural Heritage Landscapes*

(February 2007). The process of field review and consultation with municipalities identified a total of 23 Built Heritage Resources and Cultural Heritage Landscapes in or adjacent to the Study Area that have already been recognized or have the potential to be recognized for heritage significance. Of these properties, three are Designated under Part IV of the *Ontario Heritage Act*; 12 are listed on Municipal Heritage Registers or Inventory Lists, and 8 are unrecognized at present but have potential for heritage significance.

TABLE 9-7: MUNICIPALLY IDENTIFIED AND POTENTIAL BUILT HERITAGE RESOURCES (BHRS) AND CULTURAL HERITAGE LANDSCAPES (CHLS)

Site Number / Type	Municipality	Property Description	Heritage Status	Impacts from Recommended Plan
01/CHL	Ajax	St. Francis de Sales Cemetery Notion Rd South	Listed	Indirect impact
02/CHL	Ajax	Part of neighbourhood north of Highway 401 between Harwood Avenue and Cedar Park	None at present, in process	Displacement of 17 residential homes in neighbourhood
03/CHL	Clarington	Trull Cemetery, west of 1558 Baseline Road	None at present, Cemeteries Act	No impact
04/BHR	Clarington	1558 Baseline Road	None at present	No impact
05/BHR	Clarington	Jesse Trull House, 1598 Baseline Road	Primary listing	No impact
06/CHL	Clarington	1711 Baseline Road	Primary listing	No property impacts as part of current study [1]
07/CHL	Clarington	1719 Darlington Park Road	Primary listing	No property impacts as part of current study [1]
08/BHR	Oshawa	St. George Ukrainian Catholic Church, 597 Albert St	"A" Listed Property	Indirect impact
09/BHR	Oshawa	St John the Baptist Ukrainian Orthodox Church, 31 Bloor Street East	"A" Listed Property	Minor property encroachment on edge of parking area, no direct impacts to building
10/BHR	Oshawa	Greek Orthodox Church Evangelismos Tis Theotokou, 261 Bloor Street East	None at present	Indirect impact
11/BHR	Oshawa	213 College Ave.	"B" Listed Property	Indirect impact
12/BHR	Oshawa	13 Knight's Road	"B" Listed Property	No impact
13/BHR	Oshawa	566-68 Simcoe Street S.	"B" Listed Property	Indirect impact
14/BHR	Oshawa	Railway underpass, Simcoe Street S.	None at present	No impact
15/BHR	Whitby	1100 Brock Street	None at	Outside current

Site Number / Type	Municipality	Property Description	Heritage Status	Impacts from Recommended Plan
			present	study limits[2]
16/BHR	Whitby	1124 Brock Street	Listed	Outside current study limits[2]
17/BHR	Whitby	1132 Brock Street	Listed	Outside current study limits[2]
18/BHR	Whitby	1200 Brock Street	Designated OHA pt IV	Outside current study limits[2]
19/BHR	Whitby	1207 Brock Street	Listed	Outside current study limits[2]
20/BHR	Whitby	1601 Hopkins Street South	Designated OHA pt IV	Indirect impact
21/BHR	Whitby	1119 King Street	None at present	Outside current study limits[2]
22/BHR	Whitby	600 Victoria Street East	None at present	Indirect impact
23/BHR	Whitby	601 Victoria Street East	Designated OHA pt IV	No impact

[1] Portions of these properties will be impacted to accommodate the re-configuration of the Courtice Road interchange, which was reviewed as part of the previously approved Highway 407 East Environmental Assessment Study.

[2] These properties fall within the limits of the Highway 401 Salem Road to Brock Street Environmental Assessment Study, and are therefore considered outside the current study limits.

Of the 23 resources identified within the overall study limits, two of the properties will be impacted by the re-configuration of the Courtice Road interchange which was reviewed as part of the Highway 407 East Environmental Assessment Study. These impacts are therefore not considered as part of the current study.

An additional six sites are located in the immediate vicinity of the Brock Street interchange, which was reviewed as part of the Highway 401 Salem Road to Brock Street Environmental Assessment Study.

Of the remaining 15 sites, one site is directly impacted by the Recommended Plan (02/CHL), while one additional site (09/BHL) will have a minor property taking but no direct impact to the heritage structure itself. Seven of these resources are in areas that may experience indirect impacts such as noise, vibration and visual disruption during and/or after construction, and no direct or indirect impacts are anticipated to the remaining six sites.

For the two sites with direct property impacts, a Cultural Heritage Evaluation Report (CHER) will be prepared during Detail Design to determine the specific values of the properties or landscape setting.

In addition to the sites identified in the municipal jurisdiction, there are five locally significant MTO structures in the Study Area, as evaluated by the Heritage

Bridge Committee. Two of these structures, including Brock Street and Henry Street, were reviewed as part of the Highway 401 Salem Road to Brock Street Environmental Assessment study and are considered outside the scope of this study. The remaining three sites are summarized in **Table 9-8**.

TABLE 9-8: MTO BRIDGE SITES WITHIN STUDY AREA WITH HERITAGE SIGNIFICANCE

Name	MTO Site No.	Year Built	Comments	Impacts from Recommended Plan
Oshawa Creek	22-175	1939	CHER completed score of 77, Locally significant 9/06	Rehabilitation and widening of structure required
Albert Street	22-177	1939	CHER completed score of 66, Locally significant 9/06	Structure replacement required
Simcoe Street	22-176	1941	CHER completed score of 62, Locally significant 9/06	Structure replacement required

Recommended Mitigation Measures

Direct Resources:

For resources directly impacted, the MTO *Environmental Guide for Built Heritage and Cultural Heritage Landscapes, Section 6.3.1* Built Heritage Resources states that the preservation / mitigation approaches include:

- Preserve / retain in-situ
- Relocate and adaptive re-use
- Document and salvage

The preferred mitigation for Cultural Heritage Resources is avoidance. Where this is not possible, resource in question should be relocated and conserved for adaptive reuse. Where neither of these options is viable, the resource must be documented according to the *MTO Environmental Guide for Built Heritage and Cultural Heritage Landscapes (February 2007)*, sub-section *6.3.1.4 Cultural Heritage Resource Documentation Report for Built Heritage Resources.*

The resources directly impacted will be determined in Detail Design to be either relocated and conserved or documented and salvaged. Refer to *Built Heritage Assessment Report (April 2013)*, available under separate cover for additional details on the methods. Any additional directions to the Contractor will need to be provided in a non-standard Special Provision.

Indirect Resources:

For resources indirectly impacted, care will be taken to reduce the potential for indirect impacts during and/or after construction due to noise, access and visual disruption to heritage properties.

Heritage Bridges:

A Cultural Heritage Evaluation Report (CHER) has previously been prepared for each of the three MTO bridges impacted. Sympathetic consideration of potential heritage features for bridge design will be confirmed during Detail Design. Any additional directions to the Contractor regarding the incorporation of sympathetic designs will need to be provided in appropriate Contract Documents during Detail Design.

9.4 TRANSPORTATION

9.4.1 Traffic Disruption and Construction Staging

Conceptual construction staging plans have been developed as part of this study for the overall Highway 401 mainline improvements and at key locations within the Study Area. The final construction staging strategy will be determined during Detail Design, subject to:

- Confirmation of pavement and structure rehabilitation requirements based on additional investigations including additional boreholes and detailed condition surveys at all structures;
- Further refined traffic analysis based on updated traffic volume forecasts to define a detailed staging plan and understand lane closure implications; and
- Consideration of other closure options, e.g. weekend or long-term closures of individual ramps or interchanges, etc.

It is anticipated that some smaller components of the Recommended Plan or rehabilitation assignments such as individual structural rehabilitations or localized pavement improvements may be constructed in advance of the main rehabilitation or widening contracts. The details of these contracts will be determined by MTO based on future assessments or localized rehabilitation requirements.

9.4.2 Additional Interchange Access Locations

Colonel Sam Drive and Townline Road Extension/Prestonvale Road

The Region of Durham's Transportation Master Plan identifies future interchanges with Highway 401 at Colonel Sam Drive and a Townline Road Extension / Prestonvale Road. Traffic analysis undertaken for this study has demonstrated that the future capacity and operational requirements of the section of Highway 401 between Harmony Road and Courtice Road can be sufficiently addressed with the proposed improvements to Highway 401 and the adjacent interchanges. While additional interchanges at these locations are therefore not being pursued by MTO as part of this study, the study has included review of the general technical feasibility of potential interchanges at these locations at a

concept level. The review has identified that there are potentially significant profile and grading issues associated with interchanges at both locations, given the proximity of the adjacent rail corridors and municipal road connections. Further analysis would be required to confirm whether these geometric concerns could be addressed and the technical feasibility of interchanges at both locations.

The recommendations from this study do not preclude a separate EA study to be undertaken by others to examine the need and justification for new interchanges at these locations, and to confirm the technical feasibility of these interchanges. Should a study by others be pursued for new interchanges at these locations, it will need to examine, as a minimum, the impacts of the proposed changes on the footprint, capacity and operation of the Highway 401 mainline and the recommended interchange configurations at the adjacent Harmony Road / Bloor Street and Courtice Road interchanges with Highway 401. The study will also include mitigation measures acceptable to the Ministry that would address any impacts to the Highway 401 mainline and existing local interchanges. The technically preferred alternative and associated design must be endorsed by MTO as part of the study process.

Durham Live (Church Street)

Durham Live is a planned 220-acre, mega-entertainment tourist destination that could include a casino in the area near Bayly Street and Church Street. The planned development includes potential new interchange access to and from Highway 401 west at Church Street. Given that planning of this development is still in the early stages and has not been approved, this potential access with Highway 401 was not considered as part of the current study. Should a potential interchange be pursued at Church Street (by others), the study will need to examine, as a minimum, the impacts of the proposed changes on the capacity and operation of the Highway 401 mainline and existing local interchanges, including Salem Road and Westney Road. The study will also need to investigate impacts to the existing Highway 401 infrastructure including the Highway 401 structures over Church Street / Duffins Creek, and include mitigation measures acceptable to the Ministry that would address any impacts to the Highway 401 mainline and existing local interchanges. The technically preferred alternative and associated design must be endorsed by MTO as part of the study process.

Bloor Street / Farewell Street

The City of Oshawa has expressed an interest in the provision of an additional eastbound off-ramp from Highway 401 to Farewell Street, in order to improve truck traffic access to southern areas of Oshawa including Oshawa's port lands and a potential new container port, and for commuter traffic to the General Motors Business Park. Should a container port be approved for this location in the future, additional access opportunities to Farewell Street (such as an

eastbound off-ramp connection east of Farewell Street) may be explored at a later date as part of a separate study. The impacts to the capacity and operations of the Highway 401 mainline and proposed interchange ramps at both Ritson Road and Harmony Road / Bloor Street will need to be examined as part of the separate study. The technically preferred alternative and associated design must be endorsed by MTO as part of the study process.

9.4.3 Rail

Between approximately Brock Road and Brock Street, CN and CP Rail lines are located directly adjacent to the south side of Highway 401. The CP Rail line is utilized by GO Transit, which operates stations in the southwest quadrants of Highway 401 / Westney Road (Ajax GO Station), Highway 401 / Brock Street (Whitby GO Station), and Highway 401 / Thornton Road (Oshawa GO Station). These rail corridors are also located adjacent to Highway 401 between approximately Harmony Road and Courtice Road. The recommended widening of Highway 401 and associated interchange improvements will require new or modified retaining walls in some locations between the eastbound lanes of Highway 401 and the rail corridor. Temporary access and coordination with the rail authorities may also be required to facilitate the widening of Highway 401 beneath the existing CP Rail crossing over Highway 401 west of Stevenson Road, and various drainage and grading improvements including culvert extensions between Highway 401 and the rail corridors. Agreements regarding temporary access and construction activities within the rail corridor will be coordinated during the Detail Design stage.

9.4.4 Utilities

A number of utilities are anticipated to require relocation prior to the construction of the Highway 401 improvements. It is expected that utility relocations can be accommodated within the proposed ROW. However, this will be confirmed in consultation with the utilities during Detail Design.

All potentially affected utility companies will be contacted early during Detail Design to confirm plant location and discuss relocation strategies / cost-sharing. Impacts and mitigation requirements will be considered in relation to alternative relocation options.

Furthermore, it is anticipated that utility relocations will be completed in a timely manner before construction in certain locations. If it is necessary to complete utility relocations during construction, the Contractor will be required to coordinate the timing of each operation to ensure that they are carried out independently. Special provisions will be included in the contract documents to address this, and to ensure that care and precautions are taken to safeguard existing utilities from damage.

9.4.5 Other Transportation Issues

The recommended highway and roadway improvements have been developed based on the knowledge of future development and traffic projections available at the time of undertaking the study. During the future Detail Design stage, the recommended plan will be reviewed in light of the existing conditions at that time.

Channelized Right-Turns

The Region of Durham has expressed interest in the provision of channelized right-turn lanes at a number of municipal intersections within the Study Area, and in particular a "smart channel" design which includes a yield condition prior to the crosswalk and no acceleration lane. These locations include southbound Simcoe Street to westbound Bloor Street, southbound Harmony Road to westbound Bloor Street, westbound Bloor Street to northbound Harmony Road, and northbound Farewell Street to eastbound Bloor Street. The potential for channelization of these intersections will be reviewed further during Detail Design, in consultation with the Region of Durham.

Simcoe Street/Bloor Street Roadway Improvements

Traffic volumes and operations at the proposed Simcoe Street/1st Avenue/North Ramp Terminal intersection, and notably for the southbound left-turn lane at this intersection, are largely driven by the projected volumes associated with a future Central Oshawa GO Station along 1st Avenue, east of Simcoe Street. During Detail Design, additional consultation with GO Transit/Metrolinx will be held to review the availability of updated traffic projections or actual traffic counts associated with this GO Station. If updated information is available, the need to extend the length of the southbound left-turn lane will be reviewed based on this information. If the future GO Station is constructed (by GO Transit/Metrolinx) in advance of the improvements to the Simcoe Street interchange, it is expected that GO Transit/Metrolinx would review the need for providing adequate turning lane storage requirements along the surrounding municipal road network. In addition, the City of Oshawa may consider restricting Elena Avenue to northbound right-in/right-out access only.

The Region of Durham has also expressed interest in additional roadway or entrance access restrictions in the vicinity of the Simcoe Street interchange. These potential refinements will be considered further during Detail Design, in consultation with the Region of Durham, City of Oshawa and adjacent land owners, as appropriate. Potential modifications may include:

- Restrict access to/from southbound Simcoe Street and plaza entrance located between Lviv Street and 1st Avenue (access restricted to northbound right-in/right-out);
- Restrict westbound access from Lviv Boulevard to southbound Simcoe Street; and,
- Extend raised median island along Bloor Street at Albert Street, to re-enforce the proposed westbound right-in/right-out condition at the intersection.

Champlain Avenue Widening

The Region of Durham has plans for a future widening of Champlain Avenue from the entrance at Durham College to east of Thornton Road, and subsequently from the Durham College entrance northwesterly towards Thickson Road. While the widening of Highway 401 and associated minor realignment of the westbound off-ramp to Thickson Road will encroach into the existing Champlain Avenue right-of-way, it is anticipated that the Champlain Avenue widening can generally be undertaken within the existing municipal right-of-way. However, the final property limit and acquisition requirements on the north side of Champlain Avenue will be determined during the future Detail Design for the Durham Region widening of Champlain Avenue.

Future Widening

The Region of Durham's Transportation Master Plan identifies widening of Wilson Road from 2 to 4 lanes beneath Highway 401, along with the provision of bicycle lanes on either side of Wilson Road. The Wilson Road overpass structure will be replaced as part of the Recommended Plan. The incremental cost of the larger structure to accommodate a future widening of Wilson Road and inclusion of bike lanes will be subject to cost sharing agreements between MTO and the Region or municipality.

9.5 SUMMARY OF ENVIRONMENTAL EFFECTS, MITIGATION AND FUTURE COMMITMENTS

The recommended mitigation measures and commitments to future work to address specific concerns associated with the Recommended Plan are summarized in **Table 9-9**.

Legend

MTO: Ministry of Transportation

MNRF: Ministry of Natural Resources and Forestry

MOECC: Ministry of the Environment and Climate Change

OMAFRA: Ministry of Agriculture, Food and Rural Affairs

TRCA: Toronto and Region Conservation Authority

LSRCA: Lake Simcoe Regional Conservation Authority

MTCS: Ministry of Tourism, Culture, and Sport

MUN: City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa and the Municipality of Clarington in the Region of Durham

UTIL: Utilities

TC: Transport Canada

DFO: Department of Fisheries and Oceans

DEVEL: Developers

OPP: Ontario Provincial Police

CN Rail: Canadian National Rail

CP Rail: Canadian Pacific Rail

TABLE 9-9: SUMMARY OF ENVIRONMENTAL CONCERNS, MITIGATION MEASURES AND COMMITMENTS TO FUTURE WORK

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Mitigation/Protection/Monitoring/Commitments to Future Work
1.0	**Soils**	MTO	• An erosion and sediment control plan will be implemented during construction of proposed works. Measures to be incorporated can include but are not limited to: catchbasin sediment traps, silt fences, rock check dams, erosion control blankets, etc. • Erosion and sediment control structures will be designed, installed, maintained, and removed according to Ontario Provincial Standard Specifications (OPSS).
2.0	**Fish & Fish Habitat**	DFO / TRCA, CLOCA / MNRF / MTO	• Comply with the *Fisheries Protection Policy Statement (DFO 2013)* that requires proponents to demonstrate that measures and standards have been applied to avoid, then mitigate and finally offset residual serious harm to fish that are part of or support commercial, recreational or Aboriginal fisheries. • During construction, apply mitigation measures that encompass implementation of all relevant standard and nonstandard / site-specific protection measures and management practices embodied in MTO's Operational Constraints and Construction Specifications. • The Preliminary Design Recommended Plan will result in permanent occupancy of the creek bed in Oshawa Creek (B-03) and Harmony Creek (C31) which are considered as High and Moderate sensitive systems, respectively. As a result there is a moderate risk of resulting in serious harm to fish and an MTO Project Notification "Moderate/High Risk" Form 2 should be prepared submitted to DFO in Detail Design prior to construction. • The proposed works at Duffins Creek West (B-01), Corbett Creek West (C22), Tributary of Corbett Creek East (C23), 2 Tributaries of Harmony Creek (C29 and C30), Farewell Creek (B-04) and Robinson Creek (C35) represent a low risk of resulting in serious harm to fish. A Fisheries Assessment was undertaken. As a result, an MTO Project Notification "Low Risk" form should be prepared and submitted to DFO in Detail Design prior to construction. • Due to the nature of works proposed at B-01, C22, C23, B-03, C29, C30, C31, B-04, and C35 and the sensitivity of fish and fish habitat within these watercourses, further assessment of impacts as per *MTO's Environmental Guide for Fish and Fish Habitat (2013; the Guide)* is required. A Fisheries Assessment was completed at a Preliminary Design level to determine the risk of causing serious harm to fish and fish habitat at the nine locations listed above. • As a result of this Self-Assessment process, impacts of the Recommended Plan were considered at the following culvert crossings which are all considered Low sensitivity: C01, C02, C03, C04, C05, C06, C07, C08, C09, C10, C11, C19, C20, C21, C24, C25, C26, C27, C28, C32, C33, and C34. There is low risk of the proposed work resulting in serious harm to fish. Confirmation of the results during Detail Design is required prior to construction. **<u>Fish Protection Mitigation Measures</u>** • The MNRF classifies the majority of watercourses in the Study Area as warmwater and therefore, in-water work in many of watercourses will only occur between the months of July 1 to March 31. o Where salmonid migration occurs, in-water work will only occur between July 1 and September 15 (more restrictive timing window to allow for construction works). o In the coldwater/coolwater watercourses, in-water work is only to occur between the months of June 1 to September 15. • All in-water activities shall be performed in the dry. This will require construction to occur behind water tight isolation barriers (coffer dam, Aqua-Dam, sheet piling, etc.). • The water tight work zones shall not occupy more than one third of the active channel at any point in time to maintain downstream flow and fish passage. • Any fish stranded within the temporary in-water work zones will be removed and relocated using appropriate techniques by a qualified fisheries specialist possessing a valid Scientific Collector's Permit. **<u>Erosion and Sediment Control Mitigation Measures</u>** A comprehensive erosion and sediment control (ESC) plan will be developed in subsequent design phases and implemented to prevent migration of sediment laden runoff (or other contaminants), from the construction zone to the creek. This plan will include inspection and maintenance of the measures until final cover is established. Specific aspects include: • Perimeter silt fence installed between the work areas and along the banks of watercourses within the area of construction (where feasible). • Temporary silt fence placed around inlets and outlets of existing culverts in the drainage system (where feasible). • Silt fence properly installed and regularly inspected and maintained. It will be left in place and maintained until all surfaces contributing drainage to these watercourses are fully stabilized. • All exposed and newly constructed surfaces will be stabilized using appropriate means in accordance with the characteristics of the soil material. These surfaces will be fully stabilized and re-vegetated as quickly as possible following completion of the proposed works.

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Mitigation/Protection/Monitoring/Commitments to Future Work
			• Contingency procedures, materials and notification procedures will be readily available for use in the event of a silt release and for general application in regular maintenance and repair. • Grassed swales to be enhanced with rock check dams to provide storage and additional treatment capacity, where necessary. Rock protection is to be provided for swales with velocities greater than 1.5 m/s (where feasible) • During construction, erosion and sedimentation controls (ESC) (rip-rap, silt fence etc.) are to be installed to intercept drainage from external areas and direct it away from exposed surfaces. • Straw bale and rock flow checks to be provided in roadside ditches as required. **Construction Access, Site Controls and Operational Constraints** • The construction access and work areas to be confined to the extent required for the construction activities, and these areas are to be defined in the field using appropriately installed protective fencing or other suitable barriers. • Removal of riparian vegetation, particularly woody vegetation, will be kept to the minimum necessary for the project works. The woody vegetation that will likely require removal will be replaced with appropriate native species. • Any temporarily stockpiled material, construction or related materials will be properly contained (e.g. within silt fencing) in areas separated a minimum of 30 m from any waterbody. • All construction materials and debris will be removed and appropriately disposed of following construction. • Every effort will be made to retain as much of the natural vegetation as reasonably possible to help ensure bank stability, control erosion and expedite the re-colonization of vegetative cover. • Removal of natural vegetation will take place outside of the breeding bird window (April 15 to July 31) in order to avoid disturbance of migratory breeding birds protected by the *Migratory Birds Convention Act (1994).* • Removed shoreline vegetation from watercourses is to be replaced using native vegetation along the newly created shoreline at a ratio that exceeds the removal of woody stock. • All activity will be controlled so as to prevent entry of any petroleum products, debris or other potential contaminants / deleterious substances, in addition to sediment as outlined above, to any waterbody. No storage, maintenance or refuelling of equipment will be conducted near any waterbody. A Spills Prevention and Response Plan will be developed and kept on site at all times. **Protection during Removal and Extension of the Existing Bridges and Culverts** • Appropriate containment systems (e.g. coffer dams, Aqua-Dam, sheet piling, etc.) will be designed and implemented during the removal of the existing structures to prevent entry of debris into watercourses. This system(s) will address large materials and fine particulates, and will be regularly monitored to remove and appropriately dispose of accumulated material. • Materials that fall in the water will be carefully retrieved to minimize disturbance. • All excavated material shall be removed and deposited in an area above the high water mark of the shoreline and be contained behind properly installed and maintained sediment barriers or devices. **Rehabilitation Following Construction** • All of the areas disturbed during construction will be restored, stabilized and revegetated as soon as the works are completed to prevent migration of fine material to watercourses during runoff events, as well as minimizing the opportunity for colonization of the area by invasive species. • To reduce the potential impact of this activity on fish, rounded river stone (cobble stone) to be applied to areas of disturbance as a means of stabilizing and naturalizing the creek banks (where feasible). • Only native plants, compatible with site conditions will be used. **Site Inspection and Monitoring** • A qualified Fisheries Contracts Specialist will be responsible for conducting regular inspections of the environmental protection measures (ESCs, containment measures, etc.) and

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Mitigation/Protection/Monitoring/Commitments to Future Work
			identifying deficiencies. The inspector will ensure all environmental mitigation and design measures are properly installed / constructed and maintained, and appropriate contingency and response plans are in place and implemented if required. **<u>Impact Off-Setting Measures</u>** Typically, a project strives to minimize impact to fish and fish habitat through relocating works, the evaluation of alternatives, the application of redesign of particular components, and effective selection of both construction materials and techniques. In some instances, these approaches and the application of sound mitigation techniques are insufficient to entirely reduce the impacts to fish habitat. In such cases, alternatives are often selected that create unavoidable harmful effects on fish habitat and offsets for habitat loss is required. The outcome of this Impact Assessment Process has identified that offset measures may be required for to account for impacts to fish and fish habitat at Oshawa Creek and Harmony Creek. The following habitat enhancement opportunities within the ROW have been identified: • Plant woody vegetation along a narrow riparian area along the downstream banks • Restore active erosion areas • Remove existing pollution from watercourses • Removal of identified migratory barriers (e.g. Tributary of Harmony Creek and Tooley Creek). CLOCA has identified that the Highway 401 culvert at Tooley Creek is the main migration corridor to upstream habitat. Furthermore, this location should be prioritized over other candidate locations for habitat restoration works within the study area. • Invasive species management (phragmites) in newly disturbed riparian areas at Tributary of Corbett Creek East (C23) to prevent re-establishment; • Monitor and remove obstructions in culverts.
3.0	**Groundwater**	MTO	• Limit the depth of excavation and minimize the need for dewatering during construction, particularly in HVAs and IPZs; • If dewatering is required, dewatering activities will be conducted in accordance with control procedures as specified in OPSS 518 Control of Water from Dewatering Operations. A Permit to Take Water (PTTW) must be obtained from the Ministry of the Environment (MOE) if the amount of water taken exceeds 50,000 litres/day (50 m^3/day) as per Ontario's Water Taking Regulation (*Ontario Regulation 387/04* made under the *Ontario Water Resources Act*). • In the areas where deep excavations are expected, a pre-construction water well survey will be conducted to confirm the presence or absence of active water wells, and if any are present, a well monitoring program will be established to monitor the wells that could be potentially affected, prior to, during and after the construction activities; any wells to be removed during the highway improvement activities will have to be decommissioned properly as per the Ontario Wells Regulation (R.R.O. 1990, Reg. 903); • Minimize disturbance to existing vegetation and grassed slopes where re-grading is required (disturbed areas will be re-vegetated as quickly as possible after completion of construction activities); • Prepare and implement a stormwater management plan to protect the quality of surface runoff that may infiltrate groundwater resources; • Prepare and implement a spill prevention and control management plan; • Minimize commercial fertilizer usage and runoff by following the MTO prescribed best management practices and Ontario Provincial Standard Specification (OPSS 0804); and • Minimize salt usage and runoff during road de-icing applications by following best practices consistent with those used across North America and employ the latest winter maintenance technologies.
4.0	**Drainage & Hydrology**	MTO	• Where there are proposed storm connections into an existing municipal storm network, flow controls will be implemented to prevent surcharging the receiving system • The proposed stormwater management plan (SWM) includes the use of both existing and proposed SWM ponds. Three new SWM ponds are proposed as follows: o Northeast quadrant of the Westney Road interchange (within the northbound Westney Road to westbound Highway 401 inner loop on-ramp). The pond will provide quantity and quality control prior to discharge into Miller Creek. o Dry pond located on south side of Highway 401, west of Park Road within the existing MTO ROW. o Dry pond located on south side of Highway 401 between the highway and rail corridor, east of Farewell Creek within the existing MTO ROW. • Existing SWM ponds south of the Salem Road interchange and within the Stevenson Road interchange have sufficient capacity to service the proposed Highway 401 widening. • From a fisheries perspective, the three new proposed SWM ponds will not directly outlet into watercourses with direct fish and fish habitat. • During the subsequent Detail Design stage, the existing servicing along the subject municipal roads and the associated drainage impacts of lowering the road profiles will be confirmed. In the event that the existing storm outlet in the sag locations cannot be used to service the proposed road profile, the following servicing options will be considered in

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			the final design stage: o Create a parallel storm sewer to service the sag location and outlet further downstream; and o Implement a mechanical drainage system, such as a pumping station unit, to drain the sag. • A review of additional municipal data and other relevant information should be collected prior to Detail Design to assess the full extent of potential servicing improvements to achieve a gravity outlet. This will include review of more detailed as-built records or sub-surface utility investigations of the existing municipal services, which were unavailable at the time of this study. • Provide both quality and quantity control where required at existing outlet locations. • Generally, the existing road drainage patterns have been maintained under proposed conditions to the extent possible to minimize the potential impacts to existing outlets. • Constraint outlets should be assessed during Detail Design stage to determine the residual conveyance capacity of the receiving storm sewer network. • Additional coordination with municipalities would be required at the final design stage to confirm whether more stringent water quantity controls are necessary. • Quantity control (post-to-pre peak flow controls up to and including the 10 year design flow) should be implemented for the new highway drainage prior to connecting into the municipal system to avoid potential surcharging of the receiving system. • Pipe storage is proposed within the highway corridor to achieve the required storage volumes. • Construction of enhanced ditches. In order to improve the effectiveness of enhanced ditches in the treatment of water consideration should be given during Detail Design for the inclusion of additional treatment features spaced along the enhanced ditches where feasible. • The combination of ponds and enhanced swales will treat a total of 86.4 ha of highway impervious area or the equivalent to 136% of the new pavement area. • Additional information is required from municipalities to confirm available conveyance capacities in receiving storm systems. This assessment will also confirm the necessity for using more stringent quantity control criteria for outlets that discharge into municipal storm systems. • Details for erosion and sediment control measures will be established during Detail Design.
5.0	**Terrestrial Ecosystems**	TRCA / CLOCA / MNRF / MOECC / MTO	• Current measures and Best Management Practices available at the time of construction will be implemented. • Relevant Ontario Provincial Standards Specifications (OPSS) are to be followed during Detail Design. • In order to off-set the residual effects of vegetation clearing and removal, vegetation restoration and enhancement should be used throughout the project limits with particular attention given to the following areas: Duffins Creek bridge, Oshawa Creek bridge and interchange, Harmony Road interchange, and Farewell Creek bridge. • The application of appropriate mitigation strategies and implementation of vegetation restoration and landscaping during the construction phase of the project will further reduce the magnitude of impacts posed to by this project. • At Detail Design additional opportunities to integrate techniques from the Wildlife Corridor Protection and Enhancement Plan (CLOCA, 2015) should be explored. *Clearing and Grubbing* • Mitigation measures will be applied during clearing and grubbing activities to minimize removal of native vegetation; minimize impact to retained features, maintain water balance and avoid native soil disturbance. Mitigation measures that should be applied where applicable include: o Removal of natural vegetation will take place outside of the breeding bird window (April 1- to August 31) in order to avoid disturbance of migratory breeding birds protected by the Migratory Birds Convention Act (1994). o Further screening for Barn Swallow (SAR) nesting activity at structures requiring replacement or rehabilitation will be performed during subsequent Detail Design phases given the confirmed presence of this species within the Study Area. o Tree removal will be restricted to the working area and minimized were possible. o Trees will be felled into the ROW to avoid damaging other standing vegetation. Trees will be felled away from any watercourse where it is safe to do so. o Tree grubbing will be restricted to the required construction activity zone. Where possible, tree stumps will be cut flush to the ground and grubbing avoided to minimize soil disturbance, particularly in erosion prone areas adjacent to Duffins Creek Bridge, Oshawa Creek Bridge and interchange, Harmony Road interchange and Farewell Creek Bridge. o Trees along newly created edges of forests will be flush cut (not grubbed) to stimulate suckering regeneration along remaining forest edge. This is particularly relevant in FOD

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			units associated with the Simcoe Street and Harmony Road interchanges. o Tree hording fence (i.e. tree protection fence) will be established along the edge of disturbance to prevent intrusion and stockpiling of materials into adjacent forest and swamp areas etc. *Sediment and Erosion Control* • Mitigation measures should be used for erosion and sediment control to prohibit sediment from entering adjacent water bodies, wetlands and forested areas. The primary principles associated with erosion and sediment control (ESC) protection measures are to a) minimize soil mobilization; b) minimize the duration of soil exposure; c) retain existing vegetation where feasible; d) keep runoff velocities low; and, e) trap sediment as close to the source as possible. Mitigation measures that should be applied where applicable include: o Silt fence will be established adjacent to sensitive features at the limit of construction throughout the Study Area to prevent sediment laden water from entering these features. Specific locations requiring silt fence and other erosion and sediment control structures will be determined at Detail Design. o Erosion and sediment control structures will be designed, installed, maintained, and removed according to Erosion and Sediment Control Guideline for Urban Construction (2006), applicable OPSS Guidelines, and/or established MTO procedures. o Exposed soils will be stabilized and/or re-vegetated as soon as possible (within 45 days) with native seed mixes to reduce erosion. If stabilization is not possible by plantings, then other appropriate erosion controls (e.g. coir mats) will be applied in the interim. o Sediment control structures will be regularly inspected and checked after storms and repaired as required. The structures will be cleaned out when accumulated sediment reaches half the design height. *Grading* • Mitigation measures that should be applied where applicable include: o The need for grading will be narrowed where possible during Detail Design within and adjacent to all natural areas with particular attention given to the following locations: west of Carruthers Creek adjacent to the Salem Road westbound off-ramp, West Corbett Creek, Oshawa Creek (Simcoe Street interchange), and Harmony Road interchange. o Mitigation measures will be used during grading to minimize the overall grading footprint and keep gradients low. *Equipment Maintenance and Materials Management and Disposal* • Mitigation measures that should be applied where applicable include: o Refueling will not be permitted within 30 m of any woodland, wetland or watercourse, or the top of bank areas. o Stockpiling of materials and staging will be located outside of woodlands and thickets to the extent possible. o Soil from vegetation communities containing invasive plant species will not be transported or used in adjacent areas unless it is placed in an area that will be actively managed (e.g., mowed park) or buried below an impervious surface (e.g., road). *Restoration* • Mitigation measures that should be applied where applicable include: o Restoration of land will be designed toward enhancement of ecological function and improvement of landscape interconnectedness at all valley creek crossings. This is of particular importance at the following locations: Duffins Creek Bridge, Oshawa Creek Bridge and interchange, Harmony Road interchange, and Farewell Creek Bridge. o Restoration of vegetation within stockpiles and staging areas used within the MTO ROW will be restored with native vegetation. Use of non-native species will be avoided. o Restoration and landscaping plans will use only native species, and ideally those found within the watersheds of TRCA and CLOCA. Vegetation will be sourced from appropriate local genetic stock where possible. o Use a variety of seeding and planting methods, multiple species and relatively high planting densities for woody species to build natural redundancy into the restoration plans. *Design and Operations* • Mitigation measures that should be applied where applicable include: o Terrestrial passage for small mammals will be considered during Detail Design of new ramps, bridges and culverts where feasible. This is of particular importance at Oshawa Creek (Simcoe Street) and Farewell Creek bridges. o MTO salt management policy related to salt application, storage and stockpiling of salt-laden snow will be implemented, as well as any new salt management initiatives in place at the time of operation. These measures will reduce salt use and wastage with benefits to the natural environment.

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6.0	**Property Impacts and Acquisition Process**	MTO / MUN / Property Owners	• Efforts have been made, where appropriate at key locations, to minimize the extent of additional property that is required to accommodate the proposed highway improvements by including retaining walls, curb and gutter and other measures in the Recommended Plan. Property impacts will be confirmed during the subsequent Detail Design stage, and once they are confirmed representatives from the MTO Property Section will contact affected property owners to discuss the proposed impacts to their property and begin negotiations to acquire the required property. • For permanent property taking, compensation will be provided at fair market value. Compensation will also be provided with respect to temporary property requirements that may be constructed for construction of the recommended improvements (i.e. temporary limited interest). Upon completion of construction, temporary property will be returned to the owner.
7.0	**Landscape Composition**	MTO / MUN / Property Owners	• The Recommended Plan will result in minor edge impacts to natural/open space features adjacent to Highway 401 including: Oshawa Creek and Harmony Creek and municipal parks including Cedar Park, Storie Park, and Chopin Park. Landscaping plans will be developed during Detail Design to re-vegetate disturbed areas. • The Recommended Plan will result in an encroachment into the south edge of Cedar Park, including impacts to a portion of an existing baseball diamond, basketball court and parking area. A potential concept for the re-configuration of Cedar Park was prepared as part of this study, which would include provision of additional parking on the east side of the park and removal of the south baseball diamond. Further discussions on the reconfiguration of this park will be undertaken with the Town of Ajax at the Detail Design stage once the final property requirements are confirmed. • The Recommended Plan will result in an encroachment into the south edge of Chopin Park, located on the north side of Highway 401 between Ritson Road and Wilson Road in the City of Oshawa. Further discussions on the reconfiguration of this park and/or associated compensation will be undertaken with the City of Oshawa at the Detail Design stage once the final property requirements are confirmed.
8.0	**Active Transportation**	MTO / Municipalities	• Where works to crossing roads are required to accommodate the proposed improvements, existing active transportation networks including trails, cycling routes and sidewalks on bridges will be maintained or replaced in kind. • Should the municipality wish to have sidewalks and/or bike lanes included as part of the current study, the Ministry will work cooperatively with the municipality to find the most suitable way to provide the facilities. However, the provision of these sidewalks will be subject to cost sharing agreements between the Ministry and the Region or municipality. • The existing connections to the Michael Starr Trail crossing at the Albert Street structure will be maintained and/or re-constructed as required to accommodate the future widening of Highway 401 and re-configuration of the Simcoe Street interchange. • The existing Albert Street structure will be replaced to maintain the existing trail crossing on the bridge. • The Recommended Plan includes a new structure to accommodate the proposed westbound on-ramp over Oshawa Creek. This structure will be constructed to accommodate and minimize impacts to this existing trail. • The City of Oshawa has future plans for providing a Harmony Creek Trail crossing of Highway 401, in the vicinity of the Harmony Road interchange. Potential crossing locations for this trail could include along the proposed eastbound ramp structure over Highway 401, at the Harmony Creek culvert or Farewell Creek structure, or on a separate structure. Further discussions will be required during future stages of design to confirm the recommended crossing location and design requirements. Provision of this trail crossing will be subject to cost sharing agreements between the Ministry and the City of Oshawa.
9.0	**Air Quality**	MTO / MOECC	With respect to the potential for temporary air quality impacts during construction of the proposed project, it is recommended that an emissions management strategy based on established best practices be implemented that includes the following: • Use of dust suppressants, reduced travel speeds for heavy vehicles, efficient staging of activities and minimization of haul distances, covering stockpiles, and periodic watering (as required). • Regular cleaning of construction sites and access roads to remove construction-caused debris and dust. • Dust suppression on unpaved haul roads and other traffic areas susceptible to dust, subject to the area being free of sensitive plant, water or other ecosystems that may be affected by dust suppression chemicals. • Covered loads when hauling fine-grained materials. • Use of enclosures, wet sandblasting and/or other techniques to minimize dust during any sandblasting operations. • Prompt cleaning of paved streets/roads where tracking of soil, mud or dust has occurred. • Tire washes and other methods to prevent trucks and other vehicles from tracking soil, mud or dust onto paved streets or roads.

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			• Covered stockpiles of soil, sand and aggregate as necessary. • Compliance with posted speed limits and, as appropriate, further reductions in speeds when travelling at sites with unpaved surfaces. In order to minimize potential air quality impacts during construction, the contract package prepared in Detail Design will include requirements for implementing best management practices for control of dust and other emissions.
10.0	**Noise**	MTO / MOECC	*Noise Barrier Recommendations* • Existing noise barriers which are directly impacted by the proposed widening of Highway 401 and associated interchange improvements will be replaced/relocated adjacent to the new lanes at a similar height as the existing barriers. In addition, the relocated barrier adjacent to the eastbound lanes of Highway 401 at Ritson Road (NSA-15) will be extended by approximately 120 m along the new highway on-ramp. • Additional noise mitigation (i.e. noise walls) will be provided at two locations: o NSA-1 – The recommended barrier in this area is approximately 330 meters in length and 3.5 to 4 meters in height. This noise barrier will be located adjacent to the edge of pavement of the southbound Brock Road to westbound Highway 401 on-ramp. Thirty-one dwelling units would be benefitted according to MTO guidelines (achieving mitigation of > 5 dBA average over the first row). o NSA-17 – The recommended barrier in this area is approximately 800 meters in length and 4 to 5.5 meters in height. The noise barrier will be located adjacent to the westbound lanes of Highway 401, east of the Harmony Road interchange. This noise barrier will provide noise protection for the residential neighbourhood of multi-family residences northeast of Highway 401, bounded on the southwest by Highway 401, on the east by Townline Road, and on the northwest by approximately Bloor Street. Forty-nine dwelling units would be benefitted according to MTO guidelines (achieving mitigation of > 5 dBA average over the first row). During the Detail Design stage, further investigation for barrier placement and analysis should be carried out due to possible variations in topography along the MTO ROW. *Construction Noise Mitigation* • During construction, the Contractor will be required to abide by any municipal noise control bylaws, keep idling of construction equipment to a minimum, maintain equipment in good working order to reduce noise from construction activities and be available to address any concerns that may arise with respect to noise during construction. Furthermore, complaints will be investigated according to the provisions of the MTO Environmental Guide for Noise (October 2006). Any initial complaint from the public requires verification by MTO that the general noise control measures agreed to are in effect. If not, MTO will advise the Contractor of any problems, and enforce its contract. • To mitigate impacts of any noise barrier replacements within the project limits noise barriers should be planned to be replaced on a staggered basis (i.e. only removed and replace in approximately 100m lengths, leaving an approximate 300m section of existing noise barrier in place between replacement areas in an attempt to keep increased noise levels during construction to a minimum). Any open gaps in the noise barrier walls during construction are to be temporarily fenced off to prevent trespassing onto the highway. • A noise by-law exemption permit will be pursued from municipalities as appropriate to facilitate night time and weekend construction which may be required in order to minimize impacts to traffic operations. • Construction equipment should be maintained in an operating condition that prevents unnecessary noise, including but not limited to non-defective muffler systems, properly secured components, and the lubrication of moving parts. • Idling of equipment should be restricted to the minimum necessary to perform the specified work. • During construction noise complaints will be investigated according to the provisions of the MTO Environmental Guide for Noise (October 2006). Any initial complaint from the public requires verification by MTO that the general noise control measures agreed to are in effect. If not, MTO will advise the Contractor of any problems, and enforce its contract. • A variety of construction noise mitigation strategies can be employed, depending on a variety of conditions. During the Detail Design process, when construction activities and processes are better defined, potential noise impacts and mitigation measures may be re-visited. • Substantial noise impacts could be triggered not just by the general construction and realignment of traffic lanes and interchange ramps, but potentially from demolition and reconstruction of existing bridges and overpasses for local roads to accommodate the wider roadway. A variety of construction noise mitigation strategies can be employed, depending on a variety of conditions. The appropriateness and application of these types of mitigation strategies will be examined further during Detail Design when the design and construction details of the Recommended Plan have been determined. Construction noise mitigation strategies include the following: • Time Periods and Duration: Time constraints and use of equipment regulations can be effective in reducing the impacts caused during sensitive time periods (especially during nighttime periods). In addition, operating noisy equipment only when necessary and switching off such equipment when not in use can minimize noise impacts;

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			• Storage Areas: During the planning and design stages of a project, storage areas may be able to be designated in locations removed from sensitive receptors. Where this is not possible, the storage of waste materials, earth, and other supplies may be able to be positioned in a manner that will function as a noise barrier; • Concurrent Operations: It may be possible to schedule several noisy operations concurrently to take advantage of the fact that the combined noise levels produced may not be significantly greater than the level produced if the operations were performed separately; • Early Construction of Noise Barriers: Ultimately, noise barriers that are to be constructed as part of the project for traffic noise abatement can possibly be installed during the initial stages of construction to reduce the noise impacts of the construction; • Alternative Construction Methods: Alternatives to standard construction techniques may also be available and determined to be more practical and/or cost-effective in dealing with construction noise impacts and perceptions; • Less Noisy Equipment: One of the most effective methods of diminishing the noise impacts caused by individual equipment is to use less noisy machinery. For example, electric compressors are significantly quieter than diesel or gasoline engine powered compressors. By specifying and/or using less noisy equipment, the impacts produced can be reduced or, in some cases, eliminated. Source control requirements may have the added benefits of promoting technological advances in the development of quieter equipment; • Enclosures: Enclosures for stationary work may be constructed of wood or any other suitable material and typically surround the specific operation area and equipment. The walls could be lined with sound absorptive material to prevent an increase of sound levels within the structure. They should be designed for ease of erection and dismantling and provide proper ventilation; • Temporary Abatement: Advantage may also be taken of the screening effect of any nearby object such as parapet walls, buildings, trailers, or temporary site offices. Other temporary abatement techniques include the use of temporary and/or movable shielding for both specific and nonspecific operations. Some mobile shielding is capable of being moved intact or being repeatedly erected and dismantled to shield a moving operation. An example of such a barrier utilizes noise curtains in conjunction with trailers to create an easily movable, temporary noise barrier system; and • Monitoring Noise Levels: Regardless of the types of noise abatement strategies and techniques employed on any particular project, successes or failures are ultimately determined by resultant effects on noise levels at sensitive sites and the adherence of the resultant noise levels to the stated construction noise level criteria.
11.0	**Property Waste and Contamination**	MTO / MOECC	The following recommendations should be carried out during the Detail Design phase: • As per the *MTO's Environmental Standards and Practices User Guide* dated December 2006, a more detailed review including a site visit, an interview and completion of a Preliminary Site Screening (PSS) will be undertaken for the properties that are rated as having "high" or "medium" potential for contamination and which will be required to accommodate the proposed improvements to this section of the Highway 401 corridor. • Based on the nature of the land uses in the Study Area, it is expected that Phase I Environmental Site Assessments (ESAs) will also be required for selected on-site industrial and/or commercial properties that are required for the highway improvements. Since the responsibility for any contamination that is discovered after a property transaction generally rests with the new owner of the property, PSS, Phase One and Phase Two ESA are often conducted prior to any property transactions. • In addition, 37 significant spill locations were identified within the Study Areas. If highway improvement work (i.e. excavation) is conducted in the vicinity of the spill locations, special attention should be paid to the soil and groundwater in the area for any visual evidence of contamination (i.e. discoloration, odour or free product); if visual evidence of contamination is noted, further investigation work of the soil and/or groundwater quality in the area will be required. • Excess material will be generated during construction and require proper management (removal, storage and disposal). Materials will be managed in accordance with Ontario Provincial Standard Specification (OPSS) 180 – General Specification for the Management of Excess Materials. Should any contaminated materials be encountered during the undertaking, caution will be exercised while handling and disposing of contaminated materials and will be managed in accordance with provincial regulations. • There is the potential that the structures (bridges, retaining walls etc.) may have asbestos containing materials (ACM). If ACMs are identified and determined to require abatement as a result of the proposed works, appropriate handling, health and safety, abatement and waste disposal protocols will be followed according to the *Ontario Environmental Protection Act – R.R.O. 1990 Regulation 347: General – Waste Management and the Ontario Occupational Health and Safety Act – O. Regulation 278/05: Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*. Information on the management of asbestos is to be included in the contract documents as a precautionary measure.
12.0	**Navigable Protection Act**	MTO / TC	• Appropriate consultation and paperwork is to be submitted to Transport Canada during Detail Design relating to any bridges that cross or affect a potentially navigable waterway.
13.0	**Archaeological Resources**	MTO / MTCS	• For lands assessed during this Stage 1, should the proposed improvements to Highway 401 from Brock Road to Courtice Road result in the encroachment upon previously undisturbed lands determined to have archaeological site potential, a Stage 2 archaeological assessment should be conducted by a licensed consultant archaeologist in accordance

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			with the MTCS Standards and Guidelines for Consultant Archaeologists (2011) prior to any land disturbing activities. o Notable areas where Stage 2 investigations are recommended include the lands adjacent to Duffins Creek on the north side of Highway 401, the vicinity of the Thickson Road interchange, the lands adjacent to Oshawa Creek, and the lands adjacent to Harmony Creek and Farewell Creek near the Harmony Road/Bloor Street interchange. • The condition of the three previously registered three sites which are within the immediate Study Area is presently not known due to lack of reporting information. Therefore, it is recommended that an attempt be made to re-locate these sites during the Stage 2 assessment in order to determine their presence. • No archaeological assessment is required in those portions of the Study Corridor that are deemed to have had all archaeological potential removed through past disturbances. Additional details can be found in the Stage 1 Archaeological Assessment (September 2013), available under separate cover. • The above recommendations are subject to MTCS approval, and it is an offence to alter any archaeological site without MTCS concurrence. No grading or other activities that may result in the destruction or disturbance of an archaeological site are permitted until notice of MTCS approval has been received. Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48 (1) of the *Ontario Heritage Act*. The *Cemeteries Act, R.S.O. 1990, c.C.4* and the *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* (when proclaimed in force) require that any person discovering human remains must notify the police or corner and the Registrar of Cemeteries at the Ministry of Consumer Services.
14.0	**Built Heritage Resources**	MTO / MTCS	*Direct Resources:* • For resources directly impacted the *MTO Environmental Guide for Built Heritage and Cultural Heritage Landscapes*, Section 6.3.1 Built Heritage Resources states that the preservation / mitigation approaches include: o preserve / retain in-situ o relocate and adaptive re-use o document and salvage • The preferred mitigation for Cultural Heritage Resources is avoidance. Where this is not possible, resource in question should be relocated and conserved for adaptive reuse. Where neither of these options is viable, the resource must be documented according to the MTO Environmental Guide for Built Heritage and Cultural Heritage Landscapes (February 2007), sub-section 6.3.1.4 Cultural Heritage Resource Documentation Report for Built Heritage Resources. • The resources directly impacted will be determined in Detail Design to be either relocated and conserved or documented and salvaged. Refer to Built Heritage Assessment Report (April 2013), available under separate cover for additional details on the methods. Any additional directions to the Contractor will need to be provided in a non-standard Special Provision. *Indirect Resources:* • For resources indirectly impacted, care will be taken to reduce the potential for indirect impacts during and/or after construction due to noise, access and visual disruption to heritage properties. *Heritage Bridges:* • A Cultural Heritage Evaluation Report (CHER) has previously been prepared for each of the three MTO bridges impacted. Sympathetic consideration of potential heritage features for bridge design will be confirmed during Detail Design. Any additional directions to the Contractor regarding the incorporation of sympathetic designs will need to be provided in appropriate Contract Documents during Detail Design.
15.0	**Contract Sequencing and Construction Staging**	MTO / MUN	• It is anticipated that some smaller components of the overall recommended improvements or rehabilitation assignments may be constructed in advance of the main rehabilitation or widening contracts, such as individual structural rehabilitations or localized pavement improvements. The details of these contracts including construction staging requirements and contract sequencing will be determined by MTO at a later date subject to the following: o Extent of rehabilitation requirements o Availability of funding o Other provincial priorities • As part of this study, conceptual construction staging plans were developed for the overall mainline improvements and at key locations such as at the Simcoe Street and Harmony Road interchanges to illustrate the general feasibility and concept for construction of the Recommended Plan. Typical staging cross-sections were developed at critical locations

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			along the corridor, particularly at structures, to confirm the general feasibility of the recommended approach. • The conceptual staging strategy was based on the assumption that the existing number of lanes along Highway 401 will generally be maintained during construction, including five lanes in each direction throughout the west section (Brock Road to Salem Road) and three lanes in each direction throughout the east section (Salem Road to Courtice Road). The final construction staging strategy will be determined during Detail Design subject to: o The overall scope of the construction contract including timing of the contract relative to the long-term widening of Highway 401. o Confirmation of pavement and structure rehabilitation requirements based on additional investigations including additional boreholes and detailed condition surveys at all structures; o Further traffic analysis based on updated traffic volume forecasts to define a detailed staging plan and understand lane closure implications; and o Consideration of other closure options, e.g. weekend or long-term closures of individual ramps or interchanges, etc. • It is anticipated that replacement of various bridge structures along the corridor, and notably through the City of Oshawa, will require temporary or long-term road closures along municipal roads. In particular, full road closures of Park Road, Cubert Street, Albert Street, Ritson Road and Wilson Road are anticipated to facilitate replacement of the structures at these locations. The timing of the replacement of these structures will be coordinated to avoid closure of adjacent municipal road crossings at the same time, and additional traffic analysis will be undertaken during Detail Design to review the traffic implications of these closures. Lane reductions are also anticipated along Westney Road, Simcoe Street and Bloor Street (at Harmony Road) to facilitate rehabilitation or replacement activities at these structures. Details of these lane or road closures will be confirmed during the Detail Design stage, in consultation with the local municipalities.
16.0	**Additional Interchange Access Locations**	MTO / MUN / DEVEL	• The Region of Durham's Transportation Master Plan identifies future interchanges with Highway 401 at Colonel Sam Drive and a Townline Road Extension/Prestonvale Road. Traffic analysis undertaken for this study has demonstrated that the future capacity and operational requirements of the section of Highway 401 between Harmony Road and Courtice Road can be sufficiently addressed with the proposed improvements to Highway 401 and the adjacent interchanges. While additional interchanges at these locations are therefore not being pursued by MTO as part of this study, the study has included review of the general technical feasibility of potential interchanges at these locations at a concept level. The review has identified that there are potentially significant profile and grading issues associated with interchanges at both locations, given the proximity of the adjacent rail corridors and municipal road connections. Further analysis would be required to confirm whether these geometric concerns could be addressed and the technical feasibility of interchanges at both locations. The recommendations from this study do not preclude a separate EA study to be undertaken by others to examine the need and justification for new interchanges at these locations, and to confirm the technical feasibility of these interchanges. Should a study by others be pursued for new interchanges at these locations, it will need to examine, as a minimum, the impacts of the proposed changes on the footprint, capacity and operation of the Highway 401 mainline and the recommended interchange configurations at the adjacent Harmony Road/Bloor Street and Courtice Road interchanges with Highway 401. The study will also include mitigation measures acceptable to the Ministry that would address any impacts to the Highway 401 mainline and existing local interchanges. The technically preferred alternative and associated design must be endorsed by MTO as part of the study process. • Durham Live is a planned 220-acre, mega-entertainment tourist destination that could include a casino in the area near Bayly Street and Church Street. The planned development includes potential new interchange access to and from Highway 401 west at Church Street. Given that planning of this development is still in the early stages and has not been approved, this potential access with Highway 401 was not considered as part of the current study. Should a potential interchange be pursued at Church Street (by others), the study will need to examine, as a minimum, the impacts of the proposed changes on the capacity and operation of the Highway 401 mainline and existing local interchanges, including Salem Road and Westney Road. The study will also need to investigate impacts to the existing Highway 401 infrastructure including the Highway 401 structures over Church Street/Duffins Creek, and include mitigation measures acceptable to the Ministry that would address any impacts to the Highway 401 mainline and existing local interchanges. The technically preferred alternative and associated design must be endorsed by MTO as part of the study process. • The City of Oshawa has expressed an interest in the provision of an additional eastbound off-ramp from Highway 401 to Farewell Street, in order to improve truck traffic access to southern areas of Oshawa including Oshawa's port lands and a potential new container port, and for commuter traffic to the General Motors Business Park. Should a container port be approved for this location in the future, additional access opportunities to Farewell Street (such as an eastbound off-ramp connection east of Farewell Street) may be explored at a later date as part of a separate study. The impacts to the capacity and operations of the Highway 401 mainline and proposed interchange ramps at both Ritson Road and Harmony Road/Bloor Street will need to be examined as part of the separate study. The technically preferred alternative and associated design must be endorsed by MTO as part of the study process.
17.0	**Rail**	MTO / CN Rail / CP Rail	• Between approximately Brock Road and Brock Street, CN and CP Rail lines are located directly adjacent to the south side of Highway 401. Temporary access and coordination with the rail authorities may also be required to facilitate the widening of Highway 401 beneath the existing CP Rail crossing over Highway 401 west of Stevenson Road, and various drainage and grading improvements including culvert extensions between Highway 401 and the rail corridors. Agreements regarding temporary access and construction activities

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			within the rail corridor will be coordinated during the Detail Design stage.
18.0	**Utilities**	MTO / UTIL	• A number of utilities are anticipated to require relocation prior to the construction of the Highway 401 improvements. It is expected that utility relocations can be accommodated within the proposed ROW. However, this will be confirmed in consultation with the utilities during Detail Design. • All potentially affected utility companies will be contacted early during Detail Design to confirm plant location and discuss relocation strategies/cost-sharing. Impacts and mitigation requirements will be considered in relation to alternative relocation options. • It is anticipated that utility relocations will be completed in a timely manner before construction in certain locations. If it is necessary to complete utility relocations during construction, the Contractor will be required to coordinate the timing of each operation to ensure that they are carried out independently. Special provisions will be included in the contract documents to address this, and to ensure that care and precautions are taken to safeguard existing utilities from damage.
19.0	**Other Transportation Issues**	MTO / MUN / GO Transit/Metrolinx	*Channelized Right-Turns* • The Region of Durham has expressed interest in the provision of channelized right-turn lanes at a number of municipal intersections within the Study Area, and in particular a "smart channel" design which includes a yield condition prior to the crosswalk and no acceleration lane. These locations include southbound Simcoe Street to westbound Bloor Street, southbound Harmony Road to westbound Bloor Street, westbound Bloor Street to northbound Harmony Road, and northbound Farewell Street to eastbound Bloor Street. The potential for channelization of these intersections will be reviewed further during Detail Design, in consultation with the Region of Durham. *Simcoe Street/Bloor Street Roadway Improvements* • Traffic volumes and operations at the proposed Simcoe Street/1st Avenue/North Ramp Terminal intersection, and notably for the southbound left-turn lane at this intersection, are largely driven by the projected volumes associated with a future Central Oshawa GO Station along 1st Avenue, east of Simcoe Street. During Detail Design, additional consultation with GO Transit/Metrolinx will be held to review the availability of updated traffic projections or actual traffic counts associated with this GO Station. If updated information is available, the need to extend the length of the southbound left-turn lane will be reviewed based on this information. If the future GO Station is constructed (by GO Transit/Metrolinx) in advance of the improvements to the Simcoe Street interchange, it is expected that GO Transit/Metrolinx would review the need for providing adequate turning lane storage requirements along the surrounding municipal road network. In addition, the City of Oshawa may consider restricting Elena Avenue to northbound right-in/right-out access only. • The Region of Durham has expressed interest in additional roadway or entrance access restrictions at the Simcoe Street interchange and vicinity. These potential refinements will be considered further during Detail Design, in consultation with the Region of Durham, City of Oshawa and adjacent land owners, as appropriate, and include: o Restrict access to/from southbound Simcoe Street and plaza entrance located between Lviv Street and 1st Avenue (access restricted to northbound right-in/right-out); o Restrict westbound access from Lviv Boulevard to southbound Simcoe Street; and, o Extend raised median island along Bloor Street at Albert Street, to re-enforce the proposed westbound right-in/right-out condition at the intersection. *Champlain Avenue Widening* • The Region of Durham has plans for a future widening of Champlain Avenue from the entrance at Durham College to east of Thornton Road, and subsequently from the Durham College entrance northwesterly towards Thickson Road. While the widening of Highway 401 and associated minor realignment of the westbound off-ramp to Thickson Road will encroach into the existing Champlain Avenue right-of-way, it is anticipated that the Champlain Avenue widening can generally be undertaken within the existing municipal right-of-way. However, the final property limit / acquisition requirements on the north side of Champlain Avenue will be determined during the future Detail Design stage for the Durham Region widening of Champlain Avenue. *Future Road Widenings* • The Region of Durham's Transportation Master Plan identifies widening of Wilson Road from 2 to 4 lanes beneath Highway 401, along with the provision of bicycle lanes on either side of Wilson Road. The Wilson Road overpass structure will be replaced as part of the Recommended Plan. The incremental cost of the larger structure to accommodate a future widening of Wilson Road and inclusion of bike lanes will be subject to cost sharing agreements between MTO and the Region or municipality. *Ritson Road Ramps* • The provision of a westbound off-ramp to Ritson Road and on-ramp from Ritson Road has been included within the Recommended Plan. These ramps have been identified by the Region of Durham and City of Oshawa as providing significant benefits to the municipalities, and provide better distribution of traffic through the local road network, reducing traffic volumes along the Simcoe Street corridor. The provision of a westbound off-ramp to Ritson Road and on-ramp from Ritson Road has been included within the Recommended Plan. These ramps have been identified by the Region of Durham and City of Oshawa as providing significant benefits to the municipalities, and provide better distribution of traffic through the local road network, reducing traffic volumes along the Simcoe Street corridor. The proponency for the Ritson Road westbound off-ramp will be

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			determined in the future based on further discussions with municipal staff and other relevant parties. *Carpool Lots* • A review of potential carpool lot locations within the corridor was undertaken. Of the potential locations identified within the Study Area, the carpool lot located in the northwest quadrant of the Stevenson Road interchange (with access off of Champlain Avenue) was identified as the most desirable location. However, it is noted that a detailed assessment and evaluation of carpool lot alternatives was not undertaken as part of this study, and further analysis and potential implementation of carpool lots at these or other locations within the Study Area will be completed at the discretion of MTO based on provincial priorities during future stages of design. Alternatives will be evaluated with consideration to impacts to the natural environment, social environment, economic environment and cultural environment, as well as transportation considerations such as accessibility and anticipated utilization. *HOV Lanes* • The current study has reviewed the general feasibility of providing HOV lanes along the corridor as part of the ultimate widening of Highway 401, and the Recommended Plan will not preclude the provision of HOV lanes. However, the decision as to whether HOV lanes are ultimately provided will be made at a later date, closer to the construction of the actual widening of Highway 401. Development of a full HOV system design, including consideration of potential access / egress locations to the HOV lanes, was not undertaken as part of this study. *Miscellaneous* • The traffic analysis identified that with a 10-lane cross-section some congestion may be present in the westbound direction in the AM peak hour between Brock Street and the future West Durham Link. Provision of a continuous auxiliary lane between the Brock Street westbound on-ramp (from the north), and the westbound off-ramp to the West Durham Link is anticipated to decrease congestion levels through this section of Highway 401 in the 2031 horizon year. This section of Highway 401 was reviewed as part of the Highway 401 Salem Road to Brock Street Environmental Assessment study, and the current study is therefore not seeking EA Approval for any additional improvements. However, the provision of the continuous auxiliary lane through this section of Highway 401 will be considered further during the subsequent Detail Design stage for the widening of Highway 401.

9.6 FUTURE CONSULTATION COMMITMENTS

The Project Team will continue to consult with agencies, interest groups, Aboriginal Communities, property owners, and stakeholders regarding the proposed improvements during the Detail Design phase of the project. The Detail Design may also take place under various contracts and at varying times.

9.6.1 Agency Consultation

The Project Team will continue to consult with at a minimum those on the project contact list which include: the Department of Fisheries and Oceans, Transport Canada (regarding the *Navigable Protection Act*) the Ministry of Natural Resources and Forestry, the Toronto and Region Conservation Authority, the Central Lake Ontario Conservation Authority, the Ministry of the Environment and Climate Change, the Ministry of Tourism, Culture, and Sport and the Ministry of Municipal Affairs and Housing will be contacted.

The provincial agencies consulted will be apprised of the commencement of Detail Design for the proposed Highway 401 improvements, as appropriate.

Follow-up work, including field investigations will be undertaken as required to identify site specific sensitivities and to facilitate the development of mitigation measures / compensation plans, and to obtain any necessary permits and approvals.

9.6.2 Municipal Consultation

On-going municipal consultation will continue during Detail Design to discuss impacts of the project (i.e. future development, emergency services, drainage and hydrology, temporary road closures) and recommended mitigation measures with the City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa, Region of Durham, Municipality of Clarington, and emergency service providers.

9.6.3 Aboriginal Groups

Aboriginal Group and Métis Nation of Ontario consultation is required of all Ministry of Transportation highway improvement projects as defined by the Supreme Court of Canada and the *Constitution Act*. At a minimum, the following communities will be consulted during future design stages of this project.

- Mississaugas of Scugog Island First Nation
- Chippewas of Georgina Island First Nation
- Chippewas of Mnjikaning First Nation
- Chippewas of Rama First Nation
- Hiawatha First Nation
- Beausoleil First Nation
- Alderville First Nation

- Curve Lake First Nation
- Williams Treaties First Nations
- Kawartha Nishnawbe First Nation
- Huron Wendat Nation
- Peterborough and District Wapiti Métis Council

9.6.4 Public Consultation

There will be opportunities for consultation during the next phase of the study. The level of consultation with the public will be defined during the next phase (i.e. Detail Design phase). A host of methods may be employed to engage the public, consisting of a mix of: newspaper advertisements, information centres, and other engagement techniques.

9.7 PROJECT MONITORING

9.7.1 Project Specific Technical Monitoring

During construction, MTO or its agent will ensure that the implementation of the mitigating measures and key design features are consistent with the contract and that external notification and consultation are consistent with any commitments that may have been made earlier. Following construction, monitoring will make sure that any follow-up information is provided to external agencies as required. In addition, MTO or its agent will assess the effectiveness of its environmental mitigating measures to ensure the following:

- Mitigating measures are providing the intended control and/or protection;
- The control and/or protection provided by mitigating measure is adequate;
- Additional mitigating measures are provided as required for any unanticipated environmental conditions which may develop during construction;
- Information is available regarding required mitigating measures; and
- Environmental monitoring, after a project is completed, may involve follow-up monitoring of significant measures and/or significant concerns.

9.7.2 Project Specific Class EA Monitoring

During the planning and design stage, MTO or its agent will confirm compliance with the Class EA process before issuing “environmental clearance” for project implementation. Documentation is prepared that is used to assist in scheduled reviews of the current Class EA to ascertain the need for alterations or amendments to improve the application of the Class EA planning process.

9.7.3 Implementation of Environmental Monitoring Framework - Construction

Inspection by Construction Administration Staff

Construction is subject daily to general on-site inspection to ensure the execution of the environmental component of the work and to deal with environmental problems that develop during construction. This is the primary method for compliance monitoring. Staff will use the inspection tasks outlined in the *Construction Administration and Inspection Task (CAIT) Manual,* Contract Special Provisions and Ontario Provincial Standard Specifications (OPSS) as a guide for the monitoring of all aspects of the work.

Site Visits by Environmental Staff

Construction projects with significant mitigating measures / concerns are subject to periodic site visits by consultant construction administration environmental staff. The timing and frequency of such site visits are determined by the schedule of construction operations, the sensitivity of environmental concerns and the development of any unforeseen environmental problems during construction.

10.0 APPLICATION OF CLASS EA PRINCIPLES AND PROCESS

The planning and preliminary design of improvements to Highway 401 from Brock Road to Courtice Road followed the study principles and process set forth in the *Class EA for Provincial Transportation Facilities (amended 2000)*. This section summarizes how the transportation engineering, environmental protection, external consultation, evaluation, documentation, bump-up, and environmental clearance principles were met through the study process undertaken for this project.

10.1 TRANSPORTATION ENGINEERING PRINCIPLES

The transportation engineering principles set forth in the Class EA were addressed throughout the course of this study. The Recommended Plan will allow the Ministry to construct interim improvements (general rehabilitation works) for Highway 401 from Brock Road to Courtice Road along with the proposed long-term widening. The long-term widening improvements may not take place for several years; however, MTO may proceed in advance with rehabilitation works subject to the MTO Class EA process (Detail Design). The improvements to this section of the Highway 401 corridor will enhance the safe and efficient movement of people and goods, meeting the needs of the traveling public, and addressing the transportation problems and opportunities that were identified for this section of the highway. Throughout this project, sound engineering judgment was used to develop a design that responded to the specific needs of the Highway 401 corridor. An analysis of the existing and projected traffic volumes, collision records, highway geometrics and existing infrastructure such as structures and pavement was performed to determine the rehabilitation needs of the corridor and long-term improvement requirements to address future needs.

Various alternatives were evaluated and a technically preferred alternative was selected for preliminary design. The selection of the technically preferred alternatives was based on a number of factors that included: minimizing environmental impacts, minimizing property requirements and impacts to adjacent properties, and providing the maximum transportation benefits in a cost effective manner.

10.2 ENVIRONMENTAL PROTECTION PRINCIPLES

The environmental protection principles described in the Class EA were addressed throughout this study. Minimizing impacts to the environment was a guiding principle at each stage of the planning and preliminary design process. Design alternatives were evaluated, in part, on the basis of potential environmental impacts.

In order to characterize baseline conditions, the existing natural and socio-economic environments were inventoried and described and sensitive and significant features were identified (refer to **Chapter 4**). Potential environmental impacts and mitigation measures were also identified and described (refer to **Chapter 9**).

This study has been conducted to meet the statutory duties and other requirements of federal and provincial environmental legislation and to adhere to MTO's *Statement of Environmental Values*. In some instances, transportation-engineering considerations necessitate activities that would result in impacts to the environment. Appropriate and technically feasible mitigation measures were recommended where such impacts were unavoidable.

Liaison between members of the transportation engineering and environmental teams was an essential component of the study process. This provided a balance between transportation engineering and environmental considerations and allowed the development of reasonable and technically feasible solutions on those instances where environmental impacts could not be avoided entirely.

10.3 EXTERNAL CONSULTATION PRINCIPLES

The external consultation principles outlined in the Class EA were addressed through the external and public consultation process described in **Chapter 3** of this report. An initial notification letter advising of study commencement was distributed to external stakeholders on the Project Team's mailing list.

Two Public Information Centres (PICs) were held to provide an opportunity for the public and agencies to provide input. The PICs were scheduled at key stages of the project, namely the generation of preliminary design alternatives, and the evaluation of the preliminary design alternatives leading to the selection of the Recommended Plan. The PICs were scheduled at key stages of the project, namely to introduce the study and review issues, opportunities and alternatives, and later to review the evaluation of the alternatives, the Recommended Plan and potential mitigation measures. The two PICs were held during the late afternoon / early evening for convenience to stakeholders. PIC #1 was held at two venues over two nights, including at the Quality Hotel and Conference Centre in the City of Oshawa and at the Ajax Convention Centre in the Town of Ajax. PIC #2 was held at the Best Western Plus Durham Hotel and Conference Centre in the City of Oshawa.

A public notice ("Notice of Public Information Centre") was placed in the *Ajax Pickering News Advertiser*, the *Oshawa Whitby Clarington This Week*, the *Toronto Star*, and in the online newspapers at www.durhamregion.com/printeditions for each PIC. The MTO Senior Project Engineer's and the consultant Project Manager's contact information was provided in the notices for those who were unable to attend the PIC.

Consultation with the public and external agencies was used to obtain information regarding the Study Area, the potential effect on external agency mandates as it pertains to the project, and identify issues and concerns. Comments raised by the public and external agencies were addressed appropriately. Letters were prepared in response to specific concerns and the design features were reviewed in light of comments received and incorporated appropriately. Key issues and concerns raised during public and agency consultation are outlined in **Chapter 3**.

Meetings were held at key stages of the study with representatives from the Regional Municipality of Durham, City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa, Town of Clarington, TRCA, CLOCA and GO Transit to identify issues and concerns and seek feedback and endorsement on the proposed improvements.

The Project Team's mailing list was continually updated throughout the project so that all individuals and external agencies were kept apprised of project activities.

A *Notice of Study Completion and Transportation Environmental Study Report Submission* was placed in the *Ajax Pickering News Advertiser*, the *Oshawa Whitby Clarington This Week*, the *Toronto Star* to notify interested parties of the opportunity for review (30-day review period) and comment on this TESR. Letters were also sent to individuals on the Project Team's contact list.

10.4 EVALUATION PRINCIPLES

The evaluation principles outlined in the Class EA were addressed through the analysis and evaluation of alternative designs as described in **Chapter 6** of this report. The evaluation process based on all factors relevant to the decision-making process is also discussed in **Chapter 6**. The evaluation method used in this study was the Reasoned Argument (trade-off) Method. Alternatives were evaluated based on their advantages / disadvantages to the natural environment, social-economic environment, cultural environment, and transportation considerations and cost.

10.5 DOCUMENTATION PRINCIPLES

The documentation principles set forth in the Class EA were addressed through the preparation of this *TESR*, which fulfills the content requirements outlined in the Class EA. This document provides a summary of the study process, recommended improvements, consultation undertaken during the study, and potential environmental issues and mitigation measures.

10.6 PART II ORDER (BUMP-UP) PRINCIPLES

The Part II Order (or bump-up) principles identified in the Class EA were addressed upon submission of this TESR. Following the publication of the *Notice of Study Completion and Transportation Environmental Study Report Submission*, the TESR will be available for public and agency review for a period of 30-day (ending **December 19, 2015**). Letters were also sent to individuals on the Project Team's contact list to inform stakeholders of the 30-day review. No construction activities can commence until all Part II Order requests (if any) have been addressed.

10.7 ENVIRONMENTAL CLEARANCE PRINCIPLES TO PROCEED

This project has followed the study principles and processes set forth in the *Class EA for Provincial Transportation Facilities (2000)* for a Group 'B' project. Environmental clearance for this study to proceed is subject to the following:

- No Part II Order requests submitted during the 30-day TESR review period and all public and external agency comments have been addressed; and
- There are no outstanding issues related to the design of this project that prevent it from proceeding.

If a Part II Order request is received, the decision rests with the Minister of the Environment and Climate Change on whether the project complies with the requirements of the Class EA.