10 ENVIRONMENTAL EFFECTS AND MITIGATION OF THE RECOMMENDED PLAN

This section identifies the impacts on environmental features resulting from the Recommended Plan as described in Chapter 9 and summarizes the proposed measures for mitigation.

As noted in Chapter 9, subsequent to the selection and presentation of The Windsor-Essex Parkway, Plaza B1 and Crossing X-10B as the components of the TEPA, several refinements were developed. These refinements were based on additional technical analysis and stakeholder consultation, with the objectives of further enhancing the benefits or mitigating the effects of the TEPA and are discussed in more detail in the introduction to Chapter 9.

A factor-specific assessment and analysis of environmental impacts was carried out for the TEPA. The refinements to the TEPA were being undertaken during the summer and fall of 2008, in parallel with the factor-specific analysis. The analysis undertaken for the TEPA has been reviewed and updated for the Recommended Plan, as appropriate. The updated work is documented in a series of technical memoranda listed below. In the case of the reports dealing with Natural Heritage and Landscape Planning, timing permitted inclusion of the Recommended Plan in the original technical reports, and no technical memorandum is required.

The most significant refinement to the TEPA is the modification to the alignment of The Windsor-Essex Parkway, which has been shifted to the north, to integrate The Windsor-Essex Parkway into the E.C. Row Expressway corridor, further away from the Spring Garden area. This refinement was included in the assessment of the impacts that are summarized in the following sections of this chapter.

In summary, all of the mitigation measures outlined in this chapter apply to the Recommended Plan

List of Technical Reports and Memoranda

- *Air Quality Impact Assessment - Technically and Environmentally Preferred Alternative (December 2008)*
- *Air Quality Impact Assessment – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Human Health Risk Assessment - Technically and Environmentally Preferred Alternative (December 2008)*
- *Human Health Risk Assessment – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Social Impact Assessment - Technically and Environmentally Preferred Alternative (December 2008) –*
- *Social Impact Assessment – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Noise & Vibration Impact Assessment - Technically and Environmentally Preferred Alternative (December 2008)*
- *Noise & Vibration Impact Assessment – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Built Heritage Impact Assessment - Technically and Environmentally Preferred Alternative (December 2008)*
- *Built Heritage Impact Assessment – The Recommended Plan Analysis – Technical Memorandum (December 2008*
- *Archaeological Assessment - Technically and Environmentally Preferred Alternative (December 2008)*
- *Archaeological Assessment – The Recommended Plan Analysis – Technical Memorandum (December 2008*
- *Natural Heritage Assessment - The Recommended Plan (December 2008)*
- *Urban Design and Landscape Planning Report – The Recommended Plan (December 2008)*
- *Draft Practical Alternatives Evaluation Working Paper – Economic Impact (May 2008)*
- *Economic Impact – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Draft Practical Alternatives Evaluation Working Paper – Waste and Waste Management (May 2008)*
- *Waste and Waste Management – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Existing and Planned Land Use – The Recommended Plan Analysis – Technical Memorandum (December 2008)*
- *Draft Practical Alternatives Evaluation Assessment Report – Existing and Planned Land Use (May 2008)*

It should be noted that all of the environmental factors, with the exception of the Human Health Risk Assessment have been used at every evaluative stage leading to the development of the Recommended Plan. The Human Health Risk Assessment was conducted for the Recommended Plan.

To facilitate the reader's understanding of this section, some background information drawn from the technical reports and technical memoranda is included for each factor.

The methodologies for the various investigations are consistent with the work plans that were prepared by the study team and reviewed by applicable agencies and interested stakeholders. This approach is also consistent with the approved *EA Terms of Reference (ToR)*, May 2004.

For each factor, including the Human Health Risk Assessment, the analysis of the environmental effects has been made of the future "No-Build" case and for the Recommended Plan.

10.1 Air Quality

ASSESSING AIR QUALITY IMPACTS

The Ontario Ministry of the Environment (MOE) as a component of the MOE standard setting process has developed a list of the Ambient Air Quality Criteria (AAQCs). The AAQCs are effect-based levels in air, with variable averaging time (e.g., 24-hour, 1 hour and 10 minutes) appropriate for the effect that it is intended to protect against. The AAQCs, which represent desirable levels in ambient air, are used for assessing general air quality and the potential for causing an adverse effect. The Standards Development Branch of the MOE publishes a set of guideline limits in *Ontario's Ambient Air Quality Criteria* (MOE, 2008). These criteria are not enforceable and with certain contaminants such as acrolein, the AAQCs are set below ambient background concentrations.

Federal Air Quality Objectives encompass three levels of air quality objectives: maximum desirable level (MDL), maximum acceptable level (MAL) and maximum tolerable level (MTL). The MAL is intended to provide adequate protection against effects on soil, water, vegetation, materials, visibility, personal comfort and well-being. The MAL is considered to be a realistic objective. Table 10.1 summarizes the applicable available criteria from the MOE and Environment Canada.

The existing air quality is greatly influenced by local, regional, and long range (cross-border) contaminants generated in upwind urban and industrial areas. The predominant wind directions in Windsor are from the west to southwest, which brings contaminants from the heavily industrialized areas of Detroit, nearby communities and beyond. Air quality impacts in the area are dominated by the substances that combine to produce smog or acid rain. A report by the Ministry of the Environment on *Transboundary Air Pollution in Ontario (2005)* indicates that for Windsor, eliminating all Ontario sources of emissions of $PM_{2.5}$ and NO_2 will have no impact on air quality during smog days due to the significant contribution from transboundary sources.

Air quality effects of the Recommended Plan and future "No-Build" have been assessed using a combination of existing air monitoring data and air dispersion modelling. Air dispersion modelling must be used to assess the impacts of future changes, such as implementation of the alternatives, and changes in fuels, vehicle technologies and traffic volumes. The predictive air quality model (CAL3QHCR) used is specifically designed to assess impacts from roads and highways. The model incorporates the differences between moving vehicles, and queued vehicles that are idling, as well as differences in road elevations and other parameters.

Potential air quality effects from roadways decrease with increasing distance from the roadway. Therefore, the greatest effects will occur immediately adjacent to the roadway.

TABLE 10.1 - AIR QUALITY CRITERIA FOR ASSESSED CONTAMINANTS

Contaminant	Averaging Time	MOE AAQC µg/m³ (ppb)	Federal AQ Objective or Maximum Acceptable Level (MAL) (µg/m³)
NO_x	1 h	400 (200)	400
	24 h	200 (100)	200
	Annual	-	100[1]
$PM_{2.5}$	24 h	30	30 *
PM_{10}	24 h	50 (interim)	-
PM	24 h	120	120
	Annual	60	70
Acrolein	24 h	0.08	-
	½ hr	0.24	-
SO_2	1 hr	690	900
	24 hr	275	310
	Annual	55	62
Carbon Monoxide (CO)	1 hr	36,200	36,200
	8 hr	15,700	15,700
Carbon Dioxide (CO2)	-	-	-
VOC	-	-	-
1,3 Butadiene	-	-	-
Benzene	-	-	-
Acetaldehyde	½ hr	500	-
	24 hr	500	-
PAHs[2]	24 hr-	22.5	-
Formaldehyde	24 hr	65	-

Notes
NO_x – nitrogen oxides – sum of nitrogen dioxide (NO_2) and nitric oxide (NO)
$PM_{2.5}$ includes all particulate matter with an aerodynamic diameter less than 2.5 µm – considered respirable
[1] MAL is for NO_2
- Indicates no criterion available
comes into force in 2010
2 – surrogate of naphthalene used

ASSESSMENT METHODOLOGY

The analysis of future air quality conditions was completed using the following approach:

- Compile data on contaminants listed in the Air Quality Work Plan, which was approved by regulatory agencies;
- Determine background concentrations;

- Input traffic data for future conditions, including The Windsor-Essex Parkway, Plaza B1 and Crossing X-10B;
- Calculate pollutant emissions from the highway corridor for existing and future conditions;
- Use air dispersion model (CAL3QHCR) with meteorological data from Windsor Airport to determine future air pollutant concentrations in the vicinity of the corridor (essentially all of west Windsor) and at sensitive receptor locations (such as schools and residences); and,
- Compare pollution concentrations corresponding to future "Build" and future "No-Build" conditions.

Data on the existing air pollutant concentrations in the Windsor area was obtained from two MOE air monitoring stations located on College Avenue and on University Avenue. These monitoring stations were considered representative of air quality in Windsor.

Traffic projections were developed for the Detroit River International Crossing study for all main roads in the corridor for each year considered in the assessment, which were 2015, 2025 and 2035. This included the future "No-Build" case (i.e. expected traffic volumes if no new access road/crossing is built), as well as for the Recommended Plan.

Emission rates from these vehicles were input into the CalTrans CAL3QHCR roadway dispersion model, which is accepted for use in Ontario by the MOE for assessment of transportation impacts and is supported by Environment Canada. Improvements in fuels and technologies legislated to occur over the next several years and historical fleet turnover rates were considered in these emission rates. The model incorporated meteorological data from Windsor Airport, to determine predicted air pollutant concentrations at over 2400 receptor locations in West Windsor.

The uncertainties and inevitable variability associated with predicting future traffic flows, weather conditions and emission rates place some limitations on the accuracy of model results; however, the results are useful and acceptable for comparing between the future "No-Build" and the Recommended Plan.

PREDICTED AIR QUALITY IMPACTS

In general, the air quality assessment shows that potential impacts from The Windsor-Essex Parkway would be small relative to background concentrations and limited to areas in close proximity to the road. The greatest benefit of The Windsor-Essex Parkway will be from the reduction in truck idling along the traffic corridor. Overall the implementation of The Windsor-Essex Parkway will mitigate future transportation related air quality impacts within the study area over the future "No-Build" alternative because it provides a wide right-of-way and improvements in traffic flow, by eliminating stop-and-go conditions caused by the traffic signals that exist in the Highway 3 / Huron Church Road corridor today.

The study found that in comparing future conditions to existing conditions for both future "No-Build" and with The Windsor-Essex Parkway, air quality will improve for gaseous pollutants, particularly NO_x, due to newer engine technologies and fuels despite the predicted increase in traffic due to population growth, but could slightly deteriorate for coarser particulate due to road dust arising from increased traffic flows. Standards for coarser particulate (PM_{10}) are based on visibility.

The results of the study show, that the existing air quality in the study area is typical of an urban setting, which is characterized by elevated pollutant concentrations in relation to rural areas, with periodic compromised air quality due to particulate based contaminants, which typically occurs during smog events.

Overall, based on the results of the study, the air dispersion modelling demonstrated that the potential air quality impacts arising from either future "No-Build" or the Recommended Plan would be very small and limited to nearby the roads.

In general terms, The Windsor-Essex Parkway will mitigate future transportation related air quality impacts within the study area for gaseous contaminants but may result in higher concentrations of PM within a limited distance from The Windsor-Essex Parkway. However, by implementing The Windsor-Essex Parkway, air quality improvements will be realized outside the Area of Continued Analysis (ACA), as traffic will be returned to the corridor, instead of infiltrating throughout local streets.

Air quality in the vicinity of the proposed plaza will be impacted relative to future "No-Build" within approximately 250 m from the Plaza property boundary by 2035. The highest impacts will likely occur within 50 to 100 m of the boundary. Given the location of the plaza in an industrial area, impacts to residential areas are minimized.

The results for the proposed crossing indicate that the maximum predicted concentrations of $PM_{2.5}$ and NOx are generally similar to those of The Windsor-Essex Parkway. Given the location of the crossing impacts to air quality for residential areas are not predicted.

The Ministry of the Environment (MOE) publishes air quality conditions in different locations in Ontario, including Windsor, through their Air Quality Index (AQI). This information is available to the public on an hourly basis. The AQI is an indicator of air quality based on the highest pro-rated hourly pollutant measurements of six common air contaminants, of which NO_2 and $PM_{2.5}$ are considered. The range of concentration of the contaminants determines the Air Quality Index. When $PM_{2.5}$ is the driver for air quality, a change of about 6 $\mu g/m^3$ is required to move the Index from one rating to another. For NO_2 the concentration differences required to move the Index from one rating to another is about 100 $\mu g/m^3$.

Air quality impacts generally follow expected trends based on the changes in vehicle emission factors and increases in traffic volumes over time. In summary, results of the modelling indicate that:

- the concentrations of the contaminants decrease as the distance from the roadway increases;
- with the exception of 1hr concentrations of NOx and 24 hr concentrations of $PM_{2.5}$ under maximum conditions in the vicinity of the proposed plaza, there are no differences in concentrations relating to the Recommended Plan that would cause the AQI to be degraded;
- gaseous contaminants generally reduce over time although the reduction is partially off-set by the increase in traffic; and
- the PM concentrations increase with time, as traffic volumes are predicted to increase from 2015 through 2035.

While not specifically included in the analysis, traffic conditions along Huron Church Road north of the E.C. Row towards the Ambassador Bridge are expected to decrease by approximately 20 per cent with the Recommended Plan. Congestion and traffic queuing should also decrease accordingly, thereby resulting in further air quality improvements.

MITIGATION MEASURES

The construction of the Recommended Plan has the potential to affect the air quality in the vicinity of the site during the construction phase. As with any construction site, these emissions will be of

relatively short duration and are unlikely to have any long-lasting effect on the surrounding area. Dust impacts should be mitigated through the use of proper controls, such as:

- periodic watering of unpaved (unvegetated) areas;
- periodic watering of stockpiles;
- limiting speed of vehicular travel;
- use of water sprays during the loading, unloading of materials;
- sweeping and/or water flushing of the entrances to the construction zones; and,
- use of calcium chloride.

Road sweeping practices in accordance with maintenance standards will be employed to reduce silt loading on The Windsor-Essex Parkway.

These types of controls aid in minimizing impacts to the environment during the construction phase.

10.1.1 Human Health Risk Assessment

The primary objective of the Human Health Risk Assessment (HHRA) was to help determine the potential for an overall adverse effect on human health for residents in the immediate area of the Recommended Plan.

Human Health Risk Assessments are used to determine if a particular chemical poses a significant risk to human health. If it were possible to prevent humans from being exposed to chemicals then there would be no need to conduct a risk assessment. Since it is impossible to prevent such exposure, and since exposure to many naturally occurring substances also pose health risks, risk assessments become an important tool in evaluating these risks.

Risk assessment helps scientists and regulators identify serious health hazards and determine ways to reduce exposure so that there is no significant health risk to the public. The term “human health risk assessment” is often misinterpreted because people think that a risk assessment will provide information as to whether an exposure to a chemical causes a current health problem or symptom that they are experiencing. Risk assessments do not provide this information; studies that look for these types of linkages are generally epidemiological studies. These studies generally include a survey of health problems in a community and provide a comparison of these health problems to other cities, communities or populations as a whole.

While both of these types of studies are important, health risk assessments and epidemiological studies have different objectives. Most epidemiological studies examine whether past chemical exposures may be responsible for documented health problems in a specific group of people whereas human health risk assessments evaluate whether current or future chemical exposures will pose health risks to a broad population such as a city or a community. The scientific methods used in a human health risk assessment cannot be used to link individual illnesses to past exposures to chemicals; additionally, health risk assessments and epidemiological studies cannot prove that a specific chemical caused an individual’s illness.

Regulatory bodies use risk assessments to determine drinking water guidelines, site clean-up criteria, and the safe use of pesticides, to name a few. Human health risk assessments use both sound science and professional judgment and are a constantly developing process.

Health Canada has carried out a preliminary epidemiological study in the Windsor area related to mortality and cancer incidence for the period 1979-1999. The results suggest a potential risk for diseases associated with long-term air pollution exposure such as bronchitis, emphysema, lung cancer and lung cancer incidence and mortality from circulatory diseases. These diseases were attributed to transborder air pollution but are preliminary in nature and further studies are underway to assess chronic cardiorespiratory outcomes in relation to air and traffic pollution.

HUMAN HEALTH RISK ASSESSMENT PROCESS

The primary objective of the human health risk assessment was to help interpret the potential for an overall adverse effect of the Recommended Plan, including potential adverse effects to people and in the immediate area surrounding the proposed roadway. The human health risk assessment used the predicted concentrations for the Recommended Plan that were provided in the Air Quality Impact Assessment. The plaza and crossing were not assessed in the Human Health Risk Assessment since there were no nearby receptors (see *Air Quality Impact Assessment - Technically and Environmentally Preferred Alternative (December 2008)* for more details). Three horizon years (2015, 2025 and 2035) were evaluated in the risk assessment.

The methods followed in this risk assessment comply with procedures outlined by regulatory agencies such as Ontario Ministry of the Environment, Environment Canada, Health Canada, the Canadian Council of Ministers of the Environment (CCME) and the United States Environmental Protection Agency (U.S. EPA).

The chemicals of concern identified in the Air Quality Impact Assessment (refer to Section 10.1) were gaseous air pollutants (nitrogen oxides (NO_2), and sulphur dioxide (SO_2)), fine particulate matter ($PM_{2.5}$), and volatile organic compounds (VOC) such as acrolein, acetaldehyde, benzene, formaldehyde and 1, 3-butadiene which are associated with vehicle emissions. The Human Health Risk Assessment used four different steps as provided in the various regulatory frameworks. They are:

- the problem formulation stage, in which the various chemicals of concern, receptors, exposure pathways, and scenarios are identified;
- the exposure assessment, where predicted exposures are calculated for the various receptors and chemicals of concern;
- the hazard assessment, in which exposure limits for the chemicals of concern are determined; and,
- the risk characterization stage, where the exposure and hazard assessment steps are integrated.

Since the Recommended Plan for the Detroit River International Crossing study is currently in the planning stage, it is not possible to directly measure emissions associated with the proposed roadway, their potential effect on the ground level air concentrations or possible health outcomes in the community. Therefore, various mathematical models for the prediction of emission rates were used. These are summarized in the document entitled, “*Air Quality Impact Assessment - Technically and Environmentally Preferred Alternative (December 2008)* to determine the exposure to various human receptors considered to be representative of the community. The risk assessment included exposure through inhalation and ingestion of chemicals associated with vehicle emissions through direct deposition to vegetation, as well as deposition to soils and uptake by vegetation.

ASSESSMENT METHODOLOGY

The Human Health Risk Assessment involved a comparative evaluation between the Recommended Plan for the Detroit River International Crossing and the existing conditions or future "No-Build" scenario in the local area as outlined in the Air Quality Impact Assessment (Section 10.1).

The possibility of short-term (1 hour, 8 hour, 24 hour) and long-term (annual) adverse human health outcomes were assessed based on exposures at the maximum concentration that would occur at different areas along The Windsor-Essex Parkway. The use of the maximum predicted pollutant concentrations in each area covered the range of air concentrations that potentially could occur from activities on The Windsor-Essex Parkway. Conservative assumptions of exposure were used in the assessment to ensure that risks were not underestimated and this most likely resulted in an over-estimate of exposure. One example of a cautious assumption is that it was assumed that residents were exposed to vehicle emissions 24 hours a day, 7 days a week over their entire lifetime.

The Human Health Risk Assessment results were expressed as deterministic (single point) hazard quotients and cancer risk levels for long-term exposures, as well as hazard quotient values for both short-term and long-term exposures to gaseous air pollutants. In general, regulatory agencies such as Health Canada, the Ontario Ministry of the Environment and the U.S. EPA concur that a hazard quotient value below one (1) (for assessing gaseous air pollutants since they include background), a hazard quotient of 0.2 (for pathways assessment examining direct and indirect exposure from air pathways) and an incremental life-time cancer risk level of one in a million (1×10^{-6}) are not considered significant and are legislated by the Ontario Ministry of the Environment. The use of an incremental risk limit of 1×10^{-6} as set out by the Ontario Ministry of the Environment is more stringent than the $1x10^{-5}$ incremental risk limit that is acceptable to Health Canada and the U.S. EPA.

PREDICTED HUMAN HEALTH RISKS

The short-term and long-term health risk associated with exposure to the gaseous air pollutants (SO_2 and NO_2) was assessed based on using a hazard quotient value of 1 since background exposures were taken into account. The results showed that:

- The emissions of sulphur dioxide (SO_2) arising from vehicles traveling along the roadway for the future "No-Build" and the Recommended Plan scenarios were similar to background. Therefore, short-term risks arising from exposure to SO_2 were no different to background and the Recommended Plan does not result in any increased risk in comparison to the future "No-Build" scenario.
- The short-term and long-term risks associated with NO_2 were similar to background. In general, the short term and long term risks associated with exposure to NO_2 for the Recommended Plan are lower than the future "No-Build" scenario, indicating that there is less risk to residents in communities surrounding The Windsor-Essex Parkway for the Recommended Plan scenario. This is due to the reduction of stops and starts and idling on The Windsor-Essex Parkway. The Air Quality Impact Assessment attributes the lower NO_2 concentrations to less stopping and starting and idling on The Windsor-Essex Parkway.

There are no health based thresholds for Total Particulate Matter; the World Health Organization has concluded that fine particulate matter ($PM_{2.5}$) is more hazardous to health than coarser particles such as PM_{10}. Fine particulate matter ($PM_{2.5}$) background concentrations in the Windsor area are relatively high and are above health based toxicity reference values. The predicted concentrations for background exposure to $PM_{2.5}$ accounts for a significant portion of the hazard quotient for both the future "No-Build" and the Recommended Plan scenarios. In general, the Recommended Plan scenario results in lower hazard quotients than the future "No-Build" scenario. Thus, the results of the risk assessment associated with ($PM_{2.5}$) demonstrate that in general, future risks to residents in communities adjacent to the Recommended Plan will be lower than the future "No-Build" scenario which indicates that there is less risk to residents in communities surrounding The Windsor-Essex Parkway for the Recommended Plan scenario. This is due to the reduction of stops and starts and idling on The Windsor-Essex Parkway.

The incremental cancer risk values for long-term exposure to carcinogenic VOCs were above the regulatory risk level of one-in-a-million (1×10^{-6}) as was background exposure. However, the incremental risks for the Recommended Plan were no different than the risks associated with background. Thus, the Recommended Plan does not result in increased incremental cancer risks over background.

Hazard quotients for non-carcinogenic VOCs (predicted exposure dose ÷ chronic toxicity reference value) for background, future "No-Build" and the Recommended Plan scenarios were below 0.2 for benzene and 1,3-butadiene. Hazard quotients for acrolein, acetaldehyde and formaldehyde were all above 0.2 for background for the future "No-Build" and the Recommended Plan scenarios. However, the hazard quotients for the Recommended Plan were no different than the risks associated with background. Thus, the Recommended Plan does not result in increased incremental adverse health risks over background since background air concentrations in the Windsor area accounts for the major exposure for residents.

CONCLUSIONS

Based on the risk assessment, the following key conclusion can be drawn:

- Predicted concentrations of gaseous air pollutants, fine particulate matter, and Volatile Organic Compounds for the future "No-Build" and the Recommended Plan scenarios are not much different from each other and background. Thus, the Recommended Plan does not result in an increased health risk over the future "No-Build" or background scenarios. This conclusion supports the findings of the Air Quality Impact Assessment.

An evaluation of the uncertainties in various measurements and methods used in the risk assessment indicated that the risks have been over-estimated as a result of the assumptions made about exposure (which were generally cautious) (i.e. assumptions were made to overestimate exposures). The results of this uncertainty analysis support the overall conclusion of the assessment that the Recommended Plan does not result in an increased health risk over the future "No-Build" or background scenarios.

10.2 Socio-Economic Environment

10.2.1 Noise and Vibration

The Ontario Ministries of Transportation (MTO) and Environment (MOE) have developed a series of policies and guidelines for assessing noise impacts from transportation projects which must be applied to all MTO projects in the province. In late 2006, the MTO released its *Environmental Guide for Noise* to provide guidance to MTO personnel and consultants in the analysis of highway noise and its effects.

In general terms, the noise impact is determined by comparing the predicted noise levels after implementation of the Recommended Plan with the predicted future "No-Build" noise levels experienced by sensitive receptors. Typically, where the predicted Recommended Plan noise level exceeds the future "No-Build" noise level by 5 or more decibels (dB), mitigation measures to reduce the predicted levels to within 5 dB of the future "No-Build" levels, are to be considered. However, additional mitigation may also be required in specific circumstances.

Vibration impact is usually evaluated in terms both human response to building vibration and potential for structural damage to buildings. It is generally accepted that 0.14 mm/sec is the threshold of vibration perception for the average person. As the vibration level increases from this threshold, the average person will become increasingly uncomfortable. At 50 mm/sec, vibrations are likely to cause structural damage to buildings.

ASSESSMENT METHODOLOGY

The methodology for estimating noise levels consisted of the following key steps for evaluation of the Recommended Plan:

- Traffic data were established for the base year (2006), as well as for future years (2015, 2025 and 2035), representing baseline conditions and conditions for the Recommended Plan. Also, certain key information was determined, including Annual Average Daily Traffic (AADT), percentage of automobiles, percentage of heavy and medium trucks, speed limit, road elevation, local topography, surrounding ground conditions, etc.
- Sensitive noise receptors along the Recommended Plan route were identified. The receptors selected for assessment were those that were most potentially impacted (i.e. subject to frontline exposure) by the Recommended Plan. Multiple receptors were selected to capture the anticipated variations in exposure to noise from traffic based on the alignment of existing roads, and variations in traffic volumes. On this basis, a total of 41 receptors were selected along The Windsor-Essex Parkway.
- Baseline future ("No-Build") and project noise levels were estimated at each of the receptors, using the MOE's STAMSON traffic noise model. This was performed for 2015, 2025, and 2035. The key inputs to the STAMSON noise model are: traffic volume, percentage of automobiles, percentage of heavy and medium trucks, posted speed limit, road gradient, road surface type, local topography, surrounding ground surface cover, noise source height, receptor height and source to receptor distance.
- The impact of the plaza/crossing was assessed based on two groups of receptors; a total of 21 and 13 receptors were identified in Sandwich Towne and areas between Ojibway Parkway to Malden Road, respectively.
- The CADNA-A noise model was used to estimate receptor noise levels for the plaza and crossing. This model can be used to predict noise levels from both stationary and mobile noise sources. The modelling approach considered vehicle queuing, idling and acceleration. The key inputs to this model included maximum hourly vehicular traffic (cars and trucks), plaza layout, vehicle sound levels, and locations of vehicles at plaza sites.

The methodology used for estimating vibration impacts consisted of the following key steps:

- Identify areas within the proximity to the crossing, plaza and access road alternatives that were potentially vulnerable to ground vibrations.
- Receptors within the potentially vulnerable areas were identified for vibration monitoring.
- Ground vibration levels were measured at two locations (side by side) at each of eight receptors. The traffic at each location was monitored over a period of 30 minutes. The monitoring was conducted over two different days to identify any differences in the vibration patterns. (Note: If traffic is busy, truck speed reduces considerably, thereby reducing the vibration levels).

PREDICTED NOISE AND VIBRATION IMPACTS

The following points summarize the noise and vibration impacts predicted at receptor locations near the Recommended Plan:

- In terms of construction related noise, additional details on construction equipment quantities, work schedules and duration will be available during subsequent design phases. However, based on past experience, it is anticipated that activities such as clearing, excavation, soil compaction, roadway construction, etc., would increase sound levels at receptor locations in close proximity to construction staging and work areas. A wide variety of mitigation measures can be employed to reduce construction noise at receptor locations.
- Without mitigation, noise exceedances of >5 dB were observed at many of the receptors along The Windsor-Essex Parkway when compared to the future "No-Build" sound levels. In several cases, an exceedance of >10 dB was predicted.
- Given their relative distances to sensitive receptors, the noise generated solely from the plaza location and crossing is not expected to cause a high noise impact. The noise modelling results show that a high noise impact (> 10 dB above future "No-Build" receptor sound levels) is predicted, without mitigation, for some of the receptors located in the Ojibway Parkway to Malden Road area.
- Baseline vibration levels were measured in 2006 at eight locations, including areas close to a church and houses. The Recommended Plan was reviewed to identify residences, hospitals and other potentially vulnerable receptors, within 25 m from the edge of the roadway. The results showed for the most part that, the levels measured were within the threshold of perception limit of 0.14 mm/sec. These levels decay slowly with distance at close proximities to the road edges and should the roadway contain an expansion joint, etc., these levels may increase to the threshold level of perception. Hence, as a precautionary measure, receptors within 25 m from the edge of the roadway were counted as potential locations where vibration levels could potentially reach the threshold value of 0.14 mm/sec.

MITIGATION RESULTS

While a number of specific mitigation measures are identified below, there will be an opportunity for refinement to these measures during the subsequent design phases of the project and through ongoing consultation with residents during the next stages of the project.

- The study determined that many locations adjacent to The Windsor-Essex Parkway, will realize reductions in noise levels and that most other locations will be below the threshold for hearing an increase in noise in comparison with the future "No-Build". The noise barrier locations are illustrated in the plan included in Appendix A Recommended Plan - Concept Design Plans.
- Vibration mitigation measures are not required for the Recommended Plan since vibration levels are not expected to approach 50 mm/sec which is the threshold for structural damage.

The following measures will be undertaken to mitigate noise during the construction phase of the Recommended Plan:

- Ensure that all construction equipment used are in good repair, fitted with functioning mufflers, and complies with the noise emission standards outlined in MOE guidelines.
- To the greatest extent possible, limit the most noisy construction activities to daytime hours.
- Where the sequencing of construction permits, permanent noise barriers and/or berms may be built during the early phases of construction in order to reduce construction noise levels at receptor locations.
- Maximize the distance between the construction staging areas and nearby receptors to the greatest extent possible.
- Maintain construction haul roads to prevent potholes and ruts to avoid the loud noise caused by construction vehicles travelling over uneven road surfaces.
- Develop a process for receiving, investigating and addressing construction noise complaints received from the public.

Consultation with communities will continue during the design and construction phases, to provide additional opportunities for input on noise mitigation measures during both the construction and operation stages.

CONCLUSIONS

Based on the noise and vibration analyses completed, the following key conclusions can be drawn:

- With a 5 m high barrier in place, the proposed project is predicted to result in no to a marginal noise impact for The Windsor-Essex Parkway It should also be noted that for many receptors, especially along the north side of the Windsor-Essex Parkway, a decrease in noise levels compared to future "No-Build" noise levels was predicted.
- For Plaza B1, a potential noise impact was identified for receptors in the Ojibway Parkway to Malden Road areas that are in the vicinity of the proposed approach roadway. However, the receptor sound levels can be reduced to within 5 dB above the future "No-Build" sound levels with a 5 m high acoustic barrier installed on the proposed approach roadway. Due to the relatively large distance between Crossing B and the closest receptors in Sandwich Towne, no noise mitigation measures are proposed for the Crossing.
- The Windsor-Essex Parkway is not expected to cause vibrations in the 50 mm/sec range; therefore, no structural damage is anticipated from vehicular traffic.
- Through the use of best practices, noise can be mitigated during the construction and operating phase.
- There will be opportunities for public input into specific noise mitigation measures during the next stages of design and construction.

10.2.2 Protection of Community and Neighbourhood Characteristics

Social impacts can be positive or negative but the goal within a specific undertaking is to produce an overall improved benefit to society (otherwise the project would have never been undertaken in the first place). However, with any project there remains the potential for parts of the population to be negatively impacted in particular those who work, live or recreate where an actual physical undertaking is to occur.

The Social Impact Assessment (SIA) examined the effects to the communities of South and West Windsor, LaSalle, and Tecumseh as a result of the proposed project activities. Within these larger communities a number of smaller neighbourhood communities were identified and studied as part of the SIA.

ASSESSMENT METHODOLOGY

The methodology and tools for predicting the social impacts of the Recommended Plan included both quantitative and qualitative data. Social data collection for this study included use of the social household questionnaire data, public consultation activities and comment forms, context sensitive solution workshops, and the review of information provided by the Ministry of Transportation (MTO) property agents. In addition, input from other disciplines was also incorporated.

The household questionnaire was initially administered to residents potentially displaced by one or more of the practical alternatives in July 2006. The household questionnaire was intended to capture information about the affected population, their sense of attachment (tenure, status of ownership), property usage, and the perceived effect of the Recommended Plan on their use and enjoyment of their property. Due to design refinements, including the addition of the green space buffer with The Windsor-Essex Parkway, additional households, not previously approached to complete a questionnaire, were identified. In addition, those households within the Recommended Plan that did not previously complete a questionnaire were also identified. For all of these households, residents were provided an opportunity to complete the questionnaire in August 2008.

A similar approach was taken in July 2006 for identifying and collecting data from social features displaced or potentially disrupted by the project. A facility-specific questionnaire was developed to collect data for potentially displaced or disrupted social features and was administered during an interview with the facility manager. The questionnaire and interviews collected information on programs, the service catchment area, number of users, and access to the facilities.

The Public Information Open Houses (PIOH) held June 18 & June 19, 2008 and the Context Sensitive Solution Workshop (CSS) held on June 24 & 25, 2008, regarding design features of the TEPA and mitigation measures to reduce impacts, provided the opportunity to obtain qualitative data from attendees. The PIOH and CSS were particularly helpful in gaining insight with respect to:

- Neighbourhood community character and cohesiveness;
- Satisfaction with the community as a place to live;
- Perceptions of the various components (tunnel locations, length, green space usage) of The Windsor-Essex Parkway alternative and related issues/concerns on how the proposed access road, may or may not effect residents and the community; and

- Unique features related to individual properties, and/or the neighbourhoods within the area of investigation.

Several neighbourhood meetings were also conducted at the request of residents (including two with Spring Garden/Bethlehem and Armanda Street residents, and one with Oliver Estates). These neighbourhood meetings were particularly helpful in gaining insight with respect to:

- Specific neighbourhood concerns;
- Specific neighbourhood design improvements, and
- Perceptions of how the Recommended Plan would impact residents and the neighbourhood.

PREDICTED SOCIAL IMPACTS

The Windsor-Essex Parkway

Key objectives of the community identified early in the study process included the removal of truck traffic from local streets and an overall improvement to the quality of life for residents living adjacent to the existing transportation corridor. In response to consultation input during the analysis and evaluation of practical alternatives, The Windsor-Essex Parkway was designed to help mitigate identified community concerns associated with the corridor. Benefits to the communities along the corridor provided by The Windsor-Essex Parkway include improving cross border traffic flow, separation of local and freeway traffic, the addition of over 300 acres of a green space buffer between the freeway/local service roads and adjacent residents, eleven tunnels providing greater connectivity between neighbourhood communities on both sides of the Highway 3/Huron Church Road corridor, and providing opportunities for 20 km of recreational trails.

The Windsor-Essex Parkway will result in displacement of approximately 360 homes, located along the periphery of neighbourhoods from Howard Avenue to Ojibway Parkway; changes to cohesion and character in some neighbourhood communities; the loss of 48 businesses; and, overall disruption and nuisance effects to both residents and the travelling public during the construction period.

The social features that are displaced by the project serve the broader community, and include the Montessori Pre-School, the Royal Canadian Legion, the Heritage Park Alliance Church, and Trillium Court Housing. In all cases, the Ministry of Transportation will assist these parties where possible to help ensure a seamless transition for the relocation of the facilities, programs and services offered by these social features.

The displacement of businesses along the proposed access road will have limited overall economic impact. Despite the immediate loss of revenue and employment, the loss of business will be offset by gains in other businesses, or the displaced businesses will relocate to other areas.

Noise attenuation for the effects of The Windsor-Essex Parkway have been addressed by locating much of the roadway below grade and through the construction of noise barriers or berms where necessary. Commitments are also being made to ensure that the construction noise is addressed through specific measures outlined in the Noise and Vibration Technical Report (*Noise and Vibration Assessment - Technically and Environmentally Preferred Alternative (December, 2008*) and in the *Noise and Vibration – The Recommended Plan Analysis – Technical Memorandum (December 2008).*

Emergency service providers have been consulted and are aware that they will need to reassess their resources, level of service and access routes for The Windsor-Essex Parkway, and in general, their ability to access their entire area of coverage, in order to ensure provincially mandated response times are met.

During construction, MTO has committed to maintaining traffic flow in the Highway 3/Huron Church Road corridor, and utilizing best practices for dust suppression and noise attenuation. Although by its very nature, the construction phase will result in disruption and nuisance effects to residents and the travelling public, the MTO commitment will minimize these impacts.

Plaza and Crossing

The plaza is located within the industrial lands along the Detroit River. Within the industrial park, there are only a small number of residents that did not move out with the creation of the industrial park. The five properties remaining will be displaced with the new plaza and crossing.

The only social feature to be displaced is the Erie Wildlife Rescue. This is a regional facility with unique requirements; however, its continued programming and services are not dependant on its existing location.

Generally, due to its location in industrially designated lands, the plaza will have limited social impacts. As discussed in the "*Draft Practical Alternatives Evaluation Working Paper – Economic Impact (May 2008)*" (Section 10.2.3), there are impacts associated with the loss of industrial park space; however, from a community perspective, the plaza will not change community character, and will impact few residents.

Nuisance impacts to residential areas associated with the operation of the plaza and crossing are not anticipated, given the significant distance from these areas.

MITIGATION MEASURES

The Windsor-Essex Parkway design was developed based on a combination of the practical below grade and tunnel alternatives. The alternative was developed to help mitigate identified community concerns including the need to provide and enhance community connections between neighbourhoods on either side of the freeway. The tunnel sections included as part of The Windsor-Essex Parkway have been strategically placed to maintain and enhance existing access across and along the corridor, as well as to provide new connections for roads, trails and wildlife linkages. In addition, the green space buffer along the corridor helps to protect adjacent residents from noise and dust affects associated with local and freeway traffic.

Other mitigation measures recommended to reduce the social impact on the broader and neighbourhood communities include those that are currently taking place and those actions that will take place during future design stages:

- Implementation of the "willing seller-willing buyer" property purchase program;
- Fair market value for properties required for the project;
- Develop and maintain regular communications with emergency services and the municipalities with regard to changes to the road network, municipal services, etc.
- Implement a communication process during construction to manage disruption effects experienced by residents;
- Assess the need for improvements to Montgomery Drive.

- For residents in the Spring Garden area, protect and maintain and landscape as much as possible to enhance the lands between the residences and the facility.
- For The Windsor-Essex Parkway, illumination will be designed to provide sufficient lighting for the roadways while limiting light trespass beyond the roadways, and full cut-off luminaires will be provided. Additional details of the illumination system will be determined during subsequent stages of design.
- Where practical, lighting used at the plaza should be designed to minimize light intrusion into surrounding areas, while ensuring adequate lighting for operational requirements. This may involve using full cut-off luminaires, shielding, if necessary, and investigating the use of conventional lighting in place of high mast lighting. Lighting should be focused downwards and shielded where necessary to prevent light spillage into nearby residential and community areas.

CONCLUSION

Despite the potential for impacts for a project of this magnitude, community consensus dating back to the time of the Planning/Need and Feasibility (P/NF) Study (2001 to 2004) supports the need for the project. For those who are directly impacted (businesses and residences displaced), strategies such as advance purchases have been offered as detailed in the mitigation measures. As detailed in Chapter 3, meetings with residents directly impacted by the Recommended Plan have occurred, leading to further analysis and refinements to the Recommended Plan and in some cases, additional property acquisition.

The extensive level of consultation associated with this project has provided MTO with strong insights into community impacts and, therefore, the ability to design and mitigate around those impacts to the extent that is feasible. With the commitments that MTO has made with regard to minimizing impacts to the neighbourhoods during construction, that is, maintaining access and traffic flow, implementing best practices for dust suppression and noise attenuation, residents will experience effects typical of highway construction projects.

It is recognized that the project will impact the adjacent neighbourhood communities to varying degrees. Through continued consultation with those impacted, residents can contribute to the management of the changes that affect them and their quality of life.

The operation of The Windsor-Essex Parkway will result in a number of benefits to the community and to the neighbourhoods along its route. Specific design features that collectively contribute to an improved quality of life for residents include:

- Placement of the highway below grade and the elimination of stop-and-go traffic.
- A 300 acre green space buffer protects adjacent neighbourhoods and residents from long term nuisance effects such as noise and dust generated by the freeway and service roads.
- Strategic placement of the 11 tunnels and noise barriers and earth berms
- Enhanced recreational opportunities as a result of the proposed trail network and green space.
- New and enhanced community linkages to neighbourhoods adjacent to and across the transportation corridor.

10.2.3 Economic Impacts

Individual business impacts were analyzed in terms of two categories: displaced businesses and disrupted businesses. Displaced businesses would cease to operate at their current location due to the physical alignment of The Windsor-Essex Parkway, plaza or crossing. These businesses will be financially compensated. A disruption to a business occurs when the proposed roadway, plaza or border crossing encroaches on a business' property, decreases the amount of passing traffic, or alters traffic access and/or visibility. When physical disruptions requiring property acquisition occur, financial compensation will be provided.

The positive and negative impacts of the alternatives on businesses beyond the ACA were also assessed. This included the impact of the alternatives on the businesses located along Huron Church Road north of the E.C. Row Expressway.

Through the property acquisition process, displaced businesses are offered fair market value for their businesses which will provide them an opportunity to relocate if they so choose. The *Draft Practical Alternatives Evaluation Working Paper – Economic Impact (May 2008)* documents that there are many opportunities for businesses to relocate.

PREDICTED ECONOMIC IMPACTS

The impacts associated with the Recommended Plan are summarized in Table 10.2.

TABLE 10.2 - SUMMARY OF ECONOMIC IMPACTS ASSOCIATED WITH THE RECOMMENDED PLAN

Segment	Businesses Displaced	Businesses Disrupted	Number of Jobs Displaced	Assessed Property Value Displaced ($Millions)[1]
W-E Parkway Highway 401 to Howard Avenue	8 Businesses • XTR Gas & Convenience • Vachon Bakery Outlet • Nature's Health Consulting Co. • The Sleep Factory • Autobon Car Wash • Phillips Tool & Mould Ltd. • Tyler Hard Chrome Inc. • Hellenic Banquet Halls	2 Businesses • Kentown Power Equipment • Weston Bakeries Ltd. Ontario	90	$4.4
W-E Parkway Howard Avenue to Cousineau Road	16 Businesses • Windsor Crossing Outlet Mall (15 businesses) • Alibis Sports Bar & Music	30 Businesses • Windsor Crossing Outlet Mall (30 businesses)	112	$11.3
W-E Parkway Cousineau Road	None	None	None	None

[1] The assessed property values provided in this column have been updated based on the latest assessment information and may differ slightly from the values used in the May 2008 Economic Impact Practical Alternative Working Paper.

Segment	Businesses Displaced	Businesses Disrupted	Number of Jobs Displaced	Assessed Property Value Displaced ($Millions)[1]
to Lennon Drain				
W-E Parkway Lennon Drain to Pulford Street	8 Businesses • L.A. Collision South Windsor Ltd. • Town & Country Animal Clinic • Mac's Convenience Stores • Sandcastle Recreation • Fred's Farm Fresh Ltd. • Joe's Woodcraft Of Windsor Ltd. • Tim Hortons • Best Western Continental Inn	None	120	$7.0
W-E Parkway Pulford Street to Malden Road	20 Businesses • Montessori Preschool (Lambton Plaza) • C.K. Havana Shop (Lambton Plaza) • Scholar's Choice (Lambton Plaza) • Outbreak Sportz (Lambton Plaza) • Second Edition (Lambton Plaza) • Worldsource Financial Management (Lambton Plaza) • First Choice Chinese Restaurant (Lambton Plaza) • Lily's Nail (Lambton Plaza) • Gino's Pizza (Lambton Plaza) • A.C. Soccer & Sports (Lambton Plaza) • Century Fire Equipment Ltd. • Blue Bell Motel • Feelgood's Billiard's Sports Pub Rhythm & Grill • Comfort Inn • Petro Canada • Golden Griddle Family Restaurants • King Kone Ice Cream • Garry St. John 1996 • Euro Tech Auto Service • Aqua Turf Lawn Sprinkler	None	120	$8.2
Total W-E Parkway	52	32	442	$31.0
Plaza B1-Crossing B	1 Business • A&P Metals	3 Businesses • Southwestern Sales Corporation Ltd. • Nemak of Canada Corp. • West Windsor Power – Suez Energy Generation NA	5	$0.13
TOTAL	53	35	447	$31.1

MITIGATION MEASURES

Through the property acquisition process, displaced businesses are offered fair market value for their operation, which will provide them with an opportunity to relocate if they so choose.

In total, the Recommended Plan is expected to displace 53 businesses that employ 447 full-time equivalent staff. The combined assessed value of displaced business property is $31.1 million. A total of 35 businesses will be disrupted by the Recommended Plan.

For businesses that are physically disrupted, financial compensation will be offered. For businesses that are not physically disrupted but are affected through visibility, or reduced traffic volumes, several other forms of mitigation will be used:

- The service road network will allow for adequate access to existing commercial corridors;
- Signage will be considered at certain locations to make motorists aware of businesses/business clusters, as policies permit; and
- Efforts will be made during the construction phase to ensure access is maintained to operating businesses.

CONCLUSION

The Recommended Plan results in the displacement of 53 businesses and the disruption of 35 additional businesses. Displaced and physically disrupted businesses will be offered financial compensation. The mitigation measures summarized above will be used to assist the newly disrupted businesses.

As discussed in the "*Draft Practical Alternatives Evaluation Working Paper – Economic Impact (May 2008)*", it is estimated that construction of The Windsor-Essex Parkway (estimated to cost approximately $1.6 billion) could provide 12,000 project related jobs. When the crossing and plaza are included, the economic benefits are even greater. Given the current economic climate in Windsor, the jobs created through the project have added significance. Furthermore, the expanded transportation network and new border crossing will improve the speed and efficiency of goods and services crossing the border which will have a tremendous impact on the economies of both Ontario and the Windsor-Essex region.

10.2.4 Impacts to Existing and Planned Land Use

The Windsor-Essex Parkway with its provision for buffer space adjacent to the corridor, and the opportunities for various recreational land uses such as trails and greenspace is consistent with local municipal planning policies.

Potential impacts result from land use being changed from either residential, commercial, open space, industrial, or vacant to a transportation-related use.

When examining the various Official Plan policies, the Recommended Plan is consistent with the development strategy, healthy communities, environment, land use, infrastructure, urban design and heritage conservation policies of the *City of Windsor Official Plan* and greenway land use policies of the Town of LaSalle. The Recommended Plan provides opportunities to connect communities and provide new open space and parklands in areas that previously did not have such land uses. In addition, the Recommended Plan provides opportunities to create new recreation way land uses, as supported in the *Town of LaSalle Official Plan.*

The proposed plan will not have a significant impact on the development plans outlined in the Official Plans of the *City of Windsor, Town of Tecumseh, Town of LaSalle, and Essex County.* Opportunities to minimize potential property impacts associated with the Recommended Plan will be reviewed during future design stages in consultation with municipalities.

The international plaza on the Canadian side of the bridge crossing will be situated within the former Brighton Beach residential neighbourhood, which is currently zoned for industrial land uses. Over time, most of the residences have been acquired and removed so the area is generally vacant. Heavy industrial land uses surround these sites and are considered more compatible with the activities that are associated with a plaza. Government and institutional land use impacts for the plaza consist of less than one hectare of impacts. Additionally, there are no agricultural land uses in the vicinity of the plaza crossing alternatives.

The bridge crossing is also located in a predominately industrial area, and will impact water dependant industrial land uses. Water dependant industrial land uses are often hard to relocate, due to the lack of available industrial waterfront property.

The bridge approach traverses the eastern portion of Hydro One's Keith Transformer Station site. The bridge approach has been situated to avoid the need for physical relocation of the existing transformers. Although it is not currently scheduled, Hydro One has also indicated that at some point in the future there may be a need to expand the Keith Transformer Station. The location of the bridge approach structure will preclude the ability for expansion of the transformer station to the north. Studies to secure the necessary approvals to expand have not been initiated by Hydro One. Hydro One has also indicated that the use of salt as a de-icing agent on the bridge approach may have a negative impact to the operation of the existing transformers.

MITIGATION MEASURES

The bridge approach was situated to avoid the need for physical relocation of the existing Keith Transformer Station. Potential future expansion of the Keith Transformer Station will be considered during the property acquisition process. Further consultation with Hydro One will be conducted during future design phases to identify the need to mitigate impacts with respect to salt usage on the bridge approach (i.e. deck heating, use of other de-icing agents, shielding of certain transformer elements, etc.). Potential compensation regarding restrictions to future expansion plans will be dealt with by Transport Canada/Public Works Canada during the property acquisition process.

CONCLUSION

In summary, the Recommended Plan provides opportunities to develop new open spaces, natural areas and which can be made consistent with the existing and future the land use envisioned for the *City of Windsor, Town of Tecumseh, Town of LaSalle and Essex County* through the development of an integrated Urban Design and Landscape Plan during later design stages (refer to the *Urban Design and Landscape Planning Report – The Recommended Plan (December 2008).*

Further consultation between Hydro One and Transport Canada/Public Works Canada will be completed during future design phases.

10.2.5 Property Acquisition Process

In order to reduce uncertainty for property owners affected by the Recommended Plan, MTO and TC are proceeding with property acquisition on a willing buyer/willing seller basis. Compensation will be provided at fair market value, which is determined at the time of purchase by a property appraisal report forming the basis for negotiations. Other ancillary costs are negotiated on a case-by-case basis.

In some locations, it may be necessary to acquire property on a temporary basis, in order to facilitate a particular construction operation. Compensation will also be provided with respect to temporary property requirements. Upon completion of construction, temporary property will be returned to the owner. All reasonable attempts will be made to restore the land to its original condition.

If the Detroit River International Crossing environmental assessment study has been approved by the Minister of the Environment, MTO and TC will initiate purchase of all the remaining lands required for construction.

If an amicable agreement cannot be reached, MTO and TC will proceed in accordance with the provisions of the applicable Expropriations Act. MTO and TC respect owners rights under the laws of Ontario and Canada, and those rights will be fully explained to applicable residents.

CONCLUSION

The advance purchase process initiated by MTO and TC has been beneficial in reducing uncertainty for affected parties.

10.2.6 Waste and Waste Management

An area of investigation was established for the Waste and Waste Management report that encompasses directly impacted properties associated with the Recommended Plan. For the purposes of this discussion, "directly impacted" properties refers to those properties in which all or a portion is situated within the proposed land requirements of the crossing, plaza or The Windsor-Essex Parkway.

Neighbouring and adjacent properties that are not situated within the proposed property requirements have not been visited; however, as part of the evaluation of specific sites, adjacent properties were evaluated. This evaluation focused on the potential for the presence of pre-existing contaminants and wastes.

The MTO has established guidelines related to environmental protection, including "*Environmental Protection Requirements, for Transportation Planning and Highway Design, Construction, Operation and Maintenance, April 2004*" and the "*Environmental Standards and Practices User Guide, December 2006"* (ESP Guide). The ESP Guide is further divided into specific sections including Section 9, *Contaminated Property and Excess Materials Management* which covers the identification and management of contaminated property referred to as MTO's contaminated property process.

ASSESSMENT METHODOLOGY

MTO's contaminated property process has the following major stated goals:

- identify past and present site activities;
- evaluate the existing environmental liabilities, current environmental performance, and environmental risk of a property; and
- determine and undertake contamination management.

To achieve these goals, the MTO's process for evaluating contaminated property is divided into the following six (6) steps:

1) Contamination Overview Study (COS): is a general overview of the study area to identify properties/areas with the potential for site contamination.
2) Preliminary Site Screening (PSS) is a quick and broad review of a single property to determine the potential for contamination.
3) Phase I Environmental Site Assessment (ESA): is a detailed review and non-intrusive investigation to identify actual, or potential contamination on, in, or adjacent to, a property. The Phase I ESA must be prepared according to the *Canadian Standards Association Z768-01 Phase I Environmental Site Assessment.*
4) Phase II Environmental Site Assessment (ESA) is an intrusive site investigation to confirm and delineate the extent of suspected environmental liabilities and property contamination issues that have been identified in previous steps. The Phase II ESA is typically conducted as part of the detail design.
5) Site Management is the management of contamination at the site and can include preparing the Remedial Work Plan / Site Management Plan, conducting remedial work and carrying out confirmatory sampling, and it may involve both facilities and property.
6) Risk Assessment is the management of the site based on the risk associated with the contamination on that specific site; this is unlike the above assessments that compare results to contaminant criteria.

The Contamination Overview Study (COS) undertaken for this study involved record reviews and study area reconnaissance. Collected data (i.e., base land use, select environmental databases, aerial photographs, available technical reports, historical topographic maps and fire insurance plans) was analyzed to identify known contaminated sites. Data was further analyzed to evaluate the relative potential and severity for contamination. Ratings of Known, High, Moderate or Low potential for contamination were applied to properties impacted by the Recommended Plan. The assignment of ratings was based on the potential likelihood and severity of contamination based on land use and URS' estimate of relative risk. Properties that were rated Known, High or Medium were identified for further investigation using the PSS process.

RESULTS

Approximately 36 individual properties have been assessed based on PSS. To thoroughly evaluate each site, the review also included a review of historical aerial photographs, a review of available City directories, a request for fire insurance plans and inspection reports provided by Risk Management Services (RMS, formerly CGI) and a EcoLog ERIS database covering the TEPA (dated July 23, 2008) Additionally, materials were compiled and a review was conduction using additional historical aerial photographs, at scales ranging from 1:4,000 to 1:10,000, obtained from the City of Windsor and the National Air Photo Library.

The properties visited to date have primary been commercial/light industrial properties which were initially developed in the 1950s and 1960s. Based on site visits, interviews, and historical information, the Areas of Concern (AOC) identified to date are associated with:

- former gasoline service stations,
- former landfills,
- former vehicle repair facilities,
- former auto wreckers,
- facilities with on-site fuel storage,
- existing autobody shops,
- former coal and coal slag and coal ash storage facilities,
- industrial facilities with septic systems (which increase the likelihood of contaminants entering soil or groundwater), and
- potential for contaminated fill materials to have been imported to the sites during development.

No actual contamination has been noted on these properties; however the potential for contamination has been identified, based on previous usage. The types of contaminants that may have impacted soil or groundwater can cover a broad range, including, but not limited to:

- volatile organic compounds (VOCs),
- waste materials, including material legally and illegally deposited,
- chlorinated solvents,

- polyaromatic hydrocarbons (PAHs)
- petroleum hydrocarbons,
- polychlorinated biphenyls (PCBs), and
- heavy metals.

In addition, based on the date of construction of some of the structures on these sites, some may contain asbestos-containing materials (ACMs), lead-based paints (LBP), and polychlorinated biphenyls (PCBs) in electrical equipment.

MITIGATION

To reduce the uncertainty of whether contamination is present, Phase II ESAs are being conducted on properties identified as having contamination potential. The Phase II ESA is an intrusive investigation, involving sampling and analysis of soil, water or other components.

To assess the environmental quality of the soil and groundwater, the laboratory analytical results will be compared to applicable site restoration standards provided in *Soil, Groundwater and Sediment Standards for Use Under Part XV.1* of the *Environmental Protection Act* (EPA), dated March 9, 2004 (MOE SCS).

These standards are referred to in *Ontario Regulation 153* under the EPA called the *Record of Site Condition Regulation (O.Reg.153/04*). O. Reg. 153/04, which came into effect October 1, 2004, applies to properties that require the filing a Record of Site Condition (RSC) either due to a zoning bylaw change to a more sensitive use (e.g. industrial to residential) or for voluntary purposes. O.Reg.153/04 presents a methodology for the environmental assessment of properties in Ontario. Although O.Reg.153/04 does not apply to sites where an RSC is not filed, it is anticipated that the general requirements of the regulation will become the de facto guideline. It should be pointed out that the site restoration standards provided in Ontario Regulation 153/04 is currently under review and amendments are introduced which are expected to pass in the earlier part of 2009.

If contamination to soil and/or groundwater is identified, a Site Management Plan may be developed for further investigation, which may include a Phase III ESA. Phase III ESA generally defines the lateral and aerial extent of impacted zones and examines options for managing the contamination or cleaning up the site. This may include remediation activities which could include excavation and off-site disposal, or on site treatment, in-situ or ex-situ remediation or monitoring of natural attenuation (MNA) of contaminants.

Further evaluations could include risk assessments to determine whether the contamination represents a potential threat to human health or the environment, typically followed by MNA.

To evaluate the presence of ACMs, LBP and PCBs, in structures and equipment a Designated Substance Survey (DSS) may be required prior to demolition. A DSS will identify the type, location and concentration of any Designated Substances on-site so that applicable measures can be taken to ensure the safety of those working on the site and the general public during the removal.

CONCLUSION

These standard practices for assessing contamination will ensure the contamination risks associated with properties acquired by the ministry are identified and mitigated.

10.3 Cultural Resources (Built Heritage and Cultural Landscapes) and Archaeology

10.3.1 Archaeological Resources

Archaeological resources are considered to be elements of the environment as defined in both the *Ontario and Canadian Environmental Assessment Acts* as well as the *Ontario Planning and Heritage Act* and in the *Provincial Policy Statement (2005)*.

Archaeological sites are generally described as the physical remains of past human activity. They can take a range of forms from small scatters of artifacts to the remains of structures and can range in size from a single, isolated object to large and complex sites containing thousands of artifacts covering a hectare or more. The relative significance of any one site is measured on the basis of its temporal and cultural associations, information and contextual values and degree of integrity or disturbance.

Archaeological Assessment in the development process is conducted in four stages:

Stage 1: Background Research and Assessment of Archaeological Potential,

Stage 2: Field Survey to identify sites that may be present within the study area,

Stage 3: Site testing to evaluate the character, age and extent of sites identified at Stage 2 and,

Stage 4: Mitigation through either avoidance or excavation and documentation.

Each stage represents a distinct element in the overall process of archaeological assessment and each builds on the results of previous stages. To date, Stage 1 and 2 archaeological assessments have been conducted for a significant portion of the Recommended Plan.

ASSESSING IMPACTS TO ARCHAEOLOGICAL RESOURCES

In Ontario, the Ministry of Culture (MCL) acts as the regulatory body for the conduct of archaeological and heritage assessments and their concurrence with all work and reporting is a regulatory requirement under the *Ontario Heritage Act*. The identification and assessment of impacts to archaeological resources, including reporting, is conducted under archaeological licence issued by the Ministry of Culture (MCL). Standards for field methodology for work by archaeological consultants are described in two technical guidelines set out by MCL. *The Archaeological Assessment Technical Guidelines* (1993) describes the requirements that must be met in order to satisfy the Ministry of Culture that all work is completed appropriately. The Draft *Standards and Guidelines for Consulting Archaeologists* (2006) set out the standards and practices for archaeologists in greater detail. However, they have not been formally adopted by MCL. As a matter of policy, the Ministry of Transportation (MTO) mandates that consultants working on MTO projects adhere to the 2006 Draft standards. The 2006 Standards have been followed throughout the Detroit River International Crossing study.

ASSESSMENT METHODOLOGY

The methodology for the archaeological assessment consisted of the following key steps for evaluation of the Recommended Plan:

As part of the assessment of the illustrative and practical crossing, plaza and access road alternatives a Stage 1 Assessment of archaeological potential was completed for the original study area and Area of Continued Analysis (refer to Chapter 4 and Chapter 7, respectively). This required detailed

research on known archaeological resources within these area as well as land-use history and physiographic conditions including drainage, soils, vegetation cover and land disturbance. This assessment included a detailed field review of the study area to verify the research results. From this research and field review, a determination was made regarding the potential for encountering archaeological resources within the study area.

Stage 2 Assessment was undertaken in those areas determined to have archaeological potential. Because the Recommended Plan passes through an area that is largely urbanized, the main determinant of overall survey coverage is access to individual properties.

Stage 2 assessment was conducted using two methods – Pedestrian and test-pit survey. In the case of the former, open lands that are suitable for cultivation are ploughed and allowed to weather for at least two weeks. Following weathering, the subject lands are surveyed at five metre intervals to identify any archaeological materials visible on the ground surface.

Test Pit Survey was used in areas that have forest, scrub, or other, heavy vegetation cover or are too small (*i.e.* less than one hectare) to allow for plough access. This form of survey consisted of digging small (30cm by 30 cm) test-holes at regular intervals across each property. The survey interval for most projects is five metres. All soils from the test-pits are screened through 6mm mesh to aid in the identification of archaeological materials.

In both pedestrian and test-pit surveys, all identified site locations are systematically recorded using hand-held GPS units and subsequently mapped at 1:5000 or larger scale.

Upon completion of Stage 2 Assessment, those sites considered to be of potential significance are recommended for Stage 3 Assessment. Stage 3 Assessment requires the excavation of a series of one metre by one metre test units across the site area to firmly establish its size, age, cultural affiliation, and whether there are intact subsurface features present across the site.

Upon completion of Stage 3, a determination is made as to whether the site warrants a further Stage 4 assessment, mitigation or can be considered free of further archaeological concerns. The main criteria for determining whether a site has archaeological significance are:

1. *Information potential for the site*. This includes evaluation of the site's integrity (extent of past disturbances to the site, extent of a multi-component mix to deposits, etc.), Rarity or Representativeness (locally, regionally and provincially), Cultural-Temporal Affiliations, (age, aboriginal/European pioneer associations, etc.), Potential Data Productivity (settlement and artifact distribution data, subsistence and ecological data, cultural behaviour, artifacts yields, etc.), Site Context (temporal and spatial, inter-site relationships, demonstrated relationship to known historic events, people, etc.), and potential for the presence of human remains.
2. *Perceived Value potential.* This is the value the site may have to a local community or specific groups. As noted in the 1993 Technical Guidelines, a site may have low information potential but still have a high value because of its significance to a particular cultural group or because it can be used for educational opportunities.

PREDICTED IMPACTS TO ARCHAEOLOGICAL RESOURCES

Stage 1 and preliminary Stage 2 archaeological assessments of areas with archaeological potential within or in close proximity to the Recommended Plan, and for which permission to enter had been obtained were undertaken for 503 parcels, or 49 per cent of the 973 parcels in The Windsor-Essex Parkway.

A Stage 2 assessment of the project area for the Recommended Plan was conducted and survey crews investigated 146 parcels (14 per cent of the 973 parcels in the project). There remain 260 parcels that await Stage 2 assessment, with 253 pending permissions to enter. There are currently 7 properties outstanding (incomplete or pending ploughing) for which permissions to enter have been granted.

Forty-three archaeological sites have been identified in this area (fourteen Aboriginal, seventeen Historic and six with both an aboriginal and historic component), and twenty-nine of these have been recommended for further Stage 3 assessment. Twenty-four of the twenty-nine sites lie within the Recommended Plan.

Mitigation of impacts to archaeological sites takes only two forms: Avoidance and Mitigative Excavation. Avoidance often includes measures to stabilize a site to protect against erosion and other passive impacts. Where a site is avoided it is often necessary to designate the site area as "off limits" for construction equipment to prevent against damage to artifacts and features.

Mitigative excavation involves the complete excavation and recording of all site areas to be disrupted or otherwise altered by an undertaking. Where only a portion of the site is subject to impacts protective measures will be required to ensure that remaining site areas are not damaged by construction and operational activities.

The mitigative requirements in advance of construction of the Recommended Plan are not known at this phase of the project because the archaeological assessment has not been completed to the extent that would allow for determination of all impacts and required mitigation alternatives.

For the construction phase the following measures apply:

- Should deeply buried archaeological remains be found on the property during construction activities, the Manager, Cultural Programs Unit, Ontario Ministry of Culture, should be notified immediately.
- In the event that human remains are encountered during construction, the proponent must immediately contact both the Ontario Ministry of Culture and Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ontario Ministry of Small Business and Consumer Services.

CONCLUSIONS

Based on the archaeological assessment completed to date, the following key conclusions can be drawn:

- Archaeological resources have been identified within the Recommended Plan.
- The exact nature, extent and significance of these resources will not be known until the completion of the Stage 2 and 3 assessments within the Recommended Plan.
- Upon completion of Stage 2 & 3 assessment, determination of the extent of impacts to significant archaeological resources can be made.
- Where significant archaeological resources are encountered, mitigation will be required. This will entail either avoidance or mitigative excavation.
- The study team will continue to consult with Walpole Island First Nations (WIFN) throughout future phases of the project. Results of Stage 2 archaeological investigations will be presented at regular update meetings. WIFN will be afforded every opportunity to review and comment on this work its

associated reporting and to provide advice and comment on subsequent Stage 3 assessment work and any associated reporting. It is also understood that WIFN may wish to have monitors present during future Stage 3 or 4 fieldwork.

10.3.2 Cultural Resources

Cultural Heritage Resources are described under three broad headings: Built Heritage Features (BHF), Built Heritage Resources (BHR) and Cultural Landscape Units (CLU). Generally, a BHF is understood to be "an individual part of a cultural heritage landscape such as buildings or structures of various types, cemeteries, planting and landscaping structures, etc that contribute to the heritage character of the cultural heritage landscape". In other words the Term Built Heritage Feature acts as a catch-all term that includes individual BHR and CLU features.

A BHR is defined as "(O)ne or more significant buildings, structures, monuments, installations or remains associated with architectural, cultural, social, political, economic or military history and identified as being important to a community. These resources may be identified through designation or heritage conservation easement under the Ontario Heritage Act, or listed by local, provincial or federal jurisdictions".

Cultural landscapes are "(a) defined geographical area of heritage significance that has been modified by human activities and is valued by a community. It involves a grouping(s) of individual heritage features such as structures, spaces, archaeological sites and natural elements, which together form a significant type of heritage form, distinctive from that of its constituent elements or parts. Examples may include, but are not limited to, heritage conservation districts designated under the *Ontario Heritage Act*; and villages, parks, gardens, battlefields, main streets and neighborhoods, cemeteries, trail ways and industrial complexes of cultural heritage value".

The analysis of impacts to Built Heritage features within the Recommended Plan has included four major elements:

- The identification of BHF's within the Recommended Plan,
- Assessment of Cultural Heritage value or interest for all identified BHF's,
- Description of impacts; and,
- Identification of mitigation options and requirements.

ASSESSING IMPACTS TO CULTURAL HERITAGE FEATURES – BUILT HERITAGE

The Proposed undertaking may impact directly or indirectly Cultural Heritage Resources through:

- Destruction or alteration of all or part of a cultural heritage property
- Isolation of a cultural heritage property from its surrounding environment, or
- Introduction of physical, visual, audible or atmospheric elements that are not in character with a cultural heritage property or its setting

As described in the Ministry of Transportation's *Environmental Guide for Built Heritage and Cultural Landscapes* the assessment of impacts to identified Built Heritage Features (BHF) includes preparation of detailed documentary research for a historical review, determination of heritage value for individual BHF's, followed by the specific description of impacts.

The Practical Alternative Evaluation Working Paper, Cultural Heritage (March 2008, hereafter *Working Paper 2008*) has identified 13 Built Heritage Features within the Recommended Plan. A detailed documentary research was conducted for all features identified to be of potential interest within the Recommended Plan. This research included reference to Registry Plans and abstracts, local histories, archival maps, and secondary sources.

Based on these findings, a field review of these features, and the application of the Criteria listed in Regulation 9/06 of the *Ontario Heritage Act (R.S.O. 1990)*, seven Built Heritage Features have been rejected as potential Cultural Heritage Resources, while six (five residences and one institutional structure) are recommended for continuing analysis and determination of impacts. These include residential structures and a single CLU. All six features are considered to be of Cultural Heritage Value or Interest.

PREDICTED BUILT HERITAGE IMPACTS

Impacts to Built Heritage Resources are generally classed as direct or indirect. Direct impacts include loss or significant alteration of BHF's and loss of overall contextual integrity as a result of an undertaking. Indirect impacts are generally less severe and include, but are not limited to, encroachment of non-sympathetic elements in proximity to a feature and introduction of noise, dust, vibration and other elements that may affect the long-term stability and integrity of the resource. For the Recommended Plan, all of the impacts to identified BHF are direct. In all, there are six BHR's for which, removal of the structures will be required.

The following features have some potential as heritage resources according to the Criteria for determining Cultural Heritage Value or Interest for architectural, historical or community associative reasons. This is based on their application of Ontario Regulations 9/06 and 10/06. Further investigation is recommended for the following:

- BHR 1: 2746 Talbot Road, Windsor
- BHR 2: Legion Branch 594, 3920 Huron Church Line Road, La Salle
- BHR 7: 2310 Spring Garden Road, Windsor
- BHR 8: 2290 Spring Garden Road, Windsor
- BHR 9: 2284 Spring Garden Road, Windsor
- BHR 19: 2369 Spring Garden Road, Windsor

MITIGATION MEASURES

Mitigation measures were investigated for the six Built Heritage Features. All mitigation options will require a Built Heritage Resource Documentation Report. This report includes detailed photo-documentation of the structure and a plan of salvage for character contributing architectural elements.

Only two mitigation options are considered practical for the Recommended Plan as the single identified CLU does not have sufficient integrity to warrant further investigation, therefore, no mitigation measures have been identified:

1. Relocation of individual structures within the City of Windsor or,
2. Salvage of significant architectural elements followed by demolition.

Where relocation is recommended, the City of Windsor Heritage Committee should be consulted.

CONCLUSIONS

Based on the Built Heritage analyses completed for the Recommended Plan, the following key conclusions can be drawn:

- Without mitigation, there is a potential for the loss of six heritage features with cultural heritage value or interest within the Recommended Plan.
- A Built Heritage Documentation Report will be required for all six Built Heritage Features.
- Relocation of individual structures may be done through MTO's Heritage House Relocation programme.
- For those features not deemed sufficiently noteworthy for relocation, salvage and demolition will be recommended.

10.4 Natural Environment

The potential environmental impacts on fisheries, vegetation, wildlife and designated natural areas associated with the Recommended Plan as well as proposed mitigation measures have been assessed as described in the following sections.

10.4.1 Natural Heritage

Natural heritage is defined in Ontario as:

"features and areas, including significant wetlands, significant coastal wetlands, fish habitat, significant woodlands, significant valley lands, significant habitat of endangered and threatened species, significant wildlife habitat, and significant areas of natural and scientific interest, which are important for their environmental and social values as a legacy of the natural landscapes of an area" (OMMAH 2005).

The natural heritage investigation is guided by government legislation, regulations, policies and guidelines within federal, provincial and municipal jurisdictions. The primary source documents for the natural heritage investigation included:

Federal

- Canadian Biodiversity Strategy
- Fisheries Act
- Species at Risk Act
- Migratory Birds Convention Act
- Canada Wildlife Act
- Policy for the Management of Fish Habitat
- Canadian Federal Policy on Wetland Conservation

Provincial

- Ontario Biodiversity Strategy
- Endangered Species Act, 2007
- Fish and Wildlife Conservation Act
- Ontario Water Resources Act
- Lakes and Rivers Improvement Act
- Planning Act and the Provincial Policy Statement
- Conservation Authorities Act
- Forestry Act
- Implementation Strategy: Areas of Natural and Scientific Interest

In addition, the Ontario Ministry of Transportation (MTO) has adopted environmental practices and standards for highway design and construction. The environmental practices include environmental design criteria, stormwater management practices/best management practices, *Ontario Provincial Standards, Standard Special Provisions* and *Non-standard Special Provisions*. The environmental standards adopted by MTO involve a comprehensive, current and consistent end-results oriented approach to environmental compliance that encompasses all environmental factors for all highway activities from planning through to operation and maintenance.

ASSESSING NATURAL HERITAGE IMPACTS

MTO has developed a guidance document for assessing natural heritage impacts from transportation projects. The *Environmental Reference for Highway Design (MTO 2006)* provided a framework for natural heritage investigations including defining the study area, collecting data, determining significance, assessing environmental effects and identifying environmental protection measures. In addition, the *MTO/DFO/MNR Fisheries Protocol (2006)* establishes a procedure for addressing fisheries issues on MTO projects.

ASSESSMENT METHODOLOGY

A description of the methods for data collection and analysis and the results of the analysis for the Area of Investigation are summarized in Chapter 7 and presented in the *Practical Alternatives Evaluation Working Paper – Natural Heritage*. The natural heritage investigation conducted for the Recommended Plan served to update, verify and augment existing conditions information and to conduct effects assessment, including identification of mitigation and monitoring measures as it pertains to natural heritage.

The study area for the Recommended Plan includes the footprint of the Windsor-Essex Parkway, inspection plaza and crossing and adjacent lands located within 120 m of the footprint for the Recommended Plan.

The impact assessment is specific to each biological discipline (i.e. vegetation, fisheries, wildlife, etc.) and is based on two general categories of impacts: displacement and disturbance effects. Displacement effects include loss or destruction of natural heritage areas, attributes or functions located within the footprint of the Recommended Plan. Disturbance effects include disruption or disturbance to natural heritage areas, attributes or functions located on adjacent lands within 120 m of

the footprint of the Recommended Plan. A summary of the results of the impact assessment for each biological discipline is presented in the sections below.

10.4.2 Vegetation and Vegetation Communities

ASSESSMENT METHODOLOGY

A rare vascular plant survey of all vegetation communities located within the study area was conducted to confirm the presence/absence of species at risk and to classify additional vegetation communities not inventoried in 2006. The survey was designed to investigate potential effects of displacement and disturbance by the Recommended Plan on species at risk and rare vegetation communities. The rare vascular plant survey examined the study area for species regulated by the *Species at Risk Act* (SARA) and the *Endangered Species Act, 2007* (ESA 2007). Field investigations were performed in June, July, August, September and October 2008, to provide reliable information on rare vascular plant species presence, location, population size and management concerns.

Descriptions, illustrations and photographs of all potentially rare vascular plant species present were collected and compiled for field use. A series of approximately parallel transects in a search unit was used to maximize coverage of the area. Spacing of the transects depended on the density of the vegetation cover, visibility and plant morphology.

The location and abundance of each specimen/colony was recorded in the field using a differential GPS unit. Points, lines and polygons were used to delineate the location of each rare vascular plant population. Lines were used when rare vascular plants were located in a linear pattern, while polygons were used when rare vascular plant species were situated in a non-linear pattern. UTM coordinates recorded on the hand-held data logger were downloaded and mapped on an orthorectified digital air photo using a geographical information system (GIS).

Floristic quality assessment was used to determine the quality of each vegetation community located in the study area. This information was then used to determine the significance of displacement/ disturbance effects and to prioritize vegetation communities for protection, enhancement or restoration.

RESULTS

Vegetation Communities

Nine types of ELC vegetation communities located in the study area are considered Provincially Extremely Rare (S1), Provincially Very Rare (S2) or Provincially Rare to Uncommon (S3), while others and/or the same communities are considered Globally Extremely Rare (G1) or Globally Very Rare (G2) (NHIC 1997). Notable communities include Fresh-Moist Tallgrass Prairie, Pin Oak Mineral Deciduous Swamp, Dry-Fresh Black Oak Deciduous Forest, Dry-Fresh Mixed Oak Deciduous Forest, Fresh-Moist Black Walnut Lowland Deciduous Forest, Fresh-Moist Black Oak-White Oak Tallgrass Woodland, Dry-Fresh Oak-Hickory Deciduous Forest, Fresh-Moist Pin Oak-Bur Oak Tallgrass Savannah and Fresh-Moist Pin Oak Tallgrass Woodland. An additional 11 vegetation community polygons have been added (BBA 18-23, NAR21, MAL 13, NSG16-18), four altered (BBA4M, BB4MB, BBA17, HWY1) and one removed from the AOI (HWY5) since 2006.

Vegetation

A total of 648 species of vascular plants were identified within the study area, 72 of which are considered Extremely Rare (S1), Very Rare (S2) and Rare to Uncommon (S3) according to the MNR Natural Heritage Information Centre (NHIC).

Species at Risk

Ten plant species are regulated as Endangered, Threatened or Special Concern in the schedules to SARA and ESA 2007. American chestnut is regulated as Endangered in Schedule 1 of SARA and Schedule 3 of ESA 2007. Colicroot, common hoptree, dense blazing star, dwarf hackberry, Kentucky coffee-tree and willowleaf aster are regulated as Threatened in Schedule 1 of SARA and Schedule 4 of ESA, 2007. Climbing prairie rose, Riddell's goldenrod and Shumard oak are regulated as Special Concern in Schedule 1 of SARA and Schedule 5 of ESA 2007.

POTENTIAL ENVIRONMENTAL EFFECTS

Site preparation activities will result in the displacement of vegetation, vegetation communities and species at risk located within the footprint of the Recommended Plan. Disturbance to vegetation, vegetation communities and species at risk may occur on adjacent lands located within 120 m of the footprint of the Recommended Plan.

Operation of the Recommended Plan will require winter maintenance activities such as sanding, which may introduce exotic invasive plant species into the nearby vegetation communities. Salting in the winter may affect salt intolerant plant species located adjacent to the footprint of the Recommended Plan.

A total of 134 vegetation communities (131.71 ha) will be partially or fully displaced by the footprint of the Recommended Plan, including eight high quality communities (3.62 ha), 45 moderate quality communities (40.72 ha) and 81 low quality communities (87.37 ha). Within these vegetation communities up to 648 vascular plant species could be displaced by the construction activities.

A total of 137 vegetation communities (88.61 ha) located on adjacent lands within 120 m of the footprint of the Recommended Plan may be disturbed including 15 high quality communities (15.89 ha), 57 moderate quality communities (36.78 ha) and 65 low quality communities (35.94 ha). Within these habitat units up to 648 known vascular plant species could be disturbed by the construction activities.

A total of eight species at risk regulated as Threatened or Special Concern under SARA and ESA 2007 are found within the footprint of the Recommended Plan. This total includes 418 climbing prairie rose, 929 colicroot, two planted common hoptree, one planted dwarf hackberry, 951 dense blazing star, 20 Kentucky coffee-tree, 1,285 Riddell's goldenrod and 11,676 willowleaf aster. No species at risk are located within the footprint of the crossing and five species at risk are located within the footprint of the inspection plaza.

A total of eight species at risk regulated as Endangered, Threatened or Special Concern are located on adjacent lands within 120 m of footprint of the Recommended Plan. This total includes one American chestnut, 511 climbing prairie rose, 14 colicroot, 2,114 dense blazing star, 21 Kentucky coffee-tree, 443 Riddell's goldenrod, 24 Shumard oak and 27,874 willowleaf aster.

MITIGATION MEASURES

The area for vegetation removals has been minimized to the extent possible based on the selection of the Recommended Plan. Areas that should be protected during construction will be delineated prior to construction start using construction fencing and no activities will be permitted in these areas.

Construction fencing should also be used around the perimeter of the inspection plaza to mark the limit of construction areas and sensitive off-site areas including the Black Oak Woods. Edge management measures should be identified during later design stages to reduce edge effects such as windthrow, increased light and wind penetration, drainage modifications and invasion by exotic or invasive plant species. Erosion and sedimentation control will be used on-site during construction to prevent the migration of sediments and stormwater from the work area. Rare, threatened and endangered plant species located within the footprint of the inspection plaza and The Windsor-Essex Parkway should be transplanted prior to vegetation removals. Landscape plantings within the plaza site should be limited to native, non-invasive species typical of the tallgrass prairies/Carolinian forest. Restoration, enhancement and land securement opportunities should be explored for lands such as the Black Oak Woods adjacent to the inspection plaza and The Windsor-Essex Parkway.

The detailed landscape plan to be prepared during later design stages will identify areas for protection, enhancement and restoration. The landscape plan will include detailed prescriptions for vegetation management including edge management plans, soil management plans, use of native and non-invasive plant materials, prairie disturbance regimes, control of exotic and invasive species and management of species at risk. The landscape plan will address restoration of several types of vegetation communities including tallgrass prairie, savannah and woodland, Carolinian forest and wetlands. A like-for-like approach will be taken where feasible and practical, with the default restoration target being tallgrass prairie, savannah and woodland.

Restoration and enhancement measures included in the landscape plan will be designed to off-set the loss of vegetation area, attributes or function as a result of the Recommended Plan. An array of restoration and enhancement techniques will be identified including seeding, planting (plugs and seedlings) or transplanting (sod) that includes only native species present within the study area. Appropriate locations for removal of invasive and exotic plant species through the use of possible measures such as herbicides, weed torches and prescribed burns will also be identified. The above mitigation techniques will also be employed with the objective of achieving a net benefit to all regulated species at risk populations located within the study area.

Opportunities to forge partnerships with parties to relocate plant material to lands in public ownership, to otherwise restore and enhance these lands with native plants and species at risk and to transfer lands within the Recommended Plan to parties that can best protect sensitive areas will be sought.

FOLLOW-UP AND MONITORING

During construction, an environmental inspector should schedule site visits during critical stages (such as prior to and during clearing operations) to ensure that construction activities are not causing any harm in areas that are to be protected. Post-construction monitoring should occur to ensure successful plant establishment and reproduction. Monitoring for species at risk should be conducted two times per year for up to five years following construction to ensure their sustainability. Prairie management should be an ongoing and long-term process that should involve the cooperation of appropriate parties to remove invasive exotics, burn as frequently as possible, protect high significance vegetation communities and species at risk.

CONCLUSIONS

A total of up to 131.7 ha of vegetation communities will be removed to implement the Recommended Plan. At the same time, the design of the Recommended Plan affords the opportunity to establish approximately 120 ha of green space using ecological restoration and enhancement principles. Active management in areas located adjacent to the footprint of the Recommended Plan can result in a substantial improvement to the quality of these natural heritage areas. As a result, opportunities are available to offset the loss of vegetation and vegetation communities and to naturalize lands located within the Recommended Plan and on adjacent lands. In addition, partnership opportunities for naturalization of other lands in public ownership will be explored to offset vegetation losses. MTO will consider entering into agreements with organizations for the transfer and long-term management of surplus lands.

Permits and approvals under SARA and ESA 2007 will be obtained prior to construction. A SARA permit will be required for the inspection plaza for threatened species including dense blazing star, Kentucky coffee-tree and willowleaf aster. An ESA 2007 permit will be required for The Windsor-Essex Parkway for threatened species including colicroot, common hoptree, dense blazing star, dwarf hackberry, Kentucky coffee-tree and willowleaf aster. Detailed mitigation strategies will be developed in order to obtain the permits Consideration of these options would be done in consultation with appropriate regulatory agencies (e.g. DFO, MNR) and with other authorities who may have a role in environmental stewardship, including municipalities, ERCA and WIFN.

10.4.3 Molluscs and Insects

ASSESSMENT METHODOLOGY

During the evaluation of practical alternatives stage secondary source data on molluscs and insects was reviewed and compiled into two databases (molluscs and insects). For the assessment of the Recommended Plan, the scope of the investigation was limited to provincially and federally regulated species present within the study area.

RESULTS

Based on a review of secondary sources of information and discussions with regulatory agencies and experts on aquatic invertebrates, no provincially or federally regulated mollusc species at risk are known to occur in the study area, including the Detroit River. Investigations by the U.S. team have determined that no mollusc species at risk persist in the Detroit River in the vicinity of the bridge crossing. As a result, no impacts to mollusc species at risk are anticipated.

One provincially and federally regulated species of insect is known to occur in the study area: the Monarch butterfly (*Danaus plexippus*). The Monarch is regulated as Special Concern in Schedule 1 of SARA and Schedule 5 of ESA 2007.

POTENTIAL ENVIRONMENTAL EFFECTS

Site preparation activities during construction have the potential to impact Monarchs, since the larval stage feeds exclusively on milkweed and the adults feed upon nectar flowers, which are found in prairies, meadows and gardens, as well as more disturbed areas. Not only will clearing activities remove host plants, they may also kill juveniles and adults. Contaminants from emissions and spills, as well as those used for highway and roadside maintenance have the potential to poison host plants and the Monarchs themselves. Mowing of vegetation, if conducted from late spring to early fall, can remove larval feeding plants (milkweeds) and adult nectar plants as well.

MITIGATION MEASURES

Impacts to Monarchs cannot be avoided entirely given the scope and nature of the Recommended Plan and the cosmopolitan nature of this species. The area for vegetation removals has been minimized to the extent possible, and areas that should be protected during construction will be delineated prior to construction start. To avoid impacts to species at risk and their critical habitat, vegetation removals will be avoided in the vicinity of species at risk and their habitat during the growing season.

The areas for restoration and enhancement will result in the creation of new Monarch habitat as those areas will be intentionally or naturally seeded by host plants. Following construction other disturbed areas that revegetate are also likely to self-seed with host plants and create additional Monarch habitat.

The construction limits will be delineated with sensitive areas identified prior to the start of construction. Good housekeeping practices will be employed to prevent the contamination of habitat adjacent to the work area. In the event of an upset or spill, a quick and effective response to contain the spill and clean up the area will be employed. No follow-up or monitoring programs specific to Monarchs are recommended.

CONCLUSION

No significant adverse effects to Monarchs are anticipated as a result of this project. The mitigation measures prescribed for Monarchs will also reduce potential impacts to other insect species.

10.4.4 Fish and Fish Habitat

ASSESSMENT METHODOLOGY

In addition to the detailed fisheries investigations conducted during 2006, a detailed field investigation of fish habitat and fish presence was conducted in areas of known or potential northern pike (*Esox lucius*) spawning in April 2008. Detailed air photos were used to record fish habitat and northern pike presence within Cahill, Wolfe and Collins Drains, Lennon Drain, Youngstown Drain, Basin Drain, Titcombe Drain and McKee Drain/Creek. Other, smaller drains were investigated for fish habitat presence, specifically for potential Northern Pike habitat, during the spring spawning period for this species.

RESULTS

Northern pike presence, and the presence of spawning habitat, was identified in Cahill and Wolfe Drains, Lennon Drain, Titcombe Drain and McKee Creek (the portion nearest the Detroit River). Northern pike were absent from Collins Drain, Wolfe Drain upstream of Talbot Road/Highway 3, Cahill Drain upstream of Talbot Road/Highway 3, Youngstown Drain, Basin Drain and McKee Drain, although all of these watercourses/drains are connected to downstream northern pike habitat.

Most habitat located within the study area can be categorized as having low overall sensitivity and significance with few having moderate to high sensitivity. All watercourses, with the exception of the Detroit River, are classified as municipal drains.

POTENTIAL EFFECTS TO FISH AND FISH HABITAT

Since no piers, abutments or other bridge components will be located in the Detroit River, a detailed assessment of potential impacts on fish and fish habitat was not conducted at the Detroit River. If it is necessary to undertake construction activities within the Detroit River, an assessment of potential impacts will be completed, subject to approval from the relevant regulatory agencies.

Impacts to fish and fish habitat have the potential to occur as a result of the construction and operation of the Recommended Plan.

Permanent loss and/or impacts to fish habitat may result from the following:

- Barriers to fish passage: The construction of submerged culverts at Cahill and Lennon Drains may cause barriers to fish passage that will be permanent in nature.
- Loss of fish habitat: The loss of habitat through enclosure or physical destruction will likely occur in 10 of the 15 watercourses/drains within the study area (excluding the Detroit River). The enclosures may result from five culvert extensions and three new crossings. Physical destruction may occur at four watercourses/drains where realignment may be required. A realignment of Broadway Drain located at the inspection plaza will be required. Although occurring within the construction phase of the project, these effects will be permanent.
- Effects to water quality and quantity: The Recommended Plan will increase the overall impervious area and vehicle emission loadings. This may potentially have a negative impact on the recipient watercourses by increasing the peak flows and the pollutant loadings. This will lead to negative watercourse impacts such as degraded fish habitat, increased floodlines upstream and increased erosion downstream.

Details of stormwater quantity and quality assessment are outlined in Section 10.4.9.

Construction related impacts associated with the Recommended Plan may result in the following:

- Changes to water quality and quantity: Water quality may be affected through activities associated with general construction and site preparation, which could release sediments to the watercourses/drains. The refueling of construction vehicles and the oils, greases and other lubricants used in their maintenance have the potential to affect water quality. In-water work, and associated damming and unwatering have the potential to alter water quantity. These effects are temporary in nature.
- Alterations to baseflow: These effects are consistent with those listed for water quantity above. Groundwater drawdown may be required to construct below grade sections of The Windsor-Essex Parkway. This may result in temporary reductions in baseflow within watercourses.
- Mortality of fish species: During construction, the direct mortality of fish is possible in areas where unwatering occurs. Fish could become entrained or impinged on pump intakes or stranded in unwatered areas. Increased sedimentation and the discharge of deleterious substances from spills also have the potential to cause mortality of fish.

Impacts associated with the operations phase of the Recommended Plan include the following:

- Changes to water quality and quantity: Winter maintenance activities (sanding, salting) have the potential to affect water quality through release into the watercourses/drains. The increased imperviousness of the drainage area for the watercourses/drains has the potential to alter water quantity through increased run-off and decreased infiltration.

- Alterations to baseflow: These effects are consistent with those listed for water quantity above.
- Changes in water temperature: The thermal regime of the receiving watercourses/drains may be altered by stormwater run-off or removal of riparian vegetation that provides shading, especially during summer, when run-off can become superheated through contact with paved surfaces resulting in thermal shock when it reaches fish habitat.

MITIGATION OF POTENTIAL EFFECTS TO FISH AND FISH HABITAT

The following mitigation measures can be employed to address the above noted impacts of the construction and operation of the Recommended Plan.

Permanent loss and/or impacts to fish habitat may be mitigated by the following:

- Barriers to fish passage: Culverts, designed using fish-friendly methods, and channels, designed using natural channel design principles, should not form barriers to fish passage. At Cahill and Lennon Drains, where a deep submerged culvert is required, fish passage options, including mechanical systems such as fish locks/lifts and manual systems such as the capture, physical transport and release of fish across the potential barrier, will be considered to maintain fish access to upstream reaches. If the feasibility of maintaining fish passage in Cahill and Lennon Drains is found to be impractical due to costs, maintenance, hazards to roadway, etc., additional habitat creation areas within the Recommended Plan area will be examined, in addition to the possibility of off-site compensation for the potential loss of productivity in the form of financial contributions to fund, or help to fund, nearby fish habitat restoration/enhancement projects. Consideration of these options would be done in consultation with appropriate regulatory/environmental agencies (e.g., DFO, ERCA, MNR, and municipalities). Walpole Island First Nations have also expressed an interest in the development of solutions to address possible fisheries impacts.
- Loss of fish habitat: The extent of fish habitat affected can be minimized through engineering structures to fit within the smallest possible footprint areas. Culvert lengths and extensions can be minimized through the use of headwalls, wingwalls and guide rails and extensions should match the inverts of the existing culverts and streambeds. New crossing structures should be constructed using fish-friendly designs including appropriate horizontal and vertical clearances, open bottoms, countersinking, etc. Realigned channels should be designed using natural design principles to enhance new habitat over existing habitat. Riparian vegetation should be maintained where possible. A fish habitat compensation plan will be prepared during later design stages to ensure no net loss of the productive capacity of fish habitat.
- Effects to Water Quality and Quantity: Stormwater runoff from roads and highways located within the study area does not currently receive quality or quantity treatment. Stormwater runoff associated with the Windsor-Essex Parkway and the inspection plaza will be treated in stormwater management wet ponds designed in accordance to the MOE document "Stormwater Management Planning and Design Manual" for Enhanced Protection Level. This will require the removal of 80 per cent of total suspended solids (TSS), as well as providing erosion attenuation of the 25 mm storm for 24 hours. In addition, the stormwater management ponds will provide quantity storage to control peak flows from the Windsor-Essex Parkway and inspection plaza to pre-development rates. This approach will lead to overall enhancements to water quality and net benefits to fish and fish habitat for receiving watercourses along The Windsor-Essex Parkway and will prevent water quality impacts to the Detroit River associated with operation of the inspection plaza. In addition, deck drains are not proposed on the crossing and runoff from the crossing will be collected and conveyed for quality treatment on land prior to discharging to the Detroit River.

  The removal of 30 entrance culverts and the plan to provide a natural channel configuration for a significant area of the Wolfe Drain will result in a net gain of fish habitat.

Construction related impacts associated with the Recommended Plan may be mitigated by the following:

- Changes to water quality and quantity: Best construction practices should be employed to reduce the potential for spills and materials/equipment from entering water. Maintenance, fuelling and storage should occur at least 30 m from watercourses/drains. Debris should be prevented from entering watercourses/drains and a spill response plan should be developed. Sediments should be prevented from reaching sensitive areas through erosion and sediment controls and exposed soils stabilized as soon as possible. A stormwater management plan should be developed and implemented to treat run-off during operations.
- Alterations to baseflow: The increases in impervious surfaces and areas of soil compaction should be minimized to facilitate as much infiltration of surface water as possible. Management of stormwater through the development and implementation of a stormwater management plan will address potential reductions in baseflow. Methods that encourage infiltration will be investigated. Flows in watercourses will be monitored during dewatering activities and measures will be implemented in the event that baseflow is significantly affected. If required, a Permit to Take Water will be secured from the Ontario Ministry of the Environment during later design phases.
- Barriers to fish passage: Water flow should be maintained during construction.
- Mortality of fish species: The magnitude of effects should be minimized through the employment of timing windows for in-water work, commencing work only when all materials are present and staging of work to minimize duration. Work should be performed in the dry and isolated fish should be captured and relocated by qualified personnel. The in-water construction timing restriction should reflect the warmwater fish communities present (April 1 to June 30) with an extension to March 16 to account for northern pike migration.

Impacts as a result of operations phase on fish and fish habitat can be mitigated by the following:

- Changes to water quality and quantity: In general, stormwater management throughout the Recommended Plan will improve water quality and quantity (through attenuation of peak run-off flows) over what exists currently. Run-off from the crossing and plaza will be collected and conveyed to stormwater detention facilities for treatment. No deck drains will be provided on the bridge.
- Alterations to baseflow: A stormwater management plan will be developed and implemented to ensure that reductions in baseflow do not occur.
- Changes to water temperature: A stormwater management plan will be developed which will address the treatment of run-off and investigate methods to reduce its temperature prior to discharge into receiving watercourses/drains.
- Barriers to fish passage: Culverts, designed using fish-friendly methods, and channels, designed using natural channel design principles, should not form barriers to fish passage during operations.

Fish passage systems should be implemented if feasible at Cahill and Lennon Drains to provide safe fish passage across The Windsor-Essex Parkway.

MONITORING

An environmental inspector will be present on site during critical in-water work activities. Post-construction monitoring is typically prescribed in the *Fisheries Act* authorization. The terms and conditions of the *Fisheries Act* authorization will be met. Post-construction monitoring, if prescribed, will determine the effectiveness of environmental protection and compensation measures, identify problem areas and recommend corrective measures.

The performance of any fish passage system (mechanical or manual lifts) should be monitored for at least two years after construction to ensure that they are passing fish as designed. The target species for passage systems is northern pike. During spring migration (March/April), a fish passage study using mark-recapture or radio-telemetry could assist in determining the effectiveness of fish passage. Both techniques apply in the assessment of passage success. In order to assess downstream passage, similar studies should be repeated later in the spring (late April/May) to see if fish are successfully migrating back to summer habitats.

CONCLUSIONS

A Letter of Intent and Application for Works will be prepared during later design stages to secure a *Fisheries Act* authorization for this project. Watercourse reaches will be restored and enhanced using natural channel design principles to maintain no net loss of the productive capacity of fish habitat as a result of this project. Options have been identified that will maintain fish access to upstream reaches in Cahill and Lennon Drains. Further mitigation and compensation measures, including financial contributions to nearby restoration/enhancement projects if required, will be considered during later design stages in consultation with regulatory agencies. Enhancements to realigned reaches and the removal of entrance culverts along Wolfe Drain will augment the productive capacities of these systems and will result in an overall net gain of habitat area. Stormwater management practices will result in an overall improvement in water quality within the study area, including the Detroit River.

10.4.5 Wildlife and Wildlife Habitat

ASSESSMENT METHODOLOGY

In 2008 the spring and summer wildlife investigations concentrated on the four wildlife species at risk identified during the 2006 detailed wildlife investigations for the practical alternatives stage: Golden-winged Warbler (*Vermivora chrysoptera*), Red-headed Woodpecker (*Melanerpes erythrocephalus*), Butler's gartersnake (*Thamnophis butleri)* and eastern foxsnake (*Elaphe gloydi*).Field observations were undertaken throughout the spring and summer months in areas where the two bird species at risk had been recorded in 2006 and in potentially new habitats in the study area. A mark-recapture population study was initiated for Butler's gartersnake and a radio-telemetry study to track eastern foxsnake movements was also initiated to determine locations of their hibernacula.

RESULTS

The Golden-winged Warbler was observed in the Brighton Beach area in 2006, while the Red-headed Woodpecker was observed in the Black Oak Woods in 2006. Intensive observations during the 2008 spring migration and breeding season failed to confirm the presence of these species in the study area for the Recommended Plan.

The Butler's gartersnake population study determined that approximately 150 adult snakes inhabit the study area. Over 50 neonates were also discovered in August confirming that the population is reproducing successfully. A number of hibernacula locations for this species were found in the same area.

One eastern foxsnake was tracked and its movements in the fall led to areas of potential hibernacula which will be further investigated next spring. Based on anecdotal evidence, numerous easterm foxsnake hibernacula exist within the proposed area of The Windsor-Essex Parkway. Butler's gartersnake and eastern foxsnake were not recorded at or in the vicinity of the inspection plaza or crossing.

POTENTIAL ENVIRONMENTAL EFFECTS

Site preparation activities within the footprint of the Recommended Plan will result in the displacement of wildlife and wildlife habitat and potential mortality to species at risk. Portions of provincially significant wildlife habitat will be lost. Areas located adjacent to the footprint of the Recommended Plan the right-of-way may be affected by light trespass, noise and human intrusion during the construction and operation phases. The Windsor-Essex Parkway and inspection plaza may also create barriers to wildlife movement.

Portions of the habitat of the Butler's gartersnake and eastern foxsnake may be displaced by construction of The Windsor-Essex Parkway. It is possible that a new crossing of the Detroit River may result in migratory and resident bird mortality along the Detroit River, given that the Detroit River is host to large bird migrations and resident bird populations. Studies indicate that avian mortalities at tall structures have been found to be a function of structure size, visibility, migration times, weather conditions, and lighting.[2] The degree to which the new crossing may result in bird mortality depends on these factors, as well as the species, population size and the behaviour of the migratory and resident birds present. It is recognized that lighting and illumination of the bridge structure and bridge facility may pose a hazard to nocturnal bird species, with the degree of hazard also being a function of the bridge type (cable-stayed or suspension). Bridge lighting, including the need and treatment of showcase lighting to highlight the architectural amenities of the bridge, will be reduced while still satisfying the principal needs of lighting as a safety enhancement. Architectural lighting to highlight the aesthetics of the bridge should be developed with consideration for its effect on migratory birds. Site-specific mitigation measures will be developed during future design phases.

MITIGATION MEASURES

Vegetation removals should occur outside of the growing season to avoid loss of wildlife and wildlife habitat to the extent possible. The growing season in Windsor extends from April 1 to October 31. A construction timing restriction extending from May 1 to July 23 has been recommended by Environment Canada to avoid the incidental take of migratory birds. If vegetation removals are required during this period, a nest survey should be conducted by a qualified avian biologist immediately prior to commencement of construction to identify and locate active nests of migratory birds and to develop a mitigation plan.

Extensive efforts have been made to avoid and minimize impacts to Butler's gartersnake and Eastern foxsnake populations including refinements to the alignment of The Windsor-Essex Parkway. Habitat

[2] Manville, A.M. II. 2000. *The ABCs of Avoiding Bird Collisions at Communications Towers: The Next Steps*. Proceedings of the Avian Interactions Workshop, December 2, 1999. Charleston S.C., Electric Power Research Institute.

restoration and enhancement will be implemented to create new and higher quality habitat for these species. A snake barrier will be installed along side portions of the construction area to prevent snakes from entering the work zone and redirect snake movements to safer areas. Permanent snake barriers will also be installed to prevent snake mortality during facility operation. Options for permanent protection of critical Butler's gartersnake habitat will be developed in later consultation phases.

The presence/absence of Eastern foxsnake hibernacula within the study area will be investigated during the subsequent design stages to determine the potential for impacts. The creation of new snake nesting areas and hibernacula will occur to compensate for any losses of habitat. Snakes will be captured and relocated prior to construction to avoid mortality.

Habitat restoration and enhancement will be used to replace habitat lost during construction. Areas of habitat to be retained will be clearly marked in the field and protected from construction activities. Wildlife salvage will be carried out prior to clearing/grubbing to reduce the risk of wildlife mortality. Restoration and enhancement of habitat located along The Windsor-Essex Parkway including the tunnel sections, will be used at strategic locations to reconnect significant wildlife habitat located on both sides. The site plan for the inspection plaza incorporates several mitigation measures including: landscaping and the establishment of setbacks and a stormwater detention pond. On the south side of the inspection plaza, a stormwater detention pond is proposed in association with a vegetative buffer. The stormwater detention pond also provides buffer width between the plaza and the Black Oak Woods to the south.

Wildlife salvage should be performed on-site prior to vegetation removals. Vegetation removals will be avoided in the vicinity of species at risk and their habitat during the growing season.

Disturbance to wildlife during the operations phase will be mitigated through fencing berming, light shielding and prohibiting access to significant wildlife habitat by humans. Measures to mitigate potential bird mortality from the crossing will be investigated in greater detail during later design phases. Final bridge design and lighting will need to take appropriate safety measures into account, in consideration of marine navigation on the Detroit River, the needs of motorists using the bridge and the aviation warning systems.

Consideration should be given to conducting a migratory bird survey at the location of the crossing to ascertain the species, population size and behaviour of birds migrating through and residing along the Detroit River. The investigations should include mobile radar studies in association with acoustical recordings and point count surveys during peak spring and fall migration periods. Further discussion will be undertaken with Canadian and U.S. wildlife authorities to determine the need and level of assessment required.

A continued study of the Butler's garter snake population and the restoration area should be carried out once the Recommended Plan is constructed. The effects of The Windsor-Essex Parkway's proximity to the remaining Butler's gartersnake population and their hibernacula should be monitored. A strategy should be developed to ensure permanent protection of the Butler's garter snake population and their habitat.

Eastern foxsnake tracking should continue to determine their egg laying sites and hibernacula sites. Knowing these locations could assist in preventing future conflicts with this species. Man-made structures that are known to provide hibernacula for eastern foxsnake should be inspected by a qualified biologist prior to demolition. Education programs to inform the public of the benefits and harmlessness of snakes should be promoted.

CONCLUSIONS

The population of Butler's gartersnake and Eastern foxsnake are anticipated to remain stable following construction of this project.

The bridge design will be developed during later design phases. The selection of the bridge type (suspension or cable-stayed) should take into consideration the potential impact of bridge design on migratory birds.

Enhancement and restoration of habitat located along The Windsor-Essex Parkway will offset habitat loss and will establish connections between designated natural areas. Tunnels in selected areas including the Oakwood Tunnel will reduce existing barriers for wildlife and enhance wildlife movement.

Permits and approvals under SARA and the ESA 2007 will be obtained prior to construction. An ESA 2007 permit will be required for Butler's gartersnake and eastern foxsnake which are located along The Windsor-Essex Parkway. Detailed mitigation strategies will be developed in order to obtain the permits. On-going consultation with regulatory agencies such as ERCA, MNR, CWS in addition to continuing discussions with First Nations will occur during future design stages.

10.4.6 Designated Natural Areas

Designated natural areas or environmental policy areas are identified by regulatory agencies or municipalities for conservation purposes. These areas include: Areas of Natural and Scientific Interest (ANSIs); Provincially Significant Wetlands (PSWs); Environmentally Sensitive Areas (ESAs); Candidate Natural Heritage Sites (CNHS) and areas designated for protection in municipal official plans.

ASSESSMENT METHODOLOGY

Secondary source information on designated natural areas was collected and reviewed to identify the geographical extent and major ecological functions for which the area was designated. Field investigations were used to confirm and reconcile the boundaries of the designated natural areas where encroachment may occur. The *Ontario Wetland Evaluation System* (OMNR 2002) was also used to evaluate the significance of several wetland units located in the study area.

RESULTS

Numerous designated natural areas are located in the study area for the Recommended Plan including:

- Detroit River Canadian Heritage River;
- Black Oak Woods ANSI, ESA and CNHS;
- Ojibway Park ANSI, ESA and CNHS;
- Spring Garden Forest ANSI, ESA and CNHS;
- St. Clair College Prairie ESA and CNHS;
- Oakwood Bush CNHS;
- Canada Malden Park CNHS;
- Candidate Natural Heritage Site TC2; and,
- Potential Provincially Significant Wetlands (PSWs) to be determined.

Additional designated natural areas identified during the practical alternatives stage are located beyond the vicinity of the Recommended Plan.

POTENTIAL ENVIRONMENTAL EFFECTS

The potential environmental effects on designated natural areas are similar to the effects on vegetation and wildlife. Construction of the Recommended Plan may result in the loss of area or ecological function for which an area is identified. Operation of the Recommended Plan is not anticipated to result in significant impacts.

The crossing is not anticipated to have an effect on the natural heritage attributes of the Detroit River Canadian Heritage River.

A total of 5.47 ha of designated natural area will be displaced by the footprint of the Recommended Plan including the Black Oak Woods (1.68 ha of a total area of 46 ha), Ojibway Park (0.51 ha of a total area of 64 ha) and TC2 (3.28 ha of a total area of 9.0 ha). No encroachment will occur at the St. Clair College Prairie.

A total of 27.06 ha of designated natural area may be disturbed on adjacent lands located within 120 m of the footprint of the Recommended Plan. The major ecological functions for which these areas are identified will be maintained, enhanced or restored following construction.

MITIGATION MEASURES

Mitigation measures for the loss of area or ecological function of designated natural areas are similar to the mitigation measures identified for vegetation and wildlife. In addition, MTO will discuss the dedication of protected, enhanced or restored lands with appropriate agencies to ensure permanent protection and conservation.

FOLLOW-UP AND MONITORING

Monitoring requirements are similar to those identified for vegetation and wildlife. Further discussions with conservation organizations including local municipalities, ERCA, MNR, as well as further consultation with First Nations will occur during future design stages. Once the geographical extent and functions of PSWs are identified, measures will be investigated to mitigate potential impacts on these designated natural areas.

CONCLUSIONS

The landscape plan prepared for the Recommended Plan identifies up to 120 ha of MTO-owned lands that are available for protection, enhancement and restoration. Opportunities to dedicate portions of these lands to appropriate parties for protection will be discussed at later design stages. Lands will be available to be dedicated for protection including provincially rare vegetation communities, habitat for species at risk, wildlife corridors and other ecological functions.

10.4.7 Landscape Plan

The Landscape Plan represents an overall mitigation strategy to help ensure the Recommended Plan is designed and constructed in a manner that is sensitive to community expectations. The plan sets out guidelines that will direct the planning and design of the open spaces, natural areas and trails associated with the Recommended Plan. This plan also outlines a strategy for including aesthetic and design considerations in all new construction, including, but not limited to, structural elements, landscaping, barriers, wayfinding, and lighting. Refer to the "*Urban Design and Landscape Planning Report – The Recommended Plan (December 2008)* report and to Appendix B *Recommended Plan – Landscape Plan of* this report.

A key focus of the Recommended Plan is to provide additional greenspace and recreational opportunities for surrounding communities. The plan includes over 300 acres of greenspace / parklands. The types of greenspaces will be consistent with community goals and landscaping concept.

The Recommended Plan is unique from an urban design and landscape standpoint in several ways:

- its integration into the adjacent communities through the inclusion of significant open space buffer areas accessible by pedestrians with landscaped tunnels and open spaces adjacent to the community;
- the opportunity that it provides for ecological protection, restoration and enhancement, including linking existing natural heritage areas;
- its inclusion of a multi-use trail system;
- the opportunities to incorporate gateway features into the landscape plan.

The Recommended Plan will be experienced both by drivers on The Windsor-Essex Parkway and by adjacent residents. The Recommended Plan will not simply be understood as a transportation facility, but also as an integral part of the urban fabric of the adjacent communities. This unique project requires a specialized approach to urban design and the design of the associated open spaces, natural areas and multi-use trail system. As a major international gateway, the Recommended Plan will be designed as a landmark that will be known not only for its function but its form and presence within the landscape.

Elements of the plaza must also be designed in recognition of its importance as a gateway and to buffer its presence in the vicinity of sensitive natural area.

CONTEXT-SENSITIVE SOLUTIONS

"Context sensitive solutions (CSS) is a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic and environmental resources, while maintaining safety and mobility. CSS is an approach that considers the total context within which a transportation improvement project will exist."[3]

The Detroit River International Crossing Study has included an extensive consultation process that has incorporated several CSS events designed to inform stakeholders about the study and to generate feedback and input on the study. Landscape and urban design issues were introduced and discussed with stakeholders within a CSS approach.

Through events such as bus tours, Public Information Open Houses, and workshops concepts were developed to help formulate the urban design and landscape plan for the Recommended Plan. A variety of visualization tools including three-dimensional models, precedent images, photo-simulations and videos, allowed stakeholders to clearly understand the landscape, aesthetic and urban design implications of the practical alternatives and the Recommended Plan.

[3] US Federal Highway Administration (USFHWA) on www.contextsensitivesolutions.org

Introducing Landscape Principles and Themes

At public workshops in June 2006, landscape and urban design issues were introduced and broadly discussed in relation to the practical alternatives.

Opportunities for mitigation were discussed and precedent images were presented illustrating Ontarian, Canadian and International examples of mitigation solutions. Images shown included examples of noise barriers, vegetation, landforming and berms, land bridges, stormwater management facilities, and theming and gateways.

Landscape Impacts and Visualizations

At public workshops in October 2006 a series of themes was introduced as possible landscape and urban design treatments for the Recommended Plan. Each theme was applied to representative areas within each of the practical alternatives through the use of photo-simulations and sketch images.

The three themes were created in order to gauge interest in different approaches to design. The "Motor City" theme showed an approach to landscape and urban design that, while historically sensitive to the local history of automotive production, was at the same time focused on contemporary design. The "Rose City" theme showed an approach to design that was highly ornate, higher-maintenance and included design references from the late 19th and early 20th century. Public reaction was strongly in favour of "Carolinian", the theme that reflected the least ornate, most ecologically sensitive, and maintenance conscious design, but that remained contemporary in its approach

From these workshops, it was clear that landscape, environmental and urban design for the Recommended Plan should respect local natural heritage, focus on connections between human and natural communities and should consider maintenance of large open spaces as part of the design.

In August 2007, a PIOH was held that included high-resolution photo-simulations of the tunnels and a series of views of the facility from adjacent areas.

Moving Forward with Landscape Solutions

Following the establishment of The Windsor Essex Parkway as part of the preferred alternative, consultation regarding landscape and urban design solutions turned towards the establishment of the urban design, aesthetic and landscape guidelines that are outlined in the *Urban Design and Landscape Planning Report – The Recommended Plan (December 2008)*.

In July 2008, a draft landscape plan was discussed at public workshops. It was clear from the workshops that stakeholders remained focused on ecological principles and a green facility. Additionally, it was clear that the open spaces associated with the Recommended Plan should be focused primarily on providing a passive rather than active recreation function and that the most ecologically sensitive solutions should be pursued.

FUTURE CSS PROCESS

Future design phases should include a CSS-based consultation process to establish appropriate site-specific landscape treatments.

URBAN DESIGN

As a major international gateway, the Recommended Plan will be a landmark and a cultural symbol. As such, the aesthetic impact of the Recommended Plan and its integration into the landscape will be the subject of a more detailed Urban Design and Landscape Plan during subsequent design stages. This plan will build upon the concepts and principles established at this stage. The Urban Design Plan will address the visual aspects of the form, finish and materials used in the landscape and open spaces as well as in proposed structures (e.g. bridges, abutments, retaining walls, noise attenuation and safety barriers). It will also be closely coordinated with the future Landscape Design Plan. The Urban Design Plan should be developed as part of a consultation process with local stakeholders. The planning process will also seek opportunities to establish partnerships with First Nations, federal, provincial and local stakeholders to provide for the curation and funding of public art associated with potential gateway features.

AESTHETIC DESIGN PRINCIPLES

The Landscape Plan will form part of the Urban Design and Landscape Plan and will be composed of two parts: the elaboration of a theme or motif to be applied to the Recommended Plan; and a plan for incorporating public art in The Windsor-Essex Parkway corridor. The central principles of the Landscape Design Plan are unity of aesthetic experience and the creation of a gateway. The Landscape Plan will refer to the MTO Aesthetic Guidelines for Bridges 4 and will need to consider coordination with bridge and plaza designs to ensure a unified experience from one end of the proposed facility to the other. The landscape plan will consider the experience of the proposed facility from the point of view of:

- Drivers on The Windsor-Essex Parkway,
- Pedestrians utilizing the open spaces within The Windsor-Essex Parkway; and
- People viewing the Recommended Plan from adjacent residences, parks, streets, or businesses

The theme or motif will consider a palette of colours, forms and materials that may be used in the design of structural elements and in landscape design. The following elements will be subject to the aesthetic design plan:

- Barriers (including sound barriers, safety barriers, fencing)
- Retaining walls
- Tunnel abutments, parapets and columns
- Bridges and overpass structures
- Pedestrian and service road lighting
- Multi-use Trail crossing structures
- Landscaping
- Pedestrian signage and facilities.

Open spaces that are associated with The Windsor-Essex Parkway will be designed according to the following principles:

UNIFIED: The open spaces associated with the Recommended Plan will be considered as a unified whole. These spaces will be planned to function in an integrated manner and to present a unified aesthetic and visual environment for drivers and community users.

4 Aesthetic Guidelines for Bridges, Ontario Ministry of Transportation, Queen's Printer for Ontario, 2004.

GREEN: The vision for the Recommended Plan is to create a green corridor that supports new, viable natural communities and links existing natural areas.

CONNECTION: The tunnels provide an opportunity to create connections between communities on either side of The Windsor-Essex Parkway and along its length.

INTEGRATION: The Windsor-Essex Parkway travels through three municipalities, Tecumseh, LaSalle and Windsor, Ontario. The Windsor-Essex Parkway open spaces should integrate with the urban design, parks and recreation plans for these three municipalities as well as local and regional natural heritage systems.

GATEWAY: The Recommended Plan will be designed as a gateway to Canada, Ontario and Windsor-Essex.

Future design phases should include a CSS-based consultation process with local stakeholders to establish appropriate site-specific landscape treatments.

LANDSCAPE TYPES

The landscape plan divides the proposed landscape into different types that perform specific functions. Each of these landscape types employs a different combination of landscape elements such as grading, vegetation, multi-use trails and landscape amenities to create site-appropriate features:

- Gateway Landscapes function to provide an aesthetic, sculptural and memorable gateway to Canada, Ontario and Windsor-Essex. They will integrate a gateway and welcome feature into the highway design and, by creating monumental landforms, serve to accommodate some of the fill generated by highway construction.
- Screening Landscapes create a visual and noise screen / barrier between residences and road infrastructure. The screening landscape is a combination of one or more screening methods (sound barrier, vegetation, berming, fence), depending on the site characteristics and safety and engineering requirements.
- Stormwater Management Landscapes combine stormwater management with landscape amenity and are located in areas where stormwater management ponds are planned for technical design.
- Ecological Landscapes are the predominant landscape type within the Recommended Plan. Ecological landscapes will provide natural open spaces that knit the Recommended Plan into the natural landscape of the city, and provide the setting for the multi-use trail system. There are three main types: ecological protection landscapes, where existing sensitive habitat and vegetation are protected; ecological enhancement landscapes, where the ecological function and complexity of existing habitat and open spaces is improved; and ecological restoration landscapes, where new habitat will be created to extend and connect habitat within and around the Recommended Plan.
- Roadside Landscapes are located on the embankments of the freeway portion of The Windsor-Essex Parkway as well as between ramps and access roads and other areas inaccessible to pedestrians. This landscape type includes geometrically strong plantings and structural elements that provide a green, aesthetic driving experience for users of the freeway portion of The Windsor-Essex Parkway.
- The Multi-Use Trail travels through the various landscape types and allows pedestrians and cyclists to experience the landscape of The Windsor-Essex Parkway. Construction materials and alignments of the multi-use trail will vary depending on site and landscape type.

CONCLUSION

CSS workshops using visualizations, photography, and three-dimensional modelling have helped establish a suitable approach to the urban, landscape and aesthetic design of the Recommended Plan. Mitigation measures to reduce or improve visual and landscape impacts will include:

- the development of clear urban design and aesthetic guidelines to guide all aspects of future design
- the use of landforming and vegetation strategies to improve views, aesthetics, ecological function and screening
- the inclusion of a multi-use trail system and pedestrian-accessible open space within the facility

These mitigation measures will improve the visual character, aesthetic presence and landscape impact of The Windsor-Essex Parkway and thereby help to address the overall goal of improving the quality of life for residents achieved through buffering the communities from the roadway. The result of the landscape and visual impact mitigation will be a landscape that is unified, green, connected, integrated, and functions as a culturally significant gateway.

10.4.8 Groundwater

Groundwater pressure head levels within the granular soils and bedrock (near the soil-bedrock interface) range from about Elevation 182 m near the intersection of Highway 401 and Highway 3 (about 3.5 to 4 m below ground surface), to about Elevation 179 to 180 m near E.C. Row Expressway and Ojibway Parkway (about 1.2 m above ground surface). Artesian groundwater containing hydrogen sulphide was encountered during investigations near the intersection of Ojibway Parkway and E.C. Row Expressway. Similar groundwater conditions were encountered during drilling for the potential bridge crossing sites along and west of Sandwich Street.

The groundwater conditions within the bedrock or overlying granular soil aquifer could affect the feasibility of constructing deep excavations (greater than about 10 m) unless other excavation stability enhancement measures are implemented. In addition, temporary depressurization or dewatering of either granular soils near the bedrock interface or the bedrock could induce measurable consolidation settlements within the overlying silty clay soils. The need for such dewatering or depressurization will depend on the depth and size of specific excavations.

Creating permanent, open, and below-grade roadways within the native clays using slopes or supported with retaining walls (that do not cut off groundwater pressure gradients from adjacent higher grades) will result in a permanent lowering of the groundwater pressures within the clay soils surrounding the permanent cuts. Based on the estimated variation in vertical and horizontal permeability, and for preliminary planning purposes, it is anticipated that the zone of influence of such groundwater lowering within the silty clay should be assumed to be a distance up to about 5 times the depth of cut. Such groundwater lowering will induce settlement within the silty clay subsoils within this zone. It is anticipated that if low permeability in situ walls (e.g. contiguous caisson walls or concrete diaphragm walls) are used for excavation support or for permanent below grade structures, the influence of the excavation on near-surface groundwater would be much less. Further refinement of this zone of influence and the magnitude of potential settlement requires additional site-specific investigation and analyses.

At the time this report was prepared, no detailed dewatering assessments had been completed as the locations and dimensions of the potential areas requiring groundwater control had not been defined. Based on the anticipated condition of the soil and bedrock near the bedrock interface and the likely overall dimensions of construction, it is likely that significant volumes of water would require extraction in order to have measurable effects on the groundwater pressures. The natural groundwater contains hydrogen sulphide that must be managed and may require treatment during any extraction, collection, and disposal process. Disposal of the volumes that might be generated by construction dewatering may be impractical or prohibitively costly and will certainly require that a Permit to Take Water be obtained from the MOE for the project.

The need for dewatering should be minimized by limiting the depths of temporary and permanent excavations to the extent practicable. It is anticipated that limiting the maximum depth for the approach highway permanent cuts to depths on the order of about 9 m, generally east of the intersection of Huron Church Road and E.C. Row Expressway, should be sufficient to minimize the need for temporary construction dewatering that might otherwise induce settlements, impractical dewatering rates, treatment of groundwater and the need for MOE Permits to Take Water. In areas with artesian groundwater pressures, generally west of Malden Road, groundwater pressure mitigation measures may include use of controlled density drilling fluids for installation of deep foundations (e.g. drilled shafts or caissons) so as to minimize or avoid the need for dewatering.

Where contaminated soils and material are encountered, the procedures outlined in Section 10.2.6 should be followed to minimize the risk of mobilizing contaminants due to dewatering activities. In the event that hydrogen sulphide and any other contaminants are present in the groundwater, an *Ontario Water Resources Act*-approved treatment system may be required before discharging to a watercourse.

CONCLUSION

Due to the current groundwater conditions in the corridor, based on geotechnical investigations and analysis completed as part of this study, it is likely that in the event that deep excavations are undertaken requiring temporary depressurization of groundwater, significant volumes of water would require extraction in order to have measurable effects on the groundwater pressures. As such, the need for dewatering should be minimized by limiting the depths of temporary and permanent excavations to the extent practicable.

In general, south and east of the Huron Church Road/E.C. Row Expressway interchange, it is anticipated that limiting the maximum depth of the freeway to approximately 9 m below-grade would be sufficient to minimize the need for temporary construction dewatering that might otherwise induce settlements, impractical dewatering rates, treatment of groundwater and the need for MOE Permits to Take Water.

Also, generally west of Malden Road, where artesian groundwater pressures are present, measures to minimize or avoid the need for dewatering during construction may include use of controlled density drilling fluids for installation of deep foundations.

In the event that contaminated soils are encountered, the procedures outlined in Section 10.2.6 should be followed to minimize the risk of mobilizing contaminants due to dewatering activities. Where dewatering is necessary, if hydrogen sulphide or any other contaminants are encountered in the groundwater, an *Ontario Water Resources Act*-approved treatment system may be required before discharging to a watercourse.

10.4.9 Drainage and Stormwater Management

A Stormwater Management Plan has been developed for the purpose of mitigating potential effects to stormwater quantity and quality as a result of the proposed undertaking. The Stormwater Management Plan is described in the following paragraphs. Additional information on the stormwater management plans for the crossing, plaza and The Windsor-Essex Parkway is presented in Sections 9.1.5, 9.2.6 and 9.3.7, respectively.

STORMWATER MANAGEMENT ALTERNATIVES

A list of stormwater management practices (SWMP's) was screened, along with the "do nothing" alternative, with consideration of the general advantages and disadvantages, experience, and practical feasibility for the site specific conditions, such as:

- Integration with the standard type of drainage (storm sewers and outside ditches);
- Space available (within the proposed right-of-way), and practical outlet points;
- Functionality of using small orifice sizes to control peak outflow.

Although the "do nothing" alternative was initially considered, it was determined that this is not an acceptable course of action. The proposed increase in pavement area and the associated potential increase in pollutant loading to the receiving watercourses would result in negative effects such as reduced stream water quality, degraded aquatic habitat, flooding, and in-stream erosion, which necessitates provision of appropriate mitigation measures.

The list of SWMP's reviewed for appropriateness included:

- Storage SWMP's such as wet ponds, dry ponds, constructed wetlands and underground storage tanks;
- Infiltration SWMP's such as infiltration basins, infiltration trenches, sand filters and porous pavement;
- Vegetative SWMP's such as buffer strips, grassed swales and filter strips;
- Soft SWMP's such as conservation/restoration and source controls; and
- Special purpose SWMP's such as oil/grit separators and filter devices.

Based on an initial screening of SWMP's, it was concluded that:

- Storage SWMP's can be effective in providing combined quality/quantity control where drainage areas are sufficient and space is available.
- SWMP's based on infiltration can be effective in treating stormwater runoff, but their effectiveness is limited with respect to flooding and erosion control. Disadvantages include the high level of maintenance required and the potential for clogging. It should also be noted that the relatively high salt concentration associated with a highway would be infiltrated directly into the groundwater, which is not considered acceptable.
- Vegetative SWMP's such as grassed swales provide water quality treatment primarily by filtering out fine sediments and promoting infiltration, but can also be used to provide secondary erosion control. Filtering of highway runoff can also be accomplished with vegetative buffers and filter strips. Grassed swales are primarily designed to provide water quality control by limiting flow

velocities and increasing the wetted perimeter, while enhanced grass swales have permanent rock check dams to detain water during small events and/or flat bottoms to increase storage and contact. Vegetative SWMP's can be readily applied to highway situations, and are relatively inexpensive and particularly effective for small catchment areas.

- The implementation of soft SWMP's such as conservation/restoration and source control of pollutants such as de-icing salt are beyond the scope of this study and are addressed through MTO's policies and guidelines for roadway maintenance.
- Special purpose SWMP's, such as oil/grit separators, have limited application in highway runoff control.

Based on the results of the screening process, the solutions retained for further analysis were storage SWMP's and those based on the filtering effect of grass, namely, conventional and enhanced grassed swales.

According to research, for grassed swales to be very effective for quality control, it is desirable to limit:

- The maximum grade to 1.5 per cent;
- The maximum velocity to 0.5 m/s; and
- The maximum water depth to 0.5 m.

Due to the high groundwater level of associated with the study area, clay or impermeable liners will be required for swales in areas of high aquifer vulnerability. This will help prevent grit and roadway contaminants from infiltrating into the groundwater.

ASSESSING DRAINAGE AND STORMWATER MANAGEMENT IMPACTS

The Ontario Ministries of Transportation (MTO) and the Environment (MOE) have developed specific protocols for assessing drainage impacts which must be applied to all transportation projects in the province. In general terms, the drainage impact is determined by comparing the existing condition runoff effects within the study area to the proposed condition runoff effects.

For all development projects, quality and quantity treatment of runoff is necessary. Stormwater quality is degraded by increased pollutant loadings (oil, gravel, garbage, etc.), measured based on the total impervious percentage increase over the existing condition. The MOE document "*Stormwater Management Planning and Design Manual*" outlines the increase in pollutants over the development area, as well as providing guidelines for potential mitigations. Increases to surface runoff which exceed the existing peak flows to the watercourse will negatively impact the watercourse floodline and erosion condition. This can be mitigated by providing stormwater management practices which provide quantity control and erosion treatment to runoff from the study area, or resizing impacted crossing structures in order to prevent increases in floodlines. However, additional mitigation may also be required in specific circumstances.

Roadway drainage impact is determined by the number and frequency of flooding within the travel lanes. Flooding of the travel lanes can result in lane closures, traffic delays, or even accidents associated with hydroplaning.

POTENTIAL IMPACTS

Within the study area, runoff from the highway will discharge to a combination of intermittent and permanent watercourses via highway ditches. In order to assess the potential impacts of the Recommended Plan on the water quality and quantity of downstream watercourses, as well as the potential for erosion and fish habitat impacts, two types of critical areas were identified:

- Highway areas draining to watercourses that support fish habitat adjacent to the highway; and
- Highway areas that result in a large increase in pavement area relative to their total upstream drainage area, either because the upstream drainage area is relatively small or because the drainage area includes a large section of the highway. These result in a larger potential for erosion, flood risk, and water quality degradation in these watercourses.

As indicated previously, the proposed improvements will result in an increase in pavement area. The receiving watercourses for the Recommended Plan are all classified as Warm Water Fishery habitat, and thus proper stormwater management controls should be implemented throughout the site.

MITIGATION MEASURES

The proposed stormwater management strategy consists of utilizing flat-bottomed grassed swales in all locations for surface drainage and stormwater management wetponds to provide *Enhanced Protection Level* treatment, as outlined in the Ministry of the Environment (MOE) document entitled *Stormwater Management Planning and Design Manual*, for quality, quantity and erosion control to runoff. In addition, vegetative SWMP's such as enhanced ditches, bio-swales and plunge pools are to be utilized along critical highway areas where access to a Stormwater management pond is limited, as well as to provide localized erosion control measures. Furthermore, due to the high groundwater level associated with the study area, clay or impermeable liners will be required for swales in areas of high aquifer vulnerability.

Deck drains are not recommended for drainage of the bridge deck, as direct discharge to the Detroit River without out providing quality control would occur. Possible alternatives may utilize pipe systems integrated within the crossing to convey stormwater off of the structure. If determined to be feasible, the runoff could be conveyed to a treatment facility (wetpond or grassed swales) where quality, quantity and erosion treatments could be provided. The feasiblilty, sizing and location of the treatment facility will be confirmed during future design stages.

To account for potential contaminant spills (e.g. oil, chemical, etc.) on the crossing structure and within the plaza area, design details will be developed during future design stages in accordance with applicable standards. For the plaza area, a shut-off valve or other alternative damming procedures may be proposed for the adjacent stormwater management ponds. The preferred treatment will be determined during future design stages.

Under existing conditions, surface water runoff is not controlled. As such the level of quality treatment provided for surface water runoff discharging to receiving watercourses in the study area with the proposed stormwater management plan in place will be improved. However, the need for measurement of baseline conditions in watercourses will be investigated during future design stages in consultation with the appropriate regulatory agencies.

MTO employs and recognizes the importance of best salt management practices and has developed a Salt Management Plan in accordance with *Environment Canada's Code of Practice for the Environmental Management of Road Salts (Environment Canada, 2004)*. MTO follows 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. Best management practices include advanced

weather forecasting, electronic spreader equipment, the use of brines in pre-wetted salt, and varying application rates of road maintenance materials to match weather conditions. MTO will continue to investigate de-icing alternatives to control and reduce salt usage while ensuring highway safety.

A monitoring plan may be required to confirm that the construction and operation of the project will not degrade water quality. This requirement will be investigated during future design stages. If required, elements of the plan would include inspections by an Environmental Monitor. Elements of a possible monitoring plan are summarized below:

- Minimum weekly inspections of all erosion and sediment control (ESC) measures, including all siltation fencing;
- Mandatory inspections of all ESC measures following a rainfall event;
- Inspections after significant snow-melts;
- Daily inspections during extended rain or snowmelt periods;
- High-risk areas (soil stockpiles, dewatering locations, etc) may require more frequent inspections;
- An ESC report will be required after each inspection, citing all deficient measures (broken/torn silt fence, siltation entering watercourse, etc);
- All damaged/deficient ESC measures should be repaired or replaced within 48-hours of the inspection.

These elements will be subject to further refinement during subsequent design stages based on the availability of more detailed information. In addition, the monitoring plan will include specific contingency measures to rectify degradation that is identified based on monitoring data.

CONCLUSION

A Stormwater Management Plan has been developed for the purpose of mitigating potential effects on the quantity and quality of stormwater runoff being discharged to local watercourses as a result of the proposed undertaking.

To achieve an *Enhanced Protection Level* of treatment, as outlined in the Ministry of the Environment (MOE) document entitled *Stormwater Management Planning and Design Manual*, the proposed stormwater management strategy consists of the use of flat-bottomed grassed swales, stormwater management wetponds as well as provision of localized erosion control measures and localized use of vegetative SWMP's such as enhanced ditches, bio-swales and plunge pools along critical highway areas where access to a Stormwater management pond is limited.

In addition, due to the high groundwater level associated with the study area, clay or impermeable liners will be required for swales in areas of high aquifer vulnerability. This will help prevent grit and roadway contaminants from infiltrating into the groundwater.

Stormwater management for runoff treatments for the crossing structure will be investigated during future design stages. Alternative methods for providing quantity and quality treatment will be examined, all in accordance with the latest applicable MOE design standards and guidelines.

To account for potential contaminant spills (e.g. oil, chemical, etc.) on the crossing structure and within the plaza area, design details will be developed during future design stages in accordance with applicable standards. For the plaza area, a shut-off valve or other alternative damming procedures may be proposed for the adjacent stormwater management ponds, however, the preferred treatment will be determined during future design stages.

With the proposed stormwater management plan in place, the level of quality treatment provided for surface water runoff discharging to receiving watercourses in the study area will be improved. However, the need for measurement of baseline conditions in watercourses will be investigated during future design stages in consultation with the appropriate regulatory agencies.

In addition, MTO employs and recognizes the importance of best salt management practices and will continue to investigate de-icing alternatives to control and reduce salt usage while ensuring highway safety

A monitoring plan may be required to confirm that the construction and operation of the project will not degrade water quality in watercourses receiving runoff. This requirement will be investigated during future design stages. If required, elements of the plan would include inspections by an Environmental Monitor and specific contingency measures to rectify degradation that is identified based on monitoring data. The need for, and design of, a monitoring plan will be determined during subsequent design stages based on the availability of more detailed information.

10.5 Commitments to Future Work

The following outlines commitments to future environmental work to be undertaken during subsequent design stages of this project.

10.5.1 Air Quality

The air quality modelling demonstrates that overall, implementation of the Recommended Plan will reduce future transportation related air quality impacts within the study area. Therefore, the Recommended Plan will act as a small mitigation measure for future transportation related air quality impacts within Windsor Region.

Best practices for maintenance will be employed to minimize dust levels from operation of The Windsor-Essex Parkway and thereby minimizing the risk of localized elevated fine particulate matter levels.

10.5.2 Socio – Economic Environment

NOISE

Final recommendations with respect to the location, height, etc. of noise barriers, berms or a combination of both will be reviewed during future design stages.

Consultation with communities will continue during the design and construction stages, to provide additional opportunities for input on noise mitigation measures during both the construction and operation stage.

PROTECTION OF COMMUNITY AND NEIGHBOURHOOD CHARACTERISTICS

In addition, a communication process will be implemented during construction to manage disruption effects experienced by residents, and regular communications will be maintained with emergency services and the municipalities with regard to changes to the road network, municipal services, etc.

EXISTING AND FUTURE LAND USE

Opportunities to minimize potential property impacts associated with the Recommended Plan will be reviewed during future design stages in consultation with municipalities and property owners.

PROPERTY AND WASTE CONTAMINATION

To reduce the uncertainty of whether contamination is present, a Phase II ESA should be conducted during future design phases. Phase III work will be undertaken as necessary to further investigate and mitigate possible contamination as necessary.

10.5.3 Natural Environment

Follow-up work, including field investigations will be undertaken as required to facilitate the development of mitigation measures, compensation plans, and to obtain necessary permits and approvals.

WILDLIFE AND WILDLIFE HABITAT

The following measures will be employed during future design stages:

- Options for permanent protection of critical Butler's gartersnake habitat will be developed in later consultation phases.
- The presence/absence of Eastern foxsnake hibernacula within the vicinity of the Recommended Plan will be investigated during subsequent design stages to determine the potential for impacts.
- A continued study of the Butler's garter snake population and the restoration area is necessary once the proposed highway is completed.

MIGRATORY BIRDS

Migratory bird species have been identified. However, populations and behaviours of migratory and resident bird species should be further studied in the vicinity of the Detroit River crossing. Radar studies, acoustic studies and point count surveys may be carried out to provide input to bridge design.

VEGETATION

Effective techniques for mitigating impacts for individual species at risk and significant plant communities will be further investigated in discussion with agencies, First Nations and other interested parties toward the achievement of overall net benefits and permitting under the *Ontario Endangered Species Act, 2007* and the federal *Species At Risk Act.*

MOLLUSCS AND INSECTS

The following measures will be employed during subsequent design stages to protect Monarch populations and habitat:

- Opportunities to minimize vegetation removals will continue to be examined in future design stages, and areas that should be protected during construction will be delineated prior to construction start.
- Following construction other disturbed areas that revegetate are also likely to self-seed with host plants and create additional Monarch habitat.
- The construction limits will be delineated with sensitive areas identified prior to the start of construction.

FISHERIES

Measures to mitigate impacts to fish habitat and fish passage at the submerged culvert locations will be developed in the subsequent design phase in consultation with Fisheries and Oceans Canada. A Letter of Intent and Application will be prepared during subsequent design stages to secure the required federal *Fisheries Act* authorizations for this project.

DESIGNATED NATURAL AREAS

MTO will discuss the dedication of protected, enhanced or restored lands located within the right-of-way for The Windsor-Essex Parkway to appropriate agencies, First Nations and other stakeholders to ensure permanent protection, conservation and research.

LANDSCAPE PLAN

The overall Landscape Plan for the Recommended Plan will be developed through ongoing consultation with the adjacent communities. The multi-use trail is part of an active transportation network for the neighbouring municipalities and as such will be integrated to the extent possible into existing and planned regional and local cycling and active transportation networks.

EMERGENCY SERVICE

Emergency service providers have been consulted and are aware that they will need to reassess their resources, level of service, access routes for the freeway, and in general, their ability to access their entire area of coverage, in order to ensure provincially mandated response times are met. Future consultation with emergency services will take place.

10.5.4 Cultural Environment

Assessments of Archaeological Resources and Cultural Heritage Resources will continue during subsequent design stages. The archaeological assessment will consist of completion of Stage 2 for all properties that have not yet been evaluated. Stage 3 Assessment will be completed for all sites identified to date within the Recommended Plan and for those sites identified during the remaining Stage 2 testing. The study team will continue to consult with WIFN regarding archaeology work.

Assessment for Cultural Heritage resources will consist of completion of Cultural Heritage evaluation reports for three structures (BHR's 1, 8 and 19) and Detailed Documentation reports for three others (BHR's 2, 7 and 9).

10.5.5 Groundwater

Detailed investigations, testing, and analyses will be required during final design to adequately assess the feasibility of dewatering or groundwater depressurization within the bedrock or overlying granular soils, and to minimize the risk of mobilizing contaminants due to dewatering activities.

In addition, if a Permit to Take Water is required, Ministry of the Environment (MOE) approval, under the *Ontario Water Resources Act*, will be sought.

10.5.6 Stormwater Management

Design details will be developed during future design stages in accordance with applicable standards to treat stormwater runoff from the crossing and to account for potential contaminant spills (e.g. oil, chemical, etc.) on the crossing structure and within the plaza area.

In addition, the need for measurement of baseline conditions in watercourses will be investigated during future design stages in consultation with the appropriate regulatory agencies.

The need for a monitoring plan to confirm that the construction and operation of the project will not degrade water quality will also be investigated during future design stages

MTO will continue to investigate de-icing alternatives to control and reduce salt usage while ensuring highway safety.

10.6 Project Monitoring

PROJECT SPECIFIC TECHNICAL MONITORING

During construction, MTO or its agent will ensure that the implementation of the mitigating measures and key design features are consistent with the approvals of the EA and in accordance with the contract. In addition, MTO or its agent will assess the effectiveness of its environmental mitigating measures to ensure the following:

- Individual mitigating measures are providing the expected control and/or protection;
- Composite control and/or protection provided by mitigating measure is adequate;
- Additional mitigating measures are provided as required for any unanticipated environmental conditions which may develop during construction;
- Information is available for the overview assessment of mitigating measures; and,
- Environmental monitoring, after a project is completed, may involve follow-up monitoring of significant measures and /or significant concerns.

10.6.1 Implementation of Environmental Monitoring Framework

INSPECTION BY CONSTRUCTION ADMINISTRATION STAFF

Construction is subject to daily general on-site inspection to ensure the execution of the environmental component of the work and to deal with environmental problems that develop during construction. This is the primary method for compliance monitoring.

SITE VISITS BY ENVIRONMENTAL STAFF

Regular site visits by well qualified and experienced construction administration environmental staff to ensure mitigation elements are being carried out. The timing and frequency of such site visits will be determined by the schedule of construction operations, the sensitivity of environmental concerns and the development of any unforeseen environmental problems during construction.

10.7 Summary of Environmental Mitigation and Commitments to Future Work

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
1.0	AIR QUALITY	10.1	Construction / Operation	MOE/ EC/ MTO	*Air Quality Mitigation During Construction and Operation* Various mitigation measures will be employed during construction to minimize adverse air quality effects such as dust impacts through the use of proper controls, such as: • periodic watering of unpaved (unvegetated) areas; • periodic watering of stockpiles; • limiting speed of vehicular travel; • use of water sprays during the loading, unloading of materials; • sweeping and/or water flushing of the entrances to the construction zones; and, • use of calcium chloride. Road sweeping practices in accordance with maintenance standards will be employed to reduce silt loading on The Windsor-Essex Parkway during the operations phase.
2.0	NOISE & VIBRATION	10.2.1	Construction / Operation	MOE/ MTO	*Noise Mitigation During Construction and Operation* The following measures will be undertaken to reduce noise during the operating phase: • Mitigation measures were identified to address operation effects for the Recommended Plan as outlined below: In all cases, for receptors located in areas along The Windsor-Essex Parkway, the proposed 5 m high noise barrier where required was effective in reducing the predicted project noise to within 5 dB of the estimated baseline noise levels. • In many cases, especially for receptors on the north side of the Windsor-Essex Parkway a decrease in noise levels compared to future "No-Build" noise levels was predicted. The following measures will be undertaken to mitigate noise during the construction phase of the Recommended Plan: • Ensure that all construction equipment used is in good repair, fitted with functioning mufflers, and complies with the noise emission standards outlined in MOE guidelines; • To the greatest extent possible, limit the most noisy construction activities to daytime hours; • Where the sequencing of construction permits, permanent noise barriers and/or berms may be built during the early phases of construction in order to reduce construction noise levels at receptor locations; • Maximize the distance between the construction staging areas and nearby receptors to the greatest extent possible; • Maintain construction haul roads to prevent potholes and ruts to avoid the loud noise caused by construction vehicles travelling over uneven road surfaces; and • Develop a process for receiving, investigating and addressing construction noise complaints received from the public.

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
					Consultation with communities during the design and construction phases will provide additional opportunities for input on noise mitigation measures during both the construction and operation stages. The pavement design shall consider the generation of noise from roadway elements does not exceed the noise levels assumed within the acoustic modelling carried out within this Environmental Assessment for the purposes of identifying impacts to surrounding communities and mitigation strategies. Based on the field monitoring results, it is expected that the vibration levels as a result of implementation of the Recommended Plan will comply with MOE criteria. For this reason, no measures are being proposed to mitigate vibration levels.
3.0	PROTECTION OF COMMUNITY AND NEIGHBOURHOOD CHARACTERISTICS	10.2.2	Construction / Operation	MTO/ MOE	*Protection of Community and Neighbourhood Characteristics* Mitigation measures recommended to reduce the social impact on the broader and neighbourhood communities include: • Implementation of the "willing seller-willing buyer" property purchase program; • Fair market value for properties required for the project; • Implement a communication process during construction to manage disruption effects experienced by residents; • Develop and maintain regular communications with emergency services and the municipalities with regard to changes to the road network, municipal services, etc.; • For residents in the Spring Garden area, protect and maintain and landscape as much as possible to enhance the lands between the residences and the facility; • Assess the need for improvements to Montgomery Drive; and, • For The Windsor-Essex Parkway, illumination will be designed to provide sufficient lighting for the roadways while limiting light trespass beyond the roadways, and full cut-off luminaires will be provided. Additional details of the illumination system will be determined during subsequent stages of design. • Where practical, lighting used at the plaza should be designed to minimize light intrusion into surrounding areas, while ensuring adequate lighting for operational requirements. This may involve using full cut-off luminaires, shielding, if necessary, and investigating the use of conventional lighting in place of high mast lighting. Lighting should be focused downwards and shielded where necessary to prevent light spillage into nearby residential and community areas.

4.0	ECONOMIC IMPACTS	10.2.3	Construction/ Operation	MTO	*Economic Impacts*
					Construction of the Recommended Plan will lead to 12,000 project related jobs. Mitigation measures recommended to reduce economic impacts are identified below.
					• For businesses that are physically disrupted, financial compensation will be offered.
					• For businesses that are not physically disrupted but are affected through visibility, or reduced traffic volumes, several other forms of mitigation will be used:
					  • The service road network will allow for adequate access to existing commercial corridors;
					  • Signage will be considered at certain locations to make motorists aware of businesses/business clusters, as policies permit; and

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
					• Efforts will be made during the construction phase to ensure access is maintained to operating businesses.
5.0	EXISTING AND PLANNED LAND USE	10.2.4	Operation	MTO/ MUNICIPALITIES	*Existing and Planned Land Use* Mitigation measures and commitment to future consultation recommended to reduce existing and planned use impacts are identified below. • The following municipalities will be consulted; City of Windsor, Town of Tecumseh, Town of LaSalle and Essex County through the development of an integrated Urban Design and Landscape Plan during later design stages. • Further consultation between Hydro One and Transport Canada/Public Works Canada will be completed during future design phases.
6.0	WASTE AND WASTE MANAGEMENT	10.2.6	Construction	MTO/ MOE	*Waste and Waste Management* Mitigation measures recommended for waste and waste management to reduce impacts are identified below. • If contamination to soil and/or groundwater is identified, a Site Management Plan may be developed for further investigation, which may include a Phase III ESA. • Further evaluations could include risk assessments to determine whether the contamination represents a potential threat to human health or the environment, typically followed by monitoring of natural attenuation (MNA). • Should any contaminated materials be encountered during construction, caution will be exercised while handling and disposing of contaminated materials. Excess materials will be managed in accordance with normal MTO practices (as governed by OPSS 180, or the most current standard at the time of construction). • To evaluate the presence of ACMs, LBP and PCBs, in structures and equipment a Designated Substance Survey (DSS) may be required prior to demolition.
7.0	ARCHAEOLOGICAL RESOURCES	10.3.1	Construction	MCL / MTO	*Archaeological Resources* Mitigation measures required for Archaeology Resources prior to and during construction are identified below. • Should deeply buried archaeological remains be found on the property during construction activities, the Manager, Cultural Programs unit, Ontario Ministry of Culture, should be notified immediately; and, • In the event that human remains are encountered during construction, the proponent should immediately contact both the Ontario Ministry of Culture and Registrar or Deputy Registrar of the Cemeteries Regulation Unit of the Ontario Ministry of Small Business and Consumer Services. The study team will continue to consult with WIFN regarding archaeology work.
8.0	CULTURAL HERITAGE RESOURCES	10.3.2	Construction	MCL / MTO	*Built Heritage Resources* Mitigation measures recommended for Cultural Resources to reduce any impacts are identified below. • A Cultural Heritage Resource Documentation Report will be prepared for applicable features. • Relocation of individual structures within the region; or

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
					• Salvage of significant architectural elements followed by demolition. Where relocation is recommended, the City of Windsor Heritage Committee should be consulted.
9.0	VEGETATION AND VEGETATION COMMUNITITES	10.4.3	Construction / Operation	MNR / MTO / MUNICIPALITIES	**Vegetation and Vegetation Communities** The following mitigation measures can be employed to address impacts to Vegetation and Vegetation Communities as a result of the construction and operation of the Recommended Plan. • Areas that should be protected during construction will be delineated prior to construction start and no activities will be permitted in these areas. • The Urban Design and Landscape Plan will include detailed prescriptions for vegetation management including edge management plans, soil management plans, use of native and non-invasive plant materials, prairie disturbance regimes, control of exotic and invasive species and management of species at risk. The landscaping plan will be prepared in later design stages. • Permits and approvals required under SARA and ESA 2007 will be obtained prior to construction. Detailed mitigation strategies will be developed in order to obtain the permits. • Vegetation removals will be avoided in the vicinity of species at risk and their habitat during the growing season. • Opportunities will be sought to forge partnerships with parties to relocate species to lands in public ownership, to otherwise restore and enhance these lands with native plants and species at risk and to transfer lands within The Windsor-Essex Parkway to parties that can best protect sensitive areas. • Consideration of these strategies would be done in consultation with appropriate regulatory agencies (e.g. CWS, MNR) and with other authorities who may have a role in environmental stewardship, including municipalities, ERCA and WIFN. *Monitoring Activities* • During construction, an environmental inspector will make frequent random site visits to ensure that construction activities are not causing any harm in areas that are to be protected. • Post-construction monitoring should occur to ensure successful plant establishment and reproduction.
10.0	MOLLUSCS AND INSECTS	10.4.4	Construction / Operation	MNR / MTO	**Molluscs and Insects** The following mitigation measures can be employed to address impacts to Molluscs and Insects as a result of the construction and operation of the Recommended Plan. • The area for vegetation removals has been minimized to the extent possible, and areas that should be protected during construction will be delineated prior to construction start. The mitigation measures prescribed for Monarchs will also reduce potential impacts to other insect species. • To avoid impacts to species at risk and their critical habitat, vegetation removals will be avoided in the vicinity of species at risk and their habitat during the growing season. • The areas for restoration and enhancement will result in the creation of new Monarch habitat, as those areas will be intentionally or naturally seeded by host plants.

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
					• Following construction other disturbed areas that re-vegetate are also likely to self-seed with host plants and create additional Monarch habitat. The construction limits will be delineated with sensitive areas identified prior to the start of construction. • Good housekeeping practices will be employed to prevent the contamination of habitat adjacent to the work area. In the event of an upset or spill, a quick and effective response to contain the spill and clean up the area will be employed.
11.0	FISH AND FISH HABITAT	10.4.5	Construction / Operation	MTO/ MNR/ DFO	**Fish and Fish Habitat** *The following mitigation measures can be employed during construction to avoid or reduce impacts of the Recommended Plan:* *Changes to water quality and quantity:* • Best construction practices should be employed to reduce the potential for spills and materials/equipment from entering water. • Maintenance, fuelling and storage should occur at least 30 m from watercourses/drains. • Debris should be prevented from entering watercourses/drains and a spill response plan should be developed. • Sediments should be prevented from reaching sensitive areas through erosion and sediment controls and exposed soils stabilized as soon as possible. • A stormwater management plan should be developed and implemented to treat run-off during operations. • If it is necessary to undertake construction activities within the Detroit River, an assessment of potential impacts will be completed, subject to approval from the relevant regulatory agencies. *Alterations to baseflow:* • The increases in impervious surfaces and areas of soil compaction should be minimized to facilitate as much infiltration of surface water as possible. • Management of stormwater through the development and implementation of a stormwater management plan will address potential reductions in baseflow. • Methods that encourage infiltration will be investigated. • Flows in watercourses will be monitored during dewatering activities and measures will be implemented in the event that baseflow is significantly affected. *Barriers to fish passage:* • Water flow should be maintained during construction. *Mortality of fish species:* • The magnitude of effects should be minimized through the employment of timing windows for in-water work, commencing work only when all materials are present and staging of work to minimize duration. • Work should be performed in the dry and isolated fish should be captured and relocated by qualified personnel.

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
					Impacts associated with the operations phase for the Recommended Plan on fish and fish habitat can be mitigated by the following: *Barriers to fish passage:* • Culverts, designed using fish-friendly methods, and channels, designed using natural channel design principles, should not form barriers to fish passage during operations. • Fish passage options (including mechanical and manual lifts) will be considered at Cahill and Lennon Drains to provide safe fish passage across the Windsor-Essex Parkway. • If the feasibility of maintaining fish passage in Cahill and Lennon Drains is found to be impractical due to costs, maintenance, hazards to roadway, etc., additional habitat creation areas within the Recommended Plan area will be examined, in addition to the possibility of off-site compensation for the potential loss of productivity in the form of financial contributions to fund, or help to fund, nearby fish habitat restoration/enhancement projects • Consideration for project funding regarding fish passage options should be done in consultation with appropriate regulatory/environmental agencies (e.g., DFO, ERCA, MNR, municipalities). Walpole Island First Nations have also expressed an interest in the development of solutions to address possible fisheries impacts *Loss of fish habitat:* • The extent of fish habitat affected can be minimized through engineering structures to fit within the smallest possible footprint areas. • Culvert lengths and extensions can be minimized through the use of headwalls, wingwalls and guide rails and extensions should match the inverts of the existing culverts and streambeds. • New crossing structures should be constructed using fish-friendly designs including appropriate horizontal and vertical clearances, open bottoms, countersinking, etc. • Realigned channels should be designed using natural design principles to enhance new habitat over existing habitat. • Riparian vegetation should be maintained where possible. • A fish habitat compensation plan will be prepared during later design stages to ensure no net loss of the productive capacity of fish habitat. *Effects on Water Quality and Quantity:* • Stormwater quality control that will be provided with the Windsor-Essex Parkway will lead to an overall enhancement to water quality and a net benefit to fisheries. • Stormwater runoff associated with The Windsor-Essex Parkway and the plaza will be treated in stormwater management wet ponds designed in accordance to the MOE document “Stormwater Management Planning and Design Manual” for Enhanced Protection Level. This will require the removal of 80 per cent of total suspended solids (TSS), as well as providing erosion attenuation of the 25mm storm for 24 hours. • In addition, the stormwater management ponds will provide quantity storage to control peak flows from The Windsor-Essex Parkway to pre-development rates. • Deck drains are not proposed on the crossing and runoff will be collected to stormwater detention facilities for quality treatment prior to discharging to the river, as necessary and feasible.

ID #	Environmental Element/Concern and Potential Impact	Reference Section	Anticipated Timeframe	Concerned Agencies	Summary of Environmental Mitigation and Commitments to Future Work
					• In addition, the removal of 30 entrance culverts and the plan to provide a natural channel configuration for a significant area of the Wolfe Drain will result in a gain of fish habitat. *Alterations to baseflow:* • A stormwater management plan should be developed and implemented to ensure that reductions in baseflow do not occur. *Changes to water temperature:* • A stormwater management plan will be developed which will address the treatment of run-off. *Monitoring Activities* • An environmental inspector should be present on site during critical in-water work activities. • Post-construction monitoring is typically prescribed in the federal Fisheries Act authorization. The terms and conditions of the federal Fisheries Act authorization will be met. • Post-construction monitoring, if prescribed, will determine the effectiveness of environmental protection and compensation measures, identify problem areas and recommend corrective measures. • The performance of any fish passage system (mechanical or manual lifts) should be monitored for at least two years after construction to ensure that they are passing fish as designed. • During spring migration (March/April), a fish passage study using mark-recapture or radio-telemetry could assist in determining the effectiveness of fish passage.
12.0	WILDLIFE AND WILDLIFE HABITAT		Construction / Operation	MNR/ MTO	**Wildlife and Wildlife Habitat Mitigation Measures** The following mitigation measures may be employed to address impacts to Butler's gartersnake and eastern foxsnake populations and other wildlife as a result of the construction and operation of The Windsor-Essex Parkway. • Permits and approvals under SARA and ESA 2007 will be obtained prior to construction. Detailed mitigation strategies will be developed in order to obtain the permits. On-going consultation with regulatory agencies such as ERCA, MNR, CWS as well as on-going consultation with First Nations will occur during future design stages. • To avoid impacts to species at risk and their critical habitat, vegetation removals should not occur during the growing season in specified areas. • Habitat restoration and enhancement will be implemented to create new and higher quality habitat. • Areas of habitat to be retained will be clearly marked in the field and protected from construction activities. • Wildlife salvage will be carried out prior to clearing/grubbing to reduce the risk of wildlife mortality. • Enhancement and restoration of habitat located along The Windsor-Essex Parkway will offset habitat loss and will establish connections between designated natural areas. • A snake barrier will be installed along side portions of the construction area to prevent snakes from entering the work zone and redirect snake movements to safer areas, like the restored habitat.

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					• Options for permanent protection of critical Butler's gartersnake habitat will be developed in later consultation phases. • The creation of new snake nesting areas and hibernacula will occur to compensate for any losses of habitat. • Snakes will be captured and relocated prior to construction as necessary, to avoid mortality. • Disturbance to wildlife during the operations phase will be mitigated through berming, light shielding and prohibiting access to significant wildlife habitat by humans. • Measures to mitigate potential bird mortality from the Detroit River crossing such as bridge design and lighting will be investigated in greater detail during future design phases. • The Ministry of Transportation will consult with relevant agencies and authorities with regard to future lighting requirements for the proposed crossing. • Architectural lighting to highlight the aesthetics of the bridge should be developed in consideration with the effect of the migrating birds. • Monitoring of the remaining Butler's garter snake population and their hibernacula should be undertaken in order to provide for long-term protection of the Butler's gartersnake population and their habitat. • Eastern foxsnake tracking should continue to determine their egg laying sites and hibernacula sites. The following mitigation measures can be employed to address impacts to these species and others as a result of the construction and operation of the plaza and crossing. • The site plan for the inspection plaza incorporates several mitigation measures including: berming, landscaping, the establishment of buffer areas/setbacks and a stormwater detention pond. • On the south side of the inspection plaza, a stormwater detention pond is proposed in association with a vegetative buffer. The stormwater detention pond enhances the buffer width between the inspection plaza and the Black Oak Woods to the south. • Lighting used at the inspection plaza should be designed to minimize light intrusion into surrounding areas, while ensuring adequate lighting for operational requirements. This may involve using full cut-off luminaires, shielding, if necessary, and investigating the use of conventional lighting in place of high mast lighting. Lighting should be focused downwards and shielded where necessary to prevent light spillage into nearby natural areas such as the Black Oak Woods. • Wildlife salvage should be performed on-site prior to vegetation removals. Vegetation removals should be avoided in the vicinity of species at risk and their habitat during the growing season.
13.0	DESIGNATED NATURAL AREAS	10.4.6	Construction / Operation	MNR/ MTO	**Designated Natural Areas** Mitigation measures and consultation recommended to reduce impacts on designated natural areas include: • Opportunities to dedicate portions of these lands to appropriate parties for protection will be discussed at later design stages. Lands will be available to be dedicated for protection including provincially rare vegetation communities, habitat for species at risk, wildlife corridors and other ecological functions. • Mitigation measures for the loss of area or ecological function of designated natural areas are similar to the mitigation measures identified for vegetation and wildlife.

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					Monitoring Activities • Consideration of these options would be done in consultation with appropriate regulatory agencies (e.g. DFO, MNR) and with other authorities who may have a role in environmental stewardship, including municipalities, ERCA and WIFN.
14.0	URBAN DESIGN AND LANDSCAPE PLAN	10.4.7	Operation	MTO / MUNICIPALITIES	**Urban Design and Landscape Plan** Commitments for future consultation and work with regard to the Urban Design and Landscape Plan. • This plan will build upon the concepts and principles established at this stage. • The Urban Design Plan will address the visual aspects of the form, finish and materials used in the landscape and open spaces as well as in proposed structures (e.g. bridges, abutments, retaining walls, noise attenuation and safety barriers). • The Urban Design Plan will also be closely coordinated with the future Landscape Plan. The Urban Design Plan should be developed as part of a consultation process with local stakeholders. • Partnerships will be developed with First Nations, federal, provincial and local stakeholders to provide for the curation of public art associated with potential gateway features. Mitigation measures to reduce or improve visual and landscape impacts will include: • The development of clear urban design and aesthetic guidelines to guide future design. • The use of landforming and vegetation strategies to improve views, aesthetics, ecological function and screening. • The inclusion of a multi-use trail system and pedestrian-accessible open space within the facility.
15.0	GROUNDWATER	10.4.8	Construction/ Operation	MTO	**Groundwater** Mitigation measures recommended to reduce groundwater impacts include: • In areas with artesian groundwater pressures, generally west of Malden Road, groundwater pressure mitigation measures may include use of controlled density drilling fluids for installation of deep foundations (e.g. drilled shafts or caissons) so as to minimize or avoid the need for dewatering. • Detailed investigations, testing, and analyses will be required during final design to adequately assess the feasibility of dewatering or groundwater depressurization within the bedrock or overlying granular soils, the consequent effects of dewatering/depressurization (if any), and any mitigation measures needed to minimize or avoid the influence of such work on the surrounding area. • If a Permit to Take Water is required, Ministry of the Environment (MOE) approval, under the Ontario Water Resources Act, will be sought. • As discussed in Section 10.2.6, there are potential contaminated sites within the corridor. Where contaminated soils and material are encountered, the procedures outlined in Section 10.2.6 should be followed to minimize the risk of mobilizing contaminants due to dewatering activities. In the event that hydrogen sulphide and any other contaminants are present in the groundwater, an Ontario Water Resources Act approved treatment system may be required before discharging to a watercourse.

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16.0	DRAINAGE AND STORMWATER MANAGMENT	10.4.9	Construction/ Operation	MTO	**Drainage and Stormwater** Mitigation measures recommended to reduce drainage and stormwater impacts include: • Stormwater quality control that will be provided with the Windsor-Essex Parkway will lead to an overall enhancement to water quality. • The proposed stormwater management strategy consists of utilizing flat-bottomed grassed swales where feasible for surface drainage and stormwater management wetponds to provide Enhanced Protection Level quality, quantity and erosion control to runoff. • Vegetative SWMP's such as enhanced ditches, bio-swales and plunge pools are to be utilized along critical highway areas where access to a Stormwater management pond is limited, as well as to provide localized erosion control measures. • Due to the high groundwater level of associated with the study area, clay or impermeable liners will be required for swales in areas of high aquifer vulnerability. • To account for potential contaminant spills (e.g. oil, chemical, etc.) on the crossing structure and within the plaza area, design details will be developed during future design stages in accordance with applicable standards. • For the plaza area, a shut-off valve or other alternative damming procedures may be proposed for the adjacent stormwater management ponds. The preferred treatment will be determined during future design stages. • Stormwater management for runoff treatments for the crossing structure will be investigated during future design stages. Alternative methods for providing quantity and quality treatment will be examined, all in accordance with the latest applicable MOE design standards and guidelines. Deck drains are not recommended for drainage of the bridge deck, as this would release discharge directly to Detroit River without providing quality control. Possible alternatives may utilize pipe systems integrated within the crossing to convey stormwater off of the structure. However this will be subject to an assessment of technical feasibility during future design stages. If determined to be feasible, the runoff will be conveyed to a treatment facility (wetpond or grassed swales) where quality, quantity and erosion treatments can be provided as per the MOE requirements. The sizing and location of the treatment facility will be confirmed during future design stages. • The need for measurement of baseline conditions in watercourses will be investigated during future design stages in consultation with the appropriate regulatory agencies. • Alternative stormwater solutions for the plaza that may be considered include permeable pavers, perforated storm sewer pipes, Green Roof systems, and infiltration basins. These alternative solutions will be designed to provide additional upstream quality and quantity control of runoff prior to reaching the stormwater management ponds. Additional analysis will be performed during subsequent design stages to assess the effectiveness and feasibility of these solutions at the plaza location. Measures to reduce the area of impervious surface associated with the new plaza will also be investigated during future design phases. • A Salt Management Plan has been developed in accordance with Environment Canada's *Code of Practice for the Environmental Management of Road Salts (Environment Canada, 2004)*. MTO follows 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. Best management practices include advanced weather forecasting, electronic spreader equipment, the use of brines in pre-wetted salt, and varying application rates of road maintenance materials to match weather conditions. MTO will continue to investigate de-icing alternatives to control and reduce salt usage while ensuring highway safety. • A monitoring plan may be required to confirm that the construction and operation of the project will not degrade water quality. This requirement will be investigated during future design stages.

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18.0	TRANSPORTATION FACTORS FOR THE RECOMMENDED PLAN	9.1 – 9.3	Construction	MTO / TC / MUNICIPALITIES / COAST GUARD	**General Transportation Commitments** • Construction of the crossing, plaza and The Windsor-Essex Parkway will be completed in such a manner so as to minimize disruption to the surrounding community and local traffic patterns as much as possible, and to maintain local access to residences and businesses. In order to ensure minimal disruption, maintaining four lanes of traffic in the Highway 3/Huron Church Road corridor as well as the E.C. Row Expressway corridor has been established as a principle for development of the staging concept of The Windsor-Essex Parkway. This principle will be a key requirement in the development of detailed staging plans in future design phases. • Temporary assumptions of portions of municipal roads will be required to facilitate construction. Assumed portions not required for highway purposes will be transferred back to municipalities upon completion of construction. • The relocation of existing utilities and other municipal services will be required to facilitate construction of the Recommended Plan. • Relocations and approvals will generally take place in the early stages of construction to minimize risk to construction schedules, but may be included within a design-build contract. • Complete details and a utility relocation strategy will be prepared during future design stages of the project. • Future stages of design will include the consideration of renewable energy sources to power portions of the illumination system, including the use of solar panels to power lighting along the trail system. **Specific Transportation Commitments – Crossing X-10B** • A navigation clearance envelope of adequate size will be provided at the international crossing so as not to restrict marine traffic along the Detroit River. • The proposed crossing will avoid the placement of piers in the Detroit River for both the suspension bridge and cable-stayed bridge options. • Specific access requirements for delivery of prefabricated deck units by barge will be quantified and included in the future permit applications. • Subsequent stages of the main bridge design will consider the visual quality and aesthetic development of the design. A series of Context Sensitive Design Workshops have been conducted in parallel with the development of the bridge concepts and the results of those workshops should be reasonably factored into the visual development of the bridge. • Full illumination will be provided along the approach to the main bridge and along the main bridge itself. Bridge lighting should be designed with considerations for mitigating potential bird mortality while still satisfying the principle needs of lighting as a safety enhancement. **Specific Transportation Commitments – Plaza B1** • The international customs plaza will be designed to accommodate projected border traffic to beyond the 2035 design year. Although the precise layout of the various facilities within the plaza may be modified during future design stages of the plaza, the type and function of the major facilities within the plaza will remain generally unchanged. The final layout of the plaza will be based on consultation with the Canada Border Services Agency (CBSA). Ultimate ownership and operation of the plaza will be under the direction of the Government of Canada. • Full illumination of the plaza will be provided. Lighting of the plaza should be designed to minimize light intrusion into surrounding areas, while ensuring adequate lighting for operational requirements. This may involve using full cut-off luminaires, shielding, and investigating the use of conventional lighting in place of high mast lighting.

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					Specific Transportation Commitments – The Windsor-Essex Parkway • The vertical alignment of the proposed freeway will adhere to general principles as outlined in Section 9.3.1 of the report. From the plaza to the Huron Church Road corridor, the Windsor-Essex Parkway will be constructed to match the existing profile of E.C. Row Expressway and will be grade separated over Matchette Road, Ojibway Parkway and the Essex Terminal Railway. The freeway will generally be constructed between 4 and 7 m below-grade along the Highway 3/Huron Church Road corridor, except for a stretch at Turkey Creek where the freeway will be between zero and 2m below grade. • Additional study will be completed during future design stages to determine the layout and general feasibility of providing a carpool lot on the Howard Avenue diversion, south of the proposed roundabout at realigned Highway 3. • Additional consultation with the public and local municipalities will guide future decisions regarding the proposed trail network. Future design and consultation stages will include a consideration of issues such as winter maintenance of the trail system, illumination, potential connections to the Chrysler Greenway, and the surface treatment to be provided along the trail. • Full illumination will also be provided along the freeway portion of The Windsor-Essex Parkway. Lighting should be designed to minimize light intrusion into surrounding areas, while ensuring adequate lighting for operational requirements. This may involve using full cut-off luminaires, shielding, if necessary, and investigating the use of conventional lighting in place of high mast lighting. • Illumination within the tunnel sections of the freeway will be designed to ensure driver's eyes can adjust to the changing lighting conditions between the tunnel and open sections of the freeway. Adaptive lighting will be provided that varies the strength of illumination depending on the time of day and lighting conditions outside the tunnel. • In keeping with the concept of creating an Intelligent Border Crossing, The Windsor-Essex Parkway will include an Advanced Traffic Management System (ATMS). The ATMS will help to reduce travel delay and travel time uncertainty, enhance safety, reduce the costs associated with cross-border travel, and reduce the negative impacts of the border crossing to surrounding communities. • Utilities that must be maintained parallel to The Windsor-Essex Parkway will be relocated to utility corridors, where possible and as required.