



# **Appendix B**

## **Natural Environment Inventory**

**DATE** April 20, 2017**PROJECT** 05-1112-010**TO** Richard Wootton  
Region of Waterloo**CC** John Piersol, Jennifer Hancox**FROM** Amber Sabourin, Richard Booth**EMAIL** asabourin@golder.com**CAMBRIDGE EAST NATURAL ENVIRONMENT EXISTING CONDITIONS**

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**1.0 INTRODUCTION**

Golder Associates Ltd. (Golder) was retained by the Regional Municipality of Waterloo (the Region) to conduct this desktop natural environment inventory report to support an assessment of potential effects that could occur as a result of various groundwater supply options considered under the municipal Class Environmental Assessment (EA) to identify the preferred alternative for optimizing municipal groundwater supply in Cambridge East (the Project).

**2.0 SITE DESCRIPTION**

The Cambridge East Class EA Study Area, as shown on Figure 1, includes the Pinebush, Clemens Mill and Shade's Mills well fields. The study area is bounded on the west by Franklin Boulevard and extends east of Townline Road to include portions of the Townships of Puslinch and North Dumfries. It is bounded on the north by Highway 401 and by Clyde Road on the south. The Class EA is focused on assessing options for restoring groundwater supply capacities to the Pinebush, Turnbull (Clemens Mill) and Shade's Mills Water Treatment Plants (WTPs).

West of Townline Road, the Study Area is primarily developed in residential, commercial and industrial land uses. East of Townline Road, the land is primarily rural. Several large areas of wetlands, and two large waterbodies, also occur in the Study Area.

All three water treatment plants are located in the western portion of the Study Area in an urban setting. Small areas of wetland occur adjacent to the Pinebush and Shade's Mills Treatment Plants. The Shade's Mills Treatment Plant is also located immediately adjacent to the Shade's Mills Conservation Area.

**3.0 POLICY CONTEXT****3.1 Provincial Policy Statement (PPS)**

The PPS was issued under Section 3 of the *Planning Act*, and came into effect on April 30, 2014.

The natural heritage policies of the PPS (MMAH 2014) indicate that:

- 2.1.1 Natural features and areas shall be protected for the long term;



- 2.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features and groundwater features;
- 2.1.3 Natural heritage systems shall be identified in Ecoregions 6E and 7E, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas;
- 2.1.4 Development and Site alteration shall not be permitted in:
  - a) Significant wetlands in Ecoregions 5E, 6E and 7E; and
  - b) Significant coastal wetlands.
- 2.1.5 Unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions, development and Site alteration shall not be permitted in:
  - a) Significant wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;
  - b) Significant woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
  - c) Significant valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
  - d) Significant wildlife habitat;
  - e) Significant areas of natural and scientific interest; and
  - f) Coastal wetlands in Ecoregions 5E, 6E and 7E that are not subject to policy 2.1.4(b).
- 2.1.6 Development and Site alteration shall not be permitted in fish habitat except in accordance with provincial and federal requirements;
- 2.1.7 Development and Site alteration shall not be permitted in habitat of endangered species and threatened species, except in accordance with provincial and federal requirements; and
- 2.1.8 Development and Site alteration shall not be permitted on adjacent lands to the natural heritage features and areas identified in policies 2.1.3, 2.1.4 and 2.1.5 unless the ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or on their ecological functions.

## 3.2 Species at Risk

### 3.2.1 *Species at Risk Act (SARA)*

At a federal level, species at risk designations for species occurring in Canada are initially determined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). If approved by the federal Minister of the Environment, species are added to the federal List of Wildlife Species at Risk (Government of Canada, 2002). Species that are included on Schedule 1 as endangered or threatened are afforded protection of critical habitat on federal lands under the *Species at Risk Act* (SARA). On private or provincially-owned lands, only

aquatic species listed as endangered, threatened or extirpated and migratory birds are protected under SARA, unless ordered by the Governor in Council.

### **3.2.2 Endangered Species Act (ESA)**

Species at risk designations for species in Ontario are initially determined by the Committee on the Status of Species at Risk in Ontario (COSSARO), and if approved by the provincial Minister of Natural Resources and Forestry, species are added to the provincial *Endangered Species Act* (ESA), which came into effect June 30, 2008 (Ontario, 2007). The legislation prohibits the killing or harming of species identified as 'endangered' or 'threatened' in the various schedules to the Act. The ESA also provides habitat protection to all species listed as threatened or endangered. As of June 30, 2008, the Species at Risk in Ontario (SARO) List is contained in O. Reg. 230/08.

Subsection 9(1) of the ESA prohibits the killing, harming or harassing of species identified as 'endangered' or 'threatened' in the various schedules to the Act. Subsection 10(1) (a) of the ESA states that "*No person shall damage or destroy the habitat of a species that is listed on the SARO List as an endangered or threatened species*".

General habitat protection is provided by the ESA to all threatened and endangered species. Species-specific habitat protection is only afforded to those species for which a habitat regulation has been prepared and passed into law under the ESA. The ESA has a permitting process where alterations to protected species or their habitats may be considered.

### **3.3 Fisheries Act**

The purpose of the *Fisheries Act* is to maintain healthy, sustainable and productive Canadian fisheries through the prevention of pollution, and the protection of fish and their habitat. In 2012, changes were made to the *Fisheries Act* to enhance Fisheries and Oceans Canada's (DFO) ability to manage threats to Canada's commercial, recreational and Aboriginal (CRA) fisheries.

Projects affecting waterbodies supporting Canada's CRA fisheries must comply with the provisions of the *Fisheries Act*. The proponent is responsible for determining if the project is likely to cause impacts to CRA fish and if these impacts can be avoided or mitigated. The proponent must gather information on the type and scale of impact on the fishery and determine if the impacts will result in *serious harm to fish*. Proponents have a duty to maintain records of self-assessments completed for projects they undertake, and need to provide this information to DFO upon request. Serious harm to fish is defined as: the death of fish; and/or any permanent alteration to, or destruction of, fish habitat. If it is determined that the impacts cannot be avoided or mitigated and will result in serious harm to fish, an application for authorization must be submitted to the DFO. Projects that have the potential to obstruct fish passage or, affect flows needed by fish also require an authorization; even if these occur outside of CRA fishery areas (DFO 2013a).

Proponents of projects requiring a Fisheries Act Authorization are required to submit a Habitat Offsetting Plan, which provides details of how the serious harm to fish will be offset, as well as outlining associated costs and monitoring commitments (DFO 2013b). Proponents also have a duty to notify DFO of any unforeseen activities that cause serious harm to fish and outline the steps taken to address them.

### **3.4 Grand River Conservation Authority**

The Study Area is within the jurisdiction of the Grand River Conservation Authority (GRCA). Any work proposed within watercourses, wetlands or waterbodies and within the regulated limits of the GRCA must be in compliance

with the regulations of O.Reg 150/06 Grand River Conservation Authority: Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses.

### **3.5 City of Cambridge Official Plan**

The portion of the Study Area west of Townline Road is located within the City of Cambridge and the Project must comply with the policies of the City of Cambridge Official Plan (OP) (2012). Development and site alteration within or adjacent to designated natural features may be prohibited. In some cases, development and site alteration may be permitted with the completion of appropriate environmental studies, such as an Environmental Impact Study (EIS).

The Study Area encompasses natural areas designated as Core Environmental Features and Environmentally Sensitive Landscapes. Core Environmental Features are features identified as provincially or regionally significant, and include Provincially Significant Wetlands (PSW), Environmentally Sensitive Policy Areas (ESPA), Significant Woodlands and Environmentally Significant Valley Features. Development and site alteration within these areas are prohibited, except as in accordance with the policies of the Regional Official Plan Section 7.2. Development and site alteration on lands adjacent to these features is permitted where it is shown that no adverse impacts to the features or functions will occur. A minimum buffer width of 10 m from all Core Environmental Features must be implemented (Cambridge 2012).

Locally Significant Natural Areas (LSNA) include other natural areas not designated as a Core Environmental Feature and include: wetlands regulated by the GRCA, wooded areas identified by the MNR, significant wildlife habitat, perennial or intermittent watercourses and Environmentally Significant Groundwater Discharge and Recharge Areas. Development and site alteration on or adjacent to LSNAs is permitted where it is shown that the ecological function will be maintained, enhanced or restored (Cambridge 2012).

Environmentally Sensitive Landscapes (ESL) are designated in the Region of Waterloo Official Plan.

### **3.6 Region of Waterloo Official Plan**

The portion of the Study Area west of Townline Road is located within the Region of Waterloo. The Study Area includes portions of the Region's Greenlands Network. The Greenlands Network is composed of Environmentally Sensitive Landscapes, Core Environmental Features, fish habitat, and Supporting Environmental Features and linkages. Core Environmental Features include PSWs, significant woodlands, ESPAs, significant valley features, significant Areas of Natural and Scientific Interest (ANSI), and significant habitat of threatened and endangered species (Region of Waterloo 2015).

Development and site alteration may be permitted within and adjacent to Environmentally Sensitive Landscapes where an EIS demonstrates there will be no adverse impact to the features or functions of the landscape (Region of Waterloo 2015).

Development and site alteration within Core Environmental Features is prohibited, with some exceptions for activities such as construction or upgrades to trunk sewers, watermains, wastewater treatment facilities and groundwater taking (Region of Waterloo 2015). Development and site alteration on lands adjacent to Core Environmental Features is permitted where it is shown that no adverse impacts to the features or functions will occur (Region of Waterloo 2015).

### **3.7 County of Wellington Official Plan**

East of Townline Road and north of Clyde Road, the Study Area is located within the County of Wellington. The Study Area includes portions of the County's Greenlands System. The Greenlands System includes streams

and valleylands, wetlands, environmentally sensitive areas, waterbodies, ANSIs, woodlands, fish and wildlife habitat, floodplains and threatened or endangered species. Areas designated as Core Greenlands include PSWs, other wetlands, habitat of threatened or endangered species, fish habitat and hazardous lands (Wellington County 2015).

Development and site alteration within, and adjacent to, other features of the Greenlands System is permitted where it is demonstrated no adverse impacts to the features or function will occur (Wellington County 2015).

## 4.0 METHODS

### 4.1 Background Review

The investigation of existing conditions in the Study Area included a background information search and literature review to gather data about the local area and provide context for the evaluation of the natural features.

As part of the background review, a number of resources were used to evaluate the existing conditions in the Study Area including:

- Natural Heritage Information Centre (NHIC) database maintained by the Ontario Ministry of Natural Resources (MNRF) (NHIC 2016);
- Atlas of Breeding Birds of Ontario (Cadman, *et al.* 2007);
- Atlas of the Mammals of Ontario (Dobbyn 1994);
- Royal Ontario Museum (ROM) range maps (ROM 2010);
- Bat Conservation International (BCI) range maps (BCI 2016);
- Ontario's Reptile and Amphibian Atlas (Ontario Nature 2016);
- Ontario Butterfly Atlas (Jones *et al.* 2016);
- Land Information Ontario (MNRF 2016);
- City of Cambridge Official Plan (2012);
- County of Wellington Official Plan (2015);
- Region of Waterloo Official Plan (2015);
- Cambridge East Boundary Road Natural Environment Report (Savanta 2015);
- Puslinch Tract Conservation Area Master Plan (GRCA 2004);
- Puslinch Lake Fish Habitat Assessment (Bonter *et al.* 2000); and
- Existing aerial imagery.

To develop an understanding of the ecological communities, wildlife habitat and potential natural heritage features that may be affected by the proposed Project, MNRF Land Information Ontario (LIO) data were used to create base layer mapping for the study area. A query of the NHIC database was conducted to identify element occurrences of any natural heritage features, including wetlands, Areas of Natural and Scientific Interest

(ANSIs), life science sites, rare vegetation communities, rare, threatened or endangered species and other natural heritage features within the study area.

## 4.2 Species at Risk Screening

Species at Risk (SAR) considered for this report includes those species listed under SARA and the ESA, as well as species ranked S1-S3 (NHIC). An assessment was conducted to determine which SAR had potential habitat within the Study Area. A desktop screening of all SAR which have the potential to be found in the Study Area was conducted as a desktop exercise, using the sources listed above. Species with ranges overlapping the Study Area, or recent occurrence records in the vicinity, were screened by comparing their habitat requirements to habitat conditions in the Study Area.

The potential for the species to occur was determined through a probability of occurrence. A ranking of low indicates no suitable habitat availability for that species in the Study Area and no specimens identified. Moderate probability indicates more potential for the species to occur, as suitable habitat appeared to be present in the Study Area, but no occurrence of the species has been recorded. High potential indicates a known species record in the Study Area (as determined through the background data review) and good quality habitat is present.

## 5.0 EXISTING CONDITIONS

A desktop assessment was conducted to determine if any significant environmental features, or SAR exist, or have moderate or high potential to exist, in the Study Area.

### 5.1 Natural Areas

#### 5.1.1 Terrestrial Features

In addition to features noted under the various OP's and associated schedules, there are also features that have been designated provincially or federally based on their ecological importance and sensitivity. These include provincially significant wetlands (PSW) and regionally significant Areas of Natural Scientific Interest (ANSI), as shown on Figure 1. Based on MNR and GRCA mapping, designated sensitive features occurring in the Study Area include:

- Puslinch Lake Bog and Wetlands (regionally significant Earth Science ANSI);
- Galt Creek and Forests (regionally significant Life Science ANSI);
- Puslinch Tract (Paris Moraine) (regionally significant Life Science ANSI);
- Puslinch Lake – Irish Creek Complex (PSW);
- Mill Creek Wetland (PSW);
- Moffat Creek Swamp (PSW); and
- Portuguese Swamp (PSW).

Designated sensitive features are protected under specific provincial policies, as noted previously, and represent the highest level of constraint to proposed development, including municipal based infrastructure.

## **Regionally Significant ANSIs**

Puslinch Lake Bog and Wetlands is a life science ANSI that largely corresponds with the Puslinch Lake – Irish Creek Complex PSW. It is noted that much of this area is designated as Core Greenlands in the Centre Wellington Official Plan. The ANSI contains a kettle lake, and several wetland types, including a black spruce bog (rare in southern Ontario), swamp, and shrub wetlands. Pockets of upland deciduous forest also occur throughout the feature. Galt Creek and Forests is a life science ANSI located to the east of Townline Road and to the north of Concession 1. It is composed of lowland mixed and coniferous swamp forest with some upland forest. This feature also encompasses the Mill Creek PSW.

Puslinch Tract (Paris Moraine) is designated as an earth science ANSI and is located to the northeast of Puslinch Lake and south of Highway 401. This area was historically used for aggregate extraction during construction and expansion of Highway 401. Portions of the area were transferred to MNR ownership and managed for forest production through the 1960s and 1970s. The entire property was purchased by the GRCA in 1999 and is currently managed as a conservation area (GRCA 2004). Small portions of the Puslinch Lake – Irish Creek Complex and the Mill Creek PSW also overlap the Puslinch Tract.

Regionally designated significant ANSI's do not receive regulatory protection. Instead, decisions related to assigning appropriate levels of protection and land uses fall under the responsibility of the local municipality or conservation authority and the environmental protection and land use criteria provided in official planning documents apply. The exception being where regional ANSIs overlap with or fall within the 120 m buffer of PSWs. In this case, provincial regulations for the protection of PSWs apply.

## **PSWs**

The Puslinch Lake – Irish Creek Complex of about 3.7 km<sup>2</sup> in area is located to the east of Townline Road and south of Highway 401, with Puslinch Lake, a large kettle basin, within the centre of the wetland complex. Surrounding wetland is composed of four wetland types (2% bog, 2% fen, 47% swamp and 49% marsh), including the McCormack Point Wetland, a peatland bog that has been studied extensively by the University of Waterloo (Currie, 1995; Warner, 2010). A piezometer was installed in the PSW by Golder in 2006. At the time of the installation, the plant community at the station was assessed to be a mature beech (*Fagus grandifolia*)-white ash (*Fraxinus americana*)-maple (*Acer* sp.) deciduous forest transitioning to a wetland community composed of cattail (*Typha* sp.), sensitive fern (*Onoclea sensibilis*), willows (*Salix* spp.), and mixed herbs. Ecological functions of the Puslinch Lake-Irish Creek Complex include an active feeding area of nesting waterbirds, winter cover for wildlife, with local significance for deer, and regional significance for waterfowl staging.

Mill Creek Wetland Complex PSW partially overlaps with the Galt Creek and Forest ANSI described above, totalling 5.4 km<sup>2</sup> in area. The PSW is composed of two wetlands types (95% swamp and 5% marsh).

The Portuguese Swamp PSW is located immediately south of municipal supply wells P11 and P17 and is also classified as an Environmentally Sensitive Policy Area (ESPA) by the Region. It is approximately 0.6 km<sup>2</sup> in area and consists of two wetland types (95% swamp and 5% marsh). During the 2006 piezometer installation, the plant community at the station was assessed to be a silver/red maple swamp with standing surface water, and sparse ground cover of cinnamon fern (*Osmunda cinnamomea*) and mayapple (*Podophyllum peltatum*) confined to hummock areas. Its ecological functions include active feeding area of nesting waterbirds and winter cover for wildlife.

Moffat Creek Swamp is a PSW located in the southern portion of the Study Area that is approximately 1.5 km<sup>2</sup> in area. This PSW is a complex of 39 individual wetlands composed of two wetland types (85% swamp and 15% marsh).

Based on MNRF mapping, other wetlands that have not been evaluated by the MNRF also occur in the Study Area.

Wetlands are dependent on surface water and groundwater on a seasonal or permanent basis to support their unique hydraulic and vegetation characteristics. Consequently, wetlands are sensitive to changes in hydrologic or hydrogeologic regimes. Such changes may impact the wetland hydroperiod or persistence of certain wetland types, such as bog or fen, with a low tolerance for water level fluctuations. PSWs are provided higher levels of protection based on policies of the Provincial Policy Statement (PPS). Further assessment and monitoring of potential impacts to PSWs resulting from future pumping may be required.

### ***Conservation Areas and Parks***

There are also three conservation areas or parks that occur in the study area: Puslinch Lake Park, Puslinch Tract Conservation Area and Shade's Mills Conservation Areas.

Shade's Mills is a day-use park open to the public and managed by the GRCA. The conservation area is located along Mill Creek and is surrounded by mature deciduous forest (Conservation Ontario 2015).

The Puslinch Tract Conservation Area, now owned by the GRCA, largely overlaps the Puslinch Tract (Paris Moraine) regionally significant ANSI described previously.

Puslinch Lake Park is a 0.9 ha privately owned park in the private community of Puslinch Lake, located on the south point of Puslinch Lake. A local group, the Puslinch Lake Conservation Association, has taken on the responsibility of cleaning up Puslinch Lake, which tends to have dense aquatic vegetation growth due to the isolated nature of the kettle lake feature (Monteith and Brown 2015).

### ***Significant Woodlands***

Although the City of Cambridge, Region of Waterloo and County of Wellington Official Plans provide criteria for identifying significant woodlands, these features are not mapped. Based on the OPs of the City of Cambridge (2012) and Region of Waterloo (2015), significant woodlands are defined as woodlands that are:

- Greater than 4 ha in size (excluding adjoining hedgerows);
- Consisting primarily of indigenous (i.e. native) species of trees; and
- Meets the criteria of a woodland in accordance with the provisions of the Regional Woodland Conservation By-Law.

The County of Wellington identifies woodlands over 4 ha in size and plantations over 10 ha in size as significant (Wellington County 2015).

Based on these criteria, there may be a number of significant woodlands within the Study Area. Based on the results of surveys conducted for another Project that overlapped the southern end of the Class EA Study Area along Townline Road between Avenue Road and Old Beverly Road, Moffat Creek Swamp PSW and Mill Creek Wetland PSW have been identified as significant woodlands (Savanta 2015).

Significant woodlands are areas which are: 1) ecologically important in terms of features such as species composition, age of trees and stand history; 2) functionally important due to their contribution to the broader landscape because of their location, size or due to the amount of forest cover in the planning area; or 3) economically important due to site quality, species composition, or past management history (MMAH 2014). Where works are proposed within or adjacent (i.e. within 120 m) of a significant woodland, an assessment must be completed to demonstrate that development will not adversely affect the feature or its ecological function (e.g. ability to provide wildlife habitat, structural stability on slopes, etc.).

## 5.1.2 Aquatic Features

### ***Surface Water Features***

Watercourses and waterbodies occurring within the Study Area are components of the Grand River watershed. The Grand River watershed supports a number of coldwater and warmwater aquatic features; each having unique aquatic communities linked to their thermal characteristics. Named watercourses and waterbodies in the Study Area (Figure 1) and their thermal designations are as follows:

- Cedarbrook Creek (Coldwater) - a small tributary to Mill Creek;
- Mill Creek (Coldwater);
- Moffat Creek (Coldwater);
- Irish Creek (Warmwater); and
- Puslinch Lake (Warmwater).

Warm water aquatic features are generally considered to be more robust and tolerant to external effects. Fish species occupying warm water are likewise considered to be more tolerant to changes in groundwater discharge. In contrast, cold water systems are supported by groundwater inputs and are considered to be capable of supporting cold water fish species, which may be sensitive to reductions in groundwater discharge. Many cold water systems contain transitional coolwater areas that often support both cold water and warmwater species. Coolwater features and fish species are generally considered similarly to those designated cold water.

The Grand River and associated riparian habitat has also been identified as a Significant Valley by the City of Cambridge (Cambridge 2012) and the Region of Waterloo (Region of Waterloo 2015).

### ***Fish Habitat***

Fish species reported in watercourses within the Study Area include a range of cold to warm water species. There are approximately 83 native and non-native fish species present in waterbodies of the Study Area. Cold headwater species such as brook trout (*Salvelinus fontinalis*) and mottled sculpin (*Cottus bairdii*) and top predator warm species such as largemouth bass (*Micropterus salmoides*), northern pike (*Esox Lucius*) and walleye (*Stizostedion vitreum vitreum*) are resident in many areas, but the more dominant and common fish groups are represented by baitfish (i.e. minnows) (Wright and Imhof 2001).

A fish inventory of Cedarbrook Creek was conducted by Golder in 2006. Based on the results of the inventory, 108 fish were caught consisting of 16 species (Golder 2006). One adult brook trout was observed, and Cedarbrook Creek was assessed to provide potential spawning habitat for this species. Although two brown trout (*Salmo trutta*) were observed, habitat characteristics of the creek indicated it was not suitable spawning habitat for brown trout. Other common species observed included creek chub (*Semotilus atromaculatus*),

blacknose dace (*Rhinichthys atratulus*), fathead minnow (*Pimephales promelas*), and bluntnose minnow (*Pimephales notatus*).

Sixteen species of fish are known to occur in Puslinch Lake, including northern pike (*Esox lucius*), white sucker (*Catostomus commersoni*), brown bullhead (*Ameiurus nebulosus*), yellow perch (*Perca flavescens*), smallmouth bass (*Micropterus dolomieu*) and largemouth bass. Walleye have also been stocked historically in the lake (Bonter et al. 2000) but their current status and success of the stocking efforts are not well documented.

Aquatic SAR mapping provided through DFO indicates the potential presence of fish and mollusc SAR within the Grand River. Potential aquatic SAR may include redbside dace (*Clinostomus elongatus*), silver shiner (*Notropis photogenis*), and wavy-rayed lampmussel (*Lampsilis fasciola*) (DFO 2015).

Direct and indirect effects on watercourses and fish habitat, including potential changes to baseflow or drainage, thermal regime, erosion or sedimentation, can affect the quality and quantity of fish habitat and contribute to harm to fish. Works involving activities within 30 m of a waterbody require assessment for potential impacts to fish and fish habitat in accordance with the protection provisions of the federal *Fisheries Act*. Where there is no activity within 30 m, but effects may still occur (e.g. changes to local hydrology or hydrogeology), an assessment is also required.

## 5.2 Species at Risk

Based on the desktop assessment, 30 species designated as special concern, threatened or endangered under the ESA or SARA were assessed to have moderate or high potential to occur within the Study Area (Attachment 1). Of these, 18 have been designated as threatened or endangered under the ESA and receive individual and habitat protection. The other species with moderate or high potential, as indicated in Attachment 1, do not have regulatory protection. However, habitat for these species must still be considered under the Significant Wildlife Habitat criteria of the PPS in the impact assessment for the Class EA:

- Six (6) birds (bank swallow, barn swallow, bobolink, chimney swift, eastern meadowlark, whip-poor-will);
- Four (4) mammals (small-footed myotis, little brown myotis, northern myotis, and tri-colored bat);
- Two (2) fish (redside dace and silver shiner);
- One (1) mollusc (wavy-rayed lampmussel);
- One (1) reptile (Blanding's turtle); and
- Four (4) vascular plants (American columbo, butternut, eastern flowering dogwood, and false hop sedge).

The majority of potential suitable habitat for these SAR is concentrated in the woodlands, wetlands and lakes in the Study Area (Figure 1). Some species, such as chimney swift, may also use anthropogenic structures for habitat. Based on the results of surveys conducted for another Project that overlapped the southern end of the EA Study Area, three bird SAR have been recently observed (Savanta 2015). These include barn swallow (*Hirundo rustica*), bobolink (*Dolichonyx oryzivorus*), and eastern meadowlark (*Sturnella magna*).

Surveys completed in the Puslinch Tract Conservation Area have also identified several SAR, including little brown myotis, barn swallow, and eastern meadowlark (GRCA 2004).

Further assessment for potential SAR or their habitat may be warranted within the Study Area and any zone of influence based on the project description. Direct effects (i.e. removal of habitat or harm to individuals) and indirect effects (i.e. changes to habitat form or function) on SAR and/or SAR habitat should be considered in the EA assessment. Where impacts cannot be avoided, consultation with the MNRF may be required to determine if a permit is required.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the natural environment screening assessment, there are locally and provincially important natural features in the Study Area. The assessment has identified the presence of unevaluated wetlands, PSWs, regionally significant ANSIs, features protected under the PPS and OPs, as well as waterbodies under the regulation of the GRCA.

The locally and provincially important natural features in the Study Area should be considered as part of the Class EA assessment and in the development of environmental monitoring programs. These features should be considered in the assessment of potential effects associated with groundwater pumping and the siting of all surface facilities, access roads and temporary construction infrastructure. The construction of these facilities and infrastructure and subsequent groundwater pumping increases should follow the general protection commitments outlined in the Class EA, supplemented by specific impact assessment and mitigation undertaken during detail design and permitting stages.

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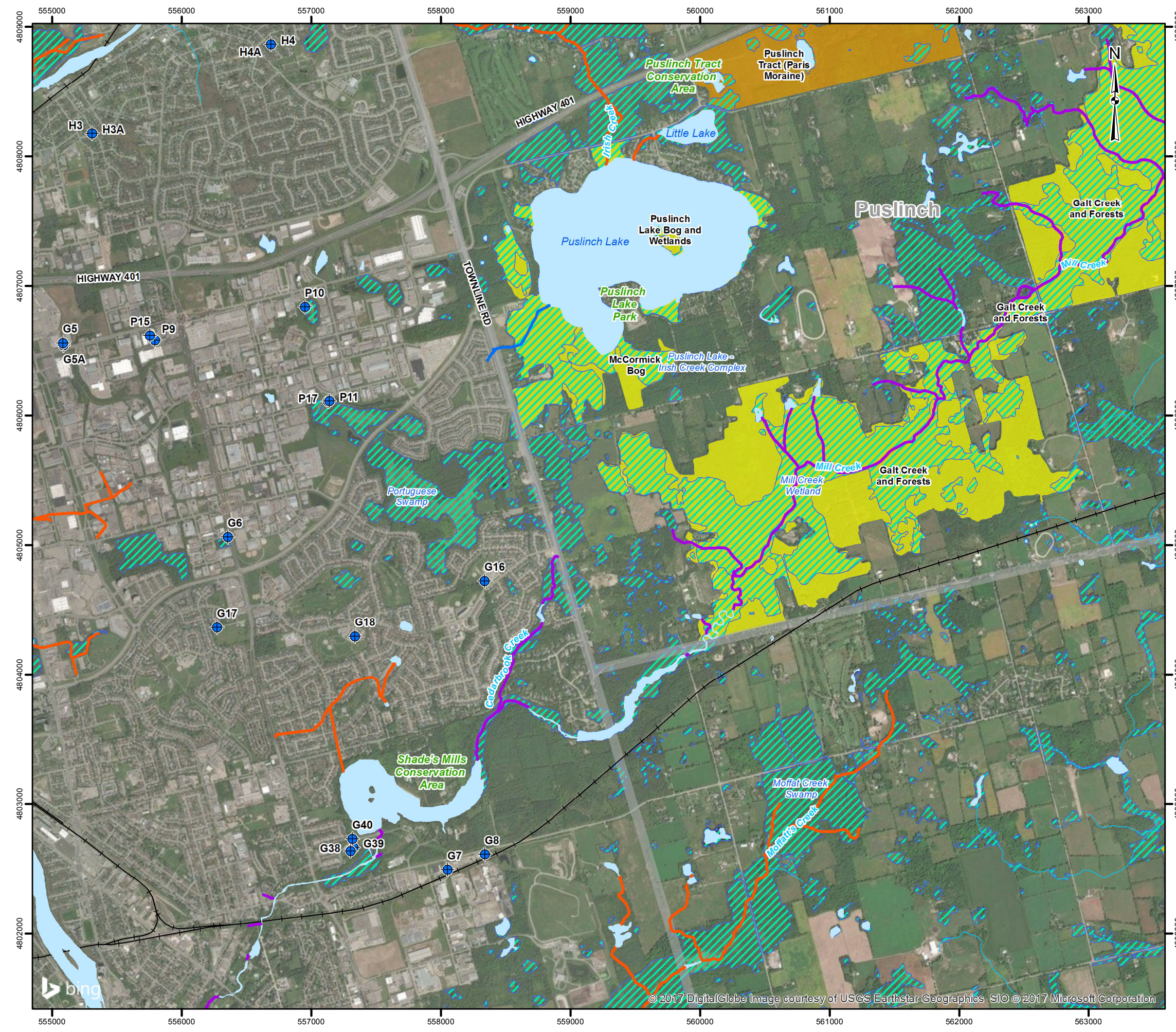
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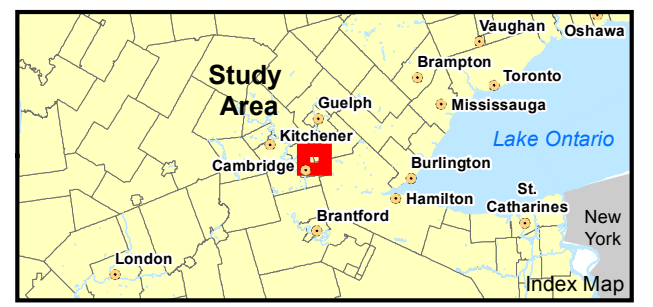
**LEGEND**

- Municipal Supply Well
- Railway

**Watercourse Thermal Regime**

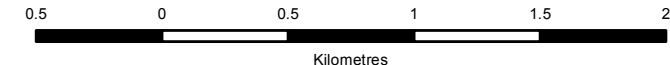
- Unknown
- Cold
- Cool
- Warm

- Water
- Provincially Significant Wetlands
- ANSI, Earth Science
- ANSI, Life Science
- Municipalities



**REFERENCE**

Base Data - MNR LIO, obtained 2016  
 Produced by Golder Associates Ltd under licence from  
 Ontario Ministry of Natural Resources, © Queens Printer 2016  
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17



PROJECT		CAMBRIDGE EAST WATER SUPPLY CLASS ENVIRONMENTAL ASSESSMENT	
TITLE		ENVIRONMENTALLY SENSITIVE AREAS	
	PROJECT No.	05-1112-010	SCALE 1:30,000
	DESIGN	CGG 10 Mar. 2005	REV. 2
	GIS	PR 25 Jan. 2017	
	CHECK	JLH 25 Jan. 2017	
	REVIEW	JAP 25 Jan. 2017	
<b>FIGURE: 1</b>			



**ATTACHMENT 1**  
Species at Risk Screening

Common Name	Scientific Name	Species At Risk Act (Sch 1) <sup>1</sup>	Endangered Species Act <sup>2</sup>	COSEWIC <sup>3</sup>	Provincial (SRank) <sup>4</sup>	Habitat Requirements <sup>5</sup>	Potential to Occur on Site	Rationale for Potential to Occur on Site
Western chorus frog - Great Lakes St. Lawrence/Canadian Shield Population	<i>Pseudacris triseriata</i>	THR	—	THR	S3	In Ontario, habitat of this amphibian species typically consists of marshes or wooded wetlands, particularly those with dense shrub layers and grasses, as this species is a poor climber. They will breed in almost any fishless pond including roadside ditches, gravel pits and flooded swales in meadows. This species hibernates in terrestrial habitats under rocks, dead trees or leaves, in loose soil or in animal burrows. During hibernation, this species is tolerant of flooding (Environment Canada 2015).	Moderate	There are several wetlands in the study area that may provide suitable breeding habitat.
Monarch	<i>Danaus plexippus</i>	SC	SC	SC	S2N, S4B	In Ontario, monarch is found throughout the northern and southern regions of the province. This butterfly is found wherever there are milkweed ( <i>Asclepius</i> spp.) plants for its caterpillars and wildflowers that supply a nectar source for adults. It is often found on abandoned farmland, meadows, open wetlands, prairies and roadsides, but also in city gardens and parks. Important staging areas during migration occur along the north shores of the Great Lakes (COSEWIC 2010).	Moderate	There are numerous parks and wetlands in the study area that may provide areas of foraging habitat or host plants.
Rusty-patched bumble bee	<i>Bombus affinis</i>	END	END	END	S1	In Ontario, rusty-patched bumble bee is found in areas from the southern Great Lakes – St. Lawrence forest region southwards into the Carolinian forest. It is a habitat generalist, but it is typically found in open habitats, such as mixed farmland, savannah, marshes, sand dunes, urban and lightly wooded areas. It is cold –tolerant and can be found at high elevations. Most recent sightings in Ontario have been in oak savannah habitat with well-drained, sandy soils and moderately open canopy. It requires an abundance of flowering plants for forage. This species most often builds nests underground in old rodent burrows, but also in hollow tree stumps and fallen dead wood (Colla and Taylor-Pindar 2011). The only recent sightings in Ontario are from the Pinery Provincial Park.	Low	Although there are numerous parks and wetlands in the study area that may provide areas of foraging habitat, there are no recent occurrence records of this species in the area.
West Virginia white	<i>Pieris virginiensis</i>	—	SC	—	S3	In Ontario, West Virginia white is found primarily in the central and southern regions of the province. This butterfly lives in moist, mature, deciduous and mixed woodlands, and the caterpillars feed only on the leaves of toothwort ( <i>Cardamine</i> spp.), which are small, spring-blooming plants of the forest floor. These woodland habitats are typically maple-beech-birch dominated. This species is associated with woodlands growing on calcareous bedrock or thin soils over bedrock (Burke 2013).	Low - Moderate	Although there are areas of deciduous forest that may provide suitable habitat, there are no recent occurrence records in the area.
Acadian flycatcher	<i>Empidonax virescens</i>	END	END	END	S2S3B	In Ontario, the Acadian flycatcher breeds in the understory of large, mature, closed-canopy forests, swamps and forested ravines. This bird prefers forests greater than 40 ha in size, and exhibits edge sensitivity preferring the deep interior of the forest. Its nest is loosely woven and placed near the tip of branch in a small tree or shrub often, but not always, near water (Whitehead and Taylor 2002).	Low	Although there are areas of deciduous forest in the study area, they are likely too small to provide preferred habitat conditions. In addition, there are no recent occurrence records in the area.



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Bank swallow	<i>Riparia</i>	—	THR	THR	S4B	In Ontario, the bank swallow breeds in a variety of natural and anthropogenic habitats, including lake bluffs, stream and river banks, sand and gravel pits, and roadcuts. Nests are generally built in a vertical or near-vertical bank. Breeding sites are typically located near open foraging sites such as rivers, lakes, grasslands, agricultural fields, wetlands and riparian woods. Forested areas are generally avoided (Garrison 1999).	Moderate	Suitable valley slopes or steep banks may occur in the study area to provide nesting habitat.
Barn swallow	<i>Hirundo rustica</i>	—	THR	THR	S4B	In Ontario, barn swallow breeds in areas that contain a suitable nesting structure, open areas for foraging, and a body of water. This species nests in human made structures including barns, buildings, sheds, bridges, and culverts. Preferred foraging habitat includes grassy fields, pastures, agricultural cropland, lake and river shorelines, cleared right-of-ways, and wetlands (COSEWIC 2011). Mud nests are fastened to vertical walls or built on a ledge underneath an overhang. Suitable nests from previous years are reused (Brown and Brown 1999).	Moderate	Suitable structures may occur in the study area to provide nesting habitat. There are also numerous open areas, including parks, lakes and streams, to provide foraging habitat.
Black tern	<i>Chlidonias niger</i>	—	SC	NAR	S3B	In Ontario, black tern breeds in freshwater marshlands where it forms small colonies. It prefers marshes or marsh complexes greater than 20 ha in area and which are not surrounded by wooded area. Black terns are sensitive to the presence of agricultural activities. The black tern nests in wetlands with an even combination of open water and emergent vegetation, and still waters of 0.5-1.2 m deep. Preferred nest sites have short dense vegetation or tall sparse vegetation often consisting of cattails, bulrushes and occasionally burreed or other marshland plants. Black terns also require posts or snags for perching (Weseloh 2007).	Low	Although there may be suitable wetland habitat in the study area, there are no recent occurrence records.
Bobolink	<i>Dolichonyx oryzivorus</i>	—	THR	THR	S4B	In Ontario, bobolink breeds in grasslands or graminoid dominated hayfields with tall vegetation (Gabhauer 2007). Bobolink prefers grassland habitat with a forb component and a moderate litter layer. They have low tolerance for presence of woody vegetation and are sensitive to frequent mowing within the breeding season. They are most abundant in established, but regularly maintained, hayfields, but also breed in lightly grazed pastures, old or fallow fields, cultural meadows and newly planted hayfields. Their nest is woven from grasses and forbs. It is built on the ground, in dense vegetation, usually under the cover of one or more forbs (Martin and Gavin 1995).	Moderate	There may be suitable open grassland habitat in the study area.
Canada warbler	<i>Cardellina canadensis</i>	THR	SC	THR	S4B	In Ontario, breeding habitat for Canada warbler consists of moist mixed forests with a well-developed shrubby understory. This includes low-lying areas such as cedar and alder swamps, and riparian thickets (McLaren 2007). It is also found in densely vegetated regenerating forest openings. Suitable habitat often contains a developed moss layer and an uneven forest floor. Nests are well concealed on or near the ground in dense shrub or fern cover, often in stumps, fallen logs, overhanging stream banks or mossy hummocks (Reitsma et al. 2010).	Low	Although there may be suitable forested habitat in the study area, there are no recent occurrence records in the area.



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Cerulean warbler	<i>Setophaga cerulea</i>	SC	THR	END	S3B	In Ontario, breeding habitat of cerulean warbler consists of second-growth or mature deciduous forest with a tall canopy of uneven vertical structure and a sparse understory. This habitat occurs in both wet bottomland forests and upland areas, and often contains large hickory and oak trees. This species may be attracted to gaps or openings in the upper canopy. The cerulean warbler is associated with large forest tracks, but may occur in woodlots as small as 10 ha (COSEWIC 2010). Nests are usually built on a horizontal limb in the mid-story or canopy of a large deciduous tree (Buehler et al. 2013).	Low	Although there may be suitable forested habitat in the study area, there are no recent occurrence records in the area.
Chimney swift	<i>Chaetura pelagica</i>	THR	THR	THR	S4B, S4N	In Ontario, chimney swift breeding habitat is varied and includes urban, suburban, rural and wooded sites. They are most commonly associated with towns and cities with large concentrations of chimneys. Preferred nesting sites are dark, sheltered spots with a vertical surface to which the bird can grip. Unused chimneys are the primary nesting and roosting structure, but other anthropogenic structures and large diameter cavity trees are also used (COSEWIC 2007).	Moderate	Suitable anthropogenic structures or large diameter cavity trees may occur in the study area to provide nesting habitat.
Common nighthawk	<i>Chordeiles minor</i>	THR	SC	THR	S4B	These aerial foragers require areas with large open habitat. This includes farmland, open woodlands, clearcuts, burns, rock outcrops, alvars, bog ferns, prairies, gravel pits and gravel rooftops in cities (Sandilands 2007)	Moderate	Suitable open areas, such as parks and wetlands, occur in the study area and may provide suitable nesting habitat.
Eastern meadowlark	<i>Sturnella magna</i>	—	THR	THR	S4B	In Ontario, eastern meadowlark breeds in pastures, hayfields, meadows and old fields. Eastern meadowlark prefers moderately tall grasslands with abundant litter cover, high grass proportion, and a forb component (Hull 2003). They prefer well drained sites or slopes, and sites with different cover layers (Roseberry and Klimstra 1970)	Moderate	There may be suitable open grassland habitat in the study area.
Eastern wood-pewee	<i>Contopus virens</i>	—	SC	SC	S4B	In Ontario, the eastern wood-pewee inhabits a wide variety of wooded upland and lowland habitats, including deciduous, coniferous, or mixed forests. It occurs most frequently in forests with some degree of openness. Intermediate-aged forests with a relatively sparse midstory are preferred. In younger forests having a relatively dense midstory, it tends to inhabit the edges. Also occurs in anthropogenic habitats providing an open forested aspect such as parks and suburban neighborhoods. Nest is constructed atop a horizontal branch, 1-2 m above the ground, in a wide variety of deciduous and coniferous trees.	Moderate	Suitable forested habitat may occur in the study area to provide suitable breeding habitat.
Golden-winged warbler	<i>Vermivora chrysoptera</i>	THR	SC	THR	S4B	In Ontario, golden-winged warbler breeds in regenerating scrub habitat with dense ground cover and a patchwork of shrubs, usually surrounded by forest. Their preferred habitat is characteristic of a successional landscape associated with natural or anthropogenic disturbance such as right-of-ways, and field edges or openings resulting from logging or burning. The nest of the golden-winged warbler is built on the ground at the base of a shrub or leafy plant, often at the shaded edge of the forest or at the edge of a forest opening (Confer et al. 2011).	Low - Moderate	Suitable shrub or successional habitat may occur in the study area to provide breeding habitat.



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Henslow's sparrow	<i>Ammodramus henslowii</i>	END	END	END	SHB	In Ontario, Henslow's sparrow breeds in large grasslands with low disturbance, such as lightly grazed and ungrazed pastures, fallow hayfields, grassy swales in open farmland, and wet meadows. Preferred habitat contains tall, dense grass cover, typically over 30 cm high, with a high percentage of ground cover, and a thick mat of dead plant material. Henslow's sparrow generally avoids areas with emergent woody shrubs or trees, and fence lines. Areas of standing water or ephemerally wet patches appear to be important. This species breeds more frequently in patches of habitat greater than 30 ha and preferably greater than 100 ha (COSEWIC 2011).	Low	Although there may be suitable open grassland habitat in the study area, there are no recent occurrence records in the area.
Hooded warbler	<i>Setophaga citrina</i>	THR	NAR	NAR	S4B	In Ontario, the hooded warbler breeds in large, mature, mixed hardwood forests, usually dominated by maple, beech, and oak with canopy gaps. They are most often found in forests greater than 100 ha, but may breed in smaller woodlands that are part of a region of high overall forest cover (Environment Canada 2012). The nest is built in a dense shrub patch in a forest opening, and is often along the edge of the forest or of the shrub patch (Badzinski 2007).	Low	There are no suitable large tracts of forest in the study area to support this species. In addition, there are no recent occurrence records in the area.
King rail	<i>Rallus elegans</i>	END	END	END	S2B	In Ontario, the king rail breeds in freshwater marshes, especially large marshes with a variety of water level conditions and a mosaic of habitats. This species prefers relatively shallow wetlands containing dense emergent vegetation (especially cattails), patches of open water, hummocks, mudflats and shrubby swales. Nests are generally well concealed in patches of dense, uniform vegetation over shallow water areas (COSEWIC 2011).	Low	Although there may be suitable wetland habitat in the study area, there are no recent occurrence records.
Least bittern	<i>Ixobrychus exilis</i>	THR	THR	THR	S4B	In Ontario, the least bittern breeds in marshes, usually greater than 5 ha, with emergent vegetation, relatively stable water levels and areas of open water. Preferred habitat has water less than 1 m deep (usually 10 – 50 cm). Nests are built in tall stands of dense emergent or woody vegetation (Woodliffe 2007). Clarity of water is important as siltation, turbidity, or excessive eutrophication hinders foraging efficiency (COSEWIC 2009).	Low	Although there may be suitable wetland habitat in the study area, there are no recent occurrence records.
Louisiana waterthrush	<i>Parkesia motacilla</i> (formerly <i>Seiurus motacilla</i> )	SC	SC	THR	S3B	The Louisiana waterthrush inhabits mature forests along steeply sloped ravines adjacent to running water. It prefers clear, cold streams and densely wooded swamps. Trees, bushes, exposed roots, cliffs, banks and mossy logs are favoured nesting spots. Riparian woodlands are preferred stopover sites during migration. Nests are concealed from view at the base of uprooted trees, among mosses, or under logs and in cavities along the stream bank (COSEWIC 2006).	Low	Although suitable forest habitat may occur in the study area, there are no recent occurrence records.
Peregrine falcon (anatum subspecies)	<i>Falco peregrinus anatum</i>	SC	SC	SC	S3B	In Ontario, peregrine falcon breeds in areas containing suitable nesting locations and sufficient prey resources. Such habitat includes both natural locations containing cliff faces (heights of 50 - 200 m preferred) and also anthropogenic landscapes including urban centres containing tall buildings, open pit mines and quarries, and road cuts. Peregrine falcons nest on cliff ledges and crevices and building ledges. Nests consist of a simple scrape in the substrate (COSEWIC 2007).	Moderate	Suitable anthropogenic structures may occur in the study area to provide nesting habitat.



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Prothonotary warbler	<i>Protonotaria citrea</i>	END	END	END	S1B	In Ontario, the prothonotary warbler breeds in mature and semi-mature, deciduous swamp forest with a closed canopy, and large expanses of relatively deep, open standing water. Swamps are typically dominated by silver maple, black ash, yellow birch, and black gum. These birds nest in tree cavities, favouring small, shallow holes often situated at low heights in dead or dying trees. Nests are typically situated over standing or slow-moving water. Artificial nest boxes are also readily accepted. This species is area sensitive and is seldom found in forests less than 100 ha in size (COSEWIC 2007).	Low	There are no suitable large tracts of forest in the study area to support this species. In addition, there are no recent occurrence records in the area.
Red-headed woodpecker	<i>Melanerpes erythrocephalus</i>	THR	SC	THR	S4B	In Ontario, the red-headed woodpecker breeds in open, deciduous woodlands or woodland edges and are often found in parks, cemeteries, golf courses, orchards and savannahs (Woodliffe 2007). They may also breed in forest clearings or open agricultural areas provided that large trees are available for nesting. They prefer forests with little or no understory vegetation. They are often associated with beech or oak forests, beaver ponds and swamp forests where snags are numerous. Nests are excavated in the trunks of large dead trees (Smith et al. 2000).	Low - Moderate	Suitable woodland and park habitat may occur in the study area.
Short-eared owl	<i>Asio flammeus</i>	SC	SC	SC	S2N,S4B	In Ontario, the short-eared owl breeds in a variety of open habitats including grasslands, tundra, bogs, marshes, clearcuts, burns, pastures and occasionally agricultural fields. The primary factor in determining breeding habitat is proximity to small mammal prey resources (COSEWIC 2008). Nests are built on the ground at a dry site and usually adjacent to a clump of tall vegetation used for cover and concealment (Gahbauer 2007).	Low	Although there may be suitable open grassland habitat in the study area, there are no recent occurrence records in the area.
Eastern whip-poor-will	<i>Antrostomus vociferus</i>	THR	THR	THR	S4B	In Ontario, the whip-poor-will breeds in semi-open forests with little ground cover. Breeding habitat is dependent on forest structure rather than species composition, and is found on rock and sand barrens, open conifer plantations and post-disturbance regenerating forest. Territory size ranges from 3 to 11 ha (COSEWIC 2009). No nest is constructed and eggs are laid directly on the leaf litter (Mills 2007).	Moderate	Suitable forested habitat may occur in the study area to provide breeding habitat.
Wood thrush	<i>Hylocichla mustelina</i>	—	SC	THR	S4B	In Ontario, wood thrush breeds in moist, deciduous hardwood or mixed stands that are often previously disturbed, with a dense deciduous undergrowth and with tall trees for singing perches. This species selects nesting sites with the following characteristics: lower elevations with trees less than 16 m in height, a closed canopy cover (>70 %), a high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soil, and decaying leaf litter (COSEWIC 2012).	Moderate	Suitable forested habitat may occur in the study area to provide breeding habitat.
Yellow-breasted chat	<i>Icteria virens</i>	SC	END	END	S2B	In Ontario, yellow-breasted chat breeds in early successional, shrub-thicket habitats including woodland edges, regenerating old fields, railway and hydro right-of-ways, young coniferous reforestations, and wet thickets bordering wetlands. Tangles of grape ( <i>Vitis</i> spp.) and raspberry ( <i>Rubus</i> spp.) vines are features of most breeding sites. There is some evidence that the yellow-breasted chat is an area sensitive species. Nests are located in dense shrubbery near to the ground (COSEWIC 2011).	Low	Although suitable shrub or successional habitat may occur in the study area, there are no recent occurrence records.



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Black redbhorse	<i>Moxostoma duquesnei</i>	—	THR	THR	S2	In Ontario, black redbhorse is limited to only six watersheds. In the Lake Huron drainage, it is found in the Bayfield River, Maitland River and Ausable River watersheds. In the Lake Erie drainage, it is known from the Catfish Creek and Grand River watersheds. It is also present in the Thames River watershed in the Lake St. Clair drainage. The Catfish Creek population is considered extirpated. The black redbhorse is a species of freshwater fish endemic to Ontario. Habitats are typically found in moderately sized to large rivers and streams with moderate flows. It is rarely found associated with aquatic vegetation. Preferred substrates include rubble, gravel, sand, boulders and silt. In summer, this fish species generally prefers pools, and they overwinter in deeper pools. Spring spawning has been observed in riffle habitats, over substrates ranging from fine gravel to large cobble, and at water temperatures between 15°C and 21°C (COSEWIC 2005).	Low	Black redbhorse has not been reported from any of the watercourses in the study area.
Lake sturgeon - Great Lakes / upper St.Lawrence Population	<i>Acipenser fulvescens</i>	—	THR	THR	S2	In Ontario, the lake sturgeon, a large prehistoric freshwater fish, is found in all the Great Lakes and in all drainages of the Great Lakes and of Hudson Bay. This species typically inhabits highly productive shoal areas of large lakes and rivers. They are bottom dwellers, and prefer depths between 5-10 m and mud or gravel substrates. Small sturgeons are often found on gravelly shoals near the mouths of rivers. They spawn in depths of 0.5 to 4.5 metres in areas of swift water or rapids. Where suitable spawning rivers are not available, such as in the lower Great Lakes, they are known to spawn in wave action over rocky ledges or around rocky islands (Golder Associates Ltd. 2011).	Low	Lake sturgeon has not been reported from any of the watercourses in the study area.
Redside dace	<i>Clinostomus elongatus</i>	—	END	END	S2	In Ontario, the redbside dace, a small coolwater species common in the USA but less so in Canada, is found in tributaries of western Lake Ontario, Lake Erie, Lake Huron and Lake Simcoe. They are found in pools and slow-moving areas of small headwater streams with clear to turbid water. Overhanging grasses, shrubs, and undercut banks, are an important part of their habitat, as are instream boulders and large woody debris. Preferred substrates are variable and include silt, sand, gravel and boulders. Spawning occurs in shallow riffle areas (Redside Dace Recovery Team 2010).	Moderate	Redside dace may occur in the Grand River.
Silver shiner	<i>Notropis photogenis</i>	—	THR	THR	S2S3	In Ontario, the silver shiner is found in the Thames and Grand Rivers, and it has been recently reported in Bronte Creek and Sixteen Mile Creek which flow into Lake Ontario. They prefer moderately-flowing sections of larger streams with clear water and moderate currents. Usual substrates include gravel, rubble, boulder, and sand. Aquatic vegetation may be present or absent. The silver shiner most frequently occurs in deep, swift riffles and faster currents of pools below riffles. Spawning habitat is suggested to occur in relatively deep riffles (COSEWIC 2011).	Moderate	Silver shiner may occur in the Grand River.



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American badger jacksoni subspecies (southwestern population)	<i>Taxidea taxus jacksoni</i>	END	END	END	S2	In Ontario, American badger's preferred habitats include undisturbed grasslands, shrubby areas and open woodlands, but the species will also use old fields, pastures, edges of agricultural fields and roadsides. The key factor for habitat suitability for this species is presence of prey, comprised mainly of woodchuck and eastern cottontail, and Franklin's ground squirrel in northwestern Ontario (Ontario American Badger Recovery Team 2010).	Low	The study area is likely too populated and fragmented to provide the preferred open country habitat.
Eastern cougar	<i>Puma concolor cougar</i>	—	END	DD	SU	This species historically inhabited extensive forested areas in Ontario. It is found in habitats suitable for white-tailed deer and mule deer, which are the preferred prey of the cougar. Dense cover is considered the key habitat feature for cougar. An average home range for males is 300 square kilometers, and for females, 150 square kilometers (Environment Canada and Canadian Wildlife Federation 2013).	Low	The study area lacks the extensive forest cover preferred by this species. The study area is also fragmented from a larger overall region of forest cover.
Grey fox	<i>Urocyon cinereoargenteus</i>	THR	THR	THR	S1	While the Ontario range of this species extends across much of southern and southeastern Ontario, the only known population in the province is on Pelee Island, with very rare sightings elsewhere in the province at points close to the border with the United States. This species inhabits deciduous forests and marshes, and will den in a variety of features including rock outcroppings, hollow trees, burrows or brush piles, usually where dense brush provides cover and in close proximity to water. This species is considered a habitat generalist (COSEWIC 2002).	Low	This species is only currently known to occur on Pelee Island.
Eastern small-footed myotis	<i>Myotis leibii</i>	—	END	—	S2S3	This species is not known to roost within trees, but there is very little known about its roosting habits. The species generally roosts on the ground under rocks, in rock crevices, talus slopes and rock piles. It occasionally inhabits buildings. Areas near the entrances of caves or abandoned mines may be used for hibernaculum, where the conditions are drafty with low humidity, and may be subfreezing.	Moderate	Suitable rock piles or exposed bedrock may occur in the study area to provide roosting habitat.
Little brown myotis	<i>Myotis lucifugus</i>	END	END	END	S4	In Ontario, this species range is extensive and covers much of the province. It will roost in both natural and man-made structures. They require a number of large dead trees, in specific stages of decay and that project above the canopy in relatively open areas. May form nursery colonies in the attics of buildings within 1 km of water. Caves or abandoned mines may be used for hibernaculum, but high humidity and stable above freezing temperatures are required.	Moderate	Suitable forested habitat may occur in the study area to provide roosting habitat.
Tri-colored bat	<i>Perimyotis subflavus</i>	END	END	END	S3?	In Ontario, tri-colored bat may roost in foliage, in clumps of old leaves, hanging moss or squirrel nests. They are occasionally found in buildings although there are no records of this in Canada. They typically feed over aquatic areas with an affinity to large-bodied water and will likely roost in close proximity to these. Hibernation sites are found deep within caves or mines in areas of relatively warm temperatures. These bats have strong roost fidelity to their winter hibernation sites and may choose the exact same spot in a cave or mine from year to year.	Moderate	Suitable forested habitat may occur in the study area to provide roosting habitat.



**ATTACHMENT 1**  
Species at Risk Screening

Common Name	Scientific Name	Species At Risk Act (Sch 1) <sup>1</sup>	Endangered Species Act <sup>2</sup>	COSEWIC <sup>3</sup>	Provincial (SRank) <sup>4</sup>	Habitat Requirements <sup>5</sup>	Potential to Occur on Site	Rationale for Potential to Occur on Site
Northern myotis	<i>Myotis septentrionalis</i>	END	END	END	S3	In Ontario, this species range is extensive and covers much of the province. It will usually roost in hollows, crevices, and under loose bark of mature trees. Roosts may be established in the main trunk or a large branch of either living or dead trees. Caves or abandoned mines may be used for hibernaculum, but high humidity and stable above freezing temperatures are required.	Moderate	Suitable forested habitat may occur in the study area to provide roosting habitat.
Mapleleaf mussel	<i>Quadrula quadrula</i>	—	THR	THR	S2	In Ontario, the mapleleaf is usually found in medium to large rivers with slow to moderate currents and firmly packed substrate of sand, coarse gravel or clay/mud. It may also occur in shallow lakes, big river embayments and deep river impoundments (COSEWIC 2006).	Low	This mussel species has not been reported from any watercourses in the study area.
Rainbow mussel	<i>Villosa iris</i>	—	THR	SC	S2S3	In Ontario, the rainbow mussel is found in shallow, well- oxygenated waters of small to medium-sized rivers and sometimes lakes. It is most abundant in waters less than 1 m deep. Preferred substrates are cobble, gravel, sand and occasionally mud (COSEWIC 2006).	Low	This mussel species has not been reported from any watercourses in the study area.
Wavy-rayed lampmussel	<i>Lampsilis fasciola</i>	END	THR	SC	S1	In Ontario, wavy-rayed lampmussel inhabits clear, medium-sized rivers and streams, with steady flow and stable substrate. It is typically found in clean sand or gravel substrates, often stabilized with cobble or boulders, in and around riffle areas up to 1 m in depth. It may also be found in large creeks and rivers (Morris 2011).	Moderate	Wavy-rayed lampmussel may occur in the Grand River.
Pygmy pocket moss	<i>Fissidens exilis</i>	SC	SC	SC	S1	In Ontario, pygmy pocket moss grows in the southwestern region of the province. Pygmy pocket moss typically grows on bare, moist, clay soil. It occurs primarily in woodlands, but also on disturbed soils, such as in floodplains (COSEWIC 2005).	Low	Although suitable habitat may occur in the study area, there are no recent occurrence records.
Blanding's turtle - Great Lakes/St.Lawrence population	<i>Emydoidea blandingii</i>	THR	THR	THR	S3	In Ontario, Blanding's turtle will use a range of aquatic habitats, but favor those with shallow, standing or slow-moving water, rich nutrient levels, organic substrates and abundant aquatic vegetation. They will use rivers, but prefer slow-moving currents and are likely only transients in this type of habitat. This species is known to travel great distances over land in the spring in order to reach nesting sites, which can include dry conifer or mixed forests, partially vegetated fields, and roadsides. Suitable nesting substrates include organic soils, sands, gravel and cobble. They hibernate underwater and infrequently under debris close to water bodies (COSEWIC 2005).	Moderate	Suitable aquatic habitat may occur in the study area.
Eastern hog-nosed snake	<i>Heterodon platirhinos</i>	THR	THR	THR	S3	Eastern hog-nosed snake can be classified as a habitat generalist as it uses a variety of habitats across its range. In Ontario, this snake typically uses habitat with open vegetation cover, including open woodlands, wetlands, fields, forest edges, beaches and dunes, and disturbed sites, most often near water. In the Georgian Bay area, disturbed fields, rock barrens and forests appear to be preferred habitats. This species relies on sandy well drained soils. Hibernation occurs in sandy soils below the frost line. This species has been observed excavating hibernation sites in mixed intolerant upland forests. Nesting and oviposition has been noted in upland sandy areas and rock outcrops under large flat rocks. The majority of their diet is comprised of American toad and Fowler's toad (Kraus 2011).	Low	Although suitable aquatic and wetland habitat may occur in the study area, there are no recent occurrence records.



**ATTACHMENT 1**  
Species at Risk Screening

Common Name	Scientific Name	Species At Risk Act (Sch 1) <sup>1</sup>	Endangered Species Act <sup>2</sup>	COSEWIC <sup>3</sup>	Provincial (SRank) <sup>4</sup>	Habitat Requirements <sup>5</sup>	Potential to Occur on Site	Rationale for Potential to Occur on Site
Eastern ribbonsnake - (Great Lakes population)	<i>Thamnophis sauritus</i>	SC	SC	SC	S3	In Ontario, eastern ribbonsnake is semi-aquatic, and is rarely found far from shallow ponds, marshes, bogs, streams or swamps bordered by dense vegetation. They prefer sunny locations and bask in low shrub branches. Hibernation occurs in mammal burrows, rock fissures or even ant mounds (COSEWIC 2012).	Low	Although suitable aquatic and wetland habitat may occur in the study area, there are no recent occurrence records.
Milksnake	<i>Lampropeltis triangulum</i>	SC	NAR	SC	S3	In Ontario, milksnake uses a wide range of habitats including prairies, pastures, hayfields, wetlands and various forest types, and is well-known in rural areas where it frequents older buildings. Proximity to water and cover enhances habitat suitability. Hibernation takes place in mammal burrows, hollow logs, gravel or soil banks, and old foundations (COSEWIC 2014).	Moderate	Suitable habitat, including forest, wetland and grassland, may occur in the study area.
Queensnake	<i>Regina septemvittata</i>	END	END	END	S2	In Ontario, queensnake requires permanent aquatic habitat with large flat rocks, either submerged or on the bank/shoreline. Individuals rarely leave the shoreline of permanent bodies of water with abundant shoreline cover and a healthy population of crayfish. They are fairly intolerant of silty substrates and most commonly are found in streams with bedrock and gravel substrates. The best sites have water temperatures that remain at or above 18°C during the active season, have a swift to moderate current and woodland surroundings. Hibernacula may occur in the abutments of old bridges, in clay slopes above the high water mark and in bedrock fissures (Gillingwater 2011).	Low	Although suitable aquatic and shoreline habitat may occur in the study area, there are no recent occurrence records.
Northern map turtle	<i>Graptemys geographica</i>	SC	SC	SC	S3	In Ontario, the northern map turtle prefers large waterbodies with slow-moving currents, soft substrates, and abundant aquatic vegetation. Ideal stretches of shoreline contain suitable basking sites, such as rocks and logs. Along Lakes Erie and Ontario, this species occurs in marsh habitat and undeveloped shorelines. It is also found in small to large rivers with slow to moderate flow. Hibernation takes place in soft substrates under deep water (COSEWIC 2012).	Low	Although suitable aquatic habitat may occur in the study area, there are no recent occurrence records.
Snapping turtle	<i>Chelydra serpentina</i>	SC	SC	SC	S3	In Ontario, snapping turtle utilizes a wide range of waterbodies, but shows preference for areas with shallow, slow-moving water, soft substrates and dense aquatic vegetation. Hibernation takes place in soft substrates under water. Nesting sites consist of sand or gravel banks along waterways or roadways (COSEWIC 2008).	Moderate	Suitable aquatic habitat may occur in the study area.
Spotted turtle	<i>Clemmys guttata</i>	END	END	END	S3	In Ontario, spotted turtle habitat consists of shallow, slow-moving and unpolluted water such as ponds, bogs, marshes, ditches, vernal pools and sedge meadows. It is also occasionally found in woodland streams or sheltered shallow bays. These habitats are characterized by soft substrates and abundant aquatic vegetation. Females lay eggs in soil and leaf litter in wooded areas close to wetlands. Hibernation takes place in substrates under water, often under moss hummocks or muskrat dens (COSEWIC 2014).	Low	Although suitable aquatic habitat may occur in the study area, there are no recent occurrence records in the area. This species is more common along the shoreline of Lake Erie and Georgian Bay areas.



**ATTACHMENT 1**  
Species at Risk Screening

Common Name	Scientific Name	Species At Risk Act (Sch 1) <sup>1</sup>	Endangered Species Act <sup>2</sup>	COSEWIC <sup>3</sup>	Provincial (SRank) <sup>4</sup>	Habitat Requirements <sup>5</sup>	Potential to Occur on Site	Rationale for Potential to Occur on Site
Wood turtle	<i>Glyptemys insculpta</i>	THR	END	THR	S2	In Ontario, wood turtle spends spring and fall in or near waterbodies, including clear rivers and streams with sandy or gravel-sand substrates and moderate to fast current. During the summer, this species is often found on land in habitats with moderate or patchy shrub and tree cover, often more than 500 m from water. Hibernation takes place in substrates under water. Nesting sites are found on sand or gravel-sand beaches and banks with patchy vegetation cover. Other sites less often used include gravel holes, roadsides, railways, utility corridors, farm land and pastures (Ontario Wood Turtle Recovery Team 2010).	Low	Although suitable aquatic habitat may occur in the study area, this species is considered a historic occurrence in the Region of Waterloo.
American chestnut	<i>Castanea dentata</i>	END	END	END	S2	In Ontario, American chestnut occurs in mixed or deciduous forests in the Carolinian zone (Farrar 1995). It is often found in communities with dense canopy cover and often associated with oak and maple. This tree grows primarily on acidic, sand or gravel soils (Boland et al. 2012).	Low	Although suitable forested habitat may occur in the study area, there are no recent occurrence records.
American columbo	<i>Frasera caroliniensis</i>	END	END	END	S2	In Ontario, American columbo is most commonly associated with open deciduous forested slopes, but it can also be found in thickets, swamps and clearings. It is often associated with oak, hickory and sassafras trees. American columbo grows on a wide variety of soils, particularly dry mesic to mesic clay and clay loam soils (COSEWIC 2006).	Moderate	Suitable forested habitat may occur in the study area.
American ginseng	<i>Panax quinquefolius</i>	END	END	END	S2	In Ontario, American ginseng is found in moist, undisturbed and relatively mature deciduous woods often dominated by sugar maple. It is commonly found on well-drained, south-facing slopes. American ginseng grows under closed canopies in neutral, loamy soils (COSEWIC 2000).	Low	Although suitable forested habitat may occur in the study area, there are no recent occurrence records.
Bashful bulrush or Few-flowered club-rush	<i>Trichophorum planifolium</i>	END	END	END	S1	In Ontario, bashful bulrush grows in open deciduous forests, especially dry oak woodlands, with an open understory. This plant requires warmth and good drainage, and occurs on steep slopes with neutral to slightly acidic soils (Smith and Rothfels 2010; Crins 1989).	Low	Dry, oak woodlands are rare in the region and unlikely to occur in the study area.
Broad beech fern	<i>Phegopteris hexagonoptera</i>	—	SC	SC	S3	In Ontario, broad beech fern inhabits rich, undisturbed mature deciduous forest dominated by beech and maple. It typically grows in moist to wet, sandy soils of lower valley slopes and occasionally swamps (van Overbeeke et al. 2013).	Low	Although suitable forested habitat may occur in the study area, there are no recent occurrence records.
Butternut	<i>Juglans cinerea</i>	END	END	END	S3?	In Ontario, butternut is found along stream banks, on wooded valley slopes, and in deciduous and mixed forests. It is commonly associated with beech, maple, oak and hickory (Voss and Reznicek 2012). Butternut prefers moist, fertile, well-drained soils, but can also be found in rocky limestone soils. This species is shade intolerant (Farrar 1995).	Moderate	Potential suitable habitat occurs in the study area.
Eastern flowering dogwood	<i>Cornus florida</i>	END	END	END	S2?	In Ontario, eastern flowering dogwood grows in the understory of dry to rich deciduous forests, especially on hillsides and riverbanks. It prefers sandy acidic soils but occasionally is found in loams, clays and organic soils (Waldron 2003). This species is restricted to the Carolinian zone of southern Ontario.	Low – Moderate	Although suitable forested habitat may occur in the study area, the study area is located at the northern edge of the Carolinian zone.



**ATTACHMENT 1**  
Species at Risk Screening

Common Name	Scientific Name	Species At Risk Act (Sch 1) <sup>1</sup>	Endangered Species Act <sup>2</sup>	COSEWIC <sup>3</sup>	Provincial (SRank) <sup>4</sup>	Habitat Requirements <sup>5</sup>	Potential to Occur on Site	Rationale for Potential to Occur on Site
False hop sedge	<i>Carex lupuliformis</i>	END	END	END	S1	In Ontario, false hop sedge occurs in marshes, riverine swamps, borders of vernal pools, and wet depressions of forests. It occasionally occurs in shallow water or very wet floodplain forests. Usually grows under a moderately open canopy but can tolerate high levels of sunshine. Substrates are calcareous or neutral and include moist wet mucks, silt loams, or alluvial deposits with a sandy texture (Environment Canada 2014).	Moderate	Suitable wetland habitat may occur in the study area.
Green dragon	<i>Arisaema dracontium</i>	—	SC	SC	S3	In Ontario, green dragon occurs in somewhat-wet to wet deciduous forests along streams. In particular, it grows in maple forest and forest dominated by red ash and white elm trees. Green dragon is restricted to shaded or partially shaded seasonally inundated floodplains (Donley et al. 2013). It is primarily restricted to southwestern Ontario.	Moderate	Suitable forested habitat may occur in the study area.

<sup>1</sup> Species at Risk Act (SARA), 2002. Schedule 1 (Last amended 17 Dec 2014); Part 1 (Extirpated), Part 2 (Endangered), Part 3 (Threatened), Part 4 (Special Concern)

<sup>2</sup> Endangered Species Act (ESA), 2007 (O.Reg 242/08 last amended 14 Sept 2016 as O.Reg 308/16). Species at Risk in Ontario List, 2007 (O.Reg 230/08 last amended 15 June 2016 as O. Reg 200/16, s. 1.); Schedule 1 (Extirpated - EXP), Schedule 2 (Endangered - END), Schedule 3 (Threatened - THR), Schedule 4 (Special Concern - SC); NAR = Not at Risk

<sup>3</sup> Committee on the Status of Endangered Wildlife in Canada (COSEWIC) <http://www.cosewic.gc.ca/>

<sup>4</sup> Provincial Ranks (SRANK) are Rarity Ranks assigned to a species or ecological communities, by the Natural Heritage Information Centre (NHIC). These ranks are not legal designations. SRANKS are evaluated by NHIC on a continual basis and updated lists produced annually. SX (Presumed Extirpated), SH (Possibly Extirpated - Historical), S1 (Critically Imperiled), S2 (Imperiled), S3 (Vulnerable), S4 (Apparently Secure), S5 (Secure), SNA (Not Applicable), S#S# (Range Rank), S? (Not ranked yet), SAB (Breeding Accident), SAN (Non-breeding Accident), SX (Apparently Extirpated). Last assessed August 2011.

<sup>5</sup> General References:

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# **Appendix C**

## **On-going Region Monitoring Program**

**Table C1:  
Ongoing Groundwater Monitoring Program**

Well Field	Well Name	Measurement Frequency	Monthly WL Required by PTTW	Top Screen	Bottom Screen	Overburden / Bedrock
Pinebush	P10	hourly		31.1	64.3	Bedrock
Pinebush	P11	hourly		44.8	83.8	Bedrock
Pinebush	P17	hourly		48.2	110.6	Bedrock
Pinebush	OW1A-92	hourly	yes	29.5	84.1	Bedrock
Pinebush	OW1B-92	hourly	yes	18.3	21.3	Overburden
Pinebush	OW1C-92	hourly	yes	7.3	10.4	Overburden
Pinebush	OW3A-95	monthly	yes	143.3	146.3	Bedrock
Pinebush	OW3B-95	monthly	yes	84.7	90.8	Bedrock
Pinebush	OW3C-95	monthly	yes	66.1	72.2	Bedrock
Pinebush	OW3D-95	monthly	yes	47.9	52.4	Bedrock
Pinebush	OW3E-95	monthly	yes	36.0	39.0	Bedrock
Pinebush	OW3F-95	monthly	yes	34.8	36.3	Bedrock
Pinebush	OW3G-95	monthly	yes	29.0	30.5	Overburden
Pinebush	OW3H-95	monthly	yes	7.0	8.5	Overburden
Pinebush	OW5A-94	monthly		137.0	140.0	Bedrock
Pinebush	OW5B-94	hourly		104.0	110.0	Bedrock
Pinebush	OW5C-94	monthly		53.3	59.7	Bedrock
Pinebush	OW5D-94	monthly		43.3	48.3	Bedrock
Pinebush	OW5E-94	monthly		36.3	39.3	Overburden
Pinebush	OW5F-94	hourly		6.1	9.1	Overburden
Pinebush	OW5G-94	monthly		14.8	17.8	Overburden
Pinebush	PBOW1A-06	hourly		91.4	109.1	Bedrock
Pinebush	PBOW1B-06	monthly		48.2	54.3	Bedrock
Pinebush	PBOW1C-06	monthly		35.4	41.5	Bedrock
Pinebush	PBOW1D-06	monthly		32.0	35.5	Bedrock
Pinebush	PBOW1E-06	monthly		19.8	22.9	Overburden
Pinebush	PBOW1F-06	hourly		8.2	11.3	Overburden
Pinebush	PBOW2A-06	hourly		91.4	109.8	Bedrock
Pinebush	PBOW2B-06	monthly		48.9	55.0	Bedrock
Pinebush	PBOW2C-06	monthly		33.5	44.4	Bedrock

**Table C1:  
Ongoing Groundwater Monitoring Program**

Well Field	Well Name	Measurement Frequency	Monthly WL Required by PTTW	Top Screen	Bottom Screen	Overburden / Bedrock
Pinebush	PBOW2D-06	monthly		33.2	36.3	Bedrock
Pinebush	PBOW2E-06	monthly		25.0	28.0	Overburden
Pinebush	PBOW2F-06	hourly		14.0	17.1	Overburden
Pinebush	PLOW1A-06	hourly		9.1	10.7	Overburden
Pinebush	PLOW1B-06	hourly		3.8	5.3	Overburden
Pinebush	PBOW1B-08	monthly	yes	18.0	19.8	Overburden
Pinebush	G5-TW2A-08	monthly	yes	99.1	102.1	Bedrock
Pinebush	G5-TW2B-08	monthly	yes	55.9	59.0	Bedrock
Pinebush	G5-TW2C-08	hourly	yes	28.9	32.0	Bedrock
Pinebush	P10-TW1A-09	hourly		104.6	107.6	Bedrock
Pinebush	P10-TW1B-09	monthly		86.0	89.0	Bedrock
Pinebush	P10-TW1C-09	hourly		34.1	37.2	Bedrock
Pinebush	P10-TW1D-09	monthly		25.6	28.7	Overburden
Pinebush	P10-TW1E-09	monthly		4.5	7.6	Overburden
Pinebush	PBOW1A-11	monthly	yes	19.8	22.9	Overburden
Pinebush	PBOW1B-11	monthly	yes	6.1	7.6	Overburden
Pinebush	PBOW1A-13	monthly	yes	120.4	123.4	Bedrock
Pinebush	PBOW1B-13	monthly	yes	107.4	110.5	Bedrock
Pinebush	PBOW1C-13	hourly	yes	75.6	78.6	Bedrock
Pinebush	LWL	monthly				Surface Water
Clemens Mill	OW4A-92	hourly	yes	36.9	37.8	Bedrock
Clemens Mill	OW4B-92	hourly	yes	28.4	29.9	Overburden
Clemens Mill	OW4C-92	hourly	yes	8.8	10.4	Overburden
Clemens Mill	OW6A-94	monthly	yes	155.5	158.5	Bedrock
Clemens Mill	OW6B-94	monthly	yes	130.0	133.0	Bedrock
Clemens Mill	OW6C-94	monthly	yes	111.0	114.0	Bedrock
Clemens Mill	OW6D-94	monthly	yes	68.6	71.6	Bedrock
Clemens Mill	CMOW1A-06	hourly		102.1	120.4	Bedrock
Clemens Mill	CMOW1B-06	monthly		48.8	57.9	Bedrock
Clemens Mill	CMOW1C-06	monthly		36.6	39.6	Bedrock

**Table C1:  
Ongoing Groundwater Monitoring Program**

Well Field	Well Name	Measurement Frequency	Monthly WL Required by PTTW	Top Screen	Bottom Screen	Overburden / Bedrock
Clemens Mill	CMOW1D-06	monthly		30.2	33.1	
Clemens Mill	CMOW1E-06	monthly		14.0	17.1	Overburden
Clemens Mill	CMOW1F-06	hourly		4.6	7.6	Overburden
Clemens Mill	CMOW2A-06	hourly		91.4	111.6	Bedrock
Clemens Mill	CMOW2B-06	monthly		45.0	58.2	Bedrock
Clemens Mill	CMOW2C-06	hourly		30.5	35.4	Bedrock
Clemens Mill	CMOW2D-06	monthly		27.4	29.0	Overburden
Clemens Mill	CMOW2E-06	monthly		13.7	16.8	Overburden
Clemens Mill	CMOW2F-06	hourly		4.6	7.6	Overburden
Clemens Mill	CMOW3A-06	monthly	yes	77.7	108.2	Bedrock
Clemens Mill	CMOW3B-06	monthly	yes	50.3	56.1	Bedrock
Clemens Mill	CMOW3C-06	monthly	yes	36.6	39.6	Bedrock
Clemens Mill	CMTW3A-05	monthly		106.7	125.0	Bedrock
Clemens Mill	CMTW3B-05	monthly		64.0	70.1	Bedrock
Clemens Mill	CMTW3C-05	monthly		38.4	46.0	Bedrock
Clemens Mill	CMOW1A-10	hourly	yes	9.8	12.8	Overburden
Clemens Mill	CMOW2A-10	monthly	yes	33.8	35.4	Overburden
Clemens Mill	CMOW2B-10	monthly	yes	9.7	12.7	Overburden
Clemens Mill	CMOW1A-15	monthly		93.0	96.0	Bedrock
Clemens Mill	CMOW1B-15	monthly		77.1	80.2	Bedrock
Clemens Mill	CMOW1C-15	monthly		30.5	33.5	Bedrock
Shade's Mills	SMOW3B-93	monthly		16.8	18.2	Overburden
Shade's Mills	SMOW3C-93	monthly		7.6	9.1	Overburden
Shade's Mills	SM1A-02	monthly	yes	12.2	15.5	Overburden
Shade's Mills	SMTW1A-05	hourly		83.2	101.5	Bedrock
Shade's Mills	SMTW1B-05	monthly		47.9	57.0	Bedrock
Shade's Mills	SM3A-07	monthly	yes	91.4	109.7	Bedrock
Shade's Mills	SM3B-07	monthly	yes	48.8	64.0	Bedrock
Shade's Mills	SM3C-07	monthly	yes	27.4	30.5	Bedrock
Shade's Mills	NDTW1A-08	hourly		79.2	97.5	Bedrock

**Table C1:  
Ongoing Groundwater Monitoring Program**

Well Field	Well Name	Measurement Frequency	Monthly WL Required by PTTW	Top Screen	Bottom Screen	Overburden / Bedrock
Shade's Mills	NDTW1B-08	monthly		44.1	51.8	Bedrock
Shade's Mills	NDTW1C-08	hourly		25.9	28.9	Bedrock
Shade's Mills	NDTW1D-08	monthly		14.6	17.7	Overburden
Shade's Mills	NDTW1E-08	hourly		5.5	8.5	Overburden
Shade's Mills	SMOW1A-11	monthly	yes	47.3	50.3	Bedrock
Shade's Mills	SMOW1B-11	monthly	yes	32.9	36.0	Overburden
Shade's Mills	SMOW1-14	hourly		11.9	15.0	Overburden
Shade's Mills	SMOW2-14	monthly		11.0	14.0	Overburden
Shade's Mills	SMOW3-14	monthly		11.0	14.0	Overburden
Shade's Mills	SMOW4-14	hourly	yes	14.4	17.5	Overburden
Shade's Mills	SMOW5-14	hourly	yes	14.3	17.3	Overburden