

Appendix C – Natural Environment Report



University Avenue Municipal Class Environmental Assessment

Natural Environment Technical Report

Prepared for:

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NATURAL RESOURCE SOLUTIONS INC.

Aquatic, Terrestrial and Wetland Biologists

University Avenue Municipal Class Environmental Assessment

Natural Environment Technical Report

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1.0 Introduction

Natural Resource Solutions Inc. (NRSI) was retained in 2019 by IBI Group on behalf of the Region of Waterloo to complete the natural heritage component of the Class Environmental Assessment (EA) for a section of University Avenue (Regional Road 57) between Albert Street and Weber Street North in Waterloo, Ontario (Maps 1a-1b). The Schedule C Class EA has been commissioned by the Region of Waterloo in relation to proposed improvements to University Avenue, in accordance with the Region of Waterloo and the City of Waterloo Transportation Master Plans.

This report summarizes background information on natural heritage features, as well as results of original field surveys including tree inventory and Species at Risk (SAR) bat habitat assessment. The study area crosses grid squares of 1km² from which legacy data from agencies and wildlife atlases can be obtained; data from this extent was considered to ensure that all surrounding natural features were included. This background information, along with the results of original field surveys, are summarized in this Natural Environment Technical Report (NETR). The NETR comprises one part of the EA process that will inform the selection of a preferred alternative for road improvements. Other components—prepared by other project team members—that will be considered include technical feasibility, potential impacts to the local community, cost, and input from a variety of stakeholders. Once a preferred solution is selected, this report will be updated to include an assessment of the environmental impacts associated with the development details.

1.1 Study Area

The term 'study area' refers to the University Avenue Right-of-Way (ROW) between Albert Street and Weber Street North and areas around major and minor intersections as shown on Maps 1a-1b. This study area falls within Ecoregion 6E and is located within the Laurel Creek subwatershed, with Laurel Creek approximately 250m to the east of Weber Street in this area. The University Avenue study area is highly urbanized with residential, commercial, and institutional (i.e. Wilfrid Laurier University, St. Michael Catholic Church) properties along both the north and south sides of the road. No natural features exist within or directly adjacent to the study area.

1.2 Project Scoping

In order to determine a study approach for the natural heritage characterization portion of the EA, existing natural heritage information was gathered and reviewed to identify natural heritage features and species that are known, or have the potential to occur, in the study area. This included reviewing applicable existing databases and species atlases. Initial wildlife species lists were compiled to provide information on species reported from the vicinity of the study area (up to a 10km radius) using various atlases; including the Ontario Mammal Atlas (Dobbyn 1994), the Ontario Reptile and Amphibian Atlas (Ontario Nature 2019), the Ontario Butterfly Atlas (Jones et al. 2013), and the Ontario Odonata Atlas (MNRF 2019). Data on breeding birds in the area was extracted from the Ontario Breeding Bird Atlas (BSC et al. 2006). Since this atlas provides data based on 10x10km survey squares, information on breeding birds from the 1x1km square that overlaps the study area (17NJ38) was compiled.

Based on these initial species lists, a total of 12 SAR and 9 Species of Conservation Concern (SCC) were identified as having records from within the vicinity of study area (Appendix I). For the purpose of this report, SAR are defined as species listed as 'Threatened' or 'Endangered' provincially, which are afforded protection under the *Endangered Species Act* (ESA), or federally in Schedule 1 of the *Species at Risk Act* (SARA). In Ontario, provincial SCC include:

- Species designated under the ESA as 'Special Concern' within Ontario;
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the Natural Heritage Information Centre (NHIC);
- Species that have a high percentage of their global population in Ontario, and
- Species that are designated federally as 'Threatened' or 'Endangered' by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by the Committee on the Status of Species at Risk in Ontario (COSSARO). These species are protected by the federal SARA but not provincially by the ESA.

Habitat for SCC may be considered Significant Wildlife Habitat (SWH), which is afforded protection under the Provincial Policy Statement (PPS, OMMAH 2014) and various municipal natural heritage protection policies. SCC are discussed within the context of SWH further in this report. Despite the study area being almost entirely comprised of urban development, a preliminary screening exercise was conducted to identify which species may have suitable habitat within the study area. This involved cross-referencing the preferred habitat for reported

SAR and SCC against habitats known to occur within the study area or adjacent lands (OMNR 2000). This was completed to ensure that the potential presence of all SAR and SCC within the study area was adequately assessed in this EA.

A preliminary screening for the presence of SWH was also completed for the study area (Appendix II). The Significant Wildlife Habitat Technical Guide (SWHTG) is a guideline document that outlines the types of habitats that the Ministry of Natural Resources and Forestry (MNRF) considers significant in Ontario as well as criteria to identify these habitats (OMNR 2000). The SWHTG groups SWH into 4 broad categories: i) seasonal concentration areas, ii) rare vegetation communities and specialized wildlife habitat, iii) habitats of SCC, and iv) animal movement corridors. Based on the results of this preliminary screening exercise, only habitat for SCC (Special Concern and rare wildlife species) was considered to be candidate SWH for the study area. This candidate SWH type is discussed in this report and full results of the SWH screening are provided in Appendix II.

2.0 Relevant Policies, Legislation and Planning Studies

Table 1 provides an overview of policies that were considered and that informed the field program and analysis. This section of the report may be used to guide the evaluation of alternatives by identifying specific implications of these policies to each scenario. The PPS (OMMAH 2014) and the local Official Plan (City of Waterloo 2018) have specific policies that speak to activities that create or maintain infrastructure authorized under an EA process with respect to natural heritage features. Development adjacent to, or within important natural features (which would otherwise be strictly prohibited) may be permitted if it is demonstrated through an EIS that there will be no serious adverse negative impacts to the feature's form or function. As such, minor encroachment into natural features may be endorsed by the municipalities in support of this road improvement project if they are required.

Table 1. Relevant Policies, Legislation and Planning Studies

Policy/Legislation	Description	Project Relevance
Provincial Policy Statement (PPS) (OMMAH 2014)	- Issued under the authority of Section 3 of the Planning Act and came into effect on April 30, 2014, replacing the 2005 statement; - Section 2.1 of the PPS – Natural Heritage establishes clear direction on the adoption of an ecosystem approach and the protection of resources that have been identified as ‘significant’; - The Natural Heritage Reference Manual (OMNR 2010) and the Significant Wildlife Habitat Technical Guide (OMNR 2000) were prepared by the MNRF to provide guidance on identifying natural features and in interpreting the Natural Heritage sections of the PPS.	- Based on a preliminary analysis, 2 natural features were identified within the study area which have implications under the PPS: - Potential habitat for endangered and threatened species (<i>Myotis lucifugus</i>, <i>Myotis septentrionalis</i>, <i>Perimyotis subflavus</i>); and - Candidate Significant Wildlife Habitat: Special Concern and Rare Wildlife Species (Habitat for SCC).
Endangered Species Act (Government of Ontario 2007)	- The original ESA, written in 1971, was revised in 2007; - The ESA prohibits killing, harming, harassing or capturing SAR and protects their habitats from damage and destruction.	Through the background review several SAR were identified with records in atlas squares around the study area. These include birds, amphibians, reptiles, and mammals (Appendix I).
Fish and Wildlife Conservation Act (Government of Canada 2019)	The FWCA provides protection for certain bird species not protected under the MBCA (e.g. raptors), as well as furbearing mammals and their dens or habitual dwellings. The Act however does not include Red Fox (<i>Vulpes vulpes</i>) or Striped Skunk (<i>Mephitis mephitis</i>).	The timing of construction activities, especially vegetation clearing and site grading, must have consideration for bird nesting and dens sites of furbearing mammals.
Migratory Birds Convention Act (CWS 2013)	- Protects migratory game birds, insectivorous birds, and several other migratory non-game birds; - The Act prohibits the harassment and destruction of bird nests during the course of construction and other related activities except under the authority of a permit obtained through the Canadian Wildlife Service;	- During the site preparation and/or construction phase of the project there is the potential for implications to birds and bird nests. - The schedule of actual on-site work, especially any vegetation clearing, must consider the MBCA nesting timing windows for this part of southern Ontario which is

Policy/Legislation	Description	Project Relevance
	• “Incidental take” is considered illegal, with the exception of a permit obtained by the Canadian Wildlife Services (CWS).	typically between April 1 and August 31; however, this is a guideline, since the MBCA applies to nesting bird species at any time.
Region of Waterloo Official Plan (2015)	• The Regional Official Plan (OP) sets out policies to guide growth and land use, economic development, and natural heritage protection. • The OP outlines policies for the protection of natural features and connections between those features (the Greenlands Network) within the Region (Region of Waterloo 2015).	• Policies speak to the protection of natural features including habitat for threatened and endangered species, and floodplain hazard lands, both of which occur within the study area.
City of Waterloo Official Plan (2018)	• The City of Waterloo Official Plan (2018) outlines current policies for, among other things, the protection of the City’s Natural System. • The Natural System is composed of Landscape Level Systems, Core Natural Features, and Supporting Natural Features, as well as fish habitat, Restoration Areas, and Linkages.	• Within the study area floodplain hazards are present.
City of Waterloo Urban Forest Policy (1998)	• Sets out the benefits conferred by the urban forest to the community and sets its protection as a priority. • Presents specifications for the protection of existing trees and the planting (design and installation) of new trees.	• Detailed designs at a later stage should consider tree protection methods and landscape plans should conform to the street tree planting specifications.
City of Waterloo By-Law No. 2014-078, For the Protection of Trees on City Property (2014)	• Prohibits the harm or destruction of publicly-owned trees on City property, and regulates the planting of trees on City property.	• Some of the trees within the study area may be within the University Avenue ROW and therefore publicly-owned trees. • There is an exemption in the By-law for “matters undertaken by a municipality of a local board of a municipality” (City of Waterloo 2014).
Ontario Regulation 150/06	• Regulation issued under <i>Conservation Authorities Act</i>, R.S.O. 2013. • Through this regulation, the Grand River Conservation Authority (GRCA) has the responsibility to regulate activities in natural and hazardous areas (i.e., areas in and near rivers, streams, floodplains, wetlands, and slopes).	• The GRCA regulates a portion of the study area as a Special Policy Area due to the floodplain of Laurel Creek. • As such, permitting from the GRCA must be obtained for proposed works within the regulation limit.

Policy/Legislation	Description	Project Relevance
	GRCA requires that an EIS be undertaken in accordance with their <i>EIS Guidelines and Submission Standards for Wetlands</i> where development is proposed within 120m of PSW or 30m of non-PSW (GRCA 2005).	

3.0 Field Methods

A scoped field program was developed for the natural heritage component of the EA based on the proposed works, background review of existing natural features and a review of aerial photos. The field program was comprised of a comprehensive tree inventory and an assessment of suitable bat maternity roost habitat between April and July, 2019. The results of the tree inventory and bat habitat assessment are described below and shown on Maps 2a-2b.

As the study area is highly urbanized, with very little natural space present, a vascular plant inventory, Ecological Land Classification (ELC), and breeding bird surveys were not conducted as part of the field program. Targeted amphibian and reptile surveys were not conducted as there is no wetland or aquatic habitat present within the study area and the proposed undertaking is unlikely to impact potential habitat nearby (e.g. the channel and riparian zone associated with Laurel Creek).

3.1 Tree Inventory

A comprehensive inventory of trees $\geq 10\text{cm}$ Diameter at Breast Height (DBH) was completed by an NRSI Certified Arborist on July 8, 2019. The inventory focused on trees within the University Avenue ROW and within approximately 5m of the ROW that may be impacted by road upgrades and associated construction activities. To account for all nearby trees close to the diameter threshold, 3 trees that were $>9\text{cm}$ DBH were included in the inventory. Each tree was given an alphabetic identifier for mapping purposes but, because many of the inventoried trees are private property, trees were not tagged in the field. Inventoried trees are shown on Maps 2a-2b and a complete list of the trees that were assessed and their overall health and potential for structural failure is included in Appendix III.

The tree inventory documented the following for each tree:

- Species (common and scientific names);
- DBH (cm);
- Number of stems;
- Crown radius (m);
- Overall condition (excellent, good, fair, poor, very poor, dead);
- Potential for structural failure (improbable, possible, probable, imminent);
- Tree location (UTM coordinates), and
- General comments (i.e. disease, aesthetic quality, etc.)

The general health and potential for structural failure of each tree was assessed based on the criteria outlined in Tables 2 and 3.

Table 2. Tree Health Assessment Criteria

Assessment Criteria	Definition¹
Health Rating*	
Excellent	Represents a tree in near perfect form, health, and vigor. This tree would exhibit no deadwood, no decline, and no visible defects.
Good	Represents a tree ranging from a generally healthy tree to a near perfect tree in terms of health, vigor and structure. This tree exhibits a complete, balanced crown structure with little to no deadwood and minimal defects as well as a properly formed root flare.
Fair	Represents a tree with minor health, balance or structural issues with minimal to moderate deadwood. Branching structure shows signs of included bark or minor rot within the branch connections or trunk wood. The root flare shows minimal signs of mechanical injury, decay, poor callusing, or girdling roots. Trees in the category require minor remedial actions to improve the vigor and structure of the tree.
Poor	Represents a tree that exhibits a poor vigor, reduced crown size (<30% of crown typical of species caused by overcrowding or decline), extreme crown unbalance, or extensive rot in the branching and trunk wood. Fungus could be seen from these rotting areas, suggesting further decay. These trees have extensive crown die back with a large amount of deadwood, and possibly dead sections. These weakened areas can lead to a potential failure of tree sections. Rooting zones show signs of extensive root decay or damage (fruiting bodies or mechanical damage) or girdling roots. Trees in this category require more extensive actions to prevent failure. A tree identified as poor would be a candidate for removal in the near future.
Very Poor	Represents a tree that exhibits major health and structural defects. Quite often the defects or diseases affecting this tree will be fatal. Large quantities of fungus, large dead sections with possible cavities and bark falling off all are signs that a tree is in a major state of decline and would be identified as very poor. These trees have a high potential for structural failure. These trees should be identified for removal.

¹Dunster 2009

Table 3. Tree Risk Assessment Criteria

Assessment Criteria*	Definition²
Improbable	The tree or branch is not likely to fail during normal weather conditions and may not fail in many severe weather conditions within the specified time frame.
Possible	Failure could occur, but it is unlikely during normal weather conditions within the specified time frame.
Probable	Failure may be expected under normal weather conditions within the specified time frame.
Imminent	Failure has started or is most likely to occur in the near future, even if there is no significant wind or increased load. This is a rare occurrence for a risk assessor to encounter, and it may require immediate action to protect people from harm.
*A specified time frame of 2 years will be used when assessing potential for structural failure.	

²Dunster et al. 2013

3.2 Bat Roost Habitat Assessment

Three bat species reported from the area are listed as Endangered provincially and are afforded general habitat protection under the ESA (2007). Bat SAR include Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*Myotis septentrionalis*), and Tri-coloured Bat (*Perimyotis subflavus*).

- Little Brown Myotis and Northern Myotis typically roost in tree cavities, hollows, under loose bark, and in buildings;
- Tri-coloured bats roosts in clusters of live or dead tree foliage in or below the canopy, Oak species are often preferred to other tree species, followed by Maple species (OMNR 2000; MNRF 2017).

The roost habitat assessment focused on trees that fall within the University Avenue ROW, and trees immediately adjacent that could potentially be impacted as part of the proposed undertaking. Leaf-off assessments were completed April 23, 2019 and leaf-on assessments were completed July 8, 2019, as per the protocols outlined in *Survey Protocol for Species at Risk Bats within Treed Habitats Little Brown Myotis, Northern Myotis & Tri-Colored Bat* (MNRF 2017) and *Use of Buildings and Isolated Trees by Species at Risk Bats—Survey Methodology* (MNRF 2014a). Each assessment was performed by NRSI biologists and Certified Arborists that are trained and experienced in the Ministry of Natural Resources and Forestry (MNRF) bat habitat assessment protocols.

Information considered (and recorded, where applicable) for candidate roost trees included tree species, location, DBH, canopy cover, tree height, decay class (Watt and Caceres 1999), and number and height of potentially suitable cavities. Other criteria were also considered, including the use of cavities by other wildlife, the potential for cavities to be used by predators, supporting/surrounding habitat, and other characteristics which may contribute to the habitat requirements of these species, such as temperature regulation.

3.3 Incidental Wildlife

Targeted wildlife surveys were not conducted but incidental wildlife observations were recorded during each field visit. These include direct visual or auditory observations, as well as signs such as dens, tracks, scat, etc.

4.0 Existing Conditions

4.1 Soil, Terrain and Drainage

The land of the study area slopes from west to east, from approximately 340masl at University Avenue and Albert Street to approximately 319masl at University Avenue and Weber Street North. As the study area is primarily composed of the ROW of an arterial regional road, it is expected that the soils here have been disturbed by past construction of the roadway and associated services, and the adjacent urban developments. Chung and Vander Doelen Engineering Ltd. conducted geotechnical evaluations through 14 boreholes in the study area. Pavement materials were directly underlain by fill soils at 6 borehole locations and by native soils at 8 borehole locations. Groundwater depths were found to be between 1.5-4m below existing grade. For more information refer to the Geotechnical Report (CVD 2019).

4.2 Vegetation

After background sources were reviewed (Section 1.2) and the study area was examined, the field work for the project was scoped to a comprehensive tree inventory and assessment of potential bat roosting habitat. A complete inventory of all vascular plant species was not completed. The study area is highly urbanized and unlikely to support significant plant species, though may support invasive species that thrive in disturbed areas. Incidental observations during the tree inventory did not find any concentration of invasive plant species within the study area.

4.2.1 Tree Inventory

In total, 76 trees, comprising 23 species, were inventoried along and within approximately 5m of the University Avenue ROW. Of the trees inventoried and assessed, 18 (24%) are native species and 58 (76%) are non-native owing to the fact that most are trees planted for ornamental purposes. The most frequently occurring species is Norway Maple, (*Acer platanoides*) at 28% of all trees inventoried. Norway Maple is a common street and yard tree and appears along this section of University Avenue in higher proportion than in the City of Waterloo's Street Tree Inventory (17%, City of Waterloo 2019).

Tree 'e' is a young Black Oak (*Quercus velutina*) observed on the property of Wilfrid Laurier University (WLU). Black Oak is a rare species in Waterloo Region when naturally occurring (Richardson and Martin 1999) but is not treated as such when a planted specimen. Six (6) of 8 White Ash (*Fraxinus americana*) inventoried were in poor, very poor or dead condition and display evidence of being affected by the Emerald Ash Borer (EAB, *Agrilus planipennis*).

A complete list of trees inventoried is provided in Appendix III and tree locations within the study area are shown on Maps 2a-2b. Table 4 provides a list of tree species inventoried within the study area, whether they are native or non-native and their overall condition. Table 5 provides a summary of the overall condition of trees inventoried along with their structural failure rating. The majority of the trees inventoried are in good to fair condition with an improbable potential for structural failure.

Table 4. Summary of Inventoried Trees

Common Name	Scientific Name	Excellent	Good	Fair	Poor	Very Poor	Dead	Total
Native Species								
Black Oak	<i>Quercus velutina</i>		1					1
Manitoba Maple	<i>Acer negundo</i>			1				1
Red Maple	<i>Acer rubrum</i>			1				1
Red Oak	<i>Quercus rubra</i>		1		1			2
Sugar Maple	<i>Acer saccharum</i> ssp. <i>saccharum</i>		1					1
White Ash	<i>Fraxinus americana</i>			2	2	3	1	8
White Birch	<i>Betula papyrifera</i>		2					2
White Spruce	<i>Picea glauca</i>			2				2
Total			5	6	3	3	1	18
Non-Native Species								
Austrian Pine	<i>Pinus nigra</i>		1					1
Black Locust	<i>Robinia pseudoacacia</i>		1					1
Callery Pear	<i>Pyrus calleryana</i>	1						1
Colorado Spruce	<i>Picea pungens</i>	2		2				4
Copper Beech	<i>Fagus sylvatica</i> f. <i>purpurea</i>			1				1
Crabapple	<i>Malus</i> sp.		2	4				6
English Oak	<i>Quercus robur</i>		2					2
London Plane-Tree	<i>Platanus X acerifolia</i>			1				1
Northern Catalpa	<i>Catalpa speciosa</i>		1					1
Norway Maple	<i>Acer platanoides</i>	1	14	5	1			21
Norway Spruce	<i>Picea abies</i>			1				1
Serviceberry species	<i>Amelanchier</i> sp.		1					1
Small Leaf Linden	<i>Tilia cordata</i>		3		1			4
Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>		5	6				11
White Mulberry	<i>Morus alba</i>		2					2
Total		4	32	20	2			58
Overall Total		4	37	26	5	3	1	76

Table 5. Overall Condition of Trees Inventoried

Potential for Structural Failure Rating	Overall Condition						Total
	Excellent	Good	Fair	Poor	Very Poor	Dead	
Improbable	4	35	23	0	0	0	62
Possible	0	2	3	5	3	1	14
Probable	0	0	0	0	0	0	0
Imminent	0	0	0	0	0	0	0
Total	4	37	26	5	3	1	76

4.2.2 Vascular Flora

The study area overlaps 2 of the 1 x 1km grid squares (17NJ3713, 17NJ3813) for species tracked by the Natural Heritage Information Centre (NHIC). Data for significant species from these squares include a record of Wild Licorice (*Glycyrrhiza lepidota*, S3) from 1976. A comprehensive vascular plant inventory not was completed in the scope of this work, but this species prefers open, sandy or rocky riverbanks (OMNR 2000). In the vicinity of these squares suitable habitat may be found along Laurel Creek, which is located outside of the study area. The undertaking between Albert Street and Weber Street North is unlikely to impact the riparian zone of Laurel Creek.

4.3 Wildlife

Targeted wildlife surveys were not conducted in the scope of this report, but incidental wildlife observations were recorded during other field work. The study area is highly urbanized but a review of available background sources indicated the presence of some significant species in the vicinity; these are discussed below.

4.3.1 Birds

Common species that are adapted to living in urban environments were observed during field work, including: Rock Pigeon (*Columba livia*), European Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), Northern Cardinal (*Cardinalis cardinalis*), Blue Jay (*Cyanocitta cristata*), White-breasted Nuthatch (*Sitta carolinensis*), and Black-capped Chickadee (*Parus atricapillus*).

A record from NHIC indicates the presence of Barn Swallow (*Hirundo rustica*), a Threatened species provincially and federally (MNR 2018, COSEWIC 2011). Barn Swallow prefers open country near to a body of water with cliffs, caves or rock niches, and nests in buildings and other

structures (OMNR 2000). Suitable habitat is not present in the study area. Appendix IV presents a number of records from the OBBA that show sensitive species from within a larger area (10 x 10km), but suitable habitat is not present in the study area (Appendix I).

4.3.2 Herpetofauna

NHIC data shows records of 2 species of Special Concern from within the study area: Snapping Turtle (*Chelydra serpentina*) and Eastern Ribbonsnake (*Thamnophis sauritus*). The Ribbonsnake prefers sunny, grassy areas with low, dense vegetation near bodies of shallow permanent quiet water, wet meadows, grassy marshes or sphagnum bogs, and borders of ponds, lakes or streams (OMNR 2000). The Snapping Turtle prefers permanent or semi-permanent fresh water, marshes, swamps or bogs, and rivers and streams with soft muddy banks or bottoms (OMNR 2000). The closest areas to the study area where these habitat characteristics are likely to be met include Laurel Creek and its riparian zones to the east, and Silver Lake, a reservoir along Laurel Creek, approximately 825m south of University Avenue. Neither of these features are anticipated to be impacted by the road improvement undertaking (Appendix I).

4.3.3 Mammals

Raccoon (*Procyon lotor*) and Gray Squirrel (*Sciurus carolinensis*) were observed during field visits; both are common species encountered in urban environments and neither are sensitive nor tracked species (Appendix V).

Bat roost habitat assessments found 5 trees that have cavities, cracks or loose bark that may provide suitable roosting habitat for Little Brown Myotis or Northern Myotis. Tri-colored Bat roosts in dead leaf clusters, preferring Oak and Maple trees; 2 Maple trees (trees 'b' and 'bc') were identified as having dead leaf clusters in 2019 (Appendix III). MNRG Guelph District's guidance (2017) for surveying for potential Tri-colored roosts suggest identifying all Oaks >10cm DBH and Maples >25cm DBH. An additional 16 inventoried trees meet these criteria as suitable roost trees for Tri-colored Bat. All suitable bat roost trees are displayed on Maps 2 and 3.

5.0 Natural Feature Significance and Sensitivity

The natural environment constraints analysis is used to identify natural features that are sensitive to disturbance based on the rarity or significance of the feature, or the functions, processes and/or policies inhibiting development within them. These areas are identified as “constraints”, and are discussed in the context of natural heritage policies governing their protection. Results of this analysis have been provided as input to the evaluation of the preferred alternatives in order to avoid and reduce impacts to natural features and functions. A summary of this analysis for the study area is discussed below.

5.1 Habitat for Provincially Endangered and Threatened Species

SAR and SCC reported from the vicinity of the study area are presented in Appendix I. Due to the urbanized nature of the study area and the linear nature of proposed road improvements, the study area does not include suitable habitat for most of these SAR and SCC. The SAR and SCC screening exercise has identified the potential for suitable roost habitat for Little Brown Myotis, Northern Myotis, and Tri-colored Bat to exist in buildings and/or trees within or adjacent to the study area.

In recent years, there has been in-fill redevelopment along the study area to construct multi-level student residential buildings and, notably, the demolition of the former St. Michael Catholic School and construction of the Laziridis School of Business and Economics (WLU). Such redevelopment projects replaced older buildings with new ones that are less likely to have features through which SAR bats could potentially access interior roost sites. Furthermore, the proposed road improvements are not anticipated to impact buildings that are adjacent to the study area. Suitable roost trees have been identified using the survey protocols from the MNRF (2014, 2017) and are shown on Maps 2 and 3. Maps 3a-3b presents natural environment constraints to the road improvement work—all suitable roost trees are included for consideration in developing detailed design for the proposed undertaking.

5.2 Significant Wildlife Habitat

The SWH screening exercise compared the characteristics of the study area and background information with the criteria in Appendix Q of the Significant Wildlife Habitat Technical Guide (OMNR 2000), as shown in Appendix II. Despite there being potential habitat for SAR bats (Section 5.1) this does not meet the requirement for SWH for Bat Maternity Colonies (seasonal concentration areas) for two reasons: (i) maternity colonies are considered SWH when found

within forested ecosites and there are no forested ecosites in or adjacent to the study area, and (ii) buildings are not to be considered SWH (OMNR 2000).

However, the potential for roosting habitat for SAR bats satisfies the SWH criteria for Special Concern and Rare Wildlife Species (Habitat for SCC). The defining criteria for this SWH type states that the presence of the identified Special Concern or provincially rare species (S1-S3, SH) needs to be confirmed through studies conducted at the time of year when the species is present or easily identifiable (OMNR 2000). If the selected design alternative is likely to impact trees with suitable habitat along University Avenue, the presence of SAR bats (Little Brown Myotis, Northern Myotis, Tri-colored Bat) may need to be confirmed through exit surveys conducted during the bat maternity roost period in June (MNRF 2014a).

5.3 Regionally Significant Species

OBBA records show 113 bird species from the vicinity of the study area, 53 of which are regionally significant (Appendix IV); none of which were incidentally observed during field work. Many of these significant species use specialized habitats like interior forest, meadow, or wetland. These habitat types are not present in the study area.

The Atlas of the Mammals of Ontario (Dobbyn 1994) showed records of 19 mammals from the area. Of these, 3 are scarce in the Region (Coyote (*Canis latrans*), Long-tailed Weasel (*Mustela frenata*), and Mink (*Mustela vison*)) and 1 is regionally rare (Bobcat (*Lynx rufus*)). Suitable habitat is not present in the study area and, if it were, each of these species tend to have large ranges and the minor disturbance created by road improvements is unlikely to impact them.

Twenty-three (23) herptile species were found in background records in the area from the Ontario Reptile and Amphibian Atlas. Of these, 9 are regionally significant, including 1 turtle species, 4 salamander species, 2 snake species, and 2 anuran species (Appendix VI). For important life stages the turtles and amphibians require wetland habitat that is not present in the study area. The Eastern Milksnake (*Lampropeltis triangulum*) and the Eastern Ribbonsnake (*Thamnophis sauritus septentrionalis*) prefer open or wooded habitats with suitable cover to shelter beneath (OMNR 2000) and are not likely to be found in the study area.

Of the 61 species of *Lepidoptera* found in local records from the butterfly atlas, 8 are rare in the Region of Waterloo and 1 is possibly extirpated (Appendix VII). The Ontario Odonata Atlas

showed 33 records of dragonflies and damselflies from the vicinity of the study area, none of which are regionally significant (Appendix VIII).

5.4 Regulated Area

Conservation authorities regulate development activities in “*areas that are river or stream valleys, wetlands and other areas where development could interfere with the hydrologic function of a wetland, adjacent or close to the shoreline of Lake Erie and inland lakes, and hazardous lands*” under the authority of Ontario Regulation 150/06 (GRCA 2015). Extending just into the eastern part of the study area is an area regulated by the GRCA that is associated with the Laurel Creek corridor (Map 3b). Section 8.1.15 of the GRCA Policies (2015) states that public infrastructure:

“may be permitted in accordance with the policies in Sections 7.1.2-7.1.3—General Policies, provided that there is no feasible alternative site outside the Riverine Flooding Hazard as determined through an Environmental Assessment...supported by the GRCA, and where it can be demonstrated that:

a) adverse hydraulic or fluvial impacts are limited and any risk of flood damage to upstream or downstream properties is not increased or is minimized through site design and the affected landowner(s) is informed of the increased risk,

b) there is no loss of flood storage wherever possible, and

c) where unavoidable, intrusions on significant natural features or hydrologic or ecological functions are minimized and it can be demonstrated that best management practices including site and infrastructure design and appropriate remedial measures will adequately restore and enhance features and functions.”

Though Laurel Creek is not within the study area, the regulated area associated with is floodplain intersects the eastern part of the study area. Therefore, the preferred design alternative will need to satisfy the GRCA’s policies, above, and permits may be required from the GRCA in order to undertake the road improvements to University Avenue near the intersection with Weber Street North.

5.5 Notable Trees

Aside from the Black Oak (tree 'e') mentioned in section 4.2.1, no other inventoried trees were provincially or regionally significant.

It is recognized, however, that large-stature trees provide more benefits to a community when compared to small-stature trees, such as greater shading cooling effects, greater mitigation of air pollutants, better stormwater management control, and higher property values (City of Waterloo 1998, USDA 2004). Therefore, it is recommended that road reconstruction design alternatives be considered that will allow for the retention and protection of the existing large trees within and/or near to the University Avenue ROW. The position of inventoried trees $\geq 40\text{cm}$ DBH have been shown on Maps 3a-3b along with their approximate driplines so that consideration can be given. Of course, many of the existing trees, if protected and well-maintained, could become large-stature trees that benefit the community. Therefore, consideration to all trees should be given during the development of design alternatives.

A preliminary analysis of inventoried trees has been performed in order to inform the development of design alternatives. Those trees recommended for removal on Map 2 are so because of their poor condition and status as a potential hazard near to heavily used sidewalks and roadway; many of these are Ash trees that have been impacted by EAB. Trees recommended for retention at this preliminary stage include those that are notable because of their size, species, or the presence of suitable bat roosting features (Maps 2 and 3). Design alternatives should try to avoid direct injury to tree parts and the disruption of root zones of trees. This may include positioning catch basins and other daylighting outside of tree driplines, directional drilling for utility installations, creative solutions to sidewalk material and routing. A detailed analysis of tree retention and removal, along with mitigation options, will be prepared when detailed designs and grading plans are available. The City of Waterloo's Urban Forest Policy (1998) suggests that construction impacts be restricted to outside 1.5x the dripline of nearby trees. This may not be feasible with the improvements to University Avenue, but tree protections will be an important mitigation. In lieu of the City of Waterloo having specifications for tree protection fencing, Map 2 includes an example from the City of Kitchener.

5.6 Summary of Natural Feature Constraints

Table 6 provides a summary of features identified as a constraint to road improvements within the study area. These features are shown on Map 3.

Table 6. Summary of Natural Feature Constraints

Natural Feature Constraint	Regulatory and Permitting Considerations	Project Considerations
Significant Wildlife Habitat and Habitat for Provincially Endangered and Threatened Species	- Provincial Policy Statement - Region of Waterloo Official Plan - City of Waterloo Official Plan	- No SWH have been confirmed within the study area. 1 Candidate SWH has been identified: Special Concern and Rare Wildlife Species (habitat for SCC). - This Candidate SWH type is associated with trees having suitable roosting sites for SAR bats. These trees are within or near to the study area and corresponding limits of impact from proposed road improvements. - If the detailed design of the preferred alternative indicates direct impacts to the trees with suitable roosting habitat identified as candidate SWH, additional survey work may be required to confirm the significance of these features.
Riverine Flooding Hazard	GRCA Ont. Reg. 150/06	- Development and site alteration within watercourses and their associated floodplain areas are prohibited unless permitted by the GRCA. - Stormwater management design associated with the preferred alternative design to ensure that flows to watercourse are maintained
Notable Trees	City of Waterloo's Urban Forest Policy	- The City of Waterloo aims to maintain and expand the publicly owned urban forest: "The Urban Forest must be considered an equal partner in the community infrastructure at the time of planning. Construction near trees and woodlots will be planned so as to ensure the long-term health of those trees and woodlots, for the preservation of the Urban Forest" (City of Waterloo 1998). - Design alternatives shall include options that minimize damage to existing trees and mitigate impacts where disruption is unavoidable. Such measures will include tree protection fencing at a minimum.

6.0 Summary and Recommendations

NRSI was retained by the Region of Waterloo as part of a team to complete the natural heritage component of the Class Environmental Assessment (EA) for a section of University Avenue between Albert Street and Weber Street North in Waterloo, Ontario (Maps 1a-1b). The Schedule C Class EA has been initiated by the Region of Waterloo to identify the preferred alternative for completing road improvements to this stretch of regional road.

The University Avenue study area is highly urbanized with residential, commercial, and institutional development along both the north and south sides of the road. Planted trees are present along the length of the study area, both within and adjacent to the University Avenue ROW. NRSI completed a tree inventory to identify and survey each of the trees within the anticipated disturbance area.

Laurel Creek lies approximately 250m to the east of the study area as it flows toward its confluence with the Grand River. The proposed undertaking will not have direct impacts to Laurel Creek but the regulated area associated its floodplain does extend into the eastern extent of the study area, around the intersection of University Avenue and Weber Street North. Appropriate permits may need to be obtained from the Grand River Conservation Authority, in accordance with their Policies (GRCA 2015), and mitigating designs may need to be implemented.

A single candidate SWH was identified within the study area: Special Concern and Rare Wildlife Species (habitat for SCC). If the detailed design of the preferred alternative indicates direct impacts to trees having suitable roost habitat features for SAR bats, which comprise the candidate SWH, additional survey work may be required to confirm the significance of these features. It is recommended that design alternatives be considered that avoid direct impact to these trees (Maps 3a-3b).

Existing trees along University Avenue are the primary natural features existing in the study area. For this reason, and in accordance with the City of Waterloo's Urban Forest Policy (1998), the EA process shall develop alternatives that allow for the retention and proper maintenance of significant and mature trees that provide benefits to the community and, potentially, suitable habitat to SAR bats. Both above-ground and below-ground tree parts shall be given consideration when developing alternatives and implementing mitigation measures.

The information provided in this report will be used to inform the design alternatives for the University Avenue road improvement project, and NRSI will work with the project team during the preparation of design alternatives. A discussion of potential and anticipated impacts to the natural features within the study area will be provided once the details of the alternatives are available.

7.0 References

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Appendix I

Species at Risk and Species of Conservation Concern Screening

University Ave, Waterloo Species at Risk (SAR) and Species of Conservation Concern (SCC) Screening

Project # 2251A

Scientific Name	Common Name	S-RANK ¹	SARO ²	COSEWIC ³	SARA ³	Background Source	Habitat Preference ^{2,4}	Suitable Habitat within Study Area
Birds								
<i>Riparia riparia</i>	Bank Swallow	S4B	THR	T	-	BSC et al. 2006	Sand, clay or gravel riverbanks or steep riverbank cliffs; lakeshore bluffs or easily crumbled sand or gravel; gravel pits, road-cuts, grassland or cultivated fields that are close to water.	No
<i>Hirundo rustica</i>	Barn Swallow	S4B	THR	T	-	BSC et al. 2006, MNRF 2014b	Farmlands or rural areas with cliffs, caves, or rich niches; buildings or other man-made structures for nesting; open country near a body of water.	No
<i>Dolichonyx oryzivorus</i>	Bobolink	S4B	THR	T	No Schedule	BSC et al. 2006	Large, open expansive grasslands with dense ground cover; hayfields, meadows or fallow fields; marshes; requires tracts of grassland >50 ha.	No
<i>Cardellina canadensis</i>	Canada Warbler	S4B	SC	T	Schedule 1	BSC et al. 2006	An interior forest species; dense, mixed coniferous, deciduous forests with closed canopy, wet bottomlands of cedar or alder; shrubby undergrowth in cool moist mature woodlands; riparian habitat; usually requires at least 30 ha.	No
<i>Sturnella magna</i>	Eastern Meadowlark	S4B	THR	T	No Schedule	BSC et al. 2006	Open, grassy meadows, farmland, pastures, hayfields or grasslands with elevated singing perches; cultivated land and weedy areas with trees; old orchards with adjacent, open grassy areas >10 ha in size.	No
<i>Contopus virens</i>	Eastern Wood-Pewee	S4B	SC	SC	-	BSC et al. 2006	Open, deciduous mixed or coniferous forest dominated by oak with little understorey. Also frequents forest clearings and edges, farm woodlots, and parks.	No
<i>Hylocichla mustelina</i>	Wood Thrush	S4B	SC	T	-	BSC et al. 2006	Carolinian and Great-Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near ponds and swamps; hardwood forest edges, and must have access to some trees higher than 12m.	No
Butterflies								
<i>Danaus plexippus</i>	Monarch	S2N, S4B	SC	E	Schedule 1	Jones et al. 2013	Open areas with milkweed species (Asclepias spp.).	No
Herpetofauna								
<i>Emydoidea blandingii</i>	Blanding's Turtle (<i>Great Lakes/St Lawrence population</i>)	S3	THR	T	Schedule 1	Ontario Nature 2019	Shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation; basks on logs, stumps or banks; surrounding natural habitat is important in summer as they frequently move from aquatic habitat to terrestrial habitats; hibernates in bogs; not readily observed.	No
<i>Lampropeltis triangulum</i>	Eastern Milksnake	S4	NAR	SC	Schedule 1	Ontario Nature 2019	Farmlands, meadows, hardwood or aspen stands; pine forest with brushy or woody cover; river bottoms or bog woods; hides under logs, stones, or boards or in outbuildings; often uses communal nest sites.	No
<i>Thamnophis sauritus septentrionalis</i>	Eastern Ribbonsnake	S3	SC	SC	Schedule 1	Ontario Nature 2019, MNRF 2014b	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups.	No. Suitable habitat may exist in the nearby riparian zone of Laurel Creek.
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	S2	END	E	Schedule 1	Ontario Nature 2019	Deciduous forests with moist, loose soil and rotting logs and leaf litter, where spring woodland ponds are present.	No

Scientific Name	Common Name	S-RANK ¹	SARO ²	COSEWIC ³	SARA ³	Background Source	Habitat Preference ^{2,4}	Suitable Habitat within Study Area
<i>Ambystoma sp.</i>	Jefferson/Blue-spotted Salamander	S2	-	-	-	Ontario Nature 2019	Moist woods in floodplains; ponds, sedge meadows, bogs, swamps or areas with semi-permanent water; occasionally in overgrown fields or in sandy soil; found under logs or other forest debris; home range size 250 m ² .	No
<i>Chrysemys picta marginata</i>	Midland Painted Turtle	S5	-	SC	-	Ontario Nature 2019	Quiet, warm, shallow water with abundant aquatic vegetation such as ponds, large pools, streams, ditches, swamps, marshy meadows; eggs are laid in sandy places, usually in a bank or hillside, or in fields; basks in	No. Suitable habitat may exist in the nearby Laurel Creek.
<i>Graptemys geographica</i>	Northern Map Turtle	S3	SC	SC	Schedule 1	Ontario Nature 2019	Large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water; home range size is larger for females (about 70 ha) than males (about 30 ha) and includes hibernation, basking, nesting and feeding areas; aquatic corridors (e.g. stream) are required for movement; not readily observed.	No
<i>Chelydra serpentina serpentina</i>	Snapping Turtle	S3	SC	SC	Schedule 1	Ontario Nature 2019, MNRF 2014b	Permanent or semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddy banks or bottoms. The species often uses soft soil or clean dry sand on south-facing slopes for nest sites and may nest at some distance from water.	No. Suitable habitat may exist in the nearby Laurel Creek.
Mammals								
<i>Taxidea taxus taxus</i>	American Badger	-	-	SC	-	Dobbyn 1994	Open grasslands and oak savannahs; dens in new hole or enlarged existing hole; sometimes makes food caches.	No
<i>Myotis lucifugus</i>	Little Brown Myotis	S4	END	E	Schedule 1	Dobbyn 1994	Uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in dark warm areas such as attics and barns; feeds primarily in wetlands, forest edges.	Possible roost sites in buildings and trees.
<i>Myotis septentrionalis</i>	Northern Myotis	S3	END	E	Schedule 1	Dobbyn 1994	Hibernates during winter in mines or caves; during summer males roost alone and females form maternity colonies of up to 60 adults; roosts in houses, man-made structures but prefers hollow trees or under loose bark; hunts within forest, below canopy.	Possible roost sites in buildings and trees.
<i>Perimyotis subflavus</i>	Tri-colored Bat	S3?	END	E	Schedule 1	Dobbyn 1994	Variety of forested habitats. Older forests and occasionally in barns or other structures may be used for roosts. They forage over water and along streams in the forest.	Possible roost sites in dead leaf clusters observed during tree inventory.
Vascular Plants								
<i>Glycyrrhiza lepidota</i>	Wild Licorice	S3	-	-	-	MNRF 2014b	Open, sandy or rocky riverbanks.	No

¹MNRF 2014b; ²MNRF 2018; ³Government of Canada 2019; ⁴OMNR 2000

LEGEND		
SRANK	SARO	COSEWIC
S1 Critically Imperiled	END Endangered	E Endangered
S2 Imperiled	THR Threatened	T Threatened
S3 Vulnerable	SC Special Concern	SC Special Concern
S4 Apparently Secure		

Appendix II
Significant Wildlife Habitat Screening

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹		Candidate SWH	Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)					
Rationale: Habitat important to migrating waterfowl.	American Black Duck Wood Duck Green-winged Teal Blue-winged Teal Mallard Northern Pintail Northern Shoveler American Wigeon Gadwall	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites.	Fields with sheet water during Spring (mid March to May). • Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available ^{cxviii} . <u>Information Sources</u> • Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence. • Reports and other information available from Conservation Authorities (CAs) • Sites documented through waterfowl planning processes (e.g. EHJV implementation plan) • Field Naturalist Clubs • Ducks Unlimited Canada • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{ccxi} • Any mixed species aggregations of 100 or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependent on local site conditions and adjacent land use is the significant wildlife habitat ^{cxviii} . • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • SWHMiST ^{cxlix} Index #7 provides development effects and mitigation measures.	Wood Duck, and Mallard have been documented in background review. However, fields with spring sheet water are not present within the study area. Not SWH.
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)					
Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.	Canada Goose Cackling Goose Snow Goose American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked Duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Common Goldeneye	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water). <u>Information Sources</u> • Environment Canada • Naturalist clubs often are aware of staging/stopover areas. • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (e.g. EHJV implementation plan) • Ducks Unlimited projects • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	Studies carried out and verified presence of: • Aggregations of 100 ^l or more of listed species for 7 days ^l , results in > 700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH ^{cxlix} • The combined area of the ELC ecosites and a 100m radius area is the SWH ^{cxviii} • Wetland area and shorelines associated with sites identified within the SWHTG ^{cxlviii} Appendix K ^{cxlix} are significant wildlife habitat. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{ccxi} • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWHMiST ^{cxlix} Index #7 provides development effects and mitigation measures.	Canada Goose has been documented in background review. However, ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration are not present in the study area. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Shorebird Migratory Stopover Area					
<u>Rationale:</u> High quality shorebird stopover habitat is extremely rare and typically has a long history of use.	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin Whimbrel	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats. Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH. <u>Information Sources</u> • Western hemisphere shorebird reserve network. • Canadian Wildlife Service (CWS) Ontario Shorebird Survey. • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Natural Heritage Information Center (NHIC) Shorebird Migratory Concentration Area	Studies confirming: • Presence of 3 or more of listed species and > 1000 shorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period) • Whimbrel stop briefly (<24hrs) during spring migration, any site with >100 Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area ^{cdviii} • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{ccxi} • SWHMiST ^{cdix} Index #8 provides development effects and mitigation measures.	Spotted Sandpiper has been documented in background review. No shorelines of lakes, wetlands, or beaches are present in the study area. Not SWH.
Wildlife Habitat: Raptor Wintering Area					
<u>Rationale:</u> Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl <u>Special Concern:</u> Short-eared Owl Bald Eagle	Hawks/Owls: Combination of ELC Community Series; need to have present one Community Series from each land class: Forest: FOD, FOM, FOC Upland: CUM, CUT, CUS, CUW	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering sites need to be > 20 ha ^{cdviii, cdix} with a combination of forest and upland. ^{xvi, xvii, xviii, xix, xx, xxi} . Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands ^{cdix} Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water, large trees and snags available for roosting <u>Information Sources</u> • OMNRF Ecologist or Biologist • Field Natural Clubs • Natural Heritage Information Center (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from Conservation Authorities CAs	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One or more Bald Eagles or; At least 10 individuals and two listed hawk/owl species • To be significant a site must be used regularly (3 in 5 years) ^{cdix} for a minimum of 20 days by the above number of birds • The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{ccxi} • SWHMiST ^{cdix} Index #10 and #11 provides development effects and mitigation measures.	Red-tailed Hawk, Northern Harrier, and American Kestrel have been documented in background review. However, the study area does not provide a combination of fields and woodlands, and is not close to open water. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Bat Hibernacula					
<u>Rationale:</u> Bat hibernacula are rare habitats in Ontario landscapes.	Big Brown Bat Tri-coloured Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	- Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. - Active mine sites should not be considered as SWH - The locations of bat hibernacula are relatively poorly known. <u>Information Sources</u> - OMNRF for possible locations and contact for local experts - Natural Heritage Information Center (NHIC) Bat Hibernaculum - Ministry of Northern Development and Mines for location of mine shafts. - Clubs that explore caves (e.g. Sierra Club) - University Biology Departments with bat experts.	- All sites with confirmed hibernating bats are SWH. - The habitat area includes a 200m radius around the entrance of the hibernaculum^{CCVIII, CCVII} for most. - Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"^{CCV} - SWHMiST^{CCIX} Index #1 provides development effects and mitigation measures.	Big Brown and Tri-colored Bats are known from the background review. However, no known hibernacula are present within 200 m of the study area and crevice or cave ecotypes are not local to the study area. Not SWH.
Wildlife Habitat: Bat Maternity Colonies					
<u>Rationale:</u> Known locations of forested bat maternity colonies is extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	Maternity colonies can be found in tree cavities, vegetation and often in buildings ^{CCIX, CCX, CCXI, CCXII, CCXIII} (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario ^{CCII} • Maternity colonies located in Mature deciduous or mixed forest stands ^{CCIX, CCX} with >10/ha large diameter (>25cm dbh) wildlife trees ^{CCVII} • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 ^{CCXIV} or class 1 or 2 ^{CCXII} • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred ^{CCX} <u>Information Sources</u> - OMNRF for possible locations and contact for local experts - University Biology Departments with bat experts.	- Maternity Colonies with confirmed use by: >10 Big Brown Bats >5 Adult Female Silver-haired Bats - The area of the habitat includes the entire woodland or a forest stand ELC Ecosite or an Ecoelement containing the maternity colonies. - Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for wind Power Projects"^{CCV} - SWHMiST^{CCIX} Index #12 provides development effects and mitigation measures.	Big Brown Bat and Silver-haired Bat have been documented in the background review. Targeted surveys have identified potential suitable habitat, such as tree cavities. However, there are no forested ecosites in or near the study area. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹		Candidate SWH	Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Turtle Wintering Area					
<u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	Midland Painted Turtle <u>Special Concern:</u> Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles - ELC Community Classes: SW, MA, OA and SA; ELC Community Series: FEO and BOO Northern Map Turtle - Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen ^{cxix, cx, cxii, cxviii} . • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. <u>Information Sources</u> • EIS studies carried out by Conservation Authorities. • Local field naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • OMNRF ecologist or biologist • Natural Heritage Information Center (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant. • The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar. – May) ^{cvii} . • Congregation of turtles is more common where wintering areas are limited and therefore significant ^{cxix, cx, cxii, cxvii} . • SWHMiST ^{cxix} Index #28 provides development effects and mitigation measures for turtle wintering habitat.	All listed turtle species have been documented in the background review. However, suitable habitat for turtle wintering areas is not present in the study area. Not SWH.
Wildlife Habitat: Snake Hibernaculum					
<u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	<u>Snakes:</u> Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake <u>Special Concern:</u> Milksnake Eastern Ribbonsnake <u>Lizard:</u> <u>Special Concern</u> (Southern Shield population): Five-lined Skink	For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats. Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator. For Five-lined Skink, ELC Community Series of FOD and FOM and Ecosites: FOC1 FOC3	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. The existence of features that go below the frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line ^{xdiv, i, ii, iii, cxix} . • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. • Five-lined skink prefer mixed forests with rock outcrop openings providing cover rock overlaying granite bedrock with fissures cciii. <u>Information Sources</u> • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information from CAs. • Local Field naturalists and experts, as well as university herpetologists may also know where to find some of these sites. clubs • Natural Heritage Information Center (NHIC) • OMNRF ecologist or biologist may be aware of locations of wintering skinks	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. <u>or</u> ; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. <u>or</u> ; individuals of two or more snake spp. near potential hibernacula (e.g. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct). • <u>Note:</u> If there are Special Concern Species present, then site is SWH • <u>Note:</u> Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population [i.e. strong hibernation site fidelity]. Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30m buffer is the SWH ⁱ . • SWHMiST ^{cxix} Index #13 provides development effects and mitigation measures for snake hibernacula. • Presence of any active hibernaculum for skink is significant. • SWHMiST ^{cxix} Index #37 provides development effects and mitigation measures for five-lined skink wintering habitat.	Eastern Gartersnake has been documented in the background review. However, suitable habitat for snake hibernaculum is not present in the study area. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹		Candidate SWH	Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)					
<u>Rationale:</u> Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow populations are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	- Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area. - Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. - Does not include a licensed/permitted Mineral Aggregate Operation. <u>Information Sources</u> - Reports and other information available from CAs - Ontario Breeding Bird Atlas^{CCV} - Bird Studies Canada; <i>NatureCounts</i> http://www.birdscanada.org/birdmon/ - Field Naturalist clubs	Studies confirming: - Presence of 1 or more nesting sites with 8^{CCVix} or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season. - A colony identified as SWH will include a 50m radius habitat area from the peripheral nests^{CCVii} - Field surveys to observe and count swallow nests are to be completed during the breeding season Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"^{CCxi} - SWHMIST^{cdix} Index #4 provides development effects and mitigation measures	Cliff Swallow and Northern Rough-winged Swallow have both been identified in the background review. Suitable habitat is not present within the study area Not SWH
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs)					
<u>Rationale:</u> Large Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night-heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	- Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. - Most nests in trees are 11 to 15m from ground, near the top of the tree. <u>Information Sources</u> - Ontario Breeding Bird Atlas^{CCV}, colonial nest records. - Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNR). - NHIC Mixed Wader Nesting Colony - Aerial photographs can help identify large heronries - Reports and other information available from CAs - MNR District Offices - Local naturalist clubs	Studies confirming: - Presence of 5ⁱ or more active nests of Great Blue Heron or other listed species. - The habitat extends from the edge of the colony and a minimum 300m radius or extent of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH^{CC, CCVii} - Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells - SWHMIST^{cdix} Index #5 provides development effects and mitigation measures.	Great Blue Heron and Green Heron have been documented in the background review. Wetlands, lakes, islands or peninsulas are not present in the study area. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Ground)					
<u>Rationale:</u> Colonies are important to local bird populations, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1:50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird) MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. <u>Information Sources</u> • Ontario Breeding Bird Atlas ^{CCV} , rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from CAs • Natural Heritage Information Center (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of >25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern ¹ . • Presence of 5 or more pairs for Brewer's Blackbird. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant. • The edge of the colony and a minimum 150m area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH ^{CC, CCVII} . • Studies would be done during May/June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{CCXII} • SWHMiST ^{CDIX} Index #6 provides development effects and mitigation measures.	No listed species are recorded as breeding within the vicinity of the study area. Islands and peninsulas are not present within study area. Not SWH.
Wildlife Habitat: Migratory Butterfly Stopover Areas					
<u>Rationale:</u> Butterfly stopovers areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral <u>Special Concern:</u> Monarch	Combination of ELC Community Series: Need to have present one Community Series from each land class: <u>Field:</u> CUM CUS CUT <u>Forest:</u> FOC FOM FOD CUP Anecdotaly, a candidate sight for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Ontario ^{CDIX} . • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south ^{XXIII, XXXIII, XXXIV, XXXV, XXXVI} . • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat cxlviii, cxlix. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes ^{XXXVII, XXXVIII, XXXIX, XL, XLII} . <u>Information Sources</u> • OMNRF (NHIC) • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs • Toronto Entomologists Association • Conservation Authorities	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct) ^{XLIII} . MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day ^{XXXVII} , significant variation can occur between years and multiple years of sampling should occur ^{XL} . • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD • MUD of >5000 or >3000 with the presence of Painted Ladies or Red Admiral's is to be considered significant. • SWHMiST ^{CDIX} Index #16 provides development effects and mitigation measures.	Study area not within 5 km of Lake Ontario. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Landbird Migratory Stopover Areas					
<u>Rationale:</u> Sites with a high diversity of species as well as high number are most significant	All migratory songbirds. Canadian Wildlife Service Ontario website: http://www.on.ec.gc.ca/wildlife_e.html All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	Woodlots need to be >10 ha ¹ in size and within 5km ^{iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv} of Lake Ontario. • If multiple woodlands are located along the shoreline, those woodlands <2km from Lake Ontario are more significant ^{Cxlix} • Sites have a variety of habitats; forest, grassland and wetland complexes ^{Cxlix} • The largest sites are more significant ^{Cxlix} • Woodlots and forest fragments are important habitats to migrating birds ^{Ccxviii} , these features located along the shore and located within 5km of Lake Ontario are Candidate SWH ^{Ccxviii} . <u>Information Sources</u> • Bird Studies Canada • Ontario Nature • Local birders and naturalist club • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the woodlot by >200 birds/day and with >35 spp. with at least 10 bird spp. recorded on at least 5 different survey dates. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (Apr/May) and fall (Aug/Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{Cccxi} • SWHMiST ^{Cxlix} Index #9 provides development effects and mitigation measures.	Study area not within 5 km of Lake Ontario. Not SWH.
Wildlife Habitat: Deer Yarding Areas					
<u>Rationale:</u> Winter habitat for deer is considered to be the main factor for northern deer populations. In winter, deer congregate in "yards" to survive severe winter conditions. Deer yards typically have a long history of annual use by deer, yards typically represent 10-15% of an areas summer range.	White-tailed Deer	Note: OMNRF to determine this habitat. ELC Community Series providing a thermal cover component for a deer yard would include: FOM, FOC, SWM and SWC. Or these ELC Ecosites: CUP2 CUP3 FOD3 CUT	• Deer yarding areas or winter concentration areas (yards) are areas deer move to in response to the onset of winter snow and cold. This is a behavioural response and deer will establish traditional use areas. The yard is composed of two areas referred to as Stratum I and Stratum II. Stratum II covers the entire winter yard area and is usually a mixed or deciduous forest with plenty of browse available for food. Agricultural lands can also be included in this area. Deer move to these areas in early winter and generally, when snow depths reach 20cm, most of the deer will have moved here. If the snow is light and fluffy, deer may continue to use this area until 30cm snow depth. In mild winters, deer may remain in the Stratum II area the entire winter. • The Core of a deer yard (Stratum I) is located within the Stratum II area and is critical for deer survival in areas where winters become severe. It is primarily composed of coniferous trees (pine, hemlock, cedar, spruce) with a canopy cover of more than 60% ^{Cxciv} . • OMNRF determines deer yards following methods outlined in "Selected Wildlife and Habitat Features: Inventory Manual" ^{Cxcv} • Woodlots with high densities of deer due to artificial feeding are not significant.	No Studies Required: • Snow depth and temperature are the greatest influence on deer use of winter yards. Snow depths > 40cm for more than 60 days in a typically winter are minimum criteria for a deer yard to be considered as SWH ^{lv, lvii, lviii, lix, lx, l} . • Deer Yards are mapped by OMNRF District offices. Locations of Core or Stratum 1 and Stratum 2 Deer yards considered significant by OMNRF will be available at local MNRF offices or via Land Information Ontario (LIO). • Field investigations that record deer tracks in winter are done to confirm use (best done from an aircraft). Preferably, this is done over a series of winters to establish the boundary of the Stratum I and Stratum II yard in an "average" winter. MNRF will complete these field investigations ^{Cxcv} . • If a SWH is determined for Deer Wintering Area or if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWHMiST ^{Cxlix} Index #2 provides development effects and mitigation measures.	White-tailed Deer have been documented in the background review. Deer yarding habitat is not identified or present within the study area. Not SWH.

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Deer Winter Congregation Areas					
<u>Rationale:</u> Deer movement during winter in the southern areas of Ecoregion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions ^{ccviii}	White-tailed Deer	All Forested Ecosites with these ELC Community Series: FOC FOM FOD SWC SWM SWD Conifer plantations much smaller than 50ha may also be used.	- Woodlots will typically be >100 ha in size. Woodlots <100ha may be considered as significant based on MNRF studies or assessment. - Deer movement during winter in the southern areas of Eco-region 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands^{ccviii}. - If deer are constrained by snow depth refer to the Deer Yarding Area habitat within Table 1.1 of this Schedule. - Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha^{ccxiv}. - Woodlots with high densities of deer due to artificial feeding are not significant. <u>Information Sources</u> - MNRF District Offices - LIO/NRVIS	Studies confirm: - Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF^{ccviii}. - Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNR¹. - Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques^{ccxiv}, ground or road surveys, or a pellet count deer density survey^{ccxiv}. - If a SWH is determined for Deer Wintering Area of if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. - SWHMiST^{ccix} Index #2 provides development effects and mitigation measures.	White-tailed Deer have been documented in the background review. Suitable deer congregation areas are not identified or present within the study area. Not SWH.

Significant Wildlife Habitat Assessment Tables

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 6E.

Rare Vegetation Community ¹	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes ¹	Habitat Description ¹	Detailed Information and Sources ¹	Defining Criteria ¹	Assessment Details
Cliff and Talus Slopes					
Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock >3m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	Most cliff and talus slopes occur along the Niagara Escarpment. <u>Information Sources</u> • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF District • Natural Heritage Information Center (NHIC) has location information on their website • Local naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes ^{boviii} • SWHMiST ^{cdix} Index #21 provides development effects and mitigation measures.	Vegetation community not present within study area. Not SWH.
Sand Barrens					
Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always <60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. They have little or no soil and the underlying rock protrudes through the surface. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%.	Any sand barren area, >0.5ha in size. <u>Information Sources</u> • OMNRF Districts. • Natural Heritage Information Center (NHIC) has location information on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens ^{boviii} • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics) ^l . • SWHMiST ^{cdix} Index #20 provides development effects and mitigation measures.	Vegetation community not present within study area. Not SWH.

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 6E.

Rare Vegetation Community ¹	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes ¹	Habitat Description ¹	Detailed Information and Sources ¹	Defining Criteria ¹	Assessment Details
Alvar					
<u>Rationale:</u> Alvars are extremely rare habitats in Ecoregion 6E. Most alvars in Ontario are in Ecoregion 6E and 7E. Alvars in 6E are small and highly localized just north of the Palaeozoic-Precambrian contact.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) <i>Carex crawei</i> 2) <i>Panicum philadelphicum</i> 3) <i>Eleocharis compressa</i> 4) <i>Scutellaria parvula</i> 5) <i>Trichostema branchiatum</i> These indicator species are very specific to Alvars within Ecoregion 6E	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoo geographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover^{boviii}.	An Alvar site > 0.5 ha in size^{bov}. <u>Information Sources</u> - Alvars of Ontario (2000), Federation of Ontario Naturalists^{bovi} - Ontario Nature – Conserving Great Lakes Alvars^{ccviii} - Natural Heritage Information Center (NHIC) has location information on their website - Field Naturalist clubs - Conservation Authorities	Field studies identify four of the five Alvar indicator species^{bov, cdx} at a Candidate Alvar site is Significant. - Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotics sp.). - The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses^{bov}. - SWHMiST^{cdix} Index #17 provides development effects and mitigation measures.	Vegetation community not present within study area. Not SWH.
Old Growth Forest					
<u>Rationale:</u> Due to historic logging practices, extensive old growth forest is rare in the Ecoregion. Interior habitat provided by old growth forests is required by many wildlife species.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old Growth forests are characterized by heavy mortality or turnover of over-storey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	Woodland Stands areas 30ha or greater in size or with at least 10 ha interior habitat assuming 100m buffer at edge of forest í. <u>Information Sources</u> - OMNRF Forest Resource Inventory mapping - OMNRF Forester, Ecologist or Biologist - Field Local naturalist clubs - Conservation Authorities - Sustainable Forestry License (SFL) companies will possibly know locations through field operations. - Municipal forestry departments	Field Studies will determine: - If dominant trees species of the ecosite are >140 years old, then stand is Significant Wildlife Habitat^{cdviii} - The stand will have experienced no recognizable forestry activities^{cdviii} - The area of Forest Ecosites combined to make up the stand is the SWH. - Determine ELC Vegetation Type for forest stand^{boviii} - SWHDSS^{cdix} Index #23 provides development effects and mitigation measures.	Old Growth Forest not present within study area. Not SWH.

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 6E.

Rare Vegetation Community ¹	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes ¹	Habitat Description ¹	Detailed Information and Sources ¹	Defining Criteria ¹	Assessment Details
Savannah					
Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%.	- No minimum size to site - Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. <u>Information Sources</u> - Natural Heritage Information Center (NHIC) has location information on their website - OMNRF Ecologists - Field naturalists clubs - Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in ^{boxv} Appendix N should be present. Note: Savannah plant spp. list from Ecoregion 6E should be used ^{cdviii} . - Area of the ELC Ecosite is the SWH. - Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics sp.). - SWHMiST^{cdix} Index #18 provides development effects and mitigation measures.	Vegetation community not present within study area. Not SWH.
Tallgrass Prairie					
Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover.	- No minimum size to site - Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. <u>Information Sources</u> - OMNR Districts - Natural Heritage Information Center (NHIC) has location information available on their website - Field naturalists clubs - Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in ^{boxv} Appendix N should be present. Note: Prairie plant spp. list from Ecoregion 6E should be used ^{cdviii} . - Area of the ELC Ecosite is the SWH - Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). - SWHMiST^{cdix} Index #19 provides development effects and mitigation measures.	Vegetation community not present within study area. Not SWH.

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 6E.

Rare Vegetation Community ¹	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes ¹	Habitat Description ¹	Detailed Information and Sources ¹	Defining Criteria ¹	Assessment Details
Other Rare Vegetation Communities					
Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG ^{Cxlviii} . Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M ^{Cxlviii} The OMNR/NHIC will have up to date listing for rare vegetation communities. <u>Information Sources</u> • Natural Heritage Information Center (NHIC) has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG ^{Cxlviii} . • Area of the ELC Vegetation Type polygon is the SWH. • SWHMiST^{Cdx} Index #37 provides development effects and mitigation measures.	No other rare vegetation communities are present within the study area. Not SWH.

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 6E.

	Wildlife Species ¹	ELC Ecosite Codes ¹	Candidate SWH Habitat Criteria and Information Sources ¹	Confirmed SWH Defining Criteria ¹	Study Area Assessment Details
Wildlife Habitat: Waterfowl Nesting Area					
Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands	A waterfowl nesting area extends 120m ^{cdix} from a wetland (> 0.5 ha) or a wetland (>0.5ha) and any small wetlands (0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120m of each individual wetland where waterfowl nesting is known to occur ^{cdix} . • Upland areas should be at least 120m wide so that predators such as raccoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. <u>Information Sources</u> • Ducks Unlimited staff may know the locations of particularly productive nesting sites. • OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from CAs	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards, or • Presence of 10 or more nesting pairs for listed species including Mallards. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{ccxd} • A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120m ^{cdviii} from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHMIST ^{cdix} Index #25 provides development effects and mitigation measures.	Wood Duck and Mallard have been identified in the background review. However, suitable upland habitat is not present within the study area. Not SWH.
Wildlife Habitat: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					
Rationale: Nest sites are fairly uncommon in Eco-region 6E are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey <u>Special Concern:</u> Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	• Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. • Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. • Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). <u>Information Sources</u> • Natural Heritage Information Center (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. • MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point and does not represent all the habitat. • Nature Counts, Ontario Nest Records Scheme data. • OMNRF Districts • Sustainable Forestry License (SFL) companies will identify additional nesting locations through field operations. • Check the Ontario Breeding Bird Atlas ^{ccv} or Rare Breeding Birds in Ontario for species documented • Reports and other information available from CAs. • Field naturalists clubs	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area ^{cdviii} . • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300m radius around the nest or the contiguous woodland stand is the SWHccvii, maintaining undisturbed shorelines with large trees within this area is important ^{cdviii} . • For a Bald Eagle the active nest and a 400-800m radius around the nest is the SWH ^{cv} , ccvii. Area of the habitat from 400-800m is dependent on site lines from the nest to the development and inclusion of perching and foraging habitat ^{cv} . • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for >3 years or suspected of not being used for >5 years before being considered not significant ^{ccvii} . • Observational studies to determine nest site use, perching sites and foraging areas need to be done from mid March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" ^{ccxd} • SWHMIST ^{cdix} Index #26 provides development effects and mitigation measures	Osprey has been documented in the background review. Suitable nesting habitat is not present within the study area. Not SWH.

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 6E.

Wildlife Species ¹		Candidate SWH		Confirmed SWH	Study Area
	ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹		Defining Criteria ¹	Assessment Details
Wildlife Habitat: Woodland Raptor Nesting Habitat					
Rationale: Nests sites for these species are rarely identified; these area sensitive habitats and are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM, SWD and CUP3.	All natural or conifer plantation woodland/forest stands >30ha with >10ha of interior habitat ^{booviii, booxix, xc, xci, xciii, xciv, xcvi, xcvi, cxooiii} . Interior habitat determined with a 200m buffer ^{cxviii} . • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Cooper's hawk nest along forest edges sometimes on peninsulas or small off-shore islands. • In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. <u>Information Sources</u> • OMNRF • Check the Ontario Breeding Bird Atlas ^{ccv} or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada • Reports and other information available from CAs	Studies confirm: • Presence of 1 or more active nests from species list is considered significant ^{cxviii} . • Red-shouldered Hawk and Northern Goshawk – a 400m radius around the nest or 28ha area of habitat is the SWH ^{ccvii} . • Barred Owl – a 200m radius around the nest is the SWH ^{ccvii} . • Broad-winged Hawk and Coopers Hawk – a 100m radius around the nest is the SWH ^{ccvii} . • Sharp-shinned Hawk – a 50m radius around the nest is the SWH ^{ccvii} . • Conduct field investigations from mid-March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWHMIST ^{cxlix} Index #27 provides development effects and mitigation measures.	Natural or conifer plantation woodland/forest stands not present within subject lands. Not SWH.
Wildlife Habitat: Turtle Nesting Area					
Rationale: These habitats are rare and when identified will often be the only breeding site for local populations of turtles	Midland Painted Turtle <u>Special Concern:</u> Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m) ^{cxviii} or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used. <u>Information Sources</u> • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Center (NHIC) • Field Naturalist clubs and landowners	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH ¹ • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependent on slope, riparian vegetation and adjacent land use is the SWH ^{cxviii} . • Travel routes from wetland to nesting area are to be considered within the SWH ^{cxlix} . • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting is a recommended method. • SWHMIST ^{cxlix} Index #28 provides development effects and mitigation measures for turtle nesting habitat.	All turtle species have been documented in the background review. However, suitable habitat which would function as turtle nesting area is not present within the study area. Not SWH.

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 6E.

	Wildlife Species ¹	ELC Ecosite Codes ¹	Candidate SWH Habitat Criteria and Information Sources ¹	Confirmed SWH Defining Criteria ¹	Study Area Assessment Details
Wildlife Habitat: Seeps and Springs					
Rationale: Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps/springs.	Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system ^{cvi} . • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species ^{cix, cx, cxi, cxii, cxiii, cxiv} <u>Information Sources</u> • Topographical Map • Thermography • Hydrological surveys conducted by CAs and MOE • Field naturalists clubs and landowners • Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	Field Studies confirm: • Presence of a site with 2 or more seeps/springs should be considered SWH. • The area of a ELC forest ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat ^{cxdvii} • SWHMIST ^{cix} Index #30 provides development effects and mitigation measures	Study area is not located within the headwaters of a stream or river system. The study area is highly urbanized, with no seeps or springs observed during the 2019 field surveys. Not SWH.
Wildlife Habitat: Amphibian Breeding Habitat (Woodland)					
Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations.	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) >500m ² (about 25m diameter) within or adjacent (within 120m) to a woodland (no minimum size) ^{cix, cxii, cxv, cxvi, cxvii, cxviii, cxix, cxx} Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat ^{cxdviii} <u>Information Sources</u> • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF District • OMNRF wetland evaluations • Field naturalist clubs • Canadian Wildlife Service Amphibian Road Call Survey • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or eggs masses) ^{cxii} or 2 or more of the listed frog species with Call Level Codes of 3. • A combination of observational study and call count surveys ^{cvi} will be required during the spring March-June when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands. • The habitat is the woodland area plus a 230m radius of woodland area ^{cxii, cxv, cxvi, cxvii, cxviii, cxix, cxx} if a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is the be included in the habitat. • SWHMIST ^{cix} Index #14 provides development effects and mitigation measures.	Most listed species have both been documented in the background review. However, there are no wetlands, ponds or woodland pools >500m ² . Suitable breeding habitat is not present in the study area. Not SWH.

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 6E.

Wildlife Species ¹		Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					
Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Tree frog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.	- Wetlands >500m² (about 25m diameter)^{ccvii} supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats^{choosv}. - Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. - Bullfrogs require permanent water bodies with abundant emergent vegetation. <u>Information Sources</u> - Ontario Herpetofaunal Summary Atlas (or other similar atlases) - Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. - OMNRF Districts and wetland evaluations - Reports and other information available from CAs.	Studies confirm: - Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species and with at least 20 -individuals (adults or eggs masses)^{boxi, boxii}, or 2 or more of the listed frog/toad species with Call Level Codes of 3. or; Wetland with confirmed breeding Bullfrogs are significant. - The ELC ecosite wetland area and the shoreline are the SWH. - A combination of observational study and call count surveys^{cviii} will be required during spring (March to June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. - If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. - SWHMIST^{cxlix} Index #15 provides development effects and mitigation measures.	Numerous listed species have been documented in the background review. However, there are no wetlands, ponds or woodland pools >500m ² . Suitable breeding habitat is not present in the study area. Not SWH.
Woodland Area-Sensitive Bird Breeding Habitat					
Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-Bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Special Concern: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series: FOC FOM FOD SWC SWM SWD	- Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs old) forest stands or woodlots >30 ha. ^{cv, cxoxi, cxoxii, cxoxiii, cxoxiv, cxoxv, cxoxvi, cxoxvii, cxoxviii, cxoxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cxlvii, cxlviii, cxlix} - Interior forest habitats are at least 200m from forest edge habitat. <u>Information Sources</u> - Local bird clubs - Canadian Wildlife Service (CWS) for the location of forest bird monitoring. - Bird studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to greatest value to interior species - Reports and other information available from CAs.	- Presence of nesting or breeding pairs of 3 or more of the listed wildlife species. - Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH. - Conduct field investigations in spring and early summer when birds are singing and defending their territories. - Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"^{ccxi} - SWHMIST^{cxlix} Index #34 provides development effects and mitigation measures.	Several listed bird species have been documented in the background review. However, no suitable habitat is present within the study area and no forest stands or woodlots are >30ha within the study area. Not SWH.

Significant Wildlife Habitat Assessment Tables

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 6E.

	Wildlife Species ¹		Candidate SWH	Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Marsh Bird Breeding Habitat					
Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Gallinule American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Sandhill Crane Green Heron Trumpeter Swan <u>Special Concern:</u> Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	- Nesting occurs in wetlands - All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present^{CCOIV}. - For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water. <u>Information Sources</u> - Contact OMNRF, wetland evaluations are a good source of information. - Field naturalist clubs - Natural Heritage Information Center (NHIC) Records - Reports and other information available from CAs. - Ontario Breeding Bird Atlas^{CCV}	Studies confirm: - Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or 1 pair of Sandhill Cranes; or breeding by any combination of 5 or more of the listed species¹. - Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH¹. - Area of the ELC ecosite is the SWH - Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats. - Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"^{CCXI}. - SWHMiST^{CCIX} Index #35 provides development effects and mitigation measures	Several listed species have been identified in the background review. However, suitable wetland habitat is not present within the study area. Not SWH.
Wildlife Habitat: Open Country Bird Breeding Habitat					
Rationale: This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow <u>Special Concern:</u> Short-eared Owl	CUM1 CUM2	Large grassland areas (includes natural and cultural fields and meadows) >30 ha ^{cb, cbj, cbk, cbll, cbdv, cbv, cbvi, cbvii, cbviii, cbix} . Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years) ¹ . Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. <u>Information Sources</u> - Agricultural land classification maps, Ministry of Agriculture. - Ask local birders - Ontario Breeding Bird Atlas^{CCV} - Reports and other information available from CAs.	Field Studies confirm: - Presence of nesting or breeding of 2 or more of the listed species. - A field with 1 or more breeding Short-eared Owl is to be considered SWH. - The area of SWH is the contiguous ELC ecosite field areas. - Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. - Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"^{CCXI}. - SWHMiST^{CCIX} Index #32 provides development effects and mitigation measures.	Several listed species have been identified in the background review. However, suitable grassland habitat is not present within the study area. Not SWH.

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat					
<u>Rationale:</u> This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records cxcix.	<u>Indicator spp.:</u> Brown Thrasher Clay-coloured Sparrow <u>Common spp.:</u> Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher <u>Special Concern:</u> Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat for some bird species.	Large field areas succeeding to shrub and thicket habitats >10ha^{cboiv} in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years)^l. Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species^{cboiii}. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. <u>Information Sources</u> • Agricultural land classification maps Ministry of Agriculture • Local bird clubs • Ontario Breeding Bird Atlas^{ccv} • Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species^l. • A field with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat. • The area of the SWH is the contiguous ELC ecosite field/thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"^{ccxi} • SWHMiST^{cdlix} Index #33 provides development effects and mitigation measures.	Some listed species have been identified in the background review. However, suitable shrub/thicket habitat is not present within the study area. Not SWH.
Wildlife Habitat: Terrestrial Crayfish					
<u>Rationale:</u> Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare.^{cci}	Chimney or Digger Crayfish: (<i>Fallicambarus fodiens</i>) Devil Crawfish or Meadow Crayfish: (<i>Cambarus Diogenes</i>)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM	Wet meadow and edges of shallow marshes (no minimum size) identified should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground can't be too moist. Can often be found far from water. • Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. <u>Information Sources</u> • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable marsh meadow or terrestrial sites^{cci} • Area of ELC Ecosite or an ecoelement area of meadow marsh or swamp within the larger ecosite area is the SWH • Surveys should be done April to August during in temporary or permanent water Note the presence of burrows or chemistry are often the only indicator of presence, observance or collection of individuals is very difficult^{cci} • SWHMiST^{cdlix} Index #36 provides development effects and mitigation measures.	Wet meadow and shallow marsh edges are not present within the study area. Not SWH.

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 6E.

	Wildlife Species ¹	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes ¹	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
Wildlife Habitat: Special Concern and Rare Wildlife Species					
<u>Rationale:</u> These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre.	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites ^{boxviii} . <u>Information Sources</u> • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data. • NHIC Website: "Get Information": http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas ^{ccv} • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	Studies Confirm: • Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable. • The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat or foraging habitat. • SWHMiST ^{cdix} Index #37 provides development effects and mitigation measures.	Several significant and rare species have been reported from the vicinity of the study area based on relevant background sources. Suitable habitat is marginal due to the limited number of natural features present within the study area, but potential roost trees for SAR bats have been identified. Candidate SWH.

Significant Wildlife Habitat Assessment Tables

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 6E.

	Wildlife Species ¹	ELC Ecosite Codes ¹	Candidate SWH Habitat Criteria and Information Sources ¹	Confirmed SWH Defining Criteria ¹	Study Area Assessment Details
Wildlife Habitat: Amphibian Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all ecosites associated with water. • Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	Movement corridors between breeding habitat and summer habitat ^{cboiv, cbov, cbovi, cbovii, cboviii, cboix, cboox, cbooi} . Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule ¹ . <u>Information Sources</u> • MNRF District Office • Natural Heritage Information Center NHIC • Reports and other information available from CAs • Field Naturalist Clubs	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant ^{cxdix} . • Corridors should have at least 15m of vegetation on both sides of waterway ^{cxdix} or be up to 200m wide ^{cxdix} of woodland habitat and with gaps <20m ^{cxdix} . • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat ^{cxdix} . • SWHMiST ^{cxdix} Index #40 provides development effects and mitigation measures.	No suitable breeding habitat found in study area. Not SWH.
Wildlife Habitat: Deer Movement Corridors					
Rationale: Corridors important for all species to be able to access seasonally important life-cycle habitats or to access new habitat for dispersing individuals by minimizing their vulnerability while travelling.	White-tailed Deer	Corridors may be found in all forested ecosites. A Project Proposal in Stratum II Deer Wintering Area has potential to contain corridors.	Movement corridor must be determined when Deer Wintering Habitat is confirmed as SWH from Table 1.1 of this schedule ¹ . • A deer wintering habitat identified by the OMNRF as SWH in Table 1.1 of this Schedule will have corridors that the deer use during fall migration and spring dispersion ^{cboodi, cboodii, cxlix, cxciiv} . • Corridors typically follow riparian areas, woodlots, areas of physical geography (ravines, or ridges). <u>Information Sources</u> • MNRF District Office • Natural Heritage Information Center (NHIC) • Reports and other information available from CAs • Field Naturalist Clubs	• Studies must be conducted at the time of year when deer are migrating or moving to and from winter concentration areas. • Corridors that lead to a deer wintering yard should be unbroken by roads and residential areas. • Corridors should be at least 200m wide ^{cxdix} with gaps <20m ^{cxdix} and if following riparian area with at least 15m of vegetation on both sides of waterway ^{cxdix} . Shorter corridors are more significant than longer corridors ^{cxdix} . • SWHMiST ^{cxdix} Index #39 provides development effects and mitigation measures.	No deer wintering habitat present within study area. Not SWH.

Significant Wildlife Habitat Assessment Tables

Table 6. Exceptions for Ecodistricts within Ecoregion 6E.

	Wildlife Habitat and Species	Candidate SWH			Confirmed SWH	Study Area
		Ecosites	Habitat Description	Habitat Criteria and Information Sources ¹	Defining Criteria ¹	Assessment Details
EcoDistrict: 6E-14						
Rationale: The Bruce Peninsula has an isolated and distinct population of black bears. Maintenance of large woodland tracks with mast producing tree species is important for bears. ^{cbooxvi, ccxvii}	Mast Producing Areas Black Bear	All Forested habitat represented by ELC Community Series: FOM FOD	- Black bears require forested habitat that provides cover, winter hibernation sites, and mast producing tree species. ^{cbooxv, cbooxvii, cbooxviii, cboodix, cxc, cxci, cxcii, cxclii, ccxvii} - Forested habitats need to be large enough to provide cover and protection for black bears ^{ccxvii}	Woodland ecosites >30ha with mast-producing tree species, either soft (cherry) or hard (oak and beech), Information Sources Important forest habitat for black bears may be identified by OMNRF.	- All woodlands > 30 ha with a 50% composition of these ELC Vegetation Types are considered significant: FOM1-1 FOM2-1 FOM3-1 FOD1-1 FOD1-2 FOD2-1 FOD2-2 FOD2-3 FOD2-4 FOD4-1 FOD5-2 FOD5-3 FOD5-7 FOD6-5 - SWHMIST ^{cxlix} Index #3 provides development effects and mitigation measures.	Not applicable to study area. Not SWH.
EcoDistrict: 6E-17						
Rationale: Sharp-tailed grouse only occur on Manitoulin Island in Ecoregion 6E, Leks are an important habitat to maintain their population	Lek Sharp-tailed Grouse	CUM CUS CUT	- The lek or dancing ground consists of bare, grassy or sparse shrubland. There is often a hill or rise in topography^{ccxix}. - Leks are typically a grassy field/meadow >15h with adjacent shrublands and >30ha with adjacent deciduous woodland. Conifer trees within 500m are not tolerated. ^{ccxix}	Grasslands (field/meadow) are to be >15ha when adjacent to shrubland and >30ha when adjacent to deciduous woodland ^{ccxix} . - Grasslands are to be undisturbed with low intensities of agriculture (light grazing or late haying) - Leks will be used annually if not destroyed by cultivation or invasion by woody plants or tree planting^{ccxix} Information Sources - OMNRF district office - Bird watching clubs - Local landowners - Ontario Breeding Bird Atlas	Studies confirming lek habitat are to be completed from late March to June. - Any site confirmed with sharp-tailed grouse courtship activities is considered significant - The field/meadow ELC ecosites plus a 200 m radius area with shrub or deciduous woodland is the lek habitat - SWHMIST ^{cxlix} Index #32 provides development effects and mitigation measures	Not applicable to study area. Not SWH.

Appendix III
Tree Inventory Data

University Avenue EA, Natural Environment Technical Report
Tree Inventory Data

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Proposed Action	Rationale for Removal	Comments
a	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	1	60.3	3.5	Possible	Poor	Institutional	--	--	Long section of included bark between codominant leaders; lawnmower damage healed; 40% live crown lost, mostly from 1 leader; minor epicormic growth; gypsy moth caterpillar.
b / CAV-006	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	37.1	4.0	Improbable	Fair	Institutional	Retain	--	10% dieback; few dead branches; girdling root; root zone compaction. Dead leaf clusters.
c / CAV-001	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	42.8	3.5	Improbable	Good	Institutional	Retain	--	Exposed roots with lawnmower damage; dense root mass appears as though once constrained by sidewalk; crown-raising pruning on road side; healthy foliage; root zone compaction. Rotting wound between leaders.
d	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	49.2	4.5	Improbable	Fair	Institutional	Retain	--	Exposed roots with lawnmower damage; basal wound partially closed, sapwood decay; included bark; 3 broken branches; epicormic growth; root zone compaction from vehicles.
e	Black Oak	<i>Quercus velutina</i>	Native	1	11.2	1.5	Improbable	Good	Institutional	Retain	--	Closed stem wound; necrotic spotting on some leaves.
f	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	38.2	4.0	Improbable	Good	Institutional	--	--	Girdling roots; root zone compaction from vehicles; good wound closure; dense but unbalanced crown.
g	White Birch	<i>Betula papyrifera</i>	Native	2	51.5	4.0	Possible	Good	Institutional	Retain	--	Minor dieback; secondary stem leans toward nearest building; root zone compaction from vehicles.
h	White Birch	<i>Betula papyrifera</i>	Native	1	36.5	4.5	Improbable	Good	Institutional	--	--	Minor dieback; low scaffold branching; few small broken branches; root zone compaction from vehicles.
i	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	1	53.4	5.5	Improbable	Good	Institutional	Retain	--	Decent structure, but with codominant leaders; pronounced reaction wood supporting 1 branch; epicormic growth and basal shoots; full crown.
j	White Ash	<i>Fraxinus americana</i>	Native	1	13.0	2.5	Possible	Fair	Institutional	--	--	EAB exit hole observed; healthy crown; good fruit set; lawnmower damage at base.
k	White Ash	<i>Fraxinus americana</i>	Native	1	22.4	3.5	Possible	Poor	Institutional	Remove	Condition	Crown thinning; bark cracks, insect galleries; basal shoots.
l / CAV-002	White Ash	<i>Fraxinus americana</i>	Native	1	20.3	4.0	Possible	Dead	Institutional	Remove	Safety	Dead crown; EAB exit holes; shedding bark. Loose bark and cracks on mid-stem.
m	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	1	61.3	6.5	Improbable	Good	Institutional	Retain	--	Broad, full crown; well-developed reaction wood supports low scaffold branches; epicormic growth and basal shoots.
n	White Ash	<i>Fraxinus americana</i>	Native	1	13.5	2.0	Possible	Very Poor	Institutional	Remove	Safety	Dead crown, live basal shoots; bark cracks and discoloration; EAB exit hole.
o	White Ash	<i>Fraxinus americana</i>	Native	1	16.0	2.5	Possible	Very Poor	Institutional	Remove	Safety	Dead crown, live basal shoots; bark cracks, insect galleries; EAB exit holes.
p	Crabapple	<i>Malus sp.</i>	Non-Native	1	25.1	2.5	Improbable	Good	Institutional	--	--	Growing on slope towards parking lot; good fruit set; epicormic growth.
q	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	1	44.7	5.0	Improbable	Good	Institutional	Retain	--	Minor dieback. Starlings may be nesting.
r	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	24.3	3.0	Improbable	Good	Institutional	--	--	Long bark seams; some sapwood decay evident where wound not fully closed.
s	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	22.6	3.0	Improbable	Good	Institutional	--	--	Stem wound not fully closed; some sapwood decay; heavy fruit set.
t	Red Maple	<i>Acer rubrum</i>	Native	1	18.0	3.0	Possible	Fair	Institutional	--	--	Significant lawnmower damage, nearly girdled; minor crown thinning; minor foliar necrosis; 1 branch-tear wound; epicormic growth.
u	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	26.9	3.5	Improbable	Good	Institutional	--	--	Long bark seam; girdling root; exposed roots damaged by lawnmower; minor epicormic growth.
v / CAV-003	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	23.6	3.0	Improbable	Good	Institutional	Retain	--	Long bark seam; buried root flare; 5% dieback.
w	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	22.8	3.5	Improbable	Good	Institutional	--	--	Buried root flare; lawnmower damage to base.
x	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	22.0	3.5	Improbable	Good	Institutional	--	--	Root ball raised; crossing branches.
y	Colorado Spruce	<i>Picea pungens</i>	Non-Native	1	54.1	3.5	Improbable	Excellent	Institutional	Retain	--	Sap exudation; very minor thinning; good structure.
z	Colorado Spruce	<i>Picea pungens</i>	Non-Native	1	39.0	3.5	Improbable	Fair	Institutional	--	--	Sap exudation; epicormic growth; dense branching.
aa	Norway Spruce	<i>Picea abies</i>	Non-Native	1	35.0	4.0	Improbable	Fair	Institutional	--	--	Broken top; heavy fruit set.
ab	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	17.1	2.5	Improbable	Good	Institutional	--	--	Lawnmower damage and stem wounds closed; good vigour; irregular crown.

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Proposed Action	Rationale for Removal	Comments
ac	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	12.5	2.0	Possible	Poor	Institutional	Remove	Condition	Significant stem wound shows sapwood decay and fruiting bodies; basal wounds; stem 0.25m from sidewalk edge; dead top, 20% live crown lost.
ad	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	19.2	2.5	Improbable	Good	Institutional	--	--	Long bark seam well-closed; sunken tissue under branch union; lawnmower damage to root flare; 1 dead branch; stem 0.4m from sidewalk edge.
ae	Red Oak	<i>Quercus rubra</i>	Native	1	27.1	4.0	Possible	Poor	Institutional	Remove	Condition	Foliar chlorosis and necrosis; brown spots concentrating in sinuses; 50% dieback; epicormic growth.
af	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	8	20.3	2.5	Improbable	Good	Institutional	--	--	Many young stems, likely arising from stump; round, squat crown with dripline at sidewalk.
ag	Austrian Pine	<i>Pinus nigra</i>	Non-Native	1	39.9	4.5	Improbable	Good	Institutional	Retain	--	Low, broad crown; minor lean away from road.
ah	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	26.1	3.0	Improbable	Excellent	Institutional	Retain	--	Good wound closure; very dense crown.
ai	Colorado Spruce	<i>Picea pungens</i>	Non-Native	1	31.0	2.5	Improbable	Fair	Institutional	--	--	Slightly crooked stem; squat crown, perhaps broken top.
aj	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	45.1	5.0	Improbable	Good	Institutional	Retain	--	Exposed roots with lawnmower damage; stem 1m from sidewalk; a few misplaced pruning cuts; 1 broken branch; very minor dieback.
ak	White Ash	<i>Fraxinus americana</i>	Native	1	29.8	3.0	Possible	Very Poor	Commercial	Remove	Safety	EAB exit holes; bark cracks; history of branch failure; 80% dieback.
al	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	19.0	2.0	Improbable	Fair	Commercial	--	--	Lawnmower damage has nearly girdled the root flare; suppressed crown; 1 large scaffold branch pruned off.
am	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	29.1	5.0	Improbable	Good	Commercial	--	--	Wounds partially closed; 1 broken branch; minor epicormic growth.
an	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	27.1	3.5	Improbable	Good	Commercial	--	--	Slight lean away from road; minor epicormic growth; good vigour.
ao	Crabapple	<i>Malus</i> sp.	Non-Native	3	38.3	4.0	Improbable	Fair	Commercial	--	--	Leaves dying on water sprouts; decent wound closure; crossing branches.
ap	Crabapple	<i>Malus</i> sp.	Non-Native	1	17.1	4.0	Improbable	Fair	Commercial	--	--	Many water sprouts; crown mostly healthy; recent trenching just beyond dripline.
aq	Crabapple	<i>Malus</i> sp.	Non-Native	1	15.9	4.0	Improbable	Fair	Commercial	--	--	Many small water sprouts; crown mostly healthy; recent trenching just beyond dripline.
ar	Crabapple	<i>Malus</i> sp.	Non-Native	3	38.4	3.5	Improbable	Fair	Commercial	--	--	Many small water sprouts, some leaves dying; minor crown thinning.
as	Copper Beech	<i>Fagus sylvatica</i> f. <i>purpurea</i>	Non-Native	1	15.9	2.5	Improbable	Fair	Commercial	--	--	Minor twig dieback from gall; bark cracks/furrows; small white scale insects.
at	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	43.4	5.0	Improbable	Good	Commercial	Retain	--	Exposed roots, some girdling; interior thinning; recent trenching intersects some of root zone.
au	Manitoba Maple	<i>Acer negundo</i>	Native	1	11.2	3.5	Improbable	Fair	Residential	--	--	Growing very close to building, asymmetrical crown; vigorous; basal shoots.
av	Red Oak	<i>Quercus rubra</i>	Native	1	25.4	3.5	Improbable	Good	Residential	--	--	Former support wire incorporated into stem, girdling risk; good structure; full crown.
aw	Serviceberry species	<i>Amelanchier</i> sp.	Non-Native	1	11.0	2.0	Improbable	Good	Residential	--	--	Good form; heavy fruit set; potential mulch 'volcano'.
ax	White Ash	<i>Fraxinus americana</i>	Native	1	20.0	3.0	Possible	Poor	Residential	Remove	Condition	30% dieback; basal shoots; bark cracks, some closed; good vigour.
ay	White Ash	<i>Fraxinus americana</i>	Native	1	22.5	3.0	Possible	Fair	Residential	--	--	Significant wounds closed but sunken: suspected decay; basal shoots; full crown; recent trenching within dripline.
az	White Spruce	<i>Picea glauca</i>	Native	1	24.0	3.0	Improbable	Fair	Residential	--	--	Upper crown thinning.
ba	White Spruce	<i>Picea glauca</i>	Native	1	23.5	3.0	Improbable	Fair	Residential	--	--	Minor thinning; 1 girdling root; recent trenching within dripline.
bb	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	27.0	4.0	Improbable	Fair	Residential	--	--	Lawnmower damage to exposed roots; minor dieback in upper branches.
bc / CAV-007	Sugar Maple	<i>Acer saccharum</i> ssp. <i>saccharum</i>	Native	1	61.1	7.0	Improbable	Good	Residential	Retain	--	Small opening at included bark between codominant leaders; good root flare, minor lawnmower damage. Dead leaf clusters.
bd	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	16.6	2.5	Improbable	Fair	Residential	--	--	Moderate thinning; wound where support wire had been.
be	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	13.4	2.5	Improbable	Fair	Residential	--	--	Minor dieback; significant swelling and woundwood where support wire had been.
bf	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	21.2	4.0	Improbable	Fair	Residential	--	--	Some chlorosis and minor dieback; good structure.

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Proposed Action	Rationale for Removal	Comments
bg	Northern Catalpa	<i>Catalpa speciosa</i>	Non-Native	1	30.7	4.5	Improbable	Good	Residential	--	--	Stem splits into codominant leaders at 1.5m; asymmetrical crown due to neighbouring tree.
bh	Black Locust	<i>Robinia pseudoacacia</i>	Non-Native	1	12.5	3.0	Improbable	Good	Residential	--	--	Included bark; full crown.
bi	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	17.4	3.0	Improbable	Good	Residential	--	--	Corrected lean; round, full crown.
bj	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	21.8	4.0	Improbable	Good	Residential	--	--	Full, low crown; codominant leaders; 1 tight branch union.
bk	London Plane-Tree	<i>Platanus X acerifolia</i>	Non-Native	1	11.5	2.5	Improbable	Fair	Residential	--	--	Slight lean toward road; fungus/mildew afflicting some leaves; basal shoot.
bl	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	27.1	3.0	Improbable	Good	Commercial	--	--	Generally good wound closure; 1 stem wound shows some sapwood decay.
bm	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	11.3	1.5	Improbable	Fair	Commercial	--	--	Minor crown thinning; buried root flare.
bn	Crabapple	<i>Malus</i> sp.	Non-Native	1	17.6	2.0	Improbable	Good	Commercial	--	--	Pollarded for compact growth; crooked branches; flat-topped crown.
bo	Norway Maple	<i>Acer platanoides</i>	Non-Native	2	79.6	6.5	Possible	Good	Residential	Retain	--	Decay at branch stub wound; roots girdling root flare; included bark between codominant leaders; asymmetrical crown due to nearby building.
bp	Norway Maple	<i>Acer platanoides</i>	Non-Native	1	47.1	5.0	Improbable	Fair	Institutional	Retain	--	Torsional growth; gypsy moth egg sac; codominant leaders; foliar ailment beginning as tiny transparencies in leaf blades, sometimes developing into holes; irregular crown.
bq	White Mulberry	<i>Morus alba</i>	Non-Native	1	17.2	1.5	Improbable	Good	Institutional	--	--	Weeping form, pollarded; twisting branches; bark staining.
br	White Mulberry	<i>Morus alba</i>	Non-Native	1	17.5	1.0	Improbable	Good	Institutional	--	--	Weeping form, pollarded; very minor dieback.
bs	Colorado Spruce	<i>Picea pungens</i>	Non-Native	1	44.7	3.5	Improbable	Excellent	Institutional	Retain	--	Sap exuding from branch stubs; great structure.
bt	English Oak	<i>Quercus robur</i>	Non-Native	1	28.1	4.5	Improbable	Good	Institutional	--	--	Long bark seam; minor foliar necrosis and twig dieback; broad crown.
bu	English Oak	<i>Quercus robur</i>	Non-Native	1	31.2	5.0	Improbable	Good	Institutional	--	--	Long bark seams; minor foliar necrosis and epicormic growth; broad crown.
bv	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	9.8	2.0	Improbable	Fair	Residential	--	--	Crown thinning; minor epicormic growth.
bw	Thornless Honey Locust	<i>Gleditsia triacanthos</i> var. <i>inermis</i>	Non-Native	1	9.4	1.5	Improbable	Fair	Residential	--	--	Crown thinning; minor epicormic growth.
bx	Callery Pear	<i>Pyrus calleryana</i>	Non-Native	1	9.7	1.5	Improbable	Excellent	Residential	Retain	--	Great structure; no visible defects.
CAV-004	Northern Catalpa	<i>Catalpa speciosa</i>	Non-Native	1	55.1	--	--	--	Commercial	Retain	--	Cavity from branch leading into hollow stem.
CAV-005	White Birch	<i>Betula papyrifera</i>	Native	2	44.0	--	--	--	Residential	Retain	--	Crack in branch creating a cavity.

Appendix IV
Bird Species Reported from the Study Area

Appendix
Bird Species Reported From the Study Area

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Grand River Watershed Conservation Priority ⁴	Region of Waterloo Status ⁵	OBBA ⁶ 17NJ31	NHIC Data ¹ (17NJ3713, 17NJ3813)	NRSI Observed
Anatidae	Ducks, Geese & Swans									
<i>Branta canadensis</i>	Canada Goose	S5						CO		
<i>Aix sponsa</i>	Wood Duck	S5					√*	CO		
<i>Anas platyrhynchos</i>	Mallard	S5						CO		
Phasianidae	Partridges, Grouse & Turkeys									
<i>Phasianus colchicus</i>	Ring-necked Pheasant	SNA						CO		
<i>Bonasa umbellus</i>	Ruffed Grouse	S4				√		CO		
<i>Meleagris gallopavo</i>	Wild Turkey	S5						CO		
Podicipediformes	Grebes									
<i>Podilymbus podiceps</i>	Pied-billed Grebe	S4B, S4N				√	√	PR		
Columbidae	Pigeons & Doves									
<i>Columba livia</i>	Rock Pigeon	SNA						CO		X
<i>Zenaidura macroura</i>	Mourning Dove	S5						CO		
Cuculiformes	Cuckoos & Anis									
<i>Coccyzus americanus</i>	Yellow-billed Cuckoo	S4B					√	PR		
<i>Coccyzus erythrophthalmus</i>	Black-billed Cuckoo	S5B				√	√	CO		
Caprimulgidae	Goatsuckers									
<i>Chordeiles minor</i>	Common Nighthawk	S4B	SC	SC	Schedule 1	√	√*	PR		
Apodidae	Swifts									
<i>Chaetura pelagica</i>	Chimney Swift	S4B, S4N	THR	T	Schedule 1			PR		
Trochilidae	Hummingbirds									
<i>Archilochus colubris</i>	Ruby-throated Hummingbird	S5B				√	√	PR		
Rallidae	Railles, Gallinules & Coots									
<i>Rallus limicola</i>	Virginia Rail	S5B				√	√	PR		
<i>Porzana carolina</i>	Sora	S4B				√	√	PO		
Charadriidae	Plovers									
<i>Charadrius vociferus</i>	Killdeer	S5B, S5N						CO		
Scolopacidae	Waders									
<i>Scolopax minor</i>	American Woodcock	S4B				√		PR		
<i>Actitis macularia</i>	Spotted Sandpiper	S5				√		PR		
Ardeidae	Hérons & Bitterns									
<i>Ardea herodias</i>	Great Blue Heron	S4B					√	PO		
<i>Butorides virescens</i>	Green Heron	S4B				√	√	PR		
Cathartidae	Vultures									
<i>Cathartes aura</i>	Turkey Vulture	S5B				√	√	PO		
Accipitridae	Hawks, Kites, Eagles & Allies									
<i>Pandion haliaetus</i>	Osprey	S5B				√	√	CO		
<i>Circus cyaneus</i>	Northern Harrier	S4B	NAR	NAR		√	√	PO		
<i>Accipiter striatus</i>	Sharp-shinned Hawk	S5	NAR			√	√	PO		
<i>Accipiter cooperii</i>	Cooper's Hawk	S4	NAR	NAR		√	√	CO		
<i>Buteo jamaicensis</i>	Red-tailed Hawk	S5	NAR	NAR				CO		

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Grand River Watershed Conservation Priority ⁴	Region of Waterloo Status ⁵	OBBA ⁶ 17NJ31	NHIC Data ¹ (17NJ3713, 17NJ3813)	NRSI Observed
Strigidae	Typical Owls									
<i>Megascops asio</i>	Eastern Screech-Owl	S4	NAR	NAR				CO		
<i>Bubo virginianus</i>	Great Horned Owl	S4						CO		
Alcedinidae	Kingfishers									
<i>Megasceryle alcyon</i>	Belted Kingfisher	S4B					√	PR		
Picidae	Woodpeckers									
<i>Melanerpes erythrocephalus</i>	Red-headed Woodpecker	S4B	SC	END	Schedule 1	√	√	CO		
<i>Melanerpes carolinus</i>	Red-bellied Woodpecker	S4				√	√	PR		
<i>Dryobates pubescens</i>	Downy Woodpecker	S5						CO		
<i>Dryobates villosus</i>	Hairy Woodpecker	S5						CO		
<i>Colaptes auratus</i>	Northern Flicker	S4B						CO		
<i>Dryocopus pileatus</i>	Pileated Woodpecker	S5				√	√	CO		
Falconidae	Caracaras & Falcons									
<i>Falco sparverius</i>	American Kestrel	S4				√		CO		
<i>Falco peregrinus anatum/tundrius</i>	Peregrine Falcon	S3B	SC	SC	Schedule 1		√	PR		
Tyrannidae	Tyrant Flycatchers									
<i>Contopus virens</i>	Eastern Wood-Pewee	S4B	SC	SC				PR		
<i>Empidonax virescens</i>	Acadian Flycatcher	S2S3B	END	E	Schedule 1	√	√	PO		
<i>Empidonax alnorum</i>	Alder Flycatcher	S5B				√	√	PR		
<i>Empidonax traillii</i>	Willow Flycatcher	S5B						PR		
<i>Sayornis phoebe</i>	Eastern Phoebe	S5B				√		CO		
<i>Myiarchus crinitus</i>	Great Crested Flycatcher	S4B						PR		
<i>Tyrannus tyrannus</i>	Eastern Kingbird	S4B				√		PR		
Vireonidae	Vireos									
<i>Vireo gilvus</i>	Warbling Vireo	S5B						PR		
<i>Vireo olivaceus</i>	Red-eyed Vireo	S5B						CO		
Corvidae	Crows & Jays									
<i>Cyanocitta cristata</i>	Blue Jay	S5						CO		X
<i>Corvus brachyrhynchos</i>	American Crow	S5B						CO		
Alaudidae	Larks									
<i>Eremophila alpestris</i>	Horned Lark	S5B				√		PR		
Hirundinidae	Swallows									
<i>Progne subis</i>	Purple Martin	S4B				√	√*	CO		
<i>Tachycineta bicolor</i>	Tree Swallow	S4B						CO		
<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow	S4B				√		PO		
<i>Petrochelidon pyrrhonota</i>	Cliff Swallow	S4B				√	√*	CO		
<i>Hirundo rustica</i>	Barn Swallow	S4B	THR	T		√		CO	X	
Paridae	Chickadees & Titmice									
<i>Poecile atricapillus</i>	Black-capped Chickadee	S5				√		CO		X
Sittidae	Nuthatches									
<i>Sitta canadensis</i>	Red-breasted Nuthatch	S5				√	√	CO		
<i>Sitta carolinensis</i>	White-breasted Nuthatch	S5						CO		X

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Grand River Watershed Conservation Priority ⁴	Region of Waterloo Status ⁵	OBBA ⁶ 17NJ31	NHIC Data ¹ (17NJ3713, 17NJ3813)	NRSI Observed
Certhiidae	Creepers									
<i>Certhia americana</i>	Brown Creeper	S5B				√	√	CO		
Troglodytidae	Wrens									
<i>Troglodytes aedon</i>	House Wren	S5B						CO		
<i>Troglodytes hiemalis</i>	Winter Wren	S5B					√	PR		
<i>Thryothorus ludovicianus</i>	Carolina Wren	S4				√	√	PR		
Poliopitidae	Gnatcatchers									
<i>Poliopitila caerulea</i>	Blue-gray Gnatcatcher	S4B				√	√	CO		
Regulidae	Kinglets									
<i>Regulus satrapa</i>	Golden-crowned Kinglet	S5B				√	√	CO		
Muscicapidae	Old world Flycatchers									
Turdidae	Thrushes									
<i>Sialia sialis</i>	Eastern Bluebird	S5B	NAR	NAR		√	√	CO		
<i>Catharus fuscescens</i>	Veery	S4B				√	√	CO		
<i>Hylocichla mustelina</i>	Wood Thrush	S4B	SC	T				CO		
<i>Turdus migratorius</i>	American Robin	S5B						CO		
Mimidae	Mockingbirds, Thrashers & Allies									
<i>Dumetella carolinensis</i>	Gray Catbird	S4B				√		CO		
<i>Toxostoma rufum</i>	Brown Thrasher	S4B				√	√	PR		
Sturnidae	Starlings									
<i>Sturnus vulgaris</i>	European Starling	SNA						CO		X
Bombycillidae	Waxwings									
<i>Bombycilla cedrorum</i>	Cedar Waxwing	S5B						CO		
Passeridae	Old World Sparrows									
<i>Passer domesticus</i>	House Sparrow	SNA						CO		X
Fringillidae	Finches & Allies									
<i>Carpodacus mexicanus</i>	House Finch	SNA						CO		
<i>Carpodacus purpureus</i>	Purple Finch	S4B				√	√	PR		
<i>Spinus pinus</i>	Pine Siskin	S4B					√	PR		
<i>Spinus tristis</i>	American Goldfinch	S5B				√		PR		
Parulidae	Wood Warblers									
<i>Seiurus aurocapillus</i>	Ovenbird	S4B				√	√	CO		
<i>Parkesia noveboracensis</i>	Northern Waterthrush	S5B				√	√	CO		
<i>Vermivora cyanoptera</i>	Blue-winged Warbler	S4B				√	√	CO		
<i>Mniotilta varia</i>	Black-and-white Warbler	S5B				√	√	PR		
<i>Oreothlypis ruficapilla</i>	Nashville Warbler	S5B				√	√	CO		
<i>Geothlypis philadelphia</i>	Mourning Warbler	S4B				√	√	PR		
<i>Geothlypis trichas</i>	Common Yellowthroat	S5B						PR		
<i>Setophaga citrina</i>	Hooded Warbler	S4B	NAR	NAR	Schedule 1	√	√	CO		
<i>Setophaga ruticilla</i>	American Redstart	S5B				√	√	PR		
<i>Setophaga cerulea</i>	Cerulean Warbler	S3B	THR	E	Schedule 1	√	√	PO		
<i>Setophaga petechia</i>	Yellow Warbler	S5B						CO		
<i>Setophaga pensylvanica</i>	Chestnut-sided Warbler	S5B				√	√	PR		
<i>Setophaga caerulescens</i>	Black-throated Blue Warbler	S5B				√		PR		
<i>Setophaga pinus</i>	Pine Warbler	S5B				√	√	CO		
<i>Setophaga coronata</i>	Yellow-rumped Warbler	S5B				√	√	PO		
<i>Setophaga virens</i>	Black-throated Green Warbler	S5B				√	√	PR		

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Grand River Watershed Conservation Priority ⁴	Region of Waterloo Status ⁵	OBBA ⁶ 17NJ31	NHIC Data ¹ (17NJ3713, 17NJ3813)	NRSI Observed
Emberizidae	New World Sparrows & Allies									
<i>Pipilo erythrophthalmus</i>	Eastern Towhee	S4B				√		CO		
<i>Spizella passerina</i>	Chipping Sparrow	S5B						CO		
<i>Spizella pusilla</i>	Field Sparrow	S4B				√		PR		
<i>Poocetes gramineus</i>	Vesper Sparrow	S4B				√	√	PR		
<i>Passerculus sandwichensis</i>	Savannah Sparrow	S4B				√		CO		
<i>Ammodramus savannarum</i>	Grasshopper Sparrow	S4B	SC	SC		√	√	PR		
<i>Melospiza melodia</i>	Song Sparrow	S5B						CO		
<i>Melospiza georgiana</i>	Swamp Sparrow	S5B				√		PR		
<i>Zonotrichia albicollis</i>	White-throated Sparrow	S5B				√	√	PR		
Cardinalidae	Cardinals, Grosbeaks & Allies									
<i>Piranga olivacea</i>	Scarlet Tanager	S4B				√	√	CO		
<i>Cardinalis cardinalis</i>	Northern Cardinal	S5						CO		X
<i>Pheucticus ludovicianus</i>	Rose-breasted Grosbeak	S4B						CO		
<i>Passerina cyanea</i>	Indigo Bunting	S4B						PR		
Icteridae	Blackbirds									
<i>Dolichonyx oryzivorus</i>	Bobolink	S4B	THR	T	No Schedule	√		PR		
<i>Agelaius phoeniceus</i>	Red-winged Blackbird	S4						CO		
<i>Sturnella magna</i>	Eastern Meadowlark	S4B	THR	T	No Schedule	√		CO		
<i>Quiscalus quiscula</i>	Common Grackle	S5B						CO		
<i>Molothrus ater</i>	Brown-headed Cowbird	S4B						CO		
<i>Icterus spurius</i>	Orchard Oriole	S4B				√	√	PR		
<i>Icterus galbula</i>	Baltimore Oriole	S4B						CO		
Total						65	53	113	1	7

¹MNRF 2014b; ²MNRF 2018; ³Government of Canada 2019; ⁴Zammit n.d.; ⁵Martin 1996; ⁶Bird Studies Canada et al. 2006

LEGEND
SRANK
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
SARA Schedule
Schedule 1 Officially Protected under SARA
Waterloo Region
√ Regionally Significant
√* Significant when nesting in natural circumstances
GRCA Priority
√ Significant

Appendix V
Mammal Species Reported from the Study Area

Appendix
Mammal Species Reported From the Study Area

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Region of Waterloo Status ⁴	Ontario Mammal Atlas ⁵	NHIC Data ¹ (17NJ3713/17 NJ3813)	NRSI Observed
Chiroptera	Bats								
<i>Eptesicus fuscus</i>	Big Brown Bat	S4					X		
<i>Lasiorycteris noctivagans</i>	Silver-haired Bat	S4					X		
<i>Lasiurus borealis</i>	Eastern Red Bat	S4					X		
<i>Lasiurus cinereus</i>	Hoary Bat	S4					X		
<i>Myotis leibii</i>	Eastern Small-footed Myotis	S2S3	END				X		
<i>Myotis lucifugus</i>	Little Brown Myotis	S4	END	E	Schedule 1		X		
<i>Myotis septentrionalis</i>	Northern Myotis	S3	END	E	Schedule 1		X		
<i>Perimyotis subflavus</i>	Tri-colored Bat	S3?	END	E	Schedule 1		X		
Rodentia	Rodents								
<i>Sciurus carolinensis</i>	Eastern Gray Squirrel	S5							X
Carnivora	Carnivores								
<i>Canis latrans</i>	Coyote	S5				S	X		
<i>Lynx rufus</i>	Bobcat	S4				R	X		
<i>Mephitis mephitis</i>	Striped Skunk	S5					X		
<i>Mustela erminea</i>	Ermine	S5					X		
<i>Mustela frenata</i>	Long-tailed Weasel	S4				S	X		
<i>Mustela vison</i>	American Mink	S4				S	X		
<i>Procyon lotor</i>	Northern Raccoon	S5					X		X
<i>Taxidea taxus taxus</i>	American Badger			SC			X		
<i>Ursus americanus</i>	American Black Bear	S5	NAR	NAR			X		
<i>Vulpes vulpes</i>	Red Fox	S5					X		
Artiodactyla	Deer and Bison								
<i>Odocoileus virginianus</i>	White-tailed Deer	S5					X		
¹ MNRF 2014b; ² MNRF 2018; ³ Government of Canada 2019; ⁴ Regional Municipality of Waterloo 1985; ⁵ Dobbyn 1994.					Total	4	19	0	2

Legend
SRANK
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
COSSARO
NAR Not at Risk
END Endangered
COSEWIC
NAR Not at Risk
SC Special Concern
E Endangered
SARA Schedule
Schedule 1 Officially Protected under SARA
Region of Waterloo Status
S Scarce
R Rare

Appendix VI
Herpetofauna Species Reported from the Study Area

Appendix

Reptile and Amphibian Species Reported From the Study Area

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Region of Waterloo Status ⁴	Ontario Reptile and Amphibian Atlas ⁵ Square: 17NJ31	NHIC Data ¹ (17NJ3713/ 17NJ3813)	NRSI Observed
Turtles									
<i>Chelydra serpentina serpentina</i>	Snapping Turtle	S3	SC	SC	Schedule 1	C	X	X	
<i>Chrysemys picta marginata</i>	Midland Painted Turtle	S5		SC		C	X		
<i>Emydoidea blandingii</i>	Blanding's Turtle (Great Lakes/St Lawrence population)	S3	THR	T	Schedule 1	√	X		
<i>Graptemys geographica</i>	Northern Map Turtle	S3	SC	SC	Schedule 1		X		
Snakes									
<i>Lampropeltis triangulum</i>	Eastern Milksnake	S4	NAR	SC	Schedule 1	√	X		
<i>Storeria dekayi dekayi</i>	Northern Brownsnake	S5	NAR	NAR		C*	X		
<i>Storeria occipitomaculata occipitomaculata</i>	Northern Red-bellied Snake	S5				C*	X		
<i>Thamnophis sauritus septentrionalis</i>	Eastern Ribbonsnake	S3	SC	SC	Schedule 1	√	X	X	
<i>Thamnophis sirtalis sirtalis</i>	Eastern Gartersnake	S5				C	X		
Salamanders									
<i>Ambystoma jeffersonianum</i>	Jefferson Salamander	S2	END	E	Schedule 1	√	X		
<i>Ambystoma</i> sp.	Jefferson/Blue-spotted Salamander Complex	S2				√	X		
<i>Ambystoma maculatum</i>	Spotted Salamander	S4				√	X		
<i>Notophthalmus viridescens viridescens</i>	Red-spotted Newt	S5				√	X		
<i>Plethodon cinereus</i>	Eastern Red-backed Salamander	S5				C	X		
Toads and Frogs									
<i>Anaxyrus americanus</i>	American Toad	S5				C	X		
<i>Hyla versicolor</i>	Tetraploid Gray Treefrog	S5				C	X		
<i>Pseudacris triseriata</i> pop. 1	Western Chorus Frog (Carolinian Population)	S4	NAR	NAR		C	X		
<i>Pseudacris crucifer</i>	Spring Peeper	S5				C	X		
<i>Lithobates catesbeiana</i>	American Bullfrog	S4				√	X		
<i>Lithobates clamitans melanota</i>	Northern Green Frog	S5				C	X		
<i>Lithobates palustris</i>	Pickerel Frog	S4	NAR	NAR		√	X		
<i>Lithobates pipiens</i>	Northern Leopard Frog	S5	NAR	NAR		C	X		
<i>Lithobates sylvaticus</i>	Wood Frog	S5				C	X		
					Total	22	23	2	0

¹MNRF 2014b; ²MNRF 2018; ³Government of Canada 2019; ⁴Regional Municipality of Waterloo 1985; ⁵Ontario Nature 2013.

Legend
SRANK
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
COSSARO
END Endangered
THR Threatened
SC Special Concern
NAR Not at Risk
COSEWIC
E Endangered
T Threatened
SC Special Concern
NAR Not at Risk
SARA Schedule
Schedule 1 Officially Protected under SARA
Region of Waterloo Status
C Common
C* Thought to be common; however, difficult to find
√ Significant

Appendix VII
Lepidoptera Species Reported from the Study Area

Appendix
Butterfly Species Reported From the Study Area

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Region of Waterloo Status ⁴	TEA Atlas ⁵ (17NJ31)	NHIC Data ¹ (17NJ3713/1 7NJ3813)	NRSI Observed
Hesperiidae	Skippers								
<i>Anatrytone logan</i>	Delaware Skipper	S4				C	X		
<i>Ancyloxypha numitor</i>	Least Skipper	S5				UC	X		
<i>Carterocephalus palaemon</i>	Arctic Skipper	S5				R	X		
<i>Epargyreus clarus</i>	Silver-spotted Skipper	S4				UC	X		
<i>Erynnis baptisiae</i>	Wild Indigo Duskywing	S4				UK	X		
<i>Erynnis juvenalis</i>	Juvenal's Duskywing	S5				R	X		
<i>Euphyes vestris</i>	Dun Skipper	S5				VC	X		
<i>Hylephila phyleus</i>	Fiery Skipper	SNA				R	X		
<i>Poanes hobomok</i>	Hobomok Skipper	S5				C	X		
<i>Poanes viator</i>	Broad-winged Skipper	S4				C	X		
<i>Polites mystic</i>	Long Dash Skipper	S5				UC	X		
<i>Polites peckius</i>	Peck's Skipper	S5				VC	X		
<i>Polites themistocles</i>	Tawny-edged Skipper	S5				C	X		
<i>Pompeius verna</i>	Little Glassywing	S4				UC	X		
<i>Thymelicus lineola</i>	European Skipper	SNA				VC	X		
<i>Wallengrenia egeremet</i>	Northern Broken Dash	S5				C	X		
Papilionidae	Swallowtails								
<i>Battus philenor</i>	Pipevine Swallowtail	SNA					X		
<i>Papilio cresphontes</i>	Giant Swallowtail	S4				UC	X		
<i>Papilio glaucus</i>	Eastern Tiger Swallowtail	S5				VC	X		
<i>Papilio polyxenes</i>	Black Swallowtail	S5				VC	X		
Pieridae	Whites and Sulphurs								
<i>Colias eurytheme</i>	Orange Sulphur	S5				VC	X		
<i>Colias philodice</i>	Clouded Sulphur	S5					X		
<i>Pieris oleracea</i>	Mustard White	S4				PE	X		
<i>Pieris rapae</i>	Cabbage White	SNA				VC	X		
Lycaenidae	Harvesters, Coppers, Hairstreaks, Blues								
<i>Celastrina neglecta</i>	Summer Azure	S5				VC	X		
<i>Cupido comyntas</i>	Eastern Tailed Blue	S5				UC	X		
<i>Glaucopsyche lygdamus</i>	Silvery Blue	S5					X		
<i>Lycaena hyllus</i>	Bronze Copper	S5				VC	X		
<i>Satyrium acadica</i>	Acadian Hairstreak	S4				UC	X		
<i>Satyrium calanus</i>	Banded Hairstreak	S4				UC	X		
<i>Satyrium edwardsii</i>	Edwards' Hairstreak	S4				R	X		

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Region of Waterloo Status ⁴	TEA Atlas ⁵ (17NJ31)	NHIC Data ¹ (17NJ3713/1 7NJ3813)	NRSI Observed
Nymphalidae	Brush-footed Butterflies								
<i>Aglais milberti</i>	Milbert's Tortoiseshell	S5				UC	X		
<i>Boloria bellona</i>	Meadow Fritillary	S5				VC	X		
<i>Cercyonis pegala</i>	Common Wood-Nymph	S5				VC	X		
<i>Chlosyne harrisii</i>	Harris's Checkerspot	S4					X		
<i>Chlosyne nycteis</i>	Silvery Checkerspot	S5				R	X		
<i>Coenonympha tullia</i>	Common Ringlet	S5				C	X		
<i>Danaus plexippus</i>	Monarch	S2N, S4B	SC	E	Schedule 1	VC	X		
<i>Euphydryas phaeton</i>	Baltimore Checkerspot	S4				R	X		
<i>Euptoieta claudia</i>	Variegated Fritillary	SNA				R	X		
<i>Junonia coenia</i>	Common Buckeye	SNA				UC	X		
<i>Lethe anthedon</i>	Northern Pearly-Eye	S5				C	X		
<i>Lethe appalachia</i>	Appalachian Brown	S4				UC	X		
<i>Lethe eurydice</i>	Eyed Brown / Northern Eyed Brown	S5				VC	X		
<i>Libytheana carinenta</i>	American Snout	SNA				R	X		
<i>Limenitis archippus</i>	Viceroy	S5				VC	X		
<i>Limenitis arthemis arthemis</i>	White Admiral/Banded Purple	S5				C	X		
<i>Limenitis arthemis astyanax</i>	Red-spotted Purple	S5				C	X		
<i>Megisto cymela</i>	Little Wood-Satyr	S5				VC	X		
<i>Nymphalis antiopa</i>	Mourning Cloak	S5				VC	X		
<i>Nymphalis l-album</i>	Compton Tortoiseshell	S5				UC	X		
<i>Phyciodes cocyta</i>	Northern Crescent	S5				UC	X		
<i>Phyciodes tharos</i>	Pearl Crescent	S4				C	X		
<i>Polygonia comma</i>	Eastern Comma	S5				VC	X		
<i>Polygonia comma</i>	Eastern Comma/Hop Merchant	S5					X		
<i>Polygonia interrogationis</i>	Question Mark	S5				VC	X		
<i>Polygonia progne</i>	Grey Comma	S5				UC	X		
<i>Speyeria cybele</i>	Great Spangled Fritillary	S5				VC	X		
<i>Vanessa atalanta</i>	Red Admiral	S5				VC	X		
<i>Vanessa cardui</i>	Painted Lady	S5				C	X		
<i>Vanessa virginensis</i>	American Lady	S5				C	X		
Total						56	61	0	0

¹MNRF 2014b; ²MNRF 2018; ³Government of Canada 2019; ⁴Regional Municipality of Waterloo 1985; ⁵Jones et al 2013.

LEGEND
SRANK
S2 Imperiled
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO
SC Special Concern
COSEWIC
E Endangered
SARA Schedule
Schedule 1 Officially Protected under SARA
Region of Waterloo Status
S Scarce
VC Very Common
C Common
UC Uncommon
R Rare
PE Possibly Extirpated

Appendix VIII
Odonata Species Reported from the Study Area

Appendix
Dragonfly and Damselfly Species Reported From the Study Area

Scientific Name	Common Name	SRANK ¹	SARO ²	COSEWIC ³	SARA Schedule ³	Waterloo Status ⁴	Odonate Atlas ⁵	NRSI Observed
Calopterygidae	Broadwinged Damselflies							
<i>Calopteryx maculata</i>	Ebony Jewelwing	S5				X	X	
Lestidae	Spreadwings							
<i>Lestes congener</i>	Spotted Spreadwing	S5				Expected	X	
<i>Lestes disjunctus</i>	Common Spreadwing	S5				Expected	X	
<i>Lestes eurinus</i>	Amber-winged Spreadwing	S3				Expected	X	
<i>Lestes rectangularis</i>	Slender Spreadwing	S5				X	X	
<i>Lestes unguiculatus</i>	Lyre-tipped Spreadwing	S5				X	X	
Coenagrionidae	Narrow-winged Damselflies							
<i>Enallagma carunculatum</i>	Tule Bluet	S5				X	X	
<i>Enallagma civile</i>	Familiar Bluet	S5				X	X	
<i>Enallagma ebrium</i>	Marsh Bluet	S5				X	X	
<i>Enallagma exsulans</i>	Stream Bluet	S5				X	X	
<i>Enallagma geminatum</i>	Skimming Bluet	S4				X	X	
<i>Enallagma signatum</i>	Orange Bluet	S4				X	X	
<i>Ischnura posita</i>	Fragile Forktail	S4				X	X	
<i>Ischnura verticalis</i>	Eastern Forktail	S5				X	X	
<i>Nehalennia irene</i>	Sedge Sprite	S5				X	X	
Aeshnidae	Darners							
<i>Aeshna constricta</i>	Lance-tipped Darner	S5				Expected	X	
<i>Aeshna tuberculifera</i>	Black-tipped Darner	S4				X	X	
<i>Anax junius</i>	Common Green Darner	S5				X	X	
Corduliidae	Emeralds							
<i>Epithea pinceps</i>	Prince Baskettail	S5				X	X	
<i>Somatochlora walshii</i>	Brush-tipped Emerald	S4				X	X	
Libellulidae	Skimmers							
<i>Celithemis elisa</i>	Calico Pennant	S5				Expected	X	
<i>Erythemis simplicicollis</i>	Eastern Pondhawk	S5				X	X	
<i>Leucorrhinia intacta</i>	Dot-tailed Whiteface	S5				X	X	
<i>Libellula luctuosa</i>	Widow Skimmer	S5				X	X	
<i>Libellula pulchella</i>	Twelve-spotted Skimmer	S5				X	X	
<i>Pachydiplax longipennis</i>	Blue Dasher	S5				X	X	
<i>Pantala hymenaea</i>	Spot-winged Glider	S4				Expected	X	
<i>Plathemis lydia</i>	Common Whitetail	S5				X	X	
<i>Sympetrum obtrusum</i>	White-faced Meadowhawk	S5				X	X	
<i>Sympetrum rubicundulum</i>	Ruby Meadowhawk	S5				X	X	
<i>Sympetrum semicinctum</i>	Band-winged Meadowhawk	S4				X	X	
<i>Sympetrum vicinum</i>	Yellow-legged (Banded) Meadowhawk	S5				X	X	
<i>Tramea lacerata</i>	Black Saddlebags	S4				X	X	
Total						33	33	0

¹MNRF 2014b; ²MNRF 2018; ³Government of Canada 2019; ⁴Regional Municipality of Waterloo 1985; ⁵MNRF 2019

LEGEND	
SRANK	
S4	Apparently Secure
S5	Secure
Region of Waterloo Status	
C	Common
C*	
G	General
O	Occasional
S	Scarce
R	Rare
√	Significant

Maps



Map 1a

University Avenue
Class EA

Study Area and Natural Features

Legend

Study Area

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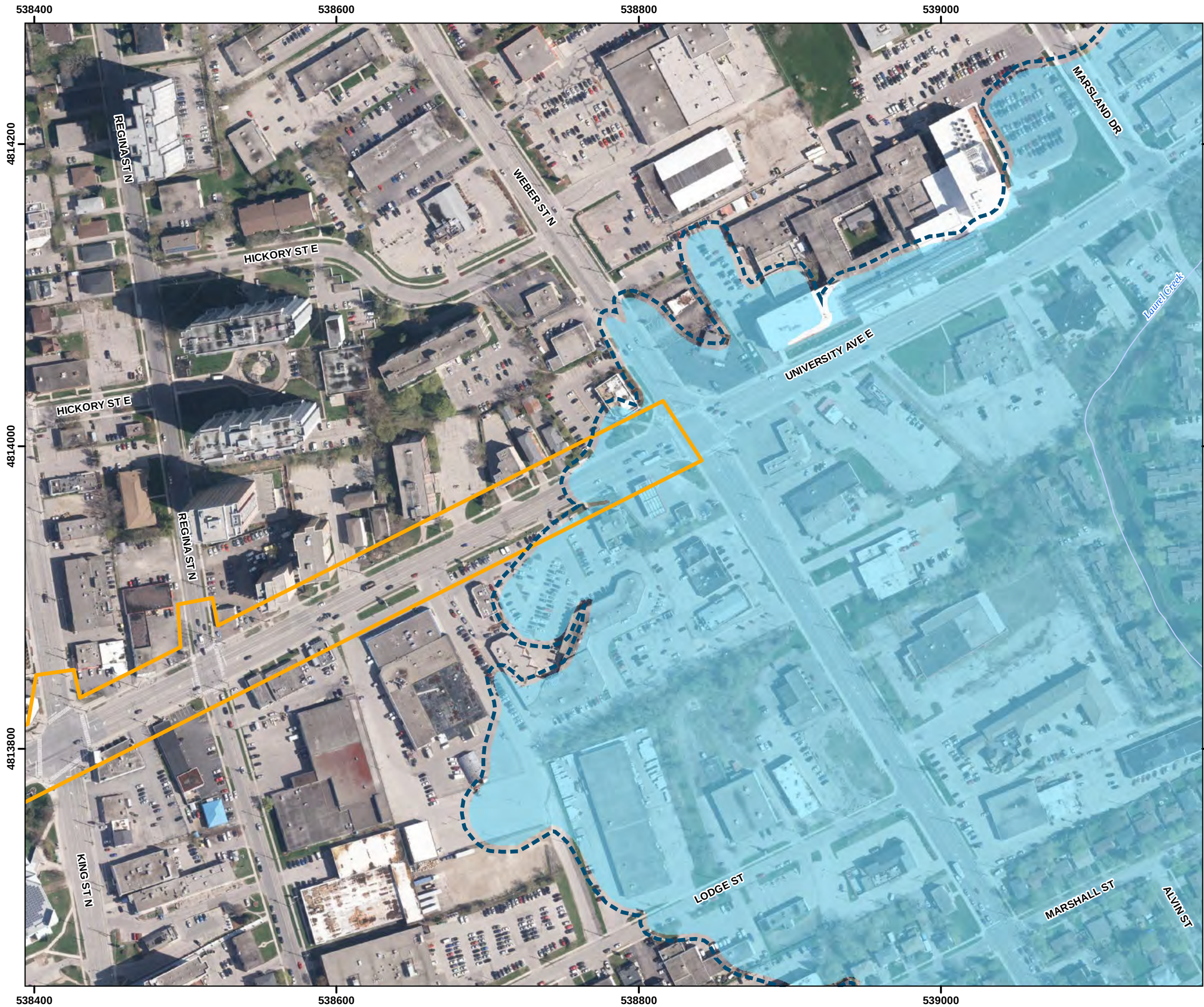
Project: 2251
Date: December 19, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,500

04080120160

Metres

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Path: X:\2251_UniversityAveDD\NRSI_2251_Map1_StudyArea_NaturalFeatures_3K_2019_10_07_DW.mxd

Map 1b

University Avenue
Class EA

Study Area and Natural Features

The inset map shows a larger area including parts of the City of Waterloo and the City of Kitchener. A red rectangle highlights the specific study area shown in the main map. Key roads like University Avenue, Weber Street, and Marshall Street are labeled. The cities are also labeled.

Legend

Study Area

Watercourse

Floodplain (GRCA)

Regulation Limit (GRCA)

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Project: 2251 Date: December 19, 2019	NAD83 - UTM Zone 17 Size: 11x17" 1:2,500
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04080120160

Metres

University Avenue EA, Natural Environment Technical Report										
Tree Inventory Data										
Tree Number	Common Name	Scientific Name	Native/ Non-native	DBH (cm)	Stem Count	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Comments
a	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	60.3	1	3.5	Possible	Poor	Institutional	Long section of included bark between codominant leaders; lawnmower damage healed; 40% live crown lost, mostly from 1 leader; minor epicormic growth; gypsy moth caterpillar.
b	Norway Maple	<i>Acer platanoides</i>	Non-Native	37.1	1	4.0	Improbable	Fair	Institutional	10% dieback; few dead branches; girdling root; root zone compaction.
c	Norway Maple	<i>Acer platanoides</i>	Non-Native	42.8	1	3.5	Improbable	Good	Institutional	Exposed roots with lawnmower damage; dense root mass appears as though once constrained by sidewalk; crown-raising pruning on road side; healthy foliage; root zone compaction.
d	Norway Maple	<i>Acer platanoides</i>	Non-Native	49.2	1	4.5	Improbable	Fair	Institutional	Exposed roots with lawnmower damage; basal wound partially closed; sapwood decay; included bark; 3 broken branches; epicormic growth; root zone compaction from vehicles.
e	Black Oak	<i>Quercus velutina</i>	Native	11.2	1	1.5	Improbable	Good	Institutional	Girdled stem wound; necrotic spotting on some leaves.
f	Norway Maple	<i>Acer platanoides</i>	Non-Native	38.2	1	4.0	Improbable	Good	Institutional	Girdling roots; root zone compaction from vehicles; good wound closure; dense but unbalanced crown.
g	White Birch	<i>Betula papyrifera</i>	Native	51.5	2	4.0	Possible	Good	Institutional	Minor dieback; secondary stem leans toward nearest building; root zone compaction from vehicles.
h	White Birch	<i>Betula papyrifera</i>	Native	36.5	1	4.5	Improbable	Good	Institutional	Minor dieback; low scaffold branching; few small broken branches; root zone compaction from vehicles.
i	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	53.4	1	5.5	Improbable	Good	Institutional	Decent structure, but with codominant leaders; pronounced reaction wood supporting 1 branch; epicormic growth and basal shoots; full crown.
j	White Ash	<i>Fraxinus americana</i>	Native	13.0	1	2.5	Possible	Fair	Institutional	EAB exit hole observed; healthy crown; good fruit set; lawnmower damage at base.
k	White Ash	<i>Fraxinus americana</i>	Native	22.4	1	3.5	Possible	Poor	Institutional	Crown thinning; bark cracks; insect galleries; basal shoots.
l	White Ash	<i>Fraxinus americana</i>	Native	20.3	1	4.0	Possible	Dead	Institutional	Dead crown; EAB exit holes; shedding bark.
m	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	61.3	1	6.5	Improbable	Good	Institutional	Broad, full crown; well-developed reaction wood supports low scaffold branches; epicormic growth and basal shoots.
n	White Ash	<i>Fraxinus americana</i>	Native	13.5	1	2.0	Possible	Very Poor	Institutional	Dead crown, live basal shoots; bark cracks and insect galleries; EAB exit hole.
o	White Ash	<i>Fraxinus americana</i>	Native	16.0	1	2.5	Possible	Very Poor	Institutional	Dead crown, live basal shoots; bark cracks and insect galleries; EAB exit holes.
p	Crabapple	<i>Malus sp.</i>	Non-Native	25.1	1	2.5	Improbable	Good	Institutional	Growing on slope towards parking lot; good fruit set; epicormic growth.
q	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	44.7	1	5.0	Improbable	Good	Institutional	Minor dieback. Starlings may be nesting.
r	Norway Maple	<i>Acer platanoides</i>	Non-Native	24.3	1	3.0	Improbable	Good	Institutional	Long bark seams; some sapwood decay evident where wound not fully closed.
s	Norway Maple	<i>Acer platanoides</i>	Non-Native	22.6	1	3.0	Improbable	Good	Institutional	Stem wound not fully closed; some sapwood decay; heavy fruit set.
t	Red Maple	<i>Acer rubrum</i>	Native	18.0	1	3.0	Possible	Fair	Institutional	Significant lawnmower damage, nearly girdled; minor crown thinning; minor foliar necrosis; 1 branch-tear wound; epicormic growth.

Tree Number	Common Name	Scientific Name	Native/ Non-native	DBH (cm)	Stem Count	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Comments
v	Norway Maple	<i>Acer platanoides</i>	Non-Native	23.6	1	3.0	Improbable	Good	Institutional	Long bark seam; buried root flare; 5% dieback.
w	Norway Maple	<i>Acer platanoides</i>	Non-Native	22.8	1	3.5	Improbable	Good	Institutional	Buried root flare; lawnmower damage to base.
x	Norway Maple	<i>Acer platanoides</i>	Non-Native	22.0	1	3.5	Improbable	Good	Institutional	Root ball raised; crossing branches.
y	Colorado Spruce	<i>Picea pungens</i>	Non-Native	54.1	1	3.5	Improbable	Excellent	Institutional	Sap exudation; very minor thinning; good structure.
z	Colorado Spruce	<i>Picea pungens</i>	Non-Native	39.0	1	3.5	Improbable	Fair	Institutional	Sap exudation; epicormic growth; dense branching.
aa	Norway Spruce	<i>Picea abies</i>	Non-Native	35.0	1	4.0	Improbable	Fair	Institutional	Broken top; heavy fruit set.
ab	Norway Maple	<i>Acer platanoides</i>	Non-Native	17.1	1	2.5	Improbable	Good	Institutional	Lawnmower damage and stem wounds closed; good vigour; irregular crown.
ac	Norway Maple	<i>Acer platanoides</i>	Non-Native	12.5	1	2.0	Possible	Poor	Institutional	Significant stem wound shows sapwood decay and fruiting bodies; basal wounds; stem 0.25m from sidewalk edge; dead top, 20% live crown lost.
ad	Norway Maple	<i>Acer platanoides</i>	Non-Native	19.2	1	2.5	Improbable	Good	Institutional	Long bark seam well-closed; sunken tissue under branch union; lawnmower damage to root flare; 1 dead branch; stem 0.4m from sidewalk edge.
ae	Red Oak	<i>Quercus rubra</i>	Native	27.1	1	4.0	Possible	Poor	Institutional	Foliar chlorosis and necrosis; brown spots concentrating in sinuses; 50% dieback; epicormic growth.
af	Small Leaf Linden	<i>Tilia cordata</i>	Non-Native	20.3	8	2.5	Improbable	Good	Institutional	Many young stems, likely arising from stump; round, squat crown with drip line at sidewalk.
ag	Austrian Pine	<i>Pinus nigra</i>	Non-Native	39.9	1	4.5	Improbable	Good	Institutional	Low, broad crown; minor lean away from road.
ah	Norway Maple	<i>Acer platanoides</i>	Non-Native	26.1	1	3.0	Improbable	Excellent	Institutional	Good wound closure; very dense crown.
ai	Colorado Spruce	<i>Picea pungens</i>	Non-Native	31.0	1	2.5	Improbable	Fair	Institutional	Slightly crooked stem; squat crown, perhaps broken top.
aj	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	45.1	1	5.0	Improbable	Good	Institutional	Exposed roots with lawnmower damage; stem 1m from sidewalk; a few misplaced pruning cuts; 1 broken branch; very minor dieback.
ak	White Ash	<i>Fraxinus americana</i>	Native	29.8	1	3.0	Possible	Very Poor	Commercial	EAB exit holes; bark cracks; history of branch failure; 80% dieback.
al	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	19.0	1	2.0	Improbable	Fair	Commercial	Lawnmower damage has nearly girdled the root flare; suppressed crown; 1 large scaffold branch pruned off.
am	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	29.1	1	5.0	Improbable	Good	Commercial	Wounds partially closed; 1 broken branch; minor epicormic growth.
an	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	27.1	1	3.5	Improbable	Good	Commercial	Slight lean away from road; minor epicormic growth; good vigour.
ao	Crabapple	<i>Malus sp.</i>	Non-Native	38.3	3	4.0	Improbable	Fair	Commercial	Leaves dying on water sprouts; decent wound closure; crossing branches.
ap	Crabapple	<i>Malus sp.</i>	Non-Native	17.1	1	4.0	Improbable	Fair	Commercial	Many water sprouts; crown mostly healthy; recent trenching just beyond drip line.
bi	Norway Maple	<i>Acer platanoides</i>	Non-Native	17.4	1	3.0	Improbable	Good	Residential	Corrected lean; round, full crown.

Map 2a

University Avenue Class EA Tree Inventory

Key Map

Legend

- Study Area
- Inventoried Tree to be Retained (Crown to Scale)
- Inventoried Tree (Crown to Scale)
- Inventoried Tree to be Removed (Crown to Scale)
- Potential Bat Roost Tree

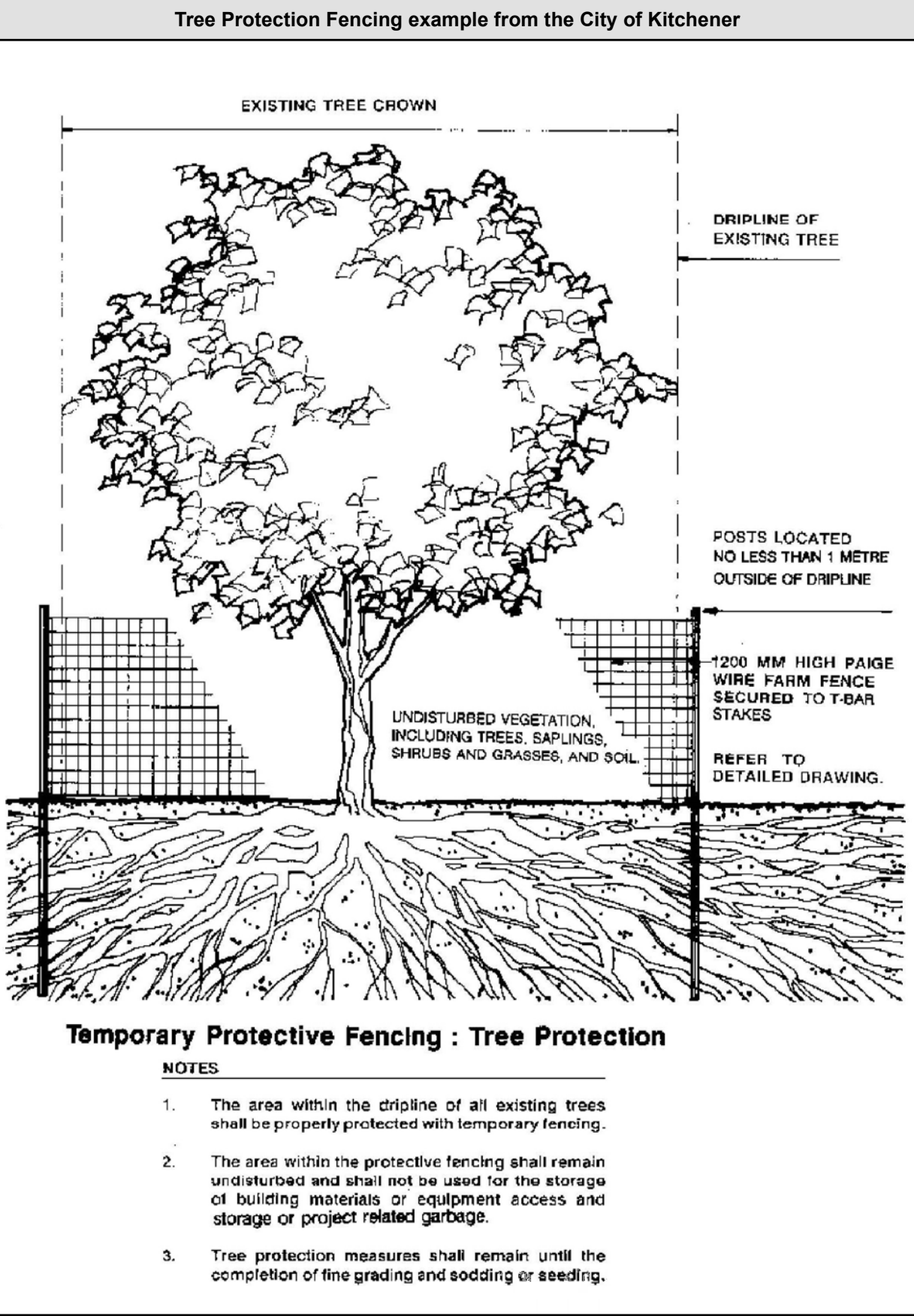
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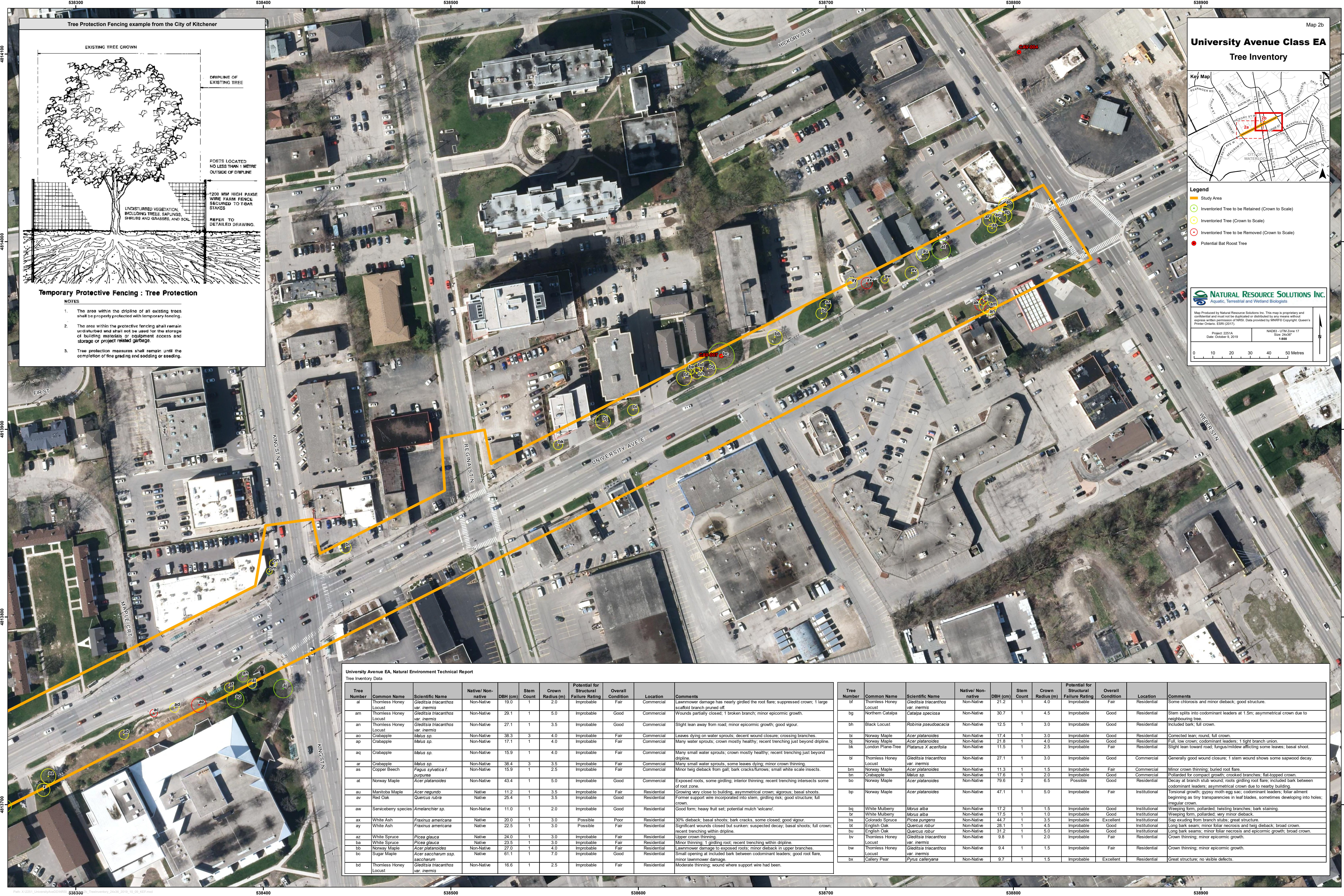
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Project: 2251A
Date: October 9, 2019

NAD83 - UTM Zone 17
Size: 24x36"
1:800

0 10 20 30 40 50 Metres





University Avenue EA, Natural Environment Technical Report

Tree Inventory Data

Tree Number	Common Name	Scientific Name	Native/ Non-native	DBH (cm)	Stem Count	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Comments	Tree Number	Common Name	Scientific Name	Native/ Non-native	DBH (cm)	Stem Count	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Location	Comments
al	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	19.0	1	2.0	Improbable	Fair	Commercial	Lawnmower damage has nearly girdled the root flare; suppressed crown; 1 large scaffold branch pruned off.	bf	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	21.2	1	4.0	Improbable	Fair	Residential	Some chlorosis and minor dieback; good structure.
am	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	29.1	1	5.0	Improbable	Good	Commercial	Wounds partially closed; 1 broken branch; minor epicormic growth.	bg	Northern Catalpa	<i>Catalpa speciosa</i>	Non-Native	30.7	1	4.5	Improbable	Good	Residential	Stem splits into codominant leaders at 1.5m; asymmetrical crown due to neighbouring tree.
an	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	27.1	1	3.5	Improbable	Good	Commercial	Slight lean away from road; minor epicormic growth; good vigour.	bh	Black Locust	<i>Robinia pseudoacacia</i>	Non-Native	12.5	1	3.0	Improbable	Good	Residential	Included bark; full crown.
ao	Crabapple	<i>Malus sp.</i>	Non-Native	38.3	3	4.0	Improbable	Fair	Commercial	Leaves dying on water sprouts; decent wound closure; crossing branches.	bi	Norway Maple	<i>Acer platanoides</i>	Non-Native	17.4	1	3.0	Improbable	Good	Residential	Corrected lean; round, full crown.
ap	Crabapple	<i>Malus sp.</i>	Non-Native	17.1	1	4.0	Improbable	Fair	Commercial	Many water sprouts; crown mostly healthy; recent trenching just beyond dripline.	bj	Norway Maple	<i>Acer platanoides</i>	Non-Native	21.8	1	4.0	Improbable	Good	Residential	Full, low crown; codominant leaders; 1 tight branch union.
aq	Crabapple	<i>Malus sp.</i>	Non-Native	15.9	1	4.0	Improbable	Fair	Commercial	Many small water sprouts; crown mostly healthy; recent trenching just beyond dripline.	bk	London Plane-Tree	<i>Platanus X acerifolia</i>	Non-Native	11.5	1	2.5	Improbable	Fair	Residential	Slight lean toward road; fungus/mildew affecting some leaves; basal shoot.
ar	Crabapple	<i>Malus sp.</i>	Non-Native	38.4	3	3.5	Improbable	Fair	Commercial	Many small water sprouts, some leaves dying; minor crown thinning.	bl	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	27.1	1	3.0	Improbable	Good	Commercial	Generally good wound closure; 1 stem wound shows some sapwood decay.
as	Copper Beech	<i>Fagus sylvatica f. purpurea</i>	Non-Native	15.9	1	2.5	Improbable	Fair	Commercial	Minor twig dieback from gall; bark cracks/furrows; small white scale insects.	bm	Norway Maple	<i>Acer platanoides</i>	Non-Native	11.3	1	1.5	Improbable	Fair	Commercial	Minor crown thinning; buried root flare.
at	Norway Maple	<i>Acer platanoides</i>	Non-Native	43.4	1	5.0	Improbable	Good	Commercial	Exposed roots, some girdling; interior thinning; recent trenching intersects some of root zone.	bn	Crabapple	<i>Malus sp.</i>	Non-Native	17.6	1	2.0	Improbable	Good	Commercial	Pollarded for compact growth; crooked branches; flat-topped crown.
au	Manitoba Maple	<i>Acer negundo</i>	Native	11.2	1	3.5	Improbable	Fair	Residential	Growing very close to building, asymmetrical crown; vigorous; basal shoots.	bo	Norway Maple	<i>Acer platanoides</i>	Non-Native	79.6	2	6.5	Possible	Good	Residential	Decay at branch stub wound; roots girdling root flare; included bark between codominant leaders; asymmetrical crown due to nearby building.
av	Red Oak	<i>Quercus rubra</i>	Native	25.4	1	3.5	Improbable	Fair	Good	Former support wire incorporated into stem, girdling risk; good structure, full crown.	bp	Norway Maple	<i>Acer platanoides</i>	Non-Native	47.1	1	5.0	Improbable	Fair	Institutional	Torsional growth; gypsy moth egg sac; codominant leaders; foliar ailment beginning as tiny transparencies in leaf blades, sometimes developing into holes; irregular crown.
aw	Serviceberry species	<i>Amelanchier sp.</i>	Non-Native	11.0	1	2.0	Improbable	Good	Residential	Good form; heavy fruit set; potential mulch volcano.	bq	White Mulberry	<i>Morus alba</i>	Non-Native	17.2	1	1.5	Improbable	Good	Institutional	Weeping form; pollarded; twisting branches; bark staining.
ax	White Ash	<i>Fraxinus americana</i>	Native	20.0	1	3.0	Possible	Poor	Residential	30% dieback; basal shoots; bark cracks, some closed; good vigour.	br	White Mulberry	<i>Morus alba</i>	Non-Native	17.5	1	1.0	Improbable	Good	Institutional	Weeping form; pollarded; very minor dieback.
ay	White Ash	<i>Fraxinus americana</i>	Native	22.5	1	3.0	Possible	Fair	Residential	Significant wounds closed but sunken; suspected decay; basal shoots; full crown; recent trenching within dripline.	bs	Colorado Spruce	<i>Picea pungens</i>	Non-Native	44.7	1	3.5	Improbable	Excellent	Institutional	Sap exuding from branch stubs; great structure.
az	White Spruce	<i>Picea glauca</i>	Native	24.0	1	3.0	Improbable	Fair	Residential	Upper crown thinning.	bt	English Oak	<i>Quercus robur</i>	Non-Native	28.1	1	4.5	Improbable	Good	Institutional	Long bark seams; minor foliar necrosis and twig dieback; broad crown.
ba	White Spruce	<i>Picea glauca</i>	Native	23.5	1	3.0	Improbable	Fair	Residential	Minor thinning; 1 girdling root; recent trenching within dripline.	bu	English Oak	<i>Quercus robur</i>	Non-Native	31.2	1	5.0	Improbable	Good	Institutional	Long bark seams; minor foliar necrosis and epicormic growth; broad crown.
bb	Norway Maple	<i>Acer platanoides</i>	Non-Native	27.0	1	4.0	Improbable	Fair	Residential	Lawnmower damage to exposed roots; minor dieback in upper branches.	bv	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	9.8	1	2.0	Improbable	Fair	Residential	Crown thinning; minor epicormic growth.
bc	Sugar Maple	<i>Acer saccharum ssp. saccharum</i>	Native	61.1	1	7.0	Improbable	Good	Residential	Small opening at included bark between codominant leaders; good root flare, minor lawnmower damage.	bw	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	9.4	1	1.5	Improbable	Fair	Residential	Crown thinning; minor epicormic growth.
bd	Thornless Honey Locust	<i>Gleditsia triacanthos var. inermis</i>	Non-Native	16.6	1	2.5	Improbable	Fair	Residential	Moderate thinning; wound where support wire had been.	bx	Galley Pear	<i>Pyrus calleryana</i>	Non-Native	9.7	1	1.5	Improbable	Excellent	Residential	Great structure; no visible defects.



Map 3a

University Avenue
Class EA
Natural Feature Constraints

Legend

Study Area

Potential Bat Roost Tree (Recommended to be Retained)

Notable Inventoried Tree (Recommended to be Retained)

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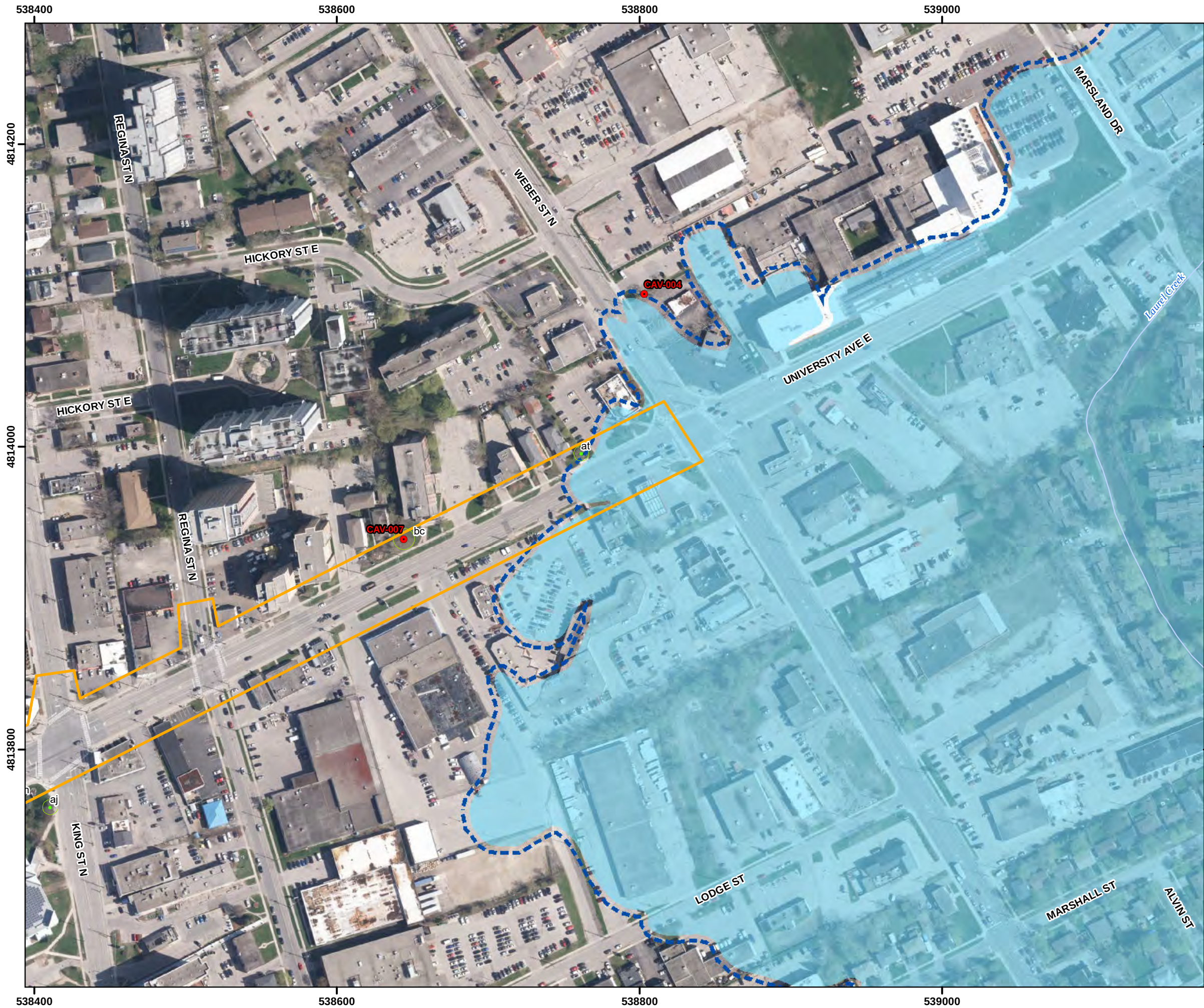
Project: 2251
Date: December 19, 2019

NAD83 - UTM Zone 17
Size: 11x17"
1:2,500

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Metres

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Map 3b

University Avenue
Class EA
Natural Feature Constraints

The inset map shows the City of Waterloo and its proximity to the City of Kitchener. A red box highlights the study area, which is further divided into sub-areas 3a and 3b. Key streets shown include University Ave, Weber St, and Marshall St.

Legend

Study Area

Potential Bat Roost Tree (Recommended to be Retained)

Notable Inventoried Tree (Recommended to be Retained)

Watercourse

Floodplain (GRCA)

Regulation Limit (GRCA)

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