DRAFT Comprehensive Study Report Pursuant to the *Canadian Environmental Assessment Act* for the proposed 407 East Transportation Corridor (October, 2010)

Prepared by:

AECOM
300 – 300 Town Centre Boulevard
Markham, ON, Canada L3R 5Z6
www.aecom.com

905 477 8400 tel
905 477 1456 fax

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60117936

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Executive Summary

ES.1 Background

The Ontario Ministry of Transportation (MTO) is proposing the construction and operation of the 407 East Transportation Corridor project, an extension of the existing 407 transportation corridor from its current terminus at Brock Road in Pickering to Highway 35/115 in Clarington, including two north-south links connecting Highway 401 to the proposed extension of 407, one in West Durham (Whitby) and the other in East Durham (Clarington). The transportation corridor includes a highway component and a transitway component (i.e. a dedicated corridor for transit). The MTO is the project proponent for the 407 East Transportation Corridor Project (the Project).

ES.2 Purpose of this Draft Comprehensive Study Report

The Canadian Environmental Assessment Agency (CEA Agency) has delegated the preparation of this draft Comprehensive Study report, and certain procedural aspects of public participation in its development, to the MTO. The purpose of this draft Comprehensive Study report is to provide, from the proponent's perspective, the information, analysis and conclusions relevant to an eventual determination by the federal Minister of Environment on the likely significance of adverse environmental effects from the project. Guidelines provided by the CEA Agency have identified the scope of the project, the scope of the assessment, and the factors to be considered in order for the Comprehensive Study report to comply with requirements under the *Canadian Environmental Assessment Act* (*CEA Act*).

ES.3 Structure of the Report – Sections 7 and 8

For the reasons explained below, this draft Comprehensive Study report was prepared after the conclusion and approval of the provincial environmental assessment. As a result, the comprehensive study report findings reflect the benefit of substantial input to the technical documentation from agencies, Aboriginal groups and the public. For each environmental component in section 7, the report contains a description of the approach taken; likely effects and mitigation; residual effects; government and public comments on the technical documentation; and how these have been addressed, to date. Section 8 provides the analysis and conclusions on the likely significance of these effects.

ES.4 Comprehensive Study Type of Environmental Assessment

The *CEA Act* applies to federal authorities when they contemplate certain actions or decisions in relation to a project that would enable it to proceed in whole or in part. Under section 5 of the *CEA Act*, a federal environmental assessment may be required when a federal authority (FA):

- is the proponent;
- provides financial assistance to a proponent;
- sells, leases or otherwise disposes of land; or
- issues a permit, licence, or any other approval as prescribed in the *Law List Regulations* under the Act.

A federal authority that proposes to undertake one of the above actions, and is required to ensure that an environmental assessment is conducted under the Act, is referred to as a responsible authority (RA). As per Section 5 of the *CEA Act*:

- Transport Canada's role as a RA under the *CEA Act* arises from its consideration of MTO's use of a small amount of Federal property in the vicinity of Brock Road and Highway 7.
- Fisheries and Ocean's role as a RA arises from the anticipated requirement for authorizations under section 35(2) of the *Fisheries Act* for 27 individual watercourse crossings.

Pursuant to the amendments to the *CEA Act* that came into force in July 2010 the CEA Agency is responsible for conducting the comprehensive study for the Project. The CEA Agency is also the Federal EA Coordinator (FEAC), ensuring that federal authorities fulfill their obligations under the *CEA Act* in a timely manner, and to the extent applicable facilitating the coordination of the federal EA process with the requirements of the Province.

The Minister of Environment receives the final Comprehensive Study report and the public comments received during the public participation phases. Once all necessary information has been provided and the concerns are addressed, the Minister issues an EA decision statement that includes:

- the Minister's opinion as to whether, taking into account the implementation of any mitigation measures the Minister considers appropriate, the project is, or is not, likely to cause significant adverse environmental effects,
- and any mitigation measures or follow-up program that the Minister considers appropriate.

The Minister then refers the project back to the RAs for a decision on their course of action.

ES.5 Consultation and Public Participation

The CEA Agency ensures consultation is carried out with the public and also consults directly with Aboriginal groups.

The required public participation for this comprehensive study involves at least three opportunities:

- initial opportunity to comment on the project and the conduct of the comprehensive study;
- opportunity to participate in the draft comprehensive study (delegated process, timing and content to be determined by the Agency); and
- facilitation of public access to the final comprehensive study report and an opportunity to file comments on it.

The first of these opportunities, comments on the Comprehensive Study Guidelines document commenced on July 19 and was completed on August 20. The current consultation on this draft Comprehensive Study report constitutes the second opportunity. The third opportunity is the comment period on the final Comprehensive Study report. For each of these opportunities, information notifying the public of the opportunity to comment is filed on the CEAR Internet website at www.ceaa.gc.ca. Individuals and groups who have indicated an interest in the project at earlier phases are also being notified directly of these opportunities.

The CEA Agency also administers the Participant Funding Program (PFP) to support participation in the EA. An independent Funding Review Committee (FRC) was established to review applications for funding under the PFP and to recommend the allocation of up to a total of $25,000 in participant funding assistance. In this case, four recipients have received funds under the PFP. In addition to these formal participation opportunities, individuals and groups may comment on the project or the environmental assessment at any time while it is under way.

ES.6 Existing Conditions

The MTO described the existing environmental conditions for 14 environmental components are described in Section 6 of this report. The components are as follows:

1. Air quality and climate (including the consideration of climate change);

2. Noise and Vibration (including the consideration of noise sensitive areas);
3. Surface and subsurface geology and soils (including the consideration of valley slopes, landforms and erosion);
4. Groundwater (including the consideration of groundwater quality and quantity, and the location and condition of drinking water wells);
5. Surface water (including the consideration of surface water quality and quantity);
6. Vegetation and vegetation communities;
7. Wetlands;
8. Fish and fish habitat (including the consideration of sediments characteristics);
9. Wildlife and wildlife habitat (including the consideration of wildlife movement corridors, specialized/sensitive habitats and their use by migratory birds);
10. Species at Risk (i.e., Federal (COSEWIC) and Provincial Species at Risk);
11. Socio-economic Environment (including the consideration of agriculture, community and neighbourhood characteristics, adjacent and nearby land uses);
12. Cultural Environment;
13. Current use of lands and resources by Aboriginal People; and
14. Contaminated Sites and Waste Management.

ES.7 Project Effects on the Environment, Mitigation Measures and Significance

The environmental effects of the "Alternative Means" of carrying out the Project were assessed by MTO on the basis of a preliminary design. Numerous technically and economically feasible route alternatives were considered and assessed by MTO in a systematic manner. This was accomplished through the identification and screening of a "long list" of route alternatives, and detailed evaluation of a "short-list" of route alternatives. The "short-list" of alternative routes was subject to a detailed net effects analysis and a comparison of the relative advantages and disadvantages of each alternative in the context of the following five factor areas:

- Natural Environment;
- Social Environment;
- Land Use/Economic Environment;
- Cultural Environment; and
- Technical Considerations.

In some cases, a large number of alternatives were examined to ensure specific environmental constraints were considered in detail. This step-wise evaluation was undertaken to arrive at a Technically Recommended Route (TRR). The alternatives analysis is summarized in Section 4 of this report.

The MTO identified likely effects of the TRR, including cumulative effects, on the 14 environmental components specified in the Comprehensive Study Guidelines document; and considered effects of the environment on the Project; effects on the capacity of renewable resources; effects of the environment on the Project; and effects of accidents and malfunctions. MTO identified numerous technically and economically feasible mitigation measures aimed at eliminating, reducing, or controlling the Project's adverse environmental effects, including restitution for any damage to the environment caused by such effects through replacement, restoration, compensation, or any other means. These mitigation measures shall be included in various Federal and Provincial approvals, licenses, permits and authorizations and MTO's Environmental Management Plans (EMPs). Taking into consideration these mitigation measures, Table 7-6 and Table 7-7 summarize the residual adverse effects of the Project for both the Construction and Operations and Maintenance Phases, including Project-specific and cumulative effects.

Taking into account the implementation of the proposed mitigation measures, the residual adverse effects of the Project (407 Project-specific effects and cumulative effects) identified were assessed for their significance and per the criteria identified in the Comprehensive Study Guidelines and an assessment framework that defined three levels of significance (low, medium and high). After the application of this framework, an effect was assessed to be a negligible effect (not significant), a minor adverse effect (not significant), a moderate adverse effect (not significant) or a significant adverse effect. This assessment identified four (4) negligible effects; nine (9) minor adverse effects, twelve (12) moderate adverse effects. None of the project-specific or cumulative residual effects were assessed to be significant.

ES.8 Monitoring and Follow-up

In accordance with the Comprehensive Study Guidelines document, the need for a follow-up program was considered for the purpose of determining if the identified environmental effects of the Project are as predicted in the federal EA, as well as to confirm whether the proposed mitigation or compensation measures are effective or whether new mitigation measures will be subsequently required. A follow-up program will be designed and implemented.

ES.9 MTO's Conclusion on the Draft Comprehensive Study Report

In accordance with subsection 17(1) of the *CEA Act*, the CEA Agency delegated the preparation of the draft Comprehensive Study report for the 407 East Transportation Corridor to the MTO. This report contributes to fulfilling the requirements of the *Canadian Environmental Assessment Act* and was prepared in accordance to the Comprehensive Study Guidelines document issued by the CEA Agency in July 2010.

MTO's analysis and conclusion on the significance of the potential project effects on 407 East Transportation Corridor project has taken into account:

- The draft comprehensive study report, which includes a description of the potential environmental effects by environmental component and the evaluation of the significance of residual effects;
- Identified mitigation measures to be implemented;
- The review of relevant reports and technical studies from the body of documentation available for this Project;
- Comments on the Project made by federal and provincial agencies, municipalities, stakeholders and the public and Aboriginal groups;
- the Provincial Conditions of Approval; and
- Commitments made by MTO to carry out environmental monitoring and follow-up.

Based on this information, the MTO's conclusion is the proposed 407 East Transportation Corridor Project is not likely to cause significant adverse environmental effects.

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1. General Information

1.1 Background

1.1.1 The Project

The Ontario Ministry of Transportation (MTO) is proposing the construction and operation of the 407 East Transportation Corridor project, an extension of the existing 407 transportation corridor from its current terminus at Brock Road in Pickering to Highway 35/115 in Clarington, including two north-south links connecting Highway 401 to the proposed extension of 407, one in West Durham (Whitby) and the other in East Durham (Clarington). The transportation corridor includes a highway component and a transitway component (i.e. a dedicated corridor for transit).

1.1.2 The Proponent

The MTO is the project proponent for the 407 East Transportation Corridor Project. The MTO contact is:

Mr. Dan Remollino, P. Eng.
Project Manager
MTO, Planning & Environmental Office
Building "D", 3rd Floor
1201 Wilson Avenue
Downsview, ON M3M 1J8
Email: *projectteam@407eastea.com*
Tel: (416) 235-5576

1.2 Purpose of this Draft Comprehensive Study Report

The CEA Agency has delegated the preparation of this draft Comprehensive Study report, and certain procedural aspects of public participation in its development, to the MTO.

The purpose of this draft Comprehensive Study report is to provide, from the proponent's perspective, the information, analysis and conclusions relevant to an eventual determination by the federal Minister of Environment on the likely significance of adverse environmental effects from the project. Guidelines provided by the CEA Agency have identified the scope of the project, the scope of the assessment, and the factors to be considered in order for the comprehensive study report to comply with requirements under the *Canadian Environmental Assessment Act*l.

The draft Comprehensive Study report is available for public comment in order to elicit any information which would strengthen its information base or its findings, and to clarify the extent and nature of public interest or concern about the project and its effects. It is also subject to consultation with Aboriginal groups for the same reasons and for the additional purpose of fulfilling the crown's duty to consult with them when they may have rights which could be affected by the project. The aboriginal consultation is led by the CEA Agency, while the procedural aspects of public consultation have been delegated to MTO, the proponent.

Sources of information from which this draft Comprehensive Study report has been written are listed below.

- 407 East Individual Environmental Assessment (IEA) and Preliminary Design Study – Environmental Assessment Report, Volume 1 – Main Report and Volume II – Appendices (August 2009).

- 407 East Individual Environmental Assessment (IEA) and Preliminary Design Study – Environmental Assessment Report Errata Sheet (August 2009)
- 407 East Transportation Corridor Environmental Screening Report (draft MTO report, December, 2009)
- 407 East Environmental Assessment Review (Ontario Ministry of Environment Report, December, 2009)
- Alternatives to the Undertaking (Transportation Alternatives) Report (MTO Reference Document #2)
- Alternative Methods Report (MTO Reference Document #3)
- Route Refinements and Preliminary Design Alternatives Comparative Assessment and Evaluation Report (MTO Reference Document #4)
- Natural Environment (Fisheries) Impact Assessment Report (MTO Reference Document #5)
- Natural Environment (Terrestrial) Impact Assessment Report (MTO Reference Document #6)
- Natural Environment (Hydrogeology) Impact Assessment Report (MTO Reference Document #7)
- Noise Impact Assessment Report (MTO Reference Document #8)
- Air Quality Impact Assessment Report (MTO Reference Document #9)
- Landscape Composition Impact Assessment Report (MTO Reference Document #10)
- Socio-Economic Impact Assessment Report (MTO Reference Document #11)
- Agricultural Impact Assessment Report (MTO Reference Document #12)
- Waste Management and Contamination Impact Assessment Report (MTO Reference Document #13)
- Archaeology Impact Assessment Report (MTO Reference Document #14)
- Built Heritage Impact Assessment Report (MTO Reference Document #15)
- Consultation Summary Report (MTO Reference Document #16)
- Natural Environment Field Investigation Report (MTO Reference Document #17).
- Human Health Implications Report (MTO Reference Document #18)
- TRCA, CLOCA and GRCA Stormwater Management Strategy Reports (MTO Reference Document #19)

These documents are available on MTO's project website at www.407eastea.com or upon request from MTO or the CEA Agency. Additional information used in the preparation of this comprehensive study report included government and public comments received by the Province during the review of the Provincial EA and comments received by MTO from the federal authorities during the preparation of the Draft Environmental Screening Report.

1.3 Environmental Assessment Requirements, Roles and Responsibilities

1.3.1 Federal Environmental Assessment Requirements

The *Canadian Environmental Assessment Act* (the *CEA Act*) applies to federal authorities when they contemplate certain actions or decisions in relation to a project that would enable it to proceed in whole or in part. Under section 5 of the CEA Act, a federal environmental assessment may be required when a federal authority (FA):

- is the proponent;
- provides financial assistance to a proponent;
- sells, leases or otherwise disposes of land; or
- issues a permit, licence, or any other approval as prescribed in the *Law List Regulations* under the Act.

A federal authority that proposes to undertake one of the above actions, and is required to ensure that an environmental assessment is conducted under the Act, is referred to as a responsible authority (RA).

In January 2008, MTO submitted a document entitled *"407 East Environmental Assessment – Project Description for CEAA"* to the Canadian Environmental Assessment Agency (the CEA Agency) and a number of federal authorities. Following the circulation of the project description, a number of FAs were identified as either having the responsibility

to ensure that an EA was carried out, and/or having specialist or expert advice that may be necessary to conduct the assessment. These included: Transport Canada (TC), Fisheries and Oceans Canada (DFO), the Canadian Transportation Agency (CTA), the National Energy Board (NEB), Environment Canada (EC), Health Canada (HC) and Natural Resources Canada (NRCan).

Giving consideration to the project description, it was initially determined that a federal environmental assessment was required in relation to the proposed 407 East Transportation Corridor because, as per Section 5 of the *CEA Act*, certain components of the proponent's development proposal were likely to require federal land or an authorization that would enable the project to be carried out in whole or in part.

- TC's role as an RA under the *CEA Act* arises from its consideration of MTO's use of a small amount of Federal property in the vicinity of Brock Road and Highway 7.
- DFO's role as a RA arises from the anticipated requirement for authorizations under section 35(2) of the *Fisheries Act* for 27 individual watercourse crossings.

In February 2009, the RAs determined that components of the 407 East Transportation Corridor that triggers RA decision making would be subject to a screening type EA and issued draft guidelines to MTO. The RAs established a public registry on the Canadian Environmental Assessment Registry (CEAR), which could be accessed on the Internet website of the CEA Agency (*www.ceaa.gc.ca*). The CEAR number was 08-03-39781.

In July 2009, MTO submitted a Draft Environmental Screening Report. After review by federal authorities, and revision, the report was made available to the public (January 2010) for downloading through the www.407eastea.com Project website. The RAs also posted a notice of its availability for review on the CEAR in January 2010.

On January 21, 2010, the Supreme Court of Canada issued a decision which changed the requirements under the *CEA Act* in relation to this and a number of other projects across Canada. This was a decision concerning the Red Chris Copper-Gold Mine Project in northern British Columbia. The Supreme Court concluded that, the scope of a project for the purposes of the environmental assessment is, at a minimum, the project as proposed by the proponent. The Supreme Court also concluded that whenever any component of a project, as described by the proponent includes an element described in the *Comprehensive Study List Regulations*, a comprehensive study is required.

In light of this decision, Fisheries and Oceans Canada and Transport Canada expanded the scope of the project they were assessing to include the entire project as proposed by MTO and determined that the 407 East Transportation Corridor Project was subject to a comprehensive study type EA under the *CEA Act* because it falls into a category of projects described in the *Comprehensive Study List Regulations*. A notice of this determination was posted on the CEAR on March 26, 2010. The CEAR number remained 08-03-39781. The preparation of a new set of Guidelines for MTO commenced.

In July 2010, a series of amendments to the *CEA Act* came into force. As part of these amendments, the CEA Agency is now responsible for the conduct of the comprehensive study.

On July 19, the Agency initiated public consultation on the project and the conduct of the comprehensive study type environmental assessment. In addition to posting a Request for Public Input on the CEAR, the Agency and the RAs prepared a Comprehensive Study Guidelines document describing the requirements of the EA and focusing the assessment to relevant issues and concerns. The public participation approach recognizes the extensive consultation work carried out previously. As such, the notification and Guidelines document were mailed to the proponent, interested stakeholders, municipalities, community advisory group members, technical advisory group members, libraries, identified Aboriginal groups and posted on the CEAR Internet website for a 30 day public comment period. The purpose of the Guidelines document was also to provide direction on how to document the

comprehensive study report, a task that has been delegated to the MTO pursuant to subsection 17(1) of the *CEA Act*.

The comment period on the guidelines document concluded on August 20th. Input was received and responses were provided. At the current phase, the CEA Agency has delegated the preparation of the draft Comprehensive Study report to the MTO and is ensuring the public is provided with an opportunity to comment on the draft Comprehensive Study report information, analysis and findings. Comments will be recorded, considered and addressed.

Following this, a final Comprehensive Study report and all comments received will be submitted. Pursuant to section 22.(1) of the *CEA Act*, the CEA Agency will facilitate public access to the final Comprehensive Study report and provide a notice outlining how copies of the report can be obtained. A four week comment period is envisioned to allow the public and Aboriginal groups sufficient time to express their views and insights. The final Comprehensive Study report and all comments will be submitted to the President of the CEA Agency and the Minister of Environment for his federal EA decision statement.

1.3.2 Roles and Responsibilities

1.3.2.1 Role of the CEA Agency

The role of the CEA Agency pursuant to the amendments to the *CEA Act* that came into force in July 2010 is described in detail in the Comprehensive Study Guidelines document. In summary, the CEA Agency is responsible for conducting the comprehensive study for the Project. The CEA Agency is also the Federal EA Coordinator (FEAC), ensuring that federal authorities fulfill their obligations under the *CEA Act* in a timely manner, and to the extent applicable facilitating the coordination of the federal EA process with the requirements of the Province. The CEA Agency also ensures (delegate or conduct) consultation is carried out with the public and with Aboriginal groups.

1.3.2.2 Role of the Responsible Authorities (RAs)

The RAs act as subject matter experts in those areas where they possess expertise, and regulators vis-à-vis the post-EA regulatory requirements. After the submission of the final Comprehensive Study report to the Minister of the Environment and to the CEA Agency, and after the Minister's decision has been taken, the responsible authorities resume their decision-making role and responsibility for ensuring mitigation and follow-up.

1.3.2.3 Role of the Expert Federal Authorities (FAs)

The following FAs participated in the EA process:

- Environment Canada provided expertise regarding environmental management and the protection of water, air and soil quality; renewable resources including migratory birds and other non-domestic flora and fauna. Specifically, Environment Canada provided expert knowledge with respect to the requirements of the *Canadian Environmental Protection Act, Migratory Bird Convention Act, Species at Risk Act* and water quality provisions under sub-section 36(3) of the *Fisheries Act.*
- Health Canada provided expertise regarding air quality and noise.
- Natural Resources Canada provided expertise regarding hydrogeology.

1.3.2.4 Other

The Canadian Transportation Agency (CTA) and the National Energy Board (NEB) were provided the project description. Pursuant to the *Canada Transportation Act*, an agreement in principle between Canadian Pacific Rail (CPR) and MTO was reached in May 2009 in order to construct the Project at two Canadian Pacific Rail (CPR) crossings. An agreement in principle has also been reached with Canadian National Rail (CNR) for the Project to cross the existing CN line south of Highway 401 in the vicinity of the West Durham Link. Similarly, an agreement between the pipeline companies (oil and gas) and MTO was reached in September 2009 in order to construct the Project at four pipeline crossings. Based on these agreements a separate approval was not required under the *Canadian Transportation Act or the National Energy Board Act* and the CTA and the NEB determined that they are not RAs.

1.3.2.5 The Minister of Environment

The Minister of Environment receives the Comprehensive Study report and the public comments received during the public participation phase. Once all necessary information has been provided and the concerns are addressed, the Minister issues an environmental assessment (EA) decision statement that includes:

- the Minister's opinion as to whether, taking into account the implementation of any mitigation measures the Minister considers appropriate, the project is, or is not, likely to cause significant adverse environmental effects,
- and any mitigation measures or follow-up program that the Minister considers appropriate.

The Minister then refers the project back to the RAs for a decision on their course of action.

Provincial Environmental Assessment Process

The MTO has been planning Highway 407 from as early as the late 1940s and early 1950s. Since that time a transportation corridor north of Toronto has been incorporated into the planning of all major transportation and land use decisions within the Greater Toronto Area. Construction of Highway 407, which originates at the Queen Elizabeth Way (QEW) in Burlington and terminates at Brock Road in Pickering, was completed in 2001.

In 2002, MTO published the Central Ontario Strategic Transportation Directions Draft, which considered a new east-west freeway corridor (407 East) through Durham Region to Highway 35/115 with two new north-south freeway corridors connecting Highway 401 and the 407 East. The plan considered the preferred routes that were identified through several previous studies undertaken in the 1990s plus a dedicated right-of-way for transit.

In January 2005, MTO initiated a Provincial Individual EA. The Provincial EA process for the 407 East Transportation Corridor Project was a two-step application to Ontario's Minister of Environment administered by the Ontario Ministry of the Environment (MOE). The first step required the proponent to prepare and submit a Terms of Reference (ToR) for MOE review and approval. On January 17, 2005, the Ontario Minister of Environment approved the ToR for the 407 East EA.

Once the ToR was approved by the Minister, MTO proceeded to prepare the EA in accordance with the ToR. MTO's EA process, including consultation, was undertaken over a four year, seven month period. On August 28, 2009, MTO submitted the EA to the MOE for review and approval.

The EA was circulated to a government review team that included federal, provincial and local agencies to ensure that the information and conclusions of the EA were valid based on the agencies' mandates. The public and Aboriginal groups also had an opportunity to review the EA between August 28, 2009 and October 16, 2009 and submit their comments to the MOE. In December 2009, the MOE published a review of MTO's EA and provided an opportunity for the public to provide comments from December 18, 2009 to January 29, 2010.

On June 3, 2010, the Ontario Minister of the Environment, with the approval of Cabinet, approved the Provincial EA and has given provincial approval for MTO to proceed with the undertaking subject to the EA commitments and identified mitigation measures within the EA and to conditions specified by the Provincial Minister.

1.3.3 Federal-Provincial Co-ordination

The Government of Canada and the Province of Ontario signed the *Canada-Ontario Agreement for Environmental Assessment Co-operation* with the objectives of achieving greater efficiency, fostering cooperation, and setting out roles and responsibilities in implementing a cooperative environmental assessment. It was within this framework that early federal participation in the provincial EA occurred. Now that a comprehensive study is required to be conducted, the existing body of information on environmental effects is being used to prepare the comprehensive study report. In addition, public consultation is being targeted to those individuals and organizations who indicated an interest during the EA process.

1.4 Permits, Approvals, Authorizations and Policy Reviews

The Federal permits and approvals that will be required to allow the 407 East Transportation Corridor to proceed includes authorizations under the *Fisheries Act* that provides for the protection of fish and fish habitat. During the EA process, Transport Canada determined that permits under the *Navigable Waters Protection Act* (NWPA) were not required. Transport Canada does however have a decision to make related to a small portion of federal lands near the vicinity of Brock Road and Highway 7. Finally, MTO's Project was reviewed against the applicable requirements of the following federal policies: the Policy for the Management of Fish and Fish Habitat; the Federal Policy on Wetland Conservation; the Federal Water Policy; and the Canadian Biodiversity Strategy.

A number of Provincial permits, approvals and agreements from Ontario government ministries and agencies will be required to allow the Project to proceed. The Minister of the Environment, with the approval of Cabinet, approves the Provincial EA and allows MTO to implement the Recommended Design and the mitigation measures identified in the Provincial EA documentation. As noted above, this Approval was granted on June 3, 2010. The key permits, approvals and agreements that will be required are:

- Permits to Take Water (*Ontario Water Resources Act*);
- Certificates of Approval (*Drainage Act / Public Transportation and Highway Improvement Act*);
- Permits for the disturbance to endangered species and their habitat (*Endangered Species Act*); and
- various approvals under the *Ontario Environmental Protection Act, Lakes and Rivers Improvement Act, Fish and Wildlife Conservation Act*, and the *Ontario Heritage Act*.

MTO will need to reach final agreement with GO Transit, the Ontario Realty Corporation and Hydro One for various permanent and temporary easements. In addition, the Project was reviewed against the applicable requirement of the various Provincial plans and policies, including: the Ontario Provincial Policy Statement (2005); Places to Grow Act (2005); Growth Plan for the Greater Golden Horseshoe (2006); The Oak Ridges Moraine Conservation Act and Plan (2001); The Greenbelt Act and Plan (2005); and Metrolinx Regional Transportation Plan (2008).

MTO anticipates that a number of municipal agreements may be required from the Region of Durham and various local municipalities, including tree removal permits; noise by-law exemptions; road occupancy permits; road closure by-laws, temporary construction access permits; and municipal sign by-laws.

2. Consultation and Public Participation

2.1 Public Participation during the Comprehensive Study

The CEA Agency ensures consultation is carried out with the public and also consults directly with Aboriginal groups.

The required public participation for a comprehensive study involves at least three opportunities:

1. initial opportunity to comment on the project and the conduct of the comprehensive study;
2. opportunity to participate in the draft comprehensive study (delegated process, timing and content to be determined by the Agency); and
3. facilitation of public access to the final Comprehensive Study report and an opportunity to file comments on it.

The first of these opportunities, comments on the Guidelines document commenced on July 19 and was completed on August 20. The current consultation on this draft Comprehensive Study report constitutes the second opportunity. The comment period on the final Comprehensive Study report will be the third opportunity. For each of these opportunities, information notifying the public of the opportunity to comment is filed on the CEAR Internet website at www.ceaa.gc.ca. Individuals and groups who have indicated an interest in the project at earlier phase are also being notified directly of these opportunities.

The CEA Agency also administers the Participant Funding Program (PFP) to support participation in EA. Through the PFP, the Agency supports participation. An independent Funding Review Committee (FRC) was established to review applications for funding under the PFP and to recommend the allocation of up to a total of $25,000 in participant funding assistance. In this case, the following recipients have received funds under the Participant Funding Program: Transport Action Ontario, the Board of Management of the Toronto Zoo, Libby Racansky and the Huron-Wendat Nation. Further details can be found at www.ceaa.gc.ca under the CEAR number - 08-03-39781.

Input at all phases is documented, and then presented to the Minister of Environment along with the final Comprehensive Study report, accompanied by responses to it. In addition to these formal participation opportunities, individuals and groups may comment on the project or the environmental assessment at any time while it is under way.

2.2 MTO's Public Consultation Process

An extensive consultation program was carried out by the MTO during the Provincial EA. Reference Document #16 of the Provincial EA documentation provides in depth detail. This process included:

- five (5) rounds of Public Information Centres (PICs) at key project milestones;
- sixteen (16) meetings of a Community Advisory Group (CAG);
- thirteen (13) meetings of a Regulatory Advisory Group (RAG) and Municipal Technical Advisory Group (MTAG);
- two (2) community workshops and three Community Value Plan workshops;
- numerous newsletters and fact sheets on various topics, including the Federal EA process;
- a Project Office where members of the public could view project material at their leisure;
- a project website (www.407eastea.com);
- a dedicated phone line;
- numerous individual meetings with any individual who requested a meeting with MTO; and
- responses to all letters, emails and phone calls received by MTO.

The Federal government's involvement in MTO's consultation process was focused on the Regulatory Advisory Group (RAG). The following Federal agencies were notified of all meetings and public events:

- Canadian Environmental Assessment Agency
- Fisheries and Oceans Canada
- Transport Canada
- Health Canada
- Environment Canada
- Canadian Coast Guard
- National Energy Board
- Department of Indian Affairs and Northern Development Canada
- Canadian National Railway
- Canadian Pacific Railway – St. Lawrence and Hudson Railway

A total of 13 RAG meetings were held between April 2005 and January 2009. In addition, a number of meetings were held with individual regulatory agencies and conservation authorities outside of the RAG forum, including monthly meetings with DFO during the Preliminary Design phase. Upon the commencement of the Federal EA process, representatives from DFO, TC and the CEA Agency participated in two EA Public Information Centres at selected locations. DFO representatives participated in all meetings regarding watercourse crossings.

In addition to the RAG, the above noted federal agencies also participated on the Government Review Team (GRT) established by the Ontario MOE for the review of the Provincial EA.

2.3 MTO's First Nations and Aboriginal Organization Consultations

First Nations and Aboriginal Organizations that were contacted and invited to participate in consultations included Aboriginal groups who identified as having an interest in the project by reason of reserve proximity, traditional land use or asserted rights:

- Curve Lake First Nation
- Mississaugas of Scugog Island
- Chippewas of Mnjikaning (Rama)
- Chippewas of Georgina Island
- Chippewas of Beausoleil Island
- Hiawatha First Nation
- Kawartha Nishnawbe First Nation
- Alderville First Nation

The Huron-Wendat Aboriginal community also has an interest in the project study area by virtue of historic occupation and related cultural heritage issues.

MTO's consultation process included the following activities:

- A notice was sent to the identified Aboriginal groups notifying them of the study commencement along with an offer to meet with them.
- The project mailing list for Aboriginal groups included the above noted communities as well as the applicable regulatory agencies, including Indian and Northern Affairs Canada and the Ministry of Aboriginal Affairs. The Huron-Wendat Community was added to the project mailing list part way through the study process as they were not initially identified as having an interest in the project.
- Aboriginal groups were contacted at each key point in the study to advise them of the study progress and upcoming events.

- MTO arranged two Workshop and Information Sharing Sessions with the Williams Treaty Group, one in September 2008 and a second one in April 2009. A representative from the federal government also attended the session.
- A similar information sharing Workshop was undertaken with the Huron Wendat community on February 26, 2010.
- MTO kept Aboriginal groups up to date with regard to the archaeological field work and findings.

During subsequent design phases and construction, ongoing engagement with First Nations communities will be carried out by MTO in accordance with the 407 East First Nations Protocol. First Nations will be notified by the MTO of the opportunity to be involved in all Stage 3 and Stage 4 archaeological assessments related to Aboriginal finds prior to their initiation. A record of contact and workshops with First Nations groups is provided in Reference Document #16 of the Provincial EA documentation.

2.4 Provincial Conditions of Approval relevant to Public Consultation and Participation

The approval granted by the Ontario Minister of Environment on June 3, 2010 indicated that from the Province's perspective, there are no outstanding concerns that have not been addressed or that cannot be addressed through commitments made during the EA process, through conditions set out in the Provincial approval, or through future approvals that will be required. Nevertheless, the Province has imposed several Conditions of Approval that are relevant to consultation and public participation and the ongoing involvement of FAs in project implementation. The Conditions of Approval relevant to public consultation and participation are:

- MTO shall establish a 407 East Advisory Committee (407 EAC) to ensure that concerns about the implementation of the Project are considered and mitigation measures are undertaken where appropriate. MTO shall provide administrative support for the 407 EAC as specified by the Minister;
- MTO shall invite representatives from the Province, the Region of Durham and relevant local municipalities and Conservation Authorities and Environment Canada to participate in the 407 EAC;
- MTO shall also consider inviting other stakeholders to participate in the 407 EAC, including, but not limited to, members of the public and other Federal and Provincial agencies;
- The 407 EAC shall be provided with and may provide advice to MTO relevant to the Project with respect to compliance reports, a stormwater management plan, the complaint protocol, and vegetation restoration plans.

MTO was directed by the Provincial Minister to hold the first 407 EAC meeting within 3 months of the date of the Provincial approval to develop its Terms of Reference in accordance with the Minister's Condition of Approval.

MTO was also directed to continue its consultations with the Aboriginal groups identified in the Provincial EA during the detailed design and implementation phases of the Project and to fulfill its commitments. MTO shall participate in discussions between the Huron-Wendat Nation and the Ontario Ministry of Tourism and Culture regarding the curation of Aboriginal heritage resources related to the Project.

The Conditions of Approval imposed by the Provincial Minister of the Environment are listed in the "Notice of Approval to Proceed with the Undertaking" available on MTO's website www.407eastea.com.

3. Project Description

3.1 Project Overview

MTO is seeking approval for a transportation corridor comprised of the following elements:

- A 50 kilometre (km) extension of Highway 407 from Brock Road to Highway 35/115 known as the east-west mainline extension;
- Two north-south freeway links connecting the proposed mainline extension to Highway 401, one in Whitby (West Durham Link) and one in Clarington (East Durham Link), each approximately 10 km in length;
- Support facilities, including two highway maintenance facilities, two commercial vehicle inspection facilities and three truck lay-bys;
- Structures, including railway crossings, watercourse crossings, wildlife crossings, retaining walls and noise walls;
- Drainage and stormwater management facilities;
- Illumination requirements; and
- Protection of a dedicated transitway corridor along the east-west mainline and East and West Durham Links, including lands for two transitway maintenance facilities and 17 transitway stations / commuter parking lots.

The Technically Preferred Route (TPR) for the 407 East Transportation Corridor is illustrated in **Figure 3-1**. The preliminary design of the proposed Project is presented in Volume II of the Provincial EA document, Appendix D.

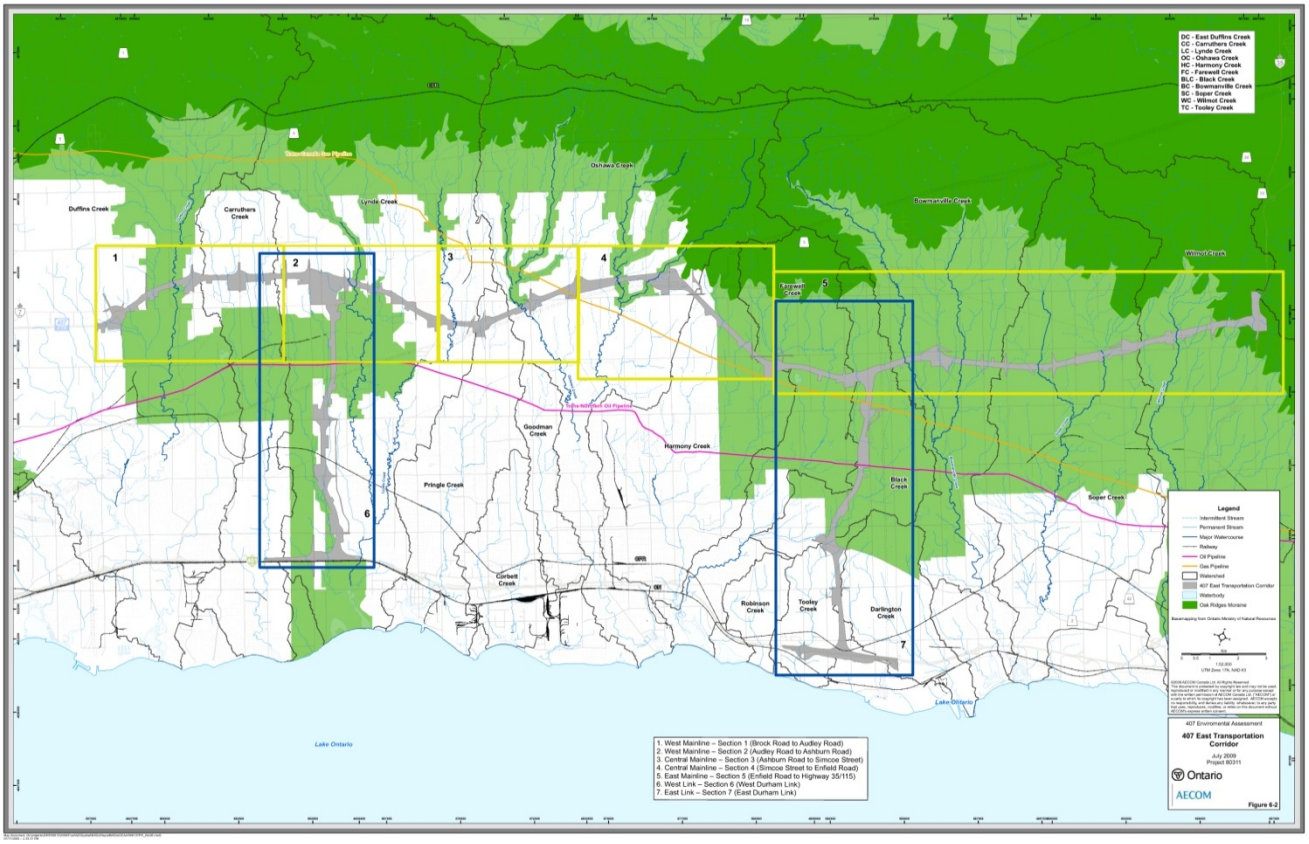

Figure 3-1 The Technically Preferred Route for the 407 East Transportation Corridor

3.2 Physical Works and Activities

The following physical works and activities are likely to be undertaken during the Construction Phase:

- **Site Preparation,** including activities associated with surveying and further geotechnical investigations; Right-of-Way (ROW) and support facility site clearing and grubbing; modifications, relocations and removal of existing structures and obstructions; and preliminary grading and installation of stormwater management features and erosion controls;
- **Roadbed Construction,** includes activities associated with the construction of the roadbed including access roads and structures. This may involve earthmoving, rock drilling, and potentially blasting activities within the ROW and specific cut and fill areas, and water takings;
- **In-stream Works**, includes (where necessary) the construction, installation or modification of culverts and bridges, rip-rap, rock gabions and potentially other structures aimed at stabilizing streambanks or shorelines deflecting and/or reducing stream flows for the purposes of construction. This may also include the installation of structures aimed at trapping sediments, deflecting and/or reducing stream flows, increasing the complexity of stream banks, channels, for cover, feeding or spawning habitat for fish or other aquatic organisms; excavation, relocation/realignment and restoration of stream channels and/or stream banks aimed at creating a stream reach that has a geomorphologically stable plan form and cross-section;
- **Surfacing and Finishing,** involves activities such as paving, line painting and installation of signs, guiderails, illumination structures, utilities, wildlife crossings and fencing;
- **Ancillary Structures and Supporting Facility Construction,** involves the development and subsequent decommissioning of temporary site access roads, borrow areas and storage areas; and the construction of permanent supporting facilities, such as maintenance facilities, vehicle inspection facilities, truck lay-bys, and transitway stations; and
- **Materials and Equipment Handling and Movement,** involves the operation of heavy equipment such as bulldozers, trucks, graders, excavators, rollers; the import / export of materials (including any contaminated soils and waste materials) from the construction site; temporary storage of materials within the ROW and worker vehicular traffic both on and off-site.

The following physical works and activities are likely to be undertaken during the Operations and Maintenance Phase:

- **Winter Safety Operations**, involve snow removal activities such as ploughing, melting and hauling of snow within the ROW; and ice control through physical means or by the application of sand, road salts and other de-icing agents.
- **Preventative Maintenance,** involves activities such as the repair of paved roadway surfaces (i.e., patching and levelling, excavation and resurfacing); grading and gravelling of shoulders; culvert clearing; cleaning and/or re-establishment of drainage ditches and storm water ponds, surface treatments, repainting and general maintenance of structures and supporting facilities.
- **Maintenance of Vegetation and Wildlife Crossings,** involves manual or mechanical clearing of regrowth of vegetation along the ROW to maintain sight lines; clearing of wildlife crossing structures; revegetation and plantings as appropriate.

3.3 Purpose, Need and Rationale for the Project

The purpose of MTO's Project is to address long standing transportation deficiencies and needs in the Region of Durham (Durham Region) by providing additional east-west and north-south transportation capacity within and through the "Analysis Area" for a 30-year planning horizon and beyond. The existing transportation network within the Analysis Area is composed of a number of Provincial highways and regional arterial roads supported by GO Transit and Regional Transit services. This network is currently constrained with respect to its ability to move people and goods effectively and efficiently. These deficiencies have been identified in previous studies and reports which have recommended a series of planned transportation improvements. Even with the planned transportation improvements, this situation will be exacerbated unless additional east-west and north-south system capacity is provided as the communities within Durham Region continue to grow. The Provincial policy framework supports changes to the existing transportation network and how the current transportation system services the Analysis Area.

4. Project Alternatives

4.1 Alternatives to the Project

"Alternatives To" the Project was a consideration in the Provincial EA, but their consideration is not a requirement for this comprehensive study. The following is a summary of MTO's "Alternatives To" analysis and is included here to provide a complete overview of the planning that was undertaken by MTO during the Provincial EA.

4.1.1 Summary of the Proponent's Analysis

A total of ten (10) "Alternatives To" the Project were considered and assessed by MTO. They included the following:

1. "Do Nothing";
2. Travel Demand Management;
3. Transportation Systems Management;
4. Improved Air Transport Service;
5. Improved and/or New Passenger Rail Service;
6. Improved and/or New Goods Movement by Rail;
7. Improved and/or New Marine Service;
8. Improved and/or New Roadways/Transitways;
9. Improved and/or New Transit Services; and
10. Combinations of the above.

Investigation of these ten alternatives revealed that, individually, these alternatives were not capable of fully meeting the need for the project or achieving the project's purpose as "stand alone" solutions. Therefore MTO created the following combinations of "Alternatives To" the Project in order to adequately address the transportation deficiencies and needs:

- Combination 1 – Enhanced Transit / Travel Demand Management / Transportation System Management;
- Combination 2 – Modified Transit/ Travel Demand Management / Transportation System Management plus Expansion of Existing Roadway; and
- Combination 3 – Combination 1 plus New Corridors

MTO evaluated the three Combination Alternatives, plus the "Do Nothing" alternative, based on their knowledge of existing transportation and environmental conditions in the Analysis Area. Secondary source data, government policies and public input from the consultation program were combined with their professional expertise to assess each alternative in each factor group and for each individual criterion. The evaluation methodology included a comparative analysis of the three combination alternatives.

The recommended Combination Alternative 3 consists of transit and Travel Demand Management enhancements (Combination 1) plus a new transportation corridor. For the purposes of the assessment, the new corridor was assumed to include a new Mainline freeway connecting the existing terminus of Highway 407 at Brock Road in Pickering to Highway 35/115 in Clarington and two north-south freeway links connecting to Highway 401, one in the general vicinity of the Ajax/Whitby boundary (West Durham Link) and the second in the general vicinity of the Oshawa/Clarington boundary (East Durham Link). The new corridor also includes a transitway corridor paralleling the freeway from Brock Road to Highway 35/115 and north-south transitways parallel to each of the links.

Combination 3 was considered the only alternative that adequately addressed:

- the identified transportation problems and opportunities;
- land use policies and plans; and
- economic growth and sustainability goals.

Chapter 6 of the Provincial EA documents the assessment of "Alternatives To" the Project. The complete set of Evaluation Tables is included in Reference Document #2 to the Provincial EA.

The "Alternatives To" assessment and the choice for the recommended "Alternative To" the Project were presented to the Regulatory Agency Group (RAG), Community Advisory Group (CAG), the Municipal Technical Advisory Group (MTAG) and the public for comment through a number of consultation activities during the preparation of the EA. They were also subject to government agency and public comment during the review of the Provincial EA.

4.1.2 Government and Public Comments

MTO received numerous comments regarding its "Alternatives To" assessment during the preparation of the EA. Reference Document #16 and Exhibits 4.9 and 4.10 in Volume 1 of the Provincial EA provide summaries of the comments received by all advisory groups (including the RAG) and the public and also detail MTO's responses to those comments. RAG members enquired about the potential environmental effects and expressed their desire to see enhancements / improvements to the current standards for mitigation. Comments from members of the public were not all focused on "Alternatives To" but rather pertained to the complexity of the EA process, the Project timing being too long and considerations in the choice of route locations (i.e., Alternative Means). Members of the public encouraged the consideration of specific environmental features, such as agriculture, trails, groundwater, property impacts and effects of noise and lighting during the assessment of "Alternative Means".

As a result of its review of the Provincial EA, the MOE concluded that MTO had considered a reasonable range of "Alternatives To" the undertaking, including the Do Nothing alternative, using criteria that considered the *Ontario Environmental Assessment Act* (EAA's) broad definition of the environment.

4.2 Alternative Means of Carrying Out the Project

"Alternative Means" of carrying out the Project were considered in the Provincial EA and the assessment of their environmental effects is a requirement for this comprehensive study. The environmental effects of the "Alternative Means" of carrying out the Project were assessed by MTO on the basis of a preliminary design.

4.2.1 Summary of the Proponent's Analysis

Numerous technically and economically feasible route alternatives throughout the Analysis Area were considered and assessed by MTO in a systematic manner. This was accomplished through the identification and screening of a 'long list" of route alternatives, and detailed evaluation of a "short-list" of route alternatives. This step-wise evaluation was undertaken to arrive at a Technically Recommended Route (TRR).

The generation of a "long list" of route alternatives took into consideration the work undertaken in previous studies as well as information obtained through the current EA process. Consideration was given to five guiding principles and 22 objectives in generating the "long-list" of alternative routes. A "short-list" of alternative routes was identified based on a three-step screening process aimed at minimizing the direct losses and adverse effects on sensitive natural, social, and cultural areas/features. The "short-list" of alternative routes was subject to a detailed net effects

analysis and a comparison of the relative advantages and disadvantages of each alternative in the context of the following five factor areas:

- Natural Environment;
- Social Environment;
- Land Use/Economic Environment;
- Cultural Environment; and
- Technical Considerations.

In some cases, a large number of alternatives were examined to ensure specific environmental constraints were considered in detail. Mapping of all alternative routes identified for the long list and the short list is provided in the main report of the Provincial EA along with details regarding their comparative evaluation. Throughout the evaluation process, a number of federal policies were considered, including the Policy for the Management of Fish and Fish Habitat (1986); Federal Policy on Wetland Conservation (1991); The Federal Water Policy (1987); and the Canadian Biodiversity Strategy (1994). The following provides an overall summary of the consideration of these "Alternative Means" for carrying out the Project.

West Mainline (WM): Following the screening of the long list of alternatives, only one feasible route alternative was recommended between Brock Road and Audley Road because the others were generally within existing developed areas. Elsewhere in the western portion of the mainline, two route alternatives were evaluated in detail - a north route (WM1) and a south route (WM2). The north route was most preferred from the natural, social, land use/economic and technical factors, and equally preferred as the south route for the cultural factor. The preferred route alternative minimizes effects on sensitive watercourses, forested valley habitat, ESAs and other natural heritage features; affects fewer residential and business properties; and, requires fewer and less significant local road realignments and allows for an interchange at Highway 7, a key east-west arterial road.

Central Mainline (CM): Following the screening of a long list of alternatives along the central portion of the mainline, only one feasible route alternative was recommended between Ashburn Road and Simcoe Street because the others were generally within existing and planned development areas. Elsewhere in the central portion of the mainline, two route alternatives were evaluated in detail - a south route (CM1) and a north route (CM2). The north route was most preferred from the social, land use/economic and technical factors, and equally preferred as the south route for the cultural factor. The north route was less preferred to the south for the natural environment factor. Overall, the north route alternative affects fewer residential, business and recreational properties, will likely result in lower noise and air quality effects and does not require a major realignment of Winchester Road.

East Mainline (EM): Twelve route alternatives (EM1 to EM12) were evaluated in detail the eastern portion of the mainline. Each route alternative had its own set of advantages and disadvantages. However, the recommended route alternative (EM9) was evaluated to have a lower potential for adverse effects on vegetation (including environmentally significant features), fish and fish habitat, wetlands and hydrological features. In addition, this route alternative displaces fewer residential properties and affects fewer specialty crop operations than the others. The route does not affect any known archaeological sites.

West Durham Link (WL): Following the screening of a long-list of alternatives, nine route alternatives (WL1 to WL9) were evaluated in detail for the West Durham Link. Each route alternative had its own set of advantages and disadvantages. However, route alternative WL7 was either preferred or equally preferred to others for the natural, social, land use/economic, and technical factors. This route avoids fragmentation of large habitat areas and retains small good quality terrestrial features. It avoids effect to watercourse confluence zones, forested riparian areas and affects fewer residential, business and agricultural properties than the other routes.

East Durham Link (EL): Twenty-six route alternatives were initially generated for the East Durham Link, largely to ensure that effects on the Harmony-Farewell Iroquois Beach Wetland Complex and other constraints were examined in detail and avoided to the extent possible. As a result of the selection of EM9 as the preferred route alternative for the mainline, a short list of 13 feasible route alternatives (EL1 to EL13) were evaluated in detail for the East Durham Link. Route alternative EL8 was either preferred or equally preferred to others for the natural, cultural and technical factors. It was evaluated to have the least potential effect on the natural environment, wetlands, core wildlife habitat areas, groundwater and vegetation (including environmentally significant areas). It minimizes effects on residential and business properties and does not affect any known archaeological sites.

Following the comparative evaluation step, the resulting recommended routes (WM1, CM1, EM9, WL7 and EL8) were combined to identify the Technically Recommended Route (TRR) in June 2007. The TRR was then presented to agencies, First Nations and the public for review and comment. Refinements were made to the TRR based on comments received and ongoing preliminary design work. The TRR was then confirmed as the Technically Preferred Route (TPR) in June 2008. In general, the TRR was selected because it had the least potential for adverse environmental effects, taking into consideration the conceptual design features and technically and economically feasible mitigation.

4.2.2 Government and Public Comments

MTO received numerous comments regarding its Alternatives Means assessment during the preparation of the EA. Reference Document #16 and Exhibits 4.11 to 4.16 in Volume 1 of the Provincial EA provide summaries of the comments received by all advisory groups (including the RAG) and the public and also detail MTO's responses to those comments.

During the review of the Provincial EA, the MOE received comments from members of the Government Review Team and the public regarding MTO's assessment of Alternative Means. A few individual comments and 85 form letters from the public were received that were largely focused on the rationale for the location of the East Durham Link (EDL), its connections to Highway 401, proximity to the Solina Bog and effects on the Harmony-Farewell Iroquois Beach Wetland Complex. Concerns were also expressed that the EDL was selected so that "the entire area south of the 407 could be developed into residential housing" and that the rural nature of the area should be considered / weighted differently from the West Durham Link.

As a result of its review of the Provincial EA, the MOE concluded that MTO had considered a reasonable range of "Alternatives Methods" to the Project, including alternative transportation corridor alignments and design elements that considered the EAA's broad definition of the environment. The approval granted by the Ontario Minister of Environment on June 3, 2010 also concluded that no other beneficial alternative method of implementing the undertaking was identified.

5. Environmental Assessment Framework

Consistent with the Comprehensive Study Guidelines document, the CEA Agency has considered the effects of the Project on the following fourteen (14) Environmental Components:

1. Air quality and climate (including the consideration of climate change);
2. Noise and Vibration (including the consideration of noise sensitive areas);
3. Surface and subsurface geology and soils (including the consideration of valley slopes, landforms and erosion);
4. Groundwater (including the consideration of groundwater quality and quantity, and the location and condition of drinking water wells);
5. Surface water (including the consideration of surface water quality and quantity);
6. Vegetation and vegetation communities;
7. Wetlands;
8. Fish and fish habitat (including the consideration of sediments characteristics);
9. Wildlife and wildlife habitat (including the consideration of wildlife movement corridors, specialized/sensitive habitats and their use by migratory birds);
10. Species at Risk (i.e., Federal (COSEWIC) and Provincial Species at Risk);
11. Socio-economic Environment (including the consideration of agriculture, community and neighbourhood characteristics, adjacent and nearby land uses);
12. Cultural Environment;
13. Current use of lands and resources by Aboriginal People; and
14. Contaminated Sites and Waste Management.

5.1 Temporal Boundaries

Consistent with the Comprehensive Study Guidelines document, the temporal boundaries encompassed the entire lifespan of the Project. Environmental effects were considered according to two phases, namely the (1) Construction Phase and the (2) Operations and Maintenance Phase. No specific timeframes have been identified for these two phases. However, it is anticipated that the earliest the Operations and Maintenance Phase could begin is 2013 if all necessary EA and permitting requirements are met. Although the Operations and Maintenance Phase of any highway is ongoing, for the purposes of this EA the year 2031 was selected as the “planning horizon”, based on the availability of population projections from the Province and Durham Region.

Consistent with the Comprehensive Study Guidelines document, decommissioning, closure and reclamation were not considered in this environmental assessment, as they are beyond the planning horizon of this Project.

5.2 Spatial Boundary

In general, the spatial boundary for the comprehensive study reflects the geographic range over which the project’s environmental effects may occur. In this case, the spatial boundary was generally defined by MTO as the Analysis Area adopted for the Provincial EA for the 407 East Transportation Corridor (see Figure 5-1). The Analysis Area was the area within and surrounding Durham Region in which transportation problems and opportunities were identified (i.e., Highway 35/115 to the east, Lake Ontario to the south, Brock Road to the west, and approximately to the CPR railway line to the north).

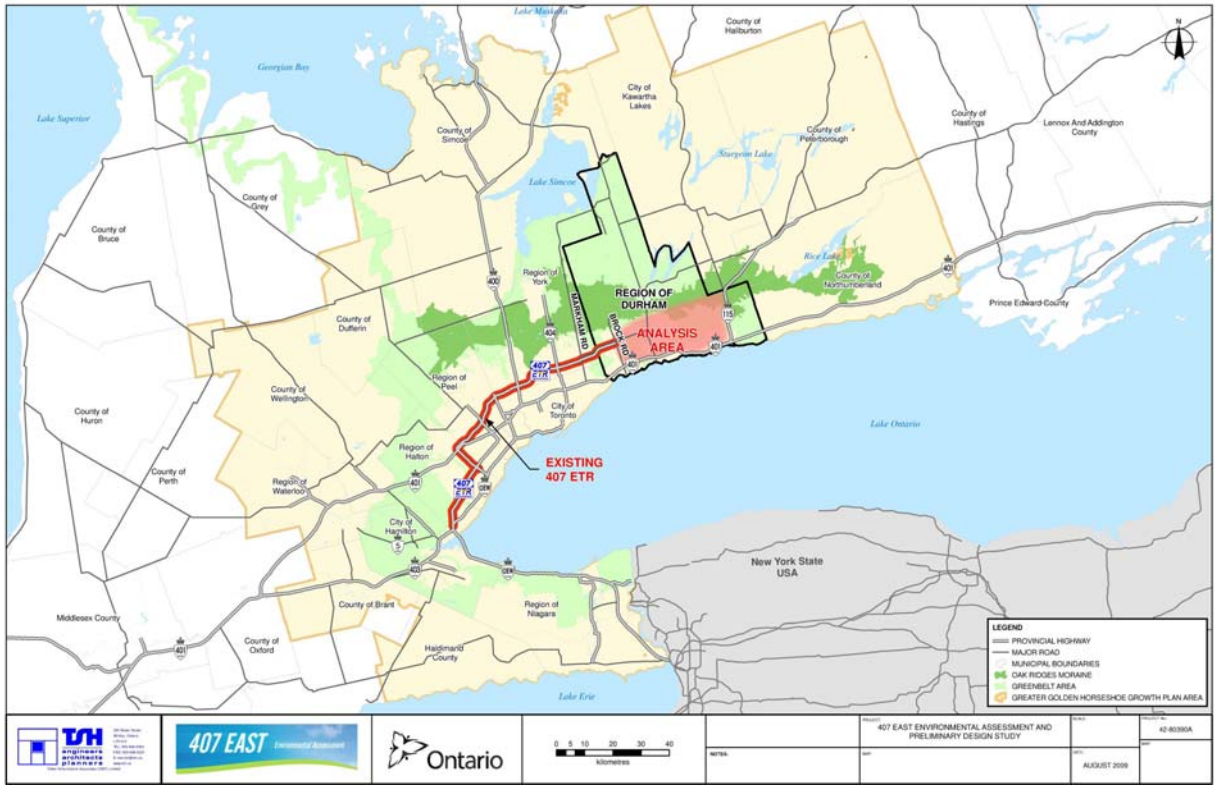

Figure 5-1 407 East EA Analysis Area

Consistent with the Comprehensive Study Guidelines, MTO determined the spatial boundary specific to each factor in order to effectively assess the potential environmental effects of the project. Of particular importance to the RAs were the study areas for investigating effects on fish and fish habitat. In this case, MTO defined the study area in accordance with MTO's Environmental Guide for Fish and Fish Habitat (2006) whereby a Zone of Detailed Assessment was defined to include the 407 East Transportation Corridor Right-of-Way (ROW) and the area of the watercourse 20 m upstream and 50 m downstream of the ROW. Where feasible, consideration was also given to a larger portion of the watercourse, namely 30 m upstream and 150 m downstream.

6. Description of the Environment

6.1 Air Quality and Climate

The key source of information from which this section has been written is the Air Quality Impact Assessment Report (MTO Reference Document #9). The following contaminants of concern were considered by MTO because they are the main contaminants emitted from vehicle tailpipes and roadway surfaces, and depending on concentrations and human exposure, they may have potential health effects associated with them:

- Carbon Monoxide (CO)
- Oxides of Nitrogen (NO_X),
- Particulate Matter (PM) including inhalable particulate matter, or PM_{10}; and respirable particulate matter, or $PM_{2.5}$.
- Volatile Organic Compounds (VOCs) including Formaldehyde, Acetaldehyde, 1,3-Butadiene, Benzene and Acrolein.

In addition, Total Suspended Particulate Matter (TSP), which gives an indication of dust levels (i.e., a nuisance contaminant), was also considered a contaminant of concern.

Consideration was given to several Provincial and Federal guidelines, in the form of ambient air quality criteria, including the Ontario Ministry of the Environment's Ambient Air Quality Criteria (AAQCs), Environment Canada's National Ambient Air Quality Objectives (NAAQOs) and the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standard (CWS) for $PM_{2.5}$.

The existing baseline conditions were established on the basis of a five year (1999-2003) historical record obtained from three MOE operated ambient air quality-monitoring stations between Pickering and Clarington, Ontario. Emphasis was placed on ambient air quality data from the closest ambient air monitoring station to the 407 East Transportation Corridor (i.e., Oshawa at 2200 Simcoe St. N., near Durham College) or from the nearest alternative stations. The data indicates that levels of CO and NO_2 are well below their respective ambient air quality guidelines. The PM_{10} and $PM_{2.5}$ air quality levels are common to many cities in Southern Ontario, where there are infrequent measured levels in excess of guideline levels for particulate matter. Acrolein and TSP levels were above their respective guideline.

MTO also identified sensitive receptors, including residences, churches, daycare facilities, schools, hospitals and senior housing facilities throughout the study area. Special consideration is given to these latter receptors because of the increased potential for adverse health effects at these locations. A total of 1,861 sensitive receptors were identified within approximately 600 m of the 407 East Transportation Corridor.

6.1.1 Climate

In general, the 407 East Transportation Corridor is in an area that represents the transition from Southwestern Ontario to Eastern Ontario. MTO collected climatic data for use in the air quality assessment. Data collected included study area climate normals (e.g., wind direction, speed, temperatures, humidity, snowfall and snow depth and rainfall). Climate normals were based on data from Lester B. Pearson International Airport and Peterborough Airport.

MTO also collected data regarding severe weather conditions for the consideration of the effects of the environment on the Project, including data regarding freezing rain, snowfall, heavy rainfall, fog and tornadoes. In general, severe weather conditions are relatively infrequent. Heavy rainfall was of particular interest to the RAs as it is an important

consideration regarding stormwater treatment. In this case, heavy rainfall events (greater than 25 mm) are infrequent, occurring 4 to 5 days/year on average. Very heavy rainfall rates, greater than 50 mm/hr, occur only 1 to 2 times per year. Periods of dry weather or drought have been relatively uncommon in Ontario (about every 10-15 years) (Ontario Ministry of Natural Resources, 2010)

6.2 Noise and Vibration

The key source of information from which this section has been written is the Noise Impact Assessment Report (MTO Reference Document #8). Ambient noise measurements were undertaken by MTO at various locations throughout the study area. The measured data indicates that sound levels are higher in areas close to existing roadways with large volumes of traffic compared to areas which are surrounded by green space or agricultural lands. Within the study area, ambient sound levels varied between a minimum level of 46 dBA and a maximum level of 69 dBA. These noise levels can be characterized as “moderate” to “loud”. In an effort to manage noise levels from construction projects in their communities, the City of Pickering, Town of Ajax, Town of Whitby, City of Oshawa, and the Municipality of Clarington have enacted noise by-laws which stipulate the times of day when the operation of construction equipment is prohibited.

Health Canada provides specialized information and expert knowledge on environmental noise issues to RAs. In 2005, Health Canada personnel published a draft “Fact Sheet for Noise Issues”, outlining their proposed approach to conducting noise impact assessments (Health Canada, Draft Fact Sheet for Noise). As these guidelines are still in draft form and still under considerable revision, they were not applied directly to this Project. Instead, Noise Sensitive Areas (NSAs) were defined in accordance with the MTO *Environmental Guide for Noise* (MTO 2006). On this basis, there are an estimated 1,841 Noise Sensitive Areas (NSAs) within 500 m of the 407 East Transportation Corridor which may be potentially affected by noise.

6.3 Surface and Subsurface Geology and Soils

Surface and subsurface geological and soil conditions were considered important to the RAs as major cuts and fills have the potential to affect groundwater aquifers and water supplies from domestic wells. Groundwater and surface water also interact to influence wetlands and their habitats. MTO characterized the study area from north to south, in terms of three east-west trending physiographic regions: the Oak Ridges Moraine, the South Slope, and the Iroquois Plain (Chapman and Putnam, 1984).

The Oak Ridges Moraine, is one of the most distinctive physiographic regions in southern Ontario and forms the drainage divide between water flowing south into Lake Ontario and water flowing north into the Trent-Severn Waterway system. The South Slope physiographic region begins on the south side of the Oak Ridges Moraine and slopes downward towards Lake Ontario. It is a gently rolling till plain, characterized by numerous drumlins oriented upslope. The gently sloping lowland extending from the till plain of the South Slope down to Lake Ontario is the Iroquois Plain physiographic region.

The bedrock is comprised of flat-lying Paleozoic limestones and shales underlying the overburden sediments throughout the study area. Only minor outcrops of the rock exist in stream valleys near the shore of Lake Ontario. The topography is predominantly controlled by thick deposits of glacial sediments, which were deposited between about 135,000 and 12,000 years ago (Eyles, 2002). The following formations that overlie bedrock were characterized by MTO in terms of their distribution throughout the study area, thickness, composition: Scarborough Formation, the Sunnybrook Drift, the Thorncliffe Formation, the Newmarket Till, the Oak Ridges Moraine and the Halton Till.

Because considerable erosion and re-deposition of glacial sediments occurred following deglaciation, streams cut gullies through till and glaciolacustrine plains, and wind erosion stripped fine sediment from exposed hills and deposited it in sand dunes or hollows. Organic material accumulated in isolated basins and kettles, particularly

where groundwater upwelled. Revegetation of plains and hillsides reduced sediment delivery to watercourses, thereby causing rivers to incise and abandon old floodplains.

6.4 Groundwater

The consideration of groundwater included the identification of key hydrostratigraphic units that comprise the shallow groundwater system and their classification as either aquifers or aquitards; groundwater flow, groundwater recharge and groundwater discharge. MTO also investigated the presence of groundwater wells and groundwater quality in the study area.

MTO studies indicate that the shallow groundwater system within the Regional Study Area (RSA) is influenced by four key hydrostratigraphic units: the Newmarket Aquitard, Oak Ridges Moraine Aquifer, Halton Till Aquitard, and Iroquois Plain Shallow Aquifer comprising sands and silts over clay. Regional groundwater flow in the aquifers within the RSA is south-southeast from the Oak Ridges Moraine (ORM) towards Lake Ontario, except where major river valleys exist. Locally, groundwater flow paths bend into river valleys and isolated topographic depressions.

Recharge areas are important because they replenish the groundwater. The ORM (where exposed) exhibits the greatest rate of groundwater recharge in the RSA. Nearly all of the precipitation infiltrates into the crest area of the ORM due to the high permeabilities of these surficial deposits. Piezometer nests installed in the ORM confirm downward groundwater flow directions and a deep water table. Minor groundwater recharge also occurs in areas of the South Slope that are underlain by ORM sediments and where the Halton Till is thin. In the areas of thicker Halton Till and/or Newmarket Till, runoff exceeds recharge due to these low permeability deposits.

Nearly 90% of the groundwater recharge that occurs between Lake Ontario and the crest of the ORM discharges into stream networks. Some wetlands exist in depressions where surface water becomes trapped due to topography and underlying low permeability sediments. However, many wetlands within the RSA are associated with areas of groundwater discharge. Of particular interest is the high water table and localized groundwater upwelling within the Iroquois sands that provide ideal conditions for wetlands to form.

A residential water well survey was undertaken by MTO in 2008 within a 1 km radius of the 407 East Transportation Corridor ROW centreline where sand deposits are present at surface and within a 500 m radius of the transportation corridor ROW centreline where till deposits are present at surface. A total of 1,328 residential groundwater wells were documented, including 327 (25%) shallow dug wells; 191 (14%) deep drilled wells; and, 810 (61%) wells having unknown construction details because the well owner was not available for an interview or did not know the construction details of their well.

A well survey was undertaken by MTO for all homes and businesses identified as having a groundwater well. While all homes and businesses were visited, interviews were only possible with 574 residents (43.2%). Well water quality samples were collected at 87 residences to obtain a representative lateral and vertical distribution of the baseline water quality across the study area. Five (5) wells were selected to gather information from upgradient and downgradient of the 407 East Transportation Corridor, to gather information from shallow and deep aquifer units, and to gather information from low sensitivity and high sensitivity aquifer units. The Natural Environment (Hydrogeology) Impact Assessment Report (MTO Reference Document #7) provides details regarding the results of the groundwater sampling program. In general, concentrations of one or more of the following parameters were found to exceed Ontario Drinking Water Standards (ODWS) for one or more of these wells: sodium, iron, manganese, nitrate, hardness, *E. coli*, total coliform, and Heterotrophic Plate Count (HPC). High concentrations of iron, manganese and hardness are found naturally in local aquifers, but exceedances of the other parameters indicate effects for surficial land use activities, such as road salt and fertilizer applications and/or improperly functioning septic beds.

6.5 Surface Water

There are thirteen major watercourses and their associated watersheds within the RSA, crossing the jurisdictions of Toronto and Region Conservation Authority (TRCA), Central Lake Ontario Conservation Authority (CLOCA) and Ganaraska Region Conservation Authority (GRCA). From west to east, these watercourses are: Duffins Creek, Carruthers Creek, Lynde Creek, Pringle Creek, Corbett Creek, Oshawa Creek, Goodman Creek, Farewell Creek, Harmony Creek, Black Creek, Bowmanville Creek, Soper Creek and Wilmot Creek. Most of these watercourses originate in the ORM to the north of the 407 East Transportation Corridor and outlet into Lake Ontario to the south. Smaller watercourses within the RSA, with drainage areas from 3 to 6 km^2, flow directly into Lake Ontario. These include Robinson Creek, Tooley Creek, Darlington Creek and West Side Creek, which collectively drain 39 km^2 of Lake Iroquois Plain between Farewell Creek and Bowmanville Creek. Details regarding the physical properties of each major watercourse and its associated watershed are described in Chapter 3 of the EA Report and Reference Documents 5, 6 and 7. These documents provide a description of the existing environmental conditions at all watercourse crossings in terms of their locations, drainage areas, flow conditions based on a 2-year storm event and a regional storm event. Water quality is described where data was available from Conservation Authorities. MTO has confirmed that none of the watercourses are used as a supply of drinking water. Although none of the watercourses were considered to be navigable at the point of crossing and are unlikely to be used for recreational purposes such as boating, they may be used by some local residents for recreational purposes such as fishing, nature viewing and unorganized play.

6.6 Vegetation and Vegetation Communities

MTO conducted extensive research and field investigations to describe the vegetation and vegetation communities potentially affected by the Project. The vegetation and vegetation communities were characterized according to each of the watersheds traversed by the 407 East Transportation Corridor. Within each watershed, MTO identified native and non-native plant species, regionally rare and locally rare plant species. There are 14 Life Science Areas of Natural and Scientific Interest (ANSIs), five (5) Earth Science Areas of Natural and Scientific Interest, 59 Environmentally Sensitive/Significant Areas (13 in TRCA; 46 in CLOCA) and Darlington Provincial Park is located along the Lake Ontario Shoreline in the Municipality of Clarington. Over 275 plant species were identified within the 407 East Transportation Corridor study area but no Provincially rare vegetation communities were identified within the corridor itself. The Natural Environment (Terrestrial) Impact Assessment Report (MTO Reference Document #6) provides further details regarding the vegetation and vegetation communities, wetlands, wildlife and wildlife habitat, and species at risk in the Regional Study Area and those traversed by the Project. Section 6.10 provides more information regarding Species at Risk in the study areas.

6.7 Wetlands

MTO conducted extensive research and field investigations to describe the wetlands potentially affected by the Project. The wetlands were characterized according to each of the watersheds traversed by the 407 East Transportation Corridor. Within the RSA, there were 29 evaluated wetlands, including 21 provincially significant wetlands (2,126.8 ha in total) and 8 locally significant wetlands (123 ha in total). The designation of wetlands as either locally or provincially significant was completed through standardized assessment developed by the Ontario Ministry of Natural Resources, known as the Ontario Wetland Evaluation System, taking into consideration their biological, social, hydrological and special features. The Transportation Corridor crosses or is adjacent to the following provincially significant wetlands: Solina Wetland, Lynde Creek Coastal Wetland, Harmony-Farewell Iroquois Beach Wetland Complex, Maple Grove Wetland Complex and the Whitby-Oshawa Iroquois Beach Wetland Complex. Durham Region is involved in a Coastal Wetland monitoring project, which has monitored 15 wetlands in 2002 and 2003. Coastal wetlands can support a mix of plant communities as a result of their location between the permanent deep water of the lake and the dry upland areas (Environment Canada 2004). In addition, the

Transportation Corridor crosses a number of unevaluated wetlands consisting of a number of wetland types. The wetlands traversed by the Project are primarily coniferous or deciduous swamps, meadow marshes, thicket swamps or mixed swamps. The draft Environmental Screening Report (December, 2009) provides a map of the evaluated wetlands in the Regional Study Area.

6.8 Fish and Fish Habitat

MTO conducted extensive research and field investigations to describe the fish and fish habitat potentially affected by the Project. Fish and fish habitat were characterized according to each of the watersheds and watercourses traversed by the 407 East Transportation Corridor. Fish and habitat conditions for each watercourse crossing were described in terms of the fish communities present, primary functions of the watercourse, its physical characteristics and flow status, groundwater influences, specialized fish habitat functions and overall sensitivity. Eighteen (18) crossings were considered to be of low sensitivity, five (5) moderate sensitivity and 23 high sensitivity, with the remainder displaying no direct fish use. These descriptions and representative photographs are provided in Natural Environment (Fisheries) Impact Assessment Report (Reference Document #5). Section 6.10 provides more information regarding Species at Risk in the study area.

6.9 Wildlife and Wildlife Habitat

The transportation corridor has the potential to affect core habitat (large blocks of wildlife habitat), interior and deep interior forest habitat, as well as specialized or sensitive wildlife habitat (SSWH) areas. A number of area-sensitive bird species and provincially rare breeding species (Carolina Wren) were observed in habitats within the transportation corridor. Forest area-sensitive breeding species abundantly recorded include: Hairy Woodpecker, Black-and-White Warbler, Black-throated Green Warbler, Ovenbird and Veery. There are over 66 breeding bird species recorded in the various vegetation units throughout the transportation corridor. Six amphibian frog species were recorded within the transportation corridor including, American Toad, Green Frog, Gray Treefrog, Spring Peeper, Wood Frog, Northern Leopard Frog. Most areas of breeding amphibian habitat in the transportation corridor contains small numbers of amphibians. Furthermore, one salamander species, a Red-backed Salamander, was located within the transportation corridor. The transportation corridor crosses a number of valleys, contiguous habitat blocks and tributaries, which vary in the level of function they provide for wildlife use and movement.

6.10 Species at Risk

Species at Risk that have been identified by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) as either Endangered or Threatened were identified within the 407 East Transportation Corridor and investigated in detail as part of the environmental assessment. These species are:

- The Golden-winged Warbler (*Vermivora chrysoptera Linnaeus*, Paruline à ailes dorées) species has been identified as “Threatened” by COSEWIC and is listed on Schedule 1 of the Federal *Species at Risk Act (*the *SARA)*. It was recorded on June 22, 2007 at approximately 6:30 am in one habitat unit approximately 150 m from the 407 East Corridor ROW. It is classed as a scarce migrant (11 to 50 records during both migration periods in a year) and very rare breeding species (less than 20 pairs) (Bain and Henshaw, 1994).
- The Blanding’s Turtle (*Emydoidea blandingii*) species has been identified as “Threatened” by COSEWIC and is listed on Schedule 1 of the *SARA*. A local resident reported the presence of Blanding’s Turtle in a dug pond that does not appear to provide good habitat for the turtle.
- The Butternut (*Juglans cinerea*) is identified as “Threatened” by COSEWIC and is listed on Schedule 1 of the *SARA*. A total of 83 Butternut trees were identified within the 407 East Transportation Corridor,

including 3 seedlings. The majority of the Butternut observed were deemed to be not retainable due to visual signs of Butternut Canker. A total of 34 Butternut trees were determined to be retainable.

- The Redside Dace (*Clinostomus elongatus*) species has been identified as "Endangered" by COSEWIC. It is currently being considered for listing under the *SARA*.
- The Atlantic Salmon (*Salmo salar*) species has been identified as "Extirpated" by COSEWIC. Re-introduced Atlantic salmon was recorded in the reaches of the East Duffins Creek within the ROW.

In addition, there is one known provincially rare terrestrial wildlife species (Carolina Wren) adjacent to the transportation corridor.

6.11 Socio-economic Environment

The Regional Study Area is contained largely within the Region of Durham, laying immediately to the east of the City of Toronto within the Greater Toronto Area and encompasses an area of approximately 2,590 km^2. The 407 East Transportation Corridor will serve all of southern Ontario including numerous individual communities and hamlets within Durham Region. Communities such as Almond Village, Brooklin, Kinsale, the Macedonian Village, Solina, Leskard, the village of Tyrone and Hampton are all located in proximity to the transportation corridor. Further, there are several proposed future growth areas, employment lands and planned communities located near the transportation corridor.

As noted above, MTO has identified 1,841 sensitive receptors along the transportation corridor. The transportation corridor also traverses the Don Beer Memorial Park and the Oak Ridges Moraine, Leskard and Darlington Trail systems. There are over 500 properties impacted by the ROW of the transportation corridor, including a number of non-farm commercial activities. Eight (8) businesses within the ROW may be potentially affected. The transportation corridor does not affect any existing mineral aggregate operations. It contains a significant amount of agricultural lands, particularly in the eastern portion of the study area (i.e., Clarington). The transportation corridor traverses a range of soil types, however there is a higher percentage of Class 1-3 type soils, which are more fertile than the Class 4-7 type soils.

6.12 Cultural Environment

There are a number of known archaeological sites and large areas of potential for archaeological finds within the transportation corridor. To date, 506 ha, or 23% of the entire transportation corridor footprint has been subject to a Stage 2 Archaeology Assessment, of which 291 ha or 13% has been submitted to the Ministry of Culture (MCL). Out of the 23% of the transportation corridor cleared to date, 36 Pre-contact aboriginal sites and 43 Early European sites have been documented.

Individual built heritage resources 40 years of age and older such as residences, barns, schools or churches were identified within the transportation corridor. Several roadscapes, farm complexes, cemeteries and agricultural lands 40 years of age and older were also identified as cultural heritage landscapes. Overall, 36 built heritage resources and 82 cultural landscape resources have been identified along the corridor. None of these resources are recognized by the Federal Government as having National Heritage Status (NHS).

6.13 Current use of Lands and Resources by Aboriginal People

There are no First Nation communities located directly within the RSA. Although there are no First Nation communities in the RSA, members of First Nations may well reside within the RSA. The closest First Nations community, the Mississaugas of Scugog Island, is located approximately 21 km north of the 407 East Transportation Corridor. Eleven (11) First Nations have been identified by MTO as having a historical relationship with the lands along the north shore

of Lake Ontario from Toronto East to the Bay of Quinte and north to Lake Simcoe and Rice Lake. The historical association with these lands resulted from occupation, traditional land use and related activities prior to European settlement.

There are three treaties with First Nations that are related to the lands comprising the RSA including: The Johnson-Butler Purchase Treaty (1788 and 1805), the Gunshot Treaty (1787); and the Williams Treaties (1923). The Aboriginal peoples in Canada, and as such their Aboriginal and treaty rights are recognized and affirmed under Section 35 of the Constitution Act, 1982.

Based on the research and field studies undertaken as part of the Provincial EA, there does not appear to be any current use of lands, water or resources by the identified First Nation communities along the 407 East Transportation Corridor and the RSA in general. No commercial fishing, traditional activities (i.e., relating to food, camping, travel, social or cultural purposes), nor First Nation communities with a dependence on country foods or harvesting on or near the 407 East Transportation Corridor were identified. At present, the vast majority of the land required for the 407 East Transportation Corridor is privately held.

In 2004, the Ontario Ministry of Natural Resources and the Métis Nation of Ontario (MNO) entered into an interim harvesting agreement allowing Métis Peoples to harvest food in traditional territories conditional upon having a harvesting card. Although there are no Métis settlements in the RSA, persons of Métis heritage may well reside within the RSA. At present, the boundaries and details of the traditional harvesting territories of Métis communities within Ontario are not fully determined. A description of the territories will be the subject of further research and consultations to take place in the near future between the MNO and Ontario Ministry of Natural Resources.

6.14 Contaminated Sites and Waste Management

The 407 East Transportation Corridor traverses over 500 properties, which are being assessed for potential site contamination. Of these properties, 385 have been assessed to date of which 24 properties have been identified as requiring additional investigations to determine the potential waste and property site contamination.

6.15 Identification of Valued Ecosystem Components

Table 6-1 describes the Valued Ecosystem Components (VECs) that were identified by MTO. They were identified based on MTO's understanding of existing environmental conditions potentially affected by the 407 East Transportation Corridor. These VECs represent specific features or attributes of the environment that are considered to be important for regulatory reasons, or because of their social, cultural, economic or ecological value. For each VEC, the following table provides a brief rationale for why the VEC was selected along with the key considerations and/or indicators to be used (where possible) in the effects assessment.

Table 6-1 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
Air Quality and Climate		
Air Quality Sensitive Receptors (Human / Ecological Receptors)	▶ Compliance will need to be assessed in terms of Provincial and Federal Ambient Air Quality Criteria for Highway Design ▶ Compliance with the requirements of the Environmental Reference for Highway Design will need to be assessed. ▶ Changes in air quality have the potential to affect socio-economic conditions (e.g., interference with activities and increased annoyance) and sensitive wildlife	▶ Potential for changes in air quality

Table 6-1 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
	ecosystems.	
Noise and Vibration		
Noise Sensitive Areas (NSAs) (Human / Ecological Receptors)	▶ Compliance with requirements of the Environmental Guide for Noise will be assessed. ▶ Changes in noise levels have the potential to affect socio-economic conditions (e.g., interference with activities and increased disruption to people's use and enjoyment of property) and sensitive wildlife ecosystems.	▶ Potential for changes in sound levels during construction ▶ Type and timing of construction activities ▶ Absolute sound exposure levels (Leq (24 h) values, in dBA) at Noise Sensitive Areas ▶ Change in sound exposure levels (L_{eq} (24 h) values, in dBA) at Noise Sensitive Areas
Surface and Subsurface Geology and Soils		
Valley Slopes and Landforms	▶ Changes to valley slopes and landforms may affect the landscape composition and consequently community character. Changes to valley slopes and landforms may result in an increased risk of erosion and sedimentation	▶ Potential for effects to valley slopes and landforms ▶ Erosion and sedimentation risk
Groundwater		
Regional Groundwater Aquifers	▶ Regional groundwater aquifers have social, economic and ecological value. Large, regional aquifers provide a source of potable water sufficient for municipal / industrial uses. They provide baseflow to larger rivers and streams	▶ Changes to Groundwater quality, water table depth and discharge
Groundwater Wells	▶ Groundwater wells have social, economic and ecological value. They are the primary potable water supply in rural areas. There are a large number of wells located near the proposed 407 East Transportation Corridor (>1,500)	▶ Changes to drinking water quality and water Level within wells
Groundwater Table in Surficial Soils	▶ The groundwater table in surficial soils may provide a source of potable water to rural residences. They can provide baseflow to small creeks and streams.	▶ Changes in the local water table at cuts and groundwater flow directions at major fills.
Surface Water		
Surface Water Bodies / Watercourses	▶ Surface water bodies and watercourses provide habitat for fish and other aquatic species and may serve as a place for some local residents to undertake recreational activities.	▶ Reduction in surface water quality and flow conditions ▶ Changes in groundwater discharge
Vegetation and Vegetation Communities		
Forested Areas	▶ Forested areas play important ecosystem functions and contribute to Canadian biodiversity.	▶ Presence and effects on forested areas
Forested Areas with Interior Habitat	▶ Forested areas with interior habitat play important ecosystem functions and contribute to Canadian biodiversity. Some woodlots may provide important wildlife habitat (e.g., breeding and/or migratory birds and Species at Risk) that need to be considered under the *Migratory Bird Convention Act* and *Species at Risk Act.*	▶ Presence and effects on forested areas with interior habitat
Wetlands		
Wetlands	▶ Wetland communities are particularly sensitive to disturbance and are difficult to recreate. Wetlands contribute to Canadian biodiversity. Some wetlands may provide important wildlife habitat (e.g., breeding and/or migratory birds and Species at Risk) that need to be considered under the *Migratory Bird Convention Act* and *Species at Risk Act.*	▶ Presence and effects on wetlands
Fish and Fish Habitat		
High Sensitivity Fish Habitat *(e.g., coldwater fish habitat)*	▶ The protection of fish and fish habitat need to be considered under the *Fisheries Act*. High sensitivity fish	▶ Presence and effects on: • Salmonid/Char spawning and rearing habitat

Table 6-1 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
	habitat offers the greatest potential for a significant harmful alteration, disruption or destruction of habitat (HADD). High sensitivity fish habitat contribute to Canadian biodiversity and may provide important habitat that need to be considered under the *Species at Risk Act.*	• Redside Dace • Specialized spawning and rearing for other species
Low to Medium Sensitivity Fish Habitat	▶ The protection of fish and fish habitat need to be considered under the *Fisheries Act*. Low or moderate sensitivity fish habitat offer some potential for a significant harmful alteration, disruption or destruction of habitat (HADD). Regardless, low and medium sensitivity fish habitat contribute to Canadian biodiversity.	▶ Presence and effects on: • spawning and rearing habitat for warm water fish species
Wildlife and Wildlife Habitat (including migratory birds)		
Specialized and Sensitive Wildlife Habitat	▶ Specialized and sensitive wildlife habitat provide unique habitat functions difficult to reproduce. Such habitats contribute to Canadian biodiversity. Some areas may provide important wildlife habitat (e.g., breeding and/or migratory birds and Species at Risk) that need to be considered under the *Migratory Bird Convention Act* and *Species at Risk Act.*	▶ Presence and effects on: • Breeding bird species richness and diversity • Habitat diversity • Species of Conservation Concern • Significant habitat types • Presence of specialized wildlife habitat • Amphibian breeding habitat • Level of anthropogenic disturbance • Habitat block size • Habitat continuity
Mammals, Amphibians and Breeding/Migratory Birds	▶ Mammal, amphibians and breeding/migratory birds are vulnerable to effects of construction and operation of transportation infrastructure.	▶ Presence and effects on mammals, amphibians, breeding/migratory birds.
Species at Risk		
Federal (COSEWIC) Species at Risk	▶ Species at Risk are indicators of specialized conditions in study areas. They contribute to Canadian biodiversity and need to be considered under the Federal *Species at Risk Act.*	▶ Presence and effects on habitats for: • Golden-winged Warbler • Redside Date • Butternut • Blanding's Turtle • Re-introduced Atlantic Salmon
Socio-Economic Environment		
Use and Enjoyment of Private Property	▶ Nuisance effects from proximity to the corridor have the potential to affect use and enjoyment of private property	▶ Projected levels of noise and dust.
Community Character	▶ The project could result in physical separation of smaller communities within a municipality from the other communities and community facilities. Changes in landscape composition, increased noise and dust could disturb the rural/agricultural atmosphere that is valued by local residents.	▶ Encroachment on the community, division of the community or creation of a barrier from other communities. ▶ Changes to noise and dust levels.
Agricultural Activity	▶ Across Durham Region, agricultural activity is an important component of the local and regional economy. Agriculture also influences a community's character and cohesion, ultimately affecting a community's well-being. Agricultural soils are a natural resource and critical to agricultural operations. Across Durham Region, agricultural operations are an important component of the local and regional economy. Agriculture also influences a community's character and cohesion, ultimately affecting a community's well-being.	▶ Presence of agricultural operations and effects on: • Landscape composition • Presence of Class 1, 2 and 3 Agricultural Soils

Table 6-1 Valued Ecosystem Components

VEC	Rationale	Effects Considerations / Indicators
Cultural Environment		
Archaeological Sites	▶ Archaeological sites with human burials are protected under the Ontario Heritage Act. ▶ Archaeological sites with human burials will require assessment and compliance with the provisions under the Ontario Cemeteries Act.	▶ Presence of and effects on: • Archaeological sites (with and without human burials)
Euro-Canadian Built Heritage and Cultural Landscapes	▶ Euro-Canadian Built Heritage and Cultural Landscapes have social value, by contributing to our understanding of Euro-Canadian history from the late 18th- to the early-20th century, for research public education purposes, and for their spiritual or cultural meaning to Canadians	▶ Presence of and effects on: • Built Heritage Resource (BHR) containing architecture and/or above-ground structural remains and artifacts • Cultural Heritage Landscapes (CHL) defined by farm complexes, roadscapes, waterscapes, railscapes, historic settlements, cemeteries, and historic/commemorative sites
Current Use of Land and Resources by Aboriginal People		
None Identified		
Waste / Property Contamination		
Soil Quality	▶ There is potential for encountering contaminated soil during construction activities and as such the contaminated soil will require remediation in accordance with environmental regulations. ▶ Cleaning up contaminated soil is important to the individual property owner and for the environment.	▶ Activities undertaken at each individual property (e.g. construction activities; waste storage and disposal; vehicle fuelling, maintenance, and storage operations). ▶ Number of properties with potential for contamination.

7. Likely Environmental Effects

The following sections provide a summary of the effects assessment undertaken for this comprehensive study, including the identification of the likely environmental effects, mitigation measures and residual adverse effects of the 407 East Transportation Corridor. These summaries are based on the complete body of documentation that includes the Provincial EA document, technical reference documents, and the draft environmental screening report (December 2009). Key government and public comments resulting from the review of the Provincial EA documentation and those initially provided by the CEA Agency, the RAs and FAs during the preparation of the draft environmental screening report (December 2009) are also summarized.

7.1 Air Quality and Climate

7.1.1 Approach

Dispersion modelling was used to assess air quality effects of the Recommended Design during the Alternative Methods phase of the Provincial EA process. This assessment included:

- Established background concentrations of the contaminants of interest in the absence of the proposed project.
- Quantified the contaminant emissions from the vehicular traffic associated with the Recommended Design.
- Used a dispersion model to predict contaminant concentrations due to the operation of the highway component of the transportation corridor at key receptor points.
- Used the predicted background concentrations to determine the combined effect on the air quality, and compared to the applicable air quality criteria to determine the nature and extent of impacts.

Consideration was given to Provincial and Federal guidelines in the form of ambient air quality criteria, including MOE's Ambient Air Quality Criteria (AAQCs); Environment Canada's (EC) National Ambient Air Quality Objectives (NAAQOs) and the Canadian Council of Ministers of the Environment (CCME) Canada Wide Standard (CWS) for $PM_{2.5}$. With the exception of Total Suspended Particulate Matter (TSP), which gives an indication of fugitive dust levels (a nuisance contaminant), all other contaminants considered are related to potential human health effects and/or effects on sensitive vegetation communities[1] and wildlife. Where there were thresholds for multiple averaging periods for a given contaminant, attainment was assessed using the threshold corresponding to the shortest averaging period (i.e., 1-hour, 8-hour, or 24-hour). With respect to effects on human health, average 24-hour pollutant concentrations were considered most appropriate. It is noted that thresholds for the protection of sensitive vegetation communities and wildlife are not available for air quality, the levels used for the protection of human health were used as indicators.

7.1.2 Likely Effects and Mitigation

During the Construction Phase, Project-related emissions were found to be of low magnitude and short term in duration, however there may be infrequent occasions where exceedances of an applicable threshold occur. The largest effects on air quality are due to releases of TSP. To minimize air quality effects during the Construction Phase, the relevant provisions contained in Environment Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (March, 2005) will be written into the contract documentation between

[1] Plants are potentially affected by high levels of TSP from dust fallout.

MTO and the construction contractor(s). In addition, the contractor may be required to implement street cleaning methods, take measures to encourage adherence to speed limits and discourage extended periods of idling.

During the Operations Phase, the Project will contribute to reduced local and regional air quality. For the most part, maximum predicted concentration are much lower than background pollutant concentrations and most are well below applicable reference criteria as summarized below.

Maximum Predicted Concentrations – Entire Transportation Corridor

Contaminant	Averaging Period	Maximum Predicted Concentration (µg/m^3)	Threshold (µg/m^3)	% of the Threshold	Attainment
CO	1-hour	3,033	36,200	8%	Yes
NO_2	1-hour	149	400	37%	Yes
$PM_{2.5}$	24-hour	20.1	30	67%	Yes
PM_{10}	24-hour	46.1	50	92%	Yes
TSP	24-hour	170	120	142%	Yes
1,3-Butadiene	24-hour	0.39	-	-	-
Benzene	24-hour	4.00	-	-	-
Formaldehyde	24-hour	4.61	65	7%	Yes
Acetaldehyde	24-hour	3.89	500	0.8%	Yes
Acrolein	24-hour	0.185	0.08	232%	No

For a worst case section of the highway (i.e., a 10 lane section with the highest traffic volumes), MTO predicted the percentage increase in 24 hour pollutant concentrations over background levels for the following contaminants of concern at both 25 m and 500 m from the edge of the highway ROW. The results are as follows:

- Carbon Monoxide - +68% (25 m) to +21% (500 m)
- Nitrogen Dioxide - +113% (25m) to 38% (500m)
- PM_{10} - +58% (25m) to +13% (500m)
- $PM_{2.5}$ - +13% (25m) to + 3.5% (500m)
- Benzene - +11% (25m) to 0% (500 m)
- Formadehyde - +5.5% (25m) to +1% (500m)
- Acetaldehyde - +1.3% (25m) to + 0.3% (500m)
- Acrolein – +1.8% (25m) to +0.4% (500m)
- 1,3-Butadiene - +7.5% (25m) to +2.5% (500m)

Despite these increases in concentrations, all of these contaminants except acrolein are below their applicable guideline thresholds. As such, acrolein was examined further. Acrolein is manufactured as an end-use product, mainly as a pesticide or it is used in production of acrylic acid. It is also a potential by-product of incomplete combustion, including motor vechicles. Acrolein is not commercially produced in Canada but is imported from the United States.

The exceedance of the applicable threshold for acrolein is due to the existing elevated ambient background concentrations in the RSA. Air quality monitoring data indicates that the 90th percentile background concentration of acolein in the RSA is approximately 225% of the threshold. The maximum predicted acrolein concentration from the roadway is 0.005 µg/m³ and the maximum cumulative acrolein concentration due to the Project was predicted to be 0.185 µg/m³. In comparison to the threshold of 0.08 µg/m³ the maximum predicted concentration from the roadway is 6.25% of the threshold.

With respect to the nuisance contaminant TSP(primarily fugitive dust), air quality modelling indicates that the maximum predicted concentration of 170 µg/m³ will exceed its applicable threshold of 120 ug/m^3 with concentrations diminishing with distance from the highway similar to PM_{10} and $PM_{2.5}$, The exceedance of the this threshold is due to a combination of re-entrained road dust, primarily from existing arterial roads within the study area and elevated ambient background concentrations. However, TSP levels are not predicted to exceed the applicable threshold for most sensitive receptors along the right-of-way. For example, only 111 (6%) of air quality sensitive receptors are anticipated to experience worst-case concentrations (90^{th} percentile background plus transportation corridor) in excess of the threshold. On a worst-case basis, 448 receptors (24%) would experience concentrations in excess of 90% of the threshold of 120 µg/m³.

With respect to human health implications, the air quality analysis focused on $PM_{2.5}$ for a representative worst-case receptor for the west Whitby area, a densely populated area along the transportation corridor. The analysis concluded that there is no apparent difference between the frequencies of occurrence of $PM_{2.5}$ levels for the transportation corridor (combined with ambient conditions) versus the ambient measurements alone. For the majority of the year, the $PM_{2.5}$ levels were predicted to be substantially lower than the maximum predicted 24-hour levels. The combined effects analysis predicted annual median concentration of $PM_{2.5}$ at a representative worst-case sensitive receptor is approximately 5 µg/m^3, which is well below the threshold.

To minimize air quality effects during the Construction Phase, MTO has committed to implementing a number of provisions from Environment Canada's Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities (March 2005) which shall be written into the contract documentation between MTO and the construction contractor(s) and used where reasonably available. In addition, the contractor(s) may be required to implement street cleaning methods, particularly on main roads adjacent to and intersecting the interchanges and the on and off-ramps to the highway. Other mitigation measures are to encourage adherence to speed limits as well as to discourage extended periods of idling by construction vehicles. MTO will provide oversight of its contractors compliance to contract Terms and Conditions.

Effects on air quality during the Operations and Maintenance Phase shall be mitigated by implementing the following measures, where feasible:

- Reducing surface loadings by paving the shoulders of the transportation corridor (where feasible).
- Ensuring that there is vegetation along the corridor which limits soil erosion and helps to remove particulate matter and other contaminants from the air.
- Reducing sand and salt loadings to the transportation corridor through improved plowing or utilization of a pavement surface texture that minimizes ice adhesion.
- Washing the sand that is used for de-icing, prior to its application, to remove fine particulates that will become re-suspended without reducing the effectiveness of the coarse particles which prevent skidding.
- Providing high occupancy vehicle lanes and a transitway corridor will promote ride sharing and transit use and therefore reduce the reliance on single occupant vehicles. In addition, a number of Provincial and Federal initiatives (e.g., fuel regulations, vehicle and engine emission regulations, and amendments to Provincial air pollution regulations) will help to further mitigate the transportation's contribution to air pollution.

Changes in air quality will also have effects on ecological receptors. These are considered in the discussion for vegetation and vegetation communities; wetlands; wildlife and wildlife habitat; and species at risk.

7.1.3 Residual Effects

During the Construction Phase, there may be infrequent occasions where exceedances of applicable thresholds occur. The largest effects on air quality are due to releases of TSP (i.e., fugitive dust). The Project is expected to result in increased emissions of contaminants of concern during the Operations and Maintenance Phase of the project, resulting in reduced air quality. The largest effects on local and regional air quality are due to releases of acrolein and TSP (i.e., fugitive dust primarily).

7.1.4 Government and Public Comments

During the formal review of the Provincial EA document, comments about air quality effects were made by the MOE and the public. Public comments were largely focused on the likelihood of reduced local and regional air quality, the potential for effects on human health, agricultural lands and crops. Concern was expressed over the process used for developing the air quality criteria, the list of chemicals evaluated and the approach taken by MTO to establish baseline conditions and complete its air quality modelling. In response to comments on air quality effects, MTO prepared information to supplement the air quality assessment and responded to the public comments. These are provided in Appendix C and D to the 407 East Environmental Assessment Review (December 2009). The MOE air quality reviewer has concluded that the additional information addresses the concerns raised.

HC provided the RAs with comments regarding air quality. HC noted that any increase in exposure may result in an incremental risk in human health and that the expression “Air Quality Threshold” that is used be avoided (especially for Particulate Matter (PM10 and PM 2.5) and for carcinogenic substances). HC suggested that ozone be considered in the air quality assessment to prevent an underestimation of potential risk to human health. HC suggested that a more complete dataset be obtained through NAPS to provide a better representation of the air. HC requested that MTO clarify how the predicted 24hr 98th percentile $PM_{2.5}$ concentration for the entire 407 Transportation Corridor during the operation and maintenance phase of 20.1 $\mu g/m^3$ and the summary of ambient air measurement table providing a value of 20 $\mu g/m^3$ for 90th percentile 24hr $PM_{2.5}$ were calculated. HC suggested the ambient data used for these predictions be updated using data from the National Air Pollutants Surveillance (NAPS) program in order to prevent potential underestimation of risk to human health. In addition, as exceedances of $PM_{2.5}$ and Ozone are suspected, HC suggested these two pollutants be added to the cumulative effect analysis and appropriate mitigation measures may be applied in order to reduce potential risk to human health. MTO indicated that it had considered $PM_{2.5}$ with respect to its human health implications as part of the cumulative effects assessment. With respect to ozone, MTO predicted the effects of the precursors of ozone (NOx and VOCs) and thus have indirectly considered the effect of the Project on ozone levels rather than through modelling.

The CEA Agency, RAs and FAs note that MTO has acknowledged that there is a residual adverse effect on air quality and an incremental human health risk associated with an increase in the concentration of some pollutants – whether below or above the ambient air quality criteria/standards. Hence, MTO endeavours to minimize the air pollution impacts of projects while observing the ambient air quality criteria/standards to the extent possible.

Finally, the approval granted by the Ontario Minister of Environment on June 3, 2010 indicated that from the Province’s perspective, MTO has demonstrated that the environmental effects of the Project can be appropriately prevented, changed, mitigated or remediated and that no outstanding concerns exist that have not been addressed or that cannot be addressed through commitments made during the Provincial EA process, through specified Conditions of Approval or through future approvals. As such, the Province has imposed several Conditions of Approval that are relevant to effects of air quality. These Conditions of Approval require MTO to prepare and implement:

- a *Complaint Protocol* on how it will deal with and respond to inquiries and complaints received during the construction and operation of the Project;
- a *Construction Noise, Vibration and Air Quality Impact Mitigation Plan.* The plan would include provisions for local air quality monitoring during construction and identify the mitigation measures to be implemented to mitigate air quality impacts; and
- a *Construction Management and Mitigation Plan*.

7.2 Noise and Vibration

7.2.1 Approach

The assessment of construction noise was undertaken for broad types of construction activities, as a function of distance. The broad types of construction activities examined by MTO included: general construction, bridge and embankment construction, bridge pile driving and rock drilling. For the Operations and Maintenance Phase, noise modelling was undertaken using a two-step process: a screening level noise modelling, and detailed noise modelling. The screening level noise modelling was conducted to identify the range of potential impacts over the entire study area and to identify areas where further investigation of impacts and noise mitigation through the detailed noise modelling process were warranted. First, the future no-build sound levels due to the existing background roadway network and the natural background ambient were estimated using the road noise prediction model. Major links of the existing roadway network were modelled to generate a grid of sound exposure levels. Secondly, the same approach was used to predict future build sound exposures, with the proposed transportation corridor in place, and with resulting future build volumes on the surrounding roadway network. Full build-out conditions for the new highway were assumed for the analysis, and a future design year of 2031 was used, which is approximately 18 years after the anticipated end-of-construction date of 2013. A similar grid of sound exposure levels was created. Finally, the two grids were subtracted to create a grid of changes in sound exposure levels. This was used to create “noise change contours” (isopleths of changes in noise level), highlighting NSAs which receive changes in 0 to 5 dB, > 5 to 10 dB, > 10 to 15 dB, and > 15 dB bands.

For those NSAs that would experience future build sound levels in excess of 65 dBA, technically feasible mitigation measures were investigated in more detail. In conducting the assessment, consideration was given to the Environmental Guide For Noise (MTO 2006) and Environmental Reference for Highway Design (MTO 2002). Under the *Environmental Guide for Noise*, mitigation is an integral part of the analysis. The *Guide* stipulates that mitigation is warranted when increases in sound level over the no-build ambient condition are 5 dB and greater. As such, mitigation measures were considered as an integral part of the effects assessment.

7.2.2 Likely Effects and Mitigation

MTO conducted an analysis of potential worst-case construction noise levels based on generic data (equipment types and activities) in order to identify potential noise effects on potential Noise Sensitive Areas (NSAs) during construction. The various construction activities were considered at the nearest NSA to each activity and for each section of the 407 East Transportation Corridor.

The construction noise analysis indicates that bridge pile driving and rock drilling tend to be the noisiest activities. Depending upon the location of the nearest NSA, noise levels could range from 63 dBA (rock drilling) to 87 dBA (bridge pile driving). More specifically, the nearest NSAs to the 407 East Transportation Corridor are located in between Audley Road to Ashburn Road in the City of Pickering and the Town of Whitby. Here, construction activities could be undertaken as close as 30 m from the NSA. Worst case construction noise levels at the nearest

NSA are anticipated to be between 75 dBA (bridge construction) and 87 dBA (bridge pile driving). At this location, sound levels would be considered to be “loud” to “very loud”.

As specified in the Comprehensive Study Guidelines document, MTO developed a “Code of Practice” to minimize potential noise and vibration effects during construction, the provisions of which will be written into the contract documentation between MTO and the construction contractor(s). Although blasting is not anticipated, blasts (if required) shall be designed to meet any applicable overpressure and vibration limits established by the MOE in Publication NPC-119 and should meet Ontario Provincial Standard Specification OPSS 120: General Specification for the Use of Explosives (MTO 2003).

During the Operations Phase, the vast majority of receptors will experience a change in noise of 0 to 5 dBA, which can range from an “imperceptible change” to a “clearly noticeable change”. Approximately 23% of receptors will experience increases of > 5 dBA and 3% will experience substantial changes in their sound environment of > 10 dBA, Approximately 10% of all receptors are anticipated to experience a positive effect, namely reduced noise levels. Noise level reductions are largely due to changed traffic patterns along local and regional roads due to the presence of the 407 East Transportation Corridor.

Overall, the sound environment changes from one where the majority of receptors are in a rural environment (sound levels < 50 dBA) to one with urban or suburban characteristics (sound levels between 50 and 60 dBA). Using 60 dBA as a threshold, and taking into consideration sound level magnitude and change from existing conditions, MTO’s analysis indicates that a small fraction of NSAs (~4%) will experience a noticeable change in sound levels (>5 dB change) and sound levels greater than 60 dBA. Overall, 56 NSA receptors were predicted to have a change in noise greater than 10 dBA. This represents 3% of the 1,827 NSA receptors along the transportation corridor. These predictions were based on the full build scenario and a future design year of 2031, which is approximately 18 years after the anticipated end-of-construction date of 2013. Therefore, it can be expected that these changes in noise levels will not be realized immediately. Rather, it can be expected that changes in noise levels at receptor locations due to the Project would increase gradually over time as the utilization of the roadway and transitway increases.

The feasibility of noise barriers was investigated by MTO. Three noise barriers were determined to be economically and technically feasible, and are to be installed to mitigate noise impacts during the operations phase. The locations include Brooklin, Hampton and along Highway 401, east of the West Durham Link. Enhanced landscaping measures will be used in other areas receiving substantial changes in noise levels. In addition, specific approvals required for the Project in relation to noise include conformance with applicable local noise control by-laws. If work outside of the allowed hours is anticipated, MTO and or its agents, will seek any required exemptions and permits directly from the affected jurisdiction. If an exemption cannot be obtained, then maintenance will proceed in accordance with the municipal by-law.

Changes in noise levels will also have effects on ecological receptors. These are considered in the discussion for wildlife and wildlife habitat.

7.2.3 Residual Effects

Overall, increased noise levels along the 407 East Transportation Corridor are anticipated during the Construction, Operations and Maintenance Phases. MTO has determined that there will be 15 sensitive noise receptors that are expected to experience high levels of noise for which there are no technically or economically feasible mitigation measures.

7.2.4 Government and Public Comments

During the review of the Provincial EA, comments about noise were made by MOE and the public. The MOE comments focussed on MTO's cost thresholds that determine mitigation to be technically and economically feasible; the potential use of noise-reducing asphalts near selected receptors; and the use of vegetative buffers as noise mitigation. The public comments received expressed concern over noise at a specific location, the effects of noise on wildlife, the scope of the detailed noise assessment and approach to mitigation.

The MOE reviewer concluded that the noise modelling undertaken to identify the range of potential effects over the entire study area was satisfactory. The reviewer also concluded that the noise impact assessment satisfactorily identified areas where further investigations of effects and noise mitigation through detailed modelling was warranted. Nevertheless, MOE requested that MTO undertake a more detailed assessment to investigate the feasibility of mitigation at 56 specified NSA receptors that were initially predicted to have a change in noise greater than 10 dBA. In response, MTO undertook a detailed review of these 56 receptors, taking into account the effect of screening by bridge embankments, the viewable portions of the roadways, and by wooded areas. In recognition that there are areas along the transportation corridor which have been designated for future development under the Growing Durham plan, MTO's more detailed assessment used a future build ambient noise level of 50 dBA (suburban / semi-rural) rather than the 45 dBA rural in the original analysis. As a result of this more detailed assessment, MTO reported the following:

MTO is in the process of acquiring properties that are physically affected by the corridor. At the time the additional more detailed assessment was being undertaken, 17 of the 56 NSA receptors had been fully purchased. Additionally, one of the receptors in the EA (Receptor No. 1744) was incorrectly identified as noise sensitive. This reduced the total number of NSAs which may be affected by noise to 38. Of the remaining 38 NSAs, 15 are undergoing partial purchase. Three (3) of the partially purchased NSAs have indicated their desire to stay and not be fully purchased. For these 15 receptors, MTO updated their future build sound level predictions to include the effects of screening from terrain and blocked views of the new highway. MTO also updated the resulting mitigation costs and their determination as to the feasibility of further mitigation.

The results of this more detailed analysis indicated that while originally, 6 receptors were identified as having changes greater than 15 dB, the more detailed assessment shows that none of the NSAs would experience a change in noise greater than 15 dB. Similarly, the number of NSAs experiencing changes from 10 to 15 dB decreased from 50 NSA receptors to 15 in the more detailed assessment. The remaining receptors either show changes less than 10 dB, or have been purchased/removed. MTO's review of mitigation costs indicated that further mitigation in the form of noise barriers were not technically and/or economically feasible. However, MTO identified further opportunities for woodland plantings and landscape treatment as visual screens at several of the 15 receptor locations.

HC provided the RAs with comments regarding noise focusing on the magnitude of noise effects at selected receptors and their health implications; the need for technically and economically feasible mitigation to be applied in order to reduce the potential health impact to the receptors; and the need for a complaint resolution strategy. HC advised MTO and the RAs that the Ontario noise criterion may not be sufficient to address the annoyance from blasting if there are more than 3 blasts per day.

MTO responded to all government and public comments. Specifically, MTO indicated that the noise assessment was undertaken in accordance with the provincial noise process and is consistent with the requirements of the Comprehensive Study Guidelines document. MTO indicated that mitigation measures have been implemented where they were technically and economically feasible and that visual screenings in combination with berms will be investigated during subsequent design phases. MTO confirmed that a complaint resolution strategy will be

developed for the Project during subsequent design phases for implementation during construction as is typically done for MTO projects. MTO also confirmed that no blasting is anticipated.

Finally, pursuant to the approval granted by the Ontario Minister of Environment on June 3, 2010, MTO will be required to prepare and implement:

- *Noise Mitigation Plans* for specified properties at which substantial noise effects were identified by MTO;
- a *Complaint Protocol* on how it will deal with and respond to inquiries and complaints received during the construction and operation of the Project;
- a *Construction Noise, Vibration and Air Quality Impact Mitigation Plan.* The plan would identify the mitigation measures for all major construction activities including those due to possible blasting and pile-driving;
- a *Construction Management and Mitigation Plan*.

7.3 Surface and Subsurface Geology and Soils

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the 407 East Transportation Corridor on surface and subsurface geology and soils. A focus has been placed on erosion and sedimentation and the overall risk to VECs such as surface waterbodies / watercourses, wetlands, specialized and sensitive wildlife habitats, high sensitivity fish habitat, and a variety of sensitive vegetation communities. Further information is provided in the Provincial Environmental Assessment Report, Volume 1 – Main Report, Chapter 8 and in the Natural Environment (Hydrogeology) Impact Assessment Report (Reference Document #7). In addition, soil contamination issues are addressed in Waste Management and Contamination Impact Assessment Report (Reference Document #13).

7.3.1 Approach

A detailed assessment of the erosion and sediment control risk within the ROW of the 407 East Transportation Corridor was completed through an air photo interpretation exercise and ecological field work. This assessment provided the basis for classifying and mapping areas according to their susceptibility to erosion, potential for delivering sediment to surface water features and potential ecological consequence of sedimentation. Ultimately, specific areas along the 407 East Transportation Corridor will be delineated and assigned qualitative ratings – *low, medium or high* – according to their overall erosion and sediment control risk. These additional, future steps to determining the overall erosion and sediment control risk will be required on a site-by-site basis during subsequent design phases. Any erosion and sediment control plan would be designed in accordance with the preliminary erosion and sediment control (ESC) protection measures described below and in the MTO Environmental Guide for Erosion and Sediment Control (2007).

7.3.2 Likely Effects and Mitigation

The 407 East Transportation Corridor will result in changes in valley slopes and landforms due to site preparation, grading and earthmoving activities associated with roadbed construction and construction of ancillary facilities. Such activities will need to be undertaken along the entire length of the 407 East Transportation Corridor to maintain appropriate grades. Cuts and fills will also be required along the transportation corridor, but especially at watercourse crossings to facilitate the installation of bridge footings and other crossing related structures. As such, the Project will result in direct changes in valley slopes and landforms, such as moraines, drumlins and hummocky deposits which tend to occur along the eastern portion of the mainline corridor. The Project will affect the valley

slopes at the crossings of approximately 79 natural watercourses. Overall, these construction activities and changes in valley slopes and landforms will likely increase the exposure of soil to erosion.

MTO determined the susceptibility of areas along the corridor to erosion given that potential exists for surface runoff to deliver sediment to a surface water feature, such as a watercourse, wetland or pond. The potential ecological consequence of sedimentation in surface water features was considered in this analysis. The overall erosion and sediment risk analysis concluded that the majority (63%) of the 407 East Transportation Corridor has a "Low Risk" from erosion and sedimentation. This is because of the large areas with till soils at surface and with agricultural fields and drainage swales dominating the ecological environment. Areas of "Moderate Risk" are the second most common (24%), which reflects some of the steeper slopes and more erosion-prone soils, as well as the 30 to 300 m downslope flow path to ecologically sensitive areas. Finally, "High Risk" areas are the least common (13%), which reflects the presence of tight surficial soils within the RSA and the careful route selection of the transportation corridor to avoid ecologically significant areas wherever possible.

During the Operations Phase, the implementation of the 407 East Transportation Corridor design features (i.e., effective stormwater management (SWM) facilities, stabilization and re-vegetation of bridge approach slopes, etc.) and other relevant mitigation measures identified by MTO will result in negligible surface erosion and instream sedimentation. Specific outfall control measures will be implemented for all SWM facilities to prevent erosion of the receiving streams, with specific attention to outfalls to the deeper valleys and at many of the high sensitivity watercourses in the eastern portion of the study area. As such, no adverse effects on surface and subsurface geology or soils are anticipated.

MTO shall develop erosion and sediment control (ESC) protection measures during subsequent design phases that will follow the most current standard industry practices available, including the Greater Golden Horseshoe Area Conservation Authorities' Erosion and Sediment Inspection Guide (2008), Ontario Guidelines on Erosion and Sediment Control for Urban Construction Sites, Ontario Provincial Standards Specifications (OPSS), and/or established MTO procedures. MTO will adhere to the requirements of all permits, acts, guidelines (i.e., Canadian Environmental Protection Act; Ontario Water Resources Act, Federal Fisheries Act, etc).

7.3.3 Residual Effects

The 407 East Transportation Corridor will result in changes in valley slopes and landforms due to site preparation, grading and earthmoving activities associated with roadbed construction and construction of ancillary facilities. Overall, these construction activities and changes in valley slopes and landforms will likely increase the exposure of soil to erosion.

7.3.4 Government and Public Comments

There were no specific comments regarding surface and subsurface geology and soils provided by Provincial government reviewers or the public. Comments regarding erosion were generally focused on their effects on surface water and wetlands. EC provided the RAs with comments regarding surface and subsurface geology and soils, requesting that MTO acknowledge a residual adverse effect given that small localized effects will occur due to construction and operation of the project, notably at the locations of major cuts and fills. MTO confirmed that the Project is likely to result in changes in valley slopes and landforms during the Construction and Operations phases and that changes in valley slopes and landforms will likely increase the exposure of soil to erosion during the Construction Phase.

7.4 Groundwater

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the 407 East Transportation Corridor on groundwater. The VECs identified for this analysis were regional groundwater aquifers, groundwater wells, groundwater in surficial soils, wetlands and specialized and sensitive wildlife habitat. Further information is provided in the Natural Environment (Hydrogeology) Impact Assessment Report (Reference Document #7).

7.4.1 Approach

MTO conducted a variety of research and hydrogeological field investigations to address effects on groundwater within 500 m of the ROW where protective dense till soils are present at surface, and within 1,000 m of the ROW where sandy soils are present at surface (potentially representing sensitive unconfined aquifers). Hydrogeological field investigations included aerial photograph interpretation and terrain mapping; borehole drilling and groundwater monitor installations, monitoring, and sampling; mini-piezometer installations and monitoring; stream reconnaissance network and monitoring; and water well survey and domestic well sampling. Investigations were undertaken across the length of the transportation corridor as well as at specific sites of interest (e.g., East Durham Link specifically within the Harmony Farewell Iroquois Beach Wetland Complex and the Maple Grove Wetland Complex, and in the vicinity of Sideline 16 Road, and Leskard Road).

A total of 37 groundwater monitoring well nests and 9 groundwater monitors were installed as part of the hydrogeology component. Single well response tests (slug tests) were completed at each groundwater monitor between April and June, 2008 (additional monitors were slug tested shortly after completion). Excavation below the water table related to Deep Cuts were the focus of the groundwater assessment as they were considered to have the greatest potential to permanently lower the water table elevation near the cut. A deep cut was defined as any excavation lower than 4.5 m below original grade (OG). For the most part, a permanent lowering of the water table of <1.0 m was not considered substantial for most private wells, and therefore the radius of drawdown or influence was estimated to this point.

The assessment considered a variety of Provincial and Federal guidelines, including: Ontario Drinking Water Standards (O. Reg. 169/03), Provincial Water Quality Objectives - Ministry of Environment and Energy 1994 (Updated July 1998); Guidelines for Canadian Drinking Water (May 2008); and the MTO Groundwater Environmental Reference Highway Design.

7.4.2 Likely Effects and Mitigation

Changes to the groundwater hydraulic regime can occur any time an excavation is conducted below the groundwater table. Depending on the location and nature of the excavation, effects can be experienced at a regional and/or local level. Excavations for bridge piers and footings, placement of buried infrastructure, and deep cuts can intercept the natural flow of water and change the groundwater flow dynamics in an area. Deep cuts can expose large areas of confined aquifer units which can de-pressurize the aquifer unit and alter the local groundwater flow patterns. Deep cuts may only require temporary dewatering to create a dry work area before the water table reaches a new equilibrium, but in some cases, where confined regional aquifer units or a perched water table in the surficial soils has been breached by excavations, permanent groundwater control may be required. Excavations below the water table may require dewatering that can temporarily disrupt the local hydraulic regime within surficial soils.

Construction of bridges or culverts over watercourses can cause temporary reductions to groundwater levels and groundwater discharge from surficial soils to receptors from dewatering of excavations, coffer dams, etc.; de-

pressurization of deep aquifer units from deep foundations; and impede groundwater flow and discharge from fill placement over high permeability alluvial materials in valleys and over groundwater seeps.

Placement of high fill can cause changes to the groundwater hydraulic regime in surficial soils by blocking groundwater flow paths and by reducing the hydraulic properties of the underlying surficial soils due to compaction. Fill placement typically has only a minor adverse effect on groundwater flow in surficial soils and is generally considered to be more of a problem for slope stability than for the groundwater, however covering groundwater springs or seeps below the fill footprint can affect groundwater discharge and species that rely on springs.

Construction of the transportation corridor (paved surface) can also reduce recharge from placement of an impervious surface; impede groundwater flow and discharge; and change local groundwater flow from buried infrastructure such as pipes.

Transferring fuels and other hazardous materials during construction can create spills that may reach the groundwater table and contaminate drinking water supplies. If management protocols are followed, the potential risk from spills is low.

Such changes to the groundwater hydraulic regime can cause a reduction in water levels in private wells, can reduce groundwater discharge to receptor water bodies or wetlands, and can reduce groundwater quality by mobilizing or transporting contaminated groundwater to new areas.

It is likely that major cuts along the transportation corridor will lower the local groundwater table at 29 major cuts. It is also likely that major fills will alter local groundwater flow in surficial soils at 41 locations. These adverse effects are most likely to be measureable in the shallow groundwater regimes present in the surficial soils. In examining effects on private wells, it was predicted that throughout the entire 407 East Transportation Corridor, only one (1) private well will most certainly be affected as a result of lowering of the water table and an addition 14 private wells are potentially affected by the Project. Other private wells will either be decommissioned or are located too far away from the transportation corridor to be measureably affected.MTO is in the process of undertaking additional geotechnical borehole drilling at the locations of deep cuts and high fills to confirm the depth of the water table, effects on private wells, and to support future detailed design phases aimed at mitigating adverse effects. While these adverse effects are most likely to occur during the Construction Phase, some measureable effects may persist throughout the Operations and Maintenance Phase of the Project. The ecological implications of these residual adverse effects on surface water, sensitive vegetation communities and wetlands are examined further in their respective sections. As noted in Section 7.16, drought conditions could potentially exacerbate these effects.

During the Operations and Maintenance Phase, reduction in groundwater quality due to stormwater runoff, salt spray, and vehicle emissions is also possible. This adverse effect would be largely minimized during operation of the transportation corridor by following appropriate salt application/management practices, installing stormwater management systems, and polishing collected runoff prior to discharge to receiving streams.

Improperly decommissioned wells can create a direct pathway for surficial contaminants to reach deep, confined aquifers and contaminate drinking water supplies derived from groundwater wells. Property acquisition in accordance with Ministry (MTO) policies and directives will be required, resulting in approximately 166 domestic water wells which will require decommissioning in accordance with *Ontario Reg. 903.*

The MTO Groundwater Environmental Reference Highway Design, Section 3.3 – Technical Requirements for Environmental Impact Study and Environmental Protection/ Mitigation, provides a comprehensive list of measures to mitigate likely effects on groundwater and private wells. Additional mitigation and design alternatives will also be considered on a site-specific basis. Where long term effects to groundwater cannot be avoided at major fills or deep

cuts, site specific engineering / foundation design measures will be undertaken as appropriate. For example, detailed site specific hydrogeological investigations (i.e., 7 boreholes and 5 mini-piezometers) undertaken in the vicinity of Sideline 16 Road and the crossing of Brougham Creek indicated that strong upwards groundwater flow conditions from a confined sand aquifer likely contribute a substantial amount of water to the creek and nearby wetland areas. Here the use of a permeable sub-base for fill placement was recommended to maintain current groundwater flow conditions. Deep foundations were also recommended at this crossing to minimize dewatering. Overall, at locations where substantial groundwater seepage is anticipated, valley fills would be designed with a permeable sub-base to maintain current groundwater flow conditions.

MTO will monitor nearby private wells prior to, during and following construction for both groundwater quality and quantity. Should monitoring and/or well inspections detect a measurable effect on private wells, contingency mitigation measures and compensation shall be provided in accordance with MTO policies and directives. These measures could include well repairs or deepening, well replacements. Unavoidable changes to groundwater quality and/or quantity affecting private wells would be compensated through the provision of a temporary or permanent water supply as determined on a case-by-case basis.

7.4.3 Residual Effects

During the Construction Phase, the Project will result in the lowering of groundwater table in surficial soils at locations where foundation excavations require dewatering. During both the Construction Phase and Operations and the Operations and Maintenance Phase, the Project will result in the lowering of the groundwater table at major cuts, and the alteration of groundwater flows and levels in surficial soils at locations of major fills and foundation structures. In addition, a reduction in groundwater quality due to stormwater runoff, salt spray, and vehicle emissions is possible during the Operations and Maintenance Phase. This latter adverse effect would be largely minimized during operation of the transportation corridor by following appropriate salt application and management practices, installing stormwater management systems, and polishing collected runoff prior to discharge to receiving streams. Because shallow groundwater resources may be used as sources of drinking water, further consideration is given to human health implications in the context of cumulative effects assessment.

7.4.4 Government and Public Comments

During the review of the Provincial EA, the MOE and members of the public provided comments. MOE reviewers requested that MTO consult with the MOE prior to detailed design to confirm Permit to Take Water (PTTW) requirements, including the development of a monitoring and mitigation program for discharge water quality and quantity. The MOE reviewer also recommended monitoring of private wells before dewatering and that Environmental Management Plans include but not be limited to plans for encountering highly productive zones, dewatering interferences with surface water and groundwater users, and groundwater and surface water monitoring plans. The MOE reviewer indicated that permits will not be issued unless the MOE was satisfied with the EMP. MTO responded to these comments and the responses were considered acceptable to the reviewers.

Comments from members of the public focussed on lowering of the water table and effects on water supply from wells, protection of aquifers / reservoirs from contamination, and mitigation for such effects. Other comments related to the effects of the East Durham Link (EDL) on groundwater recharge or infiltration. A more general comment related to how groundwater effects were predicted and if these predictions are accurate.

NRCan and EC provided the CEA Agency and the RAs with comments regarding groundwater. NRCan requested additional information from MTO regarding sampling and laboratory method, Quality Assurance/Quality control, the use of permeable sub-base material and groundwater equalization drains. NRCan requested that MTO clarify a number of issues to assist in their review (e.g., clarification regarding MTO's rationale for the application of the

< 1.0 m criterion for determining effects on a well, use of herbicides, MTO's plans for vegetative polishing for water treatment, surface and groundwater quality monitoring). MTO provided NRCan with the requested information and clarifications where available.

Given the results of the hydrogeological studies and the data presented in the Provincial EA document, NRCan requested that MTO provide a discussion of how groundwater flow regime and groundwater quality were considered in selection of alternative methods, including a rationale for placement of the EDL through the Harmony-Farewell Iroquois Beach Wetland Complex and the Maple Grove Wetland Complex.

MTO responded that hydrogeologically sensitive areas were identified on the basis of surficial geology, groundwater recharge and discharge areas, watercourse characteristics, and the locations of wetlands and water wells. Effects to groundwater flow and groundwater quality were included in the above criteria. The route selected for the EDL was selected to avoid wetland areas, the Iroquois Plain Shallow Aquifer and the Lake Iroquois Shoreline as much as possible. The route was selected to stay on Newmarket Till aquitard deposits as much as possible to minimize the potential impact to the surficial aquifers and the wetlands that they support. Each of the other alternatives encroached more significantly on either the wetlands or on the surficial aquifer deposits, than did the route that was selected. Mitigation measures have been recommended for the small areas were the EDL crosses through wetlands. A total of 25 alternatives were evaluated for the EDL. Alternatives for an eastern link to the east or west of the proposed area were not considered due to the presence of residential subdivisions that border the area. MTO also modified the preliminary design of the EDL to include a 300 m long bridge over the wetland. The MNR and the GRCA have both indicated their acceptance of the proposed design and mitigation measures.

NRCan questioned if MTO has plans to compensate for unexpected adverse effects to wetlands due to a reduction of groundwater recharge to wetlands. MTO indicated that adverse effects are not expected due to the design of the EDL and keeping the route dominantly in the till dominated landscape. In the few places where it lies in the more permeable shallow sands, the recharge of runoff from the pavement is not restricted by the soils so no measureable reduction due to the Project is expected.

NRCan questioned MTO whether conducting additional study could minimize uncertainty as to whether some deep cuts would be above or below the water table. MTO confirmed that additional geotechnical borehole drilling has been conducted at 31 deep cuts and high fills to date and that the required geotechnical studies are ongoing and will be completed to support future detailed design phases. The results of these ongoing studies will be taken into account in the site-specific foundation designs to mitigate likely effects on groundwater.

Both NRCan and EC requested that MTO acknowledge a residual adverse effect given that small localized effects will occur due to construction and operation of the Project, notably at the locations of major cuts and fills. MTO confirmed that the Project is likely to result in changes in groundwater levels and flow conditions during the Construction Phase and the Operations and Maintenance Phase, and that reduced groundwater quality in surficial soils is likely during the Operations Phase.

7.5 Surface Water

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the 407 East Transportation Corridor on surface water. The VECs identified for this analysis were surface waterbodies / watercourses and high sensitivity fish habitat. The key sources of information from which this section has been written is the Provincial EA document and Stormwater Management Strategy Reports (MTO Reference Document #19).

7.5.1 Approach

MTO's assessment of effects on surface water relied exclusively on demonstrating the effectiveness of the design of the 407 East Transportation Corridor and the watercourse crossings. To date, a preliminary design has been established on the basis of hydro-technical analyses for each crossing and geomorphological assessments at selected crossings. Detailed hydrologic modelling, further site specific geomorphological studies and detailed design of SWM facilities, including storm sewer design will be undertaken during subsequent design stages to confirm the size and configuration of the proposed stormwater management ponds, channel reconfigurations, etc.

Hydro-technical analysis, involving hydrology and hydraulics, was carried out for each of the watercourse crossings. The hydrologic models for each watershed used for these studies were provided by their respective Conservation Authorities. The models took into consideration both existing and future land use conditions. Hydrology analyses were undertaken to determine the design flow rate to the watercourse through analysis of the effective drainage area and land use that is contributing to the flood peak. Hydraulic analysis determined the size and appropriate structure opening to allow the passage of the design flow while meeting other required design parameters such as: relief flow, soffit clearance, freeboard, and headwater/structure height (H/D) ratio.

The 50 and 100 year storms were the normal design storms used by MTO to evaluate watercourse flood levels and freeboard provided at each watercourse crossing, with the 50 year storm applying to bridges and culverts under 6 m in span and the 100 year storm applying to bridges and culverts over 6 m in span. The Regional Storm event runoff was used to ensure the new highway will not overtop during a Regional Storm event and to ensure there were no increases in regulatory floodlines resulting from the development of the highway.

A risk-based geomorphological assessment was also conducted for each of the watercourse crossings. Review of aerial photography, digital mappings, rapid stream assessments, detailed field investments and risk assessments were used in order to determine the minimum recommended structure size for each crossing and to design channels that required reconfiguration. The design of the channel at each crossing was guided by the need to maintain existing channel length, mimic the existing meander amplitude and wavelength and maintain or improve aquatic habitat.

7.5.2 Likely Effects and Mitigation

There are 79 watercourse crossings along the entire 407 East Transportation Corridor. In addition, a number of stream realignments are required. None of the watercourse crossings have been identified as navigable by Transport Canada.

Construction Phase effects on surface waters in natural watercourses include changes in water quantity, water flows and water quality. Generally, decreases in water quantity in natural watercourses may result from water takings at major cuts or groundwater alteration at major fills that result in a decrease in groundwater levels and related groundwater discharges to a watercourse. As noted in Section 7.16, drought conditions could potentially exacerbate these effects. At a few deep cut locations, there exists an opportunity for positive effects on surface water.

Prior to construction, MTO shall undertake detailed hydrogeological and geotechnical work at these locations (i.e., major cuts and fills) in support of the detailed design of the transportation corridor. If discrete groundwater discharge points are identified, opportunities to direct groundwater flow to a watercourse will be evaluated and where feasible appropriate design measures (e.g., French drains, tile drains) will be implemented. MTO shall obtain Permits to Take Water (PTTW) for major dewatering activities and shall monitor stream flows upstream and downstream of crossings in accordance with the PTTW. Fill placed in deeper valleys where evidence of groundwater discharge is present and where it is functionally important to fish communities, a permeable sub-base will be used to maintain

existing groundwater movement to the streams. Other opportunities to direct groundwater flow to a watercourse will be evaluated and implemented where feasible.

Adverse effects on surface water quality during the construction phase are generally associated with increased sediment loading from erosion and in-water works. MTO conducted a detailed erosion and sediment risk analysis that concluded that 63% of the 407 East Transportation Corridor has a “Low Risk” for erosion and sedimentation, 24% had a “Moderate Risk” and only 13% of the corridor traversed “High Risk” areas, which reflects the presence of tight surficial soils within the RSA and the careful route selection of the transportation corridor to avoid ecologically significant areas wherever possible. Nevertheless, without effective mitigation, increased sediment loading from erosion and in-water works will cause increased turbidity in 79 natural watercourses for the 407 East Transportation Corridor as a whole.

Operations and Maintenance Phase effects on surface water in natural watercourses include changes in water quantity, water flow velocities and water quality. MTO considered potential effects in water quantity resulting from:

a) increased surface runoff volumes due to installation of less permeable ground cover(s);
b) changes in surface topography or the surface drainage system which expands the land area drained by surface flows; and
c) increases in groundwater levels and related groundwater discharges to a watercourse.

Conversely, MTO examined decreased water quantity in natural watercourses resulting from:

a) changes in surface topography or the surface drainage system which reduces the land area drained by surface flows; and
b) decreases in groundwater levels and related groundwater discharges to a watercourse.

MTO also considered effects on surface water quality during the Operations and Maintenance Phase resulting from changes in soil erosion rates and input of contaminants from vehicles use of the transportation facility and maintenance procedures such as road de-icing / salting, pesticide spraying and resultant stormwater runoff. Thermal effects to surface waters at outlet structures were also considered.

In general, the transportation corridor will result in increased runoff due to a less permeable surface as compared to existing conditions. However, the increased impermeable area is typically small relative to the overall watershed within which it is contained and with the proposed stormwater management measures, adverse effects to surface waters will be minimized. The overall incremental increase or change in runoff quality due to the 407 East Transportation Corridor is expected to be minimal, taking into consideration the implementation of the proposed design and mitigation measures. At a minimum, runoff will be treated in areas where treatment does not exist within current land use. MTO’s proposed stormwater management (SWM) strategy for the 407 East Transportation Corridor provides for surface water quality, quantity and erosion treatment using best management practices.

The SWM strategy takes into consideration the ultimate conditions for the 407 East Transportation Corridor (i.e., 2031 lane requirements and the transitway corridor) as well as groundwater levels in the study area. The proposed stormwater management system consists of three components, specifically storm sewers in the median where median barrier is proposed, stormwater management ponds and enhanced grass swales. Approximately 65 stormwater management ponds are proposed throughout the 407 East Transportation Corridor. Design criteria for SWM facilities were based on MOE and MTO requirements and discussions with the MOE, MNR, Toronto and Region Conservation Authority (TRCA), Central Lake Ontario Conservation (CLOCA), and Ganaraska Region Conservation Authority (GRCA).

MTO's SWM strategy ensures that existing drainage patterns are maintained as much as possible within the 407 East Transportation Corridor. Runoff from areas external to the ROW will be intercepted and conveyed directly to a watercourse. Selection of proposed stormwater management practices was based on the 407 drainage area contributing flows to local watercourses. For contributing areas of 5.0 ha or greater, Enhanced Protection Level treatment is proposed with quantity and erosion treatment. Enhanced Protection provides for 80% long-term removal of suspended solids from discharging to natural watercourses[2]. For the study area, the primary stormwater management practice for providing treatment for areas of 5.0 ha or greater consists of stormwater management wet ponds. However, for some sections of the East Mainline and the East Durham Link, the groundwater is too high for a stormwater management wet pond. In order to avoid groundwater effects under these circumstances, shallow stormwater management practices such as constructed wetlands were considered with site-specific design features that protect surface water quality and quantities, particularly in wetlands. For contributing areas less than 5.0 ha, enhanced grass lined swales will be utilized in order to provide some measure of quality treatment, although it is recognized that Enhanced Protection Level treatment will not be feasible. Nevertheless, grassed swales can be effective SWM practices for pollutant removal if designed properly. The water quality benefits associated with grassed swales depend on the contact area between the water and the swale and the swale slope. Deep narrow swales are less effective for pollutant removal compared to shallow wide swales. Therefore, such grassed swales will be well vegetated with a relatively flat gradient and a flat bottom to minimize flow velocity, maximize contact between the runoff and the vegetation, and maximize sediment retention.

Quantity control will be provided by MTO where the proposed corridor is shown to have an adverse effect on the downstream peak flows within the receiving watercourse, using either stormwater management dry ponds or enhanced grass-lined swales as storage basins.

The wet pond sizing was determined at a basic preliminary design level to identify the ultimate footprint requirements for each pond. Detailed hydrologic modelling and detailed design of SWM facilities will be undertaken during subsequent design stages to confirm the size and configuration of the proposed stormwater management ponds. Wet ponds would provide Enhanced Protection Level treatment as per the 2003 MOE document "*Stormwater Management Planning and Design Manual*".

The required volume to provide surface water quantity treatment for the upstream drainage area was based on an analysis conducted to determine a correlation between quantity control volumes required versus 100-year storm precipitation. A conservative estimate of 70% of the 100-year storm precipitation times the upstream drainage area was adopted to determine the quantity storage value up to the 100-year storm, based on an assessment of several recent stormwater management wet ponds designed within the GTA. The final stormwater management wet pond volume requirements were based on:

a) Permanent Pool sized for Enhanced Protection Level;
b) Extended Detention of 40 m^3/ha;
c) Erosion storm detention of 25 mm runoff over the catchment area; and
d) 70% of the product of the 100-year storm precipitation and the upstream catchment area.

Given the importance of SWM ponds to the mitigation of adverse effects on surface water quality, MTO in partnership with several government agencies undertook a Stormwater Assessment and Monitoring Performance (SWAMP) Program to confirm the effectiveness of the SWM ponds for highway projects. In addition to the efforts conducted under SWAMP, numerous other studies of performance have been conducted both inside and outside of Ontario. The results of these studies point to an optimistic view of SWM pond performance for the purpose of surface water quality protection.

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2. Basic Protection provides for 60% suspended solids removal and Normal Protection provides for 70% suspended solids removal.

Similarly, a preliminary evaluation of the proposed outlets was undertaken to confirm the feasibility of the pond locations. Outlet types and locations were analyzed for each of the facilities with the general layout designed based on one of the three following outlet types: at-grade outlet swales, pipe outlets with headwalls, and valleyland pipe outlets with headwalls. Energy dissipaters may be required at the end of the discharge pipe in order to prevent erosion at the watercourse. Overall, all stormwater management facility outlet locations are located on the straight sections of the watercourse to decrease the occurrence of the channel migrating away from the outlet. In addition, the outlets of the stormwater management facilities should discharge to major watercourses wherever possible, and avoid smaller watercourses and tributaries that are primarily groundwater fed. This will prevent erosion and subsequent negative impacts on the smaller watercourses from the facilities discharged flows, as the groundwater fed watercourses may not be stable enough to handle intense peaks from facility outlets.

As part of the outlet structures mentioned above, thermal impacts to receiving watercourses will be addressed for each stormwater management facility discharging to a sensitive watercourse. MTO's fish and fish habitat assessment identified those watercourses for which thermal effects of outlet structures are to be addressed. Since the current stormwater management design is conceptual, the thermal impacts of all outlet structures will require further investigation during subsequent design stages. Measures to be investigated shall include, but not be limited to:

- For at-grade swales, lining the swales with shade-producing vegetation;
- Deepening permanent pools to greater than 3 m with minor storm event flows discharged using a bottom-draw system; and
- Emerging innovative techniques.

In accordance with the Provincial EA Conditions of Approval (see Section 7.5.4), MTO will identify best management practices for the treatment of stormwater, including the use of innovative technologies on a pilot basis. These may include measures proposed by other jurisdictions such those included in the Town of Ajax's stormwater management design criteria (Town of Ajax, 2010).
Finally, effects on water flow velocities during the Operations and Maintenance Phase relate to alterations in the watercourse cross-section, specific channel characteristics (e.g., channel roughness), stormwater detention / discharge characteristics, including deck drains to watercourses. Water flow velocities shall be maintained by maintaining watercourse cross-sections and channel characteristics to the greatest extent possible through the sizing and design of appropriate crossing structures (i.e., bridges and culverts), and channel realignment design.

As noted above, a hydrotechnical evaluation was undertaken for each watercourse crossing to determine the appropriate type of structure (i.e., bridge versus culvert), size and design. In addition, risk-based geomorphological studies were undertaken at selected watercourse crossings to assist with the crossing structure and channel designs.

In accordance with the MTO Highway Drainage Design Standards, crossings were selected and designed for the 50 year storm for bridges and culvert spans less than or equal to 6 m, and the 100 year storm for bridges and culverts greater than 6 m. For structures less than 100 m in length, deck drains typically will not be required. For structures greater than 100 m in length, deck drains may be required. Where deck drains are required, runoff will be discharged to splash pads and treated with Low Impact Development (LID) measures prior to being discharged to the watercourse. The Provincial EA document (August 2009) and the Draft Environmental Screening Report (December 2009) outline additional mitigation measures, including that Erosion and Sediment Control (ESC) measures be developed during subsequent design phases that follow the most current standard industry practices available, and specifically the Greater Golden Horseshoe Area Conservation Authorities' Erosion and Sediment Inspection Guide (2008). During the detailed design phase, the following mitigation measures will also be considered by MTO to further minimize the effects of major fills and cuts on surface water quantity:

- the selected use of a permeable sub-base material at locations of major fills;
- installation of permanent groundwater control (e.g., a gravity drain system);
- shallow groundwater control if excavations at major cuts intercept a saturated aquifer; and/or
- installation of drainage systems to convey side wall seepage towards the watercourse.

In addition to the watercourse crossing designs and the management of surface quality through the SWM system, MTO shall ensure that there is vegetation along the corridor which limits soil erosion and helps remove sediment and other contaminants in runoff from entering watercourses.

MTO has greatly reduced the use of pesticides from levels 25 years ago. Usage is less than 5% of volumes used in the late 1970's. Pesticide use is for essential maintenance purposes only, and when needed is undertaken in accordance with the *Pesticides Act*. Its application is not widespread but localized and targeted to a particular species. MTO employs a number of vegetation control options, with mechanical control of vegetation being the most common method employed for most maintenance activities.

Finally, MTO recognizes the importance of best salt management practices and shall implement a Salt Management Plan developed in accordance with Environment Canada's Code of Practice for the Environmental Management of Road Salts (Environment Canada, 2004). MTO will continue to follow best management practices for road salt management, which are consistent with the best practices in North America. MTO partners with stakeholders using the latest technology, tools and methods to keep roads safe for winter driving and to minimize salt usage. MTO will continue to investigate de-icing alternatives to control and reduce salt usage while ensuring highway safety.

7.5.3 Residual Effects

During the Construction Phase, increased sediment loading from erosion and in-water works will likely decrease water quality (i.e., increased turbidity) in 79 natural watercourses. Although adverse effects shall be minimized through the implementation of the recommended erosion and sediment controls, these measures are not always completely effective. As such, increased turbidity is considered a residual adverse effect.

During the Operations and Maintenance Phase, treated effluent will be discharged from stormwater management facilities into 79 natural watercourses. Although adverse effects shall be minimized through the implementation of the recommended design and mitigation measures, the addition of residual contaminants and warmer water (i.e., thermal effect) following treatment is considered a residual adverse effect.

7.5.4 Government and Public Comments

Provincial government and public comments regarding surface water included both points of clarity and technical review comments, focussing on stormwater management and salt management. The Provincial reviewers recommended that MTO assess how stormwater water quality and quantity/flow control can be accomplished for all sub-catchments, including those areas under 5 ha in drainage and that MOE's 'Enhanced Water Quality Protection' level should be applied to all areas unless the MTO can justify a lower level. The MOE requested that increased surface runoff to receiving watercourses be quantified to determine whether water quantity control structures are required. It was felt that a balanced water budget should be developed for each sub-catchment with the objective of matching pre- and post-development hydrologic regimes. MTO indicated the SWM ponds have been sized, at a planning level of detail in consultation with the Conservation Authorities, to deal with quantity and erosion control requirements, with due consideration to upstream and downstream flood levels. The preliminary stormwater plan will continue to be developed in more detail during subsequent design phases.

The MOE reviewer indicated that site-specific information is needed on the SWM facilities planned for each of the support facilities and that site level wastewater treatment should be required for these areas before discharge to the stormwater management system. MTO indicated that the support facilities will be subject to future Class EA studies or the Transit Projects Regulation (Ontario Regulation 231/08), as appropriate, prior to implementation. Through the future studies, the specific stormwater management requirements for each site as well as wastewater treatment requirements will be identified and mitigation measures developed as appropriate.

The MOE also indicated that discharging first flush of stormwater untreated into an infiltration basin as a method of alleviating thermal impacts of SWM ponds to receiving waters is unacceptable. MTO indicated that a number of measures to alleviate thermal impacts will be investigated during subsequent design phases, including deepening permanent pools for ponds, lining swales with shade-producing vegetation and emerging innovative techniques. Appropriate measures will be selected, in consultation with the applicable regulatory agencies, and implemented.

The MOE reviewer requested that MTO consider using oil and grit separator (OGs) units specially made for deck drains and the use of OG units in combination with enhanced grass swales and or dry pond/wetlands within specific sections of the highway catchments and the possibility of pond lining alone and/or in combination with usage of hybrid wet pond and infiltration/exfiltration techniques to provide for quality, quantity control and water balance. MTO responded to each comment received, indicating that the stormwater management facilities have been designed in accordance with MOE's requirements and that management plans will continue to be developed in more detail during subsequent design phases (see EA Commitment 56 on page 9-11 of Provincial EA Report). The use of oil-grit separators will typically be considered for the support facility locations (i.e. maintenance facilities, transitway station site, etc.).

The MOE requested more information on how stormwater management facilities are to be maintained (scheduling, roles, and responsibilities etc.). MTO indicated that maintenance requirements for the stormwater management facilities will be determined during subsequent design and implementation phases.

Finally, the MOE reviewer requested up to date information regarding MTO's Salt Management Plan and how negative environmental impacts have been and are expected to be reduced as a result of its implementation. MTO indicated that the 2005 Salt Management Plan is the current plan, and that as new guidelines are implemented, they will be applied to the Project. MTO confirmed that best practices in salt management consistent with Environment Canada's "Code of Practice for the Environmental Management of Road Salts" are being implemented. MTO currently is awaiting results from a University of Waterloo study attempting to evaluate the environmental benefit of salt management best practices (Project funded by MOE, Salt Institute of Canada, Environment Canada).

Public comments focused on the design and effectiveness of MTO's stormwater management measures in addressing water quantity effects during severe weather, and water quality effects in general. Concerns were expressed that alkaline leachate from cement structures will enter coldwater streams and affect fish, and that SWM ponds should not be used for fish / wildlife mitigation. MTO responded to each public comment received. In particular, MTO noted that the pH of the soils in the study area is alkaline, so they do not promote chemical weathering of the concrete structures, and that SWM ponds are not intended to be used for mitigation of impacts to fish or wildlife habitat, but will include measures within and surrounding the facilities to prevent fish and wildlife from entering the ponds.

EC also provided the MOE, the CEA Agency and the RAs with comments regarding effects on surface water which included both points of clarity and technical review comments. The key technical comment related to the design and effectiveness of MTO's stormwater management measures in addressing TSS loading and dissolved contaminants such as nutrients and de-icing chemicals. EC suggested that the design of stormwater management for the Project should include consideration of the potential increase in extreme precipitation intensity and frequency over the

lifetime of the project, particularly in regard to the design of minor crossing structures and stormwater treatment facilities adjacent to sensitive terrestrial and wetland ecosystems. EC noted that in certain locations where only dry ponds and enhanced swales are feasible, less effective mitigation and higher residual effects would generally result. As such, EC requested that any scientific research done to substantiate be cited. In regard to deck drains, EC recommended that drains discharging directly to watercourses be avoided to the maximum extent possible, taking into consideration highway safety. EC sought clarification as to whether the proposed 'splash 'pads' will provide any level of water quality treatment of the stormwater runoff from bridges prior to discharge into watercourses. EC noted that facilities that are designed to facilitate a second level of defense against the releases of spills from the bridge into sensitive aquatic ecosystems would be desirable. EC also recommended that MTO acknowledge a residual adverse effect on water quality due to stormwater runoff and thermal effects.

MTO provided the CEA Agency, the RAs and EC with additional information and addressed each of the technical review comments. In particular, MTO confirmed that the sizing of stormwater management ponds for quantity treatment has been undertaken in accordance with MOE requirements and standard practices, which account for upstream drainage areas and are based on 100-year storm events. MTO also noted that detailed hydrologic modelling and detailed design of SWM facilities, including storm sewer design will be undertaken during subsequent design stages to confirm the size and configuration of the proposed stormwater management ponds.

Finally, the approval granted by the Ontario Minister of Environment on June 3, 2010 indicated that from the Province's perspective, MTO has demonstrated that the environmental effects of the Project can be appropriately prevented, changed, mitigated or remediated and that no outstanding concerns exist that have not been addressed or that cannot be addressed through commitments made during the Provincial EA process, through specified Conditions of Approval or through future approvals. As such, the Province has imposed several Conditions of Approval that are relevant to effects on surface water. These Conditions of Approval require MTO to prepare and implement:

- a *Stormwater Management Plan*, including:
    - plans and descriptionsfor the sections of the Project that will not be drained to a stormwater management wet pond;
    - descriptions of receiving watercourses, including their characteristics, flow rates, assimilative capacities and whether species protected under the Endangered Species Act, 2007 are known to be present;
    - a jurisdictional scan of best management practices for treating stormwater in catchment areas not sufficiently large to support a wet pond;
    - identification of best management practices for the treatment of stormwater, and innovative technologies for potential use on a pilot basis;
    - a plan outlining how the identified best management practices will be implemented;
    - identification of water quality targets for treating stormwater; and
    - identification of any changes to the design of the Project that may be required to accommodate the implementation of the identified best management practices.

- DFO and EC are to be provided this plan for review and comment.
- a *Surface Water Monitoring and Mitigation Plan*, DFO and EC are to be provided this plan for review and comment. The plan would outline the methodology and schedule for the collection of surface water quality data, including monitoring parameters, locations and frequencies. It is anticipated that this plan would include monitoring of thermal discharges from selected SWM facilities. At a minimum, data would be collected during the year prior to construction and the year following construction. The mitigation plan will include additional measures that would be implemented should the surface water monitoring program identify any areas where water quality targets are not being met; and an Ice Prevention and De-icing

Management Plan. The plan would identify the best management practices to be employed by MTO, identify road salt vulnerable areas and the additional mitigation measures needed in these areas.

7.6 Vegetation and Vegetation Communities

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the Project on vegetation and vegetation communities. The VECs identified for this analysis were high quality woodlots that support interior forest habitat and vegetation communities that are sensitive to groundwater alteration. Further information is provided in the Natural Environment (Terrestrial) Impact Assessment Report (Reference Document #6) and in the Draft Environmental Screening Report (December 2009).

7.6.1 Approach

Vegetation and vegetation communities were given consideration throughout each stage of the EA process (i.e., route planning/evaluation, preliminary design and effects assessment). During the route planning/evaluation (Alternative Methods) stage, the overall objective of the terrestrial ecosystems planning work was to ensure that terrestrial features, and particularly significant and sensitive features, were comprehensively identified and integrated during development and evaluation of alternatives to select the Technically Recommended Route. The terrestrial ecosystem-related objective during the generation of alternatives was to ensure that alternatives avoided or minimized impacts to terrestrial features, and particularly sensitive and high quality features, to the extent possible while still meeting the technical planning design objectives and requirements.

Once the Technically Recommended Route was selected, the key objective of the terrestrial ecosystem work during Preliminary Design (including developing and evaluating design refinements and alternatives) was to augment the existing information base along the 407 East Transportation Corridor to a level of detail so that a detailed effects assessment could be undertaken and appropriate mitigation measures could be developed. Field investigations were completed to ensure the database was sufficiently detailed to finalize the sensitivities analysis and support the Preliminary Design process, impact assessment and development of mitigation measures. The field data collection incorporated terrestrial ecosystem parameters outlined in the Environmental Reference for Highway Design (ERD), (MTO, 2006) as well as any additional site specific parameters of interest. The area of investigation for terrestrial surveys encompassed the ROW (SSA) and adjacent lands for 120 m unless a sensitive receptor greater than the distance of 120 m is likely to be adversely affected (LSA). The study area for the landscape connectivity and wildlife linkage analysis extends beyond the LSA to enable a regional assessment of habitat nodes and key linkages within southern Durham Region.

Any specific concerns and potential issues raised by the Ministry of Natural Resources (MNR), TRCA, CLOCA, GRCA, EC and DFO staff and other interested reviewers were also considered and incorporated into the field surveys where feasible. Furthermore, all relevant environmental management plans and resource studies continued to be used to inform the effects assessment and particularly the identification of enhancement opportunities.

The specific effects of the 407 East Transportation Corridor were assessed in accordance with the ERD, a 2006 MTO document that provides guidance to managing environmental effects of transportation projects in transportation project design. The ERD requires the consideration of the full range of direct/footprint impacts, as well as potential indirect impacts. A key part of the work was to identify terrestrial functions that may be affected by site access, staging, transportation corridor construction, any decommissioning work, and highway maintenance. Following this, the nature of anticipated terrestrial effects such as fragmentation, area removal, hydrological, loss or change of key functions, etc. was determined.

7.6.2 Likely Effects and Mitigation

Vegetation clearing (and associated habitat removal) that is required to accommodate the 407 East Transportation Corridor and all associated facilities is the primary direct effect related to the Construction Phase. MTO considered the loss of vegetation communities and associated habitat to accommodate interchanges, vertical/horizontal alignment, grading, drainage design, temporary road access, bridges, culverts and channel realignments, traffic and noise barriers, utility relocation and general construction activities.

The direct removal of vegetation often has the secondary effect of creating new edges that expose the retained vegetation to the effects of increased light, noise, wind, sun and salt spray. While the creation of the edge is a direct construction effect, the edge effects that influence the retained vegetation are considered indirect effects that will occur following construction and are discussed in the following section. In addition to these effects, the Project may also result in the following adverse effects:

- Vegetation clearing/damage beyond the working area;
- Release of construction-generated sediment to adjacent natural areas;
- Releases of fugitive dust that may reach natural areas; and
- Spills of contaminants, fuels and other materials that may reach natural areas.

In addition to the direct construction effects outlined above, the operation and maintenance of the 407 East Transportation Corridor may also result in indirect effects to the adjacent vegetation communities that are retained. The potential secondary effects to vegetation that may occur during the operation and maintenance of the transportation corridor are outlined below:

- Spills of contaminants, fuels and other materials that may reach natural areas.
- Damage from excessive or improper application of herbicides and pesticides for ROW maintenance requirements.
- Damage to adjacent natural vegetation from transportation corridor maintenance activities such as salting and sanding, structure/culvert repairs, ditch cleanout. Salt runoff and salt spray into wetland areas may cause loss of vegetation vigour and in extreme cases, vegetation dieback, and spread of salt tolerant flora (halophytes).
- Increased light, wind and sun exposure within the newly created edges of adjacent forest communities. These effects often lead to vegetation dieback, changes in the ground flora composition, windthrow, and/or spread of invasive species.
- Changes in drainage patterns (groundwater and/or surface runoff flow) that can affect dependant vegetation/wetland areas located either upgradient or downgradient of the ROW. Specifically:
    - Blocking of existing surface/subsurface drainage patterns can result in upstream and downstream vegetation dieback/condition changes (see sensitive vegetation communities identified above). An increase in downstream runoff can result in erosion effects on receiving vegetation.
    - Potential for other temporary or permanent changes in vegetation community composition may occur as a result of temporary or permanent changes in groundwater levels (see sensitive vegetation communities identified above), usually associated with localized dewatering during construction and with earth cuts that may intercept groundwater causing a permanent lowering of groundwater conditions. The extent and magnitude of the effect is related to soil type, depth of groundwater, topography and variable depth of the cut itself.

- Groundwater drawdown has the potential to shift vegetation species composition as a result of a change in moisture regime. At most locations, there are no impacts to terrestrial communities (forests, thickets, meadows) from permanent groundwater drawdown. This is because groundwater is at depth, and the infiltration of surface water is a more important source of water than is the influence of the groundwater table or the "capillary fringe" above.

The Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) identify numerous mitigation measures that will serve to avoid and/or reduce the severity of adverse effects, including relevant Ontario Provincial Standards Specifications (OPSS) and adherence to permits, Acts and guidelines, including *Migratory Birds Convention Act* and Regulations. It is noteworthy that MTO has made a commitment to offsetting the removal of vegetation through restoration, enhancement, and creation of forest communities at a ratio of a minimum of 1:1 area (ha) of removals. In selecting specific locations for replacement habitat, priority will be given to sites adjacent to or in close proximity to the habitats disturbed by the Project. Sites with similar and/or suitable ecological characteristics to those disturbed will be preferred so as to maintain their ecological functions to the greatest extent. Strategic planting can be undertaken in existing forested areas to mitigate for cumulative losses of interior forest habitat. MTO will first examine surplus properties acquired along the right-of-way and/or Conservation Authority lands that have been identified for habitat enhancement in existing plans.

The anticipated loss and/or changes in quality/function of vegetation and vegetation communities from salt application during operation of the 407 East Transportation Corridor shall be mitigated by the implementation of MTO's salt management policy related to salt application, storage and stockpiling of salt-laden snow, as well as any new salt management initiatives in place at the time of operation. Overall, MTO has concluded that adverse effects to vegetation and vegetation communities and their associated habitat features resulting from construction have been minimized to the extent possible during route planning/evaluation, preliminary design and effects assessment stages of the EA. Effects from the operation and maintenance of the corridor can also largely be mitigated, however, some of these effects may be unavoidable and can only be partially mitigated (e.g., loss of vegetation vigour and spread of salt-tolerant flora due to salt-spray).

7.6.3 Residual Effects

The 407 East Transportation Corridor will require the removal of approximately 305.1 ha of vegetation and vegetation communities, including approximately 28.9 ha of interior forest habitat. The removal of vegetation would be offset to some extent through restoring/enhancing/creating forest communities at a ratio of a minimum of 1:1.

An overall reduction in the quality/function of the retained portion of vegetation communities along/adjacent to valley crossings, including vegetation and vegetation communities sensitive to groundwater alteration and exposure to fugitive dust, light, wind and sun exposure is considered to be a residual adverse effect during both the Construction Phase and the Operations and Maintenance Phase. This conclusion is supported by the expectation that it may be difficult to find suitable lands to undertake the proposed compensation; there will likely be difficulties encountered in replacing certain lost vegetation communities with off-site communities having a similar ecological quality / function; and there will be a loss of some existing interior forest habitat for the long term.

7.6.4 Government and Public Comments

Provincial government and public comments regarding vegetation and vegetation communities included both points of clarity and technical review comments. Comments from the MNR and conservation authorities focussed on mitigation and monitoring, particularly in respect to Species at Risk (see Section 7.10). MTO responded to these comments and will continue to work with the MNR and Conservation Authorities throughout the project to ensure that all issues have been resolved. Other Provincial government comments related to alternatives to the use of

herbicides for invasive species management and vegetation salvage opportunities. MTO indicated that manual or mechanical methods for invasive species control are largely ineffective and confirmed that vegetation salvage and relocation will be undertaken on MTO owned lands, in consultation with Conservation Authorities and MNR.

Public comments focussed on general ecological concerns, the availability of appropriate mitigation measures, and the adequacy of the terrestrial field studies completed as part of the EA. MTO indicated that the natural environment has been closely evaluated and considered throughout each stage of the EA process and in the Recommended Design of the 407 corridor in particular. The EA work details the significance and sensitivities of natural areas as well as mitigation, compensation and enhancement measures to minimize impacts to these features. MTO referred to Exhibit 8.216 in the Provincial EA and its commitment to adopting these measures in Exhibit 9.2. MTO confirmed that Environmental Management Plans (EMPs) will be prepared following EA approval of the Recommended Design.

With respect to comments regarding the adequacy of the work undertaken, MTO described the extensive amount of data collection that was completed to support the assessment of route alternatives and the field investigations that were conducted in order to identify, assess, evaluate and select the Technically Recommended Route and develop that preliminary design. MTO confirmed that further work will be undertaken during subsequent detail design phases or where permission was not previously granted.

EC provided the CEA Agency and the RAs with comments regarding effects on vegetation and vegetation communities which included both points of clarity and technical review comments. The key technical comments related to the mitigation and compensation measures proposed by MTO. EC expressed its support for MTO's commitment towards the restoration, enhancement and creation of forest communities to replace losses of these habitats, but cautioned that it will likely be difficult to replace certain lost vegetation communities with offsite communities having a similar ecological function. Therefore, EC requested that MTO acknowledge a residual adverse effect on vegetation and vegetation communities and that a compensation ratio larger than 1:1 be adopted. Moreover, EC requested that compensation for expected habitat loss proceed, to the maximum extent possible, in advance of the proposed vegetation clearing and project footprint impacts. EC also recommended that MTO consider a number of specific mitigation measures regarding vegetation clearing, stockpile and re-use any topsoil/organic material.

MTO responded to each comment indicating that MTO's commitment to compensation is for a ratio of a minimum of 1:1. MTO confirmed that EC's mitigation measures regarding the timing of vegetation removal will be included in the EA and that it will continue to explore material and implementation techniques for erosion and sediment control measures that would minimize as much as possible, the affect on vegetation and wildlife (i.e., biodegradable, implemented to reduce accidental wildlife entrapment, etc.). MTO also indicated that topsoil will be stockpiled and re-used to the extent possible and that the feasibility of limiting pile heights will be reviewed during subsequent design phases, taking into consideration property constraints, design requirements and constructability issues.

Finally, the approval granted by the Ontario Minister of Environment on June 3, 2010 indicated that from the Province's perspective, MTO has demonstrated that the environmental effects of the Project can be appropriately prevented, changed, mitigated or remediated and that no outstanding concerns exist that have not been addressed or that cannot be addressed through commitments made during the Provincial EA process, through specified Conditions of Approval or through future approvals. As such, the Province has imposed several Conditions of Approval that are relevant to effects on vegetation and vegetation communities. These Conditions of Approval require MTO to evaluate options and identify a preferred response in the event that a new major biological feature is identified upon which the Project would have an adverse effect. MTO will also be required to prepare and implement a Vegetation Restoration Plan to offset effects on existing natural heritage features. The plan would be provided to EC for review and comment.

7.7 Wetlands

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the Project on wetlands, and the VEC identified for this analysis. Further information is provided in the Natural Environment (Terrestrial) Impact Assessment Report (Reference Document #6) and in the Draft Environmental Screening Report (December 2009).

7.7.1 Approach

Wetlands were given consideration by MTO throughout each stage of the EA process (i.e., route planning/evaluation, preliminary design and effects assessment) giving consideration to the key objectives of the Federal Government as articulated in the Federal Policy on Wetland Conservation. MTO conducted extensive reviews of secondary source information and field investigations within the ROW and on adjacent lands. Specific concerns and potential issues raised by the MNR, Conservation Authorities, EC and DFO staff and other interested reviewers were considered and incorporated into the field surveys where feasible. The specific effects of the 407 East Transportation Corridor were assessed in accordance with the Environmental Reference for Highway Design (ERD).

7.7.2 Likely Effects and Mitigation

MTO determined that vegetation clearing in wetland areas (and associated habitat removal) that is required to accommodate the 407 East Transportation Corridor and all associated facilities is the primary direct effect related to construction. This includes the loss of wetland areas and associated habitat to accommodate interchanges, vertical/horizontal alignment, grading, drainage design, temporary road access, bridges, culverts and channel realignments, traffic and noise barriers, utility relocation and general construction activities.

The direct removal of wetlands often has the secondary effect of creating new edges that expose the retained vegetation in wetland areas to the effects of increased light, noise, wind, sun and salt spray. While the creation of the edge is a direct construction effect, the edge effects that influence the retained vegetation are considered indirect effects that will occur following construction. In addition to these effects, the construction of the corridor may result in the following adverse effects:

- Wetland clearing/damage beyond the working area.
- Dewatering of wetlands adjacent to the removals and conversion to upland vegetation.
- Release of construction-generated sediment to adjacent wetland areas.
- Spills of contaminants, fuels and other materials that may reach natural areas.

Approximately 62.2 ha of wetland habitat would need to be removed to accommodate the Project. Smaller wetland areas included as part of larger vegetation units may also be removed.

In addition, the operation and maintenance of the 407 East Transportation Corridor may also result in indirect effects to the adjacent wetland features that are retained. The potential secondary effects to wetlands, and other adjacent vegetation that may occur during the operation and maintenance phase are similar to those described in Section 7.6, Vegetation and Vegetation Communities. Two wetland areas where there is the greatest potential for a reduction in quality / function of the wetland is the Lynde Creek Coastal Wetland Complex and the swamp communities complexed as part of the provincially significant Harmony-Farewell Iroquois Beach Wetland Complex, located just north of Highway 2 and east of Solina Road. Vegetation communities along the ROW include: Willow Mineral Thicket and Fresh-Moist Poplar Deciduous Forest, Swamp Maple Mineral Deciduous Swamp and White Birch-Poplar Mineral Deciduous Swamp.

The Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) identify numerous mitigation measures that will serve to avoid and/or reduce the severity of adverse effects, including following relevant Ontario Provincial Standards Specifications (OPSS) and adherence to permits, Acts and guidelines, including *Migratory Birds Convention Act* and Regulations. The measures have been developed giving consideration to the objectives of the Federal Policy on Wetland Conservation. Of note is MTO's commitment for the restoration, enhancement and creation of wetlands to offset the removal of vegetation resulting from construction activities. In selecting specific locations for replacement habitat, priority will be given to sites adjacent to and/or within the same drainage basins/watersheds as the habitats disturbed by the Project. Sites with similar and/or suitable ecological characteristics to those disturbed will be preferred so as to maintain their ecological functions to the greatest extent. MTO will first examine surplus properties acquired along the right-of-way and/or Conservation Authority lands that have been identified for habitat enhancement in existing plans.

Finally, MTO has committed to consider the following measures to further minimize the effects of major fills and cuts on the retained portions of wetlands:

- the selected use of a permeable sub-base material at locations of major fills;
- installation of permanent groundwater control (e.g., a gravity drain system); and/or
- installation of shallow groundwater control if excavations at major cuts intercept a saturated aquifer.

7.7.3 Residual Effects

Taking into consideration the mitigation measures identified above, the removal of 62.2 ha of wetland vegetation due to the construction of the 407 East Transportation Corridor is considered a residual adverse effect. This effect will be offset to some extent by MTO's initiatives aimed at the restoration, enhancement, and creation of wetland communities.

During both the Construction and Operations and Maintenance Phases, a reduction in the quality / function of the retained portion of wetlands along the transportation corridor is anticipated, including wetlands sensitive to turbidity, stormwater contaminants, groundwater and surface drainage alteration.

7.7.4 Government and Public Comments

Provincial government, Conservation Authority and public comments regarding wetlands focused largely on the effect of the EDL on the Harmony-Farewell Iroquois Beach Wetland Complex, which is a Provincially Significant Wetland (PSW). In recognition of this, MTO undertook a detailed analysis of numerous alignments through this wetland in order to minimize effects (see Section 4.2, Alternative Means of Carrying Out the Project). In addition, MTO conducted a workshop, held in February 2008, to identify further mitigation measures to minimize wetland losses and disruption, particularly with respect to the preservation of groundwater flow and the provision of wildlife passage. As a result, MTO modified the preliminary design of the EDL to include a 300 m long bridge structure over the wetland with a vertical clearance of 3 m. The MNR and the Conservation Authority have both indicated their acceptance of the proposed mitigation measures.

Other public comments related to the proximity of the corridor to the Solina Bog, suggesting that the highway design (ditching) could improve the conditions of the bog. MTO indicated that the Solina Bog was recognized to be one of the premier botanical sites in Durham Region and that any refinements made to the route in this area would directly impact the bog and / or its catchment area.

EC provided the CEA Agency and the RAs with comments regarding effects on wetlands which included both points of clarity and technical review comments. EC requested clarity regarding the construction and maintenance access

that would be provided, notably to valley lands at bridge crossings. MTO indicated that for the East Mainline and EDL, the ultimate design retains the open median, allowing for permanent access from the median, where feasible. For the West Mainline, Central Mainline and WDL, the construction access and interim maintenance access will be provided via the median centreline until ultimate build-out, where feasible.

EC expressed support for the restoration, enhancement and creation of (vegetation and) wetland communities that will be undertaken to replace wetland loss, but cautioned that it will likely be difficult to replace certain lost wetlands, notably the more significant wetlands, with wetlands having a similar ecological function. Therefore, EC requested that MTO acknowledge a small residual adverse effect on wetlands and that a compensation ratio larger than 1:1 be adopted. MTO responded to each comment indicating that MTO's commitment to compensation is for a ratio of a minimum of 1:1.

Finally, pursuant to the approval granted by the Ontario Minister of Environment on June 3, 2010, MTO will be required to evaluate options and identify a preferred response in the event that a new major biological feature is identified upon which the Project would have an adverse effect. MTO will also be required to prepare and implement a Vegetation Restoration Plan to offset effects on existing natural heritage features. The plan would be provided to MNR, the applicable Conservation Authorities, Environment Canada and the 407 Environmental Advisory Committee for review and comment.

7.8 Fish and Fish Habitat

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the Project on fish and fish habitat. The VECs identified for this analysis were High Sensitive Fish Habitat and Other Fish Habitat (i.e., Moderate and Low Sensitivity Fish Habitat). Further information is provided in the Natural Environment (Fisheries) Impact Assessment Report (Reference Document #5) and in the Draft Environmental Screening Report (December 2009).

7.8.1 Approach

The *Fisheries Act* provides for the protection of fish and fish habitat. No one may carry out any work in or near Canadian waters that prevents fish passage, results in fish mortality or results in the harmful alteration, disruption or destruction (HADD) of fish habitat without authorization from Fisheries and Oceans Canada. In recognition that an authorization for the HADD of fish habitat will likely be required for this Project, MTO endeavoured to undertake all of its fisheries work in a manner that would satisfy the requirements of the *Fisheries Act*. The *Fisheries Act* and the implementation of the 1986 Department of Fisheries and Oceans (DFO) *"Policy for the Management of Fish Habitat"* have strongly influenced the planning and implementation of highway projects in Ontario. In 2006, MTO, DFO and the Ontario Ministry of Natural Resources (OMNR) developed a new protocol and approach to fish habitat management with respect to provincial transportation projects in Ontario.

During the route planning/evaluation (Alternative Means of Carrying Out the Project) stage, the overall objective of the fish and fish habitat planning work undertaken by MTO was to ensure that fish and fish habitat, and particularly sensitive features, were comprehensively identified and considered in the evaluation of alternatives to select the Technically Recommended Route. MTO's objective during the generation of alternatives was to ensure that alternatives avoided or minimized potential impacts to aquatic features, and particularly sensitive and high quality features, to the extent possible while still meeting the technical planning / design objectives and requirements. The evaluation process assumed that design of the crossings can usually address most effects to fish and fish habitat (e.g., large openings/spans, bridges). Once the Technically Recommended Route was selected, the key objective of the fish and fish habitat work during Preliminary Design (including developing and evaluating design refinements and

alternatives) was to augment the existing information base along the Recommended Design to a level of detail so that an effects assessment could be completed.

The approach undertaken in completing the effects assessment was developed with reference to the MTO's Environmental Guide for Fish and Fish Habitat (2006; the Guide). The process of assessing the risk to fish and fish habitat as a result of the watercourse crossing structures and/or associated channel realignment works was developed based on an adaptation of the standard approach outlined in DFO's Risk Management Framework (RMF) and the 2006 Guide. This approach was presented to DFO at a meeting on April 15, 2008 and further discussed on October 28, 2008. MTO and DFO agreed that the approach was suitable for use on a project of this scale to facilitate an efficient and consistent application of the RMF. It was also agreed that an authorization under the *Fisheries Act* may be required at some, but likely not all, locations where it is not possible to fulfill all of the necessary design criteria for the protection of fish habitat. Overall, the analysis process was undertaken in a conservative manner and uncertainties were identified with specific recommendations for resolution during subsequent design phases.

The effects assessment and associated risk assessment were undertaken based on Preliminary Design information for the ultimate build out of the Mainline and the two highway links, as well as the planned interchanges and municipal road realignments required to accommodate this project. The anticipated extent of direct/footprint effects, as well as potential indirect/secondary effects, were assessed. A key secondary effect that was assessed was the potential implications of the die-back and loss of vegetation on bank and channel stability, and the associated potential for lateral erosion and loss of key morphological elements such as pools, as well as channel migration, de-stabilization, erosion and sediment generation generally. This risk assessment process incorporated input from the fluvial geomorphologists. Specific relationships between habitat elements and vegetation were also considered (e.g., in relation to Redside Dace and food production, over-hanging cover, etc.). Potential secondary effects of groundwater and thermal regimes of coldwater and Redside Dace streams were also considered.

The Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) identify the specific design consideration and mitigation measures that have been incorporated into the Preliminary Design and will serve to avoid and/or reduce the severity of adverse effects on fish and fish habitat. Specific attention was paid to the structure type, size and span arrangements for all new watercourse crossings at Low, Moderate and High sensitive fish and fish habitat locations. The selection and sizing of each watercourse crossing structure took into account hydrotechnical, fluvial geomopholigic, hydrogeologic, fish habitat and terrestrial habitat criteria, in combination with the structure and highway design requirements. Each watercourse crossing design recommendation was documented in individual Watercourse Crossing Reports that were reviewed by DFO, MNR and Conservation Authorities to gain their agreement in principle. As the design process progressed, the need for relocation / realignment of sections of channels was identified. In these cases, the realigned watercourse reaches were designed using natural channel design principles to ensure that they properly convey flow and sediment (i.e., ensuring stream gradient, flow velocity/discharge are such that natural geomorphic processes are maintained).

7.8.2 Likely Effects and Mitigation

The general effects associated with construction are often subsidiary effects of land based activities such as vegetation clearing, grading, and excavation. These activities, although not directly affecting fish and fish habitat, can produce stressors such as the addition or removal of instream organic structure, reduced bank stability and sediment deposition from erosion of exposed soils when adequate mitigation is not sufficiently employed.

In-water construction activities can pose potential impacts to fish and fish habitat through activities such as, placement of material or structures in water, excavation/dredging, and water extraction. Aside from direct displacement of fish and fish habitat, these activities can directly affect fish habitat by resulting in debris deposition,

bank or bed alteration, removal of aquatic macrophtyte, substrate and instream cover, alteration to fish passage and sedimentation of the water column when conducted in the absence of appropriate mitigation. Similarly, the direct alteration of a channel during realignment projects can cause changes in geometry, result in losses of morphology and in-stream habitat and produce fish passage issues where gradient changes or channel widening occur.

Effects to fish and fish habitat can result from temporary dewatering of groundwater. Construction of bridge abutments and footings often require work to temporarily be completed under dry conditions. The temporary dewatering can, in some situations, reduce baseflow contributions to groundwater fed systems. This temporary reduction in groundwater can potentially affect localized water temperatures and / or fish passage in smaller systems. Effects on base flow contributions can (by extension) affect flow/water levels as well as water temperature, which is of particular concern in watercourses that support salmonids and/or Redside Dace.

Obstruction of fish passage can occur as a result of poor construction techniques, particularly where encroachment into the channel to install the structure or realignment of channel sections is required. Potential seasonal or permanent barriers can also develop over time as a result of poorly installed structures, or possibly as a result of erosion and sedimentation triggered through destabilization of the channels following vegetation removal.

Table 7-1 provides a summary of the number of watercourse crossings affected by the construction of the 407 East Transportation Corridor in terms of their sensitivity and their preliminary risk ratings. The majority of the crossings are of watercourses with no direct fish use or of Low or Moderate sensitivity. In most of these cases, crossing structures have been designed to avoid direct impacts, and/or the crossings require channel realignments resulting in increases or reductions in channel lengths to varying degrees. High sensitivity watercourses are crossed once, all by major bridge structures. These structures have been designed to avoid direct impacts, but shading of habitat, indirect effects on channel stability and form related to vegetation loss are likely. Detailed assessments of effects at each of the watercourse crossings is provided in Natural Environment (Fisheries) Impact Assessment Report (Reference Document #5) and in individual Watercourse Crossing Reports, generated for each watercourse crossed by the 407 East Transportation Corridor. The result of these detailed assessments was a determination by DFO, MTO and applicable Conservation Authorities that 27 crossings will likely result in a HADD and will require a *Fisheries Act Authorization*. These 27 crossings include all Medium and High risk rated crossings and several lower risk rated crossings where it was determined that the scale of the effect warranted an Authorization (e.g., major channel realignments, new channel requirements, etc.).

Table 7-1 Summary of Likely Effects on Fish and Fish Habitat

VEC Sensitivity	Total # Watercourse Crossings	No / Low Risk	Low-Medium Risk	Medium Risk	Medium-High Risk	High Risk
None/No Direct Fish Use	37	37	0	0	0	0
Low	15	7	8	0	0	0
Moderate	4	1	0	2	1	0
High	24	11	0	7	6	0

Effect to fish and fish habitat during the Operations and Maintenance Phase are generally associated with the new watercourse crossings and associated works, stormwater inputs from the operation of the facility, and periodic maintenance and replacement activities. The likely effects include those associated with the permanent removal or reduction of riparian vegetation under structures. This effect can result in reduced input of organic material and nutrients (allocthanous input), increased solar inputs that influence water temperatures (which are usually offset by shading from the structures) and localized destabilization of banks. Depending on the severity of the latter effects, changes in channel form and morphology (e.g., widening, loss/reduction of pools) may occur. In most cases, the 407

East Transportation Corridor will not result in direct encroachment and the bridge spans are designed to maintain channel function, however there remains potential secondary implications on channel form and stability as a result of the loss or future die-back of vegetation, particularly under the ultimate design scenario.

Other effects during the Operations and Maintenance Phase include localized disruption in groundwater flow near abutments, obstruction of fish passage and localized effects to water quality from storm runoff and road spray. The effects to water quality from storm runoff are addressed through implementation of stormwater management (SWM) measures. However, the outlet from these facilities can also produce potential effects to receiving watercourses. Specifically, improperly designed or sited outfalls can create erosion impacts, particularly on valley slopes, as discharge flows are conveyed toward the receiving watercourse, or at the point of discharge in the watercourse. Thermal issues can also develop as a result of release of ambient temperature water to coldwater streams.

Overall, three generalized likely adverse effects have been defined for the purposes of this assessment:

1. Disruption to fish and fish habitat at channel realignments with either a decrease or increase in channel length.
2. Disruption to fish and fish habitat at locations with large span structures, resulting in indirect effects from shading and associated loss of vegetated ‘deep pool’ habitat and potentially from effects on channel stability.
3. Loss of fish and fish habitat from the removal of the existing pond at Site 92, offset by a potential net benefit to overall watershed health due to reduced thermal impacts currently occurring downstream of the pond outlet.

MTO’s Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) identify the measures to be implemented to avoid direct effects on fish and fish habitat including Erosion and Sediment Control (ESC) measures to be developed during subsequent design phases.

The following general construction mitigation measures shall be implemented where relevant based on the specific works and character of the watercourse or drainage feature, in order to minimize adverse effects to fish and fish habitat during and following construction activities. Although not intended to be exhaustive, they summarize standard mitigation requirements to be employed during construction. Although all of these measures are relevant to most watercourses, particularly diligent and rigorous application and monitoring is warranted at higher risk crossings. Generally, these crossings are those that:

- support high sensitivity fish and fish habitat;
- are located in well defined valley settings with potentially erodible steep slopes and/or soils;
- support abundant groundwater discharge; and/or
- affect channels that are vegetation controlled or otherwise susceptible to erosion following removal of vegetation.

These high risk crossings, and their specific sensitivities as relevant, will be specifically identified in the Contract documents, so that the Contractor is aware of the potential issues and can take particular care during all construction activities undertaken in their vicinity.

The following fish protection measures shall be implemented:

- All in-water and near-water activities will be conducted within the applicable in-water construction timing windows, as identified by the MNR, to protect the resident fishery life functions. The construction timing periods will be applied to all fish-bearing watercourses, as well as watercourses that drain directly to fish

bearing watercourses, based on the thermal classification of the fish community present, as outlined below:

Table 7-2 Construction Timing Windows Based on the Fishery Present[3].

Fishery	Construction Timing Window[4]	
	Start Date	End Date
Coldwater resident[5] fish community	June 1	September 15
Coldwater and warm water resident fish community	July 1	September 15
Warm water resident fish community	July 1	March 31
Warm water resident fish community with migratory salmonids (Rainbow Trout and Chinook and Coho Salmon)	July 1	September 15
Warm water resident fish community with migratory Rainbow Trout	June 15	March 31
Warm water fishery with Northern Pike Spawning	July 1	March 15

- All hoses drawing water from streams supporting fish use during temporary flow management procedures will be screened to prevent potential entrainment of fish.
- Any fish stranded within the temporary in-water work zones (including/see also measures above with respect to abandonment of old channel sections) will be removed and relocated using appropriate techniques by qualified fisheries specialist. Re-location sites for fish stranded within the temporary work zones for culverts where continuous flow is not present during the construction period will be identified. Generally, such a site will always be on a permanent reach of the watercourse, or where there is no continuous flow in the vicinity, may be on a permanent reach of the receiving/parent watercourse. A qualified fisheries specialist will identify fish relocation sites, in consultation with MNR (if required).

Groundwater and surface water aspects including stormwater management are addressed comprehensively in MTO's Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) as well as within the technical reports supporting the Provincial EA. Related measures will be encompassed in the supporting documentation for any temporary Permits to Take Water (PTTW) applications that may be required during construction. Such permit applications will also specifically address requirements pertaining to protection of specific fish habitat functions such as groundwater discharge and flow maintenance.

Specific mitigation and design principles related to groundwater and surface water inter-relationships with fish and fish habitat listed below were used during the impact assessment of the highway and will continue to be employed during subsequent design phases. Many of these design components and mitigation principles listed below have been highlighted site-specifically in the Fish and Fish Habitat Impact Assessment tables contained in the Natural Environment (Fisheries) Impact Assessment Report (Reference Document #5).

- No sub-watershed diversion of surface flow will occur. Local 'diversions' to new outfall points will only be considered on minor seasonal drainage features that do not support direct fish use.
- The functional importance of groundwater to fish and fish habitat was and will continue to be emphasized throughout the design and construction process. Specific and rigorous attention will be paid to temporary dewatering during construction at stream crossings that support coldwater fish communities and/or Redside Dace.

3. Subject to confirmation with MNR.

4. Construction Timing Windows refer to the period where construction is permitted in each watercourse associated with the thermal sensitivity of the fishery present.

5. Brook Trout, Brown Trout, Atlantic Salmon.

- Where channel relocations are required in habitat supported by groundwater discharge, the design will maintain this functional relationship in the new channel section. Preliminary conclusions that groundwater will persist in the channel realignments on the two coldwater watercourses (Lynde Creek, Oshawa Creek West and Black Creek) based on similar groundwater elevations and materials across the floodplains will be verified during subsequent design phases, and again during construction of the new channels. Specific consideration of groundwater discharge in relation to specific habitat elements (e.g., spawning habitat, refuge pools) will be integrated in this analysis and design.
- If discrete groundwater discharge points are identified during further detailed hydrogeological or geotechnical work or field work, opportunities to direct the groundwater flow to a watercourse will be evaluated, and wherever feasible, designed and implemented.
- Furthermore, if discrete groundwater discharge points are identified during subsequent field work, or during construction, all reasonable opportunities to convey groundwater to the stream, and specifically to key habitat elements such as spawning riffles and refuge pools, will be designed and implemented using appropriate measures (e.g., “French drains”, tile drains). These designs should consider channel geomorphology to ensure that the discharge of groundwater avoids erosion of the existing channel.
- Fill placed in the deeper valleys where evidence of groundwater discharge is present and particularly where it is functionally important to the fish communities should be designed using a permeable sub-base to maintain existing groundwater movement toward the streams.
- Specific outfall control measures will be implemented for all SWM facilities to prevent erosion of the receiving streams, with specific attention to outfalls to the deeper valleys at Brougham Creek and Tributary B and many of the high sensitivity watercourses in the eastern portion of the study area.
- Specific thermal controls will also be implemented at the SWM ponds that will outlet to all High sensitivity cold/cool water receiving streams. The detailed fish and fish habitat assessment provided in the Natural Environment (Fisheries) Impact Assessment Report (Reference Document #5) identifies those watercourses for which thermal effects of outlet structures are to be addressed.

Temporary Flow Management and Dewatering

- Temporary flow management plans will be developed to isolate the construction zones for watercourse crossing works and to maintain clean flow downstream. These plans will be developed based on MTO’s standards and in accordance with PTTW conditions and any other supporting measures as may be identified by the project hydrogeologists. Where appropriate, withdrawal points from the channel will be properly sited and designed to prevent intake of silt or bed materials, and the discharge points sited and designed to prevent erosion and any sediment release.
- Only clean materials free of fine particulate matter will be placed in the water for temporary construction measures (e.g., coffer dams will be constructed of ‘pea gravel’ bags, geotextile fabric or other clean material) or permanent works (e.g., substrate material).
- During all temporary dewatering required for works, appropriate energy dissipation and settling/filtration measures will be used for discharge of dewatering water to ensure no erosion or sediment release occurs in the watercourses/ drainage features. The dewatering plan will include properly sized, designed and sited temporary filtration facilities. Discharge points for release of dewatering discharge will be sited and designed to prevent erosion and ensure only clean flow is released to the watercourses. If sheet piling is used to contain dewatering areas, it will be removed following construction to prevent obstruction of groundwater movement to the streams.
- The Contractor will be informed regarding which watercourses are particularly Sensitive (e.g., presence of SAR, Brook Trout and other salmonid habitat/High Sensitivity crossings). All mitigation measures for

these crossings and adjacent works will be stringently implemented with comprehensive environmental inspection.

- Any opportunities identified during construction to divert any exposed groundwater discharge directly to the stream channels should be implemented, with input from the fish biologist, environmental inspector and/or hydrogeologist, and consultation with agency staff if appropriate.

Protection during Removal of Existing Bridges and Culverts

- In several situations, removal of existing structures will be required to construct the new highway crossings or realigned secondary roads. Appropriate containment systems will be designed and implemented during removal of the existing structures to prevent entry of debris into the 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 using appropriate mitigation measures to minimize disturbance.
- Following removal of the structure, the site and open sections of watercourse will be restored and naturalised, with specific attention to integration of fish habitat opportunities wherever feasible.

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 the watercourses during runoff events, as well as minimizing the opportunity for colonization of the area by non-native, invasive species.
- Only native plants, compatible with site conditions will be used. Detailed landscaping plans will be prepared during subsequent design phases.
- Specific attention will be directed at naturalized re-construction, stabilization, inspection and re-vegetation (where light is present) of all disturbed channel and bank transition zones, valley slopes and floodplains, to ensure there is no potential for erosion and to re-naturalize these areas.
- Temporary/biodegradable erosion control fabric or other passive means of providing temporary erosion control will be installed on the re-constructed bank zones, as well as on the disturbed embankment areas draining to the watercourses as required, to provide temporary protection until vegetative cover is fully re-established. All disturbed areas will be reseeded with appropriate native seed mixtures wherever feasible. Other means of encouraging rapid re-vegetation of appropriate species such as seedbank salvage or transplant should also be employed where appropriate.
- Specifically on the outer banks of the inlet and outlet pools, the bank protection design should emphasize use of vegetation and naturalized approaches to provide bank integrity, rather than hardened approaches such as rock.
- The unique aspects of this project in relation to the large structures required to accommodate the ultimate design scenario may require further specific restoration considerations, as outlined in the site-specific mitigation measures. Specifically, the vegetation loss and die-back under the ultimate design structures is anticipated to have potential implications for maintenance of channel form, morphology and associated habitat elements under the structures. The degree and type of potential adjustment and habitat related effects will vary with the specific fluvial geomorphologic and habitat conditions associated with the affected watercourse reach. Therefore, to address this uncertainty and inform the refinement of the design of watercourse crossings that require relocation, particularly where the watercourses are

sensitive to erosion and/or support sensitive species or habitats, the following measures are recommended:

- The site-specific susceptibility to erosion and lateral migration of the affected channel sections should be assessed further during subsequent design phases to determine the need for, and type/design of measures that can best achieve the ultimate objective of providing long-term channel stability, with minimum instream hardening/fixing and intrusion into the stream channels.
- This assessment should be integrated with a detailed understanding of the specific fish habitat elements that may be affected.

Site Inspection and Monitoring

- An environmental inspector experienced in working around watercourses will be responsible for inspecting the erosion and sediment control measures and identifying deficiencies. The inspector will also assess all of the other general mitigation measures to ensure they are implemented as intended. 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.
- For any works requiring channel realignment, appropriate specialists (fluvial geo-morphologists, hydrologists, fisheries biologists) will be used. They will also be responsible for obtaining specialist advice (e.g., hydrology/hydraulics, fisheries) as required during the construction of the new channel transition zones.
- For all crossings that involve authorization under the *Fisheries Act*, a Fisheries Contracts Specialist will conduct the inspection and documentation, in accordance with the MTO's *Environmental Guide for Fish and Fish Habitat*.

Groundwater and surface water aspects including stormwater management are addressed comprehensively within the technical reports, the Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009). Related measures will be encompassed in the supporting documentation for any temporary Permits to Take Water (PTTW) applications that may be required during construction. Such permit applications will also specifically address requirements pertaining to protection of specific fish habitat functions such as groundwater discharge and flow maintenance. Specific mitigation and design principles related to groundwater and surface water inter-relationships with fish and fish habitat used during the impact assessment of the highway will continue to be employed during subsequent design phases. MTO has also identified measures related to fish and fish habitat protection during removal of existing bridges and culverts, rehabilitation following construction and site inspection and monitoring measures. For all crossings that involve authorization under the *Fisheries Act*, a Fisheries Contracts Specialist will conduct the inspection and documentation, in accordance with the MTO's *Environmental Guide for Fish and Fish Habitat*.

7.8.3 Residual Effects

MTO has concluded that no residual adverse effects on fish and fish habitat are likely because compensation will be used by MTO to achieve a No Net Loss (NNL) of fish and fish habitat affected by the 407 East Transportation Corridor. MTO also recognizes that compensation will only be considered by DFO after it has been proven that it is impossible or impractical to avoid a HADD on fish habitat through relocation, redesign, or mitigation. As such, effects on fish and fish habitat are not considered further in the cumulative effects assessment. Finally, based on

conclusions of the surface water and groundwater assessments, it is concluded that there are no effects on fish and fish habitat that would have implications to human health attributable to the 407 East Transportation Corridor.

7.8.4 Government and Public Comments

Provincial government and public comments regarding the effects of the Project on groundwater, surface water and wetlands expressed concern over fish and fish habitat. A few reviewers offered specific comments regarding fish and fish habitat, largely because DFO, MNR and Conservation Authorities were very closely involved in virtually all aspects of routing, project design and assessment. As such, MTO had addressed their issues and concerns to the extent that no further comments during the review of the Provincial EA were required. DFO indicated that MTO should include a commitment to use sod matting, where possible, especially on sensitive streams. This was recommended to further reduce the potential for erosion and provide immediate habitat for species such as the Redside Dace. MTO agreed to this additional commitment.

7.9 Wildlife and Wildlife Habitat

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the Project on wildlife and wildlife habitat, including migratory birds. The VEC identified for this analysis was specialized and sensitive wildlife habitats. Further information is provided in the Natural Environment (Terrestrial) Impact Assessment Report (Reference Document #6) and in the Draft Environmental Screening Report (December 2009).

7.9.1 Approach

Wildlife and wildlife habitat (including Migratory Birds) were given consideration throughout each stage of the EA process (i.e., route planning/evaluation, preliminary design and effects assessment). The approach to the assessment and the methods applied were similar to those described in Vegetation and Vegetation Communities, including reviews of secondary source information and field investigations within the ROW and adjacent lands. Wildlife specific studies included winter resident and spring migrant bird studies and wildlife passage analysis.

Wildlife species status was evaluated using a variety of sources including TRCA L-rankings; Durham Region (Henshaw 1993); the Natural Heritage Information Centre website for Provincial significance; and the Committee on the Status of Endangered Wildlife in Canada website for Federal (National) significance. Species of Conservation Concern include Federally G-ranked species (G1-G3), Provincially S-ranked species (S1-S3) and/or species designated by COSEWIC or the Committee on the Status of Species at Risk in Ontario (COSSARO) or species considered of conservation concern in Toronto or Durham Region. Area-sensitive birds were identified based on the MNR Significant Wildlife Habitat Technical Guide (SWHTG).

During the Alternative Methods stage of the EA, a landscape connectivity and wildlife linkage analysis was undertaken followed by a more detailed wildlife movement and linkage analysis as part of the Preliminary Design process. As a separate exercise, the Ontario Road Ecology Group developed an independent GIS-based model to indicate potential herpetofauna mortality hotspots along the 407 East Transportation Corridor. The model output was shared with the 407 Study Team and served to support and corroborate MTO's analysis and ecopassage system recommendations.

7.9.2 Likely Effects and Mitigation

Construction of the 407 East Transportation Corridor can have a number of direct effects on wildlife. Direct construction effects are generally associated with: habitat loss or modification including interference with noteworthy species and habitats including Species at Risk; wildlife injury or mortality; and effects on animal movement. Loss of wildlife habitat may result in loss of species, fragmentation of habitat and of wildlife populations, reduction of wildlife habitat quality, and loss of active nests of migratory birds, through the removal of vegetation or features used for shelter, feeding and/or breeding; and/or physical destruction and/or severing of habitat areas. Overall, the construction of the alignment will result in the direct removal of terrestrial forest and wetland areas that provide wildlife habitat. The implications of the habitat removal were assessed, primarily in the context of potential adverse effects to elements of specialized or sensitive wildlife habitat known or likely to be present.

Road construction typically involves the clearing of existing vegetation, the removal of overburden (grubbing) and the blasting of bedrock (where encountered). All activities require the operation of heavy machinery. These activities are likely to result in some wildlife injury or mortality within the construction zone. Wildlife species vary in their vulnerability to construction-related mortality.

Species that are sensitive to disturbance and are capable of departing areas of increased human activity (i.e., most mammals and birds) are less likely to be affected by construction. Species that avoid humans through mechanisms other than flight (e.g., crypsis) and/or move too slowly to flee disturbance (such as small mammals and some herpetofauna) are at increased risk from construction activity.

Timing also determines the vulnerability of wildlife to construction-related mortality. The greatest potential for adverse effects is during the spring and summer, when migratory birds are present in the study areas, when most species (particularly mammals and birds) are rearing young in nests, burrows or dens, and when all species are most active, thus increasing their potential to enter into the construction zone.

Wildlife vulnerability to construction is reduced during the fall and winter because migratory birds have left the study area, young-of-the-year have dispersed from nests, burrows and dens, and remaining overwintering species (e.g., deer) are generally less active and thus less likely to move into the construction zone.

Terrestrial wildlife species will vary in their response to crossing the construction zone. Most tolerant species will continue to cross, but will likely adapt their movements to non-construction periods. Less mobile species may be deterred at some locations, and may seek other routes. Adjustments and changes can be anticipated during the construction period.

The effects of the 407 East Transportation Corridor on wildlife during the Operations and Maintenance Phase are habitat loss, changes in habitat quality / function and restrictions to wildlife movement and increased wildlife mortality resulting from:

- the creation of edge habitat that can affect off-site breeding, feeding, shelter quality, and/or movement opportunities for sensitive species;
- introduction of invasive species (disturbance/increased light/creation of movement passage along transportation facility);
- introduction of light and noise pollution to a habitat area;
- severing of woodlands (including woodlots) may result in residual sizes that are too small to support ‘area- sensitive’ wildlife species;

- fragmenting wildlife populations that may cause further endangerment of an already sensitive and rare species; and
- vehicular traffic collisions.

Noise implications for wildlife have been gaining increasing interest in the research community, although definitive studies are still limited and conclusions about the nature and extent of effects are variable (see recent review by the Federal Highway Administration [FHWA] 2004). MTO has indicated that there is limited information on the response of many wildlife groups to noise. While birds have been more heavily studied, the nature and extent of noise effects is still not clear. Some species appear to be negatively affected by the presence of roads, others appear to be neutral, and a number of species directly benefit from the creation of roadside habitat (FHWA 2004). Noise effects and sensitivity to noise appear to vary considerably among bird species. Similarly, some wildlife species will be more sensitive to fugitive dust, light, surface water and groundwater effects than others.

The Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) identify numerous mitigation measures that will serve to avoid and/or reduce the severity of adverse effects, including relevant Ontario Provincial Standards Specifications (OPSS) and adherence to permits, Acts and guidelines, including *Migratory Birds Convention Act* and Regulations. The primary mitigation measures aimed at minimizing effects on wildlife habitat, including migratory birds are those identified by MTO regarding vegetation and vegetation communities, and wetlands. In addition MTO has identified additional mitigation measures regarding wildlife mortality and movement by increasing transportation corridor permeability for wildlife through the provision of wildlife structures and funnel fencing. Final design details for these crossings will be prepared during subsequent design phases, with agency review and input. This will be included as part of the restoration and landscape plan. During subsequent design phases, MTO will explore material and implementation techniques for erosion and sediment control measures that would minimize as much as possible, the affect on vegetation and wildlife (i.e., biodegradable, implemented to reduce accidental wildlife entrapment, etc.). The Provincial EA (August 2009) and the Draft Environmental Screening Report (December 2009) provide further details regarding wildlife passage design elements; fencing for smaller wildlife species, and fencing for larger wildlife species.

7.9.3 Residual Effects

During the Construction Phase and Operations and Maintenance Phases, the 407 East Transportation Corridor will result in restrictions to wildlife movement and potential increased wildlife mortality. During the Operations and Maintenance Phase, wildlife mortality and the restrictions to existing wildlife movements due to the transportation corridor would be minimized by the 80 structures and wildlife fencing that will accommodate wildlife passage associated with water crossings, including six terrestrial wildlife passages not associated with watercourse crossings.

Similarly, during the Construction Phase and Operations and Maintenance Phases, the 407 East Transportation Corridor will result in the disruption to wildlife within the retained portion of vegetation communities and wetlands along/adjacent to valley crossings, including wildlife species sensitive to habitat size/diversity, fugitive dust, noise, light, surface water and groundwater effects.

7.9.4 Government and Public Comments

Provincial government, Conservation Authority and public comments regarding wildlife were made largely in the context of effects to vegetation and vegetation communities and wetlands, and the effect of the EDL in particular. One public comment related to a specific property directly affected by the EDL. MTO indicated that the EDL has been sited to avoid higher quality natural areas such as diverse forest and wetland habitats. As a result, some areas

that provide lower quality habitat for birds and other wildlife will be affected. Agricultural lands, including orchards, are not typically surveyed as a primary source for bird surveys as they primarily host common species that inhabit a range of habitat types though it is recognized that orchards can harbour numerous breeding bird species, as well as some migrants.

EC provided the CEA Agency and RAs with comments regarding wildlife and wildlife habitat, focussing on mitigation to address the potential for incidental take of migratory birds. To this end, MTO accepted EC's recommendation that construction activities with the potential to destroy migratory birds, including vegetation clearing, filling and demolition/removal of structures used by cavity nesters, should not take place in migratory bird habitat during the breeding season, generally defined (for different habitat types) as May 1 – July 31 for this region. In addition, MTO confirmed that any required avian nest surveys will be conducted by a qualified avian biologist immediately (i.e., within 2 days) prior to commencement of the works. A mitigation plan would then be developed to address any potential impacts on migratory birds or their active nests, in consultation with EC.

Finally, pursuant to the approval granted by the Ontario Minister of Environment on June 3, 2010, MTO will be required to evaluate options and identify a preferred response in the event that a new major biological feature is identified upon which the Project would have an adverse effect.

7.10 Species at Risk

The following sections summarize the likely effects, mitigation and compensation measures, and residual effects of the Project on Species at Risk. The VEC identified for this analysis was the Species at Risk identified by COSEWIC or under Ontario's Endangered Species Act (ESA). Further information is provided in the Natural Environment (Terrestrial) Impact Assessment Report (Reference Document #6) and in the Natural Environment (Fisheries) Impact Assessment Report (Reference Document #5). More specific analyses of effects at those watercourse crossings and federal lands that triggered the Federal EA are provided in the Draft Environmental Screening Report (December 2009).

7.10.1 Approach

Species at Risk were given consideration by MTO throughout each stage of the EA process (i.e., route planning/evaluation, preliminary design and effects assessment). In addition, the following Species at Risk specific studies were undertaken:

- Completing a Butternut Health Assessment of all Butternuts within approximately 120 m of the 407 East Transportation Corridor.
- The functional importance of groundwater to fish and fish habitat was emphasized throughout the EA process. Specific and rigorous attention was paid to temporary dewatering during construction at stream crossings that support coldwater fish communities, particularly the Redside Dace. Specific consideration of groundwater discharge in relation to specific habitat Redside Dace elements (e.g., spawning habitat, refuge pools) was integrated in the analysis, and the mitigation measures recommended.
- The crossings that support direct fish use by the Re-introduced Atlantic Salmon were designed to maintain hydrotechnical and fluvial geomorphologic processes, which in turn should maintain habitat and fish movement. This design process involved an integrated, multi-disciplinary review of crossing design alternatives, and iterative development of culvert alignment and bridge span arrangements in relation to channel planform/fluvial geomorphological considerations. Where there is no direct fish use, crossings

were still designed to maintain hydrotechnical and fluvial geomorphological processes to avoid exacerbation of erosion and downstream sediment transport to fish bearing receiving watercourses.

7.10.2 Likely Effects and Mitigation

The construction of the 407 East Transportation Corridor will result in the removal of 83 Butternut trees, including 3 seedlings (34 are considered retainable). A permit under the Ontario *Endangered Species Act* will be required for the removal of the retainable Butternut trees. This permit will include specific requirements for mitigation that will assist in the development of a Recovery Strategy for Butternut across Ontario. Given that a Recovery Strategy and Butternut related policies to support the implementation of Ontario's *Endangered Species Act* have not been finalized, MTO has developed a preliminary mitigation strategy in consultation with the MNR and Forest Gene Conservation Association (FGCA). The key elements of this mitigation strategy are presented in Chapter 8, Exhibit 8.216 of the Provincial Environmental Assessment Report, Volume 1 – Main Report (August 2009). In general, the strategy involves transplanting retainable trees of suitable sizes, collection of reproductive material (e.g., nuts and/or cuttings), planting of nursery stock at appropriate ratios, monitoring of transplants and/or grafts and taking contingency measures. Overall, it is anticipated that the implementation of the mitigation strategy will achieve an overall net benefit to the species. This Butternut mitigation strategy will continue to evolve during subsequent design phases of the Project and will be enforced under the *Endangered Species Act* permit.

The operations and maintenance of the 407 East Transportation Corridor will disrupt Redside Dace habitat at eight (8) watercourse crossings due to shading from large scale structures and associated loss of vegetated 'deep' pool refuge habitat used by Redside Dace. There is also some potential for indirect effects on channel stability and form related to vegetation loss that may affect this species. The functional importance of groundwater to Redside Dace and its habitat was emphasized by MTO throughout the EA process through the consideration of groundwater discharge in relation to specific habitat Redside Dace elements (e.g., spawning habitat, refuge pools). General mitigation measures and species specific measures aimed at protecting fish are identified previously in Section 7.8, Fish and Fish Habitat. Chapter 8, Exhibit 8.216 of the Provincial Environmental Assessment Report, Volume 1 – Main Report (August 2009) provides further details. Other mitigation measures aimed at protecting Redside Dace and its habitat include:

- All in-water and near-water activities will be conducted within the applicable in-water construction timing windows, as identified by the MNR, to protect the life functions of the Redside Dace. The construction timing periods will be applied to Redside Dace bearing watercourses, as well as watercourses that drain directly to fish bearing watercourses, based on the thermal classification of the fish community present, as outlined in **Table 7-3** below.

Table 7-3 Construction Timing Windows for Redside Dace fishery[6]

Fishery	Construction Timing Window[6]	
	Start Date	End Date
Redside Dace	July 1	September 15

- In situations where Redside Dace are present, a specific assessment program shall be developed and implemented, in consultation with the recognized experts and appropriate agency staff and in accordance with the *Endangered Species Act* process. Opportunities for collaboration on post-construction monitoring activities shall also be explored and implemented as feasible.

6. Construction Timing Windows refer to the period where construction is permitted in each watercourse associated with the thermal sensitivity of the fishery present.

- The site-specific susceptibility to erosion and lateral migration of the affected channel sections should be assessed further during subsequent design phases to determine the need for, and type/design of measures that can best achieve the ultimate objective of providing long-term channel stability, with minimum instream hardening/fixing and intrusion into the stream channels. This assessment should be integrated with a detailed understanding of the specific fish habitat elements that may be affected.
- No sub-watershed diversion of surface flow will occur. Local 'diversions' to new outfall points will only be considered on minor seasonal drainage features that do not support direct fish use.
- The functional importance of groundwater to fish and fish habitat will continue to be emphasized throughout the design and construction process. Specific and rigorous attention will be paid to temporary dewatering during construction and mitigation of thermal effects at stream crossings that support Redside Dace.

MTO concluded that there is a low potential to affect the Golden-Winged Warbler because its presence was recorded approximately 150 m from the ROW and only a small portion of the suitable habitat at this locale is likely to be affected. The presence of the Blandings Turtle was noted through the review process by a local resident, but subsequent field studies could not confirm its presence. MTO indicated that if a Blandings Turtle is encountered in subsequent work related to detailed design or construction, MTO will contact MNR to determine *Endangered Species Act* permit requirements. No adverse effects to the habitat of the introduced Atlantic Salmon, the Golden-Winged Warbler or Blandings Turtle are anticipated during operations.

7.10.3 Residual Effects

Taking into account the recommended mitigation measures, the Project will result in the removal of 83 Butternut trees, including three seedlings (34 are considered retainable), disruption to Redside Dace habitat at eight (8) watercourse crossings due to shading from large scale structures and associated loss of vegetated 'deep' pool refuge habitat used by Redside Dace, as well as general uncertainty associated with potential for indirect effects on channel stability and form related to vegetation loss. This residual adverse effect will be largely associated with the Operations and Maintenance Phase.

7.10.4 Government and Public Comments

During the review of the Provincial EA, one member of the public expressed concern over biodiversity and Species at Risk in particular, expressing the view that the effects of the project are in direct conflict with Ontario's *Endangered Species Act* and that mitigation cannot compensate for the habitat destruction and fragmentation that these routes will create through the Greenbelt. The commenter noted that MTO is required to get a permit under Section 17 of the *Endangered Species Act* for each species before activity can be permitted.

EC provided the CEA Agency and RAs with comments regarding Species at Risk, requesting clarification on the numbers of Butternut trees and samplings affected versus those considered retainable. EC required that if estimates of Butternut populations in the RSA are known, it would be informative to compare Project related losses to this information. EC noted that pursuant to Section 79(1) of SARA, the CEA Agency and/or RAs must notify the competent Minister responsible for the listed species, which in this case is EC, of potential adverse effects of the Project on listed species.

EC noted that the MNR, who is leading the development of the Recovery Strategy for Butternut has extensive experience with this species and an intimate knowledge of the project area and expressed confidence that MNR staff will provide "effective protection" of the species, as they are undertaking a field review in advance of the ESA permitting process. Also, given that a suite of proposed measures will be utilized in consultation with the MNR and

Forest Gene Conservation Association, EC expected that these actions will prevent significant adverse environmental effects on Butternut. EC recommended that the proponent continue to consult relevant MNR staff for information on appropriate mitigation and monitoring requirements; however, the RAs should also ensure that EC is advised by the Province of their efforts to protect the listed species.

Finally, pursuant to the approval granted by the Ontario Minister of Environment on June 3, 2010, MTO will be required to evaluate options and identify a preferred response in the event that a new major biological feature is identified upon which the Project would have an adverse effect. If at any time, MTO encounters a species protected under Ontario's *Endangered Species Act* (2007), it shall contact the Ontario MNR to determine if there are additional requirements or considerations in accordance with the *Endangered Species Act* (2007).

7.11 Socio-economic Environment

The following sections identify and describe the likely effects, mitigation and compensation measures, and residual effects of the entire 407 East Transportation Corridor on the socio-economic environment. The specific VECs that were identified for this analysis included the use and enjoyment of lands; community, recreational and institutional services; community character and agricultural soils. Further information is provided in the Socio-Economic Impact Assessment Report (Reference Document #11), the Landscape Composition Impact Assessment Report (Reference Document #10) and the Agricultural Impact Assessment Report (Reference Document #12).

7.11.1 Approach

The assessment of effects on the socio-economic environment was initially based on functional plans of the 407 East Transportation Corridor and subsequently revised as a result of Preliminary Design (including route refinements, preliminary design alternatives and identification of supporting facilities). As a result of refinements to the Recommended Design, additional research and investigations were carried out as part of the review of the transportation corridor and associated impacts. Policy documents considered in the assessment included: Provincial Policy Statement; Oak Ridges Moraine Conservation Plan; Greenbelt Protection Plan; Growth Plan for the Greater Golden Horseshoe; Region of Durham Official Plan; Area Municipal Official Plans; and the Metrolinx Regional Transportation Plan. Implications for human health were considered by MTO in the context of their cumulative effects assessment. Consistent with the Comprehensive Study Guidelines document and TC comments made during the preparation of the Draft Environmental Screening Report (December 2009), TC indicated that for the purposes of the federal environmental assessment, only indirect effects on the socio-economic environment should be considered. TC indicated that the analysis should be limited to just those socio-economic effects that are linked to a change in the environment.

7.11.2 Likely Effects and Mitigation

People's use and enjoyment of property may be disrupted due to the encroachment of construction works and activities on lands used by people for residential, business, and community/recreational purposes. Encroachment effects on people are generally limited to increases in construction noise and dust. These effects were considered in previous sections of this comprehensive study report. Encroachment effects on businesses will also include increases in construction noise and dust.

In addition, the 407 East Transportation Corridor will result in the loss of agricultural lands and disruption to farm operations that will result in reduced agricultural activity. The transportation corridor traverses a range of soil types and will result in the removal of 2,068.3 ha of land from agricultural production. There is a higher percentage

removal of Class 1-3 type soils (84.5%) than the Class 4-7 type soils. As agriculture is a dominant land use in the study area, many of the farm operations comprise large land holdings.

Changes in community character are also likely due to changes in landscape composition (i.e., changes in valley slopes and landforms), and effects of fugitive dust, noise and light associated with a large construction project within rural/agricultural communities along the transportation corridor. Temporary disruption to recreational uses during construction will be mitigated by the relocation of trail systems where feasible and restoration/provision of signage for trail systems.

The effects on people's use and enjoyment of property and reduced agricultural activity resulting from the 407 East Transportation Corridor are expected to continue during the Operations and Maintenance Phase. In addition, changes in community character are likely to result from changes in the landscape composition and effects of fugitive dust, noise and light associated with a new transportation corridor within rural/agricultural communities along the transportation corridor.

The likely effects on landscape composition from the proposed transportation corridor can be described in terms of the likely alterations to the landscape character and scenic integrity, as well as the landscape experience of the area. The primary adverse effect on the landscape character will be a disruption to the pastoral quality and landscape connectivity caused by the actual physical obstruction of the transportation corridor as well as the removal of natural and cultural resources required to construct the project.

The presence of the transportation corridor will alter existing viewsheds within the area, will require changes to the existing topography including cuts through steep slopes and raising of elevations through valley areas either by filling or by erecting bridge structures to span a creek system or environmentally sensitive area. In particular these raised elevations and structures may create some obstructions in some long north-south viewsheds.

The operation and maintenance of the 407 East Transportation Corridor will also affect surrounding residents and land users depending on their proximity to the proposed corridor due to fugitive dust, increased light and changed views. In terms of a user of the transportation corridor (i.e., the travelling public), views from it and the perception and experience of the landscape (i.e., vegetation, topography, natural features) will be one of the most distinguishing features.

Mitigation measures to minimize the effects on people's use and enjoyment of property due to effects of fugitive dust, noise and light have been addressed previously. Landscape composition effects on community character shall be mitigated by extensive vegetative screening and buffering which is consistent with the character and surrounding land uses of the area. Measures developed through the Community Values Plan (CVP) process will mitigate adverse effects to views and viewsheds and include measures which will enhance the landscape composition of the area at select locations. CVP measures proposed in areas may improve on the existing landscape composition by providing greater screening and buffering from existing land uses.

Effects to the Greenbelt areas will be mitigated by the implementation of a Greenbelt strategy. The proposed 407 East Greenbelt Strategy has been developed to recognize the importance of the Greenbelt and its features and functions and to mitigate the potential effects associated with the 407 East Transportation Corridor.

7.11.3 Residual Effects

Taking into consideration the implementation of the identified mitigation measures, the residual adverse effects of the 407 East Transportation Corridor on socio-economic conditions resulting from effects on the environment are:

1. Changes in community character due to changes in landscape composition and effects of fugitive dust, noise and light;
2. Reduced agricultural activity due to changes in landscape composition (i.e., loss and/or severance of 2,068.3 ha of agricultural land); and
3. Disruption to the use and enjoyment of property due to encroachment / proximity of the transportation corridor (i.e., increased nuisances), changed community character and landscape compositions.

7.11.4 Government and Public Comments

Provincial government comments regarding the socio-economic effects considered in the Provincial EA focused on effects on agriculture and agricultural properties, land use compatibility, long term impacts of salt spray and compensation to property owners due to land acquisition. Comments on the Community Value Plan focused on the availability of detailed landscaping plans and the effectiveness of landscaped screens at attenuating noise.

Public comments regarding socio-economic effects received during the review of the Provincial EA were largely focussed on effects to specific properties, the importance of agriculture in Durham Region and the effect of the project on agricultural land and food production. Other comments focused on the consistency of the Project with the Provincial Policy Statement, the Greenbelt Protection Plan, the Growth Plan for the Greater Golden Horseshoe and various municipal Official Plans. In general, public comments considered the Project as being inconsistent with various objectives or provisions of these policy and planning documents. Several municipalities, including the City of Pickering, the City of Oshawa and that Town of Whitby provided comments on the effects of the Project on municipally owned property, infrastructure, sidewalks, bike lanes and various timing and financial issues. MTO responded to each comment during the Provincial EA review process and continues to work with the MOE, municipal officials and property owners to resolve outstanding concerns.

Finally, pursuant to the approval granted by the Ontario Minister of Environment on June 3, 2010, MTO will be required to prepare and implement:

- a *Complaint Protocol* on how it will deal with and respond to inquiries and complaints received during the construction and operation of the Project;
- a *Construction Noise, Vibration and Air Quality Impact Mitigation Plan.* The plan would identify the mitigation measures for all major construction activities including those due to possible blasting and pile-driving;
- a *Construction Management and Mitigation Plan*.

7.12 Cultural Environment

7.12.1 Approach

The following sections identify and describe the likely effects, mitigation and compensation measures, and residual effects of the entire 407 East Transportation Corridor on physical and cultural heritage (i.e., the cultural environment). The specific VECs identified for this analysis included archaeological sites, Euro-Canadian built heritage resources and cultural landscapes. Further information is provided in the Archaeology Impact Assessment Report (Reference Document #14) and in the Built Heritage Impact Assessment Report (Reference Document #15).

In Ontario, the conservation of archaeological resources is carried out by licensed archaeologists through a four-stage assessment and mitigation process administered by the Ministry of Culture (MCL) under the provisions of the Ontario Heritage Act (R.S.O. 1990, c. O.18) and described in the MCL document, *Standards and Guidelines for*

Consultant Archaeologists (MCL 2006). The field investigations carried out for purposes of this EA constituted a Stage 2 archaeological assessment of a sample of properties throughout the transportation corridor for which both permission to enter and suitable archaeological field conditions were available. The properties assessed provided a comprehensive inventory of actual archaeological resources, both pre-contact Aboriginal and historic Euro-Canadian, rather than the estimate of archaeological potential and documentation of previously registered archaeological sites provided by Stage 1 assessment. In addition to documenting and registering archaeological resources, Stage 2 archaeological assessment also yielded recommendations pertaining to the need for Stage 3 archaeological assessment. Monthly Stage 2 report submissions have been made to the Ministry of Culture (MCL) beginning in May 2008.

Since many archaeological resources in Ontario are of Aboriginal origin, engagement with First Nations in the course of archaeological investigation of Aboriginal sites is consistent with best practices. MTO is actively engaging with First Nations on issues of interest during the course of archaeological investigations and will continue to carry out this engagement in the future.

The assessment of effects on built heritage considered the disruption and/or displacement of cultural heritage landscapes and the disruption and/or displacement of built heritage resources. This was undertaken primarily through field survey that allowed the Project to be assessed in accordance with the *Ontario Heritage Act* 2005, Ministry of Culture (MCL) Guidelines, MTO's Environmental Reference for Highway Design (ERD – MTO 2006) and its Guide for Built Heritage and Cultural Heritage Landscapes (February 2007).

7.12.2 Likely Effects and Mitigation

Construction-related activities along the 407 East Transportation Corridor threaten all archaeological sites. Stage 2 and Stage 3 archaeological assessment will determine which sites warrant Stage 4 mitigation, either avoidance and protection or salvage excavation. The effects on sites which can be avoided and protected from any land disturbance are considered to be neutral. Stage 4 salvage excavation will have an adverse effect on any site for which this mitigation option is chosen. **Table 7-4** provides a summary of the archaeological assessment findings and recommendations submitted to MCL as of December 2008.

Table 7-4 Summary of Archaeological Findings Submitted to MCL (as of December 2008)

Corridor Section	Total
Assessed Area of Land (total ha)	291
Assessed Area of Land (%)	13
Remaining Area of Land (total ha)	1886
Remaining Area of Land (%)	87
Aboriginal Sites Documented	11*
Euro-Canadian Sites Documented	21*
Total No. of Sites Recommended for Stage 3	11*

*Note: * Subject To Further Work*

The primary potential adverse effect to built heritage resources during the Construction Phase is the displacement of built heritage resources (BHRs) and cultural heritage landscape (CHLs) resources. Displacement occurs when a BHR/CHL is within the footprint of the transportation corridor and needs to be removed (through demolition, or removal and relocation to a new site). Displacement impacts are permanent and irreversible. The construction of the 407 East Transportation Corridor will result in the displacement of 25 built heritage resources, including farmsteads, residences, barns, bridges, a former school, cemeteries, a rail/hydro line and miscellaneous buildings.

The vast majority of the resources displaced are farmsteads and residences. No cemeteries are directly affected. In addition, the 407 East Transportation Corridor will require the displacement of 42 cultural heritage landscapes and 20 roadscapes.

Following construction, no adverse effects on archaeological sites are anticipated. Operations and maintenance of the 407 East Transportation Corridor will result in disruption to 9 built heritage resources, including farmsteads, residences, barns, bridges, a former school, cemeteries, a rail/hydro line and miscellaneous buildings. In addition, the 407 East Transportation Corridor will disrupt 40 cultural heritage landscapes and 40 roadscapes.

Once a complete inventory of archaeological resources within the 407 East Transportation Corridor has been completed through Stage 2 archaeological assessment, and further evaluation has been completed for those sites recommended for Stage 3 assessment, a mitigation and compensation plan will be developed for those sites recommended for Stage 4 mitigation. For Aboriginal archaeological sites, engagement with First Nations will occur in advance of Stage 3 archaeological assessment. All mitigation measures for archaeological resources will comply with MCL's draft standards and guidelines, portions of which are excerpted in the following sub-sections. Protection and avoidance measures of archaeological resources, including documentation requirements, are detailed in the document entitled, Standards and Guidelines for Consultant Archaeologists final draft, Unit 1F – Stage 4 Protection and Avoidance (MCL 2006). All archaeological work will be completed prior to construction and while avoidance is the preferred mitigation strategy, Stage 4 salvage excavation may be the only viable option.

Further investigation, including the completion of Cultural Heritage Evaluation Reports (CHERs), will be required to determine the heritage value of these properties before specific recommendations for mitigation can be provided. Specifically, resources that lie within the transportation corridor that are found to be significant would be considered for relocation, or for documentation and removal. Adverse effects on properties due to proximity will be mitigated by design features and landscape elements to screen the transportation corridor (refer to landscape composition impact assessment report).

7.12.3 Residual Effects

Although the 407 East Transportation Corridor will result in the displacement of a minimum of 11 archaeological sites and 87 cultural heritage resources (based on studies conducted to date), the conservation, preservation and protection requirements of the *Ontario Heritage Act,* the completion of CHERs and implementation of a displacement strategy will ensure that displacement effects are appropriately managed. Therefore, this is not considered to be a residual adverse effect on the cultural environment. Similarly, the 407 East Transportation Corridor will result in disruption to 89 cultural heritage resources during the Operations and Maintenance Phase. Because adverse effects on properties due to proximity will be mitigated by design features and landscape elements to screen the transportation corridor this is not considered to be a residual adverse effect on the cultural environment.

7.12.4 Government and Public Comments

Provincial government comments included both points of clarity and technical review comments. The key technical comment related to whether undiscovered archaeological sites can be avoided or protected post EA-approval and under what circumstances would avoidance of such sites be considered. MTO indicated that all archaeological work will be completed prior to construction and that while avoidance is the preferred mitigation strategy Stage 4 salvage excavation may be the only viable option.

During the review of the Provincial EA, a member of the public requested that the MCL and the Ontario Heritage Trust be consulted regarding impacts to heritage features. MTO responded that the EA has included an extensive consultation program which has included the MCL. MTO staff met with MCL staff early in the process to discuss

heritage and archaeological matters and later accompanied MCL staff on a tour of the corridor making site visits at several directly impacted heritage properties. MCL staff have reviewed the heritage impact assessment reports pertaining to the identification and evaluation of built heritage resources and cultural heritage landscapes. MCL staff has also been receiving and reviewing 'interim' archaeological assessment reports as these are being completed for sections of the 407 corridor.

7.13 Current Use of Lands and Resources by Aboriginal People

7.13.1 Approach

The following sections identify and describe the likely effects, mitigation and compensation measures, and residual effects of the entire 407 East Transportation Corridor on the current use of land and resources by Aboriginal People. Taking into account the current tenure of the land (largely private property) and the distance of Aboriginal groups to the RSA, the approach considers the effects on vegetation and vegetation communities, fish and fish habitat, wildlife and wildlife habitat (including migratory birds) and Species at Risk.

7.13.2 Likely Effects and Mitigation

Several First Nations have a strong historical connection to the land. Their Aboriginal and treaty rights ensure that Aboriginal people can continue use of the land and waters for traditional purposes such as hunting and fishing for food and cultural purposes without undue limitations.

Within this context, and based on the research and field studies undertaken as part of the Provincial EA, there does not appear to be any current use of lands, water or resources by the identified First Nation communities along the 407 East Transportation Corridor and the RSA in general. MTO's analysis indicates that there is no current existence of commercial fishing, traditional activities (i.e., relating to food, camping, travel, social or cultural purposes), nor First Nation communities with a dependence on country foods or harvesting on or near the 407 East Transportation Corridor were identified. At present, the vast majority of the land required for the 407 East Transportation Corridor is privately held. As noted previously, there are no Métis settlements in the RSA. At present, the boundaries and details of the traditional harvesting territories of Métis communities within Ontario are not fully determined. A description of the territories will be the subject of further research and consultations to take place in the near future between the Métis Nation of Ontario (MNO) and the Ontario Ministry of Natural Resources.

Among some First Nations, there is a widely held notion that the effects of today's actions must be considered on the next seven generations and points to the requirement for a long-term view to potential effects of projects. At a minimum, the 407 East Transportation Corridor will be present within the traditional lands and Treaty area of local First Nations and Métis people for several decades. The long-term effects of the Project on the environment will depend on the condition, function and integrity of the facility. There will always remain some degree of risk to the health and productivity of the lands, waters, animals, fish, plants and life in their traditional territory. The ability to use these resources to sustain their people, communities and culture is provided by Aboriginal and Treaty rights. Nevertheless, the residual adverse effects of the Project during its Construction and Operations Phases do not indicate that members of First Nations or Métis people are likely to be affected to the degree that their ability to hunt, fish or undertake other resource harvesting activities in the RSA would be impaired. The extensive mitigation and monitoring measures proposed for the Project will help ensure there are no significant environmental effects from the Project in the long term. As such, no likely significant adverse effects on the current use of lands and resources by members of First Nations or Métis people are anticipated. Nevertheless, First Nations and Métis people will be kept well informed and involved throughout the Construction Phase of the Project.

7.13.3 Residual Effects

No adverse effects on the current use of lands and resources by members of First Nations or Metis people are anticipated. There are no human health implications specifically for First Nations or Metis people associated with the current use of lands and resources.

7.13.4 Government and Public Comments

To better involve aboriginal groups in the Provincial EA, MTO arranged Workshop and Information Sharing Sessions with a number of First Nations groups, specifically the Williams Treaty First Nations and the Huron-Wendat. During the Workshops/information sharing sessions, a number of questions were raised by the aboriginal groups in attendance, though the majority of the questions were regarding the general Study progress and implementation of the transportation corridor (tolling, privatization, etc.). A number of key points were also raised with regard to the archaeological assessment. Another major item of interest was the involvement of representatives of Aboriginal groups in the actual archaeological fieldwork, once the Stage 3 archaeological assessment work is initiated. MTO responded by committing, within the Provincial EA (Chapter 9) to keeping aboriginal groups up to date with regard to the archaeological fieldwork and findings. MTO also committed to contact them prior to the initiation of Stage 3 work relate to Aboriginal finds and to determine a strategy for Aboriginal community representatives to be involved in that work. MTO also committed to future discussions regarding opportunities and approaches for involvement in archaeological fieldwork, strategies to recognize sites of significance to First Nations heritage and opportunities to display artefacts found through Stage 3 and Stage 4 Archaeological Assessments. Lastly, MTO committed to ongoing engagement with aboriginal groups to be carried out in accordance with the 407 Aboriginal groups Protocol.

7.14 Contaminated Sites and Waste Management

7.14.1 Approach

The following sections identify and describe the likely effects, mitigation and compensation measures, and residual effects of the entire 407 East Transportation Corridor from contaminated sites and waste management. The VEC identified for this analysis was soil quality. Further information is provided in the Waste Management and Contamination Impact Assessment Report (Reference Document #13).

The description of likely effects of contaminated sites and waste management as a result of the construction and operation of the 407 East Transportation Corridor addressed the effect of properties with the potential for contamination on the footprint of the transportation corridor; disruption and/or displacement of operating or closed waste management facilities; regional contamination issues associated with other land uses on the footprint of the transportation corridor; and effects of support/ancillary facilities such as transitway stations, maintenance facilities, and stormwater management ponds on the footprint of the transportation corridor.

MTO completed 54 Freedom of Information (FOI) requests with the MOE for the properties affected by the Project and a total of 14 searches resulted in property records. These records were reviewed by MTO to assess the potential for property contamination. MTO also completed additional site specific investigations or screenings to supplement secondary source data collected. The principle objective of the site specific investigations or screenings was to identify sources of waste or contamination that may have an effect on the preliminary design or subsequent phases of design for the transportation corridor. Finally, the results of a residential water well survey undertaken as part of the groundwater assessment were reviewed. As noted previously, a total of 1,328 wells were documented during completion of the water well survey. Based on the information collected, each property was classified as having either a High, Moderate or Low potential for contamination.

7.14.2 Likely Effects and Mitigation

The 407 East Transportation Corridor traverses over 500 properties, which continue to be assessed by MTO for potential site contamination.

Three waste management site properties were identified as having the potential for site contamination. These are considered to have high potential for property contamination effects due to the regulatory requirements for land acquisition and land use.

Twenty-one private/public properties were identified as having the potential for site contamination. As the footprint of the transportation corridor will affect the areas of potential environmental concern identified at each property, there is a moderate potential for contamination at 9 properties and a high potential at 12 properties.

In addition to property specific contamination based primarily on land use activities there are also a number of more regional potential contamination issues that could impact the proposed transportation corridor during construction. The other land uses in the transportation corridor that may have potential contamination were identified. Concerns over oil/gas pipelines related to potential for leaks and spills. Issues regarding hydro transmission towers relate to historical spraying of vegetation with pesticides and corrosion of the galvanized steel towers. Issues related to rail corridors include brake dust, cargo spills, oils and lubricants, and diesel fuels. Soil contamination may exist within the land on or adjacent to railway tracks in addition to railway ties being impregnated with creosote compounds. Since the transportation corridor crosses a number of high-use roadways, road salt contamination in proximity to roadways represents a potential for contamination. Finally, a large proportion of the transportation corridor will cross agricultural lands. The pesticides, herbicides and fertilizers used on these agricultural lands can accumulate in the environment and remain for long periods of time. These contaminants can be transported through surface water runoff, wind and dust generation, and groundwater and therefore represents a potential for contamination.

Finally, the construction of the transportation corridor and support/ancillary facilities (transitway stations, highway and transitway maintenance facilities, and stormwater management ponds) situated throughout the corridor will generate solid non-hazardous wastes and hazardous substances that will require management.

The operation and maintenance of the transportation corridor support/ancillary facilities (transitway stations, highway and transitway maintenance facilities, and stormwater management ponds) situated throughout the corridor will generate solid non-hazardous wastes and hazardous substances that will require management. In addition, operations and maintenance activities could affect the environment as a result of fuel, oil and road salt spills/leaks, and stormwater runoff. These effects are assessed in greater detail in Section 7.15, Accidents and Malfunctions.

Typical mitigation applied to contaminated properties and waste management sites involves site remediation (removal of the waste materials and contamination). A mitigation work plan will be designed and implemented to address all property contamination issues within the footprint of the transportation corridor. This includes all properties affected by the transportation corridor, including those screened to date and those still to be screened.

Specifically, for all High potential properties, the mitigation work plan will be designed and implemented in accordance with O.Reg. 153/04; O.Reg. 347; Section 3.6 of the ERD (2006) and applicable OHSA Regulations. MTO shall obtain approvals under the Ontario *Environmental Protection Act* and carry out any necessary conditions of approval including site remediation and leachate monitoring. For all Moderate potential properties, standard mitigation measures as per Section 3.6 of the Environmental Reference for Highway Design (2006) will be implemented. This will require that MTO complete Phase I, Phase II Environmental Site Assessments and site

remediation where necessary at all properties where contaminated soils has been identified prior to construction. Any contaminated soils uncovered during construction would also be remediated.
The design, construction, operation and maintenance of the transportation corridor support/ancillary facilities will be carried out using best management practices (BMPs) and sound engineering measures to minimize any potential contaminant losses to the environment. In the event of any such spills/leaks, rapid and appropriate response will be undertaken to control and remediate any spills/leaks.

MTO will require the construction contractor(s) and facility operators to implement a waste collection and disposal system in addition to implementing good site practices, including specific measures for the handling of solid non-hazardous waste and for the management of hazardous substances.

7.14.3 Residual Effects

Taking into account the implementation of mitigation/compensation measures (i.e., remediation and waste management practices), there will be no adverse implications for surficial soils or human health, but a positive residual effect on the environment as all waste and contamination will be removed prior to construction, and waste generated managed effectively.

7.14.4 Government and Public Comments

Provincial government comments included both points of clarity and technical review comments. Technical comments were focussed on the rationale for considering the effects of the transitway stations and maintenance facilities at this time when these facilities would be subject to further study. MTO indicated that these facilities fall within the scope of the EA approvals being sought by MTO.

The public provided comments regarding contaminated sites and waste management expressing a concern regarding a specific property that was not identified in MTO's waste report, and asking what MTO's plans were for addressing the potential contamination. MTO responded that all of the properties along the transportation corridor will be assessed for potential site contamination and that information regarding privately owned properties is kept confidential until the site is fully assessed. All properties that are contaminated and are required by MTO will be remediated in accordance with Ontario Regulations and MTO's Environmental Reference for Highway Design with all waste / contamination removed.

7.15 Consideration of Effects on the Capacity of Renewable Resources

7.15.1 Approach

Consistent with the Comprehensive Study Guidelines document and the requirements of Section 16(2) of the *Canadian Environmental Assessment Act* consideration was given to the capacity of renewable resources that are likely to be significantly affected by the Project to meet the needs of the present and those of the future. While the CEA Agency and RAs recognize that such an assessment is only required for those renewable resources that are likely to be significantly affected, a more conservative approach was taken, in that renewable resources that might be affected, significantly or otherwise, were considered. To this end, the following renewable resources that could be affected by the 407 East Transportation Corridor were identified: groundwater; surface water; vegetation and vegetation communities; wetlands; wildlife and wildlife habitat, including migratory birds; and fish and fish habitat.

7.15.2 Likely Effects and Mitigation

For the capacity of a renewable resource to be adversely affected, MTO determined that the residual adverse effects on these resources would need to be sufficiently large in magnitude, long term in duration and widespread across the RSA in order to threaten the abundance of the resource. MTO concluded that none of the residual adverse effects appear to have these characteristics.

With respect to groundwater resources, the 407 East Transportation Corridor is not anticipated to result in residual adverse effect on a groundwater aquifer or groundwater wells. Similarly, surface water resources will be maintained in terms of quantity (i.e., adequate flows in watercourses shall be maintained) and quality. Watercourses along the transportation corridor are not currently used for drinking water purposes and will likely remain attractive to local residents for recreational purposes.

Only short term losses of vegetation and vegetation communities, including wetlands are anticipated. No residual adverse effect is anticipated over the long term provided that restoration, enhancement and creation of vegetation and wetland communities is undertaken at a ratio of a minimum of 1:1. An overall reduction in interior forest habitat in the short term is anticipated. A reduction in the quality of the retained portion of vegetation and wetland habitats adjacent to major valley crossings and large forest blocks is not likely to threaten the capacity of the resource over the long term nor across a broad geographic area such as the RSA.

With respect to fish and fish habitat, channel realignment will either increase or decrease the length of the channel, and in some instances result in a net enhancement of existing habitat features. Channel realignments are very localized and are not likely to threaten fish stocks within the watercourse, nor across a broad geographic area such as the RSA.

In most cases, large structure spans have been designed to avoid direct impacts to fish and fish habitat, but shading and associated loss of vegetated ‘deep’ pool habitat, as well as general uncertainty associated with potential indirect effects on channel stability and form related to vegetation loss will result in residual adverse effects on fish and fish habitat. However, these effects are very localized and are not likely to threaten fish stocks within the watercourse, nor across a broad geographic area such as the RSA.

Increased wildlife mortality and reduced wildlife movements of some species in response to the 407 East Transportation Corridor are likely limited to wildlife located in close proximity to the transportation corridor (i.e., within the LSA). Taking into account the mitigation measures aimed at maintaining existing wildlife movement across the transportation corridor, particularly along valleys and watercourses, it is not expected that the 407 East Transportation Corridor would result in a measureable effect on wildlife populations in the RSA.

Effects on Species at Risk are very localized and are not likely to be apparent across a broad geographic area such as the RSA. Removal of 30 Butternut trees will be offset through a Butternut mitigation strategy developed in consultation with MNR and FGCA.

7.15.3 Residual Effects

Taking into account the likely magnitude, duration and geographic extent of the residual adverse effects, no residual adverse effects on the capacity of renewable resources are anticipated. The 407 East Transportation Corridor is not likely to threaten the ongoing availability of any renewable resource.

7.15.4 Government and Public Comments

No government of public comments were related specifically to the capacity of renewable resources. Refer to comments on individual environmental components for further details.

7.16 Effects of the Environment on the Project

7.16.1 Approach

Under the *Canadian Environmental Assessment Act*, an environmental assessment must consider the potential effects the environment may have on the Project as part of the evaluation of effects. MTO determined that effects of the environment on transportation undertakings are largely related to severe weather and earthquakes.

7.16.2 Likely Effects and Mitigation

Thunderstorms and hail storms are frequent occurrences and less damaging events compared to other forms of severe weather such as tornados. Thunderstorms are more common during the warmer months of the year (May to September). Damaging hail can sometimes accompany severe thunderstorms. Lightning is a common characteristic of thunderstorms that can cause serious damage to structures and interrupt power supply. Thunderstorms can damage land-based structures and systems directly through high winds, heavy rain and lightning. The types of structures and systems that are most vulnerable to such an event include the high level structures at the freeway to freeway interchanges, the electrical systems, specifically the illumination, traffic signals and associated power supplies, and overhead signs.

Ice storms are known to occur in southern Ontario, and may occur in the 407 East Transportation Corridor area. An ice storm could temporarily affect access to the transportation corridor, associated structures and possibly maintenance activities. It could cause physical damage to some land-based structures, but not the highway/transitway itself. The types of structures and systems that are most vulnerable to such an event include the electrical systems, specifically the illumination and traffic signals. An ice storm during the construction phase may also have an adverse effect resulting in a delay to implementation.

Tornados are sometimes associated with severe thunderstorms. The distribution of tornadoes, particularly in southern Ontario, appears to be random and extremely localized. The effects of a tornado would be unlikely to affect the structural integrity of the highway/transitway, bridges and culverts, but could be devastating to other systems. The types of structures and systems that are most vulnerable to such an event include the electrical systems, specifically the illumination, traffic signals and associated power supplies, and overhead signs. A tornado during the construction and development phase of the Project may also have an adverse effect resulting in a delay to implementation.

Hurricanes are large, intense storms which produce high intensity winds, tides and rainfall. If a hurricane similar in size and characteristics to Hurricane Hazel (i.e., the Regional Storm event for the 407 Transportation Corridor study area) were to pass over the transportation corridor the potential effects would include flooding however, effects on the structural integrity of the highway/transitway, bridges and culverts would be minimal as a result of the design standards used for the design of this infrastructure (see also Section 7.5. Surface Water). Nevertheless, the types of structures and systems that are most vulnerable to such an event include the watercourse crossing structures, the electrical systems, including the illumination, traffic signals and associated power supplies, and the overhead signs.

Over the past 30 years, on average, only 2 to 3 magnitude 2.5 or larger earthquakes have been recorded in the southern Great Lakes region. Earthquakes under a magnitude of 5 typically do not result in damage. Therefore, the structural integrity of the highway/transitway, bridges and culverts would not likely be affected as a result of the design standards used for the design of this infrastructure.

Global climate models indicate an increase in global average temperatures with an increase in precipitation amounts. It is expected that the severity and frequency of extreme weather events will also increase as a result of global warming. An increase in average wind speeds may be expected as a result of an extreme weather event, however, the structural integrity of the highway/transitway, bridges and culverts would not likely be affected as a result of the design standards used for the design of this infrastructure. Nevertheless, the types of systems that are most vulnerable to such an event include the electrical systems, including the illumination and traffic signals, and overhead signs.

Fog is more prevalent in late spring and early summer. Fog typically affects a limited area and only for a short period of time. Dense fog may reduce visibility and can interfere with the operation of vehicles on the highway. Periods of dry weather and low water levels or drought have been relatively uncommon in Ontario (about every 10-15 years). Below normal precipitation for an extended period of time (i.e., 3 months or more), potentially combined with high rates of evaporation, can lower lake levels, streamflows and/or baseflows and reduce soil moisture and/or groundwater storage (Ontario Ministry of Natural Resources, 2010), Drought conditions may serve to exacerbate the effects of transportation corridor on groundwater, increase the potential for effects on groundwater wells, increase the potential for erosion along the corridor. The greatest potential for such an effect is in the vicinity of deep cuts requiring dewatering, where a lowering of the groundwater table in surficial soils is anticipated and at major fills where alteration of groundwater flows are anticipated. Drought may also have indirect implications for streamflows, wetlands and sensitive terrestrial and aquatic life at these locations.

The following table identifies the key design measures and/or additional mitigation measures considered by MTO that address effects on the environment on the Project.

Table 7-5 Key Design/Mitigation Measures

Event	Design / Mitigation Measures
Heavy Rain/Flooding	Design standards for major watercourse crossing structures based on the Regional Storm event (Hurricane Hazel) to prevent potential flooding effects.
Hail	Mitigation measures include restrictions to operations in accordance with standard MTO practices.
Heavy Snow	Bridges designed in accordance with Canadian Highway Bridge Design Code which specifies applicable snow loadings for structures. Mitigation measures include snow removal operations in accordance with standard MTO practices.
Ice Storms/Freezing Rain	Bridges designed in accordance with Canadian Highway Bridge Design Code which specifies applicable snow loadings for structures. Mitigation measures include de-icing and snow removal operations in accordance with standard MTO practices.
High Winds/Tornado	Bridges designed in accordance with Canadian Highway Bridge Design Code which specifies design standards for applicable wind loadings.
Lightning	Mitigation measures include back-up systems for critical electrical systems.
Earthquake	Bridges designed in accordance with Canadian Highway Bridge Design Code which specifies design standards for applicable earthquake conditions.
Fog	Mitigation measures include installation of reflective markers on the roadway surface.
Drought	Where long term effects to groundwater cannot be avoided at major fills or deep cuts, long-term engineering / foundation design measures will be undertaken as appropriate. The implementation of the 407 East Transportation Corridor design features (i.e., effective stormwater management (SWM) facilities, stabilization and re-vegetation of bridge approach slopes, etc.) and other relevant mitigation measures identified by MTO will result in negligible surface erosion and instream sedimentation. Specific outfall control measures will be implemented for all SWM facilities to

Event	Design / Mitigation Measures
	prevent erosion of the receiving streams, with specific attention to outfalls to the deeper valleys and at many of the high sensitivity watercourses in the eastern portion of the study area.

7.16.3 Residual Effects

Taking into consideration the likelihood of extreme weather and mitigation measure identified above, no residual adverse effects of the environment on the Project are anticipated. Furthermore, the probability of the occurrence of extreme weather in the 407 East Transportation Corridor area is low.

7.16.4 Government and Public Comments

EC provided the CEA Agency and RAs with a review of the effects of the environment on the Project. EC noted that major watercourse crossing structures will be designed to convey the flood flow from the Hurricane Hazel regional storm flows. EC requested clarity as to which structures are considered to be major crossings. Also, EC requested clarity as to what design criteria was used for smaller watercourse crossings, and whether the design would be sufficiently robust to accommodate increases in flood magnitude due to climate change effects. MTO provided EC with a description of major structures and indicated that all of the watercourse crossings were designed to effectively convey the Regional Event without overtopping of the highway and without increasing floodlines on adjacent properties. Failure of any watercourse crossing within the project due to inadequate hydraulic capacity was considered by MTO to be very unlikely for storms occurring within this part of the province. Since the structures are designed for the Regional Storm event, effects of climate change on return period flows were adequately considered.

EC requested that MTO provide the design standards used for emergency overflow structures for stormwater management facilities, notably those adjacent to sensitive aquatic ecosystems (including wetlands). MTO indicated that all SWM ponds will be designed to accommodate the 100 year flood event. A freeboard of 300 to 500 mm will be provided from the 100 year water level to the crest evaluation of the emergency spillway. Spillway designs undertaken in subsequent design phases will ensure the greater of the 100 year event or the regional storm can be accommodated without failure of the pond.

7.17 Effects of Accidents and Malfunctions

7.17.1 Approach

The CEA Agency, the RAs and FAs recognize that all necessary precautions will need to be taken to avoid accidents and malfunctions during all phases of the Project, and to minimize their potential effects on the environment. To this end, it was determined that the accidents and malfunctions that pose the greatest threat of environmental effects include: spills of fuel, oils or other hazardous materials; failure of measures to control erosion and sedimentation; washout of a bridge or culvert; malfunction of stormwater management facilities; and fires. As such, the effects of these accidents and malfunctions were considered in this comprehensive study report.

7.17.2 Likely Effects and Mitigation

Spills of petroleum products such as gasoline, oils or lubricants can occur during construction or during machinery refuelling, or as the result of a hydraulic line rupturing. These spills are usually highly localized and can easily be cleaned up by on-site teams using normally available equipment. In the unlikely event of a major spill, there could be contamination of the soil, groundwater and surface water. This in turn could have adverse effects on groundwater quality, on fish and fish habitat, and on wetland habitats, and wildlife could then ingest or absorb contaminants.

Depending on the nature of the spill, it can also have an impact on residential, commercial, agricultural and other land uses. Emergency plans are recognized as effective ways of limiting the severity of environmental effects.

To this end, MTO shall develop and implement preventative measures and contingency planning in accordance with the CSA publication "Emergency Planning for Industry (CAN/CSA-Z731-99). A Spills Response Plan (SRP) will also be developed which will address the requirements of the Ontario *Environmental Protection Act*. MTO and its agent values the safety of the employees and the public, and will implement a Health and Safety plan during the construction and operation phases of the Project.

There is a risk of failure of works designed to combat erosion and sedimentation following precipitation. This could cause the discharge of large volumes of sediment-laden effluents into streams, and could have potentially harmful effects on fish and fish habitat and disrupt the quality/functions of wetlands, particularly those sensitive to sedimentation (e.g., shallow water emergent marshes and swamps). Erosion and sedimentation control measures will be implemented in accordance with the environmental specifications. These measures will be subject to oversight by an environmental inspector during construction, especially prior to and after a heavy precipitation event in the study area or during snowmelt when there is visible surface runoff. The inspector would also provide oversight of the condition of environmental mitigation measures when there is increased potential for damage (e.g., after periods of high winds, prolonged periods of drought, etc.). It is expected that inspection efforts would be focused on the most sensitive ecosystems, such as areas characterized as having high risk to erosion and sedimentation, high sensitivity watercourses, and wetlands. The duties and responsibilities of the environmental inspector shall include ensuring that corrective measures are identified and implemented as needed.

A bridge or culvert could be overtopped and/or washed out and pavement could be eroded after heavy rainfall or storms of much greater intensity than those allowed for in the design of these structures, or if a culvert is blocked by ice or debris. Current design standards are based on the 50 year storm for bridges and culvert spans less than or equal to 6 m, and the 100 year storm for bridges and culvert spans greater than 6 m. The typical environmental effects of a bridge or culvert washout include loss of riparian habitat, increased erosion and the rapid input of sediment to a watercourse. These effects are likely to result in disruption to downstream fish and fish habitat, particularly those sensitive to sedimentation (e.g., spawning habitat) and disruption to the quality/functions of wetlands, particularly those sensitive to sedimentation (e.g., shallow water emergent marshes and swamps). There is also potential for adverse effects to public safety. EC has noted that such events and effects have occurred on other projects in the past. Mitigation measures will include prohibiting access by road traffic to such structures during events of this scope, inspection and periodic maintenance of structures (e.g., removal of debris blocking culverts). As noted above, corrective measures will be identified and implemented as needed following each inspection.

A stormwater management facility could malfunction due to the occurrence of extreme flooding conditions and/or clogging by debris, ice, etc. Current design standards for stormwater management facilities include emergency spillways for all stormwater management ponds. The emergency spillways will function only under situations where the pond would otherwise overtop and wash out. All SWM ponds will be designed to accommodate the 100 year event. A freeboard of 300 to 500 mm will be provided from the 100 year water level to the crest evaluation of the emergency spillway. Spillway designs undertaken in subsequent design phases will ensure the greater of the 100 year event of the Regional Storm can be accommodated without failure of the pond. Furthermore, the standard MOE outlet structure to be used for pond outlets is not typically susceptible to blockage due to debris or ice. Mitigation measures will include periodic inspection and maintenance of stormwater management facilities. Corrective measures will be taken as needed.

Fires can lead to loss of habitat, sensory problems and mortality for wildlife, and destruction and disturbance of archaeological and heritage resources. Management of fuels and other hazardous materials as well as procedures for

storage, handling and transport will reduce the likelihood and the extent of accidental fires related to the project. In the unlikely event of a fire, local emergency response and firefighting capabilities will help reduce the severity and extent of damage. The draft Environmental screening Report (December 2009) identifies other measures that MTO will undertake to minimize the potential for causing a fire and the potential environmental effects in the event of a fire.

7.17.3 Residual Effects

Taking into account the likelihood of severe accidents and malfunctions and mitigation measures identified above, there will remain an increased risk of reduced soil, surface and groundwater quality and associated disruption to vegetation and vegetation communities, wetlands, wildlife and wildlife habitat following a major accident event. The overall risk has been minimized through design and mitigation measures, and therefore, environmental effects of accidents and malfunctions are considered to be unlikely, having a very low probability of occurrence.

7.17.4 Review of Provincial Government and Public Comments

EC provided the CEA Agency and RAs with a review of the effects of accidents and malfunctions related to the Project. EC indicated that oversight on the condition of mitigation measures should be provided prior to the expected occurrences of heavy precipitation to ensure all of the required facilities are in place and properly maintained. EC recommended that MTO include a discussion of the environmental consequences of a bridge or culvert washout to downstream ecosystems. EC also recommended that the potential for malfunction of stormwater treatment facilities, due to the occurrence of extreme flooding conditions and/or clogging by debris, ice, etc. be noted in the assessment. MTO clarified the duties and responsibilities of the Environmental Inspector during construction including their expectations on the focus of these inspections and provided a discussion of the environmental effects of washouts and malfunctions of stormwater treatment facilities.

7.18 Summary of Residual Adverse Effects

Based on the results of the effects assessment for each environmental component, **Table 7-6** summarizes the residual effects of the 407 East Transportation Corridor.

Table 7-6 Residual Adverse Effects of the 407 East Transportation Corridor

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Construction Phase	Operations and Maintenance Phase
Air Quality and Climate	Infrequent occasions where exceedance of applicable threshold occurs. The largest effect on air quality are due to releases of TSP (i.e., fugitive dust primarily)	√	
	Increased emissions of contaminants of concern resulting in reduced air quality. The largest effects on local and regional air quality are due to releases of acrolein and TSP (i.e., fugitive dust primarily))		√
Noise and Vibration	Increased noise levels along the transportation corridor	√	√
Surface and Subsurface Geology and Soils	Changes in valley slopes and landform	√	
	Increased soil exposure to erosion	√	
Groundwater	Lowering of groundwater table in surficial soils at locations with foundation excavations requiring dewatering	√	
	Lowering of groundwater table in surficial soils at locations of deep cuts requiring dewatering	√	√
	Alteration of groundwater flow and levels in surficial soils at locations of major	√	√

Table 7-6 Residual Adverse Effects of the 407 East Transportation Corridor

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Construction Phase	Operations and Maintenance Phase
	fills and foundations		
	Reduction in groundwater quality in surficial soils		√
Surface Water	Increased turbidity in 79 natural watercourses	√	
	Treated effluent discharged from stormwater management facilities into 79 natural watercourses		√
Vegetation and Vegetation Communities	Loss of 350.1 ha of existing vegetation and vegetation communities.	√	
	Loss of 28.9 ha of interior forest habitat	√	
	Reduction in the quality / function of the retained portion of vegetation communities along/adjacent to the transportation corridor, including vegetation and vegetation communities sensitive to groundwater alteration and exposure to fugitive dust, light, wind and sun exposure.	√	√
Wetlands	Loss of 62.2 ha of wetland area.	√	
	Reduction in the quality / function of the retained portion of wetlands along the transportation corridor, including wetlands sensitive to turbidity, stormwater contaminants, groundwater and surface drainage alteration.	√	√
Fish and Fish Habitat	No residual adverse effects are anticipated. As noted previously, MTO and DFO have agreed that no residual adverse effects on fish and fish habitat are likely because compensation will be used by MTO to achieve a No Net Loss (NNL) of fish and fish habitat affected by the 407 East Transportation Corridor. As such, effects on fish and fish habitat (other than those for Species at Risk) are not considered further in the cumulative effects assessment.		
Wildlife and Wildlife Habitat, including Migratory Birds	Restrictions to wildlife movement and increased wildlife mortality	√	√
	Disruption to wildlife within the retained portion of vegetation communities and wetlands along the transportation corridor, including wildlife species sensitive to habitat size/diversity fugitive dust, noise, light, surface water and groundwater effects.	√	√
Species at Risk	Removal of 83 Butternut tees, including 3 seedlings (34 are considered retainable)	√	
	Disruption to Redside Dace habitat at eight (8) watercourse crossings.		√
	Disruption to Blandings Turtle and Golden-winged Warbler habitat	√	√
Socio-economic Environment	Changes in community character due changes in landscape composition and effects of fugitive dust, noise and light.	√	√
	Reduced agricultural activity due to changes in landscape composition (i.e., loss and/or severance of 2068.3 ha of agricultural land)	√	√
	Disruption to the use and enjoyment of property due encroachment / proximity of transportation corridor (i.e., increased nuisances), changed community character and landscape composition.	√	√
Cultural Environment	No residual adverse effects are anticipated		
Current Use of Lands and Resources by Aboriginal People	No residual adverse effects are anticipated		
Contaminated Sites and Waste Management	Positive residual effect on the environment as all waste and contamination will be removed prior to construction, and waste generated managed effectively	√	
Capacity of Renewable Resources	No residual adverse effects are anticipated		
Effects of the Environment on the Project	Increased risk of reduced soil, surface and groundwater quality and associated disruption to vegetation and vegetation communities, wetlands, wildlife and wildlife habitat following a major weather /climatic event.	√	√
Effects of Accidents and Malfunctions	Increased risk of reduced soil, surface and groundwater quality and associated disruption to vegetation and vegetation communities, wetlands, wildlife and wildlife habitat following a major event.	√	√

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7.19 Cumulative Effects Assessment

7.19.1 Approach

The Comprehensive Study Guidelines document requires the consideration of cumulative environmental effects. Cumulative environmental effects are defined as effects "that are likely to result from the project in combination with other projects or activities that have been or will be carried out". MTO's assessment was undertaken in accordance with the Canadian Environmental Assessment Agency's Operational Policy Statement (CEA Agency 2007) and Cumulative Effects Assessment Practitioners Guide (CEA Agency 1999).

The cumulative effects assessment for the 407 East Transportation Corridor was focussed on those residual adverse effects caused by the Project combined with the effects caused by other projects and activities on or near the transportation corridor and/or within the watersheds traversed by the transportation corridor (where relevant). This involved the consideration of the effectiveness of the mitigation measures proposed for the Project as well as the consideration of how cumulative effects are being or can be managed through other means, such as through ongoing and future environmental initiatives of governments, conservation authorities, other project proponents and other stakeholders.

The CEA Agency's Reference Guide and Practitioners Guide for conducting cumulative environmental assessments are primarily concerned with adverse cumulative effects. Therefore, beneficial effects were not considered. The cumulative effects assessment did not consider the effects of accidents and malfunctions because they are considered to be hypothetical and significant adverse effects following a major accident or malfunction event have a very low probability of occurrence; nor the effects of the environment on the Project as these were not considered to be cumulative in nature, because they are considered to be hypothetical and significant adverse effects following a major weather / climatic event have a very low probability of occurrence. This is consistent with the CEA Agency's Practitioners Guide which acknowledges that such events are "rare" and that their potential effects are too extreme to be assessed together with those caused by normal operational activities.

Consistent with the Comprehensive Study Guidelines document and available guidance regarding cumulative effects assessment, MTO identified, described and considered the cumulative effects of a number of relevant projects and activities:

Past and existing projects and activities included in the assessment were:

- existing urban land uses
- existing rural/agricultural land uses
- existing Provincial transportation network
- existing regional transportation network
- St. Mary's Cement operations
- Darlington site and nuclear generating station (NGS) operations
- Darlington provincial park

Certain and planned projects and activities included in the assessment were:

- planned land use in the vicinity of the 407 East Transportation Corridor
- planned regional transportation network improvements

Potential and reasonably foreseeable projects and activities included in the assessment were:

- growth and development in Durham Region
- Metrolinx Regional Transportation Plan
- Highway 401 improvements and Holt Road Interchange
- GO Transit service extension to Clarington project
- Pickering airport
- new nuclear at Darlington project
- upgrade of 500kV transmission system
- Darlington NGS refurbishment and expansions to support continued operations
- Darlington NGS decommissioning
- Durham Region energy from waste facility
- Clarington Energy Business Park development
- Oshawa ethanol plant

Figure 7-1 provides a map of these other projects and activities:

7.19.2 Likely Cumulative Effects and Mitigation

Table 7-7 provides a summary of the likely cumulative effects and mitigation measures of the 407 East Transportation Corridor in combination with other projects and activities.

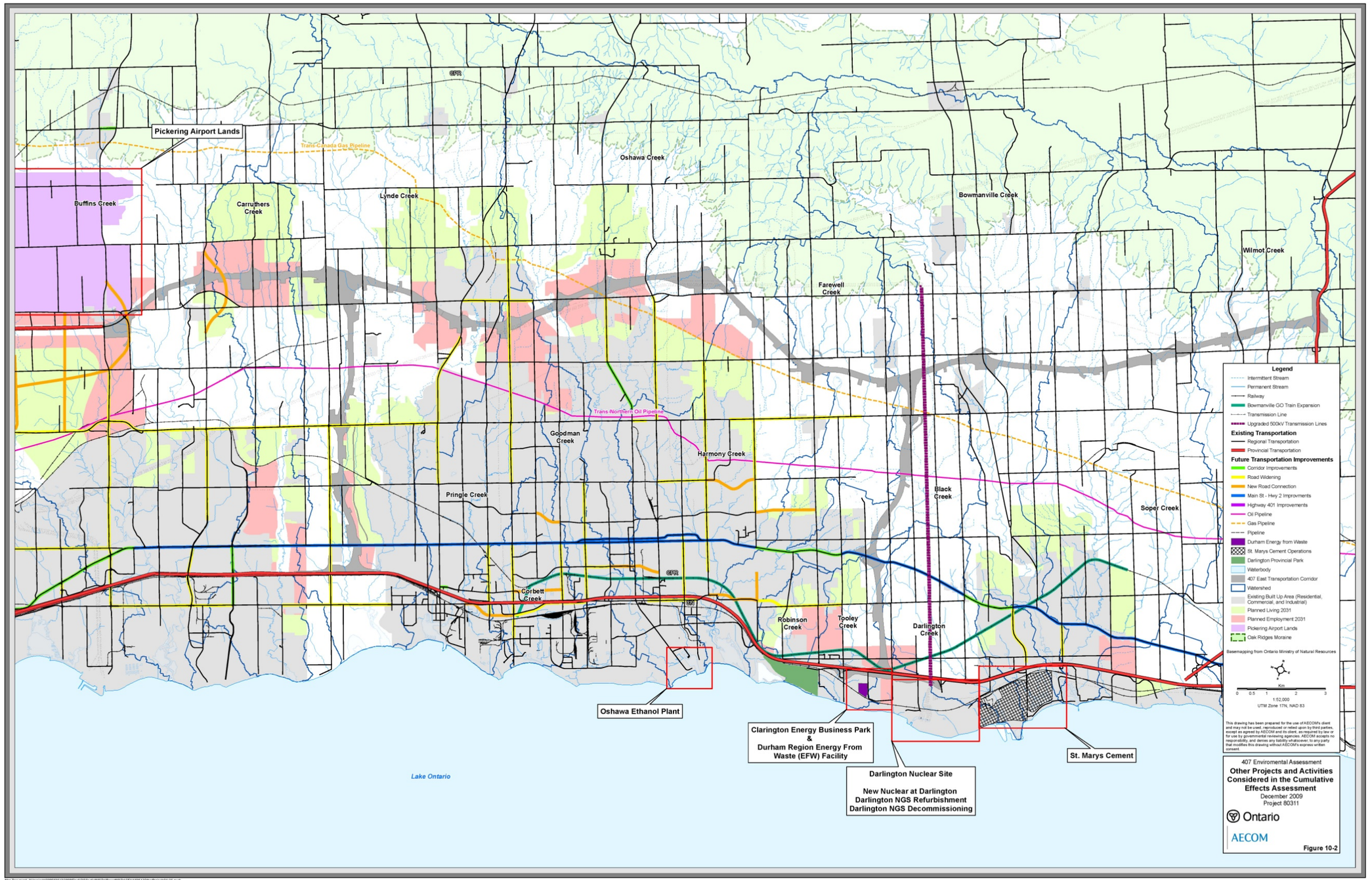

Figure 7-1 Other Projects and Activities Considered in the Cumulative Effects Assessment

Table 7-7 Summary of Cumulative Effects and Mitigation

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Project Phase	Cumulative Effects and Human Health / Ecological Implications	Mitigation / Compensation Initiatives	Residual Cumulative Effect
Air Quality and Climate	Infrequent occasions where exceedance of applicable threshold occurs. The largest effect on air quality are due to releases of TSP (i.e., fugitive dust)	Construction	• Exceedances of the TSP criterion may occur more frequently or such exceedances may last longer. This cumulative effect will most likely occur under circumstances where 407 construction activities are being undertaken simultaneously with those of other projects and activities being undertaken in close proximity.	• Effective mitigation of adverse cumulative effects can be achieved by: ▪ Timing and coordination of multiple construction projects	• Increased dust levels
	Increased emissions of contaminants of concern resulting in reduced air quality. The largest effects on local and regional air quality are due to releases of acrolein and TSP (i.e., fugitive dust primarily))	Operations and Maintenance	• 407 emissions do not represent new emissions in Ontario, but will add to the contaminant inventory in the RSA and Ontario. • 407 emissions are much lower that background pollutant concentrations and most are well below applicable reference criteria. CO (10% of AAQC), Formaldehyde and Acetalehyde (10% of AAQC), Benzene and 1,3-Butadiene (10% of AAQC), NO_2 (65% of AAQC), PM_{10} (88% of AAQC), $PM_{2.5}$ (65% of AAQC). 407 emissions represent approximately 2.9% (NO), 0.17% (VOCs), 0.77% (PM10), and 0.22% (PM2.5) respectively of those from all sectors in the Region of Durham. 407 contributions to the provincial emissions levels are considered to be negligible. Cumulative effects are not likely to approach applicable reference criteria for these parameters. • Cumulative TSP levels are likely to be measureable at a local level (i.e., in proximity of the highway) but not across the RSA or Ontario. 407 will measurably contribute to the acrolein inventory in the RSA and Ontario. The cumulative acrolein emissions will remain above its reference criterion. • Precursors to ozone are generated well away from the transportation corridor, and overall emissions of ozone precursors (NOx and VOCs) per vehicle-kilometre travelled have and are expected to continue to decline in the foreseeable future. • 407 will generate 850,067 tonnes/year of GHG emissions, approximately 1.75%, of the total GHG emissions from the road transportation network in Ontario or 0.42% of total GHG emissions from all sectors in Ontario. • Migration of vehicle travel to the 407 over time in future and improved travel efficiencies may improve some GHG emissions within the region. • Screening level health analysis indicates that the incremental health effects associated with exposure to pollutants in air attributable to emissions from the 407 are negligible today and would continue to be negligible into the foreseeable future. The contribution of the 407 to cumulative health effects will likely diminish over time.	• Effective mitigation of adverse cumulative effects can be achieved by: ▪ Reduction of the transportation sector's contribution to emission through various MTO policies and actions. ▪ Stricter federal vehicle emission and fuel consumption standards along with fuel quality standards ▪ Expansion in the production and sale of electric hybrid, plug-in hybrid and all-electric vehicles. ▪ Implementation of amendments to O. Reg. 419/05 (Air Pollution – Local Air Quality) to establish new or updated Upper Risk Thresholds (URTs) for 1,3-butadiene, acetaldehyde, acrolein and benzene.	• Reduced regional air quality (i.e., increased emission of contaminants of concern)
Noise and Vibration	Increased noise levels along the transportation corridor	Construction	• Exceedances of noise criteria may occur more frequently or such exceedances may last longer. This cumulative effect will most likely occur under circumstances where 407 construction activities are being undertaken simultaneously with those of other projects and activities being undertaken in close proximity.	• Noise levels would be reduced through the implementation of a construction code of practice, noise barriers, and the use of vegetative buffering and screening to lessen the noise effects.	• Increased noise levels along the transportation corridor
	Increased noise levels along the transportation corridor	Operations and Maintenance	• Noise level for the future no-build scenario is likely to change from one where the majority of receptors are in a rural environment (sound levels < 50 dBA) to one with more urban or suburban characteristics, namely sound levels between 50 dBA and 60 dBA. • 407 is not anticipated to substantially change the maximum and minimum sound levels experienced by existing NSAs. However, average sound levels will increase • Under future build scenario, 11 NSAs (~1%) will have future build sound levels greater than 65 dBA due to the project. 358 NSAs (~20%) have clearly noticeable increases in noise levels (> 5 dB change), 56 NSAs (~3%) will have a substantial increase (>10 dB change). More detailed assessment indicates that fewer NSAs will experience substantial increased noise levels. • Increased noise is likely to be experienced at 130 NSAs due to an operating airport in north Pickering should they be permitted to remain in the area upon the definition of an Airport Operating Area.	• Effective mitigation of adverse cumulative effects can be achieved by ensuring that future building design requirements for new construction are met by developers. The requirements for new residential construction are set out in MOE Publication LU-131 based on outdoor sound levels. • The GTAA has committed to working with all levels of government to implement an airport protection area based on the NEF 25 contour. This Airport Operating Area (AOA) would define land uses that are compatible and incompatible with airport operations to provide direction regarding future land use planning in the area. The AOA would take the noise effects of the highway operation into account at that time.	• Increased noise levels along the transportation corridor
Surface and Subsurface Geology and Soils	Changes in valley slopes and landform	Construction	• All large scale land developments or transportation infrastructure projects that will require site preparation, grading and earthmoving activities may encroach upon or traverse valley slopes and landforms, noticeably and permanently altering landscape composition. • Cumulative effects would be most noticeable for people traveling up or along-side valley corridors or travelling along heights of land such as the Oak Ridges Moraine. Noticeable cumulative effects are not anticipated on the Oak Ridges Moraine (an important regional landform) as the 407 Transportation Corridor traverses only a few kilometres of this feature at its eastern-most location, and there have been severe restrictions placed on large land development on the moraine. • Overall, the cumulative effects on valley slopes and landforms are the result of short term disturbances and are not likely to impair the ecological function of VECs over the long term.	• Implementing mitigation measures as part of the planning and approval processes for the various land developments and transportation infrastructure projects, including: ▪ establishment of buffers along valleys and key landforms, ▪ routing and engineering design of transportation infrastructure to avoid and/or minimize effects on valley lands, ▪ valley slope restoration to appropriate grades following construction.	• Changes in valley slopes and landform
	Increased soil exposure to erosion	Construction	• The greatest potential for cumulative effects due to erosion are in the watersheds traversed by the western portion of the 407 East Transportation Corridor and the West Link, namely: Duffins Creek Watershed; Carruthers Creek Watershed; Lynde Creek Watershed; Pringle Creek Watershed; and Oshawa Creek Watershed. Within each of these watersheds, there are "Moderate" or "High Risk" areas located along the 407 East Transportation Corridor. • Cumulative effects will occur only under circumstances where 407 and other project construction activities are being undertaken simultaneously in close proximity to each other. These areas would include proposed developments identified in Secondary plans along the West Link, planned regional transportation network improvements, including the proposed arterial road (Type A and B) extensions that have planned connections (via new interchanges) to the new 407 East transportation corridor and planned improvements to Highway 401.	• Effective mitigation of adverse cumulative effects can be achieved by: ▪ Timing and coordination of multiple construction projects; and ▪ Ensuring other projects and activities implement comprehensive erosion and sediment control measures to comply with relevant Ontario Provincial Standards Specification (OPSS)	• Increased soil exposure to erosion

Table 7-7 Summary of Cumulative Effects and Mitigation

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Project Phase	Cumulative Effects and Human Health / Ecological Implications	Mitigation / Compensation Initiatives	Residual Cumulative Effect
Groundwater	Lowering of groundwater table in surficial soils at locations with foundation excavations requiring dewatering	Construction	• Cumulative effects will occur under circumstances where construction activities are being undertaken in close proximity to each or several deep cuts and foundations are present in close proximity to each other (e.g., major interchanges). The level of the groundwater table will tend to adjust itself shortly after dewatering at foundation excavations cease, however the duration of the cumulative effect may be extended where multiple projects are being undertaken together. While possible, the circumstances that would cause measureable cumulative effects on groundwater are considered to be of low probability, infrequent, short term in duration and highly localized. Multiple projects that require major dewatering and occur in close proximity to each other are highly unlikely. There are no certain or reasonably foreseeable projects or activities located along the transportation corridor that might require dewatering of the magnitude required for the 407 and therefore cause measureable cumulative effects. It is also not likely that deep cuts and major foundation excavations required for the Project would occur in the same location.	• Effective mitigation of adverse cumulative effects can be achieved by: ▪ Timing and coordination of multiple construction projects; ▪ Consideration of the potential for multiple projects in PTTW terms and conditions ▪ meeting all relevant provincial guidelines and standards regarding groundwater management and Permits to Take Water. ▪ Preparation of Master Environmental Servicing Plans and potentially Neighbourhood Plans for new developments.	• Lowering of groundwater table in surficial soils at locations of foundation excavations requiring dewatering
	Lowering of groundwater table in surficial soils at locations of deep cuts	Construction and Operations and Maintenance	• Cumulative effects will occur under circumstances where construction activities are being undertaken in close proximity to each other or several deep cuts and foundations are present in close proximity to each other (e.g., major interchanges). The level of the groundwater table will tend to adjust itself shortly after dewatering at major cuts cease, but localized depression of groundwater levels are likely to persist. While possible, the circumstances that would cause measureable cumulative effects on groundwater are considered to be of low probability, infrequent, short term in duration and highly localized. There are no certain or reasonably foreseeable projects or activities located along the transportation corridor that might require major cuts of the magnitude required for the 407 and therefore cause measureable cumulative effects. It is also not likely that deep cuts and major foundation excavations required for the Project would occur in the same location.	• Effective mitigation of adverse cumulative effects can be achieved by: ▪ Timing and coordination of multiple construction projects; ▪ Ensuring that all future development, including new transportation infrastructure, meets the broader planning objectives of the Provincial Policy Statement (2005) and those of local municipalities and Conservation Authorities as set out in their various watershed management plans and the objectives of the Greenbelt Plan. ▪ meeting all relevant provincial guidelines and standards regarding groundwater management and Permits to Take Water. ▪ Preparation of Master Environmental Servicing Plans and potentially Neighbourhood Plans for new developments.	• Lowering of groundwater table in surficial soils at locations of deep cuts requiring dewatering
	Alteration of groundwater flow and levels in surficial soils at locations of major fills and foundation structures	Construction and Operations and Maintenance	• Cumulative effects will occur under circumstances where construction activities are being undertaken in close proximity to each other. While possible, the circumstances that would cause measureable cumulative effects on groundwater are considered to be of low probability, infrequent, short term in duration and highly localized. There are no certain or reasonably foreseeable projects or activities located along the transportation corridor that might require major fills or foundation structures of the magnitude required for the 407 and therefore cause measureable cumulative effects. Altered groundwater flow patterns will tend to adjust themselves shortly after the placement of major fills or foundation structures minimizing duration of measureable cumulative effects. Effects on groundwater levels in surficial soils at locations of major fills and foundation structures are likely to persist for some time over the planning horizon.	• Same as above	• Alteration of groundwater flow and levels in surficial soils at location of major fills and foundation structures
	Reduction in groundwater quality in surficial soils	Operations and Maintenance	• Measureable cumulative effects will likely be limited to locations along the transportation corridor where there is already an existing road crossing or a new crossing is proposed (i.e., a new interchange). • Existing and future built up areas represent ongoing non-point sources of contaminants to groundwaters. Future growth and development will add approximately 37% the existing built up areas. New built up areas adjacent to the 407 East Transportation Corridor are primarily located in the western portions of the transportation corridor and the West Durham Link. Little or no such planned growth is slated for development prior to 2031 in east Oshawa and the Municipality of Clarington. • Agricultural land uses also represent ongoing non-point sources of contaminants to groundwaters. The most common contaminants from agricultural practices include: nutrients and pesticides. Miscellaneous other compounds such as fuels, solvents, paints, heavy metals and waste products may also contribute to impaired groundwater quality due to agricultural practices. • Refer to Effects on Surface water for human health implications.	• Same as above. • With respect to road salt, the Government of Canada has no plans for banning the use of road salts or proposing any measures that would compromise or reduce road safety. As such, effective mitigation of adverse cumulative effects can be achieved by the implementation of: ▪ the MTO Road Salt Management Plan, and ▪ the Canadian Environmental Protection Agency Code of Practice for the Environmental Management of Road Salts; ▪ other best management practices (BMP) developed by the Transportation Association of Canada (TAC) • Durham Region and its lower tier municipalities have prepared and continue to implement road salt management plans that allow each municipality to comply with the Federal code of practice. • Durham Region is in the process of defining appropriate measures to implement, manage and/or eliminate the associated risks to the underlying groundwater from existing and potential sources of contamination through its Wellhead Protection Management Program.	• Reduction in groundwater quality in surficial soils
Surface Water	Increased turbidity in 79 natural watercourses	Construction	• Cumulative effects will occur only under circumstances where construction activities are being undertaken simultaneously in close proximity to each other. While possible, these circumstances are considered to be of low probability, infrequent, short term in duration and highly localized. Measureable effects are likely to be limited to areas immediately downstream of each crossing.	• Effective mitigation of adverse cumulative effects can be achieved by: ▪ Timing and coordination of multiple construction projects; ▪ Ensuring other projects and activities implement comprehensive erosion and sediment control measures to comply with relevant Ontario Provincial Standards Specification (OPSS)	• Increased turbidity
	Treated effluent discharged from stormwater management facilities into 79 natural watercourses	Operations and Maintenance	• Existing and future transportation facilities will result in stormwater discharges to natural watercourses, representing continuous and long-term source of contaminants such as debris, suspended solids, road salt, oil and grease, polycyclic aromatic hydrocarbons (PAHs) and metals. Discharges are also likely to be warmer than the receiving watercourse, therefore having a thermal effect. • The 407 in combination with the other projects and activities will result in an additional 273 crossings and/or increased activity at existing crossings. This represents an increase of approximately 26%, with the watercourses within the Tooley Creek and Harmony Creek watersheds likely to experience the greatest effects. • The 407 will result in a relatively small number of additional crossings, representing an increase of approximately 7% over existing watercourse crossings and 28% of the additional future crossings.	• Effective mitigation of adverse cumulative effects on surface waters can be achieved by: ▪ ensuring that all future development, including new transportation infrastructure, meets the broader planning objectives of the Provincial Policy Statement (2005) and those of local municipalities and Conservation Authorities as set out in their various watershed management plans and the objectives of the Greenbelt Plan. ▪ preparation of Master Environmental Servicing Plans and potentially Neighbourhood Plans for new developments.	• Decreased surface water quality due to effluent discharges

Table 7-7 Summary of Cumulative Effects and Mitigation

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Project Phase	Cumulative Effects and Human Health / Ecological Implications	Mitigation / Compensation Initiatives	Residual Cumulative Effect
			• Measureable cumulative effects will likely be limited to locations along the transportation corridor where there is already an existing crossing or a new crossing is proposed and are likely to be limited to areas immediately downstream of each crossing,. • Most of water crossings associated with the 407 will be associated with a SWM facility and stormwaters will receive a high level of treatment prior to discharge. The same cannot be said with certainty for the other projects and activities. In the worst case, these new crossings will represent additional direct sources of contaminants to the watercourses within each watershed. • The overall risk to human health associated with the lead, chromium, cadmium and petroleum hydrocarbons likely to be found in runoff was considered to be low. Sulphate does not have any human health implications related to it. • Concentrations of sodium and chloride that may exceed ODWS and released from SWM ponds into local water courses offer no risk to human health as the receiving water bodies are not used for drinking water • Under certain groundwater conditions the highly toxic and volatile hydrogen cyanide (HCN) can be produced when sodium ferrocyanide reactions with iron in groundwater. Based on groundwater modelling to predict the concentration of Hydrogen Cyanide (HCN) in groundwater at various distances from the highway, the future predicted concentrations of HCN will be less than the ODWS outside of the right of way. Based on this, it was concluded that sodium ferrocyanide in road salt does not present a health risk. • Given that contaminants likely to be found in runoff (e.g., nickel, zinc, copper, lead, chromium, cadmium and ptetroleum hydrocarbons and nutrients) are not likely to be discharged to surface waters at levels that would be toxic to aquatic life, cumulative effects on populations of fish and other aquatic organisms are not considered likely.	▪ meeting all relevant provincial guidelines and standards regarding stormwater management. ▪ the application of best management practices regarding fertilizers, manures, pesticides, and controlling erosion and runoff through various practices as advocated by Agriculture and Agri-food Canada (AAFC) and the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). ▪ See Groundwater measures	
Vegetation and Vegetation Communities	Loss of 350.1 ha of existing vegetation and vegetation communities.	Construction	• The cumulative removal of forested areas is approximately 476 ha, representing a decrease of 2.8% of all existing forested areas. The 407 East Transportation Corridor, represents approximately 24% of all potential removals or 0.67% of existing forested areas.	• MTO plans to restore, enhance and create vegetation communities at a ratio of a minimum of 1:1 in order to ensure that the potential for a cumulative effects resulting from the 407 East Transportation Corridor over the longer term is as low as possible. Effective mitigation of adverse cumulative effects on vegetation and vegetation communities can be achieved by: ▪ ensuring that all future development, including new transportation infrastructure, meets the broader planning objectives of the Provincial Policy Statement (2005) and those of local municipalities and Conservation Authorities as set out in their various watershed management plans and the objectives of the Greenbelt Plan.	• Increased loss of vegetation and vegetation communities
	Loss of 28.9 ha of interior forest habitat	Construction	• The cumulative removal of interior forested areas is approximately 280 ha, representing a decrease of 4.5% of all existing forested areas with some interior forest habitat. • The 407 East Transportation Corridor, represents approximately 10% of all potential removals or 0.57% of existing interior forest habitat available in the RSA.	• Same as above • As part of the proposed 1:1 vegetation replacement strategy, strategic planting can be undertaken in existing forested areas to mitigate for cumulative losses of interior forest habitat.	• Reduced area of interior forest habitat
	Reduction in the quality / function of the retained portion of vegetation communities along/adjacent to the transportation corridor, including vegetation and vegetation communities sensitive to groundwater or surface drainage alteration and exposure to fugitive dust, light, wind and sun exposure.	Construction and Operations and Maintenance	• The encroachment of new development on existing forested areas will likely result in the further reduction in the quality /function of the retained portions of forested areas and/or other vegetation and vegetation communities, including those sensitive to groundwater alteration and exposure to fugitive dust. There are 26 various vegetation communities that were considered to be sensitive to groundwater alteration. Of these 26, only 14 vegetation communities have the potential to be affected by multiple projects. At these locations, cumulative effects on the quality / function of these communities will likely occur over time as new developments are approved and constructed. Nevertheless, cumulative effects are likely to persist for some time over the planning horizon.	• Same as above	• Reduced quality/function of retained vegetation and habitat
Wetlands	Loss of 62.2 ha of wetland area.	Construction	• The maximum potential cumulative removal of wetlands is approximately 309 ha, representing a decrease of 5.4% of all existing wetlands with the greatest potential losses occurring in the Duffins Creek and Lynde Creek watersheds as a result of future growth and development and potential development of the Pickering airport in the northern portions of these watersheds. • The 407 East Transportation Corridor, represents approximately 20% of all potential removals or 1.1% of existing wetland areas. • It is not considered likely that all of these wetland areas would need to be completely removed, and to the extent possible, new projects and activities would likely be planned to avoid the removal of most wetland areas, particularly Provincially Significant Wetlands.	• MTO plans to restore, enhance and create wetland communities in order to ensure that the potential for a cumulative effect resulting from the 407 East Transportation Corridor over the longer term is minimized to the extent possible. Other project proponents may also contribute to the management of cumulative effects, by planning new development in a manner that minimizes losses and disruption; creating and enhancing existing wetlands on their properties. • The ongoing protection of wetland areas depends upon the commitment of municipal governments to zone wetlands as natural areas where no development can occur. • The effective mitigation of adverse cumulative effects on wetlands can be achieved by ensuring that all future development, including new transportation infrastructure, meets the broader planning objectives of the Provincial Policy Statement (2005) and those of local municipalities and Conservation Authorities as set out in their various watershed management plans and the objectives of the Greenbelt Plan. • The federally led Great Lakes Wetland Conservation Action Plan (GLWCAP) also provides for long term Mitigation / Compensation Measures for the adverse cumulative effects on wetlands through the co-operative action of a	• Increased loss of wetland areas

Table 7-7 Summary of Cumulative Effects and Mitigation

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Project Phase	Cumulative Effects and Human Health / Ecological Implications	Mitigation / Compensation Initiatives	Residual Cumulative Effect
				number of stakeholders.	
	Reduction in the quality / function of the retained portion of wetlands along the transportation corridor, including wetlands sensitive to turbidity, stormwater contaminants, groundwater or surface drainage alteration.	Construction and Operations and Maintenance	• The encroachment of new development on existing wetland areas will likely result in the further reduction in the quality /function of the retained portions of wetlands, including those sensitive to turbidity and groundwater alteration. These reductions in quality / function may be noticeable within individual wetlands affected by multiple projects (i.e., Harmony-Farewell Iroquois Beach Wetland Complex and Lynde Creek Coastal Wetland Complex) • Cumulative effects attributable to the 407 East Transportation Corridor are likely to be noticeable in those portions of these two wetland complexes that are closest to the highway, and where turbidity and groundwater alteration are likely to be measureable. At these locations, cumulative effects on the quality / function of these habitats would occur over time as new developments are approved and constructed. Nevertheless, they are likely to persist for some time over the planning horizon. • All other evaluated wetlands in the RSA are located well away from the 407 East Transportation Corridor where measureable effects from the transportation corridor are not anticipated, and any reductions in their quality / function would be attributable to the other projects and activities only.	• Same as above.	• Reduced quality/function of retailed portions of wetlands
Wildlife and Wildlife Habitat, including Migratory Birds	Restrictions to wildlife movement and increased wildlife mortality	Construction and Operations and Maintenance	• Approximately 400 km of new roads, road widenings or transit improvements will be undertaken in the RSA over the next 25 years to ensure adequate capacity. • Given the size of the 407 East Transportation Corridor, the west to east orientation of the mainline (i.e., crossing north-south wildlife migration routes along creek valleys), and the anticipated large volumes of traffic it is likely to accommodate, the 407 is likely to be the greatest new impediment to wildlife movement and source of wildlife mortality in the RSA.	• Effective mitigation for adverse effects on wildlife and wildlife habitat, including migratory birds is through avoidance of features of concern (with appropriate buffer zones) and ensuring that new development and infrastructure projects fulfill the requirements of the *Planning Act*, Ontario's *Environmental Assessment Act* (e.g., the Municipal Class EA, or an individual Environmental Assessments) and/or the Canadian *Environmental Assessment Act*. These planning processes provide the best opportunity for developing siting and routing alternatives that minimize the potential for adverse effects.	• Restrictions to wildlife movement and increased wildlife mortality
	Disruption to wildlife within the retained portion of vegetation communities and wetlands along the transportation corridor, including wildlife species sensitive to habitat size/diversity, fugitive dust, noise, light, surface water and groundwater effects.	Construction and Operations and Maintenance	• Increased urbanization will also disrupt wildlife within the retained portions of vegetation communities and wetlands along the transportation corridor. • Noticeable cumulative disruption effects attributable to the 407 East Transportation Corridor are likely limited to the immediate area surrounding the transportation corridor ROW, where new land developments have been approved and constructed. It is these areas that will tend to disrupt wildlife the most, particularly species sensitive to fugitive dust, noise, light, surface water and groundwater effects. • Given the magnitude of these potential cumulative losses in the context of available habitat, and the magnitude of dust, noise, surface water and ground water effects resulting from the 407 East Transportation Corridor, it is considered unlikely that measureable declines in the populations of most wildlife species or their use of retained habitat will occur at a regional scale.	• Same as above	• Disruption to wildlife within the retained portions of vegetation communities and wetlands
Species at Risk	Removal of 83 Butternut trees, including 3 seedlings (34 are considered retainable)	Construction	• It is highly likely that other projects and activities, particularly new watercourse crossings that may encroach into riparian habitat, will require that Butternuts be removed. However, it is not possible to quantify the number of individual trees that exist in the RSA nor cumulative removals. • Given a conservative estimate of the population in Ontario (largely located in southern Ontario off the Canadian Shield) is 13,000 trees, the total removal of 83 individual Butternut trees as a result of the 407 East Transportation Corridor represents approximately 0.6% of the remaining population. Given that less than half of these are considered retainable, the magnitude of these losses is considered very small. • Under Ontario's *Endangered Species Act*, the overall goal of the recovery strategy is to achieve a net beneficial effect on the species. Over the long term, the potential for cumulative adverse effects is anticipated to diminish over time Ongoing monitoring help ensure effectiveness of the strategy.	• Effective mitigation measures regarding the loss of Butternut as a result of the 407 East Transportation Corridor are currently being developed by MTO in consultation with the Ministry of Natural Resources (MNR) and the Forest Gene Conservation Association (FGCA). The draft mitigation strategy recommended by MTO, will continue to evolve but is available for application by other project proponents. • Mitigation for potential effects resulting from other projects and activities will likely be in place as part of a recovery strategy for Butternut, and Butternut related policies that are being developed to support the implementation of the *Endangered Species Act*.	• Removal of individual Butternut Trees
	Disruption to Redside Dace habitat at eight (8) watercourse crossings.	Operations	• It is highly likely that other projects and activities, particularly new watercourse crossings of cold water reaches will affect Redside Dace habitat. However, it is not possible to quantify the numbers or specific locations where Redside Dace habitat is found with certainty. However, there is a high potential for cumulative effects within those watersheds affected by the transportation corridor known to contain Red-side Dace at the eight (8) 407 East Transportation Corridor crossings (i.e., Duffins Creek, Carruthers Creek and Lynde Creek watersheds). • The 407 East Transportation Corridor in combination with other projects and activities will require an additional 122 watercourse crossings within cold water reaches of natural watercourses in the Duffins Creek, Carruthers Creek and Lynde Creek watersheds or an increase of 29.34% over the total number of existing crossings. • Under Ontario's *Endangered Species Act*, the overall goal of the recovery strategy is to achieve a net beneficial effect on the species. Over the long term, the potential for cumulative adverse effects is anticipated to diminish over time. Ongoing monitoring help ensure effectiveness of the strategy.	• See Wildlife and Wildlife Habitat. • General mitigation measures aimed at protecting fish and fish habitat, applicable to MTO are likely to be implemented by other project proponents at locations where Red-side Dace habitat is confirmed. • In situations where Redside Dace are present, a specific assessment program will need to be developed and implemented, in consultation with the recognized experts and appropriate agency staff and in accordance with the *Endangered Species Act* (ESA) process. • In addition, local Conservation Authorities have set a number of objectives regarding Species at Risk that are aimed at protection and restoration of habitats. The Greenbelt Plan is committed to protection, maintenance and enhancement of natural heritage, hydrologic and landform features and functions, including protection of habitat for flora and fauna and particularly species at risk.	• Increase disruption to Redside Dace habitat
	Disruption to habitat of Blanding Turtle and Golden-winged Warbler		• It is highly likely that other projects and activities may encroach into habitat occupied by the Blandings Turtle and the Golden-winged Warbler. However, it is not possible to quantify the number of individuals affected nor cumulative removals of their habitat. Cumulative effects may be experienced in proportion to the overall loss of forested areas, interior forest habitat and wetlands.	• See Wildlife and Wildlife habitat • In addition, local Conservation Authorities have set a number of objectives regarding Species at Risk that are aimed at protection and restoration of habitats. The Greenbelt Plan is committed to protection, maintenance and enhancement of natural heritage, hydrologic and landform features and	• Increased disruption to habitat of Blandings Turtle and Golden-winged Warbler

Table 7-7 Summary of Cumulative Effects and Mitigation

Environmental Component	Residual Effects of the 407 East Transportation Corridor	Project Phase	Cumulative Effects and Human Health / Ecological Implications	Mitigation / Compensation Initiatives	Residual Cumulative Effect
				functions, including protection of habitat for flora and fauna and particularly species at risk.	
Socio-economic Environment	Changes in community character due changes in landscape composition and effects of fugitive dust, noise and light.	Construction and Operations and Maintenance	• The character of every community in the RSA to some extent, but primarily from their combined effects on landscape composition due to the disruption to the pastoral quality and landscape connectivity caused by changes in topography, the loss of agricultural land; the actual physical obstruction of the transportation corridor along with new urban / suburban developments; as well as the removal of natural and cultural resources associated with each new development. • With the exception of the hamlet of Kinsale, there are no other projects or activities that would directly affect the character of small hamlets as they are all located within the Greenbelt, well removed from any existing or proposed urban / suburban development. Kinsale, located at the intersection of Kinsale Road and Highway 7 in the City of Pickering is likely to be surrounded and transformed by the new residential, commercial and industrial development, effectively transforming this rural hamlet into an area with an urban/suburban character. • The character of the south Clarington area is likely to change during both the construction phase as well as the operations and maintenance phase. Here, it is anticipated that that the "look and feel" of this rural area will change to a planned mix of light industrial and commercial uses. Land uses over time are likely to gradually change from non-industrial uses to more industrial uses. These cumulative effects are considered to be compatible with the existing community character during the Construction Phase of the 407 East Transportation Corridor, and a strengthening of an existing and growing industrial presence along the waterfront and the Highway 401 corridor during the Operations and Maintenance Phase. • Overall, with the exception of lands within the Greenbelt, land uses across the RSA are likely to gradually change to more intense residential, commercial and industrial uses.	• Effective mitigation of adverse cumulative effects on the socio-economic environment can be achieved by ensuring that all future development, including new transportation infrastructure, meets the broader planning objectives of the Provincial Policy Statement (2005), those of regional and local municipalities as set out in their Official Plans, and the objectives of the Greenbelt Plan.	• Changes in community character
	Reduced agricultural activity due to changes in landscape composition (i.e., loss and/or severance of 2068.3 ha of agricultural land)	Construction and Operations and Maintenance	• Reduced agricultural activity will likely occur across the RSA as a result of the change in landscape composition (i.e., the loss and/or severance of agricultural land). The cumulative amount of Class 1, 2 or 3 agricultural land that may be removed from agricultural production is 9,823 ha. • The 407 East Transportation Corridor represents a loss of 19% of all potential agricultural removals or 3.3% of available Class 1, 2 or 3 agricultural soils. • The 407 East Transportation Corridor and general growth and development in the RSA will continue the pattern of loss of farmers and the division of farm properties that can also be seen on a larger scale across Durham Region and Ontario.	• Same as above	• Reduced Agricultural Activity
	Disruption to the use and enjoyment of property due to encroachment / proximity of transportation corridor (i.e., increased nuisances), changed community character and landscape composition.	Construction and Operations and Maintenance	• The 407 East Transportation Corridor has some potential to affect up to 1827 properties (i.e., the number of receptor locations within 500 m of the transportation corridor) due to the likely disruption to their use and enjoyment of property resulting from increased fugitive dust, noise and light along the ROW and a general change in landscape composition. Assuming that each property represents one household and 2.6 persons per household, it can be very conservatively estimated that a total of 5,138 persons may experience some disruption to their use and enjoyment of property. • Increased disruption to the use and enjoyment of property is particularly likely in the area closest to the East Durham Link at Highway 401 in south Clarington. Here, there is a high potential for existing and future projects and activities to cause similar effects at the 407 East Transportation Corridor (i.e., noise, dust, light, landscape composition) that are likely to disrupt people's use and enjoyment of property in a relatively small geographic area during both their construction phases as well as the operations and maintenance phases. No cumulative adverse effect on population or population growth is anticipated, residents living and/or working in this area of the Municipality of Clarington may notice the change locally. • Cumulative effects on people's use and enjoyment of property of an operating Pickering Airport and the transportation corridor are also likely. A cumulative effect may be experienced at 130 existing NSAs should they be permitted to remain in the area upon the definition of an Airport Operating Area. The AOA would be a noise impact area (based on a Noise Exposure Forecast (NEF) 25 contour) that would extend well off the Pickering Airport lands and over the 407 East Transportation Corridor almost to the Pickering-Whitby border.	• Same as above	• Disruption to the use and enjoyment of private property

7.19.3 Residual Cumulative Effects

Based on the results of the cumulative effects analysis, **Table 7-8** summarizes the residual cumulative effects of the 407 East Transportation Corridor in combination with other projects and activities.

Table 7-8 Summary of Residual Adverse Cumulative Effects

Environmental Component	Residual Adverse Cumulative Effect	Project Phase	VEC Affected
Air Quality and Climate	Increased dust levels	Construction	• Air Quality Sensitive Receptors (Human / Ecological Receptors)
	Reduced regional air quality (i.e., increased emission of contaminants of concern)	Operations and Maintenance	• Air Quality Sensitive Receptors (Human / Ecological Receptors)
Noise and Vibration	Increased noise levels along the transportation corridor	Construction	• Noise Sensitive Areas (Human / Ecological Receptors)
	Increased noise levels along the transportation corridor	Operations and Maintenance	• Noise Sensitive Areas (Human / Ecological Receptors)
Surface and Subsurface Geology and Soils	Changes in valley slopes and landform	Construction	• Surface Waterbodies / watercourses
	Increased soil exposure to erosion	Construction	• Surface Waterbodies / watercourses
Groundwater	Lowering of groundwater table in surficial soils at location of foundation excavations requiring dewatering	Construction	• Groundwater in Surficial Soils • Surface Waterbodies / watercourses • Wetlands • Specialized and Sensitive Wildlife Habitat
	Lowering of groundwater table in surficial soils at locations of deep cuts requiring dewatering	Construction, Operations and Maintenance	• Groundwater in Surficial Soils • Surface Waterbodies / watercourses • Wetlands • Specialized and Sensitive Wildlife Habitat
	Alteration of groundwater flow and levels in surficial soils at locations of major fills and foundation structures	Construction, Operations and Maintenance	• Groundwater in Surficial Soils • Surface Waterbodies / watercourses • Wetlands • Specialized and Sensitive Wildlife Habitat
	Reduction in groundwater quality in surficial soils	Operations and Maintenance	• Groundwater in Surficial Soils • Surface Waterbodies / watercourses • Wetlands • Specialized and Sensitive Wildlife Habitat
Surface Water	Increased turbidity	Construction	• Surface Waterbodies / watercourses • High Sensitivity • Fish Habitat
	Decreased surface water quality due to effluent discharges	Operations and Maintenance	• Surface Waterbodies / watercourses • High Sensitivity • Fish Habitat
Vegetation and Vegetation Communities	Increased loss of vegetation and vegetation communities	Construction	• Forested Areas • Specialized and Sensitive Wildlife Habitat
	Reduced area of interior forest habitat	Construction	• Forested Areas with Interior Habitat • Specialized and Sensitive Wildlife Habitat
	Reduced quality/function of retained vegetation and habitat	Construction, Operations and Maintenance	• Forested Areas • Forested Areas with Interior Habitat • Specialized and Sensitive Wildlife Habitat
Wetlands	Increased loss of wetland areas	Construction	• Wetlands
	Reduced quality/function of retailed portions of wetlands	Construction, Operations and Maintenance	• Wetlands • Specialized and Sensitive Wildlife Habitat
Wildlife and Wildlife Habitat, including Migratory Birds	Restrictions to wildlife movement and increased wildlife mortality	Construction, Operations and Maintenance	• Mammals and Amphibians
	Disruption to wildlife within the retained portions of vegetation communities and wetlands	Construction, Operations and Maintenance	• Mammals, Amphibians, Breeding/Migratory Birds • Federal (COSEWIC) Species at Risk
Species at Risk	Removal of individual Butternut Trees	Construction	• Federal (COSEWIC) Species at Risk
	Increase disruption to Redside Dace habitat	Construction	• Federal (COSEWIC) Species at Risk
	Increased disruption to Blanding Turtle and Golden-winged Warbler habitat	Construction, Operations and Maintenance	• Mammals, Amphibians, Breeding/Migratory Birds • Federal (COSEWIC) Species at Risk
Socio-economic	Changes in community character	Construction, Operations	• Community character

Environmental Component	Residual Adverse Cumulative Effect	Project Phase	VEC Affected
Environment		and Maintenance	
	Reduced Agricultural Activity	Construction, Operations and Maintenance	• Agricultural Operations • Class 1,2 and 3 Agricultural Soils
	Disruption to the use and enjoyment of private property	Construction, Operations and Maintenance	• Use and enjoyment of private property

7.19.4 Government and Public Comments

Comments from the Province and the public regarding cumulative effects and human health implications were received during the review of the Provincial EA. Provincial reviewers focused their comments on measures to reduce the effects of salt, including reduction of additives to road salts and lining of ditching, stormwater management ponds and outlet channels. MTO indicated that EC continues to work with the salt industry and that MTO is committed to exploring the use of liners during the subsequent design phase.

A member of the public requested that a cumulative effects assessment be undertaken and that the Seaton lands and the Pickering Airport be considered in the EA and Human Health report specifically. MTO responded that a cumulative effects assessment will be considered within the Federal EA documentation. The Seaton Lands and the Pickering Airport and the potential interactions between those projects and the 407 East Transportation Corridor were considered throughout the 407 study during the problems and opportunities phase and the alternatives to the undertaking phase. Potential development of the Seaton lands was accounted for in the demand forecast modelling, based on population and employment figures from Growth Plan for the Greater Golden Horseshoe. As the Pickering Airport has not been approved, it was not explicitly used in the modelling for the Project. The cumulative effects of the Seaton Lands, Pickering Airport and other projects in Durham Region have been considered within the Federal EA documentation.

EC provided the CEA Agency and RAs with comments regarding cumulative effects. EC requested that MTO acknowledge a number of residual adverse effects of the Project in order to give them consideration in the cumulative effects assessment. In response, MTO has acknowledged residual adverse effects for a number of environmental components and has considered these in the cumulative effects assessment.

During the preparation of the draft environmental screening report, EC requested clarification as to why individual watersheds not affected by the 407 East Transportation Corridor were included (i.e., Corbett, Darlington, Goodman, Pringle and Robinson Creeks) in the cumulative effects analysis for the consideration of surface water effects. In EC's opinion, the inclusion of these watersheds biased quantitative cumulative effects analysis. However, in regard to the consideration of forested areas, interior forest habitat and wetlands, EC agreed that the loss of these natural features would be better placed in a regional/watershed context and that MTO's cumulative effects analysis should not be limited to only to those watersheds directly affected by the Project. EC requests that surface water analysis be amended appropriately. EC also requested that MTO report on the total number of Butternut trees to be removed for construction of the entire highway in the context of the cumulative effects assessment. MTO revised the cumulative effects analyses.

HC suggested to the CEA Agency and RAs that $PM_{2.5}$ and Ozone be considered in the cumulative effect analysis and appropriate mitigation measures be applied in order to reduce potential risk to human health. MTO's cumulative effects have considered these two contaminants.

8. Significance Assessment

8.1 Approach

The Comprehensive Study Guidelines document described the requirements for the assessment of the significance of the adverse environmental effects. Taking into account the implementation of the proposed mitigation measures, the residual adverse effects of the Project (407 Project-specific effects) were identified in **Table 7-6** and the residual adverse cumulative effects were identified in **Table 7-8.** All residual adverse effects (i.e., 407 Project-specific and cumulative effects) identified were assessed for their significance. It is noted that beneficial effects were not assessed for their significance.

As per the Comprehensive Study Guidelines, the following criteria were defined in relation to assessing the significance of the residual adverse effects from the 407 East Transportation Corridor:

Magnitude .....The size or degree of the effects compared against baseline conditions or thresholds, and other applicable measurement parameters (i.e., standards, guidelines, objectives).

Extent .....The geographic area over or throughout which the effects are likely to be measurable.

Duration .....The time period over which the effects are likely to last

Frequency.....The rate of recurrence of the effects (or conditions causing the effect).

Permanence.....The degree to which the effects can or will be reversed (typically measured by the time it will take to restore the environmental attribute or feature)

Ecological Context.....The importance of the environmental attribute or feature to ecosystem health and function.

These criteria are generally used in Federal EAs carried out under the *CEA Act* and aim to address both the nature and extent of the residual adverse effects, environmental implications of the effects, as well as human health implications (where relevant). **Table 8-1** provides the framework that was used to assess the significance of the residual adverse effects. This framework includes the significance assessment criteria and definitions for three levels of significance (low, medium and high). These levels of significance were framed to generally reflect federal and provincial regulatory and industry standards and guidelines to the extent possible. In cases where these points of reference were not available, the assessments were made based on professional judgement concerning the type and nature of the environmental effects.

Table 8-1: Significance Assessment Framework

Significance Assessment Criteria	Significance Level		
	Low	Medium	High
Magnitude of Effect	Project-specific and/or cumulative effects may be noticeable and/or measureable, but are not likely to exceed a reference criterion or guideline value.	Project-specific and/or cumulative effects are likely to be noticeable and measureable, representing a small change relative to existing condition. Adverse effects may exceed a reference criterion or guideline value on occasion and/or at an individual location.	Project-specific and/or cumulative effects are likely to be noticeable and measureable, representing large measureable changes relative to existing conditions. Adverse effects caused by the Project are likely to result in the exceedance of a reference criterion or guideline on an ongoing basis across the RSA.
Extent of Effect	Project-specific and/or cumulative effects are likely to be measureable within an area immediately surrounding the 407 East Transportation Corridor ROW, generally within 500 m. Adverse effects may be experienced within a few hamlets/built up areas traversed by the transportation corridor.	Project-specific and/or cumulative effects are likely to be noticeable and/or measureable within the RSA or within most of the hamlets/built up areas traversed by the transportation corridor	Project specific and/or cumulative effects are likely to be noticeable or measureable within the RSA. Adverse effects will be experienced by all hamlets/built up areas traversed by the transportation corridor and/or having adverse implications for VECs beyond the RSA.
Duration/Timing (of effect)	Project-specific and/or cumulative effects result from short-term events, are considered to be short-term disturbances or losses limited to within the planning horizon (i.e., up to 2031)	Project-specific and/or cumulative effects are ongoing effects related to the Construction and/or Operations and Maintenance phases of the 407 East Transportation Corridor Project.	Project-specific and/or cumulative effects are ongoing effects that are likely to persist beyond the Construction and/or Operations and Maintenance phases of the 407 East Transportation Corridor Project and there are the effects are not readily reversible despite the implementation of mitigation and/or compensation measures (see Permanence criterion below).
Frequency (or probability)	Conditions or phenomena causing a Project-specific effect occur infrequently or are effectively one-time events during the project phase in which they occur. A few other projects or activities causing cumulative effects are likely to occur along with the 407 East Transportation Corridor. They will occur periodically over the planning horizon (i.e., up to 2031)	Conditions or phenomena causing a Project-specific effect occur at regular but infrequent intervals during the project phase in which they occur. Several projects or activities causing cumulative effects are likely to occur along with the 407 East Transportation Corridor. They will occur periodically over the planning horizon (i.e., up to 2031).	Conditions or phenomena causing a Project-specific effect occur at regular and frequent intervals, or are ongoing conditions during the project phase in which they occur. The majority of projects or activities causing cumulative effects are likely to occur along with the 407 East Transportation Corridor. They are likely to occur frequently or repeatedly over the planning horizon (i.e., up to 2031).
Permanence (of effect)	Measureable or noticeable project-specific and/or cumulative effects are not likely to persist over the planning horizon (i.e., up to 2031). Project-specific mitigation and/or compensation measures and potentially those of other projects and activities will ensure that long term cumulative effects attributable to the Project are not measureable.	Measureable or noticeable project-specific and/or cumulative effects are likely to persists for some time over the planning horizon. Adverse regional trends and cumulative effects attributable to the Project are potentially reversible.	Project-specific and/or cumulative effects are not readily reversible despite the implementation of mitigation and/or compensation measures. Adverse regional trends and cumulative effects attributable to the Project are likely to persist.
Ecological Importance (of a resource or VEC)	Not Applicable	The resource / VEC is common and abundant. The resource / VEC will continue to fulfill its	The resource / VEC is not common across the RSA. Abundance and quality is required for the resource

Table 8-1: Significance Assessment Framework

Significance Assessment Criteria	Significance Level		
	Low	Medium	High
		ecological functions.	/ VEC to continue to fulfill its ecological functions.

After the application of this framework, an effect was assessed to be a negligible effect (not significant), a minor adverse effect (not significant), a moderate adverse effect (not significant) or a significant adverse effect, according to the following definitions:

a) **Negligible Effect (Not Significant)** are those environmental effects which, after taking into consideration applicable mitigation measures have been assessed to have a “low” level of significance for the majority of the significance criteria described above; or having a “low” or “medium” level of significance for the majority of the criteria with “low” permanence.

b) **Minor Adverse Effects (Not Significant)** are those environmental effects which, after taking into consideration mitigation measures, have been assessed to have a “low” or “medium” level of significance for the majority of the criteria described above.

c) **Moderate Adverse Effects (Not Significant)** are those environmental effects which, after taking into consideration mitigation measures, have been assessed to have a “medium” level of significance for the majority of the criteria described above or having a “low” or “medium” level of significance for the majority of the criteria with “high” permanence.

d) **Significant Adverse Effects** are those environmental effects which, after taking into consideration mitigation measures, have a magnitude that has a “high” magnitude, “high” extent and “high” duration.

Table 8-2 provides the significance assessment for the residual adverse effects, which includes the consideration of the residual adverse effects of the Project (i.e., Project-specific effects) and cumulative effects.

Table 8-2 Significance of Residual Adverse Effects

Residual Adverse Effects	Project Phase	VEC Affected	Significance Levels						Overall Significance of Residual Adverse Effects
			Magnitude	*Extent*	*Duration*	*Frequency*	*Permanence*	*Ecological Importance (of resource or VEC)*	
Increased Dust Levels *(Project-specific and Cumulative Effects)*	Construction	Air Quality Sensitive Receptors (Human / Ecological Receptors)	**Medium** Increased dust levels during construction of the 407 East Transportation Corridor and cumulative effects may exceed a reference criterion or guideline value on occasion or at an individual receptor location	**Low** Increased dust levels due to the Project and in combination with other projects and activities are likely to be measureable within 500 m of the 407 East Transportation Corridor	**Low** Adverse effects are likely to be short term (e.g., major earthworks during windy periods) in duration at any one receptor location along the ROW	**Low** Project-specific effects will occur periodically, but infrequently during the construction phase. Cumulative effects may occur as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Low** Project-specific and cumulative effects are not likely to persist once the activities causing the effects have ceased.	**High** Good air quality is required for the VEC to continue to function.	**Negligible Effect (Not Significant)**
Reduced Local and Regional Air Quality *(Project-specific and Cumulative Effects of increased emission of contaminants of concern, including acrolein and TSP)*	Construction, Operations and Maintenance	Air Quality Sensitive Receptors (Human / Ecological Receptors)	**Medium** Changes in local and regional air quality represent small measureable changes relative to baseline conditions and may exceed a reference criterion or guideline value on occasion or at an individual receptor location. Adverse effects of the Project are not likely to result in the exceedance of a reference criterion or guideline value on an ongoing basis across the RSA (i.e., acrolein and TSP)..	**Medium** Adverse effects are likely to be noticeable or measureable within the RSA and in most hamlets/built up areas traversed by the transportation corridor	**Medium** Adverse effects are ongoing effects related to both the Construction and/or the Operations and Maintenance Phases of the 407 East Transportation Corridor. Adverse regional trends can be are reversible (see Permanence criterion)	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Most projects and activities causing the cumulative effects are likely to occur along with the 407 East Transportation Corridor. Exceedances of reference criteria or guideline values are likely to occur periodically during the Operations and Maintenance Phase	**Medium** Reduced local and regional air quality is likely to persist over the planning horizon, but conditions contributing to regional trends and cumulative effects are likely to improve with the implementation of various Federal and Provincial government transportation and air quality initiatives.	**High** Good air quality is required for the VEC to continue to function.	**Moderate Adverse Effect (Not Significant)**
Increased Noise Levels Along the Transportation Corridor *(Project-specific and Cumulative Effects)*	Construction	Noise Sensitive Areas (Human / Ecological Receptors)	**Medium** Noise levels during construction may exceed a reference criterion or guideline value on occasion or at an individual receptor location	**Low** Adverse effects are likely to be measureable within 500 m of the 407 East Transportation Corridor.	**Low** Adverse effects are likely to be short term in duration at any one receptor location along the ROW (e.g., near a single construction site, pile driving location, etc.)	**Low** Project-specific effects will occur periodically, but infrequently during the construction phase. Cumulative effects will occur periodically during the construction phase as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Low** Adverse effects are not likely to persist once the activities causing the effects have ceased.	**N/A**	**Negligible Effect (Not Significant)**
Increased Noise Levels Along the Transportation Corridor *(Project-specific and Cumulative Effects)*	Operations and Maintenance	Noise Sensitive Areas (Human / Ecological Receptors)	**Medium** Ambient noise levels will increase over baseline conditions and may exceed a reference criterion on occasion or at an individual receptor location.	**Medium** Adverse effects are likely to be measureable and noticeable within the RSA and in most hamlets/built up areas traversed by the 407 East Transportation Corridor.	**Medium** Adverse effects are ongoing effects related to the Operations and Maintenance Phase of the 407 East Transportation Corridor	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Most projects and activities causing the cumulative effects are likely to occur along with the 407 East Transportation Corridor. Exceedances of reference criteria or guideline values are likely to occur periodically during the Operations and Maintenance Phase	**High** Adverse effects are not readily reversible despite the implementation of mitigation / compensation. Adverse regional trends and cumulative effects attributable to the Project are likely to persist	**N/A**	**Moderate Adverse Effect (Not Significant)**

Table 8-2 Significance of Residual Adverse Effects

Residual Adverse Effects	Project Phase	VEC Affected	Significance Levels						Overall Significance of Residual Adverse Effects
			Magnitude	*Extent*	*Duration*	*Frequency*	*Permanence*	*Ecological Importance (of resource or VEC)*	
Changes in Valley Slopes and Landform *(Project-specific and Cumulative Effects)*	Construction	Surface Waterbodies / Watercourses	**Low** Adverse effects on valley slopes and landforms are likely to be observable along watercourses	**Medium** Adverse effects on valley slopes and landform are likely to be observable within the RSA	**Low** Adverse effects on valley slopes and landform result from short term events and are considered to be short term disturbances	**Low** Project-specific effects will occur periodically, but infrequently during the construction phase. **Medium** Several project and activities causing the cumulative effects are likely to affect the same valleys or landforms along the 407 East Transportation Corridor	**High** Cumulative effects on valley slopes and landforms are permanent	**Medium** Natural watercourses are common and abundant. Changes in valley slopes and landforms are not likely to impair the ecological functions of the VEC	**Moderate Adverse Effect (Not Significant)**
Increased Soil Exposure to Erosion *(Project-specific and Cumulative Effects)*	Construction	Surface Waterbodies / Watercourses	**Low** Adverse effects are likely be measurable and/or noticeable, but are not likely to exceed a reference criterion or guideline value.	**Low** Adverse effects are likely measurable and/or noticeable within an area immediately surrounding the 407 East Transportation Corridor and other projects/activities	**Low** Adverse effects are considered to be short term disturbances	**Low** Adverse effects may occur periodically during the construction phase and/or as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Low** Adverse effects are not likely to be measurable or noticeable over the planning horizon	**Medium** Natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Negligible Effect (Not Significant)**
Lowering of Groundwater Table in Surficial Soils at Locations of Foundation Excavations Requiring Dewatering *(Project-specific and Cumulative Effects)*	Construction	Groundwater in Surficial Soils Surface Waterbodies / Watercourses Wetlands Specialized and Sensitive Wildlife Habitat	**Low** Adverse effects are likely to be measurable and/or noticeable	**Low** Adverse effects are likely measurable and/or noticeable within an area immediately surrounding dewatering locations along the 407 East Transportation Corridor and/or other projects/activities involving groundwater extraction	**Low** Adverse effects are considered to be short term disturbances	**Low** Adverse effects are effectively one-time events but may occur periodically during the construction phase and/or as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Low** Adverse effects are not likely to be measurable or noticeable over the planning horizon	**Medium** Groundwater and natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Negligible Effect (Not Significant)**
Lowering of Groundwater Table in Surficial Soils at Locations of Deep Cuts Requiring Dewatering *(Project-specific and Cumulative Effects)*	Construction, Operations and Maintenance	Groundwater in Surficial Soils Surface Waterbodies / Watercourses Wetlands Specialized and Sensitive Wildlife Habitat	**Low** Adverse effects are likely to be measurable and/or noticeable	**Low** Adverse effects are likely measurable and/or noticeable within an area immediately surrounding major cuts along the 407 East Transportation Corridor and/or other projects/activities involving groundwater extraction	**Medium** Adverse effects are ongoing effects related to the Construction and/or Operations and Maintenance phases of the 407 East Transportation Corridor and/or other projects/activities involving groundwater extraction.	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Low** Cumulative effects may occur periodically during the construction phase as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Medium** Measureable or noticeable project-specific and/or cumulative effects are likely to persist for some time over the planning horizon. Adverse regional trends and cumulative effects attributable to the Project are potentially reversible.	**Medium** Groundwater and natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Minor Adverse Effect (Not Significant)**
Alteration of Groundwater Flow and Levels in Surficial Soils at Locations of Major Fills and Foundation Structures *(Project-specific and Cumulative Effects)*	Construction, Operations and Maintenance	Groundwater in Surficial Soils Surface Waterbodies / Watercourses Wetlands Specialized and Sensitive Wildlife Habitat	**Low** Adverse effects are likely to be measurable and/or noticeable	**Low** Adverse effects are likely measurable and/or noticeable within an area immediately surrounding major fills / foundation structures along the 407 East Transportation Corridor and other projects/activities with major fill operations and substantial belowground structures	**Low** Adverse effects are considered to be short term disturbances	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Low** Cumulative effects may occur periodically during the construction phase as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Medium** Measureable or noticeable project-specific and/or cumulative effects are likely to persist for some time over the planning horizon.	**Medium** Groundwater and natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Minor Adverse Effect (Not Significant)**

Table 8-2 Significance of Residual Adverse Effects

Residual Adverse Effects	Project Phase	VEC Affected	Significance Levels						Overall Significance of Residual Adverse Effects
			Magnitude	*Extent*	*Duration*	*Frequency*	*Permanence*	*Ecological Importance (of resource or VEC)*	
Reduction in Groundwater Quality in Surficial Soils *(Project-specific and Cumulative Effects)*	Operations and Maintenance	Groundwater in Surficial Soils Surface Waterbodies / Watercourses Wetlands Specialized and Sensitive Wildlife Habitat	**Medium** Adverse effects may be measurable and/or noticeable and may exceed a reference criterion or guideline value in certain settings (e.g., areas of fine sands and silts)	**Low** Adverse effects may be measurable and/or noticeable within an area immediately surrounding the 407 East Transportation Corridor and/or other projects/activities.	**Medium** Adverse effects are measureable and ongoing effects related to the Operations and Maintenance Phase of the 407 East Transportation Corridor and/or other transportation infrastructure projects	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Low** Cumulative effects may occur periodically during the operation/maintenance phase as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**High** Cumulative effects are not readily reversible.	**Medium** Groundwater and natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**
Increased Turbidity *(Project-specific and Cumulative Effects)*	Construction	Surface Waterbodies / Watercourses High Sensitivity Fish Habitat	**Medium** Adverse effects may be measurable and/or noticeable and may exceed a reference criterion or guideline value in areas immediately downstream of a watercourse crossing.	**Low** Adverse effects are likely measurable and/or noticeable within an area immediately surrounding the 407 East Transportation Corridor and other projects/activities	**Low** Adverse effects are considered to be short term disturbances	**Low** Adverse effects may occur periodically during the construction phase and/or as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Low** Adverse effects are not likely to be measurable or noticeable over the planning horizon	**Medium** Natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Minor Adverse Effect (Not Significant)**
Decreased Surface Water Quality Due to Effluent Discharges *(Project-specific and Cumulative Effects)*	Operations and Maintenance	Surface Waterbodies / Watercourses High Sensitivity Fish Habitat	**Medium** Changes in surface water quality represent small measureable changes relative to baseline conditions and may exceed a reference criterion or guideline value on occasion or at an individual location (i.e., a location where treated effluent is discharged to the same watercourse from another project/activity)	**Low** Adverse effects are likely to be measureable within an area immediately downstream of a project or activity. New watercourse crossings are sufficiently widespread across the RSA such that substantial overlaps in effects are not likely.	**Medium** Adverse effects are measureable and ongoing effects related to the Operations and Maintenance Phase of the 407 East Transportation Corridor and/or other transportation infrastructure projects	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Several project and activities causing the cumulative effects are likely to affect the same watercourse as the 407 East Transportation Corridor	**Medium** Measurable effects are likely to persist for some time over the planning horizon, but regional trends are reversible.	**Medium** Natural watercourses are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**
Increased Loss of Vegetation and Vegetation Communities *(Project-specific and Cumulative Effects)*	Construction	Forested Areas Specialized and Sensitive Wildlife Habitat	**Medium** Adverse effects represent a small change relative to existing conditions.	**Medium** Adverse effects are measureable within the RSA.	**Low** Adverse effects are the result of short term losses limited to within the planning horizon	**Low** Project-specific adverse effects are effectively one-time events **Medium** Cumulative effects are the results of several projects or activities likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon (i.e., cumulative losses of vegetation communities will not occur all at once)	**Medium** Measurable effects are likely to persist for some time over the planning horizon, but regional trends are reversible given MTO's plans to restore, enhance and create vegetation and vegetative communities and other regional initiatives.	**High** Forested areas are not common across the RSA. Abundance and quality is required for the resource / VEC to continue to fulfill its ecological functions.	**Minor Adverse Effect (Not Significant)**

Table 8-2 Significance of Residual Adverse Effects

Residual Adverse Effects	Project Phase	VEC Affected	Significance Levels						Overall Significance of Residual Adverse Effects
			Magnitude	*Extent*	*Duration*	*Frequency*	*Permanence*	*Ecological Importance (of resource or VEC)*	
Reduced Area of Interior Forest Habitat *(Project-specific and Cumulative Effects)*	Construction	Forested Areas with Interior Habitat Specialized and Sensitive Wildlife Habitat	**Medium** Adverse effects represent a small change relative to existing conditions. Reduced area of interior forest habitat may exceed a reference criterion or guideline value at an individual location (i.e., an individual woodlot and/or a woodlot affected by multiple projects)	**Medium** Adverse effects are measureable within the RSA.	**Low** Adverse effects are the result of short term losses limited to within the planning horizon	**Low** Project-specific adverse effects are effectively one-time events **Medium** Cumulative effects are the results of several projects or activities likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon (i.e., cumulative losses of vegetation communities will not occur all at once)	**High** Cumulative effects on interior forest habitat are not readily reversible despite MTO's plans to restore, enhance and create vegetation and vegetation communities. Interior forest habitat of similar function to that lost is very difficult to replace.	**High** Interior forest habitat not common across the RSA. Abundance and quality is required for the resource / VEC to continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**
Reduced Quality/ Function of Retained Vegetation and Habitat *(Project-specific and Cumulative Effects)*	Construction, Operations and Maintenance	Forested Areas Forested Areas with Interior Habitat Specialized and Sensitive Wildlife Habitat	**Medium** Reduced quality of vegetation and habitat may be noticeable at an individual location (i.e., an individual vegetation community and/or a vegetation community affected by multiple projects)	**Low** Adverse effects are likely to be noticeable in close proximity to the 407 East Transportation Corridor and/or other projects and activities	**Medium** Adverse effects are ongoing effects related to the Construction, Operations and Maintenance Phases of the 407 East Transportation Corridor and/or those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Several project and activities causing the cumulative effects are likely to affect the same watercourse as the 407 East Transportation Corridor	**Medium** Adverse effects are likely to persist for some time over the planning horizon, but regional trends are reversible.	**High** Forested areas are not common across the RSA. Abundance and quality is required for the resource / VEC to continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**
Increased Loss of Wetland Areas *(Project-specific and Cumulative Effects)*	Construction	Wetlands	**Medium** Adverse effects represent a small change relative to existing conditions.	**Medium** Adverse effects are measureable within the RSA.	**Low** Adverse effects are the result of short term losses limited to within the planning horizon	**Low** Project-specific adverse effects are effectively one-time events **Medium** Cumulative effects are the results of several projects or activities likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon (i.e., cumulative losses of wetlands will not occur all at once)	**Medium** Measurable effects are likely to persist for some time over the planning horizon, but regional trends are reversible given MTO's plans to restore, enhance and create wetlands and other regional initiatives.	**High** Wetland areas are not common across the RSA. Abundance and quality is required for the resource / VEC to continue to fulfill its ecological functions.	**Minor Adverse Effect (Not Significant)**
Reduced Quality/ Function of Retained Portions of Wetlands	Construction, Operations and Maintenance	Wetlands Specialized and Sensitive Wildlife Habitat	**Medium** Reduced quality of wetlands and habitat may be noticeable at an individual location (i.e., an individual wetland and/or a wetland affected by multiple projects)	**Low** Adverse effects are likely to be noticeable in close proximity to the 407 East Transportation Corridor and/or other projects and activities	**Medium** Adverse effects are ongoing effects related to the Construction, Operations and Maintenance Phases of the 407 East Transportation Corridor and/or those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Several project and activities causing the cumulative effects are likely to affect the same wetlands as the 407 East Transportation Corridor	**Medium** Adverse effects are likely to persist for some time over the planning horizon, but regional trends are reversible.	**High** Wetland areas are not common across the RSA. Abundance and quality is required for the resource / VEC to continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**

Table 8-2 Significance of Residual Adverse Effects

Residual Adverse Effects	Project Phase	VEC Affected	Significance Levels						Overall Significance of Residual Adverse Effects
			Magnitude	*Extent*	*Duration*	*Frequency*	*Permanence*	*Ecological Importance (of resource or VEC)*	
Restrictions to Wildlife Movement and Increased Wildlife Mortality *(Project-specific and Cumulative Effects)*	Construction Operations and Maintenance	Mammals and Amphibians	**Medium** Adverse effects are likely to be noticeable and/or measureable at an individual location	**Low** Adverse effects are likely to be measureable in close proximity to the 407 East Transportation Corridor and/or other projects and activities	**Medium** Adverse effects are ongoing effects related to the Construction, Operations and Maintenance Phases of the 407 East Transportation Corridor and/or those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Low** A few projects or activities causing the cumulative effect are likely to occur along the 407 East Transportation Corridor. These are likely to occur periodically over the planning horizon	**Medium** Measureable or noticeable effects are likely to persist for some time over the planning horizon. Adverse regional trends are potentially reversible as wildlife become habituated to the presence of the transportation corridor.	**Moderate** VEC species are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**
Disruption to Wildlife Within the Retained Portions of Vegetation Communities and Wetlands *(Project-specific and Cumulative Effects)*	Construction Operations and Maintenance	Mammals, Amphibians, Breeding/Migratory Birds Federal (COSEWIC) Species at Risk	**Medium** Disruption may be noticeable and/or measureable. Adverse effects may exceed a reference criterion or guideline value at an individual location (i.e., an individual vegetation community or wetland affected by multiple projects)	**Low** Adverse effects are likely to be measureable in close proximity to the 407 East Transportation Corridor and/or other projects and activities	**Medium** Adverse effects are ongoing effects related to the Construction, Operations and Maintenance Phases of the 407 East Transportation Corridor and/or those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Several project or activities are likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon	**High** Cumulative effects are not readily reversible despite the implementation of mitigation / compensation.	**Moderate** VEC species are common and abundant. The resource / VEC will continue to fulfill its ecological functions.	**Moderate Adverse Effect (Not Significant)**
Removal of Individual Butternut Trees *(Project-specific and Cumulative Effects)*	Construction	Federal (COSEWIC) Species at Risk (i.e., Butternut Trees)	**Medium** Adverse effects represent small changes relative to existing conditions.	**Medium** Adverse effects are measureable within the RSA.	**Low** Adverse effects are the result of short term losses over the planning horizon	**Low** Adverse effects may occur periodically during the construction phase and/or as a result of a few other projects/activities that are likely to occur along the 407 East Transportation Corridor	**Low** Measureable or noticeable effects on the overall Butternut tree population are not likely to persist over the planning horizon (i.e., up to 2031). MTO's mitigation and/or compensation measures, mitigation measures of other projects and activities and the implementation of a recovery strategy for this species will ensure that long term adverse effects do not persist.	**High** Butternut trees are not common in the RSA.	**Minor Adverse Effect (Not Significant)**
Increased disruption to Redside Dace Habitat *(Project-specific and Cumulative Effects)*	Construction	Federal (COSEWIC) Species at Risk (i.e., Redside Dace Habitat)	**Medium** Adverse effects represent small changes relative to existing conditions.	**Low** Adverse effects are likely to be measureable in close proximity to the transportation corridor and/or other projects and activities	**Low** Adverse effects are the result of short term disturbances over the planning horizon	**Low** Adverse effects are effectively one-time events **Medium** Cumulative effects are the results of several projects or activities likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon (i.e., cumulative losses of vegetation communities will not occur all at once)	**Low** Given *Fisheries Act* requirements for mitigation and compensation, measurable project specific and cumulative effects attributable to the 407 East Transportation Corridor are not likely to persist over the planning horizon.	**High** Redside Dace habitat is not common in the RSA.	**Minor Adverse Effect (Not Significant)**

Table 8-2 Significance of Residual Adverse Effects

Residual Adverse Effects	Project Phase	VEC Affected	Significance Levels						Overall Significance of Residual Adverse Effects
			Magnitude	*Extent*	*Duration*	*Frequency*	*Permanence*	*Ecological Importance (of resource or VEC)*	
Increased disruption to habitat of Blandings Turtle and Golden-winged Warbler *(Project-specific and Cumulative Effects)*	Construction, Operations and Maintenance	Mammals, Amphibians, Breeding/Migratory Birds Federal (COSEWIC) Species at Risk	**Low** Adverse effects are likely to be measurable and/or noticeable within the known habitats of these two species along the 407 East Transportation Corridor	**Low** Adverse effects are likely to be measureable in close proximity to the transportation corridor and/or other projects and activities	**Medium** Adverse effects are ongoing effects related to the Construction, Operations and Maintenance Phases of the 407 East Transportation Corridor and/or those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Low** A few projects or activities causing the cumulative effect are likely to occur along the 407 East Transportation Corridor. These are likely to occur periodically over the planning horizon	**Low** Given the *Endangered Species Act* requirements for mitigation, measurable project-specific and cumulative effects attributable to the 407 East Transportation Corridor are not likely to persist over the planning horizon.	**High** Species at Risk habitats are not common in the RSA.	**Minor Adverse Effect (Not Significant)**
Changes in Community Character *(Project-specific and Cumulative Effects)*	Construction, Operations and Maintenance	Community Character	**Medium to High** Adverse effects due to changes in landscape composition are likely to represent a large change relative to baseline conditions in a Regional Study Area context. Cumulative effects due to fugitive dust, noise and light may be noticeable and/or measureable at an individual location	**Medium** Adverse effects are likely to be noticeable or measurable in most hamlets / built up areas traversed by the 407 East Transportation Corridor.	**Medium** Adverse effects are ongoing effects related to both the Construction and Operations and Maintenance Phases of the 407 East Transportation Corridor and/or those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions. **Medium** Several projects or activities are likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon (i.e., community character is not likely to change all at once).	**High** Adverse effects are not readily reversible despite the implementation of mitigation / compensation, including MTO's Community Value Plan	**N/A**	**Moderate Adverse Effect (Not Significant)**
Reduced Agricultural Activity *(Project-specific and Cumulative Effects)*	Construction, Operations and Maintenance	Agricultural Operations Class 1,2 and 3 Agricultural Soils	**Medium** Adverse effects represent small measureable changes relative to existing conditions.	**Medium** Adverse effects are measureable within the RSA.	**Low** Adverse effects are the result of short term losses over the planning horizon.	**Low** Adverse effects are the result of a one-time event **Medium** Cumulative effects are the results of several projects or activities likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon	**High** Adverse effects are not readily reversible despite the implementation of mitigation / compensation.	**N/A**	**Moderate Adverse Effect (Not Significant)**
Disruption to the Use and Enjoyment of Private Property *(Project-specific and Cumulative Effects)*	Construction Operations and Maintenance	Use and Enjoyment of Private Property	**Medium** Adverse effects represent small measureable changes relative to baseline conditions and may exceed a reference criterion or guideline value on occasion or at an individual location (i.e., at a specific residential location)	**Low** Adverse effects are likely to be noticeable or measurable within areas immediately surrounding the 407 East Transportation Corridor and within a few hamlets / built up areas traversed by the transportation corridor.	**Medium** Adverse effects are ongoing effects related to both the Construction and Operations and Maintenance Phases of the 407 East Transportation Corridor and those of other projects and activities	**High** Conditions or phenomena causing Project-specific effects to occur are ongoing conditions **Medium** Cumulative effects are the results of several projects or activities likely to occur along with the 407 East Transportation corridor. These are likely to occur periodically over the planning horizon	**Medium** Adverse effects are likely to persist for some time over the planning horizon for existing residents.	**N/A**	**Minor Adverse Effect (Not Significant)**

8.1.1 Government and Public Comments

The RAs reviewed MTO's significance assessment framework and cumulative effects analysis, cautioning MTO that a small change in the environment relative to existing conditions that reflects an ongoing trend in the environment is not a rationale for why the magnitude of a given effect would be less severe. The RAs indicated that the purpose of a cumulative effects analysis was to avoid the significant compounding of effects associated with these sort of trends. MTO completed its cumulative effects analysis in a manner that placed the effects of the Project into its broad cumulative effects context, but assessed the significance of cumulative effects within a revised framework that reflected differences in the magnitude of the cumulative change in the environment relative to existing conditions, thereby taking into consideration the relative contribution of the Project to ongoing trends in the environment. After the preparation of draft environmental screening report (December 2009), MTO revised the significance assessment framework to take into account both project-specific and cumulative effects. MTO modified the significance determination from those initially presented in the draft environmental screening report (December 2009) to reflect views of the CEA Agency and RAs following the preparation of the Comprehensive Study Guidelines document.

9. Monitoring and Follow-up

In accordance with the Comprehensive Study Guidelines document, the need for a follow-up program was considered for the purpose of determining if the identified environmental effects of the Project are as predicted in the EA, as well as to confirm whether the proposed mitigation or compensation measures are effective or whether new mitigation measures will be subsequently required. A follow-up program will be designed and implemented.

9.1 Government and Public Comments

Provincial government comments included both points of clarity and technical review comments. The key technical comments offered by the MOE related to the uncertainty that exists in determining residual impacts of the project on surface water, and the degree to which the proposed mitigation measures will be effective. The MOE recommended that a long term monitoring plan be developed with the minimum objectives of assessing effects to surface water features resulting from reduction in groundwater influence, gauging the effect of the SWM facilities on the water quality with particular emphasis to thermal impacts on the sensitive coldwater receptors; gauging the effectiveness of the mitigation measures and including a commitment to implement further mitigation actions if needed. MTO indicated that it is prepared to discuss the scope of the monitoring that would be required to satisfy the MOE and others.

Other comments related to the involvement of the MOE, other ministries, agencies, municipalities that may have an interest or role in the development of EMPs, scheduling, and MTO's plans for compliance monitoring. MTO indicated that the EMPs are intended to be a tool by which MTO and/or their agent can demonstrate how the EA commitments, monitoring requirements and approval conditions have been addressed through subsequent design phases and construction. MTO indicated that they will consult with regulatory and municipal staff during subsequent design phases to finalize the design, mitigation/compensation measures and monitoring requirements, but that no direct consultation is anticipated in the compilation / preparation of the EMPs. MTO proposed that compliance would be reported to the MOE EAAB via a letter and associated documentation (e.g. technical memorandums, etc.) to confirm that the EA commitments have been addressed / fulfilled.

The MOE also requested clarity with respect to when specific groundwater wells would be monitored and indicated that a plan for water quality and quantity/flow monitoring will need to be included as part of the Conditions of any Permits To Take Water (PTTW) issued for dewatering. MTO responded that specific groundwater wells will be monitored before, during and after construction and that a monitoring plan would be developed prior to the submission of PTTW applications.

EC provided comments on the MTO's commitments related to monitoring and follow-up. EC recommended that MTO and the RAs consider the need to visually monitor dust conditions and ensure compliance with any special contractual provisions governing dust control, heavy equipment operation / emissions, etc. be referenced as an inspection/monitoring requirement. In regard to water quality monitoring EC noted that post-construction/operational monitoring, notably to verify the effectiveness of thermal impacts on cold water fisheries, was not proposed by MTO. In order to ensure the proposed mitigation is effective in minimizing adverse environmental effects of the projects, EC recommended that the RAs obtain commitments from the proponent to take any contingency actions necessary if the proposed monitoring finds that the mitigation measures are not functioning as intended (e.g., suspend/reschedule work; repair/replace damaged mitigation; re-assess, re-design and re-construct, etc.).

MTO responded to these comments, indicating that dust will be monitored by the contract administrators and contingency measures taken as appropriate. MTO indicated that it is willing to discuss monitoring requirements

related to thermal effects and will submit any defined monitoring requirements to Environment Canada, including monitoring of sensitive watercourses as a requirement for ESA permit(s). MTO confirmed that the mitigation commitments requested by EC would be addressed through the relevant provincial and federal permitting processes. To this end, DFO confirmed that its requirements for monitoring will be contained in its *Fisheries Act* Authorization, including provisions for compliance monitoring. DFO indicated that monitoring of potential thermal effects of stormwater management facilities will not be contained in its *Fisheries Act* Authorizations as there are no federal requirements for authorization of stormwater management facilities.

Finally, pursuant to the approval granted by the Ontario Minister of Environment on June 3, 2010, MTO will be required to prepare and implement:

- a *Surface Water Monitoring and Mitigation Plan*. The plan would describe the locations, methods, parameters, frequencies and schedule for the collection of surface water quality data prior to and subsequent to construction;
- a *Construction Noise, Vibration and Air Quality Impact Mitigation Plan.* The plan would describe the locations, methods, parameters/contaminants and frequencies for the collection of ambient air quality data;
- *Vegetation Restoration Plans*; and
- *an EA Compliance Monitoring Program.* The program shall describe how MTO will monitor its fulfilments of the provisions of the EA pertaining to mitigation measures, public consultation and additional studies and work to be carried out, and the fulfilment of other commitments made in the EA and/or through Conditions of Approval.

The Provincial Conditions of Approval also require MTO to prepare an annual compliance report that would be included in the public record. MTO is also required to ensure that its contractors and subcontractors adhere to EA commitments, applicable regulatory standards and provide information and training regarding these commitments.

10. Conclusions and Recommendations

10.1 Conclusion of MTO on the Draft Comprehensive Study Report

In accordance with subsection 17(1) of the *CEA Act*, the CEA Agency delegated the preparation of the draft Comprehensive Study report for the 407 East Transportation Corridor to the MTO. This report contributes to fulfilling the requirements of the *Canadian Environmental Assessment Act* and was prepared in accordance to the Comprehensive Study Guidelines document issued by the CEA Agency in July 2010.

MTO's analysis and conclusion on the significance of the potential project effects on 407 East Transportation Corridor project has taken into account:

- The draft Comprehensive Study report, which includes a description of the potential environmental effects by environmental component and the evaluation of the significance of residual effects;
- Identified mitigation measures to be implemented;
- The review of relevant reports and technical studies from the body of documentation available for this Project;
- Comments on the Project made by federal and provincial agencies, municipalities, stakeholders and the public and Aboriginal groups;
- the Provincial Conditions of Approval; and
- Commitments made by MTO to carry out environmental monitoring and follow-up.

Based on this information, the MTO's conclusion is the proposed 407 East Transportation Corridor project is not likely to cause significant adverse environmental effects.

11. Acronyms

Acronym	Definition
407 EAC	407 East Advisory Committee
AACQ	Ambient Air Quality Criteria
ANSI	Area of Natural and Scientific Interest
BHR	Built Heritage Resource
BMP	Best Management Practice
CAG	Community Advisory Group
CCME	Canadian Council for Ministers of the Environment
CEA	Canadian Environmental Assessment
CEAR	Canadian Environmental Assessment Registry
CHER	Cultural Heritage Evaluation Report
CHL	Cultural Heritage Landscape
CLOCA	Central Lake Ontario Conservation Authority
CNR	Canadian National Rail
CO	Carbon Monoxide
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPR	Canadian Pacific Rail
CSR	Comprehensive Screening Report
CTA	Canadian Transportation Agency
CVP	Community Value Plan
CWS	Canada Wide Standard
dBA	Decibels (Acoustic)
DFO	Department of Fisheries and Oceans Canada
EA	Environmental Assessment
EAA	Environmental Assessment Act
EC	Environment Canada
EDL	East Durham Link
EMP	Environmental Management Plan
ERD	Environmental Reference for Highway Design
ESA	Endangered Species Act
ESC	Erosion and Sediment Control
ESR	Environmental Screening Report
FA	Federal Authority
FEAC	Federal Environmental Assessment Co-ordinator
FGCA	Forest Gene Conservation Association
FHWA	Federal Highway Administration
FOI	Freedom of Information
GRCA	Ganaraska Region Conservation Authority
GRT	Government Review Team
HADD	Harmful Alteration, Disruption or Destruction
HC	Health Canada
IEA	Individual Environmental Assessment
LID	Low Impact Development
LSA	Local Study Area

Acronym	Definition
MCL	Ministry of Culture
MNO	Métis Nation of Ontario
MNR	Ministry of Natural Resources
MTAG	Municipal Technical Advisory Group
MTO	Ontario Ministry of Transportation
NAAQO	National Ambient Air Quality Objective
NEB	National Energy Board
NHS	National Heritage Status
NNL	No Net Loss
NO_x	Oxides of Nitrogen
NRCan	Natural Resources Canada
NSA	Noise Sensitive Area
NWPA	Navigable Waters Protection Act
OG	Original Ground
OGS	Oil and Grit Separator
OHSA	Ontario Health and Safety Act
OPSS	Ontario Provincial Standards Specifications
ORM	Oak Ridges Moraine
PICs	Public Information Centres
PM	Particulate Matter
PM_{10}	Inhalable Particulate Matter
$PM_{2.5}$	Respirable Particulate Matter
PSW	Provincially Significant Wetland
PTTW	Permit to Take Water
QEW	Queen Elizabeth Way
RA	Responsible Authority
RAG	Regulatory Advisory Group
RMF	Risk Management Framework
ROW	Right-of-Way
RSA	Regional Study Area
SARA	Species at Risk Act
SRP	Spills Response Plan
SSA	Site Study Area
SSWH	Specialized or Sensitive Wildlife Habitat
SWAMP	Stormwater Assessment and Monitoring Performance
SWHTG	Significant Wildlife Habitat Technical Guide
SWM	Stormwater Management
TC	Transport Canada
TDM	Travel Demand Management
ToR	Terms of Reference
TPR	Technically Preferred Route
TRCA	Toronto and Region Conservation Authority
TRR	Technically Recommended Route
TSM	Transportation Systems Management
TSP	Total Suspended Particulate Matter

Acronym	Definition
TSS	Total Suspended Solids
VECs	Valued Ecosystem Components
VOCs	Volatile Organic Compounds
WDL	West Durham Link

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