Canada-United States-Ontario-Michigan
Border Transportation Partnership

Natural Heritage Impact Assessment

Recommended Plan

December 2008

EXECUTIVE SUMMARY

This document presents the results of the natural heritage investigation completed for the Recommended Plan as part of the Detroit River International Crossing (DRIC) Study.

Natural heritage is defined in Ontario as:

"features and areas, including significant wetlands, significant coastal wetlands, fish habitat, significant woodlands, significant valleylands, 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 major impetus for the natural heritage investigation includes:

Federal

- *Canadian Environmental Assessment Act*
- *Canadian Biodiversity Strategy;*
- *Species at Risk Act;*
- *Fisheries Act;*
- *Canada Wildlife Act;*
- *Migratory Birds Convention Act;*
- *Federal Policy on Wetland Conservation;* and,
- *Policy for the Management of Wetland Habitat.*

Provincial

- *Environmental Assessment Act;*
- *Biodiversity Strategy;*
- *Endangered Species Act, 2007;*
- *Fish and Wildlife Conservation Act;*
- *Planning Act* and the *Provincial Policy Statement;*
- *Lakes and River Improvement Act;*
- *Ontario Water Resources Act;*
- *Conservation Authorities Act;*
- *Forestry Act;* and,
- *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 encompass 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) provides 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.

HOW THE ANALYSIS WAS PERFORMED

A description of the methods for data collection and analysis and the results of the analysis for the Area of Investigation are presented in the *Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL 2008). 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 of the Recommended Plan. The 120 m distance provides a generous zone of imfluence for the assessment of off-site effects. The majority of off-site effects occur within approximately 30 m of the Recommended Plan footprint.

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.

VEGETATION AND VEGETATION COMMUNITIES

Assessment Methodology

A rare vascular plant survey was conducted in 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 AOI 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.

Species at Risk

Ten plant species are regulated as Endangered, Threatened or Special Concern in the schedules to SARA and ESA, 2007. American chestnut (*Castanea dentata*) is regulated as Endangered in Schedule 1 of SARA and Schedule 3 of ESA, 2007. Colic-root (*Aletris farinosa*), common hop-tree (*Ptelea trifoliata*), dense blazing star (*Liatris spicata*), dwarf hackberry (*Celtis tenuifolia*), Kentucky coffee-tree (*Gymnocladus dioicus*) and willowleaf aster (*Symphyotrichum praealtum*) are regulated as Threatened in Schedule 1 of SARA

and Schedule 4 of ESA, 2007. Climbing prairie rose (*Rosa setigera*), Riddell's goldenrod (*Solidago riddellii*) and Shumard oak (*Quercus shumardii*) are regulated as Special Concern in Schedule 1 of SARA and Schedule 5 of ESA, 2007.

Potential Environmental Effects

The potential for impacts to rare vegetation communities and species at risk was largely avoided through the selection and development of the Recommended Plan including the associated refinements.

Site preparation activities will result in 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 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 colic-root, two common hop-tree, one 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 under SARA and ESA 2007 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 colic-root, 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. Vegetation clearing in specified areas should generally occur outside of the growing season (i.e. November 1 to March 31) with restoration activities such as transplanting occurring at the start (April/May) and/or end (September/October) of the growing season. Rare, threatened and endangered plant species located within the footprint of the Recommended Plan will be transplanted prior to site preparation. Landscape plantings should be limited to native, non-invasive species typical of the tallgrass prairies/Carolinian forest. Restoration, enhancement and land securement opportunities will be explored for lands located adjacent to the Recommended Plan such as the Black Oak Woods.

Edge management measures will 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 measures will be implemented within the construction zone to prevent the migration of sediments and stormwater from the work area.

Alternatives to salt usage in areas of sensitive vegetation should be considered to reduce potential disturbance to vegetation from salt runoff/spray during operations.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 and exotic species, 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, including 3.62 ha of high quality communities, 40.72 ha of moderate quality communities and 87.37 ha of low quality communities. 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 off-set 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 off-set 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 colic-root, common hop-tree, 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, Essex Region Conservation Authority (ERCA) and Walpole Island First Nations (WIFN).

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. Investigations by the U.S. team have determined that no mollusc species at risk persist in the Detroit River in the

vicinity of the new 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.

Conclusions

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.

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. Northern pike was identified

as the management target for watercourses located within the study area. 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 Environmental Effects

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.

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 storm water 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 Measures

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 (WIFN) 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% 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 bridge will be collected and conveyed for quality treatment on land prior to discharging to the Detroit River.
- 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 net gain of fish habitat.

Stormwater quality control that will be provided with the Recommended Plan will lead to an overall enhancement to water quality and a net benefit to fisheries.

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 storm water 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 storm water through the development and implementation of a storm water 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, storm water 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 storm water management plan will be developed and implemented to ensure that reductions in baseflow do not occur.
- Changes to water temperature: A storm water 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 designed and operated at Cahill and Lennon Drains to provide safe fish passage across The Windsor-Essex Parkway.

Follow-up and 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 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.

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 eastern 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

The potential for impacts to wildlife habitat was largely avoided through the selection and development of the Recommended Plan including the associated refinements.

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 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 will 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.[1] 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 effects on migratory birds. Site-specific mitigation measures will be developed during future design phases

Mitigation Measures

Vegetation removals in specified areas should occur outside of the growing season to avoid the 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 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

[1] 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.

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 a buffer width between the plaza and the Black Oak Woods to the south.

Where practical, 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 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.

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.

Follow-up and Monitoring

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 gartersnake 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 gartersnake 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-stay) should take into consideration the potential adverse effects of bridge design on migratory birds.

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

Permits and approvals under SARA and 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, and CWS in addition to continuing discussions with First Nations will occur during future design stages.

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 the 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 for impacts to designated natural areas was largely avoided through the selection and development of the Recommended Plan including the associated refinements.

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 and MNR as well as further consultation with First Nations will occur during future design stages. Once the geographical extent and functions of potential 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 during 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.

OVERALL CONCLUSIONS

The Windsor-Essex Parkway, inspection plaza and crossing are located along an existing roadway corridor and in areas of pre-existing disturbance. Generally much of the natural heritage in the study area has already been modified by human activity, so siting of the facility in these areas greatly reduces the likelihood and significance of potential environmental effects. Most of the significant natural areas located in the study area were avoided during the facility siting process.

The approaches identified for environmental protection including avoidance/prevention; control/mitigation, compensatory mitigation, restoration/enhancement and monitoring will be implemented into facility design and will serve as conditions of approval for environmental approvals and permits. All environmental approvals and permits will be secured prior to the commencement of construction. MTO standards and practices will be followed for this undertaking to minimize environmental effects.

Based on the characteristics of the natural heritage setting, the nature and scope of the project, the potential likelihood and significance of environmental effects and the environmental protection measures to be incorporated into facility design and legislative approvals, the project is not expected to result in significant environmental effects on natural heritage. Extensive opportunities exist for restoration and enhancement, partnerships and dedication of conservation lands as part of the Detroit River International Crossing Study.

PREFACE

The Detroit River International Crossing (DRIC) Environmental Assessment study was conducted by a partnership of the federal, state and provincial governments in Canada and the United States in accordance with the requirements of the Canadian *Environmental Assessment Act* (CEAA), the Ontario *Environmental Assessment Act* (OEAA), and the U.S. *National Environmental Policy Act* (NEPA). In 2005, the Canadian and U.S. Study Teams identified 15 potential river crossing locations and associated plaza and access road alternatives. The results of the assessment of these alternatives led to the identification of an Area of Continued Analysis (ACA). Within the ACA, practical alternatives were developed for the crossings, plazas and access road alternatives.

Through the analysis of the practical alternatives, and in conjunction with ongoing consultation efforts, a new alternative was developed that combined beneficial features of the original alternatives. The new alternative was identified as the Parkway in August 2007 and included 7 kilometres of below grade freeway, an optimized service road system, a green corridor with 10 tunnelled sections totalling 1.5 km in length, a grade separated recreational trail system, and extensive green areas.

Upon completion of the analysis of the practical alternatives, the alternatives were evaluated. The Partnership announced the results of the evaluation for the access road component in May 2008. Referred to as The Windsor-Essex Parkway, the Recommended Plan access road consisted of the major components of the Parkway with some refinements made to reflect additional community consultation and analysis. These refinements included an additional tunnel in the Spring Garden area, more green space and a refined trail network. The components of the Recommended Plan for the international bridge crossing (Crossing X-10B) and Canadian plaza (Plaza B1) were announced in June 2008.

The remainder of 2008 focused on detailed analysis and identification of impacts and appropriate mitigation measures for the TEPA, along with further refinements. The June 2008 TEPA combined with the subsequent refinements and associated mitigation measures is referred to collectively as the Recommended Plan. This report summarizes the work undertaken in this regard specific to Natural Heritage. These measures were also documented in a draft version of the Ontario Environmental Assessment Report, which was made available to the public, agencies, municipalities, First Nations and other interested parties for review in November 2008.

Additional reports and details are available at the study website (www.partnershipborderstudy.com).

Natural Heritage Impact Assessment – Recommended Plan

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1.0 INTRODUCTION

The Ontario *Environmental Assessment Act* (OEAA) and the *Canadian Environmental Assessment Act* (CEAA) require assessment of all aspects of a project on the environment. The role of the natural heritage discipline in the Detroit River International Crossing Study is to assess the environmental effects of the Recommended Plan on the biophysical environment. Input is provided during site and route selection, preliminary design, detail design and construction to avoid, minimize or mitigate the potential effects of the project on natural heritage.

"Protection of the natural environment" is one of seven factors that were used to evaluate the practical alternatives in the Detroit River International Crossing Study. This Report presents the results of assessment of potential effects, mitigation and monitoring for the Recommended Plan as it pertains to natural heritage.

Natural heritage is defined in Ontario as:

"features and areas, including significant wetlands, significant coastal wetlands, fish habitat, significant woodlands, significant valleylands, 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 discipline is guided by government legislation, regulations, policies and guidelines within federal, provincial and municipal jurisdictions. The major impetus for the natural heritage investigation includes:

Federal

- *Canadian Environmental Assessment Act;*
- *Canadian Biodiversity Strategy;*
- *Species at Risk Act;*
- *Fisheries Act;*
- *Canada Wildlife Act;*
- *Migratory Birds Convention Act;*
- *Federal Policy on Wetland Conservation;* and ,
- *Policy for the Management of Wetland Habitat.*

Provincial

- *Environmental Assessment Act;*
- *Biodiversity Strategy;*
- *Endangered Species Act, 2007;*
- *Fish and Wildlife Conservation Act;*
- *Planning Act and the Provincial Policy Statement;*
- *Lakes and Rivers Improvement Act;*

- *Ontario Water Resources Act;*
- *Conservation Authorities Act;*
- *Forestry Act;* and,
- *Implementation Strategy: Areas of Natural and Scientific Interest.*

As outlined in the Natural Heritage Work Plan, consideration of natural heritage is incorporated into all four stages of the site and route selection process.

The purpose of natural heritage input at each step is described below.

Preliminary Analysis Area

To profile the natural heritage areas and features located in the Preliminary Analysis Area and identify opportunities for and constraints to facility siting.

Illustrative Alternatives

To evaluate on a comparative basis the natural heritage areas and features influenced by illustrative alternatives, including crossings, plazas and access roads to contribute to the identification of practical alternatives.

Practical Alternatives

To evaluate on a comparative basis the natural heritage areas and features influenced by practical alternatives including crossings, plazas and access roads to contribute to the identification of conceptual alternatives.

Conceptual Alternatives

To evaluate on a comparative basis the natural heritage areas and features influenced by conceptual alternatives including crossings, plazas and access roads to contribute to the identification of the Recommended Plan.

The natural heritage discipline also assesses the significant adverse effects of the Recommended Plan on natural heritage and identifies environmental protection measures.

At each stage of the study process, similar tasks occur. These tasks include:

Task 1 – Define Area of Investigation

Identify the study area for the purposes of investigating the potential effects of the project.

Task 2 – Data Collection

Identify the type, source, level of detail and methods to be used to obtain information.

Task 3 – Data Analysis

Identify how the information will be interpreted to determine the significance and sensitivity of natural heritage features.

Task 4 – Evaluate Alternatives

Identify the natural heritage criteria and indicators that will be used to compare alternatives.

Task 5 – Conduct Impact Assessment

Identify the range of potential environmental effects to be assessed.

Task 6 – Recommend Environmental Protection Measures

Identify the range of potential environmental protection measures to be assessed. Environmental protection measures typically include avoidance, minimization, mitigation, compensation and monitoring.

These tasks are summarized for each stage of the study process in Table 1. This Report presents the results of each task of the natural heritage investigation for the Recommended Plan.

Task 2, Data Collection, identified in Table 1 was revised for Stage 4 – Concept Design Alternatives because detailed, multi-season investigations were performed ahead of schedule in Stage 3 – Practical Alternatives. As a result, field investigations in Stage 4 – Concept Design Alternatives were used to update, verify and augment the information collected previously. The focus of field investigations in Stage 4 – Concept Design Alternatives was to collect detailed information on the population and distribution of species at risk and to delineate their habitat.

TABLE 1.
NATURAL HERITAGE INVESTIGATION BY STUDY STAGE

Study Stage[1]	Ecological Analysis Level	Task 1 Define Area of Investigation	Task 2 Data Collection	Task 3 Data Analysis	Task 4 Evaluate Alternatives	Task 5 Impact Assessment	Task 6 Environmental Protection Measures
Stage 1 – Define Study Area	Ecodistrict - 1:250,000 scale	Preliminary Analysis Area	• Secondary source • Air photo interpretation	Identify designated/ regulated natural heritage features to determine national, provincial, regional and local significance.	• Avoid, where feasible, designated/regulated natural heritage features located within Preliminary Analysis Area.	Opportunities/ Constraints Analysis	• Avoidance
Stage 2 – Illustrative Alternatives	Ecosection - 1:100,000 scale	Illustrative routes, plazas, plaza extensions and crossings rights-of-way, footprints and adjacent zones of influence	• Secondary source • Air photo interpretation • Windshield/ aerial surveys	Identify designated/ regulated natural heritage features to determine national, provincial, regional and local significance.	• Compare potential loss of designated/regulated natural heritage features located within rights-of-way and footprint areas (extent, significance). • Compare potential disturbance to designated/regulated natural heritage features located within adjacent zones of influence (extent, significance).	Opportunities/ Constraints Analysis	• Avoidance
Stage 3 – Practical Alternatives	Ecosite - 1:10,000 scale	Practical routes, plazas, plaza extensions and crossings rights-of-way, footprints and adjacent zones of influence	• Secondary source • Air photo interpretation • Preliminary single season pedestrian surveys	Identify landscapes, ecosystems/communities and populations/species to determine national, provincial, regional and local significance and sensitivity to impacts.	• Compare potential loss of terrestrial and aquatic landscapes, ecosystems/communities and populations/species located within rights-of-way and footprint areas (extent, type, significance, sensitivity). • Compare potential disturbance to terrestrial and aquatic landscapes, ecosystems/communities and populations/species located within adjacent zones of influence (extent, type, significance, sensitivity).	Generic Impacts	• Avoidance • Minimization • Generic mitigation

TABLE 1.
NATURAL HERITAGE INVESTIGATION BY STUDY STAGE

Study Stage[1]	Ecological Analysis Level	Task 1 Define Area of Investigation	Task 2 Data Collection	Task 3 Data Analysis	Task 4 Evaluate Alternatives	Task 5 Impact Assessment	Task 6 Environmental Protection Measures
Stage 4 – Concept Design Alternatives	Ecoelement - 1:1,000 scale	Concept design routes, plazas, plaza extensions and crossings rights-of-way, footprints and adjacent zones of influence	• Secondary source • Air photo interpretation • Detailed multi-season pedestrian surveys	Identify landscapes, ecosystems/communities and populations/species to determine national, provincial, regional and local significance and sensitivity to impacts.	• Compare potential loss of terrestrial and aquatic landscapes, ecosystems/communities and populations/species located within rights-of-way and footprint areas (extent, type, significance, sensitivity). • Compare potential disturbance to terrestrial and aquatic landscapes, ecosystems/communities and populations/species located within adjacent zones of influence (extent, type, significance, sensitivity).	Conceptual Site-Specific Impacts	• Avoidance • Minimization • Conceptual site-specific mitigation, compensation and monitoring

[1] Detail Design is not currently included in the Detroit River International Crossing Route Planning and Environmental Assessment Study

2.0 AREA OF INVESTIGATION

The area of investigation for the Recommended Plan (i.e. The Windsor-Essex Parkway, Plaza B1 and Crossing B) included:

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

The area of investigation was considered broad enough to cover the reasonable range of potential environmental effects that could result from the project The 120 m distance provides a generous zone of imfluence for the assessment of off-site effects. The majority of off-site effects occur within approximately 30 m of the Recommended Plan footprint.

3.0 DATA COLLECTION

Data collection for the Recommended Plan involved detailed field investigations to update, verify and augment the information collected during the practical alternatives stage. Detailed, multi-season field investigations were conducted to determine the population and distribution of species at risk and to delineate their habitats. For the purposes of field investigations species at risk were defined as species regulated as extirpated, endangered, threatened or special concern under the *Species at Risk Act* (2002, c.29) (SARA) and the *Endangered Species Act, 2007* (S.O. 2007, c. 6) (ESA, 2007).

3.1 Vegetation and Vegetation Communities

In addition to the detailed vegetation investigations conducted in 2006, a detailed, multi-season field investigation was conducted from June to October 2008 to determine the population and distribution of species at risk and to delineate their habitat. Efforts were focused on the ten species at risk regulated under SARA and ESA, 2007 recorded in the study area during the practical alternatives stage.

Floristic quality assessment was used to determine the quality of vegetation communities. This information was then used to determine the significance of vegetation displacement/disturbance and to prioritize vegetation communities for protection, enhancement and restoration. This assessment gives a dependable, repeatable and convenient method for evaluating the relative quality of vegetation communities in terms of their native floristic composition. It was not used as a stand-alone method. It was applied to complement and support other methods of evaluating the natural quality of a site.

Other methods used to determine the quality of each vegetation community, include abundance, sum of weediness, average coefficient of conservatism, size, soils and level of anthropogenic disturbance (Oldham *et. al.* 1995; Michigan Department of Natural Resources 2001).

Based upon the above criteria, vegetation communities were classified as high quality or protection areas if their floristic quality index (FQI) value was greater than 35, moderate quality or enhancement areas if FQI was between 20 and 35, and low quality or restoration areas if FQI was below 20. Vegetation communities not inventoried in 2006 as a result of restricted property access were also investigated and classified.

3.2 Molluscs and Insects

Information on molluscs and insects was based on secondary sources. No detailed field investigations were conducted for molluscs because investigations conducted on the U.S. side of the Detroit River revealed no mollusc species at risk, the Department of Fisheries and Oceans did not identify any mollusc species at risk located in study area watercourses and the condition of study area watercourses is not considered favourable for mollusc habitation. No detailed field investigations were conducted for insects because only one insect species at risk is known to inhabit the study area, the Monarch butterfly, and no areas of critical Monarch habitat are present in the study area.

3.3 Fish and Fish Habitat

In addition to the detailed fisheries investigations conducted in 2006, a detailed field investigation was conducted to quantify the extent of the harmful alteration, disruption and destruction (HADD) of fish habitat and to identify fish habitat compensation opportunities. A northern pike spawning survey was conducted in March 2008 to confirm the presence/absence of pike in watercourses/drains located in the study area. Northern pike was identified as the management target for watercourses located within the study area.

3.4 Wildlife and Wildlife Habitat

In addition to the detailed wildlife investigations conducted in 2006, a detailed, multi-season field investigation was conducted to confirm the presence/absence of species at risk, to determine their population and distribution, and to delineate their habitat. Efforts were focused on the four species at risk regulated under SARA and ESA, 2007 recorded in the study area during the practical alternatives stage.

No detailed field investigations were conducted for bat species because the bat species known to inhabit the study area are considered common and no critical habitat elements such as hibernacula have been reported.

No detailed field investigations for migratory birds in the vicinity of the crossing were performed as these surveys have been deferred to a subsequent design stage.

3.5 Designated Natural Areas

Designated natural areas were investigated as part of the detailed vegetation and wildlife surveys. Efforts were made in the field to delineate or reconcile the boundaries of designated natural areas where necessary.

A wetland evaluation following the Wetland Evaluation System for Southern Ontario – Third Edition (OMNR 2002) was carried out for wetland units located in the study area. The evaluation was conducted jointly by LGL Limited and the Ontario Ministry of Natural Resources (MNR).

4.0 EXISTING CONDITIONS

The existing natural heritage conditions for this study are documented in previous reports including the *Environmental Overview Paper – Canadian Existing Conditions Volume 2 – Natural Sciences* (LGL 2005), the *Draft Natural Heritage Work Plan* (LGL 2006) and the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL 2008). A brief summary and update of the existing natural heritage conditions documented in previous reports is presented below, as well as new information collected during field investigations performed throughout 2008.

The Recommended Plan is located along an existing road/highway corridor and area of pre-existing disturbance. Generally much of the natural heritage in the study area has already been modified by human activity, so development of the facility in this area will have less impact than if it were sited near less disturbed areas. Through the DRIC evaluation of alternatives process, the majority of significant natural areas in the vicinity of the study area have already been avoided.

4.1 Vegetation and Vegetation Communities

4.1.1 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 revised (BBA4M, BB4MB, BBA17, HWY1) and one removed from the study area (HWY5), since documented originally in 2006.

Five vegetation communities were either raised or lowered in quality level if their FQI value did not match the other evaluating criteria, including:

- RED8 (SWD1-3) was raised from moderate to high quality based upon a higher moderate FQI value of 32.50, same species composition as RED4 (SWD1-3) which was considered high quality, its S2S3 vegetation community designation and the presence of a number of heritage sized tree species;
- BBA15 (MAM2-10) was raised from low to moderate quality since it is a vernal pool that is seasonally flooded with a minimum of two feet of water. The high water level fluctuations have reduced the number of species that can tolerate the variable soil moisture regimes and it is dominated primarily by native wetland flora that is adapted to rapidly changing water levels;
- BBA4EC (TPO2-1) and ESA1 (TPO2-1) were raised from low to moderate quality, since they are both S1 tallgrass prairie vegetation communities that are overgrown by exotic

shrubs and vines. All that is required to return these vegetation communities to better species composition is some active management in the form of cutting, herbicides and a controlled burn; and,

- NCH12 (CUT1) was lowered from high to moderate quality because the land was cleared and fill was placed there since the initial assessment. The fill contained common reed (*Phragmites australis*) seeds, which have quickly and completely dominated the native vegetation in this area.

The location and an updated list of all the vegetation communities is provided in Appendix A and an updated list of plant species is provided in Appendix B.

4.1.2 Species at Risk

A total of 648 species of vascular plants were identified within the AOI, 72 of which are considered Extremely Rare (S1), Very Rare (S2) and Rare to Uncommon (S3) according to the MNR. Ten plant species are regulated as Endangered, Threatened or Special Concern in the schedules to SARA and ESA, 2007. American chestnut (*Castanea dentata*) is regulated as Endangered in Schedule 1 of SARA and Schedule 3 of ESA, 2007. Colic-root (*Aletris farinosa*), common hop-tree (*Ptelea trifoliatae*), dense blazing star (*Liatris spicata*), dwarf hackberry (*Celtis tenuifolia*), Kentucky coffee-tree (*Gymnocladus dioicus*) and willowleaf aster (*Symphyotrichum praealtum*) are regulated as Threatened in Schedule 1 of SARA and Schedule 4 of ESA, 2007. Climbing prairie rose (*Rosa setigera*) and Riddell's goldenrod (*Solidago riddellii*) are regulated as Special Concern in Schedule 1 of SARA and Schedule 5 of ESA, 2007. Shumard oak (*Quercus shumardii*) is regulated as Special Concern in Schedule 3 of SARA and Schedule 5 of ESA, 2007. Table 2 describes the status and abundance of the provincially rare vascular plants and species at risk present within the study area.

Based on field investigation there are approximately 418 climbing prairie rose, 929 colic-root, two common hop-tree, 951 dense blazing star, one dwarf hackberry, 20 Kentucky coffee-tree, 1,285 Riddell's goldenrod and 11,676 willowleaf aster located within the footprint for the Recommended Plan. 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 (climbing prairie rose, dense blazing star, Kentucky coffee-tree, Riddell's goldenrod and willowleaf aster).

The adjacent lands located within 120 m of the footprint of the Recommended Plan support one American chestnut, 511 climbing prairie rose, 14 colicroot, 2,114 dense blazing star, 21 Kentucky Coffee-tree (some planted and others of uncertain origin), 443 Riddell's goldenrod, 24 Shumard oak and 27,874 willowleaf aster.

In contrast, the area beyond the 120 m within the AOI contains 135 climbing prairie rose, 1,734 colic-root, 914 dense blazing star, one Kentucky coffee-tree, 1,401 Riddell's goldenrod, 33 Shumard oak and ten willowleaf aster.

These counts are considered fairly accurate but there is some double counting. Some of the species lines and polygons are located in both the footprint and within the adjacent lands located within 120 m of the footprint. The sum of the rare species with no overlap is 62,817 individuals, while with the overlap the sum of the rare species is 69,191 individuals, a difference of 6,374.

TABLE 2.
PROVINCIALLY RARE VASCULAR PLANTS LOCATED WITHIN THE STUDY AREA

#	Scientific Name	Common Name	COSEWIC	COSSARO	S Rrank	Legal	CC[1]
1	*Agalinis purpurea*	large purple agalinis			S1		10
2	*Aristida purpurascens* var. *purpurascens*	arrow-feather three-awn			S1		10
3	*Eupatorium altissimum*	tall joe-pyeweed			S1		3
4	*Euthamia gymnospermoides*	viscid bushy goldenrod			S1		10
5	*Juncus biflorus*	two-flowered rush			S1		10
6	*Juncus brachycarpus*	short-fruited rush			S1		10
7	*Ludwigia alternifolia*	rattle-box			S1		10
8	*Pycnanthemum verticillatum* var. *pilosum*	hairy mountain-mint			S1		8
9	*Rudbeckia fulgida*	orange coneflower			S1		0
10	*Scleria triglomerata*	tall nut-rush			S1		10
11	*Silphium terebinthinaceum* var. *terebinthinaceum*	prairie dock			S1		10
12	*Sisyrinchium albidum*	white blue-eyed-grass			S1		9
13	*Vitis labrusca*	fox grape			S1		3
14	*Agalinis tenuifolia* var. *macrophylla*	slender-leaved agalinis			S1?		7
15	*Sporobolus compositus var.compositus*	long-leaved rush grass			S1S2		2
16	*Aletris farinose*	colic-root	THR	THR	S2	SARA(1), ESA(4)	10
17	*Asclepias purpurascens*	purple milkweed			S2		10
18	*Asclepias sullivantii*	Sullivant's milkweed			S2		8
19	*Symphyotrichum praealtum (Aster praealtus praealtus)*	willowleaf aster	THR	THR	S2	SARA(1), ESA(4)	8
20	*Baptisia tinctoria*	wild indigo			S2		10
21	*Campsis radicans*	trumpet creeper			S2		3
22	*Carex squarrosa*	squarrose sedge			S2		8
23	*Celtis tenuifolia*	dwarf hackberry	THR	THR	S2	SARA(1), ESA(4)	10
24	*Coreopsis tripteris*	tall tickseed			S2		9
25	*Fraxinus profunda*	pumpkin ash			S2		9
26	*Gaura biennis*	biennial gaura			S2		4
27	*Gleditsia triacanthos*	honey locust			S2		3
28	*Gymnocladus dioicus*	Kentucky coffee-tree	THR	THR	S2	SARA(1), ESA(4)	6
29	*Hypericum prolificum*	shrubby St. John's-wort			S2		6
30	*Juncus marginatus*	grass-leaved rush			S2		9
31	*Krigia biflora* var. *biflora*	two-flowered Cynthia			S2		10
32	*Liatris aspera* var. *intermedia*	rough blazing star			S2		10
33	*Liatris spicata*	dense blazing star	THR	THR	S2	SARA(1), ESA(4)	9
34	*Ludwigia polycarpa*	many-fruited false loosestrife			S2		8
35	*Oxypolis rigidior*	Cowbane			S2		9
36	*Paspalum setaceum*	bristle-like paspalum			S2		8
37	*Suaeda calceoliformis*	western seablite			S2		0
38	*Thalictrum revolutum*	waxy meadow-rue			S2		9
39	*Tradescantia ohiensis*	Ohio spiderwort			S2		10

TABLE 2.
PROVINCIALLY RARE VASCULAR PLANTS LOCATED WITHIN THE STUDY AREA

#	Scientific Name	Common Name	COSEWIC	COSSARO	S Rrank	Legal	CC[1]
40	*Veronicastrum virginicum*	Virginia culver's-root			S2		10
41	*Rhus X pulvinata*	hybrid sumac			S2?		2
42	*Pinus rigida*	pitch pine			S2S3		10
43	*Ratibida pinnata*	gray-headed coneflower			S2S3		9
44	*Agrimonia parviflora*	many-flowered agrimony			S3		4
45	*Aureolaria flava*	yellow false foxglove			S3		10
46	*Aureolaria pedicularia*	fern-leaved false foxglove			S3		10
47	*Carex swanii*	swan's sedge			S3		7
48	*Carex trichocarpa*	hairy-fruited sedge			S3		8
49	*Carya glabra*	pignut hickory			S3		9
50	*Carya laciniosa*	big shellbark hickory			S3		9
51	*Castanea dentate*	American chestnut	END	END	S3	SARA(1), ESA(3)	8
52	*Eupatorium purpureum* var. *purpureum*	purple joe-pye-weed			S3		8
53	*Galium pilosum* var. *pilosum*	hairy bedstraw			S3		9
54	*Geum vernum*	spring avens			S3		7
55	*Hypoxis hirsutae*	yellow star-grass			S3		10
56	*Juncus greenei*	Greene's rush			S3		9
57	*Lechea villosa*	hairy pinweed			S3		9
58	*Lithospermum caroliniense* var. *croceum*	plains puccoon			S3		8
59	*Lythrum alatum*	wing-angled loosestrife			S3		5
60	*Nyssa sylvatica*	black gum			S3		9
61	*Panicum sphaerocarpon*	rough-fruited panic grass			S3		8
62	*Ptelea trifoliatae*	common hop-tree	THR	THR	S3	SARA(1), ESA(4)	9
63	*Quercus palustris*	pin oak			S3		9
64	*Quercus shumardii*	shumard oak	SC	SC	S3	SARA(3), ESA(5)	7
65	*Rosa setigera*	prairie rose	SC	SC	S3	SARA(1), ESA(5)	5
66	*Solidago riddellii*	Riddell's goldenrod	SC	SC	S3	SARA(1), ESA(5)	10
67	*Solidago rigida* ssp. *Rigida*	stiff-leaved goldenrod			S3		9
68	*Spiranthes magnicamporum*	great plains' ladies tresses			S3		8
69	*Strophostyles helvola*	trailing wild bean			S3		8
70	*Vernonia gigantea**	Ironweed			S3		7
71	*Aster X amethystinus*	amethyst aster			S3?		
72	*Vernonica missurica**	Ironweed			S3?		

[1]CC = Coefficient of Conservatism.
Note: Species status current to November 2008.

4.2 Molluscs and Insects

Currently ten species of molluscs, including two classes of Mollusc phyla, the Mussels (Bivalves) and the Snails (Gastropods) are regulated as Endangered or Threatened in the schedules of SARA and ESA, 2007. There was the potential that these species may occur in the AOI, but no comprehensive field investigations had been conducted of the Windsor area. Several of these species likely occurred in the Detroit River historically. Data obtained from the MNR indicated potentially that nine rare species of Bivalves and two rare species of Gastropods occur in the vicinity of the AOI. A mollusc survey conducted using a remote submarine and divers by the U.S. study team in the Detroit River confirmed that mollusc species at risk were absent from the Detroit River. A review of information provided by the DFO also indicated that mollusc species at risk were not recorded in tributaries of the Detroit River within the study area. During field investigations, visual inspections were made in area watercourses to identify mollusc or shell fragments. None were observed, likely attributed to the disturbed nature of watercourses found in the study area and poor water quality. Based on the results of the mollusc survey from the U.S., the absence of known mollusc species at risk reported by DFO and the poor habitat conditions displayed in watercourses located in the study area, it was concluded that all rare molluscs are likely absent or long extirpated from the study area.

Over 2055 species of insects have been reported from the Ojibway Prairie Complex. The Ojibway Prairie Complex and its vicinity is the only site for 16 Canadian species and 6 Ontario species records. It is one of a few sites for 37 Canada species and 29 Ontario species records. The insect, *Loxocera ojibwayensis,* is a small Psilid fly (Diptera) that was discovered at the Ojibway Prairie, and it is the only known site in the world for this species. One-hundred-and-thirteen important species are known from the Ojibway Prairie Complex and its vicinity and an additional seven species of dragonflies (Odonata) potentially occur there as well. These 113 species comprise one species of Diptera (true flies), 22 species of Auchenorrhyncha Hemiptera (hoppers), 13 species of Heteroptera Hemiptera (true bugs), 41 species of Hymenoptera (bees and wasps), 17 species of Lepidoptera (moths and butterflies), 13 species of Odonata (damselflies and dragonflies), and six species of Orthoptera (grasshoppers, crickets and katydids). The Monarch is known to occur in the study area; and it is regulated as Special Concern in Schedule 1 of SARA and Schedule 5 of ESA, 2007. No significant Monarch habitats (such as migratory stop over areas) are known to occur in the study area. A list of insect species that are potentially present in proximity to the study area is provided in Appendix C.

4.3 Fish and Fish Habitat

Most watercourses in the study area are designated as agricultural municipal drains and are altered by agricultural or urban development. The majority of the inland watercourses are dominated by warmwater fish communities, although some coolwater species are also found. The Detroit River supports warmwater, coolwater and coldwater resident and migratory fish species. Turkey Creek, Lennon Drain, McKee Creek and Wolfe Drain directly support warmwater and coolwater sportfish communities (i.e. bass, sunfish, pike, etc.). Remaining fish habitat supports warmwater baitfish communities (i.e. minnows, chubs, etc.) or no fish habitat at all. A total of 20 species of fish inhabit inland streams in the study area, and 71 species of fish are reported from the Detroit River. No critical fish habitat or fish species at risk are known to inhabit watercourses located in the study area,

other than the Detroit River. Eleven fish species are regulated as Endangered, Threatened or Special Concern, and three are listed in the schedules to the ESA, 2007; however, no specialized habitat for species at risk is located in the vicinity of this project.

A northern pike spawning survey was conducted in April 2008. High resolution air photos were used to map habitat and record any pike seen. Cahill Drain (including its tributaries Wolfe and Collins Drains), Lennon Drain, Youngstown Drain, Basin Drain, Titcombe Drain and McKee Drain were all examined for potential pike spawning habitat. Northern pike were found in Cahill Drain (reach parallel to Talbot Road/ Highway 3), Wolfe Drain (reach parallel to Talbot Road/Highway 3), Lennon Drain (up to Geraedits Drive), Titcombe Drain and McKee Creek (reach between Sandwich Street and rail tracks). Pike were absent from Collins Drain, Wolfe Drain (reach upstream of confluence with Collins Drain), Cahill Drain (reach upstream of confluence with Wolfe Drain), Youngstown Drain, Basin Drain and McKee Drain. Because northern pike were found in these watercourses/drains during the spawning season, it is assumed that they use these areas for reproduction. The location of all the watercourses and an updated list of all the fish species present are provided in Appendix D.

Since no piers or other structures associated with the bridge will be located in the Detroit River, a detailed assessment of potential impacts on fish and fish habitat was not conducted in 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.

4.4 Wildlife and Wildlife Habitat

One hundred and twenty-four wildlife habitat units were identified in the study area, many of which meet the criteria for "significance" in Ontario. A total of 139 wildlife species were recorded in the study area including 11 reptiles and amphibians, 108 birds and 20 mammals. Breeding bird surveys identified a total of 50 species of breeding birds in the study area. Red-headed Woodpecker (*Melanerpes erythrocephalus*), regulated as Special Concern in Schedule 3 of SARA and Schedule 5 of ESA, 2007, was documented breeding in the Brighton Beach area. Golden-winged Warbler (*Vermivora chrysoptera*), regulated as Threatened in Schedule 1 of SARA and Special Concern in Schedule 5 of ESA, 2007, was documented as a migrant in the study area. Eastern foxsnake (*Elaphe gloydi*) and Butler's gartersnake (*Thamnophis butleri*) were also recorded in the study area. Eastern foxsnake is regulated as Endangered in Schedule 1 of SARA, while Butler's gartersnake is regulated as Threatened in Schedule 1 of SARA. Both species are regulated as Threatened in Schedule 4 of ESA, 2007. Other Threatened, Schedule 1 SARA species known to occur in the Ojibway Prairie Complex, including eastern Massasauga (*Sistrurus catenatus*) and eastern hog-nose snake (*Heterodon platirhinos*), were not recorded in the study area during surveys.

4.4.1 Golden-winged Warbler

The Golden-winged Warbler was originally identified in the Brighton Beach area in a small cultural thicket at the southeast corner of Broadway Street and Sandwich Street in May of 2006. It was thought to be a migrant and not breeding in this habitat. Further investigations in spring and summer of 2008 did not observe the presence of this species breeding in the study area.

4.4.2 Red-headed Woodpecker

Two juvenile Red-headed Woodpeckers were observed in the Black Oak Woods along Broadway Street just east of Matchette Road in late summer of 2006. Investigations for this species in spring and summer of 2008 turned up one individual in Ojibway Prairie on April 7 and 8, 2008, east of the Ojibway Nature Center. Further investigations in Black Oak Woods and other suitable breeding habitat in the study area did not observe the presence of this species.

4.4.3 Eastern Foxsnake

Several eastern foxsnake were recorded in the study area in the summer of 2006, and as a result a tracking study to determine hibernacula locations was initiated in late summer 2008. One eastern foxsnake was captured, implanted with a radio transmitter and tracked until hibernation. Eastern foxsnake surveys using radio telemetry equipment will continue in Spring 2009.

Eastern foxsnake typically have large home-ranges spanning several kilometers. As a result, if habitat is lost, specimens will likely take up residence on adjacent lands. This species of snake lays eggs in a 'nest', and oviposition sites may be natural or anthropogenic in origin. Suitable nest sites may include fallen trees, compost piles, and rotting logs. In the fall eastern foxsnake seek out an hibernacula to over-winter and suitable sites can be natural or human-made subterranean features such as rock fissures, mammal burrows, wells, utility conduits and basements. Eastern foxsnake are known to have a strong affinity to their hibernacula and destruction of the hibernacula will likely lead to snake mortality.

4.4.4 Butler's Gartersnake

Four Butler's gartersnake were also found in the study area in the summer of 2006, and a capture-mark-recapture study was undertaken in 2008 to identify the population and distribution of this species. The home range for Butler's gartersnake is small (less than 300 m in most cases) and they require seasonally wet or near water habitat within prairie communities. These areas provide suitable habitat for their prime food source, earthworms, and suitable habitat for the digger crayfish (*Fallicambarus fodiens*) which burrows 0.5 to 1 m into the ground to reach water. These crayfish burrows are used by Butler's gartersnake during the winter as hibernacula. In contrast to the eastern foxsnake, the Butler's gartersnake give birth to live young in grassy meadows under suitable shelter. Previous studies have shown that of all the gartersnake species, Butler's gartersnake is the slowest to move, even when disturbed. If hibernacula are lost, the individual snakes denning would likely die.

4.4.5 Migratory Birds

The Detroit River is recognized as a migration intersection of two major North American flyways, the Mississippi and Atlantic. Waterfowl, shorebirds, raptors, passerines and other non-passerines migrate in large numbers along the Detroit River. For example, waterfowl, including over three million ducks, geese, swans, and coots are reported to migrate annually through this area. The Detroit Audubon Society has documented over

300 species of birds in the Detroit-Windsor area with 150 species nesting near the river. Both Canada and the United States have identified the Detroit River–Lake St. Clair ecosystem as having exceptional biological diversity. In 2001, the United States signed into law the *Detroit River International Wildlife Refuge Establishment Act* (IAGLR 2008) which recognizes this area as the first international wildlife refuge in North America.

Field investigations undertaken by LGL in fall 2006 and late winter/early spring 2007 identified the Detroit River as a migratory bird winter staging area and fall/spring migration corridor. In addition, communications with local birding organizations such as the Holiday Beach Migration Observatory (HBMO), Bird Studies Canada (BSC), Southeastern Michigan Raptor Research Center (SMRR) and Long Point Bird Observatory (LPBO) verified the existence of hundreds of thousands of migratory birds using the Detroit River as a winter staging area and migration corridor in spring and fall seasons. A number of species at risk, including the Peregrine Falcon (*Falco peregrinus*), Bald Eagle (*Haliaeetus leucocephalus*), King Rail (*Rallus elegans*), and Least Bittern (*Ixobrychus exilis*), have been recorded nesting within this ecosystem. In fact, the Peregrine Falcon was reported nesting on the Ambassador Bridge in 2008.

Discussions with local ornithologists and field naturalists have augmented the information available from secondary sources. For example, Dr. Bob Pettit, HBMO President, stated that he has seen, on numerous occasions, Sharp-shinned Hawks (*Accipiter striatus*) and Cooper's Hawks (*Accipiter cooperii*) fly along the Detroit River near the Ambassador Bridge.

Dr. Scott Petrie, Executive Director and Researcher for the Long Point Waterfowl and Wetlands Research Fund (LPWWRF), stated that he has collected years of satellite data showing waterfowl migrating through the Detroit River corridor. However, the satellite data from LPWWRF was collected for only three of about 12 species of waterfowl species known to use the Detroit River as a staging area and flyway.

Mr. Phil Roberts, a local field naturalist who has conducted extensive bird banding along the Detroit River provided information on local bird movements. Mr. Roberts is heavily involved in the Windsor-Detroit area birding community with numerous contacts in Canada and the U.S. Mr. Roberts indicated that passerines migrate along the shoreline of the Detroit River each spring and fall. In spring, most passerine movements are along the Michigan side until they reach the south side of Detroit opposite the north end of Fighting Island. From here, many passerines travel northeast across the Detroit River to Brighton Beach, where they target the natural shoreline of the Detroit River and the areas beyond, including the Ojibway Prairie Complex.

Mr. Roberts also noted that diurnal birds of prey migrate through southwest Ontario and Michigan and try to avoid crossing large bodies of water. As a result, Ontario birds of prey migrate through southwest Ontario along the shoreline of Lake Erie and then cross over the shortest stretch of open water, the mouth of the Detroit River at Lake Erie. According to Mr. Roberts, diurnal birds of prey are seldom seen migrating up or down the Detroit River. Mr. Roberts noted that of the thousands of birds netted and banded over the years, none were species regulated under SARA or ESA, 2007.

The location of wildlife habitat units and a list of all wildlife species identified in 2006 are provided in Appendix F.

4.5 Designated Natural Areas

The Ojibway Prairie Provincial Nature Reserve is a 65 ha parcel that is regulated under the *Provincial Parks Act* to protect one of the largest remnants of tallgrass prairie and oak savannah in Ontario. The Ojibway Prairie Complex is a provincially significant life science ANSI that is comprised of the following areas: Ojibway Prairie Provincial Nature Reserve; Ojibway Park; Titcombe Road North; Spring Garden Road; Black Oak Woods; and, Prairie Remnants (Southeast of Nature Reserve).

A total of five ESAs are located in the study area and its vicinity including: Ojibway Prairie Complex (#3); Sandwich West Woodlot/LaSalle Woods (#18); Ojibway Black Oak Woods (#19); Spring Garden Road Prairie (#29); and, St. Clair College Prairie (#49). Three areas are designated as Natural Environment by the Town of LaSalle Official Plan, including: Southeast of the Nature Reserve ANSI; the Spring Garden Forest ANSI; and, the LaSalle Woods.

Three areas are designated as Natural Heritage by the City of Windsor Official Plan, including: Ojibway Prairie Complex; Oakwood Bush and the eastern section of Malden Park; and, three areas are designated as Special Policy Area "A" including two areas of the Titcombe Road North ANSI, a section of the Spring Garden Forest ANSI and the St. Clair College Prairie ESA. A total of three CNHSs are identified in LaSalle and ten CNHSs are identified in Windsor. The Detroit River is designated as a Canadian Heritage River. The location of the designated natural areas is shown in Appendix G.

Field investigations were carried out in 2008 to evaluate several wetland units found in the study area using the Ontario Wetland Evaluation Manual for Southern Ontario – 3rd Edition (OMNR 2002). Surveys were performed by staff from LGL Limited and the Ministry of Natural Resources, Chatham District. The evaluation scores have not been calculated; however, it is expected that the MNR will complex the wetland units and designate the wetland complex as provincially significant due to the presence of several species at risk and their habitat.

5.0 RECOMMENDED PLAN

The Recommended Plan for the Detroit River International Crossing (DRIC) project was selected following the evaluation of practical alternatives. The evaluation of practical alternatives is described in *Environmental Assessment Report – Detroit River International Crossing Study* (December 2008) and supporting documentation. Refinements to the preferred alternative were made in response to issues encountered during concept design to generate the Recommended Plan.

The Detroit River International Crossing Project consists of an extension of Highway 401 along a new Windsor-Essex Parkway, a new inspection plaza and a new crossing of the Detroit River at Brighton Beach. The crossing will link with a new inspection plaza and freeway connection to Interstate 75 in Detroit, Michigan.

The Windsor-Essex Parkway is a below-grade, six-lane freeway with 11 tunnels and service roads. The total length of The Windsor-Essex Parkway is 11 km, with 1.8 km enclosed in tunnel sections. A local service road network will be developed to segregate local and international traffic. The Windsor-Essex Parkway includes over 120 ha of green space with more than 20 km of recreational trails. The freeway will be designed to modern safety standards including 3.75 m lane widths, 3.0 m wide fully paved shoulders and tall wall median barriers. A plan view and cross-section for The Windsor-Essex Parkway are presented in Figures 1 and 2.

The inspection plaza is a 55 ha site bounded by Broadway Street on the south side, Chappus Street on the north side, the Detroit River on the west side and the Ojibway Parkway on the east side. The inspection plaza will provide inbound inspection lanes, secondary inspection parking spaces, toll-collection lanes and state-of-the-art inspection facilities. A 17 ha buffer area will be used to shield the surrounding communities from cross-border traffic. The site plan for the inspections plaza is presented in Figure 3.

The final design of the crossing will be determined after discussions with prospective builders. Given the span required to cross the Detroit River, there are two bridge design types that could be used: a suspension bridge, which is recognized by its elongated “M” shape; or, a cable-stayed bridge, which has more of an “A” shape. Neither bridge type requires a pier in the Detroit River.

The suspension bridge option is 1,355 m in length, with a 855 m centre span. The maximum deck height is 47 m, with tower heights of 140 m. The bridge deck is approximately 35 m wide and accommodates 6 lanes, a 1.0 m flush median, shoulders and a walkway on one side. A concept drawing for the proposed suspension bridge is presented in Figure 4.

The cable-stay bridge option is 1,480 m in length, with a 840 m centre span. The maximum deck height is 47 m, with tower heights of 250 m. The bridge deck is approximately 35 m wide and accommodates 6 lanes, a 1.0 m flush median, shoulders and a walkway on one side. A concept drawing for the proposed cable-stay bridge is presented in Figure 5.

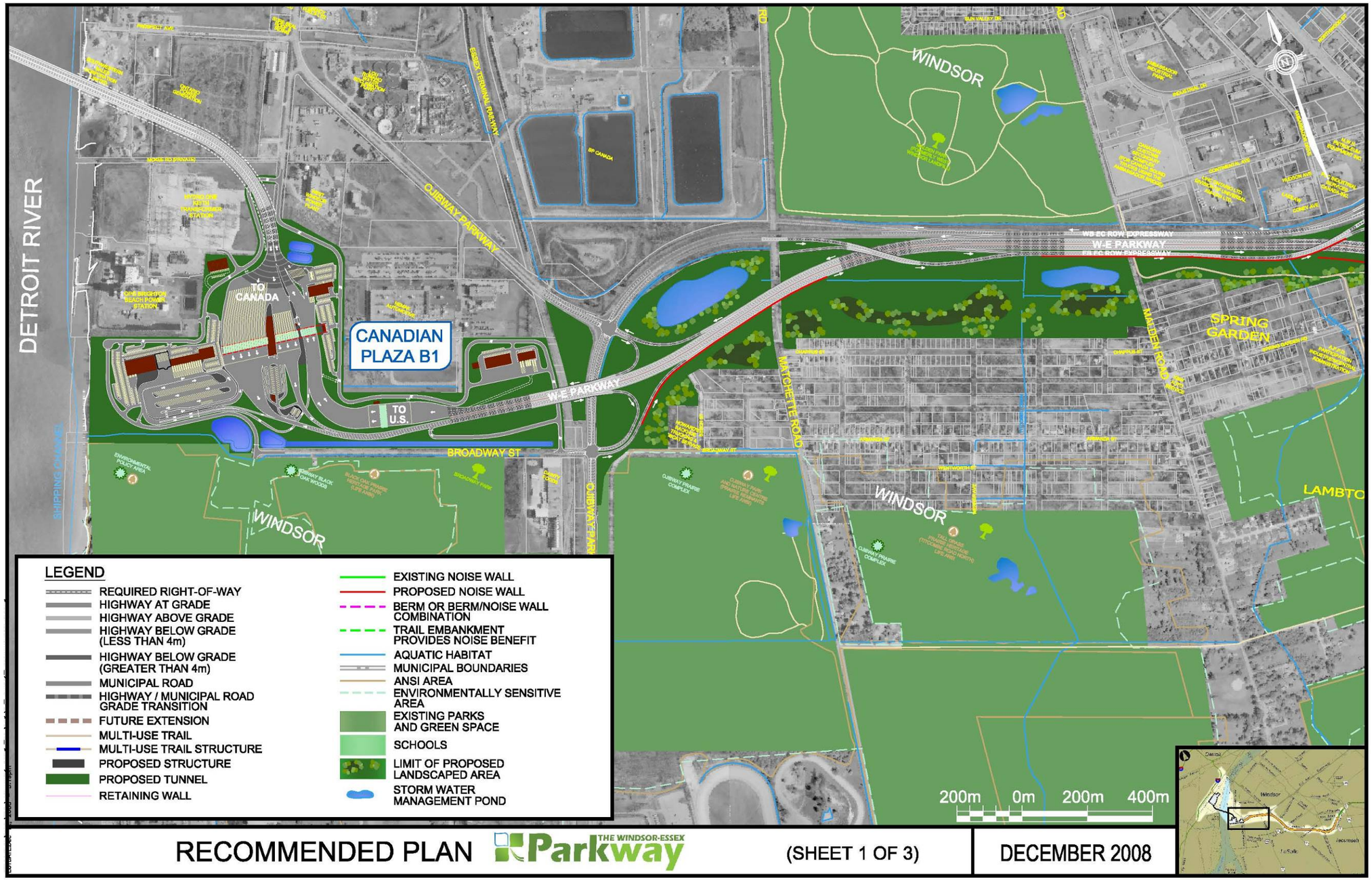

FIGURE 1A. PROPOSED PLAN VIEW OF THE WINDSOR-ESSEX PARKWAY.

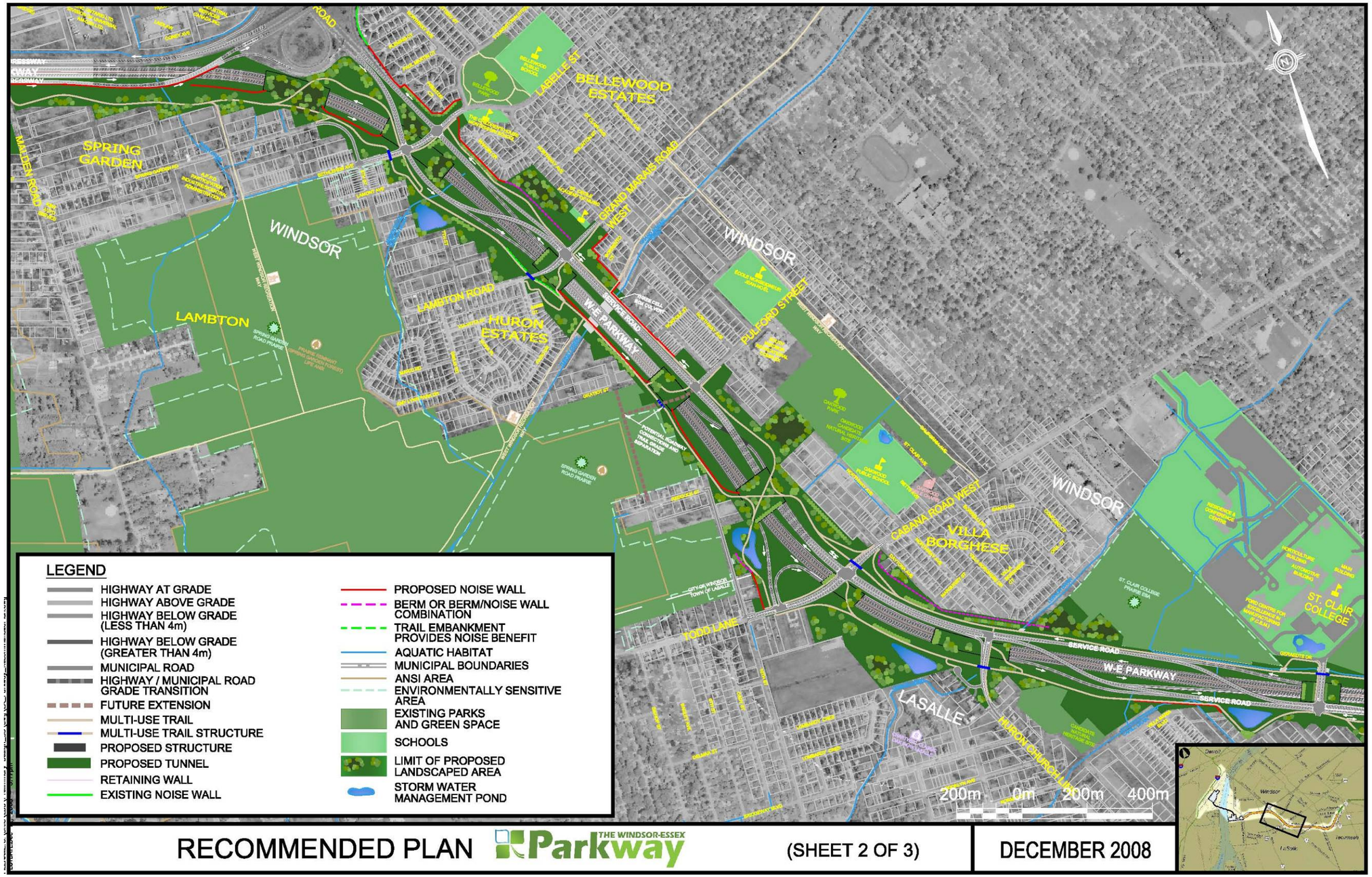

FIGURE 1B. PROPOSED PLAN VIEW OF THE WINDSOR-ESSEX PARKWAY.

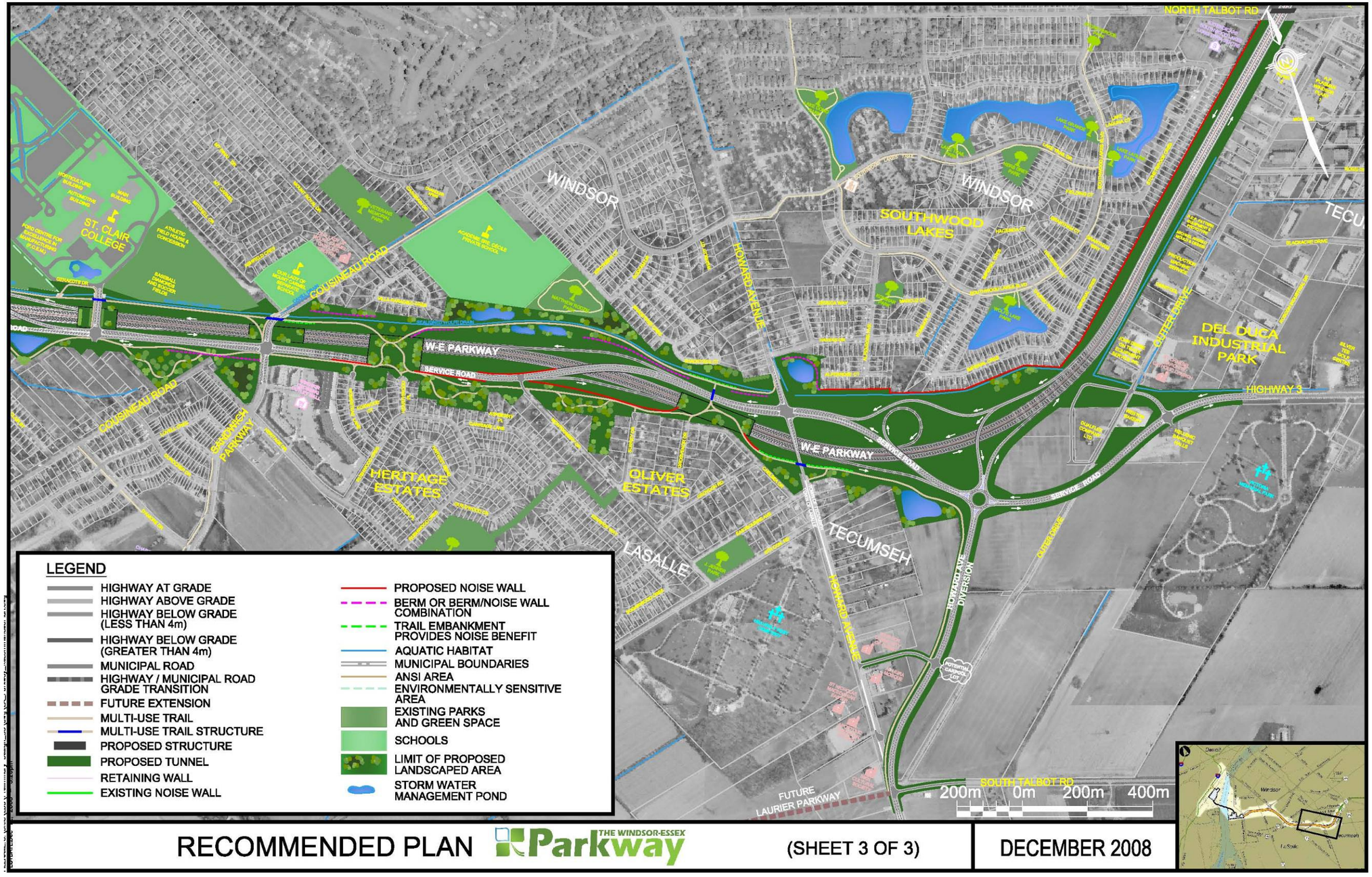

FIGURE 1C. PROPOSED PLAN VIEW OF THE WINDSOR-ESSEX PARKWAY.

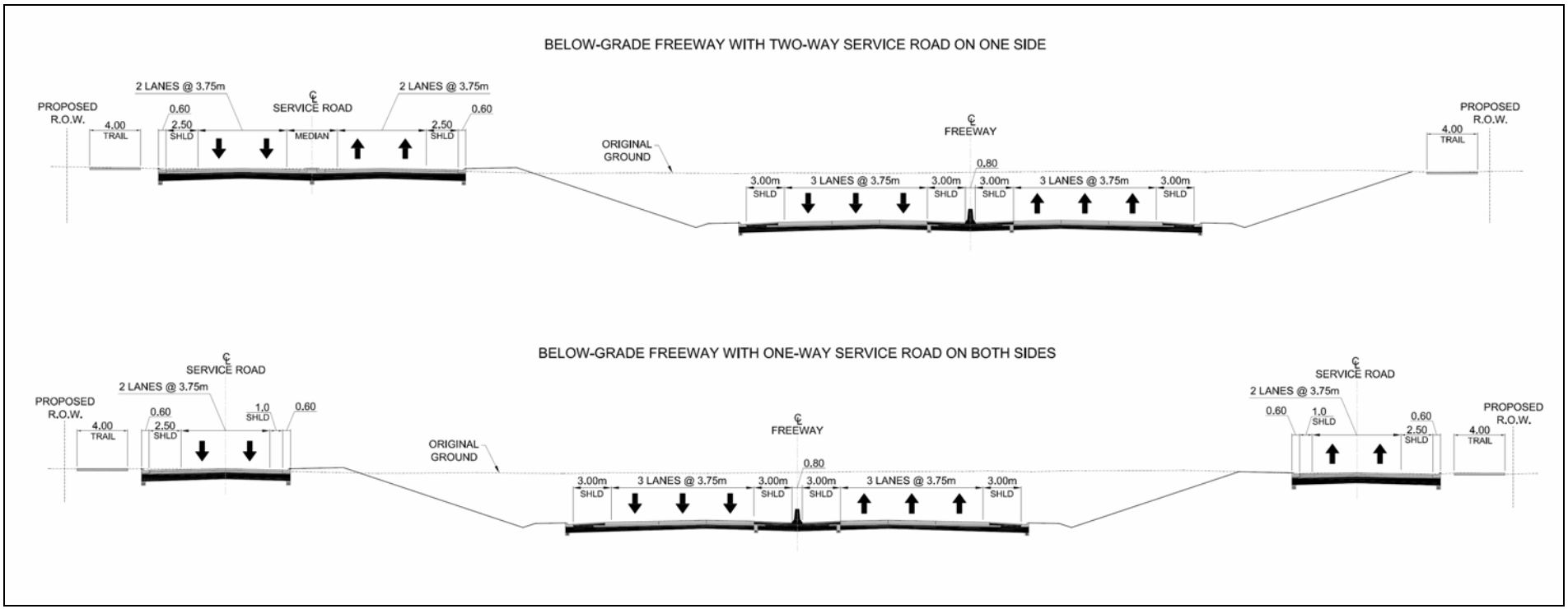

FIGURE 2. PROPOSED CROSS-SECTION OF THE WINDSOR-ESSEX PARKWAY

FIGURE 3. PROPOSED SITE PLAN FOR THE CUSTOMS INSPECTION PLAZA

FIGURE 4. CONCEPT DRAWING OF THE SUSPENSION BRIDGE OPTION

FIGURE 5. CONCEPT DRAWING OF THE CABLE-STAY BRIDGE OPTION

6.0 IMPACT ASSESSMENT, MITIGATION AND MONITORING OF THE RECOMMENDED PLAN

The impact assessment for the Recommended Plan is guided by environmental legislation, regulations and policies and MTO standards, policies and practices, all of which address the potential environmental effects associated with provincial transportation facilities. The approaches to environmental protection can be generally categorized in order of preference as:

- avoidance/prevention;
- control/mitigation (reducing the severity of environmental effects);
- compensatory mitigation (provision of equivalent or countervailing environmental features);
- restoration/enhancement (improvement over previous environmental conditions); and,
- environmental monitoring during and post-construction.

These environmental protection measures are incorporated into the planning, preliminary design, detail design and construction phases of each MTO project, including the Detroit River International Crossing.

The site-selection process for the Recommended Plan has emphasized avoidance of natural heritage features to the extent possible. The environmental protection measures identified for the Recommended Plan have continued to place an emphasis on avoidance/prevention, and also addressed control/mitigation, compensatory mitigation, restoration/enhancement and environmental monitoring where avoidance/prevention could not be achieved.

6.1 Provincial and Federal Environmental Protection Requirements

MTO complies fully with the requirements of federal and provincial environmental legislation, regulations and policies. The legislative requirements that are most applicable to the natural heritage investigation include:

Federal

- *Canadian Environmental Assessment Act;*
- *Species at Risk Act;*
- *Fisheries Act;*
- *Canada Wildlife Act;*
- *Migratory Birds Convention Act;*
- *Federal Policy on Wetland Conservation;* and,
- *Policy for the Management of Fish Habitat.*

Provincial

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

Meeting these legislative requirements is paramount for MTO on provincial transportation facility projects.

6.2 Environmental Standards

MTO has adopted environmental standards to develop 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. Environmental standards are the first step in developing a systematic approach to environmental management that:

- provides an interpretation of federal and provincial environmental requirements as applied to transportation planning, and highway design, construction, operation and maintenance;
- updates and standardizes the environmental practices for highway design and construction;
- develops ways to measure and evaluate environmental performance; and,
- improves document control to better demonstrate how the Ministry meets its commitment to the environment.

Environmental standards adopted by MTO are contained in the following documents:

- *Environmental Reference for Highway Design* (MTO 2006);
- *Environmental Protection Requirements for Transportation Planning and Highway Design, Construction, Operation and Maintenance* (MTO 2006);
- *Environmental Standards and Practices User Guide* (MTO 2006);
- *Environmental Reference for Contract Preparation* (MTO 2006);
- Environmental Guides including Fish and Fish Habitat, Wildlife in the Oak Ridges Moraine, and Erosion and Sediment Control During Construction of Highway Projects, among others; and,
- *Construction Administration and Inspection Task Manual* (MTO 2003).

6.3 Environmental Practices for Highway Design and Construction

MTO's environmental practices seek to avoid potential adverse environmental effects where possible. For situations where avoidance is not environmentally, technically or economically feasible, MTO has developed or adopted environmental practices that are incorporated into the design and construction of highway projects. These practices typically include:

- environmental design criteria (i.e. project components are designed to meet accepted prescribed or performance requirements/targets);
- stormwater management practices/best management practices (i.e. common sense actions used to protect surface water);
- Ontario Provincial Standards (OPSs) including specifications and drawings that have been adopted by the Professional Engineers Association of Ontario (PEO);
- Standard Special Provisions (SSPs) developed by MTO related to erosion and sedimentation control, protection of fish habitat, etc.; and,
- Non-standard Special Provisions (NSSPs) developed by MTO including operational constraints implemented during construction of the facility.

SSPs are used to implement technical requirements and/or administrative agreements/protocols required to constrain the Contractor which have not been prepared as OPSs. NSSPs define site-specific mitigation measures where a suitable OPS or SSP is not available or requires additional clarification. New NSSPs are prepared on a project-by-project basis to implement special provisions related to MTO environmental commitments or environmental approval, permit or exemption requirements.

A summary of environmental practices frequently used for provincial transportation facility design and construction is presented in Table 3.

6.4 Class Environmental Assessment for Provincial Transportation Facilities

The Ministry of Transportation *Class Environmental Assessment for Provincial Transportation Facilities* (MTO Class EA) is an approved planning document under the *Environmental Assessment Act* that defines groups of projects and activities and the environmental assessment processes which MTO commits to following for each of these undertakings. While not applicable to Individual Environmental Assessment projects, the MTO Class EA provides a framework for assessing the potential environmental effects associated with typical, repeated MTO projects where the environmental effects and protection measures are known and readily managed.

TABLE 3.
ENVIRONMENTAL PRACTICES FOR HIGHWAY DESIGN AND CONSTRUCTION

Ecological Component	Environmental Protection Practices	Description
Fish and Fish Habitat	Environmental Reference for Highway Design – Fish and Fish Habitat (MTO 2006)	• Provides direction on the process and procedures for the assessment, mitigation and/or compensation of fish and fish habitat during preliminary and detail design transportation projects.
	Environmental Guide for Fish and Fish Habitat (MTO 2006)	• Provides a review of fish and fish habitat considerations related to highway projects including policy, data collection, field investigations, documentation etc.
	MTO/MNR Fisheries Protocol (MTO 2006)	• Establishes procedure for agency review of MTO projects.
	MTO/DFO/OMNR Protocol for Protecting Fish and Fish Habitat on Provincial Transportation Undertakings (MTO 2006)	• Allows MTO to self screen projects with respect to the *Fisheries Act.* • DFO provides review of HADD/No HADD determination.
	Fish Habitat Conservation and Protection Guidelines for Attaining No Net Loss (DFO 1998)	• Provides guidelines to DFO staff regarding the administration of the habitat provisions in the *Fisheries Act.*
	SSP 199F47 - Watercourse/Fisheries Protection – Use of Confined Explosives	• Describes the *Fisheries Act* requirements and limitations for the use of explosives, in or near, Canadian fisheries waters.
	SSP 199F58 – Fisheries Act Compliance, Oversight, Monitoring and Documentation	• Describes measures to assist the Contractor in complying with requirements related to protection of fish and fish habitat and installation of mitigative and/or compensation measures.
	NSSP - Watercourse/Fisheries Protection – General	• Specifies operation constraints for the prevention of the entry of deleterious materials to watercourses.
	NSSP - Watercourse/Fisheries Protection During Work in Watercourses and on Watercourse Banks	• Specifies details and timing for temporary protection systems (culvert, channel, pumping/piping).
	NSSP - Watercourse/Fisheries Protection During Watercourse Relocation	• Specifies details and timing for watercourse relocation.
	NSSP - Watercourse/Fisheries Protection – Temporary Watercourse Crossing	• Specifies details and timing for watercourse crossing.
	NSSP - Water Taking	• Specifies details and timing where water taking is prohibited; or MTO has water taking permits.
Vegetation and Vegetation Communities	OPSS 565 - Construction Specification for the Protection of Trees	• Describes the protective measures required to safeguard trees from construction operations, equipment and vehicles where such trees are not designated for removal under the contract, and covers the installation of barriers.
	NSSP - Landscape Specification for Tree and Shrub Planting	• Describes the requirements for supplying and planting trees and shrubs.
	NSSP – Maintenance and Warranty for Landscaping	• Describes the requirments to provide maintenance and warranty of all plant material.

TABLE 3.
ENVIRONMENTAL PRACTICES FOR HIGHWAY DESIGN AND CONSTRUCTION

Ecological Component	Environmental Protection Practices	Description
Wildlife and Wildlife Habitat	NSSP - Migratory Bird Protection – General	• Stipulates the appropriate treatment of active bird nests (nests with eggs or young birds) and species protected under the *Migratory Birds Convention Act*, 1994. If active nests are encountered, the Ministry's Contract Administrator is to be notified.
	NSSP – Migratory Bird Protection – Specific	• Stipulates the preventative measures for Contractors to undertake to prevent species protected under the MBCA from nesting on any areas which would conflict with construction activities.
	NSSP – Harrassment of Wildlife	• Prohibits the harrassment of wildlife encountered during the course of construction.
Designated Areas	SSP 199F12 - Environmentally Sensitive Areas	• Prohibits entry into identified environmentally sensitive areas including wetlands, ANSIs, ESAs, etc.
Materials Management	OPSS 180 – Construction Specification for the Management and Disposal of Excess Materials	• Stipulates environmental requirements for management/disposal of excess materials.
Stormwater Management	Stormwater Management Planning and Design Manual (MOE 2003)	• Stipulates MOE requirements for stormwater management on development projects.
	Highway Drainage Design Standards (MTO 2008)	• States Ministry policy on drainage management practices in planning and design for provincial highways.
Erosion and Sediment Control	Environmental Guide for Erosion and Sediment Control During Construction of Highway Projects (MTO 2007)	• States Ministry policy and procedures for developing effective erosion and sediment control.
	OPSS 577 - Construction Specification for Temporary Erosion and Sediment Control Measures	• Stipulates requirements for temporary erosion control tender items. • Specifies installation and removal timing requirements for temporary erosion control tender items.
	SSP 577S01 – Turbidity Curtain	• Specifies the method of measurement and payment for the installation and maintenance of turbidity curtains.
	SSP 577F02 – Temporary Erosion and Sediment Control Measures	• Amendment to OPSS 577. • Specifies type of measure to be installed – light duty silt fence, heavy duty silt fence, straw bale flow checks, rock flow checks etc.
	NSSP - Erosion and Sediment Control – General	• Specifies time constraints for duration of earth exposure. • Specifies standby supply of silt fence and operational constraints.
	OPSS 570 - Construction Specification for Topsoil	• Stipulates the requirements for stockpiling, placing and supplying of topsoil.
	OPSS 571 – Construction Specification for Sodding	• Stipulates the requirements for sodding.
	SSP 571S01 – Sodding	• Stipulates requirements for sodding tender items.
	OPSS 572 – Construction Specification for Seed and Cover	• Stipulates the requirements for seeding with either hydraulic or straw mulching, Bonded Fibre Matrix, or erosion control blanket application.

6.5 Vegetation and Vegetation Communities

A description of the existing vegetation and vegetation communities located within the area of investigation is presented in Section 2.3.1 of the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL Limited 2008).

6.5.1 Environmental Standards and Practices

The *Environmental Standards and Practices User Guide* (MTO 2006) indicates that the construction and operation of provincial transportation facilities such as interchanges, traffic lanes, temporary access roads, bridges and culverts, and traffic and noise barriers may result in:

- encroachment on vegetation communities; and,
- road salt runoff/spray.

A description of the cause, potential effects and environmental management options for these environmental effects is presented below.

6.5.1.1 Encroachment on Vegetation Communities

Encroachment on vegetation communities may result in the displacement of the vegetation community, sensitive plant species, wildlife habitat, and wildlife corridors by:

- removal of significant or sensitive vegetation that can destroy important plant species and wildlife habitats;
- fragmentation of the vegetated feature; and,
- compacting of soils and loss of vegetation during construction.

Disturbance effects may include:

- alteration of site characteristics (i.e. temperature, moisture, light, nutrients) that may change the character of vegetated areas and their ability to support significant plants or at least native flora;
- creation of edge habitat that can affect off-site breeding, feeding shelter or movement opportunities for wildlife;
- intrusion into sensitive valley systems and disruption or blockage of corridors that can affect the movement of plant species via seed or aerial dispersal;
- tree sunscald and blow down;
- spread of invasive plant species;
- stress/dieback of vegetation; and,
- damage to vegetation located beyond the right-of-way from tree felling and/or grubbing.

Over time these disturbance effects may alter community structure, composition and function. Effects are most prominent in areas that have not been previously disturbed or in sensitive communities and habitats.

The measures prescribed for encroachment on vegetation communities include:

- set location of design feature to avoid vegetation communities;
- minimize loss of vegetation communities through location;
- minimize loss of vegetation community by reducing footprint of the transportation facility through flexibility in design standards;
- use overpass structures;
- clear delineation of right-of-way vegetation clearing zones and vegetation retention zones;
- use tree felling and grubbing procedures to minimize risk of vegetation impacts on adjacent lands;
- restore temporarily disturbed areas using a landscape planting plan based on ecological restoration principles;
- maximize the retention and reuse of original vegetation and topsoil during stabilization and revegetation;
- develop a salvage and reuse strategy to retain and reuse original vegetation and topsoil;
- undertake edge plantings along newly created edges of wooded areas; and,
- replace lost vegetation communities to soften impacts and provide or re-instate some vegetation or wildlife habitat area either within the right-of-way or on adjacent lands.

6.5.1.2 Road Salt Runoff/Spray

During the operation phase, the application of road salt or other anti-icing agents during winter maintenance activities may result in vegetation damage. Road salt application may lead to vegetation damage from salt spray caused by passing vehicles and snow ploughs. Salt runoff may contaminate water supplies to vegetated areas potentially killing plants. Soils that become saturated with salt runoff may become infertile and erosion-prone.

The measures prescribed for the management of road salt include:

- set location of design feature to avoid vegetation communities;
- provide edge plantings along the newly created edges of vegetation communities focusing on salt spray buffering;
- plant salt tolerant vegetation; and,
- use salt management options to reduce salt use or salt loss.

MTO has incorporated these environmental protection measures into the Detroit River International Crossing Study, where necessary and feasible, or will incorporate these environmental protection measures into the Detroit River International Crossing Study during later design stages.

6.5.2 Encroachment on Vegetation Communities

6.5.2.1 Potential Environmental Effects

Displacement of Vegetation Communities

A total of 134 vegetation communities (131.71 ha) will be partially or fully displaced by the proposed improvements within 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. The area and quality of vegetation communities located within the footprint of the Recommended Plan is presented in Table 4.

TABLE 4.
SUMMARY OF PROPOSED ENCROACHMENT ON VEGETATION COMMUNITIES

	High Quality	Moderate Quality	Low Quality	Total
Area Impacted(ha)	3.62	40.72	87.37	131.71
Number of Communities Impacted	8	45	81	134

There are numerous impacts associated with vegetation community displacement, including direct loss of floral and faunal habitat, reduced species richness and abundance, decreased biodiversity, reduced stability of landforms composed of unconsolidated material, soil compaction resulting from unrestricted vehicle and machinery operations, and loss of native seed bank (TRCA 2007).

Site preparation activities will be required within the footprint of the Recommended Plan. The vegetation found in the footprint of the Recommended Plan is a mix of disturbed cultural communities and naturalized native communities. Some portions of the area are heavily urbanized and disturbed, while other areas are much less disturbed and have significant natural communities. This is most evident in the areas around St. Clair College, Spring Garden, Ojibway Park and Black Oak Woods. The significant natural communities present consist of tallgrass prairies, savannahs and woodlands, as well as pin oak swamps, black walnut lowland forests, oak-hickory forests and oak forests.

Disturbance to Vegetation Communities

Up to 137 vegetation communities (88.61 ha) may be disturbed in the adjacent lands within 120 m of the footprint of the Recommended Plan, 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 vegetation communities up to 648 known vascular plant species could be disturbed by the construction and operation activities. The area and quantity of vegetation communities located adjacent to the footprint of the Recommended Plan within 120 m that may be disturbed by the Recommended Plan are presented in Table 5.

TABLE 5.
SUMMARY OF DISTURBANCE TO VEGETATION COMMUNITIES AND PROTECTION/ENHANCEMENT/RESTORATION POTENTIAL WITHIN 120 M OF THE FOOTPRINT OF THE RECOMMENDED PLAN

	High Quality/ Protection	Moderate Quality/ Enhancement	Low Quality/ Restoration	Total
Area Impacted (ha)	15.89	36.78	35.94	88.61
Number of Communities Impacted	15	57	65	137

Fragmentation of Vegetation Communities

Vegetation communities present within the footprint of the Recommended Plan are generally small in size, but they exist as part of a continuous natural corridor in patches. These patches will become further divided into separate fragments after clearing. The remaining fragmented vegetation communities in some areas will become islands isolated from each other by The Windsor-Essex Parkway or inspection plaza.

Site preparation will initially result in the reduction in the total area of natural vegetation communities, a decrease in the amount of interior habitat, isolation of some vegetation communities from others, the fragmentation of one patch of habitat into several smaller patches, decreases in the average size of each vegetation community polygon, and increase in the amount of edge.

Edge Effects on Vegetation Communities

Smaller vegetation community patches will be most affected by edge effects. When a new edge is created in a natural vegetation community, the interior natural ecosystem is seriously affected for some distance from the edge. Edge effects will be especially pronounced in areas with treed cover where the clearing will create an opening in the canopy. This opening will allow sunlight and wind to penetrate to a much greater extent, drying out the interior of the vegetation community close to the edge. Some trees with thinner bark can be susceptible to sunscald and frost cracking due to changes in light penetration. This can weaken the tree's defenses, particularly to pathogens (TRCA 2007).

Air temperature, soil temperature, humidity, soil moisture, light intensity all change at the edges. Edges encourage the growth of shade intolerant species and discourage the growth of native shade tolerant species. Trees along the new edge may be susceptible to windthrow. Regrading and fill placement along natural areas with treed cover can impact root systems of retained trees, resulting in root stress and tree decline (TRCA 2007).

Contamination of Vegetation Communities

Numerous activities during the construction, operation and maintenance phases may result in contamination of the vegetation communities, through sediment and erosion control failures, fire, hazardous materials spills, increased heavy metal, organic

molecules, ozone and nutrient concentrations and maintenance activities. Sediment and erosion controls may fail during heavy precipitation or flooding as a result of winter or spring thaws. Fire could occur during the construction or operation phase due to human activities or lightning. Hazardous materials spills could be the result of construction, operation or maintenance activities. Car and truck accidents may also kill vegetation or damage vegetation communities, through hazardous material spills and fire. The operation of the parkway, plaza and crossing will add heavy metals, organic molecules, ozone, and nutrients to roadside environments. Maintenance of the roads and roadsides will introduce herbicides and pesticides. Mowing may result in inadvertent oil and gas spills.

Introduction of Exotic or Invasive Species

The Recommended Plan may advance the dispersal of exotic or invasive species by altering vegetation communities, stressing native species composition, introducing invasive species from seeds within highway soils, and by providing dispersal corridors. Exotic plant species often displace native plant species, reducing the ability of the ecosystem to function properly and remain vigorous. The following invasive species are a major concern throughout the study area, common reed (*Phragmites australis*), multiflora rose (*Rosa multiflora*), common buckthorn (*Rhamnus cathartica*), fescues (*Festuca sp*.), sweet clovers (*Melilotus sp*.), smooth brome (*Bromus inermis*), crown vetch (*Coronilla varia*), butter and eggs (*Linaria vulgaris*), thistles (*Cirsium sp*.), exotic honeysuckles (*Lonicera sp*.), white mulberry (*Morus alba*), black locust (*Robinia pseudo-acacia*), garlic mustard (*Alliaria petiolata*), Russian olive (*Elaeagnus angustifolia*), tree-of-heaven (*Ailanthus altissima*) and Siberian elm (*Ulmus pumila*).

Operation of the Recommended Plan will require winter maintenance activities such as sanding and summer maintenance measures such as mowing. Both forms of maintenance may introduce exotic invasive plant species into the Recommended Plan, unless the soils and equipment are adequately sterilized to remove unwanted seeds and fruits. Mowing also strengthens many exotic grasses that have evolved in close association with human settlements. Constant cutting gives the exotic grasses a competitive advantage over native grasses and forbs.

Alteration to Surface and Groundwater Drainage Regimes

Construction of watercourse crossing structures could alter aquatic or wetland vegetation communities in which some aquatic species are dependent for survival. Improper installation could result in a lack of water for a prolonged period of time, flooding or extensive erosion of the wetland or aquatic vegetation communities. Changes in soil moisture may also affect adjacent terrestrial vegetation communities. There is some potential for alteration of the hydrology of the area as a result of culvert modifications, alterations in drainage patterns and improper stormwater management pond design.

Modifications to baseflow and increased imperviousness of the natural lands within the grading limits have the potential to alter water quantity changing the soil moisture regime of neighboring vegetation communities. Drier soil moisture content should favour some tallgrass prairie species that prefer drier conditions. This subject is also addressed further in the discussion of impacts to designated natural areas in Section 6.10.2.9, and readers should refer to that section for further details.

6.5.2.2 Environmental Protection Measures

A conceptual landscape plan has been prepared for the Recommended Plan. A detailed landscape plan will be prepared during later design phases to identify areas for protection, enhancement and restoration. Measures included in the landscape plan will be designed to off-set the loss of vegetation and function as a result of this project. Protection through stewardship, plus an array of restoration and enhancement techniques including seeding, planting (plugs and seedlings), and transplanting (sod and woody plants) will be employed and will include only native species present within the local Windsor area. Topsoil stripping techniques will be used in areas where there is a prairie seedbank and the soils are severely disturbed by construction activities.

Several different seed mixes and woody plantings will be required for the landscape plan as one type will not be suitable for all areas. The end goal will be to restore the available land on a like-for-like basis to a natural ecosystem endemic to the region. The vegetation community types proposed to be restored consist of:

- tallgrass prairie;
- oak savannah;
- oak woodland;
- oak forest;
- oak - hickory woodland;
- oak- hickory forest; and,
- pin oak swamp (in the wetter areas).

The MTO has acquired approximately 120 ha of land that can be used for vegetation community and species at risk protection, enhancement and restoration. This quantity of land provides the opportunity to create better quality habitat in terms of structure and composition than is currently present. The landscape plan will include detailed prescriptions for vegetation management including the use of native and non-invasive plant materials, management of species at risk, control of exotic and invasive species, edge management plans, soil management plans and prairie disturbance regimes. Mitigation techniques will be employed to seek a net benefit to all regulated species at risk populations within the Recommended Plan.

Connectivity

The Windsor-Essex Parkway design will also offer greater connection between natural areas currently fragmented by Highway 3 and Huron Church Road. Opportunities for new corridors made up of natural vegetation communities will be established with the creation of new access points over the tunnel sections of The Windsor-Essex Parkway and under the Winsor-Essex Parkway via the culvert structures. These new vegetated corridors will also act as vegetation and wildlife corridors.

Vegetation Removal Timing Window

Vegetation removals in specified areas should not occur during the growing season. The growing season in Windsor is extremely long as a result of moderating lake influences

and a southerly latitude that results in warm continental conditions. Thus vegetation removals in specified areas should be conducted from November 1 to March 31. This timing window will allow the vascular plants present, to finish their reproductive cycle prior to removal, and minimize disturbances. This timing window will also avoid potential effects on many wildlife species.

In dealing with high quality vegetation communities or plant species at risk, it may be preferential to perform vegetation removals at the start (April/May) or end (September/October) of the growing season. During this period, most species can be identified. Sods cut during the winter may expose plants to freeze-thaw cycles and cause injuries that may not heal.

Contamination of Vegetation Communities

Special efforts will be made to limit the exposure of adjacent vegetation communities to sedimentation from erosion and dewatering operations, hazardous materials spills, herbicide and pesticide spraying. Sediment and erosion control barriers will be installed near sensitive vegetation communities. Hazardous material spill response contingency procedures will be developed and implemented.

The use of herbicides and pesticides will be minimized for the Recommended Plan as a result of native plantings and vegetation community management. Herbicide use will be minimized in proximity to high quality vegetation communities.

Introduction of Exotic or Invasive Species

Native seed mixes should be used for landscaping purposes, where practical. Non-invasive native plant species should be used for plantings for the Recommended Plan and within the natural areas. If non-native shrubs and trees are used for landscaping, only species that do not self propagate, invade or sterilize soils should be used, and consideration should be given towards the locations where these plantings occur. Native tree and shrub alternatives are preferred because they offer habitat that wildlife is adapted to. Transported materials and equipment need to be screened for exotic and invasive plant and invertebrate species. Mowers used for prairie management should be thoroughly cleaned to remove invasive and exotic seeds picked up from previously mowed areas.

Exotic Species Removal

Prior to any natural remnant enlargement, enhancement or restoration occurring, all invasive and exotic species need to be removed. This is a difficult task that requires a minimum of five years of weed removals. Invasive and exotic plant species will be identified and removed through the use of targeted herbicides, spraying, wicking, weed torches and prescribed burns.

Edge Management Plan

Edge management plans are intended to help mitigate negative impacts associated with natural cover removal, especially tree clearing. Edge effects were mitigated where possible by locating the Recommended Plan away from the natural heritage features that have the greatest significance, by avoiding larger contiguous blocks of good quality

habitat, minimizing the amount of new edge created and by providing appropriate buffers. In areas where natural cover is being displaced, tree preservation plans should be completed and tree protection fencing should be installed beyond the forest edge to be retained. Disturbance widths should be minimized where possible by reducing temporary working easements, limiting equipment storage areas and vehicle turning points to open areas dominated by exotic species and reducing footprints. Native vegetation should be planted along the new edge to provide a protective "buffer" (TRCA 2007).

Vegetation removals will be especially pronounced in areas with treed cover where the clearing will create an opening in the canopy. The opening will allow for shade intolerant species to establish reducing the habitat for shade-dependent species. Native shade tolerant species, such as woodland sunflower (*Helianthus divaricatus*) and pale-leaved wood sunflower (*Helianthus strumosus*) that are hardy plants which can tolerate a broad range of conditions, such as higher levels of sunlight, should be planted along the new edges. Planting native species that can tolerate both shade and some sunlight will reduce the establishment of adventive shade intolerant plant species.

Restoration Strategies

Restoration strategies need to be site-specific to the soil conditions, topography, soil moisture regime, adjacent vegetation, and the existing seed bank. The condition of the existing site will determine how effective the restoration will be and how much initial preparation is required. It is critical that the site conditions are assessed prior to site preparation and planting. Site preparation is a huge factor in determining how successful the restoration will be; as soil compaction, grading, herbivory and altered hydrology can seriously hinder planting success. In addition to site preparation, the plan needs to document planting methods, species selection and long-term management.

The goal of the restoration strategy is to off-set the loss of area or function of provincially rare vegetation communities, including tallgrass prairie, savannah and woodland, Carolinian forest, and wetlands. Several mitigation strategies are available to compensate for the loss of provincially rare vegetation communities including, in order of preference:

- protect existing natural remnants;
- enhance existing natural remnants;
- enlarge existing natural remnants; and,
- establish or restore new provincially rare vegetation communities.

Enhance Existing Natural Remnants

Enhancement of the existing natural remnants is the most preferred compensation approach, since it benefits an existing community and may not require an intensive management effort. This approach identifies existing remnants of vegetation communities in the local area that are showing inherent prairie features or functions such as prairie flora, sandy soils, fungal soil system or lack of tree cover. This strategy involves an assessment of the needs of the natural community, which may include one or many management techniques such as planting, burning, tree cutting or exotic species removal.

Enlarge Existing Natural Remnants

Enlargement of the existing natural remnants involves adding new area to an existing vegetation community. This is likely to involve a more intensive restoration strategy to establish suitable site conditions suitable for prairie plants and other native species. Plantings can be achieved through collection and hand broadcast of seed from the adjacent unit or through the natural seed dispersal.

Establish/Restore New Prairies

Establishment or restoration involves the creation of new vegetation communities on cultural vegetation communities, plus newly disturbed, existing agricultural, degraded or stripped land. This is likely to involve the most intensive restoration strategy to recreate the ecology of a natural vegetation community.

Restoration Methods

Restoration of tallgrass prairies has been successfully conducted through five methods; seeding, plugs, planting seedlings, by transferring sod or by stripping the topsoil. Only local genetic stock (locally grown and locally collected) should be allowed for restoration use.

Seeding

Commonly, a seeding approach is undertaken which requires a long time to fully establish due to the germination cycle of seeds. Three years is a reasonable time span for an initial plant community. Very diverse seed mixes also hedge bets, fill more niches and are very effective. Seed mixes should contain native species that are suitable to the local soil, moisture, and light conditions. Seed of native prairie species should be collected from within the Recommended Plan, the adjacent lands within 120 m of the Recommended Plan, from the nature reserve and immediate area around it. The seeds should be hand broadcast a week or two after the spring burn (Roger 1998). Species should be congruent with the existing vegetation community. A lot of seed is not needed if the sites are kept free of exotics, clean, good seed is used, seeding occurs in late fall and good seed/soil contact is established. The Walpole Island First Nations have kindly offered native seed stock for naturalization purposes.

Plugs

Also done equally often is the planting of plant plugs, which is more expensive but gives a quicker and more effective response. The advantages of this option is a more efficient use of precious seed, and an even more immediate visual response, as some of the plant plugs may mature and produce their own seed in the first growing season. Some species that do not establish themselves well by seeding or have very limited seed available will especially benefit from a plug option (Roger 1998).

Sod

Transferring sod from an intact prairie can be quite successful due to the transfer of soil microorganisms, fungi, seed bank, and soil materials. Steps should be taken to salvage individual plants and/or soil and move it to appropriate areas in communities that are

being restored or enhanced. This approach requires a careful and immediate placement once removed to ensure the viability of all biota in the sod. The receiver site needs to be available and ready at all times. The receiver site may be a totally different part of the highway corridor than the site the sod is being transplanted from. Sod should be rolled out onto a new bare site leaving an equal amount of fresh bare ground between sods so that plants can spread to these.

Shrub and Tree Plantings and Transplanting

Land areas that are to be restored or enhanced to savannah or woodland should be planted with native woody vegetation. Savannah vegetation communities should be planted with the aim to have between 10 percent and 35 percent tree cover, while woodlands should be planted with the aim to have between 35 percent to 60 percent canopy cover (Bakowsky 1993). In the Windsor area, oak species are the common savannah and woodland woody vegetation, including black oak (*Quercus velutina*), white oak (*Quercus alba*), bur oak (*Quercus macrocarpa*), swamp white oak (*Quercus bicolor*) and pin oak (*Quercus palustris*). Tree species composition will be dependent on the unique environmental conditions.

Small trees and shrubs worth saving should also be dug up using tree spades and immediately transplanted. Successful establishment of transplanted and new potted stock is partly dependent on size. As a result, larger nursery stock and existing trees should be planted and transplanted. This will allow trees to compete effectively with other vegetation and encourage their successful establishment. Measures should be taken to ensure adequate protection and maintenance of these newly planted woody species, including weed control mats, rodent control and watering during the establishment phase. All trees requiring staking and guying should be staked and guyed immediately following planting to ensure vertical alignment and plant stability (Canadian Nursery Landscape Association 2006).

Topsoil Stripping

Another approach for creating tallgrass prairie is to take soil auger samples from every displaced vegetation community. The soils should be watered regularly and grown throughout the winter time in a greenhouse to see which plant species are present within the soils. If the soils within the footprint contain a prairie seedbank, the soils should be used in the adjacent lands within 120 m of the footprint. This good quality soil should be placed in areas where the soils have been disturbed and do not contain a natural plant assemblage. Within the adjacent lands, shallow clearing of the topsoil should occur in areas with prairie seedbank as well. The problem with this methodology is conditions within a greenhouse may not mimic the natural conditions within a prairie for the seeds to germinate.

The topsoil stripping technique for restoration involves the removal of the topsoil layer with heavy equipment, and this technique is useful in areas where the topsoil will be removed by construction activities. The result is that the weeds and the seed bank are removed; providing a competitive edge for prairie plants which will tolerate the poor soils that remain. In addition to reducing soil fertility, topsoil stripping also reduces the quantity of prairie species present, plus specific fungi, bacteria and beneficial soil invertebrates that some plants require to survive. However, meadow and prairie species are exceptionally good at acquiring their fungal and bacterial companions if there are nearby (approximately

500 m) sources from native stands. Fungi and beneficial soil invertebrates can also be introduced into the soils by transplanting sod from an ecologically diverse prairie. Seed can be applied to the stripped area, and bacteria can be introduced by shaking seed in bacterial inoculants prior to planting. The pH levels of the soil should be tested prior to stripping to ensure that the pH following topsoil removal is within appropriate prairie levels, otherwise additional measures should be taken.

Forest and Swamp Restoration Strategies

The strategy of the forest and swamp restoration plan involves restoring the ecological function of the communities with treed cover to their pre-disturbance conditions. By using the remnant natural areas as a reference, decisions can be made about the ideal (most similar) habitat composition and structure. To restore or enhance the available land areas, similar topography, moisture regime, and fertility must be present or restored. The topography needs to be restored by excavating the filled areas to their original contours. This will recreate a close approximation of the original topography.

Native tree saplings, shrubs, herbaceous plants (seed mixes or plugs) should be planted within the enhancement and restoration areas, plus along the edges of remnant treed areas. This will increase the quantity of native vegetation reducing the edge effect. Species should be chosen based upon their traditional plant assemblages, their shade tolerance, soil and moisture requirements. Tree seedlings should be planted on five metre centres while shrubs should be planted on three metre centres. Trees and shrubs should be planted in a random pattern. Another objective is to create vegetation communities that require little or no maintenance. Measures should be taken to ensure adequate protection and maintenance of these newly planted woody species, including weed control mats, rodent control and watering during the establishment phase. All trees requiring staking and guying should be staked and guyed immediately following planting to ensure vertical alignment and plant stability

Maintenance and Warranty

The contractor should provide a warranty of all woody plant materials. The duration of the maintenance and warranty phase should be a minimum of three years following the planting of any woody material. The contractor shall ensure that all plant materials are maintained in a horticulturally acceptable manner, including adequate watering and fertilizing, control of weeds and grasses, application of rodent repellent, attention to stakes, toes, wire and hose and the wrapping and unwrapping of all coniferous trees for winter protection. The warranty should cover any defects in material and workmanship. The Contractor should replace any plant material that is found to be unacceptable to the Contract Administrator within the duration of the maintenance and warranty period (Canadian Nursery Landscape Association 2006).

Plant material should be acceptable when it is structurally sound, when it is well furnished with living foliage, when it has normal colour, when it shows adequate annual growth and formation of buds and when it is free from blight of any description. Plant material which does not meet this standard or which has severely "died back" and has regrown from a bud or shoot or has been damaged by rodents shall be considered unacceptable (Canadian Nursery Landscape Association 2006).

Tallgrass Prairie, Savannah and Woodland Disturbance Regimes

Fire

Tallgrass prairie vegetation is naturally maintained through fire disturbance. Tallgrass prairie, savannah and woodlands contain many of the same species, but are maintained by different fire regimes, having less frequent and lower intensity fires the higher the percent tree cover. Ideally, tallgrass prairies, savannahs and woodlands should be periodically subjected to a prescribed burn. The incorporation of fire needs to be considered at the onset of the project since it may affect site selection and species selection, as well as who will carry out the long-term management. A prescribed burn plan should be developed in conjunction with the OMNR Prescribed Burn Program (Roger 1998). A recovery plan for tallgrass prairies in Southern Ontario has been developed by Roger (1998) and provides extensive details on how prairie restoration and burn programs should be conducted. The burn plan should include relevant site conditions, a timeline, including the frequency and yearly timing of burns, firebreak provisions, considerations for sensitive species and considerations for public safety (Roger 1998).

Since, fire does not burn evenly or completely it creates patches. This is a good thing, since unburned areas will become refuges for species, which will repopulate the burnt areas. This is especially important for insects. Thus, burns should only occur on half of the site each time on a rotating basis (Roger 1998).

Fire is needed to properly manage any remaining healthy tallgrass prairie, savannah or woodland communities (Roger 1998). To maintain prairie, fire frequency in a healthy prairie community should be carried out once every two or three years. As prairies mature, fire frequency should be decreased to every three to five years (Delaney, K. *et al.* 2000). The best time to burn is early spring, either in mid March or by mid April at the latest. This is the ideal time of year to burn because it leaves winter cover for wildlife, suppresses highly competitive and undesirable early emerging, non-native herbaceous species, inhibits the growth of thin-barked, woody species, makes available the nutrients that would otherwise be stored up in the vegetative litter, and it exposes the soil to the warming effects of the sun, which is especially effective if covered by a thin layer of blackened ash. This warming effect is critical to stimulate the initial growth of the prairie species. Soil temperatures beneath a layer of vegetative litter are too cool for optimal stimulation of the tallgrass prairie species (Roger 1998).

When managing a cultural meadow, thicket or woodland in the attempt to restore it to prairie, it is imperative to attempt annual prescribed burns (Roger 1998). Practical fire indices should be established by regional fire staff to take into consideration the weather conditions and herbaceous vegetation conditions during the last part of March or early part of April in order to carry out a prescribed burn as early in April as possible. Missing a burn in even one year retards the rehabilitative process. It may therefore be necessary to carry out a prescribed burn in some years under less than ideal conditions. Once a part of the prairie has been determined, by monitoring, to progress to a maintenance phase of management, then prescribed burns need not be annual, as long as the quality of the prairie is maintained (Roger 1998).

Woody Stem Cutting

Fire alone will not likely reduce the extent of thickets within the study area for many years. To speed up the rehabilitation of the prairie environment the proven practice of cutting woody stems is necessary, and will continue to be so, as these thickets will not support fire (Roger 1998). Ideally thickets should be cut in mid-summer when the woody stem's food reserves are lowest, with most of the energy above ground. Most species will resprout rather vigorously, but the extra light reaching the ground will stimulate the growth of native grasses which will provide competition to the sprouts and fuel to carry future fires. As this process is often a gradual one, some re-cutting will be required in subsequent years. Eventually regular fire alone will likely control these extensive thickets and should replace the need for cutting. When natural fuel is in quantities that are inadequate to support fire, artificial fuel in the form of straw should be scattered throughout the thicket to increase the fire intensity (Roger 1998).

Herbicides

Resprouting of woody stems in thickets may continue to hamper the rehabilitative process (Roger 1998). Also, some exotic woody species (e.g. black locust) and exotic graminoid species (e.g. common reed) are particularly persistent. Black locust will sucker vigorously after cutting or burning to the point of actually becoming more problematic. Common reed will flourish after a burn with the release of nutrients. However, the use of a short-lived, biodegradable herbicide (e.g. glyphosate) can greatly speed up restoration efforts. If the stems are large enough, they can be injected with the herbicide. If the stems are too small, they can be cut and then immediately have the herbicide brushed directly onto the cut area. As the stem dies, the sunlight reaching the ground will stimulate herbaceous prairie vegetation. Herbicides that are short lived and biodegradable should therefore be used to control persistent, exotic and invasive species (Roger 1998).

Mowing

In some areas of the study area it may be difficult to use fire, thus mowing may be used as an alternative disturbance factor. Hay must be removed from the site in order to mimic fire by lowering nitrogen levels (Roger 1998). Mowing should take place in early spring, either in mid March or by mid April at the latest. Mowing should occur at the same time and frequency as the prescribed burn regime. One can mow and then use a weed torch on moister days to achieve the same effect as fire (Roger 1998).

Mowing in itself is not the most effective prairie management technique, as it does not contribute the natural benefits as fire does (Roger 1998). Mowing in place of regular prescribed burning should not be carried out, except in three situations. One, when prescribed burns are impossible because of the proximity to residential areas and major roads. Two, mowing by hand or using light equipment may be used prior to a burn to reduce fuel near hydro poles, fence posts and fire-susceptible trees. Three, mowing may also be necessary for the control of sweet white clover, a rapidly colonizing European invader (Roger 1998).

Soil Management

Soil management is required to achieve and maintain nitrogen impoverished soils, which give prairie species a competitive advantage. Atmospheric and highway nitrogen

deposition promote the growth of invasive, non-native plants in natural systems, while carbon rich soils encourage the growth of native graminoids and forbs. A possible solution is to increase the organic carbon content within the soils through reverse fertilization (Averett *et. al.* 2002; Averett *et. al.* 2004; Morgan 1994). Reverse fertilization reduces soil nitrate through the application of wood chips, oat hulls, saw dust and sugar. As organic matter rots it encourages microbial growth, which ties up soil nitrogen so it isn't available in the soil. Wood chips and saw dust can be generated from the trees removed for construction within the Recommended Plan and applied to nitrogen rich areas.

Soils disturbed as a result of construction activities need to be stockpiled and treated with herbicides prior to being re-used and planted upon. Treated soils kill off invasive and exotic seeds present within the soils. If the invasive and exotic seeds are not removed prior to seeding or planting, they will compete with or out-compete native plant species. This will make it more difficult for native vegetation plant establishment.

Long-term Management

All of the above strategies to establish new vegetation communities require an active stewardship plan including long-term management. Proper management of the natural lands will maintain or enhance the native biodiversity, protect species at risk, control invasive exotic species, decrease soil erosion, reduce and prevent undesirable human impacts. The management plan needs to be site-specific to conditions such as soil types, topography, and soil moisture (Roger 1998). Prairies have been established on a variety of existing agricultural fields or other degraded sites. However, the condition of the existing site will determine how effective the restoration will be (endpoint) and how much initial preparation is required.

This approach also has an inherent unpredictability, as restoration is an applied science which is subject to weather, introduced species and timing. It is also important to stress that current restoration methods are unable to restore exact plant diversity in tallgrass prairie, as would be seen in a remnant tallgrass prairie. To achieve high-functioning native prairie communities' large areas are required as well as long term efforts including introductions of species of high conservation value.

Roadside Plantings

Roadside planting projects can be achieved with careful initial assessment of conditions and the implementation of an appropriate plan. The soils, moisture regimes, solar aspect, topography, adjacent vegetation and existing seed bank all need to be assessed prior to planting.

To restore the roadside landscape after construction the land should be kept rough (i.e. rocks and logs should be left in the soils). No smooth blading should be allowed. Only native prairie seed mixes, plugs, sod or woody plants should be used along the proposed Parkway. No exotic or invasive species should be allowed within the seed mix. Non-native seed mixes used along many road corridors throughout North American have resulted in the incursion of invasive, non-native species into natural areas (Kansas Native Plant Society 2008; Martin *et. al.* 2005; Noss 1995; Ries *et. al.* 2001; Roger 1998). Restoration of the roadside to native vegetation communities can benefit wildlife by adding habitat and restoring connectivity between fragmented natural areas. Another

result of restoring native vegetation is the lack of mowing and herbicide use needed to maintain the roadside (Ries *et. al.* 2001).

Terraseeding should be used to spread native seed mixes along the roadside landscape. Hydroseeding is not advised. Terraseeding broadcasts seed mixes, with a takifier and a microbial stimulant that are applied by using a blower truck. The blower truck uses a pneumatic application process to apply the mixture through a hose that reaches up to 300 feet. Mixing the ingredients together reduces soil erosion, stabilizes the soils, prevents splash, sheet and rill erosion and removes suspended soil particles from overland water flow (Hermanns 2007). A nurse crop of foxtail millet (*Setaria italica*), oats (*Avena* sp.), overlooked dropseed (*Sporobolus neglectus*) and/or ensheathed dropseed (*Sporobolus vaginiflorus*) should be sowed prior to seed application.

Native vegetation planted along the highway edge will produce a buffer for the remnant natural vegetation communities located within the adjacent lands within 120 m of the Recommended Plan. A native buffer along The Windsor-Essex Parkway will provide a safe harbour for new species that naturally establish. Native plantings are non-invasive, visually pleasing, quick growing and green growing slope stabilizers. Native prairie vegetation is drought resistant, absorbs more rainfall than planted exotic grasses, which can reduce erosion and runoff, improving water quality. Many prairie species are salt tolerant, such as little bluestem (*Schizachyrium scoparium*), which can grow on the median of roads and highways that are maintained in the winter using salt. Native vegetation once established provides wildlife habitat, increases biodiversity, helps to control invasive plant species, reduces snowdrifts and provides habitat for species at risk. Native vegetation communities are more cost effective than traditional exotic seed mixes in the long run because they don't require mowing, pesticides or herbicide, and they thrive without the use of fertilizers.

6.5.2.3 Monitoring and Follow Up

On-going consultation with regulatory agencies such as the Ontario Ministry of Natural Resources, the Canadian Wildlife Service, and with other authorities who may have a role in environmental stewardship, including municipalities, ERCA and Walpole Island First Nation will occur.

Construction activities in and adjacent to areas of vegetation not designated for removal will be monitored on a daily basis as per the MTO CAIT Manual. Monitoring of restoration activities including planting of native species will be undertaken on a daily basis for the duration of the landscaping activities. Results of these monitoring activities will be recorded in the Environmental Inspector's Daily Inspection Diary and submitted weekly to the Ministry of Transportation. Should the Contractor not be in compliance with contract documents corrective action will be taken within two days of the non-compliance being reported.

Post-construction monitoring should occur for at least five years to ensure successful plant establishment and reproduction. Management prescriptions will be monitored to determine if alternate techniques are required to meet the goals of the landscape plan. Prairie management should be an ongoing and long-term process that would require the cooperation of local organizations to remove invasive exotics, burn as frequently as possible, protect high significance vegetation communities and species at risk.

In order to monitor the effectiveness of the recommended mitigation and site restoration measures a Quantitative Photomonitoring Technique based on a program developed by Van Horn and Van Horn (1996) is suggested. This method is designed for restoration work, and provides a quantitative and qualitative assessment.

The suggested monitoring approach for various key areas, such as ANSI's, ESA's, soon to be designated PSW's, and provincially rare vegetation communities will be more frequent to insure that no significant changes have occurred. The suggested monitoring program is based on a modified version of a Quantitative Photomonitoring Technique for Restoration Projects developed by Van Horn and Van Horn (1996).

Scheduling of Photomonitoring:

- Year 1 – Establish baseline monitoring plots during the summer period to augment the database developed over the course of the study;
- Year 1 to 2 – Implement the restoration/mitigation measures;
- Year 2 to 5 – Complete annual monitoring of plots, with follow-up management treatments, as required, to achieve desired objectives;
- Year 2 Onwards – Expand management prescriptions to larger areas, based on the results of the monitoring efforts; and,
- Year 5 Onwards – Complete periodic monitoring of high use areas and restored sites on a three year interval basis. Adjust monitoring program where necessary to include new use areas or recently restored sites.

The abundance of rare, Special Concern, Threatened and Endangered plant species populations should be monitored every year to ensure that there continues to be a net benefit to each significant species.

At the completion of each photomonitoring year a summary report documenting observations, trends, and recommendations for future action will be prepared by MTO and submitted to CWS, MNR and ERCA.

6.5.3 Road Salt Runoff/Spray

6.5.3.1 Potential Environmental Effects

The effects of salt spray on vegetation are considered minor and unavoidable due to safety concerns. Vegetation dieback is typically limited to the outermost edge of vegetation communities and varies based on the orientation of the transportation corridor, the direction of the prevailing winds, the frequency and volume of salt applied, and the sensitivity of the receiving vegetation to salt. Some vegetation in proximity to the new facility is particularly sensitive to the effects of salt, and most of this vegetation occurs in the high quality vegetation communities.

Salting in the winter during the operation phase will affect salt intolerant plant species adjacent to the Recommended Plan. Road salt enters into the natural environment (surface water, groundwater and soil) through storage and application of winter salts. The highest concentrations are associated with winter and spring thaws.

6.5.3.2 Environmental Protection Requirements

Alternative management practices to minimize the exposure in areas of sensitive plants and communities to salt damage should be identified for specified areas. Salt-tolerant vegetation species will be planted in areas that will experience notable salt exposure to ensure that these areas remain vegetated. Landscaping plans will also include maintaining a sufficient buffer in areas to reduce the potential for salt spray deposition on sensitive vegetation communities and species at risk habitat.

6.5.3.3 Monitoring and Follow Up

As part of the greater restoration and species at risk monitoring, impacts associated with salt application will be monitored.

6.6 Molluscs and Insects

A description of the existing mollusc and insect species located within the area of investigation is presented in Section 2.3.2 of the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL Limited 2008).

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. As a result, no impacts to mollusc species at risk are anticipated.

Numerous rare species of insects are present in the Windsor region, with the majority of the records associated with the Ojibway Prairie Complex, as this area has been the subject of the most intensive insect investigations. Based on field investigations and a review of secondary information from regulatory agencies and entomologists, one provincially and federally regulated species of insect is known to occur in the study area: the Monarch butterfly (*Danaus plexippus*). Given that this species is provincially and federally regulated, an assessment of potential impacts to this species follows. The Monarch is regulated as Special Concern in Schedule 1 of SARA and Schedule 5 of ESA, 2007.

6.6.1 Environmental Standards and Practices

The MTO has not prepared environmental standards or practices for insects. However, the Monarch is considered a species at risk, so the *Environmental Standards and Practices User Guide* (MTO 2006) applies. The User Guide indicates that the construction and operation of provincial transportation facilities such as interchanges, traffic lanes, temporary access roads, bridges and culverts, and traffic and noise barriers may interfere with species at risk and their habitats. Interference with species at risk and their habitats can result in the reduced size or extirpation of local populations. During the operation phase, wildlife mortality may result from human/vehicle/wildlife encounters and exposure to contaminants resulting from spills or upsets.

The measures prescribed for the management of interference with species at risk and their habitat include:

- set location of design feature to avoid species at risk and their habitat;
- restrict access of construction equipment from species at risk and their habitat;
- use timing constraints to limit operations to ensure that species at risk are not present on site during construction; and,
- educate construction workers on how to manage encounters with species at risk.
- MTO has incorporated these environmental protection measures into the Detroit River International Crossing Study, where necessary and feasible, or will incorporate these environmental protection measures into the Detroit River International Crossing Study during later design stages.

6.6.2 Monarch

The lifecycle of a Monarch in southern Ontario begins with the arrival of adults in the spring who have migrated northward from the Mexico and the southern U.S. The females deposit their eggs on milkweed plants (*Asclepias sp.*) or other plants near milkweeds. The larvae (caterpillars) emerge and feed exclusively upon the milkweeds. Once sufficiently developed, the caterpillars form a chrysalis within which they pupate into an adult. Once the adult emerges it will often disperse to other regions to breed and feed. Adults feed upon nectar flowers such as butterfly-weed (*Asclepias tuberosa*) and black-eyed Susan (*Rudbeckia hirta*) found in prairies, meadows, roadsides and gardens. They generally undergo at least two generations per year and adults are present in southern Ontario from mid-April to early November, after which time they migrate to their winter habitat in southern climates.

6.6.2.1 Potential Environmental Effects

Site preparation activities 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. Site preparation activities will remove host plants and kill juveniles and adults.

Once in operation the vehicles using the facility and used to maintain the facility have the potential to strike adult Monarchs and kill them. Mowing of vegetation, if conducted from late spring to early fall, can remove larval feeding plants (milkweeds) and adult nectar plants.

Like those contaminants that threaten vegetation as previously described, contaminants such as emissions and spills from construction and operations have the potential to more specifically contaminate the habitat of Monarchs and consequently poison the individuals. The application of herbicides and insecticides for pest control and vegetation removal have the potential to poison host plants and the Monarchs themselves.

As discussed in the vegetation section, the introduction of exotic and invasive plants and invertebrates have the potential to impact vegetation and consequently the habitat of Monarchs. Exotic and invasive species can also out-compete native plants and thus

remove local host plants necessary for the Monarch's livelihood. There also exists the potential that an invasive invertebrate species may compete directly with the Monarch for resources.

6.6.2.2 Environmental Protection Measures

Impacts to Monarchs cannot be avoided entirely given the scope and nature of the proposed works and the cosmopolitan nature of this species. Several general mitigation measures will be implemented which will minimize impacts to Monarchs and other insects that reside in the study area.

The area for vegetation removals, including areas that support Monarch host plants, has been minimized to the extent possible, and areas that should be protected during construction will be delineated prior to construction start. Vegetation removals should not occur in specified areas during the growing season (April 1 to October 31) so that the core summer period of Monarch feeding upon host plants will not be affected. Removal of vegetation outside of the growing season will also minimize the mortality of Monarchs as they will have migrated south, and consequently the mortalities during construction will be reduced as there will be no habitat present in the construction area.

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.

To protect Monarchs and their habitat during the operation of the facility, mowing and maintenance activities that result in vegetation cutting, should be minimized to the extent possible from June to September to avoid the destruction of larval feeding plants (milkweeds) and adult nectar flowers. Otherwise if cutting is required, it should be staged with cut areas alternated with uncut areas, so that undisturbed resources are available to the Monarch at all times. This recommendation does not apply to areas created for more intensive recreational use. Where visibility is not a concern, mowing activities should be limited or avoided altogether.

Construction operations are not expected to be a source for the introduction of exotic and invasive species, however certain measures will be implemented to reduce the opportunities. Equipment and materials imported from abroad for the proposed works will be subject to the Canadian Food Inspection Agency and Canada Customs screening requirements. Under those requirements products that are more likely to carry exotics, such as plant material and wood, are subject to a more thorough screening. New regulations have been implemented since the introduction of the Emerald Ash Borer and Asian Long-horn Beetle, so opportunities for introductions via the route used by these species, has been further reduced.

The location that other construction equipment and materials originate from within North America will be considered. If it originates from an area with ongoing invasions by exotic plant or invertebrate species (i.e. Asian Long-Horned Beetle, *Anoplophora glabripennis*) further consideration will be given as to whether they were exposed to the invasive and what measures should be taken to remove any potential invasives (i.e. washing of

vehicles). Local regulations and government policies regarding movement of materials from control zones will be adhered to.

The most probable source for the introduction of invasive species associated with this project is via the seeds and plants used in restoration and landscaping. For this reason, the seeds and plants to be used for landscaping should be native to the region and appropriate to the habitat. They should also be obtained from credible sources that reasonably assert that the stock is free of exotic and invasive plant and insect species.

Exotic and invasive species are more likely to become established in disturbed areas and in anthropogenically modified areas. To limit this, mowing and cutting of vegetation should be performed in the appropriate season (spring & fall) and at the appropriate intensity. This will permit native vegetation to thrive and limit the opportunities for exotic and invasive species to establish.

The proposed project is not anticipated to have a deleterious effect on Monarchs and their habitat. Displacement of Monarchs and their habitat is expected to be minor, as habitat within the Recommended Plan is not locally or globally significant to the species, nor are there any known substantial migratory stopover sites in proximity to the Recommended Plan. Restoration and enhancement measures planned for this project will help to off-set any loss of Monarch habitat. The environmental protection measures identified for Monarchs will also reduce potential impacts to other insect species.

6.6.2.3 Follow Up and Monitoring

No follow-up or monitoring programs specific to Monarchs are recommended.

6.7 Fish and Fish Habitat

A description of the existing fish and fish habitat located in the area of investigation is presented in Section 2.3.3 of the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL 2008).

6.7.1 Environmental Standards and Practices

The *Environmental Standards and Practices User Guide* (MTO 2006) indicates that the construction and operation of provincial transportation facilities such as interchanges, lanes, temporary access roads, bridges and culverts, may result in:

- encroachment on fish habitat;
- increase in quantity and rate of surface water runoff;
- change in groundwater hydraulic regime; and,
- discharge of impacted water to fish habitat.

A description of the cause, potential effects and environmental management options for these environmental effects is presented below.

6.7.1.1 Encroachment on Fish Habitat

Encroachment on fish habitat may result in:

- changes to the channel or shoreline;
- changes to flow/littoral drift characteristics;
- erosion of exposed soils, banks and beds; and,
- the resulting sedimentation and contamination of water from storage, use and waste of products such as fuels, sand blast media and concrete.

These potential effects can result in harmful alteration, disruption or destruction of fish habitat (HADD) and fish mortality.

Fish mortality may result from removal of habitat critical to the survival of the species (i.e. spawning, rearing and feeding sites), addition of harmful substances to water and physical harm caused by construction equipment and unwatering of work areas. Over time, these impacts may lead to a reduction or loss of local populations.

The measures prescribed for encroachment on fish habitat include:

- set location of design feature to avoid fish habitat;
- minimize loss of fish habitat through location;
- reduce the modification of channel or shoreline morphology/hydraulics through designs that retain the form and processes of the watercourse through flexibility in design standards related to structure type, design and placement;
- protect fish and fish habitat during in-water work through timing restrictions, flow maintenance, pump intake screening and rescuing fish stranded in isolated work areas;
- use natural channel design principles in channel realignment to maintain or improve sediment transport;
- use erosion and sedimentation control including restricting equipment access, isolating work areas, and covering exposed soils, etc.;
- restrict access and restore temporarily disturbed areas; and,
- compensate for lost habitat within the right-of-way or in other areas.

6.7.1.2 Increase in Quantity and Rate of Surface Water Runoff

Hardening of surfaces may alter the surface water drainage patterns of the area including infiltration and storage of stormwater. Changes in surface water flows can result in blockage of fish passage and harmful alteration of fish habitat by:

- reduced flows causing dewatering of areas leading to changes in migration/access to habitats and stranding of fish; and,
- increased flows causing bank erosion and channel scour leading to changes in sediment concentrations, habitat structure and cover, substrate composition and food supply.

The measures prescribed for increases in quantity and rate of surface water run-off include:

- set location of design features to avoid surface water features;
- use groundwater management options to avoid or mitigate impacts to groundwater that supports surface water systems;
- detain surface water and control the rate of run-off using stormwater management facilities;
- reduce velocities at watercourse crossings and at drainage outlets by, for example, incorporating energy dissipating measures or drainage systems;
- increase capacity of drainage systems to accept increased flow rate by, for example, upgrading sewer systems and enlarging ditches; and,
- protect watercourse and slopes from erosion by incorporating erosion control measures.

6.7.1.3 Change in Groundwater Hydraulic Regime

Interception of groundwater and decreased surface permeability can decrease the quantity of groundwater. The excavation of the ground can intercept the natural flow of groundwater. This can occur in any excavation but is most prevalent in a cut. The construction of transportation project elements such as foundations, sewer pipes, tunnels, or bridges may require dewatering. Dewatering includes the pumping of water from an excavation to keep it free of water during construction in order to stabilize the ground and provide a safe working environment. Increased impervious areas and reduced water infiltration into the ground can lead to a reduction in groundwater quantity. Groundwater interception/reduction, depending on the extent and location, can change the thermal regime and flow regime or watercourses, leading to loss of habitat and flow and temperature barriers.

The measures prescribed for changes in groundwater hydraulic regime include:

- set location of design features to avoid intercepting significant groundwater flows;
- use any flexibility in transportation facility design to avoid cuts or minimize the depth of cuts in areas with a high water table to minimize the interception of groundwater flows;
- avoid sensitive aquifers by predicting the zone of groundwater influence of construction activities;
- reduce the changes to groundwater upwelling through crossing designs such as bridges and open bottom/perforated culverts;
- discharge significant quantities of dewatering water over a larger area and into different receptors to minimize aquatic ecosystem impacts;
- routing intercepted groundwater to aquatic ecosystems;
- monitoring surrounding areas; and,
- design stormwater management practices to promote infiltration of stormwater to maintain groundwater.

6.7.1.4 Discharge of Impacted Water to Fish Habitat

Discharge of impacted water to fish habitat can alter fish habitat or result in fish mortality. Impacted water can occur from sediment, contaminants and temperature. An increase in sediments can occur from exposed soils and increased erosion during construction, bank erosion from increased flows; and, operation of the transportation facility. An increase in contaminants can occur from hydrocarbons, heavy metals and other contaminants from spills and other sources from the operation of the Recommended Plan, and salt and other anti-icing materials used during winter maintenance. An increase in water temperature can occur from warming from paved surfaces, reduced shading of the watercourse and from stormwater management facilities. Impacted water can also be derived from groundwater sources including accidental spills during construction and operation, the use of anti-icing materials that infiltrate into groundwater and existing groundwater/soil contamination that can mobilize towards down-gradient receptors. The discharge of impacted water can reduce water quality in receiving watercourses, can in-fill habitat or bury fish eggs and poison aquatic organisms or vegetation.

The measures prescribed for discharging impacted water (sediment, contaminants and temperature) to fish habitat include:

- set location of design features to avoid sensitive groundwater areas;
- identify and manage potentially contaminated soil and contaminated groundwater plumes;
- decommission and seal wells and boreholes in accordance with Wells Regulation 903 under the *Ontario Water Resources Act;*
- manage products, fuels, waste and excess materials during construction;
- direct construction activities to minimize contamination of soils and groundwater;
- minimize use of anti-icing materials through a Salt Management Plan;
- reduce infiltration of contaminated drainage through stormwater management design;
- remediate the groundwater and conduits in the event of contamination;
- avoid setting transportation facility across or near sensitive surface water features;
- minimize sediment impacted stormwater during construction through erosion and sedimentation control, for example, temporary cover of exposed earth surfaces;
- minimize contaminant impacted stormwater during construction by directing the contractor on the use and storage of products and the management of waste and excess materials especially when working in and around water;
- enhance containment capabilities of surface water management measures in the event of an accidental spill of hazardous materials;
- remove sediment and associated contaminants from surface water run-off using surface water management measures including wet and dry ponds, vegetated swales, oil/grit separators, etc.;
- cool surface water prior to release to receiving waters by, for example, subsurface cooling trenches or bottom draw from wet ponds; and,
- protect watercourses and slopes from erosion.

MTO has incorporated these environmental protection measures into the Detroit River International Crossing Study, where necessary and feasible, or will incorporate these environmental protection measures into the Detroit River International Crossing Study during later design stages.

6.7.2 Encroachment on Fish Habitat

6.7.2.1 Potential Environmental Effects

The crossing will span the Detroit River and no piers will be located in the Detroit River or along the shoreline. As a result, the crossing will not encroach on fish habitat.

The inspection plaza will require the realignment of 375 m of Broadway Drain and a 350 m enclosure of Healey Drain. Broadway Drain is characterized by low habitat sensitivity and significance, and the Healey Drain does not directly support fish habitat.

The Windsor-Essex Parkway will require culvert replacement, extension or removal, or channel realignment at nine watercourses. In addition, the unnamed pond currently located to the south of Talbot Road/Highway 3 will be converted to a stormwater management pond.

Of the watercourse crossings that currently exist, five will require extensions or replacements (Wolfe Drain, Grand Marais Drain/Turkey Creek, Basin Drain, Cahill Drain and Lennon Drain). Culvert extensions/replacements range in length from 40 m to 100 m. These watercourses have low sensitivity and significance; however, Grand Marais Drain/Turkey Creek, Cahill Drain, Lennon Drain and Wolfe Drain directly support warmwater/coolwater sportfish species, at least for portions of the year. The replacement culverts at Cahill and Lennon Drains will be submerged 5.0 to 7.0 m to convey flows under the depressed Windsor-Essex Parkway. In addition to the culvert work just mentioned, approximately 30 entrance culverts that currently cross Wolfe Drain to access private properties will be removed. These culverts average 5 m in length.

Two new crossings will be required to accommodate the proposed design (both at Burke Drain). New culverts will range in length from 25 m to 60 m. These watercourses have low overall sensitivity and significance.

The realignment of five watercourse reaches is required to accommodate the proposed Windsor-Essex Parkway (Burke Drain, Wolfe Drain, Cahill Drain, Youngstown Drain and McKee Drain). These realignments will range in length from 350 m to 1,500 m. The habitat at the reach where potential realignment will occur on Cahill Drain has moderate to high sensitivity habitat, while the remaining four watercourses (Burke Drain, Wolfe Drain, Youngstown Drain and McKee Drain) have low overall sensitivity and significance.

A summary of potential encroachment on fish habitat is presented in Table 6.

TABLE 6.
SUMMARY OF POTENTIAL ENCROACHMENT ON FISH HABITAT

Waterbody Name	Location	Existing Crossing	Proposed Work	Comments
Burke Drain	430 m reach along Outer Drive north of South Talbot Road	n/a	realignment of 430 m of channel/drain along Outer Drive for new roadway	• will be HADD because of realignment • natural channel design will enhance overall habitat quality of watercourse/ drain over existing
	new crossing location of Talbot Road/Highway 3	n/a	new 60 m culvert on a skew across watercourse/drain	• enclosure of some site specific habitat
	new crossing of South Talbot Road	n/a	new 25 m culvert	• enclosure of some site specific habitat
Wolfe Drain	at crossing of Highway 401	50 m long concrete open-bottomed	approximately 40 m extension	• HADD anticipated • compensation required to ensure no net loss of fish habitat
	along north side of new Windsor-Essex Parkway between Cousineau Road and Howard Avenue	n/a	realignment of approximately 1500 m of channel/drain	• will be HADD because of realignment • new channel will be longer because of meanders and will contain better quality habitat than existing • removal of entrance culverts will daylight approximately 156 m of habitat
Cahill Drain	from culvert crossing of Talbot Road/Highway 3 to Cousineau Road	n/a	realignment of approximately 730 m of channel/drain	• will be HADD because of realignment • new channel will be longer because of meanders and will contain better quality habitat than existing
	crossing of new Windsor-Essex Parkway	open footing concrete	construct a longer submerged culvert under Windsor-Essex Parkway	• enclosure of some site specific habitat within culvert • barrier to fish passage created by culvert • fish passage will be provided using a mechanical or manual lift, which will likely alleviate fish passage problems created by the submerged culvert
Lennon Drain	crossing of new Windsor-Essex Parkway	open footing concrete	construct a longer submerged culvert under Windsor-Essex Parkway	• enclosure of some site specific habitat within culvert • barrier to fish passage created by culvert • fish passage will be provided using a mechanical or manual lift, which will likely alleviate fish passage problems created by the submerged culvert

TABLE 6.
SUMMARY OF POTENTIAL ENCROACHMENT ON FISH HABITAT

Waterbody Name	Location	Existing Crossing	Proposed Work	Comments
Grand Marais Drain/Turkey Creek	crossing of new Windsor-Essex Parkway	Bridge	construct new, wider (by 100 m) bridge over new Windsor-Essex Parkway	• likely no effects, beside added shading to channel, if bridge constructed outside of channel
Youngstown Drain	at Windsor-Essex Parkway and Huron Church Road/E.C. Row Expressway interchange	corrugated steel pipe	realign channel to north of E.C. Row Expressway to avoid crossing below-grade Windsor-Essex Parkway	• enclosure of some potential seasonal site specific habitat • loss of approximately 85 m of potential seasonal habitat through diversion of flows to north • will be HADD because of realignment
Basin Drain	at E.C. Row Expressway/ Windsor-Essex Parkway crossing	concrete box	extend culvert by approximately 40 m	• enclosure of some site specific habitat
McKee Drain	just northeast of intersection of E.C. Row Expressway and Ojibway Parkway	concrete	realignment of 350 m of channel/ drain	• will be HADD because of realignment • new channel will contain better quality habitat than existing
Broadway Drain	just south of proposed plaza between Sandwich Street and Detroit River	n/a	potential realignment of 375 m of channel/drain	• will be HADD because of realignment • new channel will contain better quality habitat than existing
Healy Drain	at plaza	n/a	enclosure of approximately 350 m channel/drain	• because this area is potentially only seasonally flooded and connected to downstream fish habitat within the Detroit River, no alteration of fish habitat is expected
Detroit River	Canadian side of river at crossing location	n/a	new bridge	• no alteration of fish habitat

6.7.2.2 Environmental Protection Measures

During later design stages, discussions will be held with regulatory agencies to determine approval requirements. In discussions undertaken to date with the Department of Fisheries and Ocean Canada (DFO) and Essex Region Conservation Authority (ERCA), it has been determined that some of the proposed works will likely result in a HADD and others can be mitigated through MTO standards and practices. A fish habitat compensation plan will be prepared during later design phases in consultation with the ERCA and DFO. A *Fisheries Act* authorization will be secured prior to any in-water work. All of the documentation associated with the MTO/DFO/OMNR Fisheries Protocol (2006) will be completed and submitted for a formal review of the effects of the proposed project on fisheries resources within the study area. Details of conceptual compensation strategies for each watercourse are provided below and the areas discussed are illustrated in Appendix E.

In general, habitats will be enhanced through natural channel design in all areas where realignments are needed. Because northern pike utilize Cahill and Wolfe Drains as spawning habitats, pike spawning habitat will be created/incorporated into the design of realigned channel in these watercourses.

The upstream portion of Cahill Drain that runs along the north side of Talbot Road/Highway 3 constitutes 1,464 m^2 of habitat. The reach of Cahill Drain that parallels the existing road will need to be realigned to the north to accommodate the new Windsor-Essex Parkway. Opportunities exist to enhance this habitat which currently consists of a clay-lined, shallow channel with limited water depth, vegetative cover and habitat features. Creating small meanders can increase overall channel length and the incorporation of morphological features such as refuge pools and riffles, and structural features such as boulder clusters and root wad revetments, can increase habitat diversity and quality. Plantings of instream, soft-stemmed emergent vegetation (grasses, sedges, rushes) along channel margins or in areas of the channel inundated only by spring floods can provide areas for northern pike spawning and should not interfere with water conveyance. Plantings of riparian vegetation can provide stream shading and overhead cover. Because water levels and flow drop during the dry portions of the year, refuge pools can provide areas where fish can congregate until water levels rise. The provision of in-stream structures such as boulders and root wads will provide cover for these fish within the pools. The riffles will increase the diversity of habitat and provide an area for aeration, benthic invertebrate production and suitable spawning habitat for some cyprinid species. Work in the upstream portions of Cahill Drain (e.g., along Cousineau Road) will not occur as these areas will not be altered and they are located outside of the Recommended Plan.

The situation along Wolfe Drain is similar to that along the portion of Cahill Drain that runs parallel to Talbot Road/Highway 3. This area, which constitutes approximately 5,300 m^2 of fish habitat, will require realignment to the north and is a tributary of Cahill Drain. The design of the new Wolfe Drain channel will follow the same format as that discussed above for Cahill Drain. Morphological diversity (refuge pools and riffles), increased cover (boulders and root wads), establishment of spawning habitat for northern pike (instream plantings), and increased shading and overhead cover (riparian plantings) will be incorporated into channel design to enhance the productive capacity of this watercourse. Meanders will be employed to increase overall channel length and thus increase habitat area.

The habitat diversity along Collins Drain within the MTO right-of-way upstream of its confluence with Wolfe Drain (at Outer Drive) can be increased in the same way that has been described for Cahill Drain above. This reach extends along Collins Drain for approximately 530 m upstream.

A summary of all the proposed alternations and recommended compensation areas is provided in Table 7.

TABLE 7.
SUMMARY OF FISH HABITAT ALTERATION AND COMPENSATION AREAS

Fish Habitat Alteration Area	Fish Habitat Compensation Area and Type
Culverts (extensions and new): • Wolfe Drain: 40 m^2 • Basin Drain: 40 m^2 • Burke Drain: 85 m^2 • Cahill Drain: 140 m^2 • Lennon Drain: 250 m^2 • Grand Marais Drain/Turkey Creek: 130 m^2 Total: 685 m^2	Culverts (permanent removals): • Wolfe Drain: 270 m^2 Total: 270m^2
Channel realignment: • Burke Drain: 430 m^2 • Wolfe Drain: 2,370 m^2 • Cahill Drain: 1,460 m^2 • Youngstown Drain: 45 m^2 • McKee Drain: 350 m^2 • Broadway Drain: 375m^2 Total = 5,030 m^2	Realigned/Enhanced Habitat: • Cahill Drain: 1,460 m^2+ • Collins Drain: 1,060 m^2+ • Burke Drain: 430 m^2 • Wolfe Drain: 2,370 m^2 • McKee Drain: 350 m^2 Total = 5,670 m^2
TOTAL: 5,715 m^2	TOTAL: 5,940 m^2

No net loss of the productive capacity of fish habitat will occur provided that fish passage at Cahill and Lennon Drains is accommodated. Assuming that fish are afforded passage to upstream reaches of these watercourses, a net gain of the productive capacity of fish habitat will result. In the event that The Windsor-Essex Parkway presents a barrier to fish passage, additional fish habitat compensation measures will be required to achieve no net loss.

6.7.2.3 Monitoring and Follow-up

During construction, an environmental inspector will make frequent random site visits for the duration of in-water work. The environmental inspector will be responsible for delineating work areas, ensuring that erosion and sedimentation control measures are functional, that the provisions related to fisheries and watercourse protection are met, and that fish habitat compensation measures are implemented in accordance with the terms and conditions of the *Fisheries Act* authorization.

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 entire fish habitat located within the study area, with the exception of the Detroit River, is located in watercourses classified as agricultural municipal drains. As a result, watercourses/drains are regulated under the *Drainage Act* in addition to the *Fisheries Act*. As municipal agricultural drains, the watercourses/drains can be "maintained" whenever the local municipality believes they need to be, or when they are scheduled to be. Maintenance can include anything from brush removal to scouring of substrates and banks to allow for better flow. It is recommended that the authority for the maintenance of the drains within the project area be transferred to MTO so that any fish habitat features currently present or proposed can remain in place in perpetuity. If drainage does become a problem in the future, the fish habitat features of the watercourse/drain should be considered before clean-outs occur.

6.7.3 Barriers to Fish Passage

6.7.3.1 Potential Environmental Effects

The redesigned culverts at Cahill and Lennon Drains will be submerged to accommodate the below-grade section of The Windsor-Essex Parkway. Because the quality of the soils underneath The Windsor-Essex Parkway is poor, The Windsor-Essex Parkway is not deep enough to pass the drains over The Windsor-Essex Parkway in an aqueduct. As a result, submerged culverts are required in these two locations to siphon the drains under The Windsor-Essex Parkway. These culverts will be up to 105 m long and 5 to 7 m deep. It is possible that fish will not pass through them and that the fish habitat upstream will become isolated, therefore the fish populations that currently reside there will have to become self-sustaining. Passing fish through these culverts or over the roadway will be discussed below.

As discussed above, the construction of the submerged culverts may cause barriers to fish passage in Cahill and Lennon Drains. The reason for the potential barrier effect is likely the depth and darkness of the culverts and a fishes' unwillingness to travel down 5 to 7 m when maximum depths in the watercourses are less than 1 m. It is currently unknown whether or not these culverts will present a barrier to fish passage, as little study has been done to test this assertion.

Because of the barriers noted above, the fragmentation of fish populations and fish habitat within Cahill and Lennon Drain may occur. Approximately 6,327 m of channel in Cahill Drain (including all of Wolfe Drain and part of Collins Drain) that is currently accessible to fish moving up from south of Talbot Road/Highway 3 may be isolated from downstream habitats. Approximately 780 m of Lennon Drain channel may be similarly affected by the submerged culvert.

Fish passage will be maintained at all remaining watercourse crossings through incorporation of fish-friendly culvert design.

6.7.3.2 Environmental Protection Measures

Options to facilitate fish passage (particularly for northern pike) are to install and operate mechanical fish passage systems or employ manual systems on both Cahill and Lennon Drains at the submerged culvert locations. Because these watercourses/drains are very flat, and because the fish will have to be moved up and over The Windsor-Essex Parkway, then back down the other side, conventional passive fish passage structures (i.e., fish ladders) are not practical. One option to mechanically lift the fish over The Windsor-Essex Parkway is to use a fish lock or lift. Manual systems include the capture, physical transport and release of fish across the potential barrier. The following discussion regarding fish locks has been taken from current scientific literature on fish passage.

Fish locks consist of a structure with an inlet/outlet structure at the lower water level (the watercourse's natural level), an upper inlet/outlet structure at the higher water level (the aqueduct) and a chamber that fills with water in between the inlet/outlet structures (FAO/DVWK 2002). The lock operates by attracting fish into the inlet structure at its base. This stays open for a set amount of time (Clay 1995), then a gate closes, trapping the fish inside. The chamber is then filled with water. Once the water level is even with the upper water level, a gate is opened the fish are allowed to swim out (FAO/DVWK 2002). In some cases the fish are encouraged to leave by the flow entering the chamber (Clay 1995). In others, a crowder can be used to push fish toward the exit.

Advantages of the fish lock over other passage systems is that they take up relatively little space (FAO/DVWK 2002), they are ideal for small rivers with small numbers of migrating fish (Wassvik 2004) and they can be used to facilitate downstream fish passage (Clay 1995; Wassvick 2004). They have been used successfully around the world to pass many different kinds of fish over both small and large dams (Clay 1995; FAO/DVWK 2002).

At both Cahill and Lennon Drains, fish locks would have to be constructed at both ends of the submerged culvert. Fish entrance into the lock bottom structures would have to be ensured. This could be accomplished by blocking off the entrance to the submerged culverts with screens or grates. Flow would need to be pumped up to the aqueducts to maintain an attracting current into the downstream locks. The aqueduct would need to be an open channel structure elevated above The Windsor-Essex Parkway. It would need to be deep enough to pass large fish like northern pike across to the upstream lock. The advantage of constructing fish locks on such small watercourses is that there would be no alternative location for the fish to go once they reach the end of the channel (which would be inside the lock structure). Once inside, the lock, the fish would be guaranteed to be transported up to the aqueduct.

Another option would be to move the fish upstream of The Windsor-Essex Parkway manually. For manual lifting, the fish would be captured at the downstream end of the submerged culverts and transported to the upstream end by people (e.g., local anglers association) and released. The reverse would be done to move fish back downstream.

Fish passage would have to be accommodated from March through July, at a minimum, to ensure safe passage of adult northern pike spawners upstream and back downstream, and the passage of juveniles downstream later in the spring or summer. Other resident

fish would be able to use the locks or could be manually moved during those times as well.

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, municipalities and WIFN).

6.7.3.3 Monitoring and Follow-up

The performance of the fish passage systems, if constructed, should be monitored for at least two years after construction to ensure that they are functioning properly. If a manual passage system is employed, the potential for fish passage through the submerged culverts should be monitored. The target species for passage is northern pike. During spring migration (March/April), fish should be captured downstream of The Windsor-Essex Parkway. These fish should be marked in some way such that their passage upstream, either within the fish passage systems or through the submerged culverts, can be monitored. Assessing their passage can be done by mark-recapture (fish is tagged, fin clipped) or radio-telemetry (transmitters inserted in fish and their progress followed via a radio receiver). 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.

6.7.4 Changes in Groundwater Hydraulic Regime

6.7.4.1 Potential Environmental Effect

The Windsor-Essex Parkway will be approximately 11 km long and approximately 7 km will be depressed below grade. It is anticipated that extensive dewatering will be required to facilitate construction. Dewatering may result in the drawdown of the water table and alter baseflows in watercourses. While there does not appear to be a significant groundwater contribution to watercourses located within the potential cone of influence of groundwater drawdown, potential impacts may occur over prolonged periods. Water collected through dewatering activities will also require management, including potential discharge into receiving watercourses. Local watercourses may be impacted by naturally occurring sulphur or low temperatures that may cause thermal barriers or alter the composition of aquatic communities and behaviour of aquatic organisms.

6.7.4.2 Environmental Protection Measures

A Permit to Take Water under the *Ontario Water Resources Act* will be secured during later design phases to regulate dewatering activities. Specific measures will be identified in the Permit to ensure that dewatering activities do not result in a harmful alteration of fish habitat. The Permit will include conditions related to the location, rate and volume of

groundwater drawdown, management of dewatered effluent including testing, discharge locations, rates and volumes and monitoring and contingency measures.

6.7.4.3 Monitoring and Follow-up

The Permit to Take Water will specify a monitoring program to ensure that dewatering activities do not alter fish habitat. Additional information may be required to secure the Permit including establishing static groundwater levels using piezometer nests, pumping tests to measure groundwater drawdown response and cones of influence, stream flow surveys, aquatic community surveys, water quality surveys, etc. Monitoring activities identified in the Permit may include stream flow and temperature measurements, fish and benthic community sampling, visual inspections, monitoring of erosion and sedimentation processes, monitoring of groundwater wells/piezometers, water quality monitoring and other parameters.

6.7.5 Discharge of Impacted Water to Fish Habitat

Runoff from the crossing will be captured and conveyed within a storm sewer system to a stormwater management pond located on land along the bridge approach. Minor storm runoff from the inspection plaza will be captured and conveyed within a storm sewer system to stormwater management ponds located along the south boundary of the inspection plaza. Major storm runoff will be conveyed overland to stormwater management ponds.

The stormwater management ponds will be designed to provide *Enhanced Protection Level* treatment as outlined in the Ministry of the Environment (MOE) document entitled *Stormwater Management Planning and Design Manual* prior to discharge to the Detroit River. The stormwater management practices will address potential impacts related to discharge of impacted water to fish habitat.

Runoff from the service road portion of The Windsor-Essex Parkway and below-grade sections of the freeway portion of The Windsor-Essex Parkway (generally within the Highway 3/Huron Church Road corridor) will be captured and conveyed within an urban drainage system consisting of catch basins and storm sewers. Where the proposed freeway is above-grade along The Windsor-Essex Parkway/E.C. Row Expressway core-collector system, runoff will be captured and conveyed within a median storm sewer system discharging to right-of-way ditching consisting of enhanced grassed swales and roadside ditches. Where the proposed freeway is at-grade east of existing Highway 3, runoff from the proposed freeway will be captured and conveyed within a rural-type drainage system consisting of enhanced grassed swales and roadside ditches.

The existing section of Highway 3 within the study area does not currently provide either quality or quantity treatment for runoff from the highway. Therefore, in the existing condition, all pollutant loadings from Highway 3 are discharged directly to the receiving watercourses. In an effort to improve this existing situation, stormwater management providing quality, quantity and erosion treatment will be provided for both the freeway and service road portions of The Windsor-Essex Parkway. To achieve this, stormwater management wetponds are proposed throughout The Windsor-Essex Parkway that are designed to provide *Enhanced Protection Level* treatment as outlined in the Ministry of the Environment (MOE) document entitled *Stormwater Management Planning and Design*

Manual (MOE 2003). In addition, as part of the conceptual design, oil/grit separators are proposed at various locations along the proposed service road to provide additional quality treatment for runoff. The stormwater management practices will address potential impacts related to discharge of impacted water to fish habitat and enhance the quality of surface water in receiving watercourses where no treatment occurs at present.

6.8 Wildlife and Wildlife Habitat

A description of the existing wildlife and wildlife habitat located within the study area is presented in Section 2.3.4 of the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL Limited 2008).

6.8.1 Environmental Standards and Practices

The *Environmental Standards and Practices User Guide* (MTO 2006) indicates that the construction and operation of provincial transportation facilities such as interchanges, lanes, temporary access roads, bridges and culverts, and traffic and noise barriers may result in:

- encroachment on wildlife habitat;
- wildlife mortality
- interference with noteworthy species and habitats; and,
- obstruction of wildlife movements.

A description of the cause, potential effects and environmental management options for these environmental effects is presented below.

6.8.1.1 Encroachment on Wildlife Habitat

Encroachment on wildlife habitat may result in loss of species including species at risk, fragmentation of habitat and or wildlife populations, reduction of wildlife habitat quality, and loss of active nests of migratory birds by:

- removal of vegetation or features used for shelter, feeding and/or breeding; and,
- physical destruction and/or severing of habitat areas.

Disturbance effects may include:

- creation of edge habitat that can affect off-site breeding, feeding, shelter or movement opportunities for wildlife;
- introduction of invasive species;
- introduction of light, noise and human intrusion to a habitat area; and,
- severing of habitat may result in habitat patches that are too small to support “area-sensitive” wildlife species.

Over time these disturbances may alter wildlife habitat structure, composition and function. Effects are most prominent in areas that have not been previously disturbed or in proximity to sensitive wildlife species and their habitats.

The measures prescribed for encroachment on wildlife habitat include:

- set location of design feature to avoid wildlife habitat;
- minimize loss of wildlife habitat through location;
- minimize loss of wildlife habitat by reducing footprint of the transportation facility through flexibility in design standards;
- restrict access of construction equipment to wildlife habitat and wildlife movement areas;
- clear delineation of right-of-way wildlife habitat clearing zones and wildlife habitat retention zones;
- restore temporarily disturbed areas using a landscape planting plan based on ecological restoration principles;
- maximize the retention and reuse of original vegetation and topsoil during stabilization and revegetation;
- develop a salvage and reuse strategy to retain and reuse original vegetation and topsoil; and,
- replace lost wildlife habitat to soften impacts and provide or re-instate some vegetation or wildlife habitat area either within the right-of-way or on adjacent lands.

6.8.1.2 Wildlife Mortality

Wildlife mortality may result from removal of vegetation sheltering wildlife, removal of habitat critical to the survival of the species (i.e. hibernacula, denning, nesting, breeding, rearing and feeding sites), addition of harmful substances to water and direct wildlife/human/vehicle encounters. Over time, these impacts may lead to a reduction or loss of local populations.

The measures prescribed for the management of wildlife mortality include:

- set location of design feature to avoid wildlife habitat;
- use timing constraints to limit operations to ensure sensitive species and breeding migratory birds are not present on sites during construction;
- use exclusion techniques to prevent wildlife from using construction zones and the travel surface; and,
- replace lost wildlife habitat connection areas within the right-of-way or on adjacent lands.

6.8.1.3 Interference with Noteworthy Species and Habitats

Interference with noteworthy species and their habitat can result in the reduced size or complete loss of populations of sensitive wildlife species. During the operation phase,

wildlife mortality may result from human/vehicle/wildlife encounters and exposure to contaminants resulting from spills or upsets.

The measures prescribed for the management of interference with noteworthy species and their habitat include:

- set location of design feature to avoid species at risk and their habitat;
- restrict access of construction equipment from species at risk and their habitat;
- use timing constraints to limit operations to ensure that species at risk are not present on sites during construction; and,
- educate construction workers on how to manage encounters with species at risk.

6.8.1.4 Obstruction of Wildlife Movements

Wildlife movements may be obstructed by fragmenting wildlife habitat and creating barriers to wildlife movement between the fragmented habitat patches. Severing of wildlife migration corridors that disrupt the movement of wildlife to/from breeding, feeding and over-wintering areas may reduce viability of populations due to a diminished or inability to access key habitat for food, shelter, etc. Wildlife movements will continue to be obstructed by the transportation facility during operations that could lead to long term decline in wildlife populations.

The measures prescribed for the management of obstructions to wildlife movement include:

- set location of design feature to avoid wildlife habitat; and,
- use wildlife crossing techniques to manage wildlife movements.

MTO has incorporated these environmental protection measures into the Detroit River International Crossing Study, where necessary and feasible, or will incorporate these environmental protection measures into the Detroit River International Crossing Study during later design stages.

6.8.2 Encroachment on Wildlife Habitat

6.8.2.1 Potential Environmental Effects

Displacement of Wildlife Habitat

Site preparation activities will be required within the footprint of the Recommended Plan. Some portions of the area are heavily urbanized and disturbed thus support more tolerant wildlife, while other areas are much less disturbed and have significant habitat thus supporting more sensitive wildlife species. As discussed in section 6.5.2.1 a total of 132 ha of vegetation communities will be displaced. Within these habitat units up to 139 wildlife species could be impacted by the construction activities (Appendix F).

Disturbance to Wildlife Habitat

The noise, light and visual intrusion from the activity of the new facilities as well as the delineation of new habitat limits may alter wildlife activities and patterns. In the more urban areas, wildlife has become acclimatized to the urban conditions and those fauna tolerant of human activities remain. In the naturalized, less disturbed areas, wildlife are more sensitive to disturbances and the effect may be more pronounced. Migratory birds and their nesting activities are also sensitive to disturbances.

6.8.2.2 Environmental Protection Measures

Displacement of Wildlife Habitat

The potential for impacts to wildlife habitat was largely avoided through the selection and development of the Recommended Plan including the associated refinements. Furthermore, in order to limit the amount of areas of wildlife habitat to be displaced and destroyed, the footprint of construction will be minimized, and critical habitat will be avoided to the extent possible. Modifications have been made to the designs to minimize the amount of habitat to be removed in proximity to select important areas such as Ojibway Park, Black Oak Woods, Spring Garden Forest and St. Clair College. The construction area will also be delineated to prevent damage to adjacent habitat and wildlife during construction.

As compensation for the loss of wildlife habitat, habitat restoration and enhancement is being undertaken in several areas. Within the newly restored habitat, features for specific animal activities (i.e. breeding, overwintering, etc.) will be created for select species at risk, as detailed further in section 6.9.2 and section 6.9.3.

Disturbance to Wildlife Habitat

Fencing, noise barriers and/or berms will be installed adjacent to the Recommended Plan to reduce the amount of noise, light and human activity associated intrusion infiltrating into adjacent wildlife habitat.

Where practical, 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 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. Fencing, berms and other landscaping features will also be employed at select locations of sensitive wildlife habitat, to reduce the human recreational activity in those areas.

Wildlife salvage should be performed in site preparation areas prior to vegetation removals. Vegetation removals should 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.

6.8.2.3 Monitoring and Follow-up

Construction operations related to work in and adjacent to areas of trees and vegetation not designated for removal will be monitored as per the MTO CAIT Manual. Monitoring of restoration activities including planting of native species will be undertaken for the duration of the landscaping activities. Results of these monitoring activities will be recorded in the Environmental Inspector's Daily Inspection Diary and submitted to the Ministry of Transportation. Should the Contractor not be in compliance with contract documents corrective action will be taken.

6.8.3 Wildlife Mortality

6.8.3.1 Potential Environmental Effects

Wildlife may be killed during site preparation activities or may be struck by construction equipment during construction activities.

Ninety bird species identified within the project limits are listed under the *Migratory Birds Convention Act* (MBCA). The MBCA prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or damaging, destroying, removing or disturbing of nests. Nests of migratory birds were found in habitat throughout the Recommended Plan, and of note, two colonies of swallow nests were identified under the Turkey Creek Bridge at Huron Church Road.

The new freeway will be lined with noise barriers or fencing to attenuate noise and prevent access. Fencing will prevent and deter many larger wildlife from crossing the highway and thus reduce those vehicle/wildlife collisions. However the noise barriers/fencing will not stop certain mid-sized to smaller wildlife or birds from entering on to the highway. Furthermore, the local access roads and the terminus of ramps will not be fenced. Thus with the increased roadways present and the predicted traffic volumes, there will likely be more opportunity for vehicle/wildlife conflicts.

Wildlife species at risk are not anticipated to experience significant exposure to vehicle conflicts as they do not prefer habitat in proximity to the highway platform and are generally intimidated by vehicular activity. As a precaution, temporary exclusion fencing will be installed in areas of species at risk to prevent them from entering the construction area. The exclusion fencing will be inspected regularly by a qualified Wildlife Biologist to rescue any animals that may be stranded and to ensure that the fencing remains properly installed.

6.8.3.2 Environmental Protection Measures

Vegetation removals should occur in specified areas outside of the growing season to avoid the loss of wildlife and wildlife habitat to the extent possible. The growing season in Windsor extends from April 1 to October 31 in general. 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 local vegetation removals are required during this period, then a qualified Avian Biologist will be retained to screen the site for migratory bird nests prior to removals. Any structures found to have pre-existing

migratory bird nesting activity will be outfitted with a suitable barrier/repellant during the nesting period to exclude migratory bird nesting. The MBCA prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or damaging, destroying, removing or disturbing of nests, so no such activity will occur during construction of this facility.

Conducting vegetation clearing in specified areas from November 1 to March 31 will also permit other species of wildlife to evade harm. Some mammals will have moved to other habitat for the winter, while others will have gone into hibernation, as will many herpetofauna. Many bird species not classed as 'migratory birds' under MBCA, will also have left the study area for other winter habitat. Exclusion fencing will be installed in selected locations to prevent wildlife, including snakes, from entering the work zone, and this fencing will be in place from April 1 to October 31.

If any wildlife are encountered during construction, they will be relocated to suitable nearby habitat, if the animal requires and permits assistance (i.e. turtles, snakes, etc.). A qualified Wildlife Biologist will be retained as part of the Construction Administration Team to address any wildlife concerns and oversee any wildlife rescues/relocations. Where possible wildlife attractants such as salt and food (i.e. debris, roadkill, litter, etc.) will be removed or minimized to deter wildlife from entering the construction area. The removal of vegetation outside the growing season will also permit other wildlife the opportunity to vacate the construction area prior to construction activities. Every reasonable effort will be taken to avoid the harming of wildlife during construction and little wildlife mortality is anticipated as most wildlife are expected to avoid the construction activities.

Permanent fencing and noise barriers will be installed to prevent many wildlife from entering onto the Recommended Plan. In addition, the tunnels on The Windsor-Essex Parkway will function as overpasses for wildlife. Culverts under all the roadways will also provide crossing points for wildlife. Many of these structures will be designed to be more appealing crossing points for wildlife, and thus are aimed at reducing the occasions for wildlife/vehicle conflicts. The roadway platform of the highway within the right-of-way will be designed to create a setback from adjacent potential habitat, so as to minimize accidental wildlife mortality. Species specific concrete barriers will be installed to deter select wildlife species at risk from entering onto the roadways.

6.8.3.3 Monitoring and Follow-up

Compliance monitoring will be conducted during construction to avoid the incidental take of migratory birds. If bridge construction activities occur during the nesting season, a qualified avian biologist should be retained on site to conduct frequent nesting surveys.

6.8.4 Obstruction of Wildlife Movement

6.8.4.1 Potential Environmental Effects

Barriers to Wildlife Movement

As a result of site preparation and construction activities, the movement of all wildlife, as well as that of migratory birds and species at risk may be impeded or altered. The

activities during construction will obstruct or intimidate wildlife movement, thus modify their behaviour or limit their access to habitats. The resulting interference may deprive wildlife, migratory birds and species at risk of resources (shelter, food, water, mating opportunities, and sufficient territory), cause physical distress, increased risk of predation or force wildlife to take alternative, unsafe routes. The proposed works will affect the movement of some wildlife, however the impacts overall are expected to be negligible as wildlife movement is generally concentrated at specific sites in the Recommended Plan.

Terrestrial and aquatic wildlife use pathways, stream banks and under/overpasses such as culverts to move within and between habitats. Aerial wildlife, including migratory birds and bats use expanses of particular vegetation communities or watercourses to fly between habitat and along migration routes. All these serve as wildlife movement corridors, and can exist on a small, local scale or on a large, global scale. Within the Recommended Plan there exist both local movement corridors (i.e. pathways, stream banks, culverts, vegetation expanses) and global movement corridors (i.e. bird flyways through southern Ontario). The site preparation and construction activities may result in temporary and permanent removal of features and routes that form some of the wildlife movement corridors. Some movement corridors will re-establish following construction, while others will be permanently eliminated. Opportunities for new corridors will be established with the creation of new access points over the tunnel sections of The Windsor-Essex Parkway and under The Windsor-Essex Parkway via the culvert structures.

The Windsor-Essex Parkway and inspection plaza will limit terrestrial wildlife movement in particular as much of the area will be lined with noise barriers, fenced off and/or depressed creating a 'moat' effect. However, currently much of the terrestrial wildlife does not cross the existing highways and roads along the proposed route, as limited suitable habitat exists on the other side and the roadways present a hazard to wildlife. As mentioned above, opportunities for new corridors will be establish with the creation of new access points over the tunnel sections of The Windsor-Essex Parkway and under The Windsor-Essex Parkway via the culvert structures. This will create safer crossing points for wildlife.

Interference with Bird Migration

It is possible that the crossing 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 (Manville 2000). 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.

A review of the effects of tall towers on bird mortality was conducted by Wetland and Coastal Resources Inc. on behalf of the Corradino Group and Michigan Department of Transportation for the Detroit River International Crossing Study (MDOT 2007). To avoid duplication of work, the findings of this literature review are presented here in parenthesis. Text has been deleted/revised where appropriate.

> "Two bridge types are under consideration for Crossing B: a cable-stay bridge and a suspension bridge. Based on discussions with the project's design engineers,

cable diameters and cable placement vary between bridge types, which could impact the visibility of the bridge by birds in flight. Cable-stay bridge alternatives include single cables that could range between 20 and 60 cm in diameter, depending on final designs. Suspension bridge alternatives include placement of 5 cm diameter cables clustered within a 30 to 120 cm square area, with clusters spaced approximately 15 m apart. No studies have been conducted that relate cable diameter and placement to avian mortality and it is impossible to make definitive conclusions that relate to cable size and visibility to birds. One assumption would be that larger cables are more visible and a cable-stay bridge could result in fewer bird strikes at a given altitude. However, clustered cables on a suspension bridge could also be more visible and cable-stay bridges are higher, resulting in longer cable lengths."

"The height of the bridge could also be a factor that impacts the ability of birds to avoid the bridge. Manville (2000) states that the taller the tower, the more likely birds will be killed. Findings by Crawford and Engstrom (2001) suggest that towers 94 m in height or less may pose less of a threat to avian mortality than those 200 m or greater."

"Studies have also been conducted that examined the relationship between structure lighting, weather, and avian mortality. While lighting may provide for visibility at night, lighting has been documented as an attractor resulting in increased mortality, especially during inclement weather. For example, neotropical migratory songbirds that generally migrate at night were found to be more susceptible to collisions with lit towers during fog, mist and low cloud ceiling conditions (Manville 2000). Avery *et al.* (1977) found most fall mortalities at a communications tower in North Dakota occurred under overcast skies associated with cold fronts. Morris *et al.* (2003) found decreased in avian mortality at four towers in New York and Ohio between 1970 and 1999 and concluded the decline may be related, in part, to a decrease in foggy nights, fog density, and nights with low cloud ceiling."

"Studies conducted at communications towers suggest that lighting plays a key role in attracting birds and collision mortalities. Cochran and Graber (1958) found the frequency of bird call notes decreased when lights were turned off at a communications tower and increased again when turned on. The effect occurred only during nights with low cloud ceilings. Cochrane and Graber (1958) and Avery *et al.* (1976) hypothesized that birds that enter a lighted area are hesitant to return to the dark. Larken and Frase (1988) found that on cloudy nights some birds circled a tower at altitudes below the towers top but this circling was not observed on clear nights. Birds attracted to these lights appear to circle until they collide with the structure or guide wires or become exhausted."

"Few if any studies exist that systematically assess avian mortality with specific lighting. However, some studies suggest that different light colours, intensities, and flashing intervals appear to result in differing mortalities. Jones and Francis (2003) found significantly fewer bird mortalities at a lighthouse on Lake Erie when the lighthouse was automated resulting in a narrower, less intense beam. Gauthreaux and Belser (1999) state that a few reports suggest that white strobe lights are less attractive to birds than steady or flashing red lights."

> "In Manville's 2000 review, he states that light flash appears more critical than colour and suggests that birds are less likely to be attracted to lights (on foggy or cloudy nights) the longer the "off" phase of the strobe or blinking light. He also suggests that birds may be less attracted to structures by using white strobe lights at night and using the minimum number and intensity allowed by law, and the maximum "off" phase durations (currently 3 seconds)."

Due to the height of the bridge towers, a red flashing light at the top of each support tower during daylight hours and a red flashing, white flashing or red or white steady beacon at night will likely be required. The bridge deck will also need to be lit to ensure the safety of motorists. Additional lights may also be required for navigation or security purposes.

6.8.4.2 Environmental Protection Measures

Barriers to Wildlife Movement

To limit the interference with wildlife movement, construction activities will be staged and timing restriction windows will be applied. Wildlife movement peaks during the spring and summer, when many wildlife are breeding and foraging for food. Vegetation to be cleared for construction will be removed between November 1 and March 31, which falls outside the peak movement and breeding period. Hindrances of wildlife movement in areas of construction will be reduced, since the habitat will be removed from the site before hand when animals are not present.

Construction equipment and materials in proximity to areas of wildlife movement, including species at risk, will be stored in a contained manner when not in use. Standard housekeeping practices will be employed during construction. During peak periods of animal movement, obstructions to key movement sites will not be permitted. The duration of obstructions within culverts will be minimized to the extent possible.

By reducing the construction limits and delineating the construction area, the destruction of movement corridors will be reduced. Some of the areas that will be disturbed during construction will be restored or enhanced, and terrestrial movement corridors will re-establish at those locations. Other areas within the Recommended Plan that will not be disturbed during construction, will also be enhanced to create new wildlife habitat (i.e. lawns becoming prairie), and so opportunities to establish new movement corridors will be provided between these new habitat sites and pre-existing habitat.

The installation of overpasses over the highway and culverts under the highway will permit the establishment of new wildlife movement corridors. The design and landscaping of many of these structures will expressly include consideration of the needs and attractiveness to wildlife movement. The designs will also include measures to deter wildlife from crossing roadways at unsafe points, and directing them to cross at safe points. Deterrents that will be employed include fencing, sound barriers, berms and concrete walls.

The creation of new connection points, enhancement of current connection points and installation of crossing deterrents at unsafe points will result in a significant improvement over current wildlife movement corridors in the Recommended Plan. The overall

connectivity across the Recommended Plan will be improved and wildlife will be much less likely to be struck by vehicles.

A buffer should be retained along the Detroit River within the inspection plaza. An appropriate setback from the shoreline of the Detroit River would be 30 m and this area should be vegetated to create a naturalized shoreline and corridor for wildlife movement. Fencing around the perimeter of the inspection plaza should be installed so as to not preclude the migration of wildlife along the shoreline of the Detroit River.

Interference with Bird Migration

The U.S. Fish and Wildlife Service have developed generic mitigation measures to reduce the potential for avian mortalities associated with tall towers. These mitigation measures deal primarily with the use of lighting on tall towers.

> "Based on available studies, the U.S. Fish and Wildlife Service have developed best management practices for tall buildings, towers and bridges (Manville 2005). Recommendations for bridges include the following:
>
> - [For non-pilot warning/obstruction lighting] use low-intensity lower wavelength blue, turquoise, or green lights (Wiltschko and Wiltschoko 2002). This tends not to disrupt magnetic orientation in several families of birds studied. Avoid red and yellow lights.
> - Specifically, use blue jelly jar LED (light emitting diodes) lights on suspension cables and rectangular blue LED lights on bridge deck. These produce bright but directional light (25% bright as 100W bulb), and provide long-distance viewing, while minimizing light pollution, which could lead to bird entrapment. Operate year-round from sunset to 1:00 a.m..
> - Install any lights during non-nesting periods (generally August 1 to January 15). Seek advice from nearest Field Office for guidance, especially when birds may be exhibiting breeding behaviour.
> - Where nests are active, establish 150 m buffer zone around nest. No work to be allowed until fledglings have left the nest.
> - Consider turning [non-pilot warning/obstruction lighting] off during spring and fall bird migration periods, especially during overcast, cloudy or hazy conditions.
> - Once lighting is installed, perform peer-reviewed research to determine any effects on migratory birds. Coordinate with the Division of Migratory Bird Management and Field Office on research proposals."

In general, lighting should be kept to a minimum and used only where necessary for safety purposes. Architectural lighting to highlight the aesthetics of the bridge should be developed with consideration for its potential effect on migratory and resident birds.

The bridge type, design and lighting for the new Detroit River Crossing will be developed during later design phases. Final bridge design and lighting will need to take appropriate safety measures into account, in consideration of marine navigation, the needs of motorists and aviation warming systems. The potential effects of the bridge type, design and lighting on migratory birds will be taken into consideration at that time.

6.8.4.3 Monitoring and Follow-up

Work on existing bridges/culverts should occur outside of the breeding season of migratory birds. If the construction work cannot be staged to outside of the breeding season of migratory birds, structures will be enclosed to prevent migratory birds from nesting on the structures. The nest prevention system will be monitored regularly to ensure it is functioning as designed.

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 on 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.

Compliance monitoring should be conducted during construction to avoid the incidental take of migratory birds. If bridge construction activities occur during the nesting season, a qualified avian biologist should be retained on site to conduct frequent nesting surveys.

Effects monitoring should be conducted once the bridge is operational to determine the impacts of the crossing on bird mortality and the effectiveness of mitigation measures.

On-going consultation with organizations such as the MNR, CWS and WIFN will occur.

6.9 Species at Risk

6.9.1 Environmental Standards and Practices

A description of the existing species at risk located within the study area is presented in the vegetation (Section 2.3.1.3), mollusc and insects (Section 2.3.2.2), fisheries (Section 2.3.3.4) and wildlife (Section 2.3.4.3) sections of the *Draft Practical Alternatives Evaluation Working Paper – Natural Heritage* (LGL Limited 2008).

The *Environmental Standards and Practices User Guide* (MTO 2006) indicates that the construction and operation of provincial transportation facilities such as interchanges, lanes, temporary access roads, bridges and culverts, and traffic and noise barriers may interfere with species at risk and their habitats. Interference with species at risk and their habitats can result in the reduced size or extirpation of local populations. During the operation phase, vegetation and wildlife mortality may result from human/vehicle/wildlife encounters and exposure to contaminants resulting from spills or upsets.

The measures prescribed for the management of interference with species at risk and their habitat include:

- set location of design feature to avoid species at risk and their habitat;
- restrict access of construction equipment from species at risk and their habitat;
- use timing constraints to limit operations to ensure that species at risk are not present on site during construction; and,

- educate construction workers on how to manage encounters with species at risk.

MTO has incorporated these environmental protection measures into the Detroit River International Crossing Study, where necessary and feasible, or will incorporate these environmental protection measures into the Detroit River International Crossing Study during later design stages.

ESA, 2007 provides protections for those species identified as extirpated, endangered, threatened and special concern in Ontario Regulation 230/08, also known as the Species at Risk in Ontario (SARO) List. The ESA, 2007 prohibits the killing (section 9) and destruction of habitat (section 10) of species listed on the SARO List as threatened, endangered or extirpated. Currently, those species listed under Schedule 1 of the ESA, 2007 receive general habitat protection. All species newly listed to the SARO List after June 30, 2008 receive immediate general habitat protection until a species-specific habitat regulation can be made. Those species that were listed as endangered or threatened but were not regulated under the old *Endangered Species Act* will receive general habitat protection as of June 30, 2013, unless a species-specific habitat regulation is made before then, Under section 17 of ESA, 2007, the Minister may issue a permit to a person that, with respect to a species specified in the permit that is listed on the SARO List as extirpated, endangered or threatened, authorizes the person to engage in an activity specified in the permit that would otherwise be prohibited by section 9 or 10. As The Windsor-Essex Parkway will entail killing or damage habitat of threatened species, a permit issued under section 17 of ESA, 2007 will be required by MTO to construct the project.

The inspection plaza and crossing will be acquired by Transport Canada. As a result, SARA will apply to these two components of the Recommended Plan. SARA includes prohibitions that make it an offence to:

- kill, harm, harass, capture, or take an individual of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated;
- possess, collect, buy, sell or trade an individual of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated; and,
- damage or destroy the residence (e.g. nest or den) of one or more individuals of a species listed in Schedule 1 of SARA as endangered, threatened or extirpated, if a recovery strategy has recommended the reintroduction of that extirpated species.

Schedule 1 lists species that are extirpated, endangered, threatened or of special concern; the prohibitions do not apply to species of special concern. Under SARA, permits may be issued or agreements may be entered into to authorize certain activities that would otherwise contravene the general or critical habitat prohibitions, if certain conditions are met. These authorizations are sometimes called "Section 73 Permits", referring to the section of the Act that deals with authorizations. Because the inspection plaza will affect species identified as threatened in Schedule 1 of SARA, a permit must be secured by Transport Canada prior to commencement of construction activities that will affect species at risk.

An ESA, 2007 permit will be required for The Windsor-Essex Parkway for threatened plant species including colic-root, common hop-tree, dense blazing star, dwarf hackberry, Kentucky coffee-tree and willowleaf aster and threatened wildlife species including Butler's gartersnake and eastern foxsnake. A SARA permit will be required for the

inspection plaza for threatened plant species including dense blazing star, Kentucky coffee-tree and willowleaf aster. No species at risk are located within the footprint of the crossing. 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, Ministry of Natural Resources (MNR)) and with other authorities who may have a role in environmental stewardship, including municipalities, Essex Region Conservation Authority (ERCA) and Walpole Island First Nations (WIFN).

6.9.2 Butler's Gartersnake

6.9.2.1 Potential Environmental Effects

Globally, Butler's gartersnake (*Thamnophis butleri*) has a very small range. It is found in only five areas of North America: southeastern Wisconsin, eastern Indiana, northwestern Ohio, southern Michigan and southwestern Ontario. Ontario comprises less than 10% of its global range. In Canada, it is limited to southwestern Ontario occurring only in three major areas. Luther Marsh in Dufferin and Wellington Counties and Skunk's Misery in Middlesex and Lambton Counties make up two of these areas. The third and largest area, made up of scattered populations along the Detroit River and Lake St. Clair up to Lake Huron, extends from Amherstburg, through Windsor and Sarnia to Amherst Point and Errol. There are 20 known locations in Ontario but half of these have very low numbers and more than half of the sites have not been verified for over a decade. There is little historic data concerning population sizes.

In 2006 an additional local population was recently verified in the Windsor area. The proposed Windsor-Essex Parkway footprint will disturb about 40% of this new population based on the DRIC study done in 2008. Butler's gartersnake are very habitat specific and have very small home ranges. They are susceptible to disturbances, especially to the loss of tallgrass prairie habitats. However, if the area to be affected by Recommended Plan is compensated with an area of comparable size and similar habitat type close to the remaining population, LGL is confident that this will minimize individual losses, if not enhance the size of the remaining population.

The Windsor-Essex Parkway was aligned to avoid significant portions of the habitat for a sustainable population of Butler's gartersnake. The area to be displaced represents summer habitat for the Butler's gartersnake and does not appear to support hibernacula or birthing sites. Butler's gartersnake are believed to have a strong fidelity to their hibernacula, so removal of hibernacula areas would likely lead to snake mortality. Butler's gartersnake is a habitat specialist with a small home range (approximately 300 m). As a result, they have specific life cycle requirements that must be met within a small area. Butler's gartersnake is also slow moving, so they will not likely evacuate fast enough if their habitat is being destroyed during construction.

Mortality of individual Butler's gartersnake may have a detrimental effect upon the population as a whole. The populations in the Windsor region are among the most significant in Canada, and also consist of a limited number of individuals. A minimum number of individuals (amount unknown) are needed to sustain this population, and loss of individuals may place the population below its required reproductive level to sustain itself.

Butler's gartersnake is sensitive to disturbances. Individuals located adjacent to areas of disturbance will experience a reduction in territory size and new competition from the possible few individuals that may relocate from the area of disturbance. This may cause physical distress to the snakes and increased risk of predation. The disturbance to any hibernacula areas may be catastrophic to the population.

6.9.2.2 Environmental Protection Measures

Areas located adjacent to known Butler's gartersnake habitat will be restored to a prairie habitat similar to the areas that will be eliminated by the proposed highway to compensate for this lost habitat and ultimately improve the size and quality of Butler's gartersnake habitat. Habitat restoration should occur prior to construction so that the area has an opportunity to stabilize and mature prior to snake translocation.

Butler's gartersnake translocation should proceed according to recommendations of the Butler's gartersnake IUCN/SSC Conservation Breeding Specialist Group from Apple Valley, MN. Their management models suggest at least 15 adult females should be translocated each year to have the highest chances for successful establishment. Connectivity to a larger population that can provide additional individuals should the translocated area drop in numbers is necessary.

A temporary snake exclusion fence should be installed prior to construction around the construction zone to prevent snake access to this area. This fence should be designed according to the suggestions made by the Butler's Gartersnake Conservation Strategy Team (WDNR 2005). A permanent exclusion measure, such as a toe retaining wall should be installed to prevent snake access to The Windsor-Essex Parkway during freeway operations.

Human disturbances (i.e. 4x4 vehicles, dirt bikes, snake collectors, etc.) can have detrimental effects on both the habitat and the snake population. Vehicular and pedestrian traffic should be excluded from the Butler's gartersnake habitat. Responsibilities for management of newly-created snake habitat have yet to be determined.

Instruction as to how to appropriately deal with wildlife encounters will be given to construction personnel to prevent the harassment of regulated snake species. Furthermore, all encounters should be reported to the on-site Environmental Inspector/Biologists.

6.9.2.3 Monitoring and Follow-up

A baseline study was conducted during 2008 to investigate the abundance and home range of Butler's gartersnake. This study will be continued during 2009 with the intent of locating/confirming hibernacula sites and obtaining an ESA, 2007 permit.

Due to difficulties associated with reliably locating and identifying critical habitat (hibernacula) and home-range size, as well as movement patterns of Butler's gartersnake, we recommend that a radio-telemetry study be undertaken. The study will allow biologists to reliably locate and study individual snakes, and thus obtain significant information about the biology and management of these animals.

During construction, exclusion fencing should be monitored twice a week for failures in the fencing, and continued from March 15 to October 31 or until all construction has ceased.

A continued study of the Butler's gartersnake population within the restoration area should be carried out once the Recommended Plan is constructed. The effects of the new highway's proximity to the remaining Butler's gartersnake population and their hibernacula should be monitored. Any changes to their movements and hibernacula locations should be recorded. The population of snakes, displaced from their habitats by the new highway and moved into a newly restored habitat, should also be monitored to determine the success or failure of their translocation. A successful translocation is determined by how well the newly established population is breeding and if their population size is increasing. The success of the restored habitat (i.e. invasive species removal and native species introductions) and the presence of symbiotic species of the Butler's gartersnake, like the digger crayfish (*Fallicambarus fodiens*), should also be monitored as part of the entire ecosystem to determine the success of the translocation. Long term monitoring needs will be determined in consultation with appropriate agencies.

The newly restored area, plus the prairie habitats already in existence, should have controlled burns every year or two to maintain the areas prairie plant status and keep it optimal for the Butler's gartersnake. These should occur between November 1 and March 31 when most wildlife is either dormant or has left the area. If mowing is used instead of controlled burns, it should be done in patches in a monthly rotational pattern, with no more than 33% of available grassland habitat affected in any one year (IUCN/SSC 2007).

A long-term measure would be to designate the area as a park or nature reserve so that it receives protection and active management. MTO should develop a partnership with local conservation organizations, such as the Ojibway Nature Center, ERCA, OMNR or WIFN, to ensure continued stewardship of this area.

6.9.3 Eastern Foxsnake

6.9.3.1 Potential Environmental Effects

Globally, the eastern foxsnake is restricted to Ontario, Michigan and Ohio, with an estimated 65-70% of its global population being found with Ontario. Three regional populations exist within Ontario, with the highest occurrence records being reported from Essex and Kent Counties. Detailed population studies have not been undertaken in the Windsor area; however, this species is frequently encountered. Additionally, MNR occurrence data shows a notable concentration of records within or directly adjacent to core Ojibway Prairie area. The proposed Windsor-Essex Parkway footprint will be located adjacent to the eastern and northern limits of the Ojibway Prairie area. Because foxsnake are known to show high sensitivity to disruption or destruction of their critical habitat(s), are nomadic in nature and often live in close association to urban structures, mortalities from the construction and operation of the facility may be expected. However, based on our current level of knowledge about this species, and the environmental protection measures that will be incorporated into this project (including restoration and enhancement of eastern foxsnake habitat), it is our professional opinion that the Recommended Plan will not result in extirpation or significant threat to the local population.

Active snake nests may be removed and consequently destroyed during the construction process. Alternatively, mortality may occur in an indirect manner. Studies have shown that eastern foxsnake exhibit a strong fidelity to hibernation sites. Consequently, destruction or alteration of hibernation sites may result in mortality of individuals who are exposed to the elements while they attempt to locate the removed hibernacula.

The eastern foxsnake is a habitat generalist that typically has large home-ranges spanning several kilometers. As a result, if habitat is lost, eastern foxsnake will likely take up residence on adjacent lands.

Although eastern foxsnake are frequently found in close association with anthropogenic features they generally avoid areas of intense disturbance; favouring microhabitats where disturbance is limited. Thus, only snakes residing within the construction zone will experience disturbance, with specimens residing on adjacent lands avoiding active construction zones.

6.9.3.2 Environmental Protection Measures

Although not completely effective, buildings and structures scheduled for removal can be searched by a qualified snake specialist to find and remove any eastern foxsnake that may be within the structure. Seasonally the best time to remove buildings is from May to September when eastern foxsnake are not hibernating. Eastern foxsnake may take up residence in any stock/material or debris piles left undisturbed for an extended period; consequently, all effort should be made to maintain a well organized construction zone. Heavy-duty sediment fencing should not be used, so as to avoid snake mortality cause by snakes becoming entangled in such fencing.

To compensate for the loss of snake habitat, habitat restoration and enhancement will be undertaken in several areas adjacent to current snake habitat. Within the newly restored habitat, features such as hibernacula, nest and basking/shelter structures will be created to encourage utilization by eastern foxsnake and other snake species. Snakes found in the construction zone will also be relocated to the new habitat areas.

As a precaution to protect eastern foxsnake, temporary exclusion fencing will be installed around construction zones to prevent snakes from entering the construction area. The exclusion fencing will be inspected regularly by a qualified Wildlife Biologist to rescue any animals that may be stranded and to ensure that the fencing remains effective.

Instruction as to how to appropriately deal with wildlife encounters will be given to construction personal to prevent the harassment of regulated snake species. Furthermore, all encounters should be reported to the on-site Environmental Inspector/Biologists.

6.9.3.3 Monitoring and Follow-up

A baseline study was initiated during 2008 to investigate the abundance and home range of eastern foxsnake. This study will be continued during 2009 with the intent of locating/confirming hibernacula sites and obtaining an ESA, 2007 permit. We suggest that as many appropriate individuals as possible should be captured and implanted with a radio transmitter for tracking purposes.

During construction, exclusion fencing should be monitored twice a week for failures in the fencing and continued from March 15 to October 31 or until all construction has ceased.

Habitat structures constructed for eastern foxsnake such as hibernacula, breeding sites and cover should be monitored during appropriate seasons to determine their use by the target species. Long term monitoring needs will be determined in consultation with appropriate agencies.

6.9.4 Vascular Plants

6.9.4.1 Potential Environmental Effects

Ten regulated plant species have been identified within the footprint for the Recommended Plan and on adjacent lands within 120 m of the footprint. These species at risk are scattered throughout the entire Recommended Plan limits, with concentrations around St. Clair College Prairie, Spring Garden Forest and Ojibway Park. In many cases the concentrations of species at risk corresponds with the provincially rare vegetation communities.

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 Windsor-Essex Parkway and the inspection plaza. This total number of species to be displaced includes 418 climbing prairie rose, 929 colic-root, two common hop-tree, one 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 (climbing prairie rose, dense blazing star, Kentucky coffee-tree, Riddell's goldenrod and willowleaf aster).

A total of eight species at risk regulated as Endangered, Threatened or Special Concern under SARA and ESA, 2007 are found on adjacent lands located within 120 m of the footprint of the Recommended Plan and may be disturbed. This total includes one American chestnut, 511 climbing prairie rose, 14 colic-root, 2,114 dense blazing star, 21 Kentucky coffee-tree, 443 Riddell's goldenrod, 24 Shumard oak and 27,874 willowleaf aster. A summary of the potential impacts to vascular plant species at risk is presented in Table 8.

When vegetation communities are fragmented it reduces the size or area of the community. This reduces the number of species at risk the vegetation community can support. The size also influences the viability of these species to persist. Smaller vegetation community fragments can only support small populations of plants and animals, and small populations are more vulnerable to extirpation or extinction. In fragmented landscapes, the distance between vegetation communities reduces immigration and emigration of species at risk. Edge effects created by clearing will change the microclimatic conditions, including light, temperature and wind. Fragmentation decreases the size of the interior habitat and increases the size of the exterior habitat. Exotic and invasive species can establish more easily in the disturbed conditions.

TABLE 8.
POTENTIAL ENVIRONMENTAL EFFECTS FOR VASCULAR PLANT SPECIES AT RISK

Species	Status	Range	Population	Causes for Concern in the Province	Impacts
American chestnut (*Castanea dentata*)	COSEWIC-END & SARA (1); COSSARO-END & ESA(3); S2	Essex, Kent, Elgin, Middlesex, Brant, Haldimand-Norfolk, Niagara, Hamilton, Halton, and Waterloo.	Numerous populations in Southwestern Ontario. 139 sites in Ontario.	Species has been greatly reduced in Ontario from its former abundance and now exists primarily as suckers and stump sprouts. Continued presence of Chestnut Blight disease and reinfection of trees. Very few fruit-producing trees. Logging of these trees is another limiting factor for the species.	0 American chestnut will be displaced by the Recommended Plan, one stump sprout may be disturbed within the adjacent lands and 0 are located beyond this area within the original AOI. No American chestnut will be affected by the Recommended Plan.
climbing prairie rose (*Rosa setigera*)	COSEWIC-SC & SARA (1); COSSARO-SC & ESA(5); S3	Essex, Kent and Lambton Counties.	There are 12 sites within Southwestern Ontario.	Loss of habitat and invasive exotic shrub competition. Over shading by woody species as a result of succession and fire suppression	417 climbing prairie rose will be displaced by the Recommended Plan, 511 may be disturbed within the adjacent lands and 135 are located beyond this area within the original AOI. A high number of climbing prairie rose will be affected by the Recommended Plan. 38 percent of the population within the AOI will be displaced.
colic-root (*Aletris farinosa*)	COSEWIC-THR & SARA (1); COSSARO-THR & ESA (4); S2	Elgin, Essex, Walpole and Haldimand-Norfolk	There are 17 sites within Southwestern Ontario.	Fire suppression, loss of prairie habitat, weeds and changes in hydrology Over shading by woody species as a result of succession and fire suppression Litter and trampling by trail users. Limited distribution within Ontario.	928 colic-root will be displaced by the Recommended Plan, 14 may be disturbed within the adjacent lands and 1,734 are located beyond this area within the original AOI. This is a large population of colic-root that will be affected by the Recommended Plan. 34 percent of the population within the original AOI will be displaced.

TABLE 8.
POTENTIAL ENVIRONMENTAL EFFECTS FOR VASCULAR PLANT SPECIES AT RISK

Species	Status	Range	Population	Causes for Concern in the Province	Impacts
common hop-tree (*Ptelea trifoliatae*)	COSEWIC-THR & SARA (1); COSSARO-THR & ESA(4); S3	Essex, Kent, Elgin, Haldimand-Norfolk and Niagara.	34 sites in Ontario, with numerous populations in Southwestern Ontario. There are an estimated 875 to 1025 mature individuals of the common hop-tree in Ontario.	Loss of habitat, replacement of indigenous beachside vegetation with cultivated plants, intensive beech grooming, and the construction of seawalls and other structures. A twig-boring beetle.	One common hop-tree will be displaced by the Recommended Plan, 0 will be disturbed within the adjacent lands and 0 are located beyond this area within the original AOI. The significance of the common hop-tree is diminished as a result of it being planted and unnatural in the Windsor area. Common hop-tree is usually situated on shorelines and dry sites associated with shorelines, not along a major road, in a yard, and far away from any watercourse or waterbody.
dense blazing star (*Liatris spicata*)	COSEWIC-THR & SARA (1); COSSARO-THR & ESA(4); S2	Essex County. Cultivated and escapes in Toronto and Elgin County	There are 14 known EO sites within Southwestern Ontario.	Fire suppression, Loss of Prairie habitat, weeds and changes in hydrology. Over shading by woody species as a result of succession and fire suppression. Trampling by trail users. Competition from the invasive purple loosestrife (*Lythrum salicaria*)	950 dense blazing star will be displaced by the Recommended Plan, 2,114 may be disturbed within the adjacent lands and 1,535 are located beyond this area within the original AOI. This is a large population of dense blazing star that will be affected by the Recommended Plan. 23 percent of the population within the original AOI will be displaced.
dwarf hackberry (*Celtis tenuifolia*)	COSEWIC-THR & SARA (1); COSSARO-THR & ESA(4); S2	Lambton, Middlesex and Essex Counties.	5 populations occur in Southern Ontario. Found in the Port Franks area, Point Pelee, Pelee Island, Point Anne and at two sites in the Belleville area. Canadian population is estimated to consist of about 893 individual plants.	Bark beetle infestations. Loss of habitat due to industrial activities, such as limestone quarrying and sand extraction.	One dwarf hackberry will be displaced by the Recommended Plan, 0 will be impacted within the adjacent lands and 0 are located beyond this area within the original AOI. The significance of the dwarf hackberry is diminished as a result of it being planted and unnatural in the Windsor area.

TABLE 8.
POTENTIAL ENVIRONMENTAL EFFECTS FOR VASCULAR PLANT SPECIES AT RISK

Species	Status	Range	Population	Causes for Concern in the Province	Impacts
Kentucky coffee-tree (*Gymnocladus dioicus*)	COSEWIC-THR & SARA (1); COSSARO-THR & ESA(4); S2	Essex, Kent and Lambton Counties	There are 25 known sites within Southwestern Ontario.	Double-crested cormorants (*Phalacrocorax auritus*) threaten some Kentucky Coffee-tree populations because the droppings from nesting cormorants kill most trees. Climate, lack of suitable habitat, and lack of reproduction by seeds. Canopy closure by competing tree species. Loss of habitat and changes in hydrology. Most Ontario populations appear to be single-sex clones. Low genetic diversity.	19 Kentucky coffee-tree will be displaced by the Recommended Plan, 21 may be disturbed within the adjacent lands and one is beyond this area within the original AOI. This is a small population of Kentucky coffee-tree that will be affected by the Recommended Plan. Many of the specimens appear to be planted and many of the seedlings and saplings are a result of the planted specimens. 41 percent of the population within the original AOI will be displaced.
Riddell's goldenrod (*Solidago riddellii*)	COSEWIC-SC & SARA (1); COSSARO-SC & ESA(5); S3	In Canada, Riddell's Goldenrod is restricted to southwestern Ontario and southeastern Manitoba. Essex and Lambton Counties.	More than 30 extant occurrences are known in Ontario and Manitoba.	Loss of habitat and invasive exotic shrub competition. Over shading by woody species as a result of succession and fire suppression	1,285 Riddell's goldenrod will be displaced by the Recommended Plan, 443 may be disturbed within the adjacent lands and 2,046 are located beyond this area within the original AOI A high number of Riddell's goldenrod will be affected by the Recommended Plan. 40 percent of the population within the AOI will be displaced.
Shumard oak (*Quercus shumardii*)	COSEWIC-SC & SARA (3); COSSARO-SC & ESA(5); S3	Essex, Kent and Elgin Counties	29 sites in Southwestern Ontario. More than 20 sites in Essex County. In Essex County there are an estimated 500 Shumard Oaks, some of which may be hybrids.	Loss of habitat, herbicides and grass mowing is prohibiting natural regeneration. Changes in hydrology.	0 Shumard oak will be displaced by the Recommended Plan, 24 mature trees may be disturbed within the adjacent lands and 97 are located beyond this area within the original AOI. The impact on this species will be negligible, since no individuals will be removed as a result of the Recommended Plan

TABLE 8.
POTENTIAL ENVIRONMENTAL EFFECTS FOR VASCULAR PLANT SPECIES AT RISK

Species	Status	Range	Population	Causes for Concern in the Province	Impacts
willowleaf aster (*Symphyotrichum praealtum*)	COSEWIC-THR & SARA (1); COSSARO-THR & ESA(4); S2	Essex, Kent and Lambton Counties. Primarily found in Essex County.	There are 12 EO sites within Southwestern Ontario. It is highly localized in Canada, and occurs mainly in two concentrated areas around Windsor and on Walpole Island.	Fire suppression, loss of prairie habitat, weeds and changes in hydrology Over shading by woody species as a result of succession and fire suppression Limited distribution in Ontario	11,676 willowleaf aster will be displaced by the Recommended Plan, 27,874 may be disturbed within the adjacent lands and 18,690 are located beyond this area within the original AOI. This is a large population of willowleaf aster that will be affected by the Recommended Plan. 19 percent of the population within the AOI will be displaced.

6.9.4.2 Environmental Protection Measures

Environmental protection measures typically used to mitigate the loss of species at risk and their habitat include avoidance, integration and relocation. The DRIC study team has made every reasonable attempt to avoid provincially rare habitats and species at risk. However, in areas where avoidance cannot be achieved, attempts will be made to incorporate species at risk and their habitat into the Recommended Plan to the extent feasible. Once these opportunities have been exhausted, salvage and relocation efforts will be considered. The DRIC study team will explore salvage opportunities for plants including: transplanting of live plant material, the collection and broadcasting of seeds, and the stripping, relocation and placement of sod.

Seed collection for propagation will be from within the study area. Partnerships need to be developed to gather enough people to collect enough local seed for restoration. The WIFN have offered seed for species at risk to be used for restoration and enhancement efforts.

The management options for species at risk were prepared in consultation with restoration specialists and are presented in Table 9 and Table 10.

TABLE 9.
ENVIRONMENTAL PROTECTION MEASURES FOR SPECIAL CONCERN VASCULAR PLANT SPECIES DISPLACED BY THE RECOMMENDED PLAN

Species	Management Requirements
climbing prairie rose	Carry out prescribed burns around climbing prairie rose and Riddell's goldenrod populations to reduce over shading by woody species located in the adjacent lands within 120 m of the Recommended Plan.
Riddell's goldenrod	

TABLE 10.

ENVIRONMENTAL PROTECTION MEASURES FOR THREATENED VASCULAR PLANT SPECIES DISPLACED BY THE RECOMMENDED PLAN

Species	Suitability for Relocation	Ideal Habitat/Soil Conditions	Site Preparation Requirements	Relocation Methods
colic-root (*Aletris farinosa*)	Difficult, no Ontario native plant grower has been successful at growing it. Transplantation of plugs or sod is the only solution.	Mesic dry tallgrass prairie on sand Rich sandy woods and thickets, grassy openings in forests and edges of wooded areas vegetation communities Coarse sandy soil Open canopy Coefficient of wetness: 0 facultative Requires mowing, disturbance or sandy soil with little carbon or nitrogen build up to grow	Unknown likely important not to use topsoil, plant into clean sand	Transplants - may work Sodding - may work
dense blazing star (*Liatris spicata*)	Species is short-lived and acquires diseases with age. Use locally-collected seeds from same subpopulation to grow plugs.	Mesic sandy soils in tallgrass prairie species assemblage in which it would naturally occur This species grows too tall and becomes short-lived under cultivation due to diseases, etc. It requires a prairie ecosystem to survive in the long term Wet meadows, damp thickets, marshes and tallgrass prairie vegetation communities Open canopy Coefficient of wetness: 0 facultative	Site should be mesic, weed free, no topsoil or commercial seed mixes and have a native prairie ecosystem plant assemblage either created or natural.	Collect seed from local subpopulation in September, store dry, cold moist stratify for one month, sow plugs, plant plugs out at 6-10 weeks, water occasionally as needed.

TABLE 10.

ENVIRONMENTAL PROTECTION MEASURES FOR THREATENED VASCULAR PLANT SPECIES DISPLACED BY THE RECOMMENDED PLAN

Species	Suitability for Relocation	Ideal Habitat/Soil Conditions	Site Preparation Requirements	Relocation Methods
Kentucky coffee-tree (*Gymnocladus dioicus*)	Possible to relocate suckers or seedlings or grow seedlings from local populations producing viable seed. Seed collection	Floodplain or moist rich soil, but generally adaptable under cultivation site should include appropriate species assemblage Tallgrass prairie, savannah or woodland vegetation communities Open to partial shade canopy Coefficient of wetness: 5 obligate upland	Site should be natural or effects of smooth-grading, compaction mitigated no topsoil. Prepare site as for any tree planting place 360 day slow release pellets in hole and water in with 10-52-10 transplant solution. Use water gel packs if conditions are dry. If planted as 2 m tree seedling area within one meter of trunk should be free of grasses and weeds for three additional growing seasons.	Grow out root-cuttings, seedlings or seeds in a protected nursery situation for three years or until height is greater than 2 m and transplant.
willowleaf aster (*Symphyotrichum praealtum*)	Relocate aster by seed collection and disperse in appropriate location. Use local seed collection.	Tallgrass prairie or savannah vegetation communities Open to partial shade canopy Coefficient of wetness: -3 facultative wetland	Prepare site such that there is no topsoil, no commercial mixes and that there is adequate weed control, use sterile compost and fine wood chips to provide a topsoil layer.	Direct sow wild-collected seeds, checked for hard seed content to freshly prepared appropriate sites at appropriate times of year or grow high quality plugs from seeds, plant, water and monitor for one year.

Note: Common hop-tree and dwarf hackberry are believed to be planted; therefore, environmental protection requirements, if required, will be developed during later design phases in consultation with MNR.

6.9.4.3 Monitoring and Follow-up

The monitoring program for vascular plant species at risk is species-specific and is presented in Table 11. Long term monitoring needs will be determined in consultation with appropriate agencies.

TABLE 11.
MONITORING REQUIREMENTS FOR VASCULAR PLANT SPECIES AT RISK

Species	Monitoring Requirements
American chestnut	Monitor the impacts of The Windsor-Essex Parkway construction on the American chestnut stump sprouts.
climbing prairie rose	Monitor the health of the climbing prairie rose in the adjacent lands within 120 m to ensure their survival.
colic-root	On-going management requirements to ensure survival- maintain intact tallgrass prairie fragments similar to locations where species occurs and expand and connect areas. Control and eliminate *Phragmites australis*. Prevent use of "quick greenup" mixes. Do not reuse topsoil.
dense blazing star	On-going management requirements to ensure survival – maintain within a high-quality managed tallgrass system. Protect from mowing, vehicle access, and invasive exotic weeds such as *Phragmites australis*.
Kentucky coffee-tree	On-going management requirements to ensure survival – water as needed for two to three years and monitor growth and survival. Protect from or eliminate *Phragmites australis*, prevent vehicle access. Plant specimens from various populations to try to increase the genetic diversity of the population.
Riddell's goldenrod	Monitor the health of the Riddell's goldenrod in the adjacent lands within 120 m to ensure their survival.
Shumard oak	Monitor the impacts of The Windsor-Essex Parkway construction on the Shumard Oak trees.
willowleaf aster	On-going management requirements to ensure survival - control serious exotic and invasive species such as *Phragmites australis*, and exotic biennials associated with linear infrastructure. Prevent vehicle and equipment access, and only mow if required with equipment that is washed.

Permits required under SARA and ESA, 2007 will be secured prior to construction. Detailed mitigation strategies for species at risk will be developed in consultation with ERCA, MNR, CWS and WIFN in order to obtain permits.

In addition to the species at risk identified in this section, the WIFN have indicated that a number of traditional plants used for medicine and ceremonies may be displaced or disturbed by the Recommended Plan. Further discussions with the WIFN will be carried out during later design stages to develop detailed mitigation strategies for plants with special significance to the WIFN.

6.10 Designated Natural Areas

A description of the existing designated natural areas located within the area of investigation is presented in Section 2.3.5 of the *Draft Practical Alternatives Evaluation*

Working Paper – Natural Heritage (LGL 2008). These areas are shown in Appendix G and include:

- one Canadian Heritage River – Detroit River;
- one Provincial Nature Reserve – Ojibway Prairie Provincial Nature Reserve;
- one Provincially Significant Life Science Area of Natural and Scientific Interest (ANSIs) comprised of six parcels – Ojibway Prairie Complex ANSI (Black Oak Woods, Ojibway Park, Titcombe Road North, Ojibway Prairie Reserve, Southeast Nature Reserve, and Spring Garden Forest);
- five Environmentally Sensitive Areas (ESAs) – Ojibway Black Oak Woods ESA (ESA #19), Spring Garden Road Prairie ESA (ESA #29), LaSalle Woods ESA (ESA #18), Ojibway Prairie Complex ESA (ESA #3) and St. Clair College Prairie ESA (ESA #49);
- thirteen Candidate Natural Heritage Sites (CNHSs), consisting of three in LaSalle and ten in Windsor;
- eight areas identified for environmental protection in municipal official plans, consisting of two in LaSalle and six in Windsor; and,
- Provincially Significant Wetlands to be identified by MNR.

Many of these designated natural areas overlap one another so the analysis is based on displacement of or disturbance to the natural heritage feature itself and not the feature's designation. The boundaries of the natural heritage feature were reconciled through field investigations or the outermost limits of the combined designated natural area were used.

The Ontario Ministry of Natural Resources and LGL Limited conducted wetland evaluations following the Ontario Wetland Evaluation System – 3rd Edition (OMNR 2002) in 2008 in the study area. The results of the wetland evaluations have not been released by MNR to date; however, it is anticipated that wetland units located within the study area will be identified as components of the Ojibway Prairie Complex Provincially Significant Wetland.

The Spring Garden Planning Area is bounded by E.C. Row Expressway, Huron Church Road, the Town of LaSalle municipal boundary and Malden Road. This 283 ha Secondary Plan area was approved in 2002 under OPA #5 to the City of Windsor Official Plan. The Spring Garden Forest ANSI (part of the Ojibway Prairie Complex ANSI), the Spring Garden Road Prairie ESA and a CNHS roughly overlap within this planning area. During the preparation of the Secondary Plan, the boundaries of these designated natural heritage features were reconciled to form the Spring Garden Natural Area Complex, which closely approximates the boundaries of the Spring Garden Forest ANSI. The Spring Garden Natural Area Complex is designated as "Natural Heritage" in the Spring Garden Planning Area Secondary Plan (OPA #5).

6.10.1 Environmental Standards and Practices

MTO's policy is to have regards for the specific features and functions of designated natural areas that make them unique as articulated in legislation, policies or approved management plans during transportation planning and highway design, construction, operation and maintenance activities. In areas where designated natural areas cannot be avoided as demonstrated by the Environmental Assessment approval process,

transportation planning and highway design, construction, operation and maintenance activities will be done in a manner that minimizes the extent of intrusion, minimizes visual impacts, maintains access to designated natural areas and buffers adjacent natural areas to the extent possible.

The construction and operation of provincial transportation facilities such as interchanges, lanes, temporary access roads, bridges and culverts, and traffic and noise barriers may result in encroachment on designated natural areas resulting in the loss of area or ecological function for which the area was identified.

6.10.2 Encroachment on Designated Natural Areas

6.10.2.1 Detroit River

The crossing will span the Detroit River and no piers will be placed in the wetted channel. As a result, the Recommended Plan is not anticipated to have an environmental effect on the natural heritage attributes of the Detroit River Canadian Heritage River.

The function of the Detroit River as fish habitat may be impaired by the release of contaminants or stormwater to the river. Section 36(3) of the *Fisheries Act* prohibits the release of a deleterious substance in water frequented by fish. An assessment of impacts to fish and fish habitat is presented in the Fish and Fish Habitat section of this report.

6.10.2.2 Black Oak Woods

Black Oak Woods is comprised of the Black Oak Woods ANSI, the Ojibway Prairie Complex ESA #3, the Ojibway Black Oak Woods ESA #19, CNHS W37 and CNHS W38. A portion of Black Oak Woods is located within the footprint area of the inspection plaza. As a result, the proposed project will result in the displacement of 1.68 ha of a total of 46 ha of this designated natural area, or approximately 3.7%.

Some of Black Oak Woods is also located on adjacent lands, within 120 m of the facility footprint. As a result, measures will be required to maintain the function of this designated natural heritage area. The primary ecological functions of the Black Oak Woods are to provide a natural linkage between the Detroit River and the inland components of the Ojibway Prairie Complex and to support provincially rare habitat and species. The proposed facility will have no significant adverse effect on the primary ecological functions of this designated natural area.

6.10.2.3 Ojibway Park

Ojibway Park is comprised of the Ojibway Park ANSI, the Ojibway Prairie Complex ESA #3 and CNHS W36. A portion of Ojibway Park is located within the footprint of The Windsor-Essex Parkway. As a result, the proposed project will result in the displacement of 0.64 ha of a total of 64 ha of this designated natural area, or approximately 1.0 %. The area to be displaced is already fragmented by Broadway Street and the Ojibway Parkway.

Some of Ojibway Park is also located on adjacent lands, within 120 m of the facility footprint. As a result, measures will be required to maintain the function of this designated natural heritage area. The primary ecological functions of Ojibway Park are to provide a natural linkage between the Black Oak Woods and other components of the Ojibway Prairie Complex and to support provincially rare habitat and species. The proposed facility will have no significant adverse effect on the primary ecological functions of this designated natural area.

6.10.2.4 Titcombe Road North

Titcombe Road North is comprised of the Titcombe Road North ANSI, the Ojibway Prairie Complex ESA #3 and CNHS #34. Titcombe Road North is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of the Titcombe Road North.

6.10.2.5 Ojibway Prairie Provincial Nature Reserve

Ojibway Prairie Provincial Nature Reserve is comprised of the Ojibway Prairie Provincial Nature Reserve/ANSI and the Ojibway Prairie Complex ESA #3. The Ojibway Prairie Provincial Nature Reserve is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of the Ojibway Prairie Provincial Nature Reserve.

6.10.2.6 Southeast of Nature Reserve

Southeast of Nature Reserve is comprised of the Southeast of Nature Reserve ANSI and Ojibway Prairie Complex ESA #3. Southeast of Nature Reserve is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of the Southeast of Nature Reserve.

6.10.2.7 Spring Garden Forest

Spring Garden Forest is comprised of the Spring Garden Forest ANSI, the Spring Garden Road Prairie ESA #29 and CNHS W33. Spring Garden Forest is not located within the footprint of The Windsor-Essex Parkway, plaza or crossing. As a result, the proposed project will have no significant adverse effect on the area of Spring Garden Forest.

Spring Garden Forest is however located on adjacent lands, within 120 m of the facility footprint. As a result, measures will be required to maintain the function of this designated natural heritage area. The primary ecological functions of Spring Garden Forest are to provide a natural linkage between LaSalle Woods, St. Clair College Prairie, Oakwood Bush and components of the Ojibway Prairie Complex, and to support provincially rare habitat and species. Tunnels located along The Windsor-Essex Parkway between St. Clair College Prairie, Oakwood Bush and the Spring Garden Forest provide opportunities for ecological restoration and enhancement, including bolstering the ecological linkage between these designated natural areas. As a result, the proposed facility will have no

significant adverse effect on the primary ecological functions of this designated natural area.

6.10.2.8 LaSalle Woods

LaSalle Woods is comprised of the Sandwich West Woodlot/LaSalle Woods ESA #18 and is designated "Natural Environment" in the Town of LaSalle Official Plan. The LaSalle Woods is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of this designated natural area.

6.10.2.9 St. Clair College Prairie

St. Clair College Prairie is comprised of the St. Clair College Prairie ESA #49 and CNHS W31. St. Clair College Prairie is not located within the footprint of The Windsor-Essex Parkway, plaza or crossing. As a result, the proposed project will have no significant adverse effect on the area of St. Clair College Prairie.

St. Clair College Prairie is located on adjacent lands. As a result, measures will be required to maintain the function of this designated natural heritage area. The primary ecological function of the St. Clair College Prairie is to support provincially rare habitat and species.

The prairie community in this location is typically sustained by the surface aquifer, comprised of sandy soil. The sandy soil overlies clayey soils, that form an aquatard and isolates the surface aquifer from the deeper aquifer. The surface aquifer is replenished by precipitation that provides moisture to the prairie communities. The surface aquifer is approximately one to three metres deep. Interaction between the surface aquifer and the deep aquifer is limited by the relatively impermeable clayey soil layer.

The Windsor-Essex Parkway will be excavated to a depth of 5.0 to 7.0 m below existing ground level immediately adjacent to the St. Clair College Prairie. Construction of a depressed highway at this location will require dewatering, that has the potential to lower the groundwater table found in the adjacent prairie community. A temporary water deficit may result in inhibited growth and wilting of vegetation. A prolonged water deficit may lead to mortality or changes in the composition, structure or function of the St. Clair College Prairie in the vicinity of the excavation. The relationship between the prairie ecosystem water balance and the ability of vegetation to regulate any differences in water potential is influenced by the physical features of the site (topography, soils), the characteristics of the vegetation community (species composition, seral stage), moisture inputs (rain, snow) during the dewatering period, and the rate at which the water table is drawn down by the dewatering process and its duration.

Based on a review of groundwater conditions by Golder Associates (2006) it was determined that creating permanent, open, and depressed 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 level within the clay soils. Based on the limited available information, 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 equal to

about 5 to 10 times the depth of cut. Such groundwater lowering will induce settlement within the silty clay subsoils within this zone.

Low permeability in situ walls (e.g. contiguous caisson walls or concrete diaphragm walls) should be used for excavation support or for permanent below grade structures to minimize the influence of the excavation on near-surface groundwater. The magnitude, duration and frequency of dewatering activities should also be limited to those necessary to permit construction. A more detailed investigation of the relationship between groundwater conditions and dewatering requirements should be conducted during later design stages to establish the zone of influence and the magnitude of potential settlement. The more detailed investigation could involve the use of a pumping test to measure the response of groundwater levels in monitoring wells.

An array of piezometers at various depths should be installed within the St. Clair College Prairie within the zone of influence of potential groundwater drawdown. The piezometers should be monitored on a seasonal basis to establish baseline groundwater levels within the prairie ecosystem prior to construction. Monitoring should continue during and post-construction to ensure that the surface aquifer remains saturated and that drought conditions do not occur for prolonged periods. In the event that the surficial aquifer is depleted, methods to recharge the aquifer should be investigated to ensure the long-term survival of the prairie communities.

6.10.2.10 Oakwood Bush

Oakwood Bush is comprised of CNHS W32. Oakwood Bush is not located within the footprint of The Windsor-Essex Parkway, plaza or crossing. As a result, the proposed project will have no significant adverse effect on the area of Oakwood Bush.

Oakwood Bush is however located on adjacent lands, within 120 m of the facility footprint. As a result, measures will be required to maintain the function of this designated natural heritage area. The primary ecological functions of Oakwood Bush are to provide for stormwater retention and to support provincially rare habitat and species. Due to the distance of the designated natural area from the construction zone, the proposed facility will have no significant adverse effect on the primary ecological functions of this designated natural area.

6.10.2.11 Canada Malden Park

Canada Malden Park is comprised of CNHS W35. Canada Malden Park is not located within the footprint of The Windsor-Essex Parkway, plaza or crossing. Canada Malden Park is located on adjacent lands, within 120 m of the facility footprint; however it is separated from the proposed project by the existing E.C. Row Expressway. As a result, the proposed project will have no significant adverse effect on the area or function of this designated natural area.

6.10.2.12 Candidate Natural Heritage Site TC1

CNHS TC1 is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of this designated natural area.

6.10.2.13 Candidate Natural Heritage Site TC2

CNHS TC2 is located within the footprint of The Windsor-Essex Parkway. As a result, the proposed project will result in the displacement of 3.28 ha of a total of 9.05 ha of this designated natural heritage area, or approximately 36%.

The remaining 4.46 ha of this designated natural area is located on adjacent lands within 120 m of the facility footprint. As a result, measures will be required to maintain the function of this designated natural heritage area. The primary ecological functions of TC2 are to provide a natural linkage between the St. Clair College Prairie and the LaSalle Woodlot, and to support provincially rare habitat and species. These two functions will be compromised during the construction phase; however, opportunities are available for ecological restoration and enhancement in this area after construction to bolster the ecological linkage between St. Clair College Prairie and Spring Garden Forest. The tunnel proposed at this location will also provide opportunities for naturalization. As a result, a significant portion of the area and function of this designated natural heritage feature will be lost on a temporary basis, but much of this area can be enhanced and restored following construction to offset the loss of area and function in the short term.

6.10.2.14 Candidate Natural Heritage Site CA4

CNHS CA4 is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of this designated natural area.

6.10.2.15 Candidate Natural Heritage Site W30

CNHS W30 is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of this designated natural area.

6.10.2.16 Candidate Natural Heritage Site W23

CNHS W23 is located beyond the area of influence of The Windsor-Essex Parkway, plaza and crossing. As a result, the proposed project will have no significant adverse effect on the area or function of CNHS W23.

6.10.2.17 Provincially Significant Wetland(s)

Several wetland communities are located within the facility footprint or on adjacent lands within 120 m. These wetlands were evaluated by MNR and LGL Limited in 2008 to

determine if they are provincially significant. The results of the evaluation are yet to be determined, but it is expected that these wetlands will be designated as provincially significant due to the presence of provincially rare vegetation communities and plants. As a result, the environmental effects of the Recommended Plan on these wetland units will need to be assessed during later design phases and environmental protection measures, including compensatory mitigation, will need to be identified in consultation with MNR and other agencies.

6.10.3 Summary of Potential Environmental Effects, Environmental Protection Measures, Monitoring and Follow Up

The location of the designated natural areas is provided in Appendix G, and a summary of the impacts on designated natural areas is provided in Table 12. A total of 5.47 ha of four designated natural areas will be displaced by the Recommended Plan footprint. A further 27.06 ha of seven features may be disturbed on adjacent lands located within 120 m of the Recommended Plan footprint.

TABLE 12.
SUMMARY OF ENCROACHMENT ON AND DISTURBANCE TO DESIGNATED NATURAL AREAS

Feature Name	Feature Type	Area Located Within Footprint (ha)	Area Located on Adjacent Lands Within 120 m of the Footprint (ha)
Detroit River	Canadian Heritage River	0	0
Black Oak Woods	ANSI, ESA #3, ESA #19, CNHS W37, CNHS W38	1.68	8.68
Ojibway Park	ANSI, ESA #3, CNHS W36,	0.51	3.77
Titcombe Road North	ANSI, ESA #3, CNHS W34	0	0
Ojibway Prairie Provincial Nature Reserve	Nature Reserve, ANSI, ESA #3	0	0
Southeast of Nature Reserve	ANSI, ESA #3	0	0
Spring Garden Forest	ANSI, ESA #29, CNHS W33	0	0.04
LaSalle Woods	ESA #18	0	0
St. Clair College Prairie	ESA #49, CNHS W31	0	6.95
Oakwood Bush	CNHS W32	0	2.64
Canada Malden Park	CNHS W35	0	3.16
TC1	CNHS TC1	0	0
TC2	CNHS TC2	3.28	4.46
CA4	CNHS CA4	0	0
W30	CNHS W30	0	0
W23	CNHS W23	0	0
Provincially Significant Wetland(s)	PSW (to be determined)	TBD	TBD
	Total Area	5.47	27.06

The environmental protection measures for designated natural heritage areas are identical to those described for vegetation and wildlife. On-going consultation with organizations such as ERCA, MNR, CWS, WIFN and municipalities will be carried out during later design stages to develop detailed mitigation strategies for designated natural areas.

The landscape plan will be prepared in detail during later design phases to identify areas to be protected, enhanced and restored. The detailed landscape plan will include specific measures related to designated natural areas including edge management, tree protection, soil management, transplanting of native species, removal of exotic species, prairie management, etc. The potential exists to protect, enhance and restore approximately 120 ha of habitat located within the Recommended Plan.

MTO should secure and transfer to a public conservation organization an area in size equal to or greater than the area of designated natural areas to be lost. This area should be designated for environmental protection and maintained in perpetuity for conservation purposes. A number of opportunities exist on lands purchased by MTO for this project including an enhanced linkage between the St. Clair College Prairie and Spring Garden Forest, Oakwood Bush and Spring Garden Forest and significant wildlife habitat for species at risk. Stewardship opportunities should be explored with local municipalities, ERCA, MNR and WIFN.

6.11 Conclusions

The Windsor-Essex Parkway, inspection plaza and crossing are located along an existing road/highway corridor and in areas of pre-existing disturbance. Generally much of the natural heritage in the study area has already been modified by human activity, so siting of the facility in these areas greatly reduces the likelihood and significance of potential environmental effects. Most of the significant natural areas located in the study area were avoided during the development of the Recommended Plan.

The approaches identified for environmental protection including avoidance/prevention; control/mitigation, compensatory mitigation, restoration/enhancement and monitoring will be implemented into design of the Recommended Plan and will serve as conditions of approval for environmental approvals and permits. A summary of the environmental effects and project specific mitigation is provided in Table 13. All environmental approvals and permits will be secured prior to the commencement of construction. MTO standards and practices will be followed for this undertaking to minimize environmental effects.

Based on the characteristics of the natural heritage setting, the nature and scope of the project, the potential likelihood and significance of environmental effects and the environmental protection measures to be incorporated into design of the Recommended Plan and legislative approvals, the project is not expected to result in significant environmental effects on natural heritage. Extensive opportunities exist for restoration and enhancement, partnerships and dedication of conservation lands as part of the Detroit River International Crossing Study.

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
6.5	VEGETATION AND VEGETATION COMMUNITITES	EC/MNR/ MTO/ERCA/ Municipalities	A total of approximately 130 ha of vegetation communities will be partially or fully displaced to construct the Recommended Plan, and approximately 90 ha of vegetation communities on adjacent lands will be disturbed. At the same time, the design of The Windsor-Essex Parkway affords the opportunity to establish approximately 120 ha of green space using restoration and enhancement approaches. As a result, the proposed project is expected to result in an overall net benefit to vegetation communities and to species at risk populations. In addition, there are opportunities to partner in enhancements to other lands in public ownership adds another opportunity for overall benefits. 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. • The area for vegetation removals has been minimized to the extent possible based on the selection of the Recommended Plan and the associated refinements. Areas that should be protected during construction will be delineated prior to construction start and no activities will be permitted in these areas. • The detailed landscape plan will identify areas for protection, enhancement and restoration. The landscaping 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. • Restoration and enhancement measures included in the landscaping plan will be designed to achieve no net loss of vegetation area, attributes or function as a result of this project. An array of restoration and enhancement techniques will be identified including establishing new sites, seeding, planting (plugs and seedlings), transplanting (sod and woody plants) or stripping of topsoil that includes only native species present within the Recommended Plan. Appropriate locations for removal of invasive exotic plant species through the use 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 within the Recommended Plan. • Vegetation removals in specified areas should be conducted from November 1 to March 31 to allow the vascular plants to finish their reproductive cycle prior to removal, and minimize disturbances. Restoration activities, such as transplanting, should occur at the start (April/May) and end (September/October) of the growing season. • Native prairie seed mixes, plugs, sod or woody plants will be used, where appropriate. No exotic or invasive species should be allowed within the seed mix, and multiple seed mixes will be used with a composition to emulate significant local vegetation communities. • Opportunities 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 will be sought. • Alternative management practices to minimize the exposure in areas of sensitive plants and communities to salt damage should be identified for specified areas. Salt-tolerant vegetation species will be planted in areas that will experience notable salt exposure and the landscaping plans will also include maintaining a sufficient buffer in areas to reduce the potential for salt spray deposition on sensitive

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
			vegetation communities and species at risk habitat. *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, using a Quantitative Photomonitoring Technique, should occur to ensure successful plant establishment and reproduction. • 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.
6.6	MOLLUSCS AND INSECTS	DFO/EC/ MNR/MTO/ ERCA	The only regulated mollusc or insect species known to occur in the Recommended Plan is the Monarch. The following mitigation measures can be employed to address impacts to Monarchs as a result of the construction and operation of the Recommended Plan. • Impacts to Monarchs cannot be avoided entirely given the magnitude and nature of the proposed works, 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. 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. • 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. • Vegetation removals in specified areas should not occur during the growing season (April 1 to October 31) so that the core summer period of Monarch feeding upon host plants will not be affected. 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 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. No follow-up or monitoring programs specific to Monarchs are recommended.
6.7	FISH AND FISH HABITAT	DFO/MTO/ MNR/ERCA	Effects to fish and fish habitat include the following. • The construction of submerged culverts at Cahill and Lennon Drains may cause barriers to fish passage that will be permanent in nature. • 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 two new crossings. Physical destruction may occur at five watercourses/drains where realignment may be required. Although occurring within the construction phase of the project,

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
			these effects will be permanent. • Effects to Water Quality and Quantity: The Recommended Plan will increase the overall impervious area and traffic 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. The following mitigation measures can be employed to avoid or reduce impacts of the construction and operation of the Recommended Plan. Permanent loss of 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 during operations. Fish passage systems (mechanical or manual) should be designed and operated at Cahill and Lennon Drains to provide safe fish passage across The Windsor-Essex Parkway, which bypass the submerged culverts. 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., 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 should be considered. Any consideration for such project funding 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 to Water Quality and Quantity: Stormwater runoff from the within the existing study area of The Windsor-Essex Parkway does not currently receive quality or quantity treatment. 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% 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. 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 plaza. In addition, deck drains are not proposed on the crossing and runoff will be collected for quality treatment prior to discharging to the river. • 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.

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
			• Stormwater quality control that will be provided with the Recommended Plan will lead to an overall enhancement to water quality and a net benefit to fisheries. Construction related impacts of building of 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 storm water 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 storm water through the development and implementation of a storm water 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. Impacts as a result of operations phase for the Recommended Plan on fish and fish habitat can be mitigated by the following: • Changes to water quality and quantity: in general, storm water management throughout the project area will improve water quality and quantity (through attenuation of peak run-off flows) over what exists currently. Run-off from the crossing will be collected and conveyed to stormwater detention facilities for treatment. No deck drains will be provided on the bridge. • Alterations to baseflow: a storm water management plan should be developed and implemented to ensure that reductions in baseflow do not occur. • Changes to water temperature: a storm water 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 (mechanical or manual lift) should be designed and operated at Cahill and Lennon Drains to provide safe fish passage across The Windsor-Essex Parkway which bypass the submerged culverts.

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
			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 the fish passage systems, if constructed, should be monitored for at least two years after construction to ensure that they are functioning properly. If a manual passage system is employed, the potential for fish passage through the submerged culverts should be monitored. The target species for passage is Northern Pike. During spring migration (March/April), fish should be captured downstream of The Windsor-Essex Parkway. These fish should be marked in some way such that their passage upstream, either within the fish passage systems or through the submerged culverts, can be monitored. Assessing their passage can be done by mark-recapture (fish is tagged, fin clipped) or radio-telemetry (transmitters inserted in fish and their progress followed via a radio receiver). 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.
6.8	WILDLIFE AND WILDLIFE HABITAT	EC/MNR/ MTO/ERCA	Extensive efforts have been made to avoid and minimize impacts to sensitive snake populations including refinements to the alignments of The Windsor-Essex Parkway. 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 Windsor-Essex Parkway. • 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 rescue/relocation will be carried out prior to clearing/grubbing and during construction to reduce the risk of wildlife mortality. • Restoration and enhancement of habitat located along The Windsor-Essex Parkway will be used at strategic locations to reconnect significant wildlife habitat located on both sides of The Windsor-Essex Parkway. • 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 following mitigation measures can be employed to address impacts to wildlife 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.

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
			• A 30 m setback should be maintained from the Detroit River to inspection facilities. The 30 m setback should be enhanced with a vegetative buffer to screen the plaza from view, to promote wildlife passage along a naturalized shoreline and to reduce the potential for erosion to occur. • Lighting used at the inspection plaza should be focused downwards and shielded where necessary to prevent light spillage into nearby natural areas such as the Black Oak Woods. • Wildlife rescue/relocation should be performed on-site prior to vegetation removals. Vegetation removals should be conducted from November 1 to March 31 to avoid disturbance to species at risk and migratory birds. *Monitoring Activities* • To avoid impacts to species at risk, migratory birds and their habitats, vegetation removals in specified areas should occur from November 1 to March 31. • Work on existing bridges/culverts should occur outside of the breeding season of migratory birds, otherwise structures will be enclosed to prevent migratory birds from nesting on the structures. • A migratory bird survey should be conducted for the location of the crossing and should include mobile radar surveys in association with acoustical recordings and direct observations during peak spring and fall migration periods. • Compliance monitoring should be conducted during construction to avoid the incidental take of migratory birds. If bridge construction activities occur during the nesting season, a qualified avian biologist should be retained on site to conduct frequent nesting surveys. • Effects monitoring should be conducted once the bridge is operational to determine the impacts of the crossing on bird mortality and the effectiveness of mitigation measures.
6.9	SPECIES AT RISK	EC/DFO/ MNR/MTO/ DFO/ERCA	Extensive efforts have been made to avoid and minimize impacts to species at risk populations including refinements to the alignments of The Windsor-Essex Parkway. The following mitigation measures can be employed to address impacts to species at risk and their critical habitat. • Areas of habitat to be retained will be clearly marked in the field and protected from construction activities. • Wildlife rescue/relocation will be carried out prior to clearing/grubbing and during construction to reduce the risk of species at risk mortality. • 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. • 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. • Butler's gartersnake and eastern foxsnake will be captured and relocated prior to construction to avoid mortality. • Restoration and enhancement of habitat located along The Windsor-Essex Parkway will be used at strategic locations to reconnect significant wildlife habitat located on both sides of The Windsor-Essex Parkway.

TABLE 13.
SUMMARY OF EFFECTS AND MITIGATION

ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
			• To avoid impacts to species at risk and their critical habitat, vegetation removals in specified areas should occur from November 1 to March 31. • Salvage opportunities for plant species at risk will be explored including transplanting of live plant material, the collection and broadcasting of seeds, and the stripping, relocation and placement of sod. • Restoration and enhancement measures included in the landscaping plan will be designed to achieve no net loss of vegetation area, attributes or function as a result of this project. An array of restoration and enhancement techniques will be identified including seeding, planting (plugs and seedlings), transplanting (sod) or stripping of topsoil that includes only native species present within the Recommended Plan. Appropriate locations for removal of invasive exotic plant species through the use 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 within the Recommended Plan. • Opportunities 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 will be sought. *Monitoring Activities* • The effects of The Windsor-Essex Parkway's proximity to the remaining Butler's gartersnake population and their hibernacula should be monitored. • Monitoring could be a continuous process and a strategy should be developed to ensure permanent protection of the Butler's gartersnake 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. • Permits under SARA and ESA, 2007 will need to be obtained during future design stages. Detailed mitigation strategies will be developed in order to obtain the permits. • 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, using a Quantitative Photomonitoring Technique, should occur to ensure successful plant establishment and reproduction. Species-specific post-construction monitoring and management should also be conducted for each of the plant species at risk. • 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. • Ongoing discussions with organizations such as ERCA, MNR, CWS and WIFN should occur during later design stages. Mitigation strategies should be developed in consultation with WIFN

TABLE 13.
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ID #	Environmental Element/Concern and Potential Impact	Concerned Agencies	Summary of Environmental Effects and Mitigation
6.10	DESIGNATED NATURAL AREAS	PC/MNR/ MTO/ERCA/ Municipalities	The landscaping plan prepared for the Recommended Plan identifies approximately 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. As a result, a net gain in the extent of designated natural areas with important ecological functions will result from the Recommended Plan. • 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. *Monitoring Activities* Monitoring requirements are similar to those identified for vegetation and wildlife.

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APPENDICES

APPENDIX A.
LOCATION AND LIST OF VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

Vegetation Communities

CUM1-1	Dry-Moist Old Field Meadow Type
CUP1-3	Red Oak Deciduous Plantation Type
CUP3	Coniferous Plantations
CUP3-3	Scotch Pine Coniferous Plantation Type
CUS1	Mineral Cultural Savannah Ecosite
CUS1-1	Hawthorn Cultural Savannah Type
CUT1	Mineral Cultural Thicket Ecosite
CUT1-4	Gray Dogwood Cultural Thicket Type
CUW1	Mineral Cultural Woodland Ecosite
FOD1-3	Dry-Fresh Black Oak Deciduous Forest Type
FOD1-4	Dry-Fresh Mixed Oak Deciduous Forest Type
FOD2-2	Dry-Fresh Oak-Hickory Deciduous Forest Type
FOD4	Dry-Fresh Deciduous Forest Ecosite
FOD7-1	Fresh-Moist White Elm Lowland Deciduous Forest Type
FOD7-2	Fresh-Moist Ash Lowland Deciduous Forest Type
FOD7-3	Fresh-Moist Willow Lowland Deciduous Forest Type
FOD7-4	Fresh-Moist Black Walnut Lowland Deciduous Forest Type
FOD8	Fresh-Moist Poplar-Sassafras Deciduous Forest Ecosite
FOD8-1	Fresh-Moist Poplar Deciduous Forest Type
FOD8-2	Fresh-Moist Sassafras Deciduous Forest Type
FOD9	Fresh-Moist Oak-Maple-Hickory Deciduous Forest Ecosite
MAM2	Mineral Meadow Marsh Ecosite
MAM2-10	Bluejoint Mineral Meadow Marsh Type
MAS2-1	Cattail Mineral Shallow Marsh Type
OAO	Open Aquatic
SWD1-3	Pin Oak Deciduous Swamp Type
SWD3-3	Swamp Maple Mineral Deciduous Swamp Type
TPO2-1	Fresh-Moist Tallgrass Prairie Type
TPS3-1	Fresh-Moist Pin Oak-Bur Oak Tallgrass Savannah Type
TPW2-1	Fresh-Moist Black Oak-White Oak Tallgrass Woodland Type
TPW2-2	Fresh-Moist Pin Oak Tallgrass Woodland Type

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Vegetation Community Boundary

Vegetation Community Quality/Conservation Priority

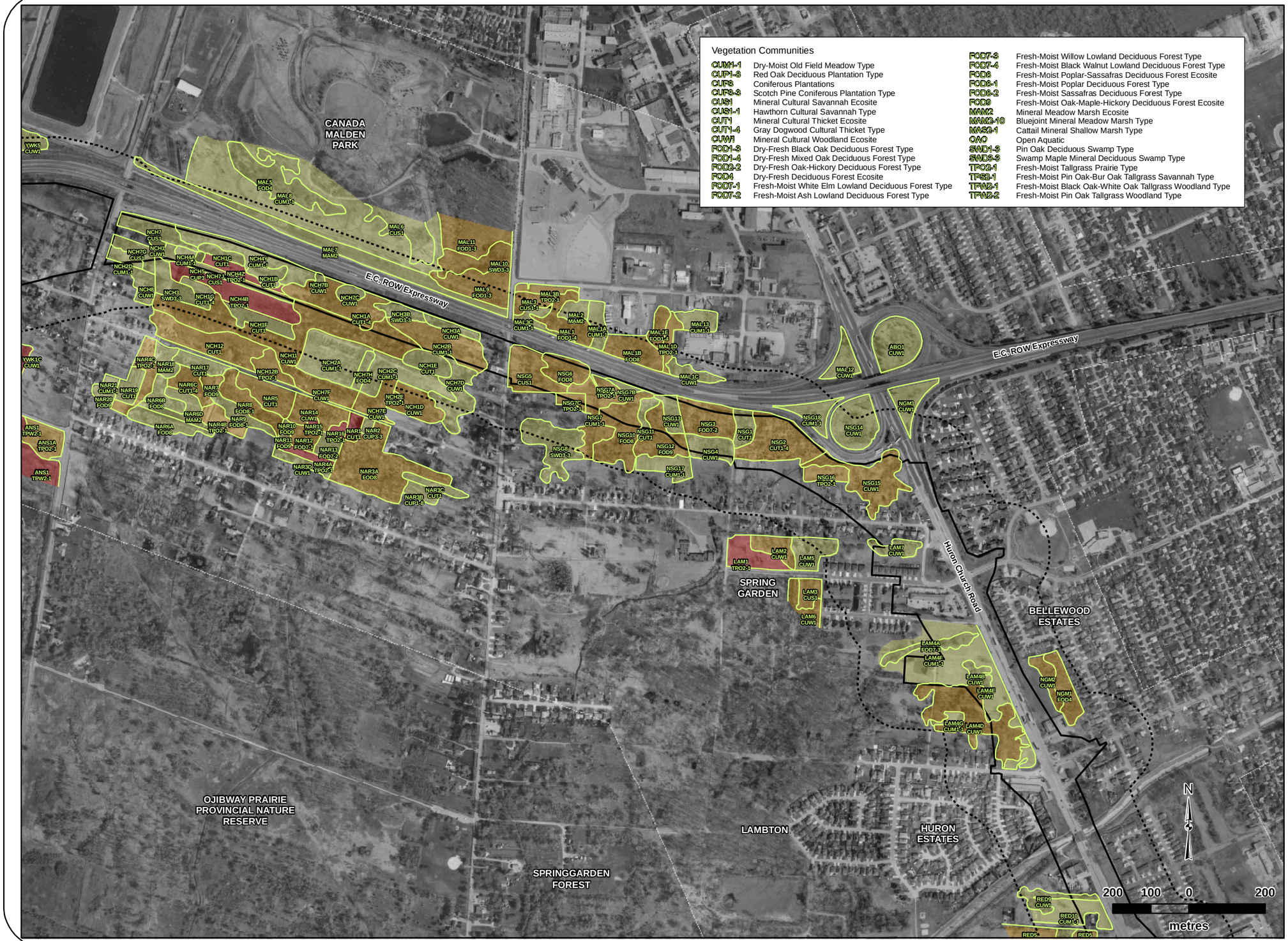
- High Quality/Protection
- Moderate Quality/Enhancement
- Low Quality/Restoration

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

ELC VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Aa
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK



Vegetation Communities

CUM1-1	Dry-Moist Old Field Meadow Type
CUP1-3	Red Oak Deciduous Plantation Type
CUP3	Coniferous Plantations
CUP3-3	Scotch Pine Coniferous Plantation Type
CUS1	Mineral Cultural Savannah Ecosite
CUS1-1	Hawthorn Cultural Savannah Type
CUT1	Mineral Cultural Thicket Ecosite
CUT1-4	Gray Dogwood Cultural Thicket Type
CUW1	Mineral Cultural Woodland Ecosite
FOD1-3	Dry-Fresh Black Oak Deciduous Forest Type
FOD1-4	Dry-Fresh Mixed Oak Deciduous Forest Type
FOD2-2	Dry-Fresh Oak-Hickory Deciduous Forest Type
FOD4	Dry-Fresh Deciduous Forest Ecosite
FOD7-1	Fresh-Moist White Elm Lowland Deciduous Forest Type
FOD7-2	Fresh-Moist Ash Lowland Deciduous Forest Type
FOD7-3	Fresh-Moist Willow Lowland Deciduous Forest Type
FOD7-4	Fresh-Moist Black Walnut Lowland Deciduous Forest Type
FOD8	Fresh-Moist Poplar-Sassafras Deciduous Forest Ecosite
FOD8-1	Fresh-Moist Poplar Deciduous Forest Type
FOD8-2	Fresh-Moist Sassafras Deciduous Forest Type
FOD9	Fresh-Moist Oak-Maple-Hickory Deciduous Forest Ecosite
MAM2	Mineral Meadow Marsh Ecosite
MAM2-10	Bluejoint Mineral Meadow Marsh Type
MAS2-1	Cattail Mineral Shallow Marsh Type
OAO	Open Aquatic
SWD1-3	Pin Oak Deciduous Swamp Type
SWD3-3	Swamp Maple Mineral Deciduous Swamp Type
TPO2-1	Fresh-Moist Tallgrass Prairie Type
TPS2-1	Fresh-Moist Pin Oak-Bur Oak Tallgrass Savannah Type
TPW2-1	Fresh-Moist Black Oak-White Oak Tallgrass Woodland Type
TPW2-2	Fresh-Moist Pin Oak Tallgrass Woodland Type

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Vegetation Community Boundary

Vegetation Community Quality/Conservation Priority

- High Quality/Protection
- Moderate Quality/Enhancement
- Low Quality/Restoration

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

ELC VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Ab
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

Vegetation Communities

CUM1-1	Dry-Moist Old Field Meadow Type	FOD7-3	Fresh-Moist Willow Lowland Deciduous Forest Type
CUP1-3	Red Oak Deciduous Plantation Type	FOD7-4	Fresh-Moist Black Walnut Lowland Deciduous Forest Type
CUP3	Coniferous Plantations	FOD8	Fresh-Moist Poplar-Sassafras Deciduous Forest Ecosite
CUP3-3	Scotch Pine Coniferous Plantation Type	FOD8-1	Fresh-Moist Poplar Deciduous Forest Type
CUS1	Mineral Cultural Savannah Ecosite	FOD8-2	Fresh-Moist Sassafras Deciduous Forest Type
CUS1-1	Hawthorn Cultural Savannah Type	FOD9	Fresh-Moist Oak-Maple-Hickory Deciduous Forest Ecosite
CUT1	Mineral Cultural Thicket Ecosite	MAM2	Mineral Meadow Marsh Ecosite
CUT1-4	Gray Dogwood Cultural Thicket Type	MAM2-10	Bluejoint Mineral Meadow Marsh Type
CUW1	Mineral Cultural Woodland Ecosite	MAS2-1	Cattail Mineral Shallow Marsh Type
FOD1-3	Dry-Fresh Black Oak Deciduous Forest Type	OAO	Open Aquatic
FOD1-4	Dry-Fresh Mixed Oak Deciduous Forest Type	SWD1-3	Pin Oak Deciduous Swamp Type
FOD2-2	Dry-Fresh Oak-Hickory Deciduous Forest Type	SWD3-3	Swamp Maple Mineral Deciduous Swamp Type
FOD4	Dry-Fresh Deciduous Forest Ecosite	TPO2-1	Fresh-Moist Tallgrass Prairie Type
FOD7-1	Fresh-Moist White Elm Lowland Deciduous Forest Type	TPS2-1	Fresh-Moist Pin Oak-Bur Oak Tallgrass Savannah Type
FOD7-2	Fresh-Moist Ash Lowland Deciduous Forest Type	TPW2-1	Fresh-Moist Black Oak-White Oak Tallgrass Woodland Type
		TPW2-2	Fresh-Moist Pin Oak Tallgrass Woodland Type

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Vegetation Community Boundary

Vegetation Community Quality/Conservation Priority

- High Quality/Protection
- Moderate Quality/Enhancement
- Low Quality/Restoration

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

ELC VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Dc
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

Vegetation Communities

CUM1-1	Dry-Moist Old Field Meadow Type
CUP1-3	Red Oak Deciduous Plantation Type
CUP3	Coniferous Plantations
CUP3-3	Scotch Pine Coniferous Plantation Type
CUS1	Mineral Cultural Savannah Ecosite
CUS1-1	Hawthorn Cultural Savannah Type
CUT1	Mineral Cultural Thicket Ecosite
CUT1-4	Gray Dogwood Cultural Thicket Type
CUW1	Mineral Cultural Woodland Ecosite
FOD1-3	Dry-Fresh Black Oak Deciduous Forest Type
FOD1-4	Dry-Fresh Mixed Oak Deciduous Forest Type
FOD2-2	Dry-Fresh Oak-Hickory Deciduous Forest Type
FOD4	Dry-Fresh Deciduous Forest Ecosite
FOD7-1	Fresh-Moist White Elm Lowland Deciduous Forest Type
FOD7-2	Fresh-Moist Ash Lowland Deciduous Forest Type
FOD7-3	Fresh-Moist Willow Lowland Deciduous Forest Type
FOD7-4	Fresh-Moist Black Walnut Lowland Deciduous Forest Type
FOD8	Fresh-Moist Poplar-Sassafras Deciduous Forest Ecosite
FOD8-1	Fresh-Moist Poplar Deciduous Forest Type
FOD8-2	Fresh-Moist Sassafras Deciduous Forest Type
FOD9	Fresh-Moist Oak-Maple-Hickory Deciduous Forest Ecosite
MAM2	Mineral Meadow Marsh Ecosite
MAM2-10	Bluejoint Mineral Meadow Marsh Type
MAS2-1	Cattail Mineral Shallow Marsh Type
OAO	Open Aquatic
SWD1-3	Pin Oak Deciduous Swamp Type
SWD3-3	Swamp Maple Mineral Deciduous Swamp Type
TPO2-1	Fresh-Moist Tallgrass Prairie Type
TPS2-1	Fresh-Moist Pin Oak-Bur Oak Tallgrass Savannah Type
TPW2-1	Fresh-Moist Black Oak-White Oak Tallgrass Woodland Type
TPW2-2	Fresh-Moist Pin Oak Tallgrass Woodland Type

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Vegetation Community Boundary

Vegetation Community Quality/Conservation Priority

- High Quality/Protection
- Moderate Quality/Enhancement
- Low Quality/Restoration

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

ELC VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Ad
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
Terrestrial-Natural/Semi-Natural				
TPO	OPEN TALL-GRASS PRAIRIE			
TPO2-1	Fresh - Moist Tallgrass Prairie	Canopy: Eastern cottonwood (*Populus deltoides* ssp. *deltoides*) is dominant. Understorey: Silky dogwood (*Cornus amomum* ssp. *obliqua*) is dominant with gray dogwood (*Cornus foemina* ssp. *racemosa*) and multiflora rose (*Rosa multiflora*) as associates. Ground Cover: Big bluestem (*Andropogon gerardii*), Canadian tick-trefoil (*Desmodium canadense*), common reed (*Phragmites australis*), gray goldenrod (*Solidago nemoralis* ssp. *nemoralis*), gray-headed coneflower (*Ratibida pinnata*), Indian grass (*Sorghastrum nutans*), ironweed (*Vernonia gigantea*), little bluestem (*Schizachyrium scoparium*), switch grass (*Panicum virgatum*), Virginia broom-sedge (*Andropogon virginicus*), Virginia mountain-mint (*Pycnanthemum virginianum*), wild bergamot (*Monarda fistulosa*) and wild carrot (*Daucus carota*) are abundant with occasional blood-red milkwort (*Polygala sanguinea*), butterfly-weed (*Asclepias tuberosa*), calico aster (*Aster lateriflorus* var. *lateriflorus*), Canada bluegrass (*Poa compressa*), Canada goldenrod (*Solidago canadensis*), colic-root (*Aletris farinosa*), cut-leaved water-horehound (*Lycopus americanus*), early goldenrod (*Solidago juncea*), field thistle (*Cirsium discolor*), flowering spurge (*Euphorbia corollata*), Kentucky bluegrass (*Poa pratensis* ssp. *pratensis*), large purple agalinis (*Agalinis purpurea*), New England aster (*Aster novae-angliae*), orchard grass (*Dactylis glomerata*), prickly raspberry (*Rubus flagellaris*), rough goldenrod (*Solidago rugosa* ssp. *rugosa*), rough-headed bush-clover (*Lespedeza capitata*), slender-leaved agalinis (*Agalinis tenuifolia* var. *macrophylla*), smooth blue aster (*Aster laevis* var. *laevis*), dense blazing star (*Liatris spicata*), stiff-leaved goldenrod (*Solidago rigida* ssp. *rigida*), swamp milkweed (*Asclepias incarnata* ssp. *incarnata*), tall cord grass (*Spartina pectinata*), tall fescue (*Festuca arundinacea*), tall goldenrod (*Solidago altissima* var. *altissima*), tall tickseed (*Coreopsis tripteris*), tall wild sunflower (*Helianthus giganteus*), Virginia culver's root (*Veronicastrum virginicum*), white heath aster (*Aster ericoides* ssp. *ericoides*), and wing-angled loosestrife (*Lythrum alatum*).	- Tree cover <= 25%; shrub cover <= 25%. - Subject to seasonal extremes in moisture conditions; spring flooding and summer drought (TPO). - Dominated by Prairie graminoids and forbs (2-1). - Pioneer community resulting from, or maintained by, frequent disturbance by fire.	ANS1A, BBA4EC, BBA4MB, ESA1, LAM1, MAL1D, MAL3B, NAR4A, NAR4B, NAR4C, NAR15, NAR16, NCH2E, NCH4B, NCH4Z, NCH12B, NSG7A, NSG7C, NSG16, OAK3, OAK4, RED5, RED12, YWK1B

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
TPS	TALL-GRASS SAVANNAH			
TPS2-1	Fresh - Moist Pin Oak - Bur Oak Tallgrass Savannah	Canopy: Pin oak (*Quercus palustris*) and bur oak (*Quercus macrocarpa*) are co-dominant with American elm (*Ulmus americana*), eastern cottonwood, red ash (*Fraxinus pennsylvanica*) and shagbark hickory (*Carya ovata* var. *ovata*) as associates. Understorey: American hazel (*Corylus americana*), black ash (*Fraxinus nigra*), black locust (*Robinia pseudo-acacia*), common buckthorn (*Rhamnus cathartica*), Drummond's dogwood (*Cornus drummondii*), gray dogwood, Manitoba maple (*Acer negundo*), red ash, staghorn sumac (*Rhus typhina*) and Tartarian honeysuckle (*Lonicera tatarica*). Ground Cover: Common dandelion (*Taraxacum officinale*), eastern cottonwood, gray goldenrod, Pennsylvania sedge (*Carex pensylvanica*), scarlet strawberry (*Fragaria virginiana* ssp. *virginiana*), spotted crane's bill (*Geranium maculatum*), tall tickseed, yellow avens (*Geum aleppicum*) and yellow trout lily (*Erythronium americanum* ssp. *americanum*).	- 25% < Tree Cover <= 35% with prairie graminoids and forbs in the Ground Cover (TPS). - Seasonal flooding followed by summer drought. - Fresh - Moist conditions, dominated by Pin Oak and Bur Oak (2-1). - Young Community.	ESA5
TPW	TALL-GRASS WOODLAND			
TPW2-1	Fresh - Moist Black Oak - White Oak Tallgrass Woodland	Canopy: Black oak (*Quercus velutina*) and pin oak are dominant with black cherry (*Prunus serotina*), eastern cottonwood, freeman's maple (*Acer X freemanii*) and white oak (*Quercus alba*) as associates. Understorey: Black cherry is dominant with American hazel, gray dogwood, prairie rose (*Rosa setigera*), riverbank grape (*Vitis riparia*), sassafras (*Sassafras albidum*), staghorn sumac, thimble-berry (*Rubus occidentalis*) and white mulberry (*Morus alba*) as associates. Ground Cover: Eastern bracken-fern (*Pteridium aquilinum* var. *latiusculum*), four-flowered loosestrife (*Lysimachia quadriflora*), glaucous white rattlesnake-root (*Prenanthes racemosa* ssp. *racemosa*), many-flowered agrimony (*Agrimony parviflora*), orchard grass, spotted crane's bill and swamp white oak (*Quercus bicolor*).	- 35% < Tree Cover <= 60% with prairie graminoids and forbs in the Ground Cover (TPS). - Seasonal flooding followed by summer drought. - Fresh - Moist conditions, dominated by Black Oak and White Oak (2-1). - Mid-age to Mature Community.	ANS1, ANS2C
TPW2-2	Fresh - Moist Pin Oak Tallgrass Woodland	Canopy: Pin oak is dominant with black cherry and freeman's maple as associates. Understorey: Black cherry is dominant with American hazel, gray dogwood, prairie rose, riverbank grape, sassafras, staghorn sumac, thimble-berry and white mulberry as associates. Ground Cover: Eastern bracken-fern, many-flowered agrimony, orchard grass, spotted crane's bill and swamp white oak.	- 35% < Tree Cover <= 60% with prairie graminoids and forbs in the Ground Cover (TPS). - Seasonal flooding followed by summer drought. - Fresh - Moist conditions, dominated by Pin Oak (2-2). - Mid-age to Mature Community.	ANS2

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
FOD	DECIDUOUS FOREST			
FOD1-3	Dry - Fresh Black Oak Deciduous Forest	Canopy: Black oak, pin oak, freeman's maple and eastern cottonwood are dominant with American elm, black cherry and swamp white oak as associates. Subcanopy: American elm, black oak, black cherry and red maple (*Acer rubrum*). Understorey: Black cherry and common reed are co-dominant with American hazel, gray dogwood, narrow-leaved crabapple (*Malus coronaria*), red ash and sassafras as associates. Ground Layer: Common reed, eastern bracken-fern (*Pteridium aquilinum* var. *latiusculum*), inserted Virginia-creeper (*Parthenocissus inserta*), Pennsylvania sedge and riverbank grape are dominant with garlic mustard (*Alliaria petiolata*), spotted crane's bill and wood anemone (*Anemone quinquefolia* var. *quinquefolia*) as associates.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Black Oak is dominant (1-3). - Sand and loam soils with rapid drainage in upper to middle slope positions (Dry-Fresh). - Mature Community.	MAL9, MAL11, YWK2
FOD1-4	Dry - Fresh Mixed Oak Deciduous Forest	Canopy: Black oak and white oak are dominant with eastern cottonwood, pin oak and swamp white oak as associates. Subcanopy: Black oak and pin oak are dominant with abundant black cherry. Understorey: American hazel and gray dogwood are co-dominant. Ground Layer: Canada goldenrod, common reed, eastern bracken-fern, inserted Virginia-creeper, interrupted fern (*Osmunda claytoniana*), rose twisted-stalk (*Streptopus roseus*), Royal fern (*Osmunda regalis*) and spotted crane's bill are dominant.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - More than two Oak species are dominant (1-4). - Sand and loam soils with rapid drainage in upper to middle slope positions (Dry-Fresh). - Mid-age to Mature Community.	MAL1, MAL1E
FOD2-2	Dry - Fresh Oak - Hickory Deciduous Forest	Canopy: Black oak, swamp white oak and shagbark hickory are dominant with bur oak, pin oak, red oak (*Quercus rubra*), freeman's maple and white oak as associates. Subcanopy: Black cherry and freeman's maple are co-dominant. Understorey: Black cherry and choke cherry (*Prunus virginiana* ssp. *virginiana*) are co-dominant with American elm and red ash as associates. Ground Layer: Garlic mustard, large-leaved aster (*Aster macrophyllus*), spotted crane's bill and yellowish enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*) are dominant with common blackberry (*Rubus allegheniensis*), inserted Virginia-creeper, Pennsylvania sedge, western poison-ivy (*Rhus rydbergii*), wild red raspberry (*Rubus idaeus* ssp. *melanolasius*) and yellow trout lily as associates.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Oak and Hickory are dominant (2-2). - Sand and loam soils with rapid drainage in upper to middle slope positions (Dry-Fresh). - Mature Community.	ESA2

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
FOD4	Dry - Fresh Deciduous Forest	Canopy: Manitoba maple, black locust and eastern cottonwood are dominant with black cherry, freeman's maple, American elm and black walnut (*Juglans nigra*) as associates. Subcanopy: Black cherry, Manitoba maple and white mulberry. Understorey: Manitoba maple is dominant with abundant black cherry, prairie rose, Tartarian honeysuckle and white mulberry with some gray dogwood, poison-ivy (*Rhus radicans*), red ash, riverbank grape, smooth sumac (*Rhus glabra*), staghorn sumac and freeman's maple. Ground Layer: Garlic mustard is dominant with common dandelion (*Taraxacum officinale*), cleavers (*Galium aparine*) and inserted Virginia-creeper.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Tree species associations that are either relatively uncommon or a result of disturbance or management (4). - Sand and loam soils with rapid drainage in upper to middle slope positions (Dry-Fresh). - Young Community.	BBA1A, BBA7,BBA8, BBA12, BBBA14, MAL5, NCH7H, NGM1
FOD7-1	Fresh - Moist White Elm Lowland Deciduous Forest	Canopy: American elm is dominant with abundant standing snags of red ash with some black cherry, eastern cottonwood, pin oak and swamp white oak. Subcanopy: American elm, pin oak and swamp white oak are dominant. Understorey: Gray dogwood is dominant with American hazel, choke cherry, prairie rose and Tartarian honeysuckle as associates. Ground Layer: Common dandelion, inserted Virginia-creeper, Manitoba maple, marsh bedstraw (*Galium palustre*), marsh fern (*Thelypteris palustris* var. *pubescens*) and Sensitive fern.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Lowland deciduous forest (7), dominated by White Elm (-1). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Mid-age community.	NAR12
FOD7-2	Fresh - Moist Ash Lowland Deciduous Forest	Canopy: Red ash is dominant with American elm, eastern cottonwood, black cherry and red maple as associates. Subcanopy: American elm, black cherry, glossy buckthorn (*Rhamnus frangula*), Manitoba maple, pin oak and red ash. Understorey: Black walnut, common buckthorn, choke cherry, gray dogwood, multiflora rose, nannyberry (*Viburnum lentago*), prairie rose, red ash, staghorn sumac and Tartarian honeysuckle. Ground Layer: Common dandelion, inserted Virginia-creeper, Manitoba maple, wild parsnip (*Pastinaca sativa*) and yellowish enchanter's nightshade.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Lowland deciduous forest (7), dominated by Red Ash (-2). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Young to Mid-age Community.	NAR13, NSG3

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
FOD7-3	Fresh - Moist Willow Lowland Deciduous Forest	Canopy: Black willow (*Salix nigra*) is dominant with black cherry and Manitoba maple as associates. Subcanopy: Manitoba maple is dominant with black cherry, Drummond's dogwood, red ash and white mulberry as associates. Understorey: Common buckthorn, gray dogwood, and Tartarian honeysuckle are dominant with American elm, Black walnut, choke cherry, inserted Virginia-creeper, multiflora rose, nannyberry (*Viburnum lentago*), riverbank grape, prairie rose, red ash, red currant (*Ribes rubrum*) and staghorn sumac as associates. Ground Layer: Awnless brome (*Bromus inermis* ssp. *inermis*), Canada goldenrod, Canada thistle (*Cirsium arvense*), Common dandelion, inserted Virginia-creeper, Manitoba maple, orchard grass, upright yellow wood-sorrel (*Oxalis stricta*), wild parsnip (*Pastinaca sativa*) and yellowish enchanter's nightshade.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Lowland deciduous forest (7), dominated by Black Willow (-3). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Mature Community.	LAM4A
FOD7-4	Fresh - Moist Black Walnut Lowland Deciduous Forest	Canopy: Black walnut is dominant with American elm, black cherry, black locust, common hackberry (*Celtis occidentalis*), eastern cottonwood, Manitoba maple, silver poplar (*Populus alba*) and freeman's maple as associates. Subcanopy: Black cherry, black walnut, common hackberry, Manitoba maple and white mulberry. Understorey: Black cherry, gray dogwood and Manitoba maple are dominant with amur honeysuckle (*Lonicera maackii*), black locust, choke cherry, common elderberry (*Sambucus canadensis*), common hackberry, narrow-leaved crabapple, poison-ivy, prairie rose, riverbank grape, sassafras, freeman's maple, Tartarian honeysuckle, thimble-berry and tree-of-heaven as associates. Ground Layer: Garlic mustard, lily-of-the-valley and inserted Virginia-creeper are dominant with Canada anemone (*Anemone canadensis*), cleavers, common burdock (*Arctium minus* ssp. *minus*), common motherwort (*Leonurus cardiaca* ssp. *cardiaca*), hound's-tongue (*Cynoglossum officinale*), Philadelphia fleabane (*Erigeron philadelphicus* ssp. *philadelphicus*), riverbank grape, scarlet strawberry, star-flowered Solomon's seal (*Maianthemum stellatum*), upright yellow wood-sorrel, white avens (*Geum canadense*) and yellow avens as associates.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Lowland deciduous forest (7), dominated by Black Walnut (-4). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Mid-age Community.	BBA2, BBA13

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
FOD8	Fresh - Moist Poplar-Sassafras Deciduous Forest	Canopy: Eastern cottonwood is dominant with abundant pin oak and freeman's maple with some black cherry, black oak, red ash, red oak and white oak. Subcanopy: Manitoba maple and red ash are dominant with black cherry, black willow, peach-leaved willow (*Salix amygdaloides*), pin oak, sassafras, freeman's maple and white mulberry as associates. Understorey: Gray dogwood, black cherry and Manitoba maple are dominant with black willow, choke cherry, common buckthorn, Drummond's dogwood, nannyberry, red ash, sassafras and wild black currant (*Ribes americanum*) as associates. Ground Layer: Canada bluegrass, Canada goldenrod, common reed, garlic mustard, inserted Virginia-creeper, Pennsylvania sedge, riverbank grape, spotted crane's bill and yellowish enchanter's nightshade.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Dominated by Poplars and Sassafras (8). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Young to Mature Community.	MAL1B, NAR3A, NAR6A, NAR6B, NSG6, NSG10, OAK2
FOD8-1	Fresh - Moist Poplar Deciduous Forest	Canopy: Eastern cottonwood is dominant with American elm, Manitoba maple and trembling aspen (*Populus tremuloides*) as associates. Subcanopy: Gray dogwood and Manitoba maple are dominant. Understorey: American hazel, black cherry, choke cherry, common buckthorn, gray dogwood, Manitoba maple, prairie rose and red ash. Ground Layer: Common dandelion, inserted Virginia-creeper, old-field cinquefoil (*Potentilla simplex*), sensitive fern, yellow trout lily and yellowish enchanter's nightshade.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Dominated by Poplars (8-1). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Young Community.	HCL2, NAR8, NAR9
FOD8-2	Fresh - Moist Sassafras Deciduous Forest	Canopy: Sassafras is dominant with black cherry, eastern cottonwood and pin oak. Subcanopy: Black cherry and sassafras are dominant. Understorey: Black cherry, choke cherry, common buckthorn and sassafras. Ground Layer: Cleavers, inserted Virginia-creeper, rose twisted-stalk, sessile-leaved bellwort (*Uvularia sessilifolia*), spotted crane's bill, wild columbine (*Aquilegia canadensis*) and yellow trout lily.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Dominated by Sassafras (8-2). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Young Community.	HCL1A, HCL10

APPENDIX A.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES LOCATED IN THE AREA OF INVESTIGATION

ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
FOD9	Fresh - Moist Oak - Maple - Hickory Deciduous Forest	Canopy: Eastern cottonwood, pin oak and freeman's maple are dominant with black cherry, black oak and red oak. Subcanopy: American elm, black cherry, Manitoba maple, red ash and white mulberry. Understorey: American hazel, black cherry, gray dogwood and multiflora rose. Ground Layer: Inserted Virginia-creeper, Pennsylvania sedge, prickly raspberry, riverbank grape and yellowish enchanter's nightshade.	- Tree cover > 60 % (FO). - Deciduous trees > 75 % of canopy cover (D). - Dominated by Oak and Maple (9). - Sand, loam and clay soils that are poorly drained, in lower slope, mid slope, and bottomland positions (Fresh-Moist). - Young to Mid-age Community.	NAR7, NAR10, NAR11, NAR20, NSG12
Terrestrial/Cultural				
CUP	CULTURAL PLANTATION			
CUP1-8	Red Oak Deciduous Plantation	Canopy: Red oak is dominant with freeman's maple as a secondary. Subcanopy: Red Oak is dominant. Understorey: Gray dogwood and red ash are co-dominant. Ground Layer: Kentucky bluegrass, choke cherry and creeping Charlie (*Glechoma hederacea*) are dominant.	- Cultural communities (CU). - Planted tree cover > 60% (P). - Deciduous trees > 75% of canopy cover (1), dominated by Red Oak (-8). - Mid-age community.	NAR3B
CUP3	Coniferous Plantation	Canopy: Eastern white cedar (*Thuja occidentalis*) is dominant with eastern white pine (*Pinus strobus*) and red ash as associates. Understorey: Red ash and riverbank grape are co-dominant. Ground Cover: Field horsetail (*Equisetum arvense*) is dominant.	- Cultural communities (CU). - Planted tree cover > 60% (P). - Coniferous trees > 75% of canopy cover (3). - Young community.	NCH5
CUP3-3	Scotch Pine Coniferous Plantation	Canopy: Scotch pine (*Pinus sylvestris*) is dominant with Manitoba maple, black oak and eastern cottonwood as associates. Subcanopy: Black cherry, red ash and common crabapple (*Malus pumila*). Understorey: Red ash, American hazel and gray dogwood. Ground Cover: Field horsetail is dominant.	- Cultural communities (CU). - Planted tree cover > 60% (P). - Coniferous trees > 75% of canopy cover (3), dominated by Scotch Pine (-3). - Young community.	NAR2

APPENDIX A.
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ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
CUM	▪ CULTURAL MEADOW			
CUM1-1	Dry - Moist Old Field Meadow	Canopy: Wild carrot, common reed, tall goldenrod, orchard grass, Canada goldenrod, Kentucky bluegrass, Canada thistle, ribgrass (*Plantago lanceolata*), common St. John's-wort (*Hypericum perforatum*), common yarrow (*Achillea millefolium* ssp. *millefolium*), white heath aster white sweet-clover (*Melilotus alba*), wild bergamot, Canada bluegrass common motherwort (*Leonurus cardiaca* ssp. *cardiaca*), creeping Charlie, garlic mustard, awnless brome, common dandelion, field horsetail, ironweed, prickly raspberry, quack grass (*Elymus repens*), scarlet strawberry, sensitive fern (*Onoclea sensibilis*) and shepherd's purse (*Capsella bursa-pastoris*).	- Cultural communities (CU). - Tree cover and shrub cover < 25% (M). - Parent mineral material or mineral soils (1). - This community can occur on a wide range of soil moisture regimes (Dry-Moist) (-1). - Pioneer community resulting from, or maintained by, anthropogenic-based influences.	BBA3A, BBA4E, BBA4EB, BBA4F, BBA4G, BBA4H, BBA4I, BBA4J, BBA4K, BBA4M, BBA4S, BBA5, BBA7B, BBA8B, BBA16B, BBA17, BBA20, BBA22, HCL7, HCL9, HWY1, LAM4F, LAM4G, MAL1A, MAL3C, MAL8, MAL13, NAR21, NCH2A, NCH2B, NCH2C, NCH2D, NCH4A, NCH4Y, NSG7, NSG17, NSG18, OAK1A, RED2B, RED10, RED11, RED15, YWK3, YWK3A, YWK6, YWK8

APPENDIX A.
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ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
CUT	▪ CULTURAL THICKET			
CUT1	Mineral Cultural Thicket	Canopy: Eastern cottonwood, red ash, American elm, freeman's maple, Cockspur thorn (*Crataegus crus-galli*) and pin oak. Understorey: Gray dogwood, staghorn sumac, common buckthorn, Manitoba maple, red ash, riverbank grape, silky dogwood and Tartarian honeysuckle. Ground Cover: Scarlet strawberry, Canada goldenrod, common dandelion, garlic mustard and sensitive fern.	- Cultural communities (CU). - Tree cover <= 25%; shrub cover > 25% (T). - Parent mineral material or mineral soils (1). - Young community resulting from, or maintained by, anthropogenic-based influences.	ESA3, ESA4, HWY4, NAR1, NAR3C, NAR5, NAR17, NAR19, NCH1B, NCH1C, NCH1E, NCH1F, NCH12, NSG1, NSG11, RED3, RED13
CUT1-4	Gray Dogwood Cultural Thicket	Canopy: Eastern cottonwood, red ash, pin oak, American elm and freeman's maple. Understorey: Gray dogwood is dominant with staghorn sumac and Drummond's dogwood as associates. Ground Cover: Common reed, common cinquefoil (*Potentilla canadensis*) and wild carrot.	- Cultural communities (CU). - Tree cover <= 25%; shrub cover > 25% (T). - Parent mineral material or mineral soils (1), dominated by Gray Dogwood (-4). - Young community resulting from, or maintained by, anthropogenic-based influences.	BBA3, HCL3, HCL6, NAR6C, NCH1A, NCH1G, NSG2
CUS	CULTURAL SAVANNAH			
CUS1	Mineral Cultural Savannah	Canopy: Manitoba maple, black walnut, eastern cottonwood, freeman's maple, tree-of-heaven (*Ailanthus altissima*) and white mulberry. Understorey: Manitoba maple, Tartarian honeysuckle, Drummond's dogwood, gray dogwood, prairie rose, Siberian elm, American elm, red ash and staghorn sumac. Ground Cover: Orchard grass, wild carrot, common mullein (*Verbascum thapsus*), common reed, white clover (*Trifolium repens*), awnless brome, Canada goldenrod, catnip (*Nepeta cataria*), common heal-all, inserted Virginia-creeper, tall goldenrod and white heath aster.	- Cultural communities (CU). - 25% < Tree Cover <= 35% (S). - Parent mineral material or mineral soils (1). - Young community resulting from, or maintained by, anthropogenic-based influences.	BBA1, BBA1B, BBA4B, BBA4C, BBA4D, BBA4L, BBA4N, BBA4P, BBA4R, BBA18, BBA23, LAM3, MAL6, NCH7, NCH7G, NCH7J, NSG5

APPENDIX A.
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ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
CUS1-1	Hawthorn Mineral Cultural Savannah	Canopy: Eastern cottonwood is dominant with Manitoba maple, red ash and black locust as associates. Understorey: Staghorn sumac is dominant with gray dogwood, cockspur thorn and eastern cottonwood as associates. Ground Cover: Common reed and Kentucky bluegrass are co-dominant with tall fescue, white sweet-clover, tall goldenrod and Orchard grass as associates.	- Cultural communities (CU). - 25% < Tree Cover <= 35% (S). - Parent mineral material or mineral soils (1), dominated by hawthorn and a mixture of other woody plants. - Young community resulting from, or maintained by, anthropogenic-based influences.	MAL3

APPENDIX A.
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ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
CUW	CULTURAL WOODLAND			
CUW1	Mineral Cultural Woodland	Canopy: Eastern cottonwood, freeman's maple, Manitoba maple, red ash, American elm, black cherry, black locust, black oak, pin oak, Siberian elm, silver maple (*Acer saccharinum*), tree-of-heaven, weeping willow (*Salix X sepulcralis*) and white mulberry. Subcanopy: Manitoba maple, red ash, American elm, Drummond's dogwood, freeman's maple and white mulberry. Understorey: Black cherry, gray dogwood, white mulberry, common buckthorn, red ash, American elm, common crabapple, eastern red cedar, guelder rose (*Viburnum opulus*), Japanese barberry (*Berberis thunbergii*), Manitoba maple, multiflora rose, nannyberry (*Viburnum lentago*), prairie rose, riverbank grape, Siberian elm, silky dogwood, staghorn sumac, Tartarian honeysuckle and thimble-berry. Ground Cover: Garlic mustard, common reed, inserted Virginia-creeper, yellowish enchanter's nightshade, calico aster, Canada bluegrass, Canada goldenrod, common dandelion, Indian hemp (*Apocynum cannabinum* var. *cannabinum*), Kentucky bluegrass, many-flowered agrimony, old-field cinquefoil, orchard grass, scarlet strawberry, sensitive fern, spotted crane's-bill, tall goldenrod, tall hairy agrimony (*Agrimonia gryposepala*), wild carrot and yellow avens.	- Cultural communities (CU) - 35% < Tree Cover <= 60% (W). - Parent mineral material or mineral soils (1). - Young community resulting from, or maintained by, anthropogenic-based influences.	ABO1, BBA4A, BBA4JB, BBA5B, BBA6, BBA9, BBA16, HCL1, HWY2, LAM2, LAM4B, LAM4D, LAM4E, LAM5, LAM6, LAM7, MAL1C MAL12, , NAR3D, NAR14, NCH1, NCH1D, NCH3A, NCH7B, NCH7C, NCH7D, NCH7E, NCH7F, NCH8, NCH11, NGM2, NGM3, NSG4, NSG7B, NSG13, NSG14, NSG15, OAK1B, OAK2B, OAK2C, RED2A, RED9, YWK1, YWK1C, YWK4, YWK5

APPENDIX A.
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ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
Wetland				
SWD	DECIDUOUS SWAMP			
SWD1-3	Pin Oak Mineral Deciduous Swamp	Canopy: Pin oak is dominant with abundant eastern cottonwood with some American elm, big shellbark hickory, black cherry, black oak, bur oak, Manitoba maple, red ash, shumard oak (*Quercus shumardii*), freeman's maple, swamp white oak, trembling aspen and white oak. Subcanopy: Pin oak is dominant with American elm, Manitoba maple, red ash, freeman's maple and swamp white oak as associates. Understorey: American hazel, big shellbark hickory (*Carya laciniosa*), black cherry, choke cherry, common buckthorn, gray dogwood, Manitoba maple, narrow-leaved crabapple and red ash. Ground Cover: Eastern cottonwood seedlings, inserted Virginia-creeper, marsh fern, Pennsylvania sedge, prickly raspberry, sensitive fern, spotted crane's bill, western poison-ivy, wood anemone, yellowish enchanter's nightshade and yellow trout lily.	- Standing water >20% of ground coverage dominated by hydrophytic shrub and tree species (SW). - Tree cover > 25% with deciduous tree species > 75% of canopy cover (D). - Mineral soil (1). - Pin Oak is dominant (-3).	HCL5, RED2. RED4, RED8
SWD3-3	Freeman's Maple Mineral Deciduous Swamp	Canopy: Eastern cottonwood and freeman's maple are dominant with American basswood, American elm, black cherry, Manitoba maple, pin oak, red ash and trembling aspen as associates. Subcanopy: Swamp maple is dominant with American elm, Manitoba maple, pin oak and red ash as associates. Understorey: Red ash, silky dogwood and freeman's maple are dominant with Black cherry, common buckthorn, gray dogwood, guelder rose, Manitoba maple, Russian olive and staghorn sumac as associates. Ground Layer: Common reed, garlic mustard, inserted Virginia-creeper, riverbank grape, sensitive fern and wood anemone are dominant.	- Standing water >20% of ground coverage dominated by hydrophytic shrub and tree species (SW). - Tree cover > 25% with deciduous tree species > 75% of canopy cover (D). - Mineral soil (3). - Freeman's Maple is dominant (-3).	MAL10, NCH3, NCH3B, NSG8, OAK2A, RED6, RED7
MAM	MEADOW MARSH			
MAM2	Mineral Meadow Marsh	Canopy: Common reed is dominant with broad-leaved cattail (*Typha latifolia*), gray dogwood, Manitoba maple, narrow-leaved cattail (*Typha angustifolia*) and riverbank grape as associates. Ground Cover: Common barnyard grass (*Echinochloa crusgalli*), eastern cottonwood, hairy aster (*Aster pilosus* var. *pilosus*), Indian hemp, ironweed, Philadelphia fleabane, riverbank grape, small-spiked barnyard grass (*Echinochloa microstachya*), straw-colored umbrella sedge (*Cyperus strigosus*), tall goldenrod, Torrey's rush (*Juncus torreyi*), tree-of-heaven and white heath aster.	- Seasonally flooded and is dominated by emergent hydrophytic macrophytes (MAM). - Represents the wetland – terrestrial interface. - Tree and shrub cover <= 25%. - Mineral soil (2), dominated by common reed. - Community age pioneer.	BBA10, BBA19, BBA21, HCL4, MAL2, MAL7, NAR6D, NAR18, RED14, YWK7

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ELC Code	Vegetation Type	Species Association	Comments	LGL Polygon Reference
MAM2-10	Forb Mineral Meadow Marsh	Canopy: European beggar-ticks (*Bidens tripartita*) is dominant with abundant devil's beggar-ticks (*Bidens frondosa*), spotted touch-me-not (*Impatiens capensis*) and tumor-curing cocklebur (*Xanthium strumarium*) as associates.	- Seasonally flooded and is dominated by emergent hydrophytic macrophytes (MAM). - Represents the wetland – terrestrial interface. - Tree and shrub cover <= 25%. - Mineral soil (2), dominated by forbs (-10). Community age pioneer.	BBA15
MAS	SHALLOW MARSH			
MAS2-1	Cattail Mineral Shallow Marsh	Canopy: Narrow-leaved cattail is dominant with calico aster, Canada thistle, field sow-thistle (*Sonchus arvensis* ssp. *arvensis*), fowl meadow grass (*Poa palustris*), orchard grass and tumor-curing cocklebur as associates.	- Standing or flowing water for much of the growing season and hydrophytic emergent macrophyte cover >25 % (MAS). - Tree and shrub cover <= 25%. - Mineral soil (2). - Narrow-leaved Cattail is dominant (-1). - Community age pioneer.	HCL8, YWK9
OAO	OPEN AQUATIC			
OAO	Open Aquatic	Ground Cover: Not applicable	- No Macrophyte vegetation, trees, or shrub cover. - Water Depth > 2m	HWY3

APPENDIX B.

LIST OF VASCULAR PLANTS RECORDED IN THE AREA OF INVESTIGATION

APPENDIX B.
LIST OF VASCULAR PLANTS RECORDED IN THE AREA OF INVESTIGATION

	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	EQUISETACEAE	HORSETAIL FAMILY							
	Equisetum arvense	field horsetail			S5		0		0
	Equisetum hyemale ssp. *affine*	scouring-rush			S5		2		-2
	Equisetum laevigatum	smooth scouring-rush			S4		7		-3
	Equisetum pratense	meadow horsetail			S5		8		-3
	Equisetum variegatum ssp. *Variegatum*	variegated horsetail			S5		5		-3
	OPHIOGLOSSACEAE	ADDER'S TONGUE FAMILY							
	Botrychium dissectum	cut-leaved grape fern			S5		6		0
	OSMUNDACEAE	ROYAL FERN FAMILY							
	Osmunda claytoniana	interrupted fern			S5		7		-1
	Osmunda regalis var. *spectabilis*	royal fern			S5		7		-5
	DENNSTAEDTIACEAE	BRACKEN FERN FAMILY							
	Pteridium aquilinum var. *latiusculum*	eastern bracken-fern			S5		2		3
	THELYPTERIDACEAE	MARSH FERN							
	Thelypteris noveboracensis	New York fern			S4S5		7		-1
	Thelypteris palustris var. *pubescens*	marsh fern			S5		5		-4
	DRYOPTERIDACEAE	WOOD FERN FAMILY							
	Athyrium filix-femina var. *angustum*	northern lady fern			S5		4		0
	Dryopteris carthusiana	spinulose wood fern			S5		5		-2
	Matteuccia struthiopteris var. *pensylvanica*	ostrich fern			S5		5		-3
	Onoclea sensibilis	sensitive fern			S5		4		-3
	PINACEAE	PINE FAMILY							
*	*Picea abies*	Norway spruce			SE3		0	-1	5
	Picea glauca	white spruce			S5		6		3
*	*Picea pungens*	Colorado spruce			SE1		0		
*	*Pinus nigra*	Austrian pine			SE2		0	-1	-5
	Pinus rigida	pitch pine			S2S3		10		5
	Pinus strobus	eastern white pine			S5		4		3
*	*Pinus sylvestris*	scotch pine			SE5		0	-3	5
	CUPRESSACEAE	CEDAR FAMILY							
	Juniperus communis	common juniper			S5		4		3
	Juniperus virginiana	eastern red cedar			S5		4		3
	Thuja occidentalis	eastern white cedar			S5		4		-3
	TAXACEAE	YEW FAMILY							
*	*Taxus cuspidata*	Japanese yew					0		
	MAGNOLIACEAE	MAGNOLIA FAMILY							
*	*Magnolia soulangeana*	saucer magnolia			SE		0		
	LAURACEAE	LAUREL FAMILY							
	Sassafras albidum	sassafras			S4		6		3
	RANUNCULACEAE	BUTTERCUP FAMILY							
	Actaea pachypoda	white baneberry			S5		6		5

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Anemone americana	round-lobed hepatica			S5		6		5
	Anemone canadensis	Canada anemone			S5		3		-3
	Anemone cylindrica	thimbleweed			S4		7		5
	Anemone quinquefolia var. *quinquefolia*	wood anemone			S5		7		0
	Anemone virginiana var. *virginiana*	thimbleweed			S5		4		5
	Aquilegia canadensis	wild columbine			S5		5		1
	Clematis sp.								
	Ranunculus abortivus	kidney-leaf buttercup			S5		2		-2
*	*Ranunculus acris*	tall buttercup			SE5		0	-2	-2
	Ranunculus hispidus var. *caricetorum*	swamp buttercup			S5		5		-5
	Ranunculus recurvatus var. *recurvatus*	hooked buttercup			S5		4		-3
	Ranunculus sceleratus var. *sceleratus*	cursed buttercup			SU		2		-5
	Thalictrum dasycarpum	purple meadow-rue			S4?		8		-2
	Thalictrum dioicum	early meadow-rue			S5		5		2
	Thalictrum pubescens	tall meadow-rue			S5		5		-2
	Thalictrum revolutum	waxy meadow-rue			S2		9		0
	BERBERIDACEAE	BARBERRY FAMILY							
*	*Berberis thunbergii*	Japanese barberry			SE5		0	-3	4
*	*Berberis vulgaris*	common barberry			SE5		0	-2	3
	Podophyllum peltatum	may-apple			S5		5		3
	MENISPERMACEAE	MOONSEED FAMILY							
	Menispermum canadense	moonseed			S4		7		0
	PAPAVERACEAE	POPPY FAMILY							
*	*Chelidonium majus*	celandine			SE5		0	-3	5
	PLATANACEAE	PLANE-TREE FAMILY							
	Platanus occidentalis	sycamore			S4		8		-3
	HAMAMELIDACEAE	WITCH-HAZEL FAMILY							
	Hamamelis virginiana	witch-hazel			S5		6		3
	ULMACEAE	ELM FAMILY							
	Celtis occidentalis	common hackberry			S4		8		1
	Celtis tenuifolia	dwarf hackberry	THR	THR	S2	SARA(1), OESA(4)	10		5
	Ulmus americana	white elm			S5		3		-2
*	*Ulmus glabra*	Scotch elm			SE1		0		
*	*Ulmus pumila*	Siberian elm			SE3		0	-1	5
	Ulmus rubra	slippery elm			S5		6	6	0
	MORACEAE	MULBERRY FAMILY							
*	*Morus alba*	white mulberry			SE5		0	-3	0
	URTICACEAE	NETTLE FAMILY							
	Boehmeria cylindrica	false nettle			S5		4		-5
	Pilea pumila	dwarf clearweed			S5		5		-3
*	*Urtica dioica* ssp. *dioica*	European stinging nettle			SE2		0	-1	-1

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	JUGLANDACEAE	WALNUT FAMILY							
	Carya cordiformis	bitternut hickory			S5		6		0
	Carya glabra	pignut hickory			S3		9		3
	Carya laciniosa	big shellbark hickory			S3		9		-3
	Carya ovata var. *ovata*	shagbark hickory			S5		6		3
	Juglans ailantifolia	*Japanese walnut*							
	Juglans nigra	black walnut			S4		5		3
*	*Juglans regia*	English walnut			SE1		0	-1	5
	FAGACEAE	BEECH FAMILY							
	Castanea dentata	American chestnut	END	END	S3	SARA(1), OESA(3)	8		5
	Quercus alba	white oak			S5		6		3
	Quercus bicolor	swamp white oak			S4		8		-4
	Quercus macrocarpa	bur oak			S5		5		1
	Quercus palustris	pin oak			S3		9		-3
	Quercus rubra	red oak			S5		6		3
	Quercus shumardii	shumard oak	SC	SC	S3	SARA(3), OESA(5)	7		-5
	Quercus velutina	black oak			S4		8		5
	BETULACEAE	BIRCH FAMILY							
	Betula papyrifera	white birch			S5		2		2
*	*Betula pendula*	European weeping birch			SE4		0	-3	-4
	Carpinus caroliniana ssp. *virginiana*	blue beech			S5		6		0
	Corylus americana	American hazel			S5		5		4
	Corylus cornuta ssp. *cornuta*	beaked hazel			S5		5		5
	Ostrya virginiana	ironwood			S5		4		4
	PHYTOLACCACEAE	POKEWEED FAMILY							
	Phytolacca americana	pokeweed			S4		3		1
	NYCTAGINACEAE	FOUR-O-CLOCK FAMILY							
	Mirabilis nyctaginea	wild four-o'clock			S4		0		5
	CHENOPODIACEAE	GOOSEFOOT FAMILY							
*	*Chenopodium album* var. *album*	lamb's quarters			SE5		0	-1	1
*	*Salsola kali*	Russian thistle			SE1		0	-1	3
	Suaeda calceoliformis	western seablite			S2		0		-3
	CARYOPHYLLACEAE	PINK FAMILY							
*	*Cerastium semidecandrum*	small chickweed			SE5		-1		5
*	*Dianthus armeria*	deptford pink			SE5		0	-1	5
*	*Lychnis coronaria*	mullein pink			SE3		0		5
*	*Saponaria officinalis*	bouncing-bet			SE5		0	-3	3
*	*Silene latifolia*	bladder campion			SE5		0	-2	5
*	*Stellaria media*	common chickweed			SE5		0	-1	3
	POLYGONACEAE	SMARTWEED FAMILY							
*	*Polygonum convolvulus*	black bindweed			SE5		0	-1	1
*	*Polygonum cuspidatum*	Japanese knotweed			SE4		0	-1	3
*	*Polygonum hydropiper*	water-pepper			SE5		4		-5
	Polygonum lapathifolium	pale smartweed			S5		2		-4

APPENDIX B.
LIST OF VASCULAR PLANTS RECORDED IN THE AREA OF INVESTIGATION

	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Polygonum pensylvanicum	Pennsylvania smartweed			S5		3		-4
*	*Polygonum persicaria*	lady's-thumb			SE5		0	-1	-3
	Polygonum punctatum	water smartweed			S5		4		-5
	Polygonum scandens	climbing false buckwheat			S4S5		3		0
	Polygonum virginianum	Virginia knotweed			S4		6		0
*	*Rumex acetosella* ssp. *acetosella*	sheep sorrel			SE		0	-2	0
*	*Rumex crispus*	curly-leaf dock			SE5		0	-2	-1
	GUTTIFERAE	ST. JOHN'S-WORT FAMILY							
*	*Hypericum perforatum*	common St. John's-wort			SE5		0	-3	5
	Hypericum prolificum	shrubby St. John's-wort			S2		6		3
	Hypericum punctatum	corymbed St. John's-wort			S5		5		-1
	TILIACEAE	LINDEN FAMILY							
	Tilia americana	American basswood			S5		4		3
	MALVACEAE	MALLOW FAMILY							
*	*Abutilon theophrasti*	velvet-leaf			SE5		0	-1	4
*	*Hibiscus syriacus*	Rose-of-Shraon					0		
*	*Hibiscus trionum*	flower-of-an-hour			SE4		0	-1	5
*	*Malva neglecta*	cheeses			SE5		0	-1	5
	CISTACEAE	ROCK-ROSE FAMILY							
	Lechea villosa	hairy pinweed			S3		9		5
	VIOLACEAE	VIOLET FAMILY							
	Viola blanda	sweet white violet			S4S5		6		-2
	Viola pubescens	downy yellow violet			S5		5		4
	Viola sagittata var. *sagittata*	arrow-leaved violet			S4		9		-2
	Viola sororia	woolly blue violet			S5		4		1
	SALICACEAE	WILLOW FAMILY							
*	*Populus alba*	silver poplar			SE5		0	-3	5
	Populus balsamifera ssp. *balsamifera*	balsam poplar			S5		4		-3
	Populus deltoides ssp. *deltoides*	eastern cottonwood			SU		4		-1
	Populus grandidentata	large-tooth aspen			S5		5		3
	Populus tremuloides	trembling aspen			S5		2		0
*	*Salix alba*	white willow			SE4		0	-2	-3
	Salix amygdaloides	peach-leaved willow			S5		6		-3
	Salix bebbiana	long-beaked willow			S5		4		-4
	Salix discolor	pussy willow			S5		3		-3
	Salix eriocephala	Missouri willow			S5		4		-3
	Salix exigua	sandbar willow			S5		3		-5
	Salix humilis	prairie willow			S5		7		3
	Salix lucida	shining willow			S5		5		-4
*	*Salix matsudana*	corkscrew willow					0		
	Salix nigra	black willow			S4?		6		-5
	Salix petiolaris	slender willow			S5		3		-4
*	*Salix X rubens*	hybrid crack willow			SE4		0	-3	-4
*	*Salix X sepulcralis*	weeping willow			SE2		0		
	BRASSICACEAE	MUSTARD FAMILY							
*	*Alliaria petiolata*	garlic mustard			SE5		0	-3	0

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
*	*Barbarea vulgaris*	yellow rocket			SE5		0	-1	0
*	*Berteroa incana*	hoary alyssum			SE5		0	-3	5
*	*Brassica nigra*	black mustard			SE5		0	-1	5
*	*Capsella bursa-pastoris*	shepherd's purse			SE5		0	-1	1
	Cardamine douglassii	purple cress			S4		7		-3
*	*Erysimum cheiranthoides* ssp. *cheiranthoides*	wormseed mustard			SE5		0	-1	3
*	*Hesperis matronalis*	dame's rocket			SE5		0	-3	5
*	*Lepidium campestre*	field cress			SE5		0	-1	5
*	*Rorippa sylvestris*	creeping yellow-cress			SE5		0	-1	-5
*	*Sisymbrium altissimum*	tall tumble-mustard			SE5		0	-1	3
*	*Thlaspi arvense*	field penny-cress			SE5		0	-1	5
	ERICACEAE	HEATH FAMILY							
	Vaccinium pallidum	pale blueberry			S4		9		5
	PYROLACEAE	WINTERGREEN FAMILY							
	Pyrola elliptica	shinleaf			S5		5		5
	PRIMULACEAE	PRIMROSE FAMILY							
	Lysimachia ciliata	fringed loosestrife			S5		4		-3
*	*Lysimachia nummularia*	moneywort			SE5		0	-3	-4
	Lysimachia quadriflora	four-flowered loosestrife			S4		10		-5
	Lysimachia quadrifolia	whorled loosestrife			S4		8		5
	GROSSULARIACEAE	GOOSEBERRY FAMILY							
	Ribes americanum	wild black currant			S5		4		-3
	Ribes cynosbati	prickly gooseberry			S5		4		5
	Ribes hirtellum	smooth gooseberry			S5		6		-3
*	*Ribes rubrum*	red currant			SE5		0	-2	5
	SAXIFRAGACEAE	SAXIFRAGE FAMILY							
	Penthorum sedoides	ditch stonecrop			S5		4		-5
	ROSACEAE	ROSE FAMILY							
	Agrimonia gryposepala	tall hairy agrimony			S5		2		2
	Agrimonia parviflora	many-flowered agrimony			S3		4		-1
	Agrimonia pubescens	hairy agrimony			S4		7		5
	Amelanchier arborea	downy juneberry			S5		5		3
	Amelanchier laevis	smooth juneberry			S5		5		5
	Aronia melanocarpa	black chokeberry			S5		7		-3
	Crataegus crus-galli	cockspur thorn			S5		4		0
	Crataegus mollis	downy thorn			S5		4		-2
*	*Crataegus monogyna*	English hawthorn			SE5		0	-1	5
	Crataegus punctata	large-fruited thorn			S5		4		5
	Fragaria virginiana ssp. *virginiana*	scarlet strawberry			SU		2		1
	Geum aleppicum	yellow avens			S5		2		-1
	Geum canadense	white avens			S5		3		0
	Geum vernum	spring avens			S3		7		1
*	*Malus baccata*	Siberian crabapple			SE1		0		
	Malus coronaria	narrow-leaved crabapple			S4		5		5
*	*Malus pumila*	common crabapple			SE5		0	-1	5

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Physocarpus opulifolius	ninebark			S5		5		-2
	Potentilla anserina ssp. *anserina*	silverweed			S5		5		-4
	Potentilla canadensis	common cinquefoil			SU		5		4
	Potentilla norvegica ssp. *norvegica*	cinquefoil			SU		0		0
*	*Potentilla recta*	rough-fruited cinquefoil			SE5		0	-2	5
	Potentilla simplex	old-field cinquefoil			S5		3		4
	Prunus americana	American plum			S4		6		5
*	*Prunus avium*	sweet cherry			SE4		0	-2	5
*	*Prunus cerasus*	sour cherry			SE1		0	-1	5
*	*Prunus domestica ssp. domestica*	damson plum			SE2			-1	5
	Prunus pensylvanica	pin cherry			S5		4		3
	Prunus serotina	black cherry			S5		3		3
	Prunus virginiana ssp. *virginiana*	choke cherry			S5		2		1
*	*Prunus virginiana* var. *Schubert*	Schubert Chokecherry					0		
*	*Pyrus communis*	common pear			SE4		0	-1	5
	Rosa acicularis ssp. *sayi*	prickly rose			S5		7		3
	Rosa blanda	smooth rose			S5		3		3
	Rosa carolina	swamp rose			S4		6		4
*	*Rosa multiflora*	multiflora rose			SE4		0	-3	3
	Rosa palustris	marsh rose			S5		7		-5
*	*Rosa rubiginosa*	sweetbrier rose			SE4		0	-1	5
	Rosa setigera	prairie rose	SC	SC	S3	SARA(1), OESA(5)	5		2
	Rubus allegheniensis	common blackberry			S5		2		2
	Rubus canadensis	smooth blackberry			S4?		7		5
	Rubus flagellaris	prickly raspberry			S4		4		4
	Rubus hispidus	trailing blackberry			S4S5		6		-3
	Rubus idaeus ssp. *melanolasius*	wild red raspberry			S5		0		-2
	Rubus occidentalis	thimble-berry			S5		2		5
*	*Sorbaria sorbifolia*	false spiraea			SE4		0	-1	5
*	*Sorbus aucuparia*	European mountain-ash			SE4		0	-2	5
	Spiraea alba	narrow-leaved meadow-sweet			S5		3		-4
*	*Spiraea prunifolia*	bridal-wreath spiraea			SE1		0		
	Spiraea tomentosa	tomentose meadow-sweet			S4S5		5		-3
	FABACEAE	PEA FAMILY							
	Amphicarpaea bracteata	hog peanut			S5		4		0
	Apios americana	groundnut			S5		6		-3
	Baptisia tinctoria	wild indigo			S2		10		5
*	*Caragana arborescens*	Siberian pea tree			SE1		0	-1	5
	Cercis canadensis	Canadian redbud			SX		8		3
*	*Coronilla varia*	variable crown-vetch			SE5		0	-2	5
	Desmodium canadense	Canadian tick-trefoil			S4		5		1
	Desmodium glutinosum	pointed-leaved tick-trefoil			S4		6		5
	Gleditsia triacanthos	honey locust			S2		3		0

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Gymnocladus dioicus	Kentucky coffee-tree	THR	THR	S2	SARA(1), OESA(4)	6		5
*	*Lathyrus latifolius*	everlasting pea			SE4		0	-1	5
	Lathyrus ochroleucus	cream-coloured vetchling			S4		8		5
	Lathyrus palustris	marsh vetchling			S5		6		-3
*	*Lathyrus tuberosus*	tuberous vetchling			SE3		0	-1	5
	Lespedeza capitata	round-headed bush-clover			S4		7		3
*	*Lotus corniculatus*	bird's-foot trefoil			SE5		0	-2	1
*	*Medicago lupulina*	black medick			SE5		0	-1	1
*	*Medicago sativa* ssp. *sativa*	alfalfa			SE5		0	-1	5
*	*Melilotus alba*	white sweet-clover			SE5		0	-3	3
*	*Melilotus officinalis*	yellow sweet-clover			SE5		0	-1	3
*	*Robinia pseudo-acacia*	black locust			SE5		0	-3	4
	Strophostyles helvola	trailing wild bean			S3		8		-1
*	*Trifolium aureum*	yellow clover			SE5		0	-1	5
*	*Trifolium hybridum* ssp. *elegans*	alsike clover			SE5		0	-1	1
*	*Trifolium pratense*	red clover			SE5		0	-2	2
*	*Trifolium repens*	white clover			SE5		0	-1	2
*	*Vicia cracca*	tufted vetch			SE5		0	-1	5
	ELAEAGNACEAE	OLEASTER FAMILY							
*	*Elaeagnus angustifolia*	Russian olive			SE3		0	-1	4
*	*Elaeagnus umbellata*	Russian olive			SE3		0	-3	3
	LYTHRACEAE	LOOSESTRIFE FAMILY							
	Lythrum alatum	wing-angled loosestrife			S3		5		-5
*	*Lythrum salicaria*	purple loosestrife			SE5		0	-3	-5
	ONAGRACEAE	EVENING-PRIMROSE FAMILY							
	Circaea lutetiana ssp. *canadensis*	yellowish enchanter's nightshade			S5		3		3
	Epilobium ciliatum ssp. *ciliatum*	ciliate willow-herb			S5		3		3
*	*Epilobium hirsutum*	great hairy willow-herb			SE5		0	-2	-4
	Gaura biennis	biennial gaura			S2		4		4
	Ludwigia alternifolia	rattle-box			S1		10		-5
	Ludwigia polycarpa	many-fruited false loosestrife			S2		8		-5
	Oenothera biennis	common evening-primrose			S5		0		3
	Oenothera perennis	perennial evening-primrose			S4S5		6		0
	CORNACEAE	DOGWOOD FAMILY							
	Cornus amomum ssp. *obliqua*	silky dogwood			S5		5		-4
	Cornus drummondii	Drummond's dogwood			S4		4		0
	Cornus foemina ssp. *racemosa*	gray dogwood			S5		2		-2
	Cornus obliqua				S5				
	Cornus rugosa	round-leaved dogwood			S5		6		5
	Cornus sericea ssp. sericea	red-osier dogwood			S5		2		-3
	NYSSACEAE	SOUR GUM FAMILY							
	Nyssa sylvatica	black gum			S3		9		-4
	SANTALACEAE	SANDALWOOD FAMILY							
	Comandra umbellata	bastard toad-flax			S5		6		3

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	CELASTRACEAE	STAFF-TREE FAMILY							
*	*Celastrus orbiculatus*	Oriental bittersweet			SE2		0	-1	5
	Celastrus scandens	climbing bittersweet			S5		3		3
*	*Euonymus alata*	winged spindle tree			SE2		0	-1	5
*	*Euonymus europaea*	spindle tree			SE2		0	-1	5
	Euonymus obovata	running strawberry-bush			S5		6		5
	EUPHORBIACEAE	SPURGE FAMILY							
	Acalypha virginica var. *rhomboidea*	three-seeded mercury			S5		0		3
*	*Chamaesyce maculata*	spotted spurge			SE5		0	-1	4
	Euphorbia corollata	flowering spurge			S4		7		5
	RHAMNACEAE	BUCKTHORN FAMILY							
*	*Rhamnus cathartica*	common buckthorn			SE5		0	-3	3
*	*Rhamnus frangula*	glossy buckthorn			SE5		0	-3	-1
	VITACEAE	GRAPE FAMILY							
	Parthenocissus inserta	inserted Virginia-creeper			S5		3		3
	Parthenocissus quinquefolia	five-leaved Virginia-creeper			S4?		6		1
	Vitis aestivalis	summer grape			S4		7		3
	Vitis labrusca	fox grape			S1		3		3
	Vitis riparia	riverbank grape			S5		0		-2
	POLYGALACEAE	MILKWORT FAMILY							
	Polygala sanguinea	blood-red milkwort			S4		9		3
	Polygala verticillata	whorled milkwort			S4		7		5
	HIPPOCASTANACEAE	BUCKEYE FAMILY							
*	*Aesculus hippocastanum*	horse chestnut			SE2		0	-1	5
	ACERACEAE	MAPLE FAMILY							
	Acer negundo	Manitoba maple			S5		0		-2
*	*Acer platanoides*	Norway maple			SE5		0	-3	5
	Acer rubrum	red maple			S5		4		0
	Acer saccharinum	silver maple			S5		5		-3
	Acer saccharum ssp. *saccharum*	sugar maple			S5		4		3
	Acer X freemanii	freeman's maple			S5?		0		
	ANACARDIACEAE	SUMAC FAMILY							
	Rhus glabra	smooth sumac			S5		7		5
	Rhus radicans	poison-ivy			S5		0		0
	Rhus rydbergii	western poison-ivy			S5		0		0
	Rhus hirta	staghorn sumac			S5		1		5
	Rhus X *pulvinata*	hybrid sumac			S2?		2		5
	SIMAROUBACEAE	AILANTHUS FAMILY							
*	*Ailanthus altissima*	tree-of-heaven			SE5		0	-1	5
	RUTACEAE	RUE FAMILY							
	Ptelea trifoliatae	common hop-tree	THR	THR	S3	SARA(1), OESA(4)	9		2
	Zanthoxylum americanum	American prickly-ash			S5		3		5
	OXALIDACEAE	WOOD SORREL FAMILY							
	Oxalis stricta	upright yellow wood-sorrel			S5		0		3
	GERANIACEAE	GERANIUM FAMILY							

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	Geranium maculatum	spotted crane's-bill			S5		6		3
	BALSAMINACEAE	TOUCH-ME-NOT FAMILY							
	Impatiens capensis	spotted touch-me-not			S5		4		-3
	ARALIACEAE	GINSENG FAMILY							
	Aralia nudicaulis	wild sarsaparilla			S5		4		3
	APIACEAE	PARSLEY FAMILY							
	Angelica atropurpurea	dark-purple alexanders			S5		6		-5
	Cicuta maculata	spotted water-hemlock			S5		6		-5
*	*Daucus carota*	wild carrot			SE5		0	-2	5
	Heracleum lanatum	cow-parsnip			S5		3		-3
	Oxypolis rigidior	cowbane			S2		9		-5
*	*Pastinaca sativa*	wild parsnip			SE5		0	-3	5
	Sanicula canadensis var. *canadensis*	Canada snakeroot			S4		7		2
	Sanicula marilandica	black snakeroot			S5		5		3
	Sium suave	hemlock water-parsnip			S5		4		-5
	Taenidia integerrima	yellow pimpernel			S4		9		5
	GENTIANACEAE	GENTIAN FAMILY							
*	*Centaurium erythraea*	erythraea-like centaury			SE2		0	-1	-4
	Gentiana andrewsii	closed gentian			S4		6		-3
	Gentianopsis crinita	fringed gentian			S5		8		-4
	APOCYNACEAE	DOGBANE FAMILY							
	Apocynum androsaemifolium ssp. *androsaemifolium*	spreading dogbane			S5		3		5
	Apocynum cannabinum var. *cannabinum*	Indian hemp			S5		3		0
*	*Vinca minor*	periwinkle			SE5		0	-2	5
	ASCLEPIADACEAE	MILKWEED FAMILY							
	Asclepias exaltata	poke milkweed			S4		8		5
	Asclepias incarnata ssp. *incarnata*	swamp milkweed			S5		6		-5
	Asclepias purpurascens	purple milkweed			S2		10		3
	Asclepias sullivantii	Sullivant's milkweed			S2		8		5
	Asclepias syriaca	common milkweed			S5		0		5
	Asclepias tuberosa	butterfly-weed			S4		8		5
*	*Cynanchum nigrum*	black swallow-wort			SE?		0	-2	5
*	*Cynanchum rossicum*	swallow-wort			SE5		0	0	5
	SOLANACEAE	POTATO FAMILY							
*	*Lycopersicon esculentum*	tomato			SE2		0	-1	5
	Physalis heterophylla	clammy ground-cherry			S4		3		5
	Physalis virginiana	Virginia ground-cherry			SU		8		5
*	*Solanum carolinense*	horse nettle			SE3		0		4
*	*Solanum dulcamara*	bitter nightshade			SE5		0	-2	0
*	*Solanum tuberosum*	potato			SE1		0	-1	5
	CONVOLVULACEAE	MORNING-GLORY FAMILY							
	Calystegia sepium ssp. *angulatum*	hedge bindweed			SU		2		0

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	Calystegia spithamaea ssp. *spithamaea*	low bindweed			S4S5		7		5
*	*Convolvulus arvensis*	field bindweed			SE5		0	-1	5
	Cuscuta sp.	dodder							
	BORAGINACEAE	BORAGE FAMILY							
*	*Cynoglossum officinale*	hound's-tongue			SE5		0	-1	5
*	*Echium vulgare*	blueweed			SE5		0	-2	5
	Hackelia deflexa	spurred stickweed			S5		5		5
	Hackelia virginiana	Virginia stickweed			S5		1		5
	Lithospermum caroliniense var. *croceum*	plains puccoon			S3		8		5
	PHRYMACEAE	LOPSEED FAMILY							
	Phryma leptostachya	lopseed			S4S5		6		5
	VERBENACEAE	VERVAIN FAMILY							
	Verbena hastata	blue vervain			S5		4		-4
	Verbena stricta	hoary vervain			S4		7		5
	Verbena urticifolia	white vervain			S5		4		-1
	LAMIACEAE	MINT FAMILY							
	Clinopodium vulgare	wild basil			S5		4		5
	Collinsonia canadensis	stoneroot			S4		8		0
*	*Glechoma hederacea*	creeping Charlie			SE5		0	-2	3
*	*Lamium amplexicaule*	henbit			SE3		0	-1	5
*	*Leonurus cardiaca* ssp. *cardiaca*	common motherwort			SE5		0	-2	5
	Lycopus americanus	cut-leaved water-horehound			S5		4		-5
	Lycopus uniflorus	northern water-horehound			S5		5		-5
	Mentha arvensis ssp. *borealis*	American wild mint			S5		3		-3
*	*Mentha X piperita*	pepper mint			SE4		0	-1	-5
	Monarda fistulosa	wild bergamot			S5		6		3
*	*Nepeta cataria*	catnip			SE5		0	-2	1
*	*Origanum vulgare*	wild marjarom			SE5			-2	5
	Physostegia virginiana ssp. *virginiana*	Virginia false dragonhead			S4		8		-3
*	*Prunella vulgaris* ssp. *vulgaris*	common heal-all			SE3		0	-1	0
	Pycnanthemum verticillatum var. *pilosum*	hairy mountain-mint			S1		8		5
	Pycnanthemum virginianum	Virginia mountain-mint			S4		8		-4
	Scutellaria lateriflora	mad-dog skullcap			S5		5		-5
	Stachys hispida	rough hedge-nettle			S4S5		7		-4
*	*Stachys palustris*	hedge-nettle			SE5		0	-1	-5
	PLANTAGINACEAE	PLANTAIN FAMILY							
*	*Plantago lanceolata*	ribgrass			SE5		0	-1	0
*	*Plantago major*	common plantain			SE5		0	-1	-1
	OLEACEAE	OLIVE FAMILY							
*	*Forsythia viridissima*	golden-bells			SE2		0		
	Fraxinus americana	white ash			S5		3		4
	Fraxinus nigra	black ash			S5		7		-4
	Fraxinus pennsylvanica	red ash			S5		3		-3

APPENDIX B.
LIST OF VASCULAR PLANTS RECORDED IN THE AREA OF INVESTIGATION

	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Fraxinus profunda	pumpkin ash			S2		9		-5
*	*Ligustrum vulgare*	common privet			SE5		0	-2	1
*	*Syringa vulgaris*	common lilac			SE5		0	-2	5
	SCROPHULARIACEAE	FIGWORT FAMILY							
	Agalinis purpurea	large purple agalinis			S1		10		-3
	Agalinis tenuifolia var. *macrophylla*	slender-leaved agalinis			S1?		7		-3
	Aureolaria flava	yellow false foxglove			S3		10		5
	Aureolaria pedicularia	fern-leaved false foxglove			S3		10		5
*	*Linaria vulgaris*	butter-and-eggs			SE5		0	-1	5
	Mimulus ringens	square-stemmed monkey-flower			S5		6		-5
	Pedicularis lanceolata	swamp wood-betony			S4		9		-4
	Penstemon digitalis	foxglove beard-tongue			S4S5		6		1
*	*Verbascum blattaria*	moth mullein			SE5		0	-1	-4
*	*Verbascum thapsus*	common mullein			SE5		0	-2	5
	Veronicastrum virginicum	Virginia culver's-root			S2		10		0
	BIGNONIACEAE	TRUMPET-CREEPER FAMILY							
	Campsis radicans	trumpet creeper			S2		3		0
*	*Catalpa bignonioides*	common catalpa			SE1		0	-1	3
*	*Catalpa speciosa*	northern catalpa			SE1		0	-1	3
	CAMPANULACEAE	BLUEBELL FAMILY							
*	*Campanula rapunculoides*	creeping bellflower			SE5		0	-2	5
	Lobelia inflata	Indian tobacco			S5		3		4
	Lobelia siphilitica	great lobelia			S5		6		-4
	Lobelia spicata	pale-spiked lobelia			S4		8		0
	RUBIACEAE	MADDER FAMILY							
	Cephalanthus occidentalis	eastern buttonbush			S5		7		-5
	Galium aparine	cleavers			S5		4		3
	Galium asprellum	rough bedstraw			S5		6		-5
	Galium circaezans	white wild licorice			S5		7		4
*	*Galium mollugo*	white bedstraw			SE5		0	-2	5
	Galium palustre	marsh bedstraw			S5		5		-5
	Galium pilosum var. *pilosum*	hairy bedstraw			S3		9		5
	Galium trifidum ssp. *trifidum*	small bedstraw			S5		5		-4
	Galium triflorum	sweet-scented bedstraw			S5		4		2
	CAPRIFOLIACEAE	HONEYSUCKLE FAMILY							
	Diervilla lonicera	bush honeysuckle			S5		5		5
	Lonicera canadensis	American fly honeysuckle			S5		6		3
	Lonicera dioica	glaucous honeysuckle			S5		5		3
	Lonicera hirsuta	hairy honeysuckle			S5		7		0
*	*Lonicera maackii*	amur honeysuckle			SE2		0	-2	5
*	*Lonicera tatarica*	Tartarian honeysuckle			SE5		0	-3	3
	Sambucus canadensis	common elderberry			S5		5		-2
	Sambucus racemosa ssp. *pubens*	red-berried elderberry			S5		5		2

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
*	*Symphoricarpos occidentalis*	wolfberry			SE3		0	-1	5
	Viburnum acerifolium	maple-leaved viburnum			S5		6		5
*	*Viburnum lantana*	bending wayfaring-tree			SE2		0	-1	5
	Viburnum lentago	nannyberry			S5		4		-1
*	*Viburnum macrocephalum*	Snowball Viburnum					0		
*	*Viburnum opulus*	guelder rose			SE4		0	-1	0
	Viburnum rafinesquianum	downy arrow-wood			S5		7		5
	Viburnum recognitum	southern arrow-wood			S4		7		-2
	DIPSACACEAE	TEASEL FAMILY							
*	*Dipsacus fullonum* ssp. *sylvestris*	wild teasel			SE5		0	-1	5
	ASTERACEAE	ASTER FAMILY							
*	*Achillea millefolium* ssp. *millefolium*	common yarrow			SE?		0	-1	3
	Ambrosia artemisiifolia	common ragweed			S5		0		3
	Ambrosia trifida	giant ragweed			S5		0		-1
	Anaphalis margaritacea	pearly everlasting			S5		3		5
	Antennaria neglecta	field pussytoes			S5		3		5
	Antennaria parlinii ssp. *fallax*	Parlin's pussytoes			SU		2		5
*	*Arctium lappa*	great burdock			SE5		0		5
*	*Arctium minus* ssp. *minus*	common burdock			SE5		0	-2	5
*	*Artemisia vulgaris*	common mugwort			SE5		0	-1	5
	Aster cordifolius	heart-leaved aster			S5		5		5
	Aster ericoides ssp. *ericoides*	white heath aster			S5		4		4
	Aster laevis var. *laevis*	smooth blue aster			S5		7		5
	Aster lanceolatus ssp. *lanceolatus*	tall white aster			S5		3		-3
	Aster lateriflorus var. *lateriflorus*	calico aster			S5		3		-2
	Aster macrophyllus	large-leaved aster			S5		5		5
	Aster novae-angliae	New England aster			S5		2		-3
	Aster oolentangiensis	sky blue aster			S4		9		5
	Aster pilosus var. *pilosus*	hairy aster			S5		4		2
	Symphyotrichum praealtum (Aster praealtus praealtus)	willowleaf aster	THR	THR	S2	SARA(1), OESA(4)	8		-3
	Aster shortii	short's aster	NAR	NAR	S4		7		5
*	*Aster subulatus* var. *subulatus*	annual saltmarsh aster			SE2		0	-1	-5
	Aster umbellatus var. *umbellatus*	flat-top white aster			S5		6		-3
	Aster urophyllus	arrow-leaved aster			S4		6		5
	Aster X amethystinus	amethyst aster			S3?				
	Bidens frondosa	devil's beggar-ticks			S5		3		-3
	Bidens tripartita	European beggar-ticks			S5		4		-3
*	*Centaurea maculosa*	spotted knapweed			SE5		0		5
*	*Chrysanthemum leucanthemum*	ox-eye daisy			SE5		0	-1	5
*	*Cichorium intybus*	chicory			SE5		0	-1	5
*	*Cirsium arvense*	Canada thistle			SE5		0	-1	3
	Cirsium discolor	field thistle			S4		9		5
*	*Cirsium vulgare*	bull thistle			SE5		0	-1	4
	Conyza canadensis	horseweed			S5		0		1

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Coreopsis tripteris	tall tickseed			S2		9		0
	Crepis capillaris	smooth hawk's beard			SE1		5		-1
*	*Echinacea purpurea*	purple coneflower			SE1		10		5
	Erechtites hieracifolia	fire-weed			S5		2		3
	Erigeron annuus	daisy fleabane			S5		0		1
	Erigeron philadelphicus ssp. *philadelphicus*	Philadelphia fleabane			S5		1		-3
	Erigeron strigosus	daisy fleabane			S5		0		1
	Eupatorium altissimum	tall joe-pyeweed			S1		3		3
	Eupatorium maculatum ssp. *maculatum*	spotted joe-pye-weed			S5		3		-5
	Eupatorium perfoliatum	perfoliate thoroughwort			S5		2		-4
	Eupatorium purpureum var. *purpureum*	purple joe-pye-weed			S3		8		0
	Euthamia graminifolia	flat-topped bushy goldenrod			S5		2		-2
	Euthamia gymnospermoides	viscid bushy goldenrod			S1		10		-1
	Helenium autumnale	common sneezeweed			S5		7		-4
*	*Helenium flexuosum*	purple-headed sneezeweed			SE2?		0	-1	-1
	Helianthus divaricatus	rough woodland sunflower			S5		7		5
	Helianthus giganteus	tall wild sunflower			S5		6		-3
*	*Helianthus tuberosus*	Jerusalem artichoke			SE5		0	-2	0
*	*Hieracium aurantiacum*	devil's paintbrush			SE5		0	-2	5
*	*Hieracium caespitosum* ssp. *caespitosum*	field hawkweed			SE5		0	-2	5
	Hieracium scabrum	rough hawkweed			S4		7		5
	Krigia biflora var. *biflora*	two-flowered Cynthia			S2		10		3
	Lactuca biennis	biennial lettuce			S5		6		0
	Lactuca canadensis	tall lettuce			S5		3		2
*	*Lactuca serriola*	prickly lettuce			SE5		0	-1	0
	Liatris aspera var. *intermedia*	rough blazing star			S2		10		5
	Liatris spicata	dense blazing star	THR	THR	S2	SARA(1), OESA(4)	9		0
*	*Matricaria matricarioides*	pineapple-weed			SE5		0		
	Prenanthes alba	white rattlesnake-root			S5		6		3
	Prenanthes racemosa ssp. *racemosa*	glaucous white rattlesnake-root			SU		10		-3
	Ratibida pinnata	gray-headed coneflower			S2S3		9		5
*	*Rudbeckia fulgida*	orange coneflower			S1		0	-1	-5
	Rudbeckia hirta	black-eyed Susan			S5		0		3
	Rudbeckia laciniata	tall coneflower			S5		7		-4
	Senecio aureus	golden groundsel			S5		7		-3
	Silphium terebinthinaceum var. *terebinthinaceum*	prairie dock			S1		10		3
	Solidago altissima var. *altissima*	tall goldenrod			S5		1		3
	Solidago bicolor	white goldenrod			S4?		8		5
	Solidago caesia	blue-stem goldenrod			S5		5		3
	Solidago canadensis	Canada goldenrod			S5		1		3

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Solidago gigantea	giant goldenrod			S5		4		-3
	Solidago juncea	early goldenrod			S5		3		5
	Solidago nemoralis ssp. *nemoralis*	gray goldenrod			S5		2		5
	Solidago ohioensis	Ohio goldenrod			S4		10		-5
	Solidago riddellii	Riddell's goldenrod	SC	SC	S3	SARA(1), OESA(5)	10		-5
	Solidago rigida ssp. *rigida*	stiff-leaved goldenrod			S3		9		4
	Solidago rugosa ssp. *rugosa*	rough goldenrod			S5		4		-1
*	*Solidago sempervirens*	seaside goldenrod			SE2		0	-1	-2
*	*Sonchus arvensis* ssp. *arvensis*	field sow-thistle			SE5		0	-1	1
*	*Sonchus asper* ssp. *asper*	spiny-leaved sow-thistle			SE5		0	-1	0
*	*Sonchus oleraceus*	common sow-thistle			SE5		0	-1	3
*	*Tanacetum vulgare*	common tansy			SE5		0	-1	5
*	*Taraxacum officinale*	common dandelion			SE5		0	-2	3
*	*Tragopogon dubius*	doubtful goat's-beard			SE5		0	-1	5
	*Vernonia gigantea**	ironweed			S3		7		0
	*Vernonica missurica**	ironweed			S3?				
	Xanthium strumarium	tumor-curing cocklebur			S5		2		0
	BUTOMACEAE	FLOWERING RUSH FAMILY							
*	*Butomus umbellatus*	flowering-rush			SE5		0	-2	-5
	ALISMATACEAE	WATER-PLANTAIN FAMILY							
	Alisma plantago-aquatica	common water-plantain			SRF		3		-5
	Sagittaria latifolia	broad-leaved arrowhead			S5		4		-5
	HYDROCHARITACEAE	FROG'S-BIT FAMILY							
	Elodea nuttallii	Nuttall's waterweed			S4		8		-5
	Vallisneria americana	water-celery			S5		6		-5
	POTAMOGETONACEAE	PONDWEED FAMILY							
	Potamogeton foliosus	leafy pondweed			S5		4		-5
	Potamogeton nodosus	knotty pondweed			S5		7		-5
	Potamogeton sp.	pondweed							
	NAJADACEAE	NAIAD FAMILY							
	Najas flexilis	slender najas			S5		5		-5
	ARACEAE	ARUM FAMILY							
	Arisaema triphyllum ssp. *triphyllum*	small jack-in-the-pulpit			S5		5		-2
	LEMNACEAE	DUCKWEED FAMILY							
	Lemna minor	lesser duckweed			S5		2		-5
	COMMELINACEAE	SPIDERWORT FAMILY							
	Tradescantia ohiensis	Ohio spiderwort			S2		10		2
	JUNCACEAE	RUSH FAMILY							
	Juncus alpinoarticulatus	Richardson's rush			S5		5		-5
	Juncus biflorus	two-flowered rush			S1		10		-3
	Juncus brachycarpus	short-fruited rush			S1		10		-3
	Juncus bufonius	toad rush			S5		1		-4
	Juncus dudleyi	Dudley's rush			S5		1		0
	Juncus greenei	Greene's rush			S3		9		0

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	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Juncus marginatus	grass-leaved rush			S2		9		-3
	Juncus nodosus	knotted rush			S5		5		-5
	Juncus tenuis	path rush			S5		0		0
	Juncus torreyi	Torrey's rush			S5		3		-3
	Luzula multiflora ssp. *multiflora*	woodrush			S5		6		3
	CYPERACEAE	SEDGE FAMILY							
	Carex arctata	drooping wood sedge			S5		5		5
	Carex bebbii	Bebb's sedge			S5		3		-5
	Carex blanda	woodland sedge			S5		3		0
	Carex brevior	shorter sedge			S4S5		7		0
	Carex buxbaumii	brown sedge			S5		10		-5
	Carex cephaloidea	thin-leaved sedge			S5		6		2
	Carex cephalophora	oval-headed sedge			S5		5		3
	Carex foena	bronzy sedge			S5		8		5
	Carex granularis	meadow sedge			S5		3		-4
	Carex lacustris	lake-bank sedge			S5		5		-5
	Carex lasiocarpa	slender sedge			S5		8		-5
	Carex normalis	larger straw sedge			S4		6		-3
	Carex pellita	woolly sedge			S5		4		-5
	Carex pensylvanica	Pennsylvania sedge			S5		5		5
	Carex pseudo-cyperus	cypress-like sedge			S5		6		-5
	Carex radiata	radiate sedge			S4		4		5
	Carex rosea	stellate sedge			S5		5		5
	Carex scoparia	pointed broom sedge			S5		5		-3
	Carex squarrosa	squarrose sedge			S2		8		-5
	Carex stipata	awl-fruited sedge			S5		3		-5
	Carex stricta	tussock sedge			S5		4		-5
	Carex swanii	swan's sedge			S3		7		3
	Carex tenera	straw sedge			S5		4		-1
	Carex trichocarpa	hairy-fruited sedge			S3		8		-5
	Carex viridula ssp. *viridula*	greenish sedge			S5		5		-5
	Carex vulpinoidea	fox sedge			S5		3		-5
	Carex woodii	wood's sedge			S4		6		0
	Cyperus esculentus	yellow nut-grass			S5		1		-3
	Cyperus odoratus	fragrant umbrella sedge			S5		5		-3
	Cyperus strigosus	straw-colored umbrella sedge			S5		5		-3
	Eleocharis erythropoda	red-footed spike-rush			S5		4		-5
	Eleocharis obtusa	blunt spike-rush			S5		5		-5
	Rhynchospora capitellata	small-headed beaked-rush			S4		10		-5
	Scirpus atrovirens	dark-green bulrush			S5		3		-5
	Scirpus pendulus	lined bulrush			S5		3		-5
	Scirpus validus	American great bulrush			S5		5		-5
	Scleria triglomerata	tall nut-rush			S1		10		0
	POACEAE	GRASS FAMILY							
*	*Agrostis gigantea*	red-top			SE5		0		0
	Agrostis stolonifera	redtop			S5		0		-3
	Andropogon gerardii	big bluestem			S4		7		1

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	Andropogon virginicus	Virginia broom-sedge			S4		5		1
*	*Anthoxanthum odoratum* ssp. *odoratum*	sweet vernal grass			SE4		0	-1	3
	Aristida purpurascens var. *purpurascens*	arrow-feather three-awn			S1		10		5
*	*Avena fatua*	wild oats			SE3		0	-1	5
*	*Bromus inermis* ssp. *inermis*	awnless brome			SE5		0	-3	5
*	*Bromus tectorum*	downy chess			SE5		0	-2	5
	Calamagrostis canadensis	blue-joint grass			S5		4		-5
*	*Dactylis glomerata*	orchard grass			SE5		0	-1	3
	Danthonia spicata	poverty oat grass			S5		5		5
	Dicanthelium acuminatum var. *acuminatum*	acuminate panic grass			S5		2		0
*	*Digitaria ischaemum*	small crabgrass			SE5		0	-1	3
*	*Digitaria sanguinalis*	large crabgrass			SE5		0	-1	3
*	*Echinochloa crusgalli*	common barnyard grass			SE5		0	-1	-3
	Echinochloa microstachya	small-spiked barnyard grass			S4S5		6		-2
	Elymus canadensis	nodding wild rye			S4S5		8		1
	Elymus hystrix	bottle-brush grass			S5		5		5
*	*Elymus repens*	quack grass			SE5		0	-3	3
	Elymus virginicus var. *virginicus*	Virginia wild rye			S5		5		-2
*	*Festuca arundinacea*	tall fescue			SE5		0	-1	2
*	*Festuca pratensis*	meadow fescue			SE5		0	-1	-4
	Festuca rubra ssp. *rubra*	red fescue			S5		0	-1	1
	Glyceria striata	fowl meadow grass			S5		3		-5
	Hierochloe odorata ssp. *odorata*	sweet grass			S4		5		-3
*	*Hordeum jubatum* ssp. *jubatum*	squirrel-tail grass			SE5		0	-1	-1
	Leersia oryzoides	rice cut grass			S5		3		-5
	Leersia virginica	white cut grass			S4		6		-3
*	*Lolium perenne*	English rye grass			SE4		0	-1	3
	Milium effusum	wood millet			S4S5		8		4
*	*Miscanthus sinensis*	Japanese plume grass			SE1		5		-1
	Muhlenbergia frondosa	leafy satin grass			S4		5		-3
	Muhlenbergia mexicana var. *mexicana*	Mexican satin grass			S5		1		-3
	Panicum acuminatum var. *acuminatum*	acuminate panic grass			S5		2		2
	Panicum capillare	witch grass			S5		0		0
	Panicum columbianum var. *siccanum*	panic grass			S4				
*	*Panicum dichotomiflorum*	fall panicum			SE5		0	-1	-2
	Panicum latifolium	broad-leaved panic grass			S4		6		3
	Panicum sphaerocarpon	rough-fruited panic grass			S3		8		3
	Panicum virgatum	switch grass			S4		6		-1
	Paspalum setaceum	bristle-like paspalum			S2		8		5
	Phalaris arundinacea	reed canary grass			S5		0		-4
*	*Phleum pratense*	timothy			SE5		0	-1	3

APPENDIX B.
LIST OF VASCULAR PLANTS RECORDED IN THE AREA OF INVESTIGATION

	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Phragmites australis	common reed			S5		0		-4
	Poa compressa	Canada blue grass			SE5		0		2
	Poa palustris	fowl meadow grass			S5		5		-4
	Poa pratensis ssp. *pratensis*	Kentucky bluegrass			S5		0		1
	Schizachne purpurascens ssp. purpurascens	false melic grass			S5		6		2
	Schizachyrium scoparium	little bluestem			S4		7		3
*	*Setaria faberi*	giant foxtail			SE4		0	-1	2
*	*Setaria pumila*	yellow foxtail			SE5		0	-1	0
*	*Setaria viridis*	green foxtail			SE5		0	-1	5
	Sorghastrum nutans	Indian grass			S4		8		2
	Spartina pectinata	tall cord grass			S4		7		-4
	Sporobolus compositus var. compositus	long-leaved rush grass			S1S2		2		5
	TYPHACEAE	CAT-TAIL FAMILY							
	Typha angustifolia	narrow-leaved cattail			SE5		3		-5
	Typha X glauca	glaucous cattail			S5		3		-5
	Typha latifolia	broad-leaved cattail			S5		3		-5
	LILIACEAE	LILY FAMILY							
	Aletris farinosa	colic-root	THR	THR	S2	SARA(1), OESA(4)	10		0
	Allium canadense var. *canadense*	Canada wild onion			S5		8		3
*	*Asparagus officinalis*	garden asparagus			SE5		0	-1	3
*	*Convallaria majalis*	lily-of-the-valley			SE5		0	-2	5
	Erythronium americanum ssp. *americanum*	yellow trout lily			S5		5		5
*	*Hemerocallis fulva*	orange day-lily			SE5		0	-3	5
	Hypoxis hirsutae	yellow star-grass			S3		10		0
*	*Lilium lancifolium*	tiger lily			SE1			-1	5
	Lilium michiganense	Michigan lily			S5		7		-1
	Maianthemum racemosum ssp. *racemosum*	false Solomon's seal			S5		4		3
	Maianthemum stellatum	star-flowered Solomon's seal			S5		6		1
	Muscari botryoides	grape hyacinth			SE3		0	-1	5
*	*Narcissus pseudonarcissus*	daffodil			SE2		0		
*	*Ornithogalum umbellatum*	summer snowflake			SE3		0	-1	1
	Polygonatum biflorum	hairy Solomon's seal			S4		8		3
	Polygonatum pubescens	hairy Solomon's seal			S5		5		5
	Streptopus roseus	rose twisted-stalk			S5		7		0
	Trillium grandiflorum	white trillium			S5		5		5
	Uvularia sessilifolia	sessile-leaved bellwort			S4		7		1
	IRIDACEAE	IRIS FAMILY							
	Iris virginica	southern blue-flag			S5		5		-5
	Sisyrinchium albidum	white blue-eyed-grass			S1		9		3
	Sisyrinchium angustifolium	pointed blue-eyed-grass			S4		6		-2
	SMILACACEAE	CATBRIER FAMILY							

APPENDIX B.
LIST OF VASCULAR PLANTS RECORDED IN THE AREA OF INVESTIGATION

	Scientific Name	Common Name	COSEWIC	COSSARO	S Rank	Legal	CC[1]	Weed[1]	CWet[1]
	Smilax herbacea	herbaceous carrion flower			S4		5		0
	Smilax hispida	bristly greenbrier			S4		6		0
	Smilax lasioneura	hairy-nerved carrion flower			S4		5		5
	DIOSCOREACEAE	YAM FAMILY							
	Dioscorea quaternata	wild yam-root			S4		7		1
	ORCHIDACEAE	ORCHID FAMILY							
	Cypripedium calceolus var. *pubescens*	large yellow lady's slipper			S5		5		-1
*	*Epipactis helleborine*	common helleborine			SE5		0	-2	5
	Platanthera lacera	ragged-fringed orchid			S4S5		6		-3
	Spiranthes magnicamporum	great plains' ladies tresses			S3		8		-3
	SAPINDACEAE	SOAPBERRY FAMILY							
*	*Koelreuteria paniculata*	Golden rain tree					0		
	TAMARICACEAE	TAMARISK FAMILY							
*	*Tamarix ramosissima*	Tamarisk					0		
	MORACEAE	FIG FAMILY							
*	*Ficus* sp.	Fig tree					0		

*denotes introduced species

[1]CC = Coefficient of Conservatism; Weed = Weediness Index; CWet = Coefficient of Wetness.

Note: Species status current to November 2008.

APPENDIX C.

LIST OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

APPENDIX C.
SUMMARY OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

Order	Family	Scientific Name	Common Name	Present	COSEWIC	COSSARO	Srank	Legal
Diptera	Psilidae	*Loxocera ojibwayensis*	A Fly	Y			SNR*	
Hemiptera	Cicadellidae	*Balclutha abdominalis*	A Leafhopper	Y			S1	
(Auchenorrhyncha)		*Chlorotettix fallax*	A Leafhopper	Y			S1	
		Chlorotettix spatulatus	A Leafhopper	Y			S2	
		Cuerna fenestella	A Leafhopper	Y			S1	
		Dorydiella kansana	A Leafhopper	Y			S1	
		Flexamia inflate	A Leafhopper	Y			S1	
		Flexamia prairiana	A Leafhopper	Y			S1	
		Graminella oquaka	A Leafhopper	Y			S1	
		Graminella pallidula	A Leafhopper	Y			S1	
		Hecalus flavidus	A Leafhopper	Y			S1	
		Laevicephalus unicoloratus	A Leafhopper	Y			S2	
		Limotettix elegans	A Leafhopper	Y			S1	
		Mesamia nigridorsum	A Leafhopper	Y			S1	
		Neokolla lugubris	A Leafhopper	Y			S1?	
		Xerophloea major	A Leafhopper	Y			S1	
		Xerophloea peltata	A Leafhopper	Y			S1	
	Delphacidae	*Delphacodes waldeni*	A Plant Hopper	Y			S1?	
		Megamelus metzaria	A Plant Hopper	Y			SNR	
	Derbidae	*Anotia westwoodi*	A Plant Hopper	Y			SNR	
	Flatidae	*Anormenis septentrionalis*	A Plant Hopper	Y			SNR	
		Ormenoides venusta	A Plant Hopper	Y			SNR	
	Membracidae	*Publilia reticulate*	A Tree Hopper	Y			S1?	

APPENDIX C.
SUMMARY OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

Order	Family	Scientific Name	Common Name	Present	COSEWIC	COSSARO	Srank	Legal
Hemiptera	Aradidae	*Neuroctenus simplex*	A Flat Bug	Y			S1S3	
(Heteroptera)	Coreidae	*Chariesterus antennator*	A Leaf-footed Bug	Y			S1S2	
		Euthochtha galeator (Fabricius)	A Leaf-footed Bug	Y			S1S3	
	Cydnidae	*Pangaeus bilineatus*	A Burrowing Bug	Y			S2S4	
	Geocoridae	*Isthmocoris piceus (Say)*	A Big-eyed Bug	Y			S2S4	
	Lygaeidae	*Lygaeus turcicus (Fabricius)*	Small Milkweed Bug	Y			S1S3	
	Nabidae	*Hoplistoscelis sordidus*	A Damsel Bug	Y			S4	
	Pentatomidae	*Amaurochroa ovalis*	A Stink Bug	Y			S1?	
		Dendrocoris humeralis	A Stink Bug	Y			S2S4	
		Stiretrus anchorago fimbriatus (Say)	A Stink Bug	Y			S1S3	
	Rhyparochromidae	*Cryphula trimaculata*	A Seed Bug	Y			S1?	
		Ozophora picturata (Uhler)	A Seed Bug	Y			S1S3	
	Tingidae	*Leptopharsa heidemanni*	A Lace Bug	Y			S1	
Hymenoptera	Andrenidae	*Perdita (Cockerellia) bequaerti bequaerti*	A Minning Bee	Y			SNR*	
	Crabronidae (Astatinae)	*Astata nubecula*	An Aculeate Wasp	Y			SNR*	
	Crabronidae	*Bicyrets quadrifasciatus*	A Digger Wasp	Y			SNR*	
	(Bembicinae)	*Clitemnestra bipunctata*	A Digger Wasp	Y			SNR*	
		Didineis texana	A Digger Wasp	Y			SNR*	
		Epinysson mellipes	A Digger Wasp	Y			SNR*	
		Epinysson tramosericus	A Digger Wasp	Y			SNR*	
		Epinysson tuberculatus	A Digger Wasp	Y			SNR*	
		Hoplisoides placidus	A Digger Wasp	Y			SNR*	
		Nysson simplicicornis	A Digger Wasp	Y			SNR*	
		Nysson subtilis	A Digger Wasp	Y			SNR*	

APPENDIX C.
SUMMARY OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

Order	Family	Scientific Name	Common Name	Present	COSEWIC	COSSARO	Srank	Legal
Hymenoptera	Crabronidae	*Ectemnius dilectus*	A Digger Wasp	Y			SNR*	
(continued)	(Crabroninae)	*Ectemnius scaber*	A Digger Wasp	Y			SNR*	
		Entomognathus lenapeorum	A Digger Wasp	Y			SNR*	
		Entomognathus memorialis	A Digger Wasp	Y			SNR*	
		Oxybelus cressonii	A Digger Wasp	Y			SNR*	
		Oxybelus decorosus	A Digger Wasp	Y			SNR*	
		Oxybelus subcornutus	A Digger Wasp	Y			SNR*	
		Tachysphex antennatus	A Digger Wasp	Y			SNR*	
		Tachysphex apicalis	A Digger Wasp	Y			SNR*	
		Tachytes crassus	A Digger Wasp	Y			SNR*	
		Tachytes harpax	A Digger Wasp	Y			SNR*	
		Tachytes intermedius	A Digger Wasp	Y			SNR*	
	Crabronidae	*Diodontus virginianus*	A Digger Wasp	Y			SNR*	
	(Pemphredoninae)	*Mimumesa leucopus*	A Digger Wasp	Y			SNR*	
		Mimumesa longicornis	A Digger Wasp	Y			SNR*	
	Crabronidae	*Cerceris astarte*	A Digger Wasp	Y			SNR*	
	(Philanthinae)	*Cerceris cruces*	A Digger Wasp	Y			SNR*	
		Cerceris echo	A Digger Wasp	Y			SNR*	
		Cerceris finitima	A Digger Wasp	Y			SNR*	
		Cerceris fumipennis	A Digger Wasp	Y			SNR*	
		Cerceris halone	A Digger Wasp	Y			SNR*	
		Cerceris insolita	A Digger Wasp	Y			SNR*	
		Cerceris kennicottii	A Digger Wasp	Y			SNR*	
		Crabro snowii	A Digger Wasp	Y			SNR*	
		Philanthus lepidus	A Digger Wasp	Y			SNR*	
	Megachilidae	*Stelis costalis*	A Cuckoo Leaf-Cutting Bee	Y			SNR*	
	Sphecidae	*Ammophila nigricans*	A Digger Wasp	Y			SNR*	
		Cerceris bicornuta	A Digger Wasp	Y			SNR*	
		Isodontia elegans	A Digger Wasp	Y			SNR*	
		Sphex pensylvanicus	A Spider Wasp	Y			SNR*	

APPENDIX C.
SUMMARY OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

Order	Family	Scientific Name	Common Name	Present	COSEWIC	COSSARO	Srank	Legal
Lepidoptera	Hesperiidae	*Amblyscirtes hegon*	Pepper and Salt Skipper	Y			S3?	
		Erynnis brizo	Sleepy Duskywing	Y			S1	
		Erynnis martialis	Mottled Duskywing	Y			S2	FWCA(P)
		Euphyes dukesi	Duke's Skipper	Y			S2	
		Poanes massasoit	Mulberry Wing	Y			S3	
		Thorybes bathyllus	Southern Cloudywing	Y			S2S3	
	Lycaenidae	*Satyrium caryaevorum*	Hickory Hairstreak	Y			S3S4	
	Noctuidae	*Papaipema baptisiae*	Wild Indigo Borer Moth	Y			S1	
		Papaipema cerussata	Ironweed Borer Moth	Y			S1	
		Papaipema sciata	Culver's-root Borer Moth	Y			S1	
	Nymphalidae	*Asterocampa celtis*	Hackberry Emperor	Y			S2	
		Asterocampa clyton	Tawney Emperor	Y			S2S3	
		Danaus plexippus	Monarch	Y	SC	SC	S4	SARA(1), OESA(5), FWCA(P)
	Papilionidae	*Papilio cresphontes*	Giant Swallowtail	Y			S2	FWCA(P)
		Papilio glaucus	Eastern Tiger Swallowtail	Y			S4S5	FWCA(P)
		Papilio polyxenes	Black Swallowtail	Y			S5	FWCA(P)
		Papilio Troilus	Spicebush Swallowtail	Y			S4	FWCA(P)

APPENDIX C.
SUMMARY OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

Order	Family	Scientific Name	Common Name	Present	COSEWIC	COSSARO	Srank	Legal
Odonata	Aeshnidae	*Aeshna clepsydra*	Mottled Darner	?[E, OD]			S3	
		Epiaeschna heros	Swamp Darner	Y			S2S3	
		Nasiaeschna pentacantha	Cyrano Darner	?[E]			S3	
	Coenagrionidae	*Argia tibialis*	Blue-tipped Dancer	?[E]			S3	
		Enallagma aspersum	Azure Bluet	Y			S3	
		Enallagma basidens	Double-striped Bluet	Y			S3	
		Ischnura hastate	Citrine Forktail	Y			S2	
	Gomphidae	*Arigomphus villosipes*	Unicorn Clubtail	?[E]			S1S2	
		Gomphus descriptus	Harpoon Clubtail	?[T]			S3	
		Gomphus fraternus	Midland Clubtail	?[E]			S3	
		Gomphus graslinellus	Pronghorn Clubtail	Y			S2	
		Gomphus vastus	Cobra Clubtail	Y			S1	
		Ophiogomphus carolus	Riffle Snaketail	?[T]			S2	
		Progomphus obscurus	Common Sanddragon	Y			S1	
		Stylurus notatus	Elusive Clubtail	Y			S2	
	Libellulidae	*Celithemis eponina*	Halloween Pennant	Y			S3	
		Libellula semifasciata	Painted Skimmer	Y			S2	
		Libellula vibrans	Great Blue Skimmer	Y			S1	
		Perithemis tenera	Eastern Amberwing	Y			S3	
	Macromiidae	*Macromia taeniolata*	Royal River Cruiser	Y			S1	

APPENDIX C.
SUMMARY OF SIGNIFICANT INSECT SPECIES POTENTIALLY PRESENT IN PROXIMITY TO THE AOI

Order	Family	Scientific Name	Common Name	Present	COSEWIC	COSSARO	Srank	Legal
Orthoptera	Acrididae	*Dicromorpha viridis*	A Short-Winged Green Grasshopper	Y			S1?	
		Melanoplus scudderi scudderi	Scudder's short-winged grasshopper	Y			S1?	
		Melanoplus walshii	A Short Horned Grasshopper	Y			S3S4	
	Gryllidae	*Anaxipha exigua*	Say's Bush Cricket	Y			S2S4	
		Neoxabea bipunctata	Two-spotted Tree Cricket	Y			S1?	
	Tettigoniidae	*Microcentrum rhombifolium*	A Katydid	Y			S2S3	

*SNR – insufficient data to rank, though potentially afforded a significant rank due to new published records.

Note: Species status current to November 2008.

Present:
Y – confirmed present in the vicinity of the area of continued analysis
? – possibly present in the vicinity of the area of continued analysis
$?^{E}$ – possibly present in the vicinity of the area of continued analysis and known to occur in Essex County according to NHIC
$?^{T}$ – possibly present in the vicinity of the area of continued analysis and know to occur in the Town of Tecumseh
$?^{OD}$ – possibly present in the vicinity of the area of continued analysis and documented in the region by the Odonate Database, NHIC

APPENDIX D.

LOCATION OF WATERCOURSES AND LIST OF FISH SPECIES LOCATED IN THE AREA OF INVESTIGATION

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Drainage - Important Fish Habitat
- Drainage - Marginal Fish Habitat
- Drainage - Not Fish Habitat
- Fish Habitat
- Seasonal Fish Habitat
- No Fish Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

WATERCOURSES AND FISH HABITAT LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Da
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Drainage - Important Fish Habitat
- Drainage - Marginal Fish Habitat
- Drainage - Not Fish Habitat
- Fish Habitat
- Seasonal Fish Habitat
- No Fish Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

WATERCOURSES AND FISH HABITAT LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Db
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Drainage - Important Fish Habitat
- Drainage - Marginal Fish Habitat
- Drainage - Not Fish Habitat
- Fish Habitat
- Seasonal Fish Habitat
- No Fish Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

WATERCOURSES AND FISH HABITAT LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Dc
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Drainage - Important Fish Habitat
- Drainage - Marginal Fish Habitat
- Drainage - Not Fish Habitat
- Fish Habitat
- Seasonal Fish Habitat
- No Fish Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

WATERCOURSES AND FISH HABITAT LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Dd
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

APPENDIX D.
FISH SPECIES OCCURRENCE RECORDS FOR THE AOI EXCLUDING THE DETROIT RIVER

Common Name	Scientific Name	COSEWIC	COSSARO	Srank	Legal Status	Basin Drain	Burke Drain	Cahill Drain	Dickson Drain	G. Marais Drain	Lennon Drain	McKee Creek	McKee Drain	Titcombe Drain	Wolfe Drain	Pond
Central Mudminnow	*Umbra limi*			S5	FA			152	46							
Northern Pike	*Esox lucius*			S5	FA								17	23		
Goldfish	*Carassius auratus*			SE	FA			152		38	153					
Common Carp	*Cyprinus carpio*			SE	FA			152		38						
Golden Shiner	*Notemigonus crysoleucas*			S5	FA			152								
Hornyhead Chub	*Nocomis biguttatus*	NAR	NAR	S4	FA					38						
Striped Shiner	*Luxilus chrysocephalus*	NAR	NAR	S4	FA			152								
Spotfin Shiner	*Cyprinella spliloptera*			S5	FA			152								
Fathead Minnow	*Pimephales promelas*			S5	FA	26		152		38, 150, 151	40, 153				55	
Bluntnose Minnow	*Pimephales notatus*	NAR	NAR	S5	FA			152		38	40					
Emerald Shiner	*Notropis atherinoides*			S5	FA			152		150						
Minnow family	Cyprinidae				FA			152			153					
White Sucker	*Catostomus commersoni*			S5	FA			152								
Black Bullhead	*Ameiurus melas*			S4	FA			152				2				
Black Crappie	*Pomoxis nigromaculatus*			S4	FA											X
Rock Bass	*Ambloplites rupestris*			S5	FA			152					2			
Largemouth Bass	*Micropterus salmoides*			S5	FA			152		38	40					
Smallmouth Bass	*Micropterus dolomieu*			S5	FA					38						
Green Sunfish	*Lepomis cyanellus*	NAR	NAR	S4	FA		47	152		150, 151						
Bluegill	*Lepomis macrochirus*			S5	FA					38						
Pumpkinseed	*Lepomis gibbosus*			S5	FA			152		38	40, 153					

Note: Species status current to November 2008; FA = *Fisheries Act*

Station information:

Historical:
ERCA (May 2000) – 152, 153
ERCA (April 2001) –150, 151

LGL Surveys:
LGL (May 2006) - 17, 23
LGL (September 2006) – 2, 26, 38, 40, 46, 47, 55, X

APPENDIX D.
FISH SPECIES OCCURRENCE RECORDS FOR THE DETROIT RIVER

Common Name	Scientific Name	COSEWIC	COSSARO	Srank	Legal
Sea Lamprey	*Petromyzon marinus*			SE	FA
Lake Sturgeon	*Acipenser fulvescens*	THR	SC	S3	FA, SARA(none), OESA(5)
Spotted Gar	*Lepisosteus oculatus*	THR	THR	S2	FA, SARA(1), OESA(4)
Longnose Gar	*Lepisosteus osseus*			S4	FA, OESA(3)
Bowfin	*Amia calva*			S4	FA
American Eel	*Anguilla rostrata*		END	S5	FA, OESA(3)
Alewife	*Alosa pseudoharengus*			SE	FA
Gizzard Shad	*Dorosoma cepedianum*			S4	FA
Mooneye	*Hiodon tergisus*			S4	FA
Chinook Salmon	*Oncorhynchus tshawytscha*			SE	FA
Coho Salmon	*Oncorhynchus kisutch*			SE	FA
Pink Salmon	*Oncorhynchus gorbuscha*			SE	FA
Rainbow Trout	*Oncorhynchus mykiss*			SE	FA
Brown Trout	*Salmo trutta*			SE	FA
Lake Trout	*Salvelinus namaycush*			S5	FA
Lake Whitefish	*Coregonus clupeaformis*			S5	FA
Rainbow Smelt	*Osmerus mordax*			S5	FA
Northern Pike	*Esox lucius*			S5	FA
Muskellunge	*Esox masquinongy*			S4	FA
Goldfish	*Carrasius auratus*			SE	FA
Common Carp	*Cyprinus carpio*			SE	FA
Silver Chub	*Macrhybopsis storeriana*	SC	SC	S2	FA, SARA(1), OESA(5)
Golden Shiner	*Notemigonus crysoleucas*			S5	FA
Bluntnose Minnow	*Pimephales notatus*	NAR	NAR	S5	FA
Emerald Shiner	*Notropis atherinoides*			S5	FA
Pugnose Minnow	*Opsopoeodus emiliae*	SC	SC	S2	FA, SARA(1), OESA(5)
Blacknose Shiner	*Notropis heterolepis*			S5	FA
Pugnose Shiner	*Notropis anogenus*	END	END	S2	FA, SARA(1), OESA(3)
Spottail Shiner	*Notropis hudsonius*			S4	FA
Sand Shiner	*Notropis stramineus*			S4	FA
Mimic Shiner	*Notropis volucellus*			S5	FA
Quillback	*Carpiodes cyprinus*			S4	FA
Longnose Sucker	*Catostomus catostomus*			S5	FA
White Sucker	*Catostomus commersoni*			S5	FA
Northern Hog Sucker	*Hypentelium nigricans*			S4	FA
Bigmouth Buffalo	*Ictiobus cyprinellus*	NAR	SC	SU	FA, OESA(5)
Smallmouth Buffalo	*Ictiobus bubalus*				FA
Spotted Sucker	*Minytrema melanops*	SC	SC	S2	FA, SARA(1), OESA(5)
Redhorse (unidentified)	*Moxostoma* sp.				FA
Silver Redhorse	*Moxostoma anisurum*			S4	FA
Golden Redhorse	*Moxostoma erythrurum*	NAR	NAR	S4	FA
Shorthead Redhorse	*Moxostoma macrolepidotum*			S5	FA
River Redhorse	*Moxostoma carinatum*	SC	SC	S2	FA, SARA(1), OESA(5)
Yellow Bullhead	*Ameiurus natalis*			S4	FA

APPENDIX D.
FISH SPECIES OCCURRENCE RECORDS FOR THE DETROIT RIVER

Common Name	Scientific Name	COSEWIC	COSSARO	Srank	Legal
Black Bullhead	*Ameiurus melas*			S4	FA
Brown Bullhead	*Ameiurus nebulosus*			S5	FA
Channel Catfish	*Ictalurus punctatus*			S4	FA
Stonecat	*Noturus flavus*			S4	FA
Northern Madtom	*Noturus stigmosus*	END	END	S1S2	FA, SARA(1), OESA(3)
Trout-Perch	*Percopsis omiscomaycus*			S5	FA
Burbot	*Lota lota*			S5	FA
Banded Killifish	*Fundulus diaphanus*			S5	FA
Brook Silverside	*Labidesthes sicculus*	NAR	NAR	S4	FA
Four Horn Sculpin	*Myoxocephalus quadricornis*			S2?	FA
White Perch	*Morone americana*			SE	FA
White Bass	*Morone chrysops*			S4	FA
Rock Bass	*Ambloplites rupestris*			S5	FA
Green Sunfish	*Lepomis cyanellus*	NAR	NAR	S4	FA
Largemouth Bass	*Micropterus salmoides*			S5	FA
Smallmouth Bass	*Micropterus dolomieu*			S5	FA
Bluegill	*Lepomis macrochirus*			S5	FA
Pumpkinseed	*Lepomis gibbosus*			S5	FA
Orangespotted Sunfish	*Lepomis humilis*	SC	SC	SE	FA, SARA(3), OESA(5)
Black Crappie	*Pomoxis nigromaculatus*			S4	FA
White Crappie	*Pomoxis annularis*			S4	FA
Logperch	*Percina caprodes*			S5	FA
Yellow Perch	*Perca flavescens*			S5	FA
Sauger	*Sander canadense*			S4	FA
Walleye	*Sander vitreus*			S5	FA
Freshwater Drum	*Aplodinotus grunniens*			S5	FA
Round Goby	*Neogobius melanostomus*			SE	FA
Tubenose Goby	*Proterorhinus marmoratus*			SE	FA

Note: Species status current to November 2008.

COSEWIC – Committee on the Status of Endangered Wildlife in Canada:
- END – Endangered
- THR – Threatened
- SC – Special Concern
- XT – Extirpated
- NAR – Not at Risk

Provincial:
- S1 – Extremely Rare
- S2 – Very Rare
- S3 – Rare to Uncommon
- S4 – Common
- S5 – Very Common
- SE – Exotic
- SXP – Extirpated

COSSARO – Committee on the Status of Species at Risk in Ontario:
- END – Endangered
- THR – Threatened
- SC – Special Concern
- EXP – Extirpated
- NAR – Not at Risk

Legal Status:
- FA - *Fisheries Act*
- SARA – Species at Risk Act
- OESA – Ontario Endangered Species Act

APPENDIX E.

LOCATION OF FISH HABITAT COMPENSATION AREAS

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

DRAFT

FISHERIES COMPENSATION STRATEGY

LGL LIMITED
environmental research associates

Project:	TA4137	**Figure:**	Appendix Ea
Date:	December 2008	**Prepared By:**	KDT
Scale:	1 : 10,000	**Checked By:**	GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

DRAFT

FISHERIES COMPENSATION STRATEGY

LGL LIMITED
environmental research associates

Project:	TA4137	**Figure:**	Appendix Eb
Date:	December 2008	**Prepared By:**	KDT
Scale:	1 : 10,000	**Checked By:**	GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

DRAFT

FISHERIES COMPENSATION STRATEGY

LGL LIMITED
environmental research associates

Project:	TA4137	**Figure:**	Appendix Ec
Date:	December 2008	**Prepared By:**	KDT
Scale:	1 : 10,000	**Checked By:**	GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Drainage
- Realigned/Enhanced Habitat

Data Sources: LGL Limited field surveys, Essex Region Conservation Authourity, Spring 2006 aerial photography.

DRAFT

FISHERIES COMPENSATION STRATEGY

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Ed
Date: December 2008	**Prepared By:** KDT
Scale: 1 : 10,000	**Checked By:** GNK

APPENDIX F.

LOCATION OF WILDLIFE HABITAT UNITS AND LIST OF WILDLIFE SPECIES LOCATED IN THE AREA OF INVESTIGATION

LEGEND

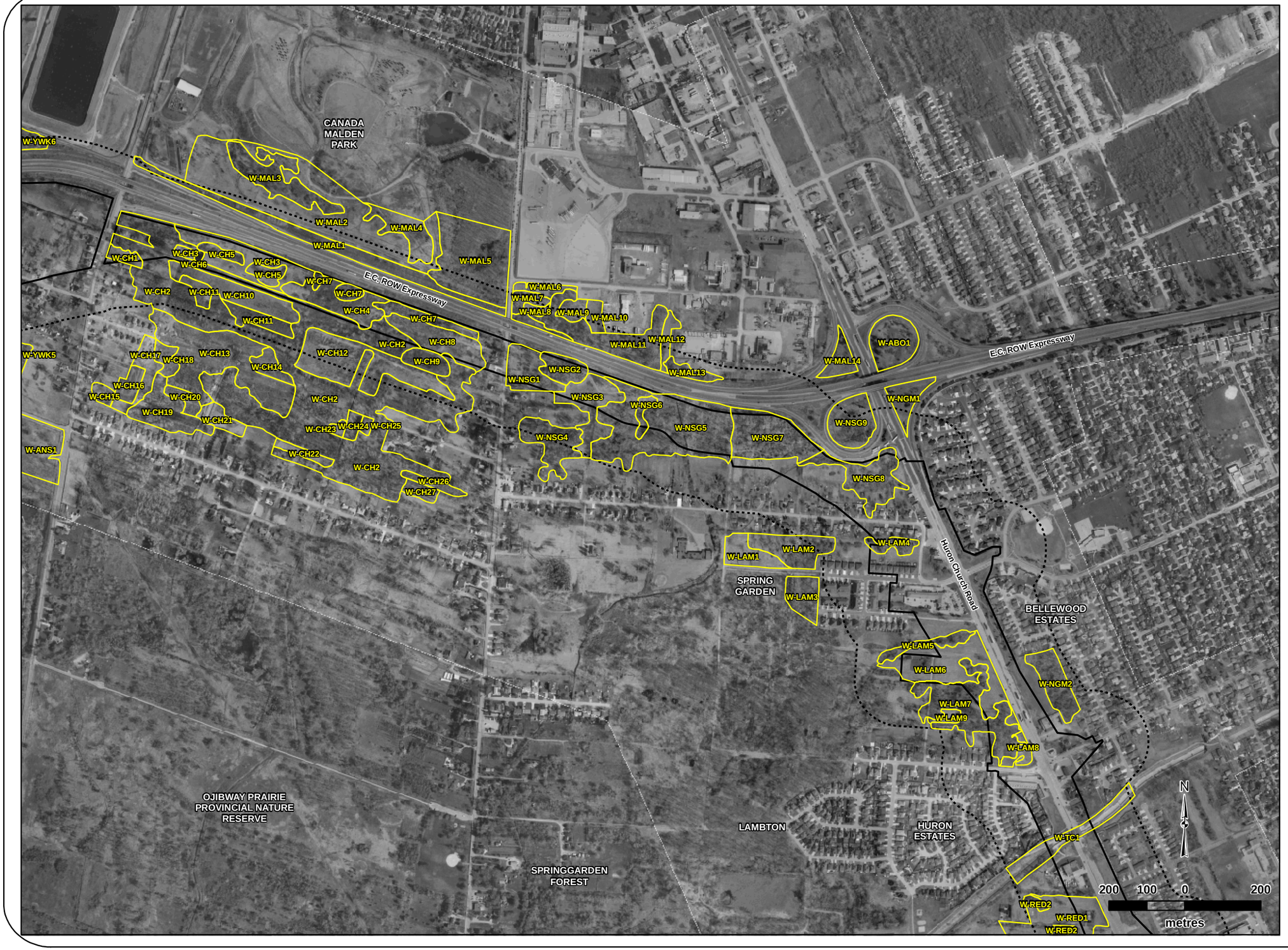
- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Wildlife Habitat Unit

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

WILDLIFE HABITAT UNITS LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Fa
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK



LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Wildlife Habitat Unit

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

WILDLIFE HABITAT UNITS LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Fb
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Wildlife Habitat Unit

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

WILDLIFE HABITAT UNITS LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Fc
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Wildlife Habitat Unit

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

WILDLIFE HABITAT UNITS LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix Fd
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 10,000	**Checked By:** GNK

APPENDIX F.
LIST OF WILDLIFE SPECIES RECORDED IN THE AREA OF INVESTIGATION

Wildlife	Scientific Name	Common Name	COSEWIC	COSSARO	Local	Legal Status	Others[1]
Herpetofauna	*Bufo americanus*	American Toad					
	Pseudacris triseriata	Western Chorus Frog					
	Rana pipiens	Northern Leopard Frog					
	Rana clamitans	Green Frog					
	Chelydra serpentina	Snapping Turtle				FWCA(G)	
	Chrysemys picta marginata	Midland Painted Turtle				FWCA(P)	
	Thamnophis sirtalis	Eastern Gartersnake					
	Thamnophis butleri	Butler's Gartersnake	THR	THR		SARA(1)/ OESA (4)/ FWCA(P)	
	Storeria dekayi	Dekay's Brown Snake					
	Storeria occipitomaculata	Northern Red-bellied Snake					
	Elaphe gloydi	Eastern Foxsnake	END	THR		SARA(none)/ OESA (4)/ FWCA(P)	
Birds	*Branta canadensis*	Canada Goose				MBCA	
	Aix sponsa	Wood Duck			BSC	MBCA	
	Anas platyrhynchos	Mallard				MBCA	
	Phasianus colchicus	Ring-necked Pheasant				MBCA / FWCA(G)	
	Phalacrocorax auritus	Double-crested Cormorant					
	Ardea herodias	Great Blue Heron				MBCA	
	Ardea alba	Great Egret				MBCA	
	Nycticorax nycticorax	Black-crowned Night Heron			BSC	MBCA	
	Cathartes aura	Turkey Vulture			BSC	FWCA(P)	
	Pandion haliaetus	Osprey			BSC	FWCA(P)	
	Accipiter striatus	Sharp-shinned Hawk				FWCA(P)	
	Accipiter cooperii	Cooper's Hawk				FWCA(P)	
	Accipiter gentilis	Northern Goshawk				FWCA(P)	
	Buteo platypterus	Broad-winged Hawk			BSC	FWCA(P)	
	Buteo jamaicensis	Red-tailed Hawk				FWCA(P)	
	Falco sparverius	American Kestrel			BSC	FWCA(P)	
	Charadrius vociferus	Killdeer				MBCA	
	Actitis macularius	Spotted Sandpiper			BSC	MBCA	
	Gallinago delicata	Wilson's Snipe			BSC	MBCA	
	Scolopax minor	American Woodcock			BSC	MBCA	
	Larus delawarensis	Ring-billed Gull				MBCA	
	Columba livia	Rock Pigeon					
	Zenaida macroura	Mourning Dove				MBCA	
	Coccyzus americanus	Yellow-billed Cuckoo			BSC	MBCA	*
	Megascops asio	Eastern Screech-Owl				FWCA(P)	
	Archilochus colubris	Ruby-throated Hummingbird			BSC	MBCA	
	Melanerpes erythrocephalus	Red-headed Woodpecker	SC	SC	BSC	OESA (5)/ MBCA	
	Melanerpes carolinus	Red-bellied Woodpecker			BSC	MBCA	
	Picoides pubescens	Downy Woodpecker				MBCA	

APPENDIX F.
LIST OF WILDLIFE SPECIES RECORDED IN THE AREA OF INVESTIGATION

Wildlife	Scientific Name	Common Name	COSEWIC	COSSARO	Local	Legal Status	Others[1]
	Picoides villosus	Hairy Woodpecker				MBCA	*
	Colaptes auratus	Northern Flicker				MBCA	
	Contopus virens	Eastern Wood Pewee				MBCA	
	Empidonax traillii	Willow Flycatcher				MBCA	
	Empidonax minimus	Least Flycatcher				MBCA	
	Sayornis phoebe	Eastern Phoebe			BSC	MBCA	
	Myiarchus crinitus	Great Crested Flycatcher				MBCA	*
	Tyrannus tyrannus	Eastern Kingbird			BSC	MBCA	
	Vireo flavifrons	Yellow-throated Vireo				MBCA	
	Vireo solitarius	Blue-headed Vireo				MBCA	
	Vireo gilvus	Warbling Vireo				MBCA	
	Vireo olivaceus	Red-eyed Vireo				MBCA	
	Cyanocitta cristata	Blue Jay				FWCA(P)	
	Corvus brachyrhynchos	American Crow					
	Eremophila alpestris	Horned Lark			BSC	MBCA	
	Tachycineta bicolor	Tree Swallow				MBCA	
	Stelgidopteryx serripennis	Northern Rough-winged Swallow			BSC	MBCA	
	Petrochelidon pyrrhonota	Cliff Swallow			BSC	MBCA	
	Hirundo rustica	Barn Swallow			BSC	MBCA	
	Poecile atricapillus	Black-capped Chickadee				MBCA	
	Sitta carolinensis	White-breasted Nuthatch				MBCA	
	Certhia americana	Brown Creeper			BSC	MBCA	
	Thryothorus ludovicianus	Carolina Wren			BSC	MBCA	
	Troglodytes aedon	House Wren				MBCA	
	Regulus satrapa	Golden-crowned Kinglet				MBCA	
	Regulus calendula	Ruby-crowned Kinglet				MBCA	
	Polioptila caerulea	Blue-gray Gnatcatcher			BSC	MBCA	
	Sialia sialis	Eastern Bluebird			BSC	MBCA	
	Cathartes fuscescens	Veery			BSC	MBCA	
	Catharus guttatus	Hermit Thrush				MBCA	
	Hylocichla mustelina	Wood Thrush				MBCA	
	Turdus migratorius	American Robin				MBCA	
	Dumetella carolinensis	Gray Catbird			BSC	MBCA	
	Toxostoma rufum	Brown Thrasher			BSC	MBCA	
	Sturnus vulgaris	European Starling					
	Bombycilla cedrorum	Cedar Waxwing				MBCA	
	Vermivora chrysoptera	Golden-winged Warbler	THR	SC		SARA (1)/ OESA (5)/ MBCA	
	Vermivora peregrina	Tennessee Warbler				MBCA	
	Vermivora ruficapilla	Nashville Warbler				MBCA	
	Parula americana	Northern Parula				MBCA	
	Dendroica petechia	Yellow Warbler				MBCA	
	Dendroica pensylvanica	Chestnut-sided Warbler			BSC	MBCA	
	Dendroica magnolia	Magnolia Warbler				MBCA	
	Dendroica caerulescens	Black-throated Blue Warbler				MBCA	
	Dendroica coronata	Yellow-rumped Warbler				MBCA	

APPENDIX F.
LIST OF WILDLIFE SPECIES RECORDED IN THE AREA OF INVESTIGATION

Wildlife	Scientific Name	Common Name	COSEWIC	COSSARO	Local	Legal Status	Others[1]
	Dendroica virens	Black-throated Green Warbler				MBCA	
	Dendroica fusca	Blackburnian Warbler				MBCA	
	Dendroica pinus	Pine Warbler				MBCA	
	Dendroica palmarum	Palm Warbler				MBCA	
	Dendroica castanea	Bay-breasted Warbler				MBCA	
	Mniotilta varia	Black and White Warbler				MBCA	
	Setophaga ruticilla	American Redstart			BSC	MBCA	
	Seiurus aurocapilla	Ovenbird			BSC	MBCA	*
	Oporornis philadelphia	Mourning Warbler			BSC	MBCA	
	Geothlypis trichas	Common Yellowthroat				MBCA	
	Wilsonia pusilla	Wilson's Warbler				MBCA	
	Piranga olivacea	Scarlet Tanager			BSC	MBCA	*
	Pipilo erythrophthalmus	Eastern Towhee			BSC	MBCA	
	Spizella passerina	Chipping Sparrow				MBCA	
	Spizella pusilla	Field Sparrow			BSC	MBCA	
	Pooecetes gramineus	Vesper Sparrow			BSC	MBCA	
	Passerculus sandwichensis	Savannah Sparrow			BSC	MBCA	
	Melospiza georgiana	Swamp Sparrow			BSC	MBCA	*
	Melospiza melodia	Song Sparrow				MBCA	
	Melospiza lincolnii	Lincoln's Sparrow				MBCA	
	Zonotrichia albicollis	White-throated Sparrow				MBCA	
	Zonotrichia leucophrys	White-crowned Sparrow				MBCA	
	Junco hyemalis	Dark-eyed Junco				MBCA	
	Cardinalis cardinalis	Northern Cardinal				MBCA	
	Pheucticus ludovicianus	Rose-breasted Grosbeak				MBCA	
	Passerina cyanea	Indigo Bunting				MBCA	
	Agelaius phoeniceus	Red-winged Blackbird					
	Quiscalus quiscula	Common Grackle					
	Molothrus ater	Brown-headed Cowbird					
	Icterus spurius	Orchard Oriole			BSC	MBCA	
	Icterus galbula	Baltimore Oriole				MBCA	
	Carpodacus mexicanus	House Finch				MBCA	
	Carduelis tristis	American Goldfinch			BSC	MBCA	
	Passer domesticus	House Sparrow					
Mammals	*Didelphis virginiana*	Virginia Opossum				FWCA(F)	
	Blarina brevicauda	N. Short-tailed Shrew				FWCA(P)	
	Eptesicus fuscus	Big Brown Bat				FWCA(P)	*
	Lasiurus borealis	Eastern Red Bat				FWCA(P)	*
	Lasiurus cinereus	Hoary Bat				FWCA(P)	*
	Sylvilagus floridanus	Eastern Cottontail				FWCA(G)	
	Lepus europaeus	European Hare				FWCA(G)	
	Tamias striatus	Eastern Chipmunk				FWCA(P)	
	Marmota monax	Groundhog					
	Sciurus carolinensis	Gray Squirrel				FWCA(G)	
	Peromyscus leucopus	White-footed Mouse					
	Microtus pennsylvanicus	Meadow Vole					
	Ondatra zibethica	Muskrat				FWCA(F)	
	Rattus norvegicus	Norway Rat					*

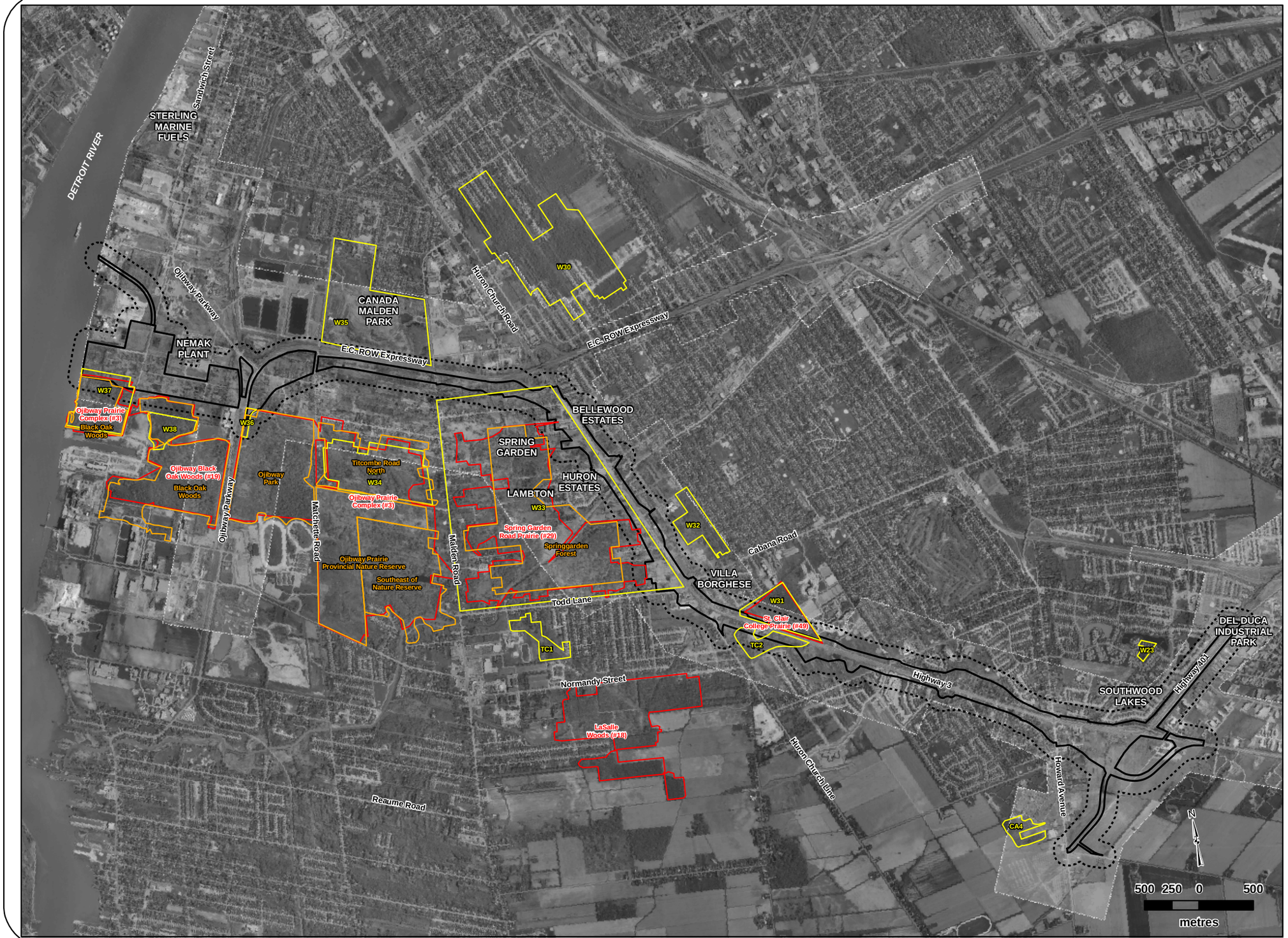
APPENDIX F.
LIST OF WILDLIFE SPECIES RECORDED IN THE AREA OF INVESTIGATION

Wildlife	Scientific Name	Common Name	COSEWIC	COSSARO	Local	Legal Status	Others[1]
	Mus musculus	House Mouse					*
	Canis latrans	Coyote				FWCA(F)	
	Vulpes vulpes	Red Fox				FWCA(F)	
	Procyon lotor	Raccoon				FWCA(F)	
	Mephitis mephitis	Striped Skunk				FWCA(F)	
	Odocoileus virginianus	White-tailed Deer				FWCA(G)	

[1] Denotes species that have been identified in the region by others and that suitable habitat exists in the area of investigation.
Note: Species status current to November 2008.

APPENDIX G.

LOCATION OF DESIGNATED NATURAL AREAS



LEGEND

- Proposed Right-of-way
- 120 metres from Proposed Right-of-way
- Area of Natural and Scientific Interest
- Candidate Natural Heritage Site
- Environmentally Significant Area

Data Sources: LGL Limited field surveys, Spring 2006 aerial photography.

DESIGNATED NATURAL AREAS LOCATED IN THE AREA OF INVESTIGATION

LGL LIMITED
environmental research associates

Project: TA4137	**Figure:** Appendix G
Date: December 2008	**Prepared By:** MWF
Scale: 1 : 35,000	**Checked By:** GNK