Draft Ecological Environment Existing Conditions Report

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WM Canada Corporation

Watford, Ontario

November 2023

Prepared by:

Natural Resource Solutions Inc.
415 Phillip Street, Unit C, Waterloo, ON N2L 3X2

Executive Summary

Natural Resource Solutions Inc. (NRSI) was contracted by HDR Corporation on behalf of WM Canada to prepare this Draft Ecological Environment Existing Conditions Report as part of the Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project Environmental Assessment (EA). The Ecological Environment considers both terrestrial and aquatic ecosystems, and includes vegetation communities, plant and wildlife species and habitats, fish and fish habitat, and aquatic resources.

The TCEC is located at 5768 Nauvoo Road in the Township of Warwick, within the County of Lambton. The TCEC lies to the north of the community of Watford and is generally bounded by Confederation Line to the south, Nauvoo Road to the west, Zion Line to the north, and agricultural lands to the east. This report summarizes the existing ecological conditions within the On-site Study Area (the existing TCEC and lands owned by WM) and the Off-site Study Area (lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area and including the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road).

There are approximately 8 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed optimization would provide additional airspace of approximately 14 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043), and may be achieved through alternative landfill configurations or alternative methods within the existing 301-hectare TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

Comprehensive field surveys were completed between late March and early December 2022 by NRSI biologists to document the existing conditions for the Ecological Environment within the On-site and Off-site Study areas. Where direct access to private property not owned by WM was not available, field assessments were completed from roadside or property boundary locations and supplemented by a review of aerial imagery.

This Ecological Environment Existing Conditions Report provides detailed descriptions of the existing form and ecological functions of the natural features documented within the On-site and Off-site Study Areas. Using the results of 2022 field surveys and available background information, an analysis of the significance and sensitivity of these natural features and their functions was also completed.

Terrestrial ecosystems within the On-site Study Area are characterized by active landfill areas, sedimentation ponds, poplar (*Populus* spp.) plantation phytoremediation systems, soil storage and maintenance facilities, a leachate storage area, and agricultural lands. Natural vegetation communities within the On-site Study Area are generally limited, but include forest, swamp, marsh, and culturally-influenced meadow communities. The Off-site Study Area is dominated by agricultural fields interspersed with residential and commercial properties, a cemetery, woodlots, and riparian areas

surrounding municipal drains and watercourses. The On-site and Off-site Study Areas contain unevaluated wetlands, areas identified on Lambton County and Warwick Township Official Plans as Significant Woodland, and several species of vascular flora considered 'Rare' in Lambton County.

Confirmed Significant Wildlife Habitat (SWH) types that occur within both Study Areas include:

- Amphibian Breeding Habitat (Woodland);
- Terrestrial Crayfish Habitat; and
- Breeding habitat for the Species of Conservation Concern (SCC) species Western Chorus Frog (*Pseudacris triseriata* pop. 2).

Within the On-site Study Area, potential (but unconfirmed) breeding habitat may also be present for two other SCC, Eastern Wood-Pewee (*Contopus virens*) and Wood Thrush (*Hylocichla mustelina*); when confirmed, important habitats of SCC are considered SWH. Within the Off-site Study Area, breeding habitat for Eastern Wood-Pewee was confirmed, and potential habitat was identified for three (3) additional bird SCC: Wood Thrush, Canada Warbler (*Cardellina canadensis*), and Tufted Titmouse (*Baeolophus bicolor*). Candidate Amphibian Breeding Habitat (Wetland) and Bat Maternity Colony SWH may also be present within the Off-site Study Area (but not within the TCEC).

Natural features within the On-site and Off-site Study Areas have the potential to support habitat for Species at Risk (SAR) listed as Threatened or Endangered and protected under the provincial *Endangered Species Act, 2007 (ESA),* including:

- Eastern Hog-nosed Snake (*Heterodon platirhinos*);
- Little Brown Myotis (*Myotis lucifungus*);
- Northern Myotis (*Myotis septentrionalis*);
- Eastern Small-footed Myotis (*Myotis leibii*);
- Tri-colored Bat (*Perimyotis subflavus*); and
- Bobolink (*Dolichonyx oryzivorus*).

Aquatic ecosystems are mainly found within the Off-site Study Area; however, lands within the On-site Study Area drain to aquatic features within both the Brown Creek and Bear Creek Headwaters subwatersheds. Other than a small portion of Brown Creek present as a naturalized watercourse south of Confederation Line, all aquatic features within the Off-site Study Area are constructed open or closed (i.e., tiled) municipal drains with a history of channelization and other anthropogenic modifications. Open channel features include Kersey Drain (the channelized reach of Brown Creek), Cameron Drain, Burchill Drain, Gilliland-Geerts Drain, Gilliland-Geerts Drain Branch, and Brown-Jarriott Drain. Perennial or seasonal direct fish habitat of moderate to good quality is present within all features except for Gilliland-Geerts Drain Branch and Burchill Drain (which were determined to provide indirect fish habitat only). Kersey Drain was determined to provide the best quality habitat and support the most diverse fish community when compared with other assessed features. Aquatic

ecosystems within the Off-site Study Area provide habitat for fish species with both coolwater and warmwater thermal regime tolerances. No aquatic SAR or SCC were documented during electrofishing surveys completed by NRSI biologists in 2022.

One of the purposes of the EA is to assess the potential effects of the proposed landfill optimization on the ecological environment. The significant species and habitats described in this report will be considered during the evaluation of alternative methods of carrying out the undertaking. The results of this Ecological Environment study will help to inform appropriate mitigation measures for protecting important natural features as needed.

Acronyms, Units and Glossary

Acronyms

Acronym	Definition
ARA	Aquatic Resource Area
CAA	*Conservation Authorities Act*, R.S.O. 1990
COSEWIC	Committee for the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CWS	Canadian Wildlife Service
DBH	Diameter at Breast Height
DFO	Department of Fisheries and Oceans
EA	Environmental Assessment
ELC	Ecological Land Classification
ESA	*Endangered Species Act*, 2007
FWCA	*Fish and Wildlife Conservation Act*, 1997
HADD	Harmful Alteration, Disruption and Destruction
MBCA	*Migratory Birds Convention Act*, 1994
MECP	Ministry of the Environment, Conservation and Parks
MNRF	Ministry of Natural Resources and Forestry
NHIC	Natural Heritage Information Centre
NRSI	Natural Resource Solutions Inc.
O. Reg.	Ontario Regulation
OBBA	Ontario Breeding Bird Atlas
OEAA	*Ontario Environmental Assessment Act,* R.S.O. 1990
OMAFRA	Ontario Ministry of Agriculture, Food and Rural Affairs
OMNR	Ontario Ministry of Natural Resources
OOAD	Ontario Odonata Atlas Database
OSAP	Ontario Stream Assessment Protocol
OWES	Ontario Wetland Evaluation System
PSW	Provincially Significant Wetland
SARO	Species at Risk in Ontario
SCC	Species of Conservation Concern
SCRCA	St. Clair Region Conservation Authority
SAR	Species at Risk
SARA	*Species at Risk Act,* 2002
SWH	Significant Wildlife Habitat

Acronyms

Acronym	Definition
SWHTG	Significant Wildlife Habitat Technical Guide
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	WM Canada

Units

Unit	Definition
A	amperes
°C	degrees Celsius
cm	centimetre
h	hour
ha	hectares
Hz	hertz
km	kilometre
L/s	Litres per second
m	metre
mS	millisiemens
ppt	parts per thousand
V	voltage

Glossary

Term	Definition
Allochthonous Inputs	Organic matter that contains nutrients from external sources, and are introduced from another ecosystem. For example, terrestrial plant matter entering a watercourse and being consumed by aquatic organisms.
Anuran	A group of amphibians comprised of frogs and toads.
Approval	Permission granted by an authorized individual or organization for an undertaking to proceed. This may be in the form of program approval, certificate of approval or provisional certificate of approval.
Aquifer	A formation or body of permeable rock that stores and transmits groundwater.
Avifauna	Birds found in a specific region.
Benthic Invertebrate	Organisms that live on or within the bottom of water bodies like rivers and lakes and do not have a vertebral column.
Biodiversity	The variety of life found in an ecosystem or region.
Canopy	The uppermost layer of vegetation formed by trees sprouting branches and leaves.
Contaminant Sink	A location that captures pollutants and environmental contaminants to mitigate environmental effects.

Acronyms

Acronym	Definition
Deciduous	A tree or plant that seasonally sheds leaves in autumn.
Ecological Land Classification	A landscape mapping tool developed for the province of Ontario by H.T. Lee and others whereby ecological units are delineated on the basis of similar vegetation and soil characteristics.
Electrofishing	A method used to sample fish populations to understand the density, abundance, and species composition in a particular waterbody. An electric current is used to temporarily stun fish, which can then be collected for identification prior to being released alive.
Environment	As defined by the Environmental Assessment Act, environment means: • air, land or water; • plant and animal life, including human life; • the social, economic and cultural conditions that influence the life of humans or a community; • any building, structure, machine or other device or thing made by humans; • any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or • any part or combination of the foregoing and the interrelationships between any two or more of them (ecosystem approach).
Environmental Assessment (EA)	A systematic planning process that is conducted in accordance with applicable laws or regulations aimed at assessing the effects of a proposed undertaking on the environment.
Evaluation Criteria	Evaluation criteria are considerations or factors taken into account in assessing the advantages and disadvantages of various alternatives being considered.
Faunal Province	A geographic region with a distinct assemblage of organisms.
Foraging	The act of searching widely to hunt for food in the wild.
Hibernaculum	A specific location or feature on the landscape where an animal seeks refuge during the winter. See also: Overwintering habitat. Plural form: Hibernacula.
Herbaceous	Plants that lack woody tissue, and are annuals or perennials.
Herpetofauna	Reptiles and amphibians found in a specific region.
Hydroperiod	The number of days per year that an area of land is wet and contains sufficient standing water to support biological life processes (e.g., amphibian breeding).
Indicators	Indicators are specific characteristics of the evaluation criteria that can be measured or determined in some way, as opposed to the actual criteria, which are fairly general.
Leachate	Liquid that drains from solid waste in a landfill and which contains dissolved, suspended and/or microbial contaminants from the breakdown of this waste.
Mitigation	Measures taken to reduce adverse impacts on the environment.
Moraine	Material (usually soil and rock) left behind by a moving glacier.
Natural Heritage	Refers to the components of the natural environment, inclusive of flora, fauna, ecosystems, and geological structures that provide important functions and hold special value for present and future generations.
Odonate	A predatory insect belonging to the order *Odonata*, comprised of dragonflies and damselflies.
Overwintering Habitat	Specific habitats used by animals to survive freezing temperatures and harsh weather conditions during the winter period. These habitats often have specific biological and physical characteristics (e.g., thermal conditions, food resources, geographic locations) that support the survival of a particular species. See also: Hibernaculum.

Acronyms

Acronym	Definition
Phytoremediation System	A technology that uses plants to reduce the level of toxic contaminants in the environment by extracting and immobilizing pollutants from soil or water.
Proponent	• A person who: • carries out or proposes to carry out an undertaking; or • is the owner or person having charge, management or control of an undertaking.
Provincially Significant Wetland	Wetlands that are designated as significant by the province of Ontario, as determined by a science-based ranking system.
Riparian Area	Refers to the area immediately adjacent to a waterbody that is the interface between terrestrial and aquatic ecosystems.
Roosting Habitat	Refers to features used by bats for shelter while resting or sleeping and rearing young. Roosting habitat requirements may vary throughout the year depending on seasonal needs of a particular species or individuals within a species (e.g., maternity roosting habitat for females and their young, hibernation roosts for overwintering individuals).
Sedimentation Pond	A constructed pond built to capture surface water runoff from impervious surfaces and retain it while suspended sediments and other particulates settle out of the water column. Used to improve water quality prior to discharging to the landscape.
Significant Species	Includes Species at Risk and Species of Conservation Concern. Generally, the term *Significant Species* is used in this report when referring to species that are provincially rare and/or have a specific designation under the provincial *Endangered Species Act (ESA, 2007)* and/or the federal *Species at Risk Act (SARA).*
Significant Wildlife Habitat	Specific habitat types used by wildlife that are considered significant in Ontario based on a discrete set of criteria developed by the Ministry of Natural Resources and Forestry. Includes seasonal concentration areas, rare vegetation communities or specialized habitats for wildlife, habitats of Species of Conservation Concern, and animal movement corridors.
Significant Woodland	Forested areas that are ecologically important in terms of species composition, tree age and stand history, ecological functions, and contributions to the broader landscape. Criteria for determining if a treed feature is a Significant Woodland in Lambton County are described in the Lambton County Official Plan (County of Lambton 2020).
Species at Risk	Species listed on the Species at Risk in Ontario List (SARO), Ontario Regulation (O. Reg.) 230/08. These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered or Threatened. Species listed by COSSARO as Endangered or Threatened are protected by the *Endangered Species Act, 2007 (ESA),* which includes protection of the species' habitat.
Species of Conservation Concern	Inclusive of species in the following categories: • Species designated provincially as Special Concern; • Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the Natural Heritage Information Centre (Ministry of Natural Resources and Forestry); 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 Committee on the Status of Species at Risk in Ontario (COSSARO). If these species are listed under the Species at Risk Act (SARA) under Schedule 1 they are protected by the federal Act but not the provincial ESA.
Study area	A designated region covered under the scope of a particular scientific investigation or study. For ecological impact studies, the Study Area typically includes a specific tract of land plus the surrounding area, or primary zone of influence. The Study Area usually considers adjacent lands (that is, the distance from a particular natural feature for considering potential negative impacts from a proposed undertaking) within at least 120m.

Acronyms

Acronym	Definition
Substrate	In the context of aquatic biology, substrates are the materials that rest at the bottom of a waterbody.
Subwatershed	A watershed is an area of land that water flows over and/or through before draining into a particular waterbody. A subwatershed is a small watershed that is generally nested within a larger watershed, and drains a smaller landmass in comparison to the overall watershed.
Terms of Reference (ToR)	A terms of reference is a document that sets out detailed requirements for the preparation of an Environmental Assessment.
Thermal regime	A regular pattern of temperature fluctuation within a waterbody.
Thermoregulation	A biological process that maintains the physiologic core body temperature of an organism by balancing heat generation with heat loss. In reptiles, behavioural thermoregulation occurs when individuals use specific microhabitats to regulate exposure to the sun or shade and maintain a preferred body temperature.
Understorey	The layer of vegetation beneath a canopy in a forest or woodland.
Undertaking	Is defined in the Environmental Assessment Act as follows: • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity by or on behalf of Her Majesty in right of Ontario, by a public body or public bodies or by a municipality or municipalities; • A major commercial or business enterprise or activity or a proposal, plan or program in respect of a major commercial or business enterprise or activity of a person or persons other than a person or persons referred to in clause (1) that is designated by the regulations; or • An enterprise or activity or a proposal, plan or program in respect of an enterprise or activity of a person or persons, other than a person or persons referred to in clause (a), if an agreement is entered into under section 3.0.1 in respect of the enterprise, activity, proposal, plan or program ("enterprise").
Vascular flora	Plant species that possess a vascular system, comprised of xylem and phloem, used to distribute water, minerals, and other resources to different tissues.
Vernal pool	Ephemeral pools in woodlands and other habitats that contain water during spring and into the summer, but tend to dry out completely each year (or every few years). Their hydrological characteristics make vernal pools generally incompatible with the establishment of permanent fish populations, which improves the reproductive success of amphibian and invertebrate species that require breeding habitats that contain water but are free from fish predators.
Woodland dripline	The outermost boundary of a woodland, delineated in reference to the outermost circumference of a tree's canopy from which water may drip onto the ground. The area below the dripline includes the majority of the root system of a tree.

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Appendices

1 Introduction

This report presents a description of the existing conditions for the Ecological Environment (terrestrial and aquatic) for the WM Canada (WM) Twin Creeks Environmental Centre (TCEC) Landfill Optimization Project in support of the environmental assessment (EA). The EA is being carried out in accordance with the requirements of the *Ontario Environmental Assessment Act* (*OEAA*) and Terms of Reference (ToR), which was approved by the Ministry of Environment, Conservation and Parks (MECP) on December 13, 2022.

WM, the owner and operator of the TCEC in Watford, Ontario, has initiated the EA seeking approval to optimize the landfill design and operation, maximizing the use of the constructed infrastructure and the significant investment made at the TCEC. There are approximately 8 years of approved landfill airspace capacity remaining at the TCEC (i.e., capacity will be reached in approximately 2031). The proposed optimization would provide additional airspace of approximately 14 million cubic metres (m^3), which could extend the site life by approximately 12 years (from 2031 to 2043), and may be achieved through alternative landfill configurations or alternative methods within the existing 301-hectare (ha) TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

The approved ToR included a preliminary description of the existing conditions within the area surrounding the TCEC, with the commitment that a more detailed description of existing environmental conditions would be prepared as part of the EA. In accordance with the approved ToR, additional investigative studies were carried out as necessary to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the TCEC Landfill Optimization Project during the EA.

This Ecological Environment Existing Conditions Report is one component of the EA. The EA Study Report will incorporate the information presented herein as appropriate, and this report will be included with the EA Study Report as a supporting document.

2 TCEC and Study Areas

The TCEC is located at 5768 Nauvoo Road in the Township of Warwick, within the County of Lambton. The TCEC lies to the north of the community of Watford and is generally bounded by Confederation Line to the south, Nauvoo Road to the west, Zion Line to the north, and agricultural lands to the east. The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are:

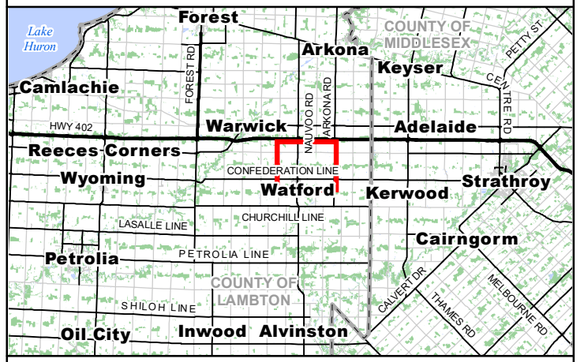
- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

For the Ecological Environment, the Off-site Study Area was extended to include the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road (**Figure 2-1**). The Off-site Study Area encompasses a 'primary zone of influence' extending 120 m from the existing TCEC in keeping with the definition of 'adjacent lands' as set forth in the Natural Heritage Reference Manual (MNRF 2010).

Twin Creeks Environmental Centre Optimization Project

Figure 2-1

On-site and Off-site Study Areas for the Ecological Environment



Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Primary Road
- Secondary Road
- Significant Woodland (Township of Warwick Official Plan 2021)

Stream Network:

Department of Fisheries and Oceans (DFO) Drain Classification

- Closed/Tiled
- Not Rated
- Class E - Permanent Flows, Warmwater Thermal Regime
- Class F - Intermittent Flows
- Natural Watercourse (Not Rated)

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Project: 2538
Date: October 18, 2023

NAD83 - UTM Zone 17
Size: 11x17"
1:19,000

0 400 800 1,200 Meters

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Path: X:\2538_TwinCreeksLandfillEA\NRSI_2538_Figure2-1_SiteStudyAreas_19K_2023_10_18_KB.mxd

3 Methods

This Ecological Environment Existing Conditions Report was developed based on the evaluation criteria, indicators, and data sources included in the approved ToR, which were developed in consultation with government agencies and other stakeholders. The evaluation criteria, rationale, indicators, and data sources used for the Ecological Environment as per the approved ToR are provided in **Table 3-1**. The approved Ecological Environment Work Plan is provided in **Appendix A**.

Table 3-1. Evaluation Criteria, Indicators and Data Sources for the Ecological Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Ecological Environment			
Terrestrial Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural terrestrial habitats, including rare, threatened, or endangered species.	• Predicted effects on vegetation communities and species including rare, threatened, or endangered species • Predicted effects on wildlife and wildlife habitat including rare, threatened, or endangered species	• Vegetation and wildlife data, including SAR data from previous studies • Terrestrial field studies • Aerial imagery • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas. • Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (Ontario Ministry of Natural Resources 2010) • Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources 2000) • Significant Wildlife Habitat (Schedule Criteria for Ecoregion 7E (Ontario Ministry of Natural Resources and Forestry 2015) • Ministry of the Environment, Conservation and Parks (MECP) background data • Ministry of Natural Resources and Forestry (MNRF) background data • St. Clair Region Conservation Authority (SCRCA) background data • Natural Heritage Information Centre background data • Ontario Breeding Bird Atlas • Ontario Butterfly Atlas • Ontario Reptile and Amphibian Atlas • Ontario Odonata Atlas • Ontario Mammal Atlas • eBird • iNaturalist • Proposed facility characteristics

Table 3-1. Evaluation Criteria, Indicators and Data Sources for the Ecological Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Survey protocol for Ontario's Species at Risk Snakes (MNRF 2016a) • Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c) • Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF 2016b) • Ontario Wetland Evaluation System: Southern Manual (MNRF 2014)
Aquatic Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural aquatic habitats and species, including rare, threatened, or endangered species.	• Predicted effects on aquatic habitat, including fish habitat • Predicted effects on aquatic biota including rare, threatened, or endangered species	• Fish and fish habitat survey data from previous studies • Aquatic field studies • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas. • MNRF review letters of previous existing conditions reports • MNRF aquatic resource data • Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping • Annual monitoring report data • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Observations obtained as part of interviews with riparian landowners

3.1 Collection and Review of Background Information

Available background information pertaining to the biological resources within the On-site and Off-site Study Areas was collected and reviewed to inform this Ecological Environment Existing Conditions Report. Background information sources that were reviewed included:

- Natural Heritage Information Centre (NHIC) database (MNRF 2023);
- Species at Risk (SAR) listings at the federal and provincial levels (MECP 2023, Government of Canada 2022);
- St. Clair Region Conservation Authority (SCRCA) regulations mapping (SCRCA 2023);

- Bear Creek Headwaters Subwatershed Report Card 2018 (SCRCA 2018a);
- Brown Creek Subwatershed Report Card 2018 (SCRCA 2018b);
- DFO Aquatic SAR Mapping (DFO 2022);
- Aquatic Resource Area (ARA) Data (Government of Ontario 2022);
- County of Lambton Official Plan (County of Lambton 2020);
- Township of Warwick Official Plan (Township of Warwick 2021);
- Ontario Breeding Bird Atlas (BSC et al. 2006);
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2019);
- Ontario Mammal Atlas (Dobbyn 1994);
- Ontario Butterfly Atlas (Macnaughton et al. 2023);
- Ontario Odonata Atlas (OOAD 2021);
- iNaturalist database (iNaturalist 2023);
- eBird database (eBird 2023); and
- Warwick Landfill Expansion Environmental Assessment Natural Environment and Resources Baseline Report (Gartner Lee Ltd. 2004).

Requests for available background information were submitted by NRSI biologists to the MECP, MNRF, and SCRCA on February 22, 2021. A response was received from the MECP on March 15, 2021 (Zarkovich, pers. comm. 2021), and from the SCRCA on February 25, 2021 (Hodgkiss, pers. comm. 2021). A response to the information request was not received from the MNRF.

3.1.1 Preliminary Significant Species Screening

A preliminary screening was completed to determine the potential for SAR, Species of Conservation Concern (SCC) and their habitats to be present within the On-site and Off-site Study Areas. Wildlife lists were compiled to provide information on species reported from within a 10 km radius of the On-site and Off-site Study Areas using the atlases and other background information sources listed in **Section 3.1**. Wildlife atlases provide data based on 10 km x 10 km survey squares; information on species from the square overlapping the Study Areas (square no. 17MH25) was compiled.

SAR are those species listed on the SAR in Ontario List (SARO), Ontario Regulation (O. Reg.) 230/08. These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered or Threatened. Species listed by COSSARO as Endangered or Threatened are protected by the *Endangered Species Act, 2007* (*ESA*), which includes protection of the species' habitat, and are referred to as regulated SAR. SCC are defined as:

- Species designated provincially as Special Concern;
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by NHIC; 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 COSSARO. If these species are listed under the *Species at Risk Act* (*SARA*) under Schedule 1 they are protected by the federal Act but not the provincial *ESA*.

The preferred habitats for SAR and SCC identified during the review of background information were cross-referenced against habitats occurring within the Study Areas. This was completed to ensure that the potential presence of SAR and SCC was adequately assessed in the EA. The full results of the Preliminary SAR/SCC Screening are presented in Appendix A of the approved ToR, and were used to guide the type and scope of wildlife surveys.

In total, 17 SAR and SCC were identified as having potentially suitable habitat within the Study Areas. Targeted surveys for these species were undertaken by NRSI biologists in 2022, and the Preliminary Significant Species Screening was updated to incorporate survey results and the most recent information from available background sources. A Final Significant Species Screening is provided in **Appendix B**.

3.1.2 Preliminary Significant Wildlife Habitat Screening

A preliminary screening was also completed to determine the potential for Significant Wildlife Habitat (SWH) to be present within the On-site and Off-site Study Areas. The Significant Wildlife Habitat Technical Guide (SWHTG) is a guideline document that outlines the types of habitats that the MNRF considers significant in Ontario (OMNR 2000), as well as criteria to identify these habitats within Ecoregion 7E where the Study Areas are located (MNRF 2015a). The SWHTG groups SWH into four broad categories: seasonal concentration areas; rare vegetation communities and specialized wildlife habitat; habitats of SCC; and animal movement corridors. Potential SWH types were screened based on NRSI's knowledge of the natural heritage features within the Study Areas and using the discrete significance criteria established by the MNRF (2015a).

In total, 14 Candidate SWH types were identified as potentially occurring within the On-site and Off-site Study Areas, pending further assessment during site investigations. The full results of the Preliminary SWH Screening are presented in Appendix B of the approved ToR, including rationale as to why SWH types are considered "Candidate SWH" or "Not Present". Targeted surveys for candidate SWH types were undertaken by NRSI biologists in 2022, and the Preliminary SWH Screening was updated to incorporate survey results. A Final SWH Screening is provided in **Appendix C**.

3.1.3 Relevant Policies, Legislation and Planning Studies

To inform the significance of natural features across the On-site and Off-site Study Areas, relevant policies and legislation are summarized in **Table 3-2**.

Table 3-2. Relevant Policies, Legislation and Planning Studies

Policy/Legislation/Planning Study	Description	Project Relevance
Provincial & Federal Legislation		
Ontario Environmental Assessment Act, 1990	• The provincial *Ontario Environmental Assessment Act* (*OEAA*) was issued in 1990 and outlines a planning and decision-making process to evaluate the potential environmental impacts of a proposed undertaking. Proponents must document their planning and decision-making process and submit results from the environmental assessment to the Minister for approval. • The purpose of the *OEAA* is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation, and wise management of the environment in Ontario.	• In accordance with Ontario Regulation 101/07: Waste Management Projects under the *OEAA* and the Guide to Environmental Assessment Requirements for Waste Management Projects, the TCEC Landfill Optimization Project is designated as an undertaking to which the *OEAA* applies. • The natural environment, as defined for the EA, includes the atmospheric environment, geology and hydrogeology, the surface water environment, and the ecological environment.

Endangered Species Act, 2007	• The provincial *Endangered Species Act, 2007* (*ESA*), prohibits killing, harming, harassing, or capturing Species at Risk (SAR) and protects their habitats from damage and destruction.
	• Species listed as Endangered or Threatened in Ontario Regulation (O. Reg.) 230/08 receive general habitat protection under the ESA.
		• No habitat for SAR has been confirmed within the On-site or Off-site Study Areas. However, potential habitat has been identified for the following SAR listed as Endangered or Threatened:
		  • Eastern Hog-nosed Snake
		  • Eastern Small-footed Myotis
		  • Little Brown Myotis
		  • Northern Myotis
		  • Tri-colored Bat

Fish and Wildlife Conservation Act, 1997	• The provincial *Fish and Wildlife Conservation Act* (*FWCA*) provides protection for certain bird species not protected under the MBCA (i.e., raptors), as well as most furbearing mammals and their dens or habitual dwellings.	• Several raptor and furbearing mammal species protected under the *FWCA* may be present within the On-site or Off-site Study Area.

Conservation Authorities Act, 1990	• Regulations of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under the provincial *Conservation Authorities Act* (*CAA*) aim to ensure public safety and protect property with respect to natural hazards and safeguard watershed health by preventing pollution and destruction of sensitive environmental areas such as wetlands, shorelines, and watercourses.
	• Ontario Regulation (O. Reg.) 171/06 is the St. Clair Region Conservation Authority (SCRCA) Regulation
		• Features regulated by the SCRCA under O. Reg. 171/06 of the *CAA* within the On-site and Off-site Study Areas include:
		  • Unevaluated wetlands
		  • Permanent and intermittent agricultural drains and naturalized watercourses

Fisheries Act, 1985	• The federal *Fisheries Act* was amended in 2019 to include new protections for fish and fish habitat in the	• Several tributaries within the Off-site Study Area provide perennial or seasonal direct habitat for fish:

Table 3-2. Relevant Policies, Legislation and Planning Studies

Policy/Legislation/Planning Study	Description	Project Relevance
	form of standards, codes of practice, and guidelines for projects near water. • The modernized *Fisheries Act* provides protection for all fish and fish habitat and prohibits the death of fish or the harmful alteration, disruption, or destruction (HADD) of fish habitat. • The Department of Fisheries and Oceans Canada's (DFO) Fish and Fish Habitat Protection Program ensures compliance with relevant provisions under both the *Fisheries Act* and the federal *Species at Risk Act* for aquatic species. The program reviews proposed works, undertakings and activities that may impact fish and fish habitat. • Works that are proposed in and around certain types of waterbodies may not require DFO review. Likewise, if proponents can follow all specified measures to protect fish and fish habitat outlined by DFO, review may not be necessary.	• Kersey Drain (Brown Creek) and its tributaries Cameron Drain and Burchill Drain • Gilliland-Geerts Drain
Species at Risk Act, 2002	• The federal *Species at Risk Act* (*SARA*) applies to all species listed on Schedule 1 that are on federal lands, are an aquatic species (e.g., fish, mussels, crayfish), or species of migratory bird protected by the federal *Migratory Birds Convention Act* (*MBCA*). • Schedule 1 is the official list of Species at Risk in Canada.	• Several migratory bird species listed on Schedule 1 of the *SARA* may be present within the On-site or Off-site Study Area.
Migratory Birds Convention Act, 1994	• The federal *Migratory Birds Convention Act* (*MBCA*), which came into force in 1994, protects migratory game birds, insectivorous birds, and several other migratory non-game birds from persecution in the form of harassment. • The schedule of site alteration work must consider MBCA windows, with timing of the breeding bird season typically occurring between April 1 and August 31 as described by the Canadian Wildlife Service (CWS); however, this is a guideline, since the MBCA applies to nesting bird species at any time. • "Incidental take" is considered illegal, except for a permit obtained by the CWS.	• Several migratory bird species protected under the *MBCA* may be present within the On-site or Off-site Study Area.

Table 3-2. Relevant Policies, Legislation and Planning Studies

Policy/Legislation/Planning Study	Description	Project Relevance
Provincial & Municipal Policies		

County of Lambton Official Plan (2020)	• The County's general environmental policies are detailed in Chapter 8 of the Official Plan.	• Natural features and habitats within the On-site and Off-site Study Areas that may have implications under the County Official Plan include:
		  • Potential Habitat of Endangered and Threatened Species
		  • Confirmed and candidate Significant Wildlife Habitat (SWH)
		  • Fish Habitat

Township of Warwick Official Plan (2021)	• The Township's most recent Official Plan outlines current policies for the protection of natural areas and natural features within its boundaries.
	• General natural environmental policies are detailed in Part B, Section 10.
		• Natural features and habitats within the On-site and Off-site Study Areas that may have implications under the County Official Plan include:
		  • Significant Woodlands
		  • Potential Habitat of Endangered and Threatened Species
		  • Confirmed and candidate Significant Wildlife Habitat (SWH)
		  • Fish Habitat

3.2 Terrestrial Field Surveys

A comprehensive field survey program was undertaken by NRSI biologists in 2022 to characterize the natural features and their ecological functions within the On-site and Off-site Study Areas. Access to lands within the Off-site Study Area was requested by WM in late March 2022. Properties where access was granted for the purpose of completing ecological field surveys are shown on **Figure 3-1**. Where direct property access was not available, NRSI biologists completed investigations from the property boundary or the road right-of-way (ROW).

In total, 28 site visits were conducted between March 29, 2022 and December 12, 2022. The dates and weather conditions of each field survey are outlined in **Table 3-3**. Surveys were undertaken in accordance with relevant provincial and local guidance documents. Terrestrial monitoring locations are shown on **Figure 3-1**.

3.2.1 Vegetation Surveys

Natural vegetation communities within the On-site and Off-site Study Areas were mapped using the Ecological Land Classification (ELC) System for Southern Ontario (Lee et al. 1998). Details on the vegetation communities were recorded, including species composition, dominance, and uncommon species or features.

A three-season vascular flora inventory was completed within each vegetation community. A comprehensive area search was undertaken and all observed plant species were recorded during spring (May 17, 19, and June 7, 2022), summer (August 25, 26, 2022), and fall (October 3, 4, 2022) surveys. Any rare species or vegetation communities identified and their location(s) were recorded.

Wetland boundaries and woodland driplines were delineated within the On-site Study Area only. Wetland boundary delineation was completed in accordance with the Ontario Wetland Evaluation System (OWES; MNRF 2014). Woodlands were delineated based on the dripline. A site visit with SCRCA (K. Smith) and County of Lambton (L. Esteves) staff was completed on October 5, 2022 where natural feature boundaries delineated by NRSI biologists within the On-site Study Area were reviewed and confirmed by agency staff.

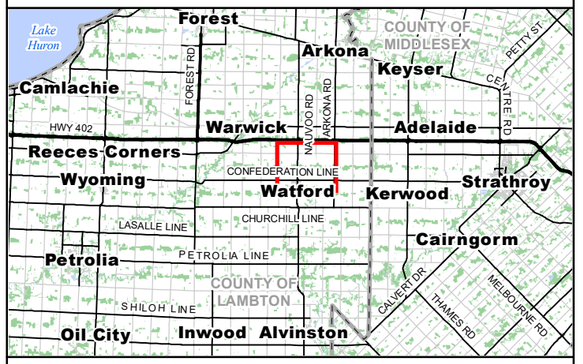
3.2.2 Avifaunal Surveys

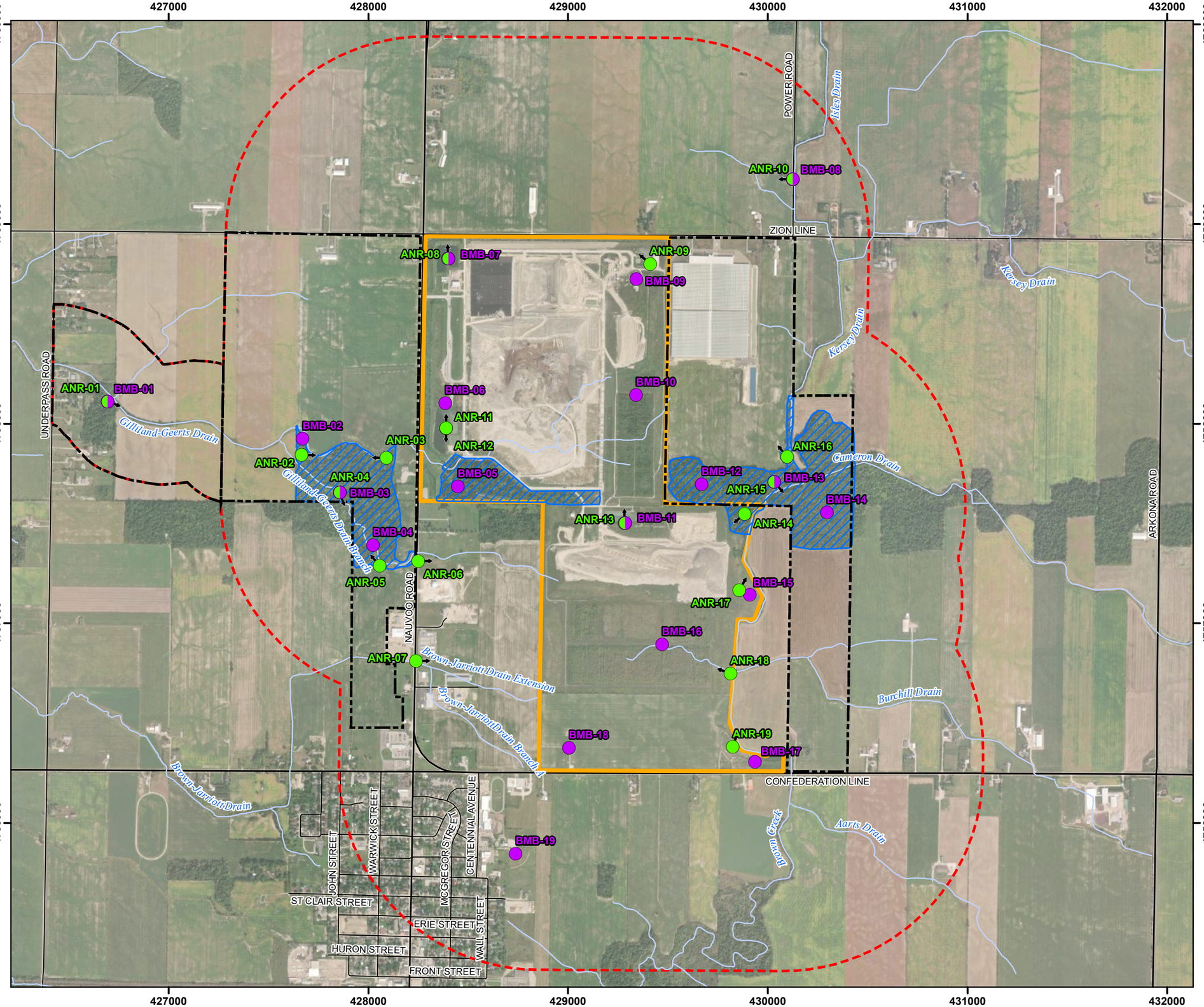
NRSI biologists completed two early morning breeding bird surveys, consisting of 10-minute point counts at 19 stations across the On-site and Off-site Study Areas **().** Area searches were also used to document bird species as biologists travelled between monitoring stations. The first survey was completed on May 31 and June 3, 2022. The second survey was completed on June 28, 2022. Surveys were conducted in accordance with Ontario Breeding Bird Atlas (OBBA 2021) and Ontario Forest Bird Monitoring Program (Cadman et al. 1998) methodology.

Figure 3-1

Twin Creeks Environmental Centre Optimization Project

Terrestrial Monitoring Stations





Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Property Access (permission to enter private property was granted by landowners for the purposes of 2022 ecological field surveys)
- Primary Road
- Secondary Road
- Drain Network
- Breeding Bird Station (BMB)
- Anuran Call Station (ANR)
- Bat Habitat Assessment

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Aquatic, Terrestrial and Wetland Biologists

Project: 2538
Date: October 18, 2023

NAD83 - UTM Zone 17
Size: 11x17"
1:19,000

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0 400 800 1,200 Meters

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Table 3-3. Summary of 2022 Field Surveys

Survey Type	Date (2022)	Start and End Time (24h)	Temp. (°C)	Wind Speed (Beaufort Scale)	Cloud (%)	Precipitation	Observer(s)
Terrestrial Field Surveys							
General Site Reconnaissance and Habitat Assessment	March 29	0900h – 1500h	-5	1	50	None	D. Frey, K. Richter
General Site Reconnaissance and Habitat Assessment & Daytime Anuran Call Surveys	April 5	1130h – 1430h	5-12	1	60-100	None	K. Richter, H. Fotherby
	April 7	1000h – 1545h	8	3	70	None	D. Frey, N. Grant
Daytime Anuran Call Survey & Bat Habitat Assessment	April 22	1000h – 1330h	6	2	30	None	D. Frey, T. Brenton
Bat Habitat Assessment	April 20	1100h – 1700h	3	1	20	None	D. Frey, J. Weber
	December 5	0900h – 1645h	3	2	50	None	J. Birtch, J. Richard
	December 12	0900h – 1445h	-1	2-3	100	None	J. Birtch, T. Brenton,
Evening Anuran Call Surveys	April 12	2040h – 2310h	8-13	1-5	10-75	None	J. Pedersen, S. Hoffstetter, S. Burgin, A. Timmerman
	May 12	2110h – 0000h	13-18.5	0-3	10	None	J. Pedersen, C. Kemp, J. Lance, E. Krauss
	June 13	2135h – 0000h	18-23	0-3	100	None-Light Rain	D. Frey, J. Dertinger, J. Pedersen, J. Birtch
Turtle Basking Surveys	April 29	1215h – 1400h	10-12	2	0	None	T. Brenton
	May 9	1140h – 1330h	19-20	4-5	0	None	A. Cantwell, C. Shaw
	May 13	0835h – 1105h	21-24	4	30	None	H. Manoharan
	May 17	1115h – 1310h	11-13	4	60	None	D. Pomezanski
	May 20	0830h – 1010h	19-23	1-4	40	Rain	N. Grant
Breeding Bird Surveys	May 31	0555h – 0930h	20-25	1	0-20	None	K. Richter, N. Sawatzky
	June 3	0645h – 0930h	9-16	0-2	0	None	N. Miller
	June 28	0600h – 0810h	6-15	2-3	0	None	K. Hoo, M. Sanderson
Ecological Land Classification and 3-Season Vascular Flora Inventories	May 17	0930h – 1630h	12-16	0-4	30-70	None	K. Richter, J. Weber
	May 19	1040h – 1700h	23	3	4	None	J. Weber, S. Munoz
	June 7	1120h – 1730h	14	3	100	Rain	T. Brenton, J. Weber
	August 25	0935h – 1800h	23	1	10	None	K. Richter, T. Sieg
	August 26	0855h – 1815h	21	1-2	100	Rain	
	October 3	1050h – 1800h	9	1	10	None	K. Richter, J. Weber
	October 4	0900h – 1745h	2	1	10	None	K. Richter, J. Weber

Table 3-3. Summary of 2022 Field Surveys

Survey Type	Date (2022)	Start and End Time (24h)	Temp. (°C)	Wind Speed (Beaufort Scale)	Cloud (%)	Precipitation	Observer(s)
Woodland Dripline & Wetland Boundary Delineation and Agency Review	October 5	0800h – 1245h	10	2	10	None	K. Richter (NRSI), J. Weber (NRSI), L. Esteves (County of Lambton), K. Smith (SCRCA)
Aquatic Field Surveys							
Aquatic Habitat Assessment & Fish Community Assessment	October 24	1250h – 1400h	12	2-3	10	None	S. Catry, J. Nene
	October 25	0810h – 1450h	12-21	1-2	40	None	

During initial site reconnaissance visits completed in late March and early April 2022, NRSI biologists completed a habitat characterization that determined that suitable open grassland habitat for the SAR Eastern Meadowlark (*Sturnella magna*) and Bobolink (*Dolichonyx oryzivorus*) were unlikely to occur. A third breeding bird survey utilizing walking transects, in accordance with the methodologies outlined in the Bobolink and Eastern Meadowlark Survey Methodology (MNRF 2015b), was therefore not undertaken. These species and their preferred habitats are discussed further in **Section 4.1.3.1.**

During all site visits, including breeding bird surveys, general observations of the abundance and activity of gulls (Laridae family) were documented specifically within the On-site Study Area.

3.2.3 Herpetofaunal Surveys

3.2.3.1 Anurans

NRSI biologists completed three evening anuran (frog and toad) call surveys, consisting of 3-minute point counts at 19 stations across the On-site and Off-site Study Areas where candidate amphibian breeding habitat was identified during initial site reconnaissance visits (**Figure 3-1**). Surveys were completed on April 12, May 12, and June 13, 2022 when ambient evening air temperatures were a minimum of 8°C, 13°C, and 18°C, respectively. Surveys were conducted at least half an hour after sunset and in accordance with the methodology outlined in the Marsh Monitoring Program protocol (BSC 2009).

NRSI biologists also completed three daytime anuran call surveys, in conjunction with other field work, to determine the presence of the SCC Western Chorus Frog (*Pseudacris triseriata* pop. 2). Surveys were completed during the species breeding season on April 5, April 7, and April 22, 2022 when ambient air temperature was at least 5°C. Daytime anuran call surveys were conducted between 1000h and 1800h and followed the methodologies outlined in the Survey Protocol for 2020 Western Chorus Frog Long-Term Monitoring Program (Blazing Star Environmental 2020).

3.2.3.2 Reptiles

Reptile surveys followed a phased approach. Phase 1 involved a habitat assessment completed prior to the spring reptile emergence period to determine if suitable habitat for significant snake and turtle species is present. NRSI biologists undertook the habitat assessment on April 5 and 7, 2022 during initial site reconnaissance visits. Natural features were reviewed and available habitats were compared with those preferred by the target species, specifically the SAR Eastern Hog-nosed Snake (*Heterodon platirhinos*) and the SCC Snapping Turtle (*Chelydra serpentina*).

The results of the Phase 1 habitat assessment indicated that summer foraging and thermoregulation habitat for Eastern Hog-nosed Snake may be present in the woodlands within the On-site and Off-site Study Areas. In keeping with the methods

outlined in the Survey Protocol for Ontario's Species at Risk Snakes (MNRF 2016a), no further targeted surveys were undertaken for this species due to its cryptic nature and the difficulty of detecting individuals within suitable habitats. Eastern Hog-nosed Snake has been assumed present within the Study Areas, and an analysis of candidate habitat is provided in **Section 4.1.5**.

The results of the Phase 1 habitat assessment indicated that marginal overwintering habitat for Snapping Turtle may be present, however suitable turtle nesting habitat was not observed. Phase 2 therefore consisted of spring turtle emergence and basking visual encounter surveys only; nest and nesting surveys were not required.

NRSI biologists completed five turtle emergence and basking surveys, consisting of visual encounter surveys at five ponds within the On-site and Off-site Study Areas (**Figure 3-1**). Surveys were completed between April 29 and May 20, 2022, commencing once ice cover on the ponds had melted. Surveys were conducted during the daytime when weather conditions were suitable for turtle basking, in accordance with the Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c); this survey protocol is also appropriate for assessing the presence of Snapping Turtle.

Reptile area searches were also carried out in tandem with all other 2022 surveys conducted by NRSI biologists during suitable weather conditions within the reptile active season (April to October). During peak reptile activity periods (e.g., spring emergence, nesting), searches were expanded to include driving surveys that documented any reptiles on roadways in the Off-site Study Area. These area searches and driving surveys informed the general abundance and diversity of reptile species in the On- and Off-site Study Areas.

3.2.4 Insect Surveys

Insect area searches focusing on butterflies, dragonflies, and damselflies were carried out in tandem with 2022 breeding bird surveys in June, and vascular flora inventories in August. NRSI biologists conducted these area searches during suitable weather conditions to determine the presence of Monarch (*Danaus plexippus*) and its larval food plants (Milkweed, *Asclepias* spp.).

3.2.5 Mammal Surveys

3.2.5.1 Bats

Bat habitat assessments were completed by NRSI biologists during leaf-off conditions, based on guidance received from the MECP in 2022 that a separate assessment during leaf-on conditions is no longer required to adequately assess potential SAR bat habitat.

Plot-based bat habitat assessments were conducted on April 20 and 22, 2022 in the forested ecosites located in the eastern portions of the On-site and Off-site Study Areas (**Figure 3-1**), and on December 5 and 12, 2022 in the forested ecosites located in the western portions of the Study Areas (**Figure 3-1**). The results of the habitat

assessments were used to analyze the presence of suitable roosting habitat (e.g., cavity trees, leaf clusters) that may be used by SAR bats, as well as Bat Maternity Colony SWH. Surveys were conducted in accordance with the Survey Protocol for Species at Risk Bats within Treed Habitats (MNRF 2017), as well as recent guidance from the MECP including the Survey Protocol for Maternity Roost Surveys (Forests/Woodlands) (MECP 2022a) and the Bat Survey Standards Note (MECP 2022b).

Plots with a fixed radius of 12.6 m (equating to an area of 0.05 ha) were randomly selected within each contiguous forested ecosite. A minimum of 10 plots for ecosites ≤10 ha were surveyed, and for larger ecosites an additional plot per hectare was added up to a maximum of 35 plots (MECP 2022a). The number of standing live or dead trees with cracks, crevices, hollows, cavities, and/or loose or naturally exfoliating bark that could provide suitable roosting habitat for bats, was documented within each plot. The presence of leaf clusters with suitable roosting habitat for Tri-colored Bat (*Perimyotis subflavus*) was also documented. All trees within plots, regardless of size, were assessed for bat habitat. Information on candidate roost trees was documented and included the location, tree species, diameter at breast height (DBH), decay class (Watt and Caceres 1999), and the number, height, and type (e.g., cavity, crevice, sloughing bark, leaf cluster) of suitable roost sites.

3.2.5.2 Other Mammals

During all site visits, general observations of the abundance and activity of all mammal species was documented especially within the On-site Study Area. A particular focus was placed on identifying the presence and type of predatory mammals. Direct observations, as well as signs such as dens, tracks, scat, scrapes, and nests were documented.

3.2.6 Other Surveys

In addition to the targeted surveys described above, all wildlife species were recorded during field surveys. Any features that may be indicative of SWH or habitat for SAR were assessed in detail, photographed, and georeferenced. General assessments of habitat connectivity and ecological linkage areas were also completed during surveys. When time permitted following the completion of scheduled field work, NRSI biologists completed driving surveys on Nauvoo Road, Zion Line, Arkona Road, Confederation Line, and Underpass Road. During driving surveys, all wildlife observations (live sightings, sign, and road mortalities) were documented.

3.3 Aquatic Field Surveys

Watercourse features assessed within the Bear Creek Headwaters subwatershed included the Gilliland-Geerts Drain, Gilliland-Geerts Drain Branch, and Brown-Jarriott Drain Extension. Features assessed within the Brown Creek subwatershed included the Kersey Drain, Cameron Drain, Brown Creek, and Burchill Drain.

3.3.1 Aquatic Habitat Assessments

NRSI biologists undertook detailed aquatic habitat assessments on October 24 and 25, 2022 to characterize the existing conditions of the watercourse features within the On-site and Off-site Study Areas as shown on **Figure 3-2**. Detailed assessments were completed for eight aquatic habitat areas; general observations were also recorded at an additional six roadside survey locations (**Figure 3-2**).

Aquatic habitat characterization followed a modified version of the standard Ontario Stream Assessment Protocol (OSAP) methodology (Stanfield 2017). The following information was recorded during the surveys:

- General characteristics and channel morphology (e.g., bankfull and wetted widths, bank height, riffle/pool characteristics);
- Substrate composition;
- Flow conditions and water depths;
- In-stream and riparian vegetation;
- Location and type of fish habitat available, if present (e.g., refuge areas, nesting sites, areas, and types of food supply including overhanging vegetation, woody debris);
- Adjacent land use and slopes;
- Indications of groundwater discharge; and
- In situ water quality measurements (e.g., water temperature, conductivity, pH, and turbidity).

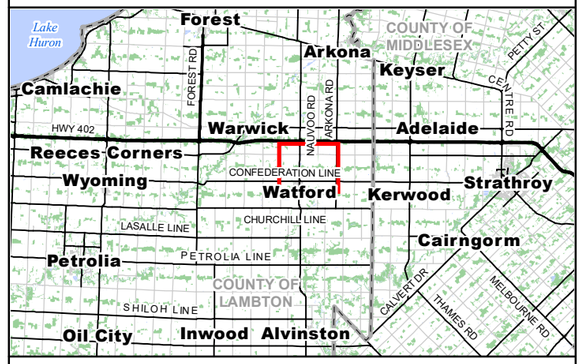
3.3.2 Fish Community Surveys

NRSI biologists completed fish community surveys simultaneously with aquatic habitat assessments in October 2022. Fish community sampling was undertaken with an electrofishing backpack unit in accordance with single-pass screening electrofishing methodology described in Section 3, Module 1 of OSAP (Stanfield 2017). This protocol is designed to provide a comprehensive fish species list for a site, characterize the fish community, and provide a qualitative assessment of species abundance. Surveys were conducted under the authority of a License to Collect Fish for Scientific Purposes (License No. 1100316) issued to NRSI on March 23, 2022 by the MNRF Aylmer District Office.

Figure 3-2

Twin Creeks Environmental Centre Optimization Project

Aquatic Monitoring Stations



Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Roadside Assessment Location
- Aquatic Habitat Area (AHA) and Electrofishing Monitoring Station (EMS)
- Primary Road
- Secondary Road

Stream Network:

Department of Fisheries and Oceans (DFO) Drain Classification

- Closed/Tiled
- Not Rated
- Class E - Permanent Flows, Warmwater Thermal Regime
- Class F - Intermittent Flows
- Natural Watercourse (Not Rated)

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Aquatic, Terrestrial and Wetland Biologists

Project: 2538
Date: October 18, 2023

NAD83 - UTM Zone 17
Size: 11x17"
1:19,000

0 400 800 1,200 Meters

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Fish community composition was sampled at eight electrofishing monitoring stations located in the same aquatic habitat areas described in **Section 3.3.1**. A Smith-Root electrofishing backpack (Model LR-24B), dip nets, and an aerated portable container were used. NRSI biologists began sampling downstream within each watercourse and moved upstream, against the flow. Different types of habitats (e.g., riffles, pools, and runs) were targeted within the watercourse to fully assess the fish community present. All fish collected were identified to species, enumerated, and released alive outside of the sampling area shortly after capture within the watercourse. Water quality conditions, electrofishing backpack settings, and the total number of shocking seconds are summarized for each electrofishing monitoring station in **Table 3-4**.

Table 3-4. Electrofishing Backpack Settings, Shocking Seconds, and Water Quality During 2022 Fish Community Surveys

Monitoring Station	Approx. Reach Length (m)	Voltage (V)	Pulsating Frequency (Hz)	Amperes (A)	Shocking Seconds	Air Temp. (˚C)	Water Quality Measurements			
							Water Temp. (˚C)	pH	Conductivity (mS)	Total Dissolved Solids (ppt)
EMS-001	245	150-200	90	3.1-4.9	1388	12.0	10.3	7.72	1.14	0.61
EMS-002	730	150	90	3.1-4.9	845	18.0	9.6	7.03	1.30	0.67
EMS-003	200	150	90	3.1-4.0	222	19.5	12.5	7.68	0.72	0.36
EMS-004	265	150	90	3.1-3.7	187	20.0	11.6	7.82	0.77	0.40
EMS-005	400	200	90	4.0-5.2	274	21.0	13.6	7.64	1.01	0.50
EMS-006	690	150-200	90	3.0-4.7	DNR	22.0	14.4	7.37	2.02	1.01
EMS-007	600	150-200	90	DNR	232	20.0	13.0	7.28	0.71	0.75
EMS-008	315	150-200	90	3.2-4.1	113	16.0	12.1	7.31	DNR	DNR

4 Description of Existing Conditions

The On-site and Off-site Study Areas are located on the Lambton Clay Plain, which is relatively flat with localized undulating topography (Chapman and Putnam 1984). The land generally drains to the southwest towards northern Lake Erie. The soils of the Lambton Clay Plain exhibit moderate drainage compared to similar but slower-draining clay plains in Southern Ontario. Soils within the Study Areas are predominantly beveled till plains and clay plains, and consist largely of silt and Whittlesey clay (Chapman and Putnam 1984, SCRCA 2018a, b).

The Study Areas are located within the jurisdiction of the SCRCA, which includes the Sydenham River watershed and smaller watersheds draining directly into southern Lake Huron, the St. Clair River, and northeastern Lake St. Clair. The majority of lands within the Study Areas drain southwest towards the St. Clair River and are within the Bear Creek Headwaters subwatershed. The southeastern portions of the Study Areas drain south towards the Sydenham River and are within the Brown Creek subwatershed. Moraines in the vicinity of the Study Areas, including the Wyoming Moraine to the northwest and the Seaforth Moraine to the southeast, give rise to shallow, unconfined aquifers that provide groundwater within the Bear Creek Headwaters and Brown Creek subwatersheds (SCRCA 2018a, b). The majority of the lands within the Study Areas are under agricultural use; due to the prevalence of moisture-retentive clay soils, fields are extensively tile drained.

4.1 Terrestrial Ecosystems

4.1.1 Vegetation

4.1.1.1 Vegetation Communities

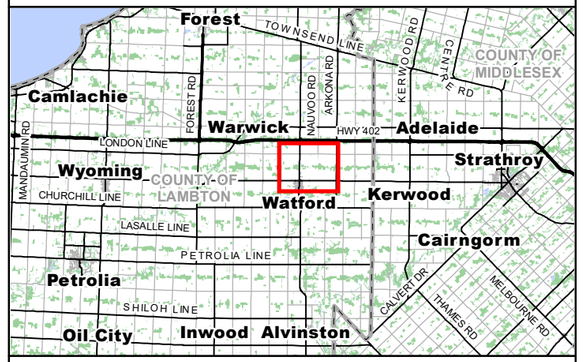
Overall, the assemblage of vegetation communities found within the Study Areas is moderately diverse, with a total of four natural (non-cultural) forest types and four wetland community types, in addition to culturally-influenced communities such as plantations, thickets, and meadows.

The lands within the On-site Study Area are comprised of active landfill areas, sedimentation ponds, active and inactive poplar (*Populus* spp.) plantation phytoremediation systems, soil storage and maintenance facilities, a leachate storage area, and agricultural lands. Natural vegetation communities within the On-site Study Area are generally limited. As shown on **Figure 4-1**, a Fresh – Moist Shagbark Hickory Deciduous Forest (FOD9-4) is located in the central-west portion of the site, corresponding to the Significant Woodland discussed in **Section 4.1.2.1** that extends off-site to the south. A 10 m-wide pedestrian walking trail bisects this woodlot. In the central-east portion of the site, a Swamp Maple Mineral Deciduous Forest (SWD3-3) extends into the On-site Study Area, although the majority of this community is located

Figure 4-1

Twin Creeks Environmental Centre Optimization Project

Vegetation Communities



Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Railway
- Primary Road
- Secondary Road
- Residential / Commercial Area
- Ecological Land Classification (ELC)
- Wetland Boundary (NRSI 2022)
- Woodland Dripline (NRSI 2022)

Stream Network:
Department of Fisheries and Oceans (DFO) Drain Classification

- Closed/Tiled
- Not Rated
- Class E - Permanent Flows, Warmwater Thermal Regime
- Class F - Intermittent Flows
- Natural Watercourse (Not Rated)

(Ag) Agriculture
(CUM1) Mineral Cultural Meadow Ecosite
(CUP) Plantation
(CUP2) Mixed Plantations
(CUT1) Mineral Cultural Thicket Ecosite
(CUW1) Mineral Cultural Woodland Ecosite
(FOD) Deciduous Forest
(FOD4-1) Dry - Fresh Beech Deciduous Forest Type
(FOD6-5) Fresh - Moist Sugar Maple - Hardwood Deciduous Forest Type
(FOD9-3) Fresh - Moist Bur Oak Deciduous Forest Type
(FOD9-4) Fresh - Moist Shagbark Hickory Deciduous Forest Type
(MAM) Meadow Marsh
(MAM2-10) Forb Mineral Meadow Marsh Type
(MAM2-2) Reed-canary Grass Mineral Meadow Marsh Type
(OA) Open Water
(SWD) Deciduous Swamp
(SWD3-3) Swamp Maple Mineral Deciduous Swamp Type
(SWT) Thicket Swamp
(SWT2-2) Willow Mineral Thicket Swamp Type
(SWT2-5) Red-osier Dogwood Mineral Thicket Swamp Type
(SWT2-8) Silky Dogwood Mineral Thicket Swamp Type

- ELC Inclusion

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Project: 2538
Date: October 18, 2023

NAD83 - UTM Zone 17
Size: 11x17"
1:19,000

0 200 400 600 800 1,000 1,200 Meters

N

Path: X:\2538_TwinCreeksLandfillEA\NRSI_2538_Figure4-1_ELC_12K_2023_10_18_KB.mxd

in the Off-site Study Area (**Figure 4-1**). The SWD3-3 community drains south to a small (~1 ha) Reed-Canary Grass Mineral Meadow Marsh (MAM2-2). Cultural Meadow (CUM) and Cultural Mixed Plantation (CUP2) communities are also located in the On-site Study Area and have the potential to support ecological functions (**Figure 4-1**).

Lands within the Off-site Study Area are dominated by agricultural fields growing row crops, including corn, soybeans, and wheat. Interspersed throughout these areas of agricultural use are residential and commercial properties, a cemetery, woodlots, and natural areas surrounding agricultural drains and natural watercourses. Natural vegetation communities within the Off-site Study Area are a combination of forest, swamp, marsh, and thicket communities. Culturally-influenced thickets and meadows are also present. Most natural vegetation communities within the Off-site Study Area have been historically disturbed by anthropogenic activity to some extent. Despite this historical influence and fragmentation due to agricultural activities, areas with important ecological and hydrological functions remain; within the Study Areas, these include interior woodland habitat, locally important wetlands and surface water drainage features, wildlife movement and linkage opportunities, and habitats of significant species.

Vegetation communities in the On-site and Off-site Study Areas are detailed in **Table 4-1** where site access permitted a thorough examination of plant species and community characteristics; these communities have been assigned a refined ELC code and are numbered on **Figure 4-1** from (1) to (23). All communities, including those that were characterized at a courser level from the roadside or property boundaries, are shown on **Figure 4-1**.

4.1.1.2 Vascular Flora

In total, 278 species of vascular flora were observed by NRSI biologists within the On-site and Off-site Study Areas during inventories completed in 2022. A list of all plant species reported from the Study Areas is included in **Appendix D.**

Of the observed species, 30 are listed as regionally rare in Lambton County (Oldham 2017). A list of these significant plant species, and the vegetation communities they were observed in, is presented in **Table 4-2**. One of these significant plant species, Red Pine (*Pinus resinosa*), is assumed to have been planted as it occurs in a Mixed Plantation (CUP2) community with other planted species and is unlikely to be of natural origin. The majority of regionally rare plant species were observed in the Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) communities, in both the On-site and Off-site Study Areas.

Based on available records and the results of 2022 field surveys, three plant SAR and four plant SCC are reported from the vicinity of the Study Areas (Gartner Lee Ltd. 2004, iNaturalist, MNRF 2023). The results of the Final Significant Species Screening are provided in **Appendix B.**

Table 4-1. Vegetation Communities within the On-site and Off-site Study Areas

ELC Ecosite Type	ELC Description	Environmental Characteristics
Forest		
FOD4-1	Dry - Fresh Beech Deciduous Forest Type	A single Dry - Fresh Beech Deciduous Forest (FOD4-1) community is present within the Off-site Study area to the east of the TCEC: Vegetation Community (15) on **Figure 4-1**. The canopy and subcanopy of this community are dominated by American Beech (*Fagus grandifolia*), Shagbark Hickory (*Carya ovata*) and American Basswood (*Tilia americana*). The community contains an understorey dominated by Chokecherry (*Prunus virginiana*) and a ground layer comprised of Spotted Geranium (*Geranium maculatum*), Running Strawberry Bush (*Euonymus obovatus*), and Graceful Sedge (*Carex gracillima*). A well-used ATV trail network and evidence of logging and hunting activities are present.
FOD6-5	Fresh - Moist Sugar Maple - Hardwood Deciduous Forest Type	In total, four Fresh - Moist Sugar Maple - Hardwood Deciduous Forest (FOD6-5) communities are present within the Off-Site Study Area: Vegetation communities (4), (5), (17), and (21) on **Figure 4-1**. These communities are located in the woodlots to the east and west of the TCEC and are characterized by canopies of Sugar Maple (*Acer saccharum*), American Beech, Shagbark Hickory, and Black Maple (*Acer nigrum*), and subcanopies of Sugar Maple, Bitternut Hickory (*Carya cordiformis*) and Eastern Hop-hornbeam (*Ostrya virginiana*). These communities contain understories of Green Ash (*Fraxinus pennsylvanica*), Bitternut Hickory and Sugar Maple. The ground layers in these features are dominated by Spotted Geranium, Sedge species (*Carex* spp.), and Yellow Trout-lily (*Erythronium americanum*). FOD6-5 (4) contains Willow Mineral Thicket Swamp (SWT2-2) and Mineral Cultural Meadow (CUM1) inclusions along its northwestern boundary. Sandbar Willow (*Salix interior*), Heart-leaved Willow (*Salix eriocephala*), Gray Dogwood (*Cornus racemosa*), and Pale Dogwood (*Cornus obliqua*) comprise the SWT2-2 inclusion. The CUM1 inclusion contains a sparse understorey of Hawthorn species (*Crataegus* sp.) and Staghorn Sumac (*Rhus typhina*) and a groundcover dominated by Tall Goldenrod (*Solidago altissima*), Kentucky Bluegrass (*Poa pratensis*), and Reed Canary Grass (*Phalaris arundinacea*). A well-used ATV trail network and evidence of logging and hunting activities are present east of the Kersey Drain/Brown Creek within FOD6-5 (17). Other FOD6-5 communities are comparatively undisturbed: (4) and (5) are bisected by an older farm access laneway that does not appear to be in regular use; no motorized vehicle trails are apparent in (21).
FOD9-3	Fresh – Moist Bur Oak Deciduous Forest Type	A single Fresh – Moist Bur Oak Deciduous Forest (FOD9-3) community is present within the Off-site Study Area, along the riparian corridor of the Kersey Drain to the east of the TCEC: Vegetation Community (19) on **Figure 4-1**. This community contains a canopy of Bur Oak (*Quercus macrocarpa*) and American Elm (*Ulmus americana*) and a subcanopy of Manitoba Maple (*Acer negundo*), Green Ash, and Common Buckthorn (*Rhamnus cathartica*). The understorey of this community is comprised of Green Ash, Common Buckthorn and Gray

Table 4-1. Vegetation Communities within the On-site and Off-site Study Areas

ELC Ecosite Type	ELC Description	Environmental Characteristics
		Dogwood, and the ground layer is dominated by Garlic Mustard (*Alliaria petiolata*), Thicket Creeper (*Parthenocissus vitacea*), and Green Ash. A man-made Open Aquatic (OA) pond inclusion (of anthropogenic origin) is present within the FOD9-3 community, along with a small recreational cabin. In the immediate vicinity of the cabin, mowed lawn comprises the ground layer.
FOD9-4	Fresh - Moist Shagbark Hickory Deciduous Forest Type	In total, five Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) communities are present within both the On-site and Off-site Study areas; these communities are located both east and west of the TCEC: Vegetation Communities (1), (6), (9), (16), and (22) on **Figure 4-1**. The community within the On-site Study Area, FOD9-4 (9) contains a canopy of Shagbark Hickory, Bitternut Hickory, American Basswood, and American Elm. The subcanopy is comprised of Shagbark Hickory, Bitternut Hickory and Eastern Hop-hornbeam, and the understorey is dominated by Green Ash, Shagbark Hickory, Black Cherry (*Prunus serotina*) and Common Buckthorn. The ground layer in this community is dominated by a mix of Panicled Aster (*Symphyotrichum lanceolatum*), Sedge species, and Broad-leaved Enchanter's Nightshade (*Circaea canadensis*). A 10 m-wide pedestrian trail runs northwest to southeast within this community, creating a narrow gap in the canopy. Netting has been installed along the entire northern boundary of the forest to prevent loose debris from the landfill from drifting into the feature. The FOD9-4 communities within the Off-site Study Area are generally similar in species composition and characteristics. The community immediately south of the TCEC was surveyed from the edge of the feature where property access had been granted. The composition of this community closely resembles the above FOD9-4 (9) in the On-site Study Area, and the two communities were likely connected historically as they are separated by approximately 200 m of cleared land that has succeeded to a Cultural Meadow. This area corresponds to the location of a historical municipal landfill. The community immediately west Nauvoo Road, FOD9-4 (6), has a canopy dominated by Shagbark Hickory and American Elm, and a subcanopy dominated by Shagbark Hickory, American Elm, and Bitternut Hickory. The understorey of this community is dominated by Bitternut Hickory and Common Buckthorn. The ground layer is comprised of Spotted Geranium, Yellow Trout-lily, and Sedge species. The community immediately east of Underpass Road, FOD9-4 (1), has a canopy comprised of Shagbark Hickory, Red Oak (*Quercus rubra*) and American Basswood, and a subcanopy of Eastern Hop-hornbeam and Shagbark Hickory. The understorey of this community is dominated by Common Buckthorn and the ground layer contains a mix of Spotted Geranium, Running Strawberry Bush (*Euonymus obovatus*) and Green Ash. The communities east of the TCEC, FOD9-4 (16) and (22), exhibit a canopy of American Basswood, Shagbark Hickory, Sugar Maple, and Black Maple. The subcanopy is dominated by Shagbark Hickory, Sugar Maple, American Basswood and American Elm, and the understorey is comprised of Eastern Hop-hornbeam, Shagbark Hickory, and Green Ash. These communities have a ground layer dominated by Spotted Geranium, Sedge species, Yellow Trout-lily, and Running Strawberry Bush.

Table 4-1. Vegetation Communities within the On-site and Off-site Study Areas

ELC Ecosite Type	ELC Description	Environmental Characteristics
Wetland		
MAM2-2	Reed-Canary Mineral Meadow Marsh Type	A single Reed-Canary Mineral Meadow Marsh (MAM2-2) community with a Mineral Cultural Woodland (CUW1) inclusion is present within the On-site Study Area: Vegetation Community (13) on **Figure 4-1**. Reed Canary Grass dominates the community. A few patches of Broad-leaved Cattail (*Typha latifolia*) and Common Teasel (*Dipsacus fullonum*) are present, and Tall Goldenrod and Grass-leaved Goldenrod (*Euthamia gramnifolia*) are interspersed throughout. Shallow standing water was observed in the feature during spring, however dry conditions were observed during the dry summer months. The CUW1 inclusion contains a canopy of Bitternut Hickory and Shagbark Hickory, with a subcanopy dominated by Eastern Hop-hornbeam and lesser amounts of American Elm, White Ash (*Fraxinus americana*) and Hawthorn species. The understorey is comprised of a mix of tree and shrub species, including Gray Dogwood, Shagbark Hickory, Common Buckthorn, and Pale Dogwood. The ground layer is dominated by Tall Goldenrod and Grass-leaved Goldenrod.
MAM2-10	Forb Mineral Meadow Marsh Type	A single Forb Mineral Meadow Marsh (MAM2-10) community with a Silky Dogwood Mineral Thicket Swamp (SWT2-8) inclusion is present in the Off-site Study Area, within the woodlot immediately west of Nauvoo Road. These communities correspond to the flow path of the Gilliland-Geerts Drain Branch: Vegetation Community (7) on **Figure 4-1**. The MAM2-10 community contains dense ground cover of hydrophytic forbs and graminoids dominated by Panicled Aster, Fringed Sedge (*Carex crinita*), and multiple other Sedge species. The SWT2-8 inclusion is dominated by Pale Dogwood with a similar herbaceous groundcover of Panicled Aster, Fringed Sedge, and Spotted Jewelweed (*Impatiens capensis*).
SWT2-5	Red-osier Dogwood Mineral Thicket Swamp Type	A single Red-osier Dogwood Mineral Thicket Swamp (SWT2-5) community is present in the Off-site Study Area within the woodlot immediately west of Nauvoo Road and corresponding to the general location of the Gilliland-Geerts Drain Branch: Vegetation Community (3) on **Figure 4-1**. This community is dominated by Red-osier Dogwood (*Cornus sericea*), with an herbaceous groundcover comprised of Fringed Sedge, Panicled Aster and a mix of other hydrophytic herbs and forbs.
SWD3-3	Swamp Maple Mineral Deciduous Swamp Type	In total, three Swamp Maple Mineral Deciduous Swamp (SWD3-3) communities are present in the Off-site Study Area, and make up part of the woodlot to the east of the TCEC: Vegetation Communities (18), (20), and (23) on **Figure 4-1**. These communities contain a canopy of Freeman's Maple (*Acer x freemannii*), Red Maple (*Acer rubrum*) and Swamp White Oak (*Quercus bicolor*) and a subcanopy of Freeman's Maple, American Elm, and Red Maple. The understorey is composed of Freeman's Maple, Green Ash, and Wild Black Currant (*Ribes americanum*), and the ground layer is dominated by hydrophytic graminoids and forbs such as Fowl Manna-grass (*Glyceria striata*), Spotted Jewelweed and multiple Sedge species.

Table 4-1. Vegetation Communities within the On-site and Off-site Study Areas

ELC Ecosite Type	ELC Description	Environmental Characteristics
		A well-used ATV trail network and evidence of logging and hunting activities are present east of the Kersey Drain/Brown Creek within SWD3-3 (18). Other SWD3-3 communities, (20) and (23), are comparatively undisturbed.
MAM/CUM	Meadow Marsh/Cultural Meadow	A meadow marsh/cultural meadow complex (MAM/CUM) is present in the Off-site Study Area in an area corresponding to the general location of the Gilliland-Geerts Drain Branch east of Nauvoo Road: Vegetation Community (8) on **Figure 4-1**. As determined through a roadside investigation and the interpretation of aerial imagery, this feature contains a mixture of upland and lowland herbaceous vegetation. Two dense patches of Broad-leaved Cattail were observed immediately adjacent to Nauvoo Road and in a depressional area approximately 175m east of Nauvoo Road. These areas, as well as other locations within the complex, are assumed to contain standing water in the spring due to the presence of breeding anurans. Surface runoff from the lands east of Nauvoo Road likely accumulates in these locations before eventually draining to the MAM2-10 (7) community west of Nauvoo Road.
Cultural		
CUM1	Mineral Cultural Meadow Ecosite	In total, two Mineral Cultural Meadow (CUM1) communities are present within both the On-site and Off-site Study areas: Vegetation Communities (10) and (12) on **Figure 4-1**. CUM1 (10) is located within the Off-site Study Area, and characterizes a 40-50m gap between the On-site FOD9-4 (9) and an identical community Off-site to the south. It contains a sparse canopy of Eastern Cottonwood (*Populus deltoides*) and Black Walnut (*Juglans nigra*) and a subcanopy of Black Walnut and Green Ash. The understorey layer, which is similarly sparse, is dominated by Hawthorn species, Pale Dogwood and Gray Dogwood. The ground layer in this community is dominated by Tall Goldenrod, Panicled Aster and Smooth Brome (*Bromus inermis*). CUM1 (10) is the location of the Old Warwick Landfill, which has not been in use for decades. Where not buried, rusted metal and piles of concrete can be observed, however the community is now densely vegetated. CUM1 (12) is located in the eastern portion of the On-site Study Area, in between the Kersey Drain corridor and the soil storage and poplar plantation areas. The community is dominated by Smooth Brome and Goldenrod species including Canada Goldenrod (*Solidago canadensis*), Tall Goldenrod, and Grass-leaved Goldenrod. Patches of invasive Common Reed were observed in a few locations near the poplar plantation.
CUT1	Mineral Cultural Thicket Ecosite	A single Mineral Cultural Thicket (CUT1) community is present within the Off-site Study Area: Vegetation Community (2) on **Figure 4-1**. This community comprises the riparian corridor of the Gilliland-Geerts Drain in the western portion of the Off-Site Study Area. CUT1 (2) is characterized by a sparse canopy of Hawthorn species and Common Buckthorn, a sub-canopy of Common Buckthorn and Willow species (*Salix* spp.) and a ground layer of Fringed Loosestrife and Green Ash seedlings.
CUW1	Mineral Cultural Woodland Ecosite	A single Mineral Cultural Woodland (CUW1) community is present within the On-site Study Area: Vegetation Community (11) on **Figure 4-1**.

Table 4-1. Vegetation Communities within the On-site and Off-site Study Areas

ELC Ecosite Type	ELC Description	Environmental Characteristics
		CUW1 (11) is rapidly succeeding to a forest community following historical tree removals. This community contains a sparse canopy of Shagbark Hickory, American Elm, and Bitternut Hickory, and a dense subcanopy of Hawthorn species, Bitternut Hickory, and American Elm. The community also exhibits a dense, shrubby understorey of Shagbark Hickory, Common Buckthorn and Green Ash. The ground layer of this community is comprised of Panicled Aster, Sedge species, Green Ash, and Shagbark Hickory. An existing and active access road is present in the eastern portion of the community, and netting has been installed along its northern boundary to prevent loose debris from the landfill from drifting into the feature.
CUP2	Mixed Plantation	A single Mixed Plantation (CUP2) community is present in the southeastern corner of the On-site Study Area: Vegetation Community (14) on **Figure 4-1**. This community is comprised of young trees planted in rows as part of a small restoration area. Trees were generally less than 10m tall, and dominated by Silver Maple (*Acer saccharinum*), Norway Spruce (*Picea abies*), and Eastern White Pine (*Pinus strobus*). The understorey is comprised of American Elm and Green Ash, and groundcover species included a variety of grasses and forbs.

Table 4-2. Vascular Flora Listed as Rare in Lambton County (per Oldham 2017) Observed by NRSI biologists in 2022

Scientific Name	Common Name	SRank1	Location Observed2
Agrimonia parviflora	Swamp Agrimony	S4	FOD9-4 (6)
Allium tricoccum var. *tricoccum*	Wild Leek	S4	FOD9-4 (16)
Betula alleghaniensis	Yellow Birch	S5	FOD9-4 (9)
Bidens vulgata	Tall Beggarticks	S5	FOD9-4 (16)
Carex bromoides	Brome-like Sedge	S5	FOD4-1 (15), FOD9-4 (9), (16)
Carex digitalis	Slender Woodland Sedge	S4S5	FOD9-4 (6)
Carex lurida	Sallow Sedge	S4S5	FOD9-4 (9), (16) MAM2-10 (7), SWT2-5 (3)
Carex prasina	Drooping Sedge	S4	FOD4-1 (15)
Carex pseudocyperus	Cyperus-like Sedge	S5	MAM2-10 (7)
Claytonia caroliniana	Carolina Spring Beauty	S5	SWT2-5 (3)
Coptis trifolia	Goldthread	S5	FOD9-4 (16)
Dryopteris cristata	Crested Wood Fern	S5	FOD6-5 (4)
Dryopteris marginalis	Marginal Wood Fern	S5	FOD6-5 (4), FOD9-4 (6), (16)
Epifagus virginiana	Beechdrops	S5	FOD4-1 (15)
Epilobium coloratum	Purple-veined Willowherb	S5	FOD9-4 (9), MAM2-10 (7)
Floerkea proserpinacoides	False Mermaidweed	S4	FOD9-4 (16), SWD3-3 (18)
Fragaria vesca	Woodland Strawberry	S5	FOD4-1 (15), FOD9-4 (9), SWD3-3 (18), CUW1 (11)
Geum aleppicum	Yellow Avens	S5	FOD9-4 (6), CUW1 (11)
Hypericum punctatum	Spotted St. John's-wort	S5	FOD9-4 (16)

Table 4-2. Vascular Flora Listed as Rare in Lambton County (per Oldham 2017) Observed by NRSI biologists in 2022

Scientific Name	Common Name	SRank1	Location Observed2
Iris versicolor	Harlequin Blue Flag	S5	SWD3-3 (18)
Lobelia cardinalis	Cardinal Flower	S5	SWT2-5 (3)
Lobelia inflata	Indian-tobacco	S5	SWD3-3 (18)
Lysimachia thyrsiflora	Water Loosestrife	S5	FOD9-4 (9)
Mimulus ringens	Square-stemmed Monkeyflower	S5	SWT2-5 (3)
Packera aurea	Golden Ragwort	S5	FOD9-4 (16), SWD3-3 (18)
Persicaria sagittata	Arrow-leaved Smartweed	S4S5	FOD9-4 (9)
Pinus resinosa	Red Pine	S5	CUP2 (14)
Salix nigra	Black Willow	S4	FOD9-4 (9)
Solidago flexicaulis	Zigzag Goldenrod	S5	FOD6-5 (4), FOD9-4 (6)
Viola rostrata	Long-spurred Violet	S5	FOD6-5 (4)

[1] Provincial Rank (SRank): S2 – imperiled; S3 – vulnerable; S4 – apparently secure; S5 – secure.
[2] Vegetation communities are numbered as per Figure 4-1.

No plant SAR or SCC were observed by NRSI biologists during comprehensive, three-season vascular flora inventories within the On-site and Off-site Study Areas in 2022. In 1998 and 1999, Black Ash (*Fraxinus nigra*) was observed in the deciduous swamp (SWD3-3) that extends into the On-site Study Area during surveys completed by Gartner Lee Ltd. to inform the Warwick Landfill Expansion EA (Gartner Lee Ltd. 2004). The species was not observed by NRSI biologists in this location or elsewhere. Black Ash and other Ash trees (*Fraxinus* spp.) are threatened throughout their ranges due to Emerald Ash Borer (*Agrilus planipennis*), which may explain the species' absence from the deciduous swamp in 2022.

4.1.2 Designated Natural Areas

4.1.2.1 Significant Woodlands

Within the On-site and Off-site Study Areas, several treed vegetation communities have been designated as Significant Woodland in the Township of Warwick Official Plan Schedule "C" Natural Heritage (Township of Warwick 2021), as shown on **Figure 2-1**.

Ranging in size from approximately 16 ha to more than 60 ha in area, Significant Woodlands in the Study Areas are comprised of deciduous forest and swamp vegetation communities. The dripline of the Significant Woodland within the On-Site Study Area was delineated by NRSI biologists and reviewed by County of Lambton staff (L. Esteves) on October 5, 2022. This Significant Woodland dripline is shown on **Figure 4-1**, along with the dripline of the Significant Woodland immediately east of the On-site Study Area that was delineated and reviewed at the same time as part of a separate study.

Section 8.4.2 of the Lambton County Official Plan (2020) states:

"*Significant woodlands include any forested area that:*

- *a) is 2 hectares or greater in size,*
- *b) has woodland interior habitat (100 metres from all edges),*
- *c) is the largest woodland patch by landform or soil type,*
- *d) is the largest woodland patch occurring on a particular valleyland, or*
- *e) is 0.5 hectares or greater in size and*
  - *i) is located within 30 metres of another natural heritage feature specifically identified in the Map 2 feature inventory;*
  - *ii) provides linkage (a "stepping stone") between (is in a line between and within 120 metres of) two or more significant woodlands that are separated by more than 120 metres of each other;*
  - *iii) is located on or within 30 metres of a surface water feature,*
  - *iv) is located above a highly vulnerable aquifer or significant groundwater recharge area;*
  - *v) has unique woodland diversity – i.e., contains target communities for Ecodistrict 7E-2 that help to conserve the biodiversity of the Great Lakes region of Ontario as identified by The Great Lakes Conservation Blueprint (Henson et al. 2005);*

vi) has uncommon characteristics such as unique species composition; a rare vegetation community (NHIC provincial ranking of S1, S2, or S3); rare, uncommon, or restricted woodland plant species habitat; older woodlands, or larger tree size structure; or

vii) has high socio-economic, cultural, historic, or educational value as identified in a local official plan."

Significant Woodlands within the On-site and Off-site Study Areas are shown mapped on Township of Warwick Official Plan Schedule "C" Natural Heritage (Township of Warwick 2021), and shown on **Figure 2-1**. These woodlands are considered significant due to their large size (generally >10 ha), the presence of woodland interior habitat and key hydrologic features, their ecological linkage functions and potential to support a variety of significant plant and wildlife species, and the relative scarcity of forested areas in Lambton County.

4.1.2.2 Wetlands

Within the On-site and Off-site Study areas, several unevaluated and unmapped wetlands are present. Wetlands are comprised of deciduous and thicket swamps and meadow marsh vegetation communities and inclusions (**Figure 4-1**). No wetlands identified as Provincially Significant Wetland (PSW) are present in the Study Areas. The nearest PSW is the Warwick Conservation Area PSW, which is located more than 5 km northwest of the TCEC. The Warwick Conservation Area PSW is upstream of any watercourses connected to the Study Areas.

The Lambton County Official Plan (2020) defines a PSW as "*a natural feature evaluated by the Ministry of Natural Resources and Forestry using the Ontario Wetland Evaluation System and officially designated as a wetland of provincial significance*." A Locally Significant Woodland (LSW) is defined as "*a natural feature classified and listed as an "other" wetland by the Ministry of Natural Resources and Forestry through the Ontario Wetland Evaluation System, meaning it has not yet been evaluated to determine its level of significance or has been evaluated and determined to be a wetland that is not of provincial significance*." No PSW, non-PSW, or unevaluated wetland features are currently mapped by the MNRF within the On-site or Off-site Study Areas (MNRF 2023).

Wetland vegetation communities are present within the On-site and Off-site Study Areas, but as they are unevaluated and unmapped by MNRF, designation as PSW or LSW under official plan policies does not apply. However, all wetlands are regulated by the SCRCA through Ontario Regulation (O. Reg.) 171/06, "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses under the provincial *Conservation Authorities Act*, R.S.O. 1990.

Wetland features within the On-site and Off-site Study Area provide ecological and hydrological functions that will require consideration and protection as appropriate. Important ecological functions documented by NRSI biologists during 2022 field surveys are summarized in the sections below.

4.1.3 Wildlife and Wildlife Habitat

4.1.3.1 Avifauna

According to available data from background information sources and this study, 124 bird species are reported from the vicinity of the Study Areas (Gartner Lee Ltd. 2004, BSC et al. 2006, MNRF 2023, eBird 2023, iNaturalist 2023). In total, 84 bird species were observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. The majority of species observed are common in southern Ontario and have stable populations. A list of all bird species reported from the Study Areas is included in **Appendix E**.

In total, 59 bird species were observed exhibiting evidence of breeding within the On-site and Off-site Study Areas. Possible or probable evidence of breeding was indicated by observations including (but not limited to) singing males, courtship displays, or the presence of the species within a permanent territory. Confirmed breeding evidence was indicated by observations such as adults carrying food or occupying a nest, nests with eggs or young, or the presence of fledged young.

A similar number of species were observed exhibiting evidence of breeding within the On-site Study Area (42 species) compared to the Off-site Study Area (44 species). More species were confirmed as breeding within the On-site Study Area (9 species) compared with the Off-site Study Area (6 species) during breeding bird surveys. **Table 4-3** provides a summary of the species with confirmed breeding habitat within the Study Areas.

Based on available records and the results of 2022 field surveys, six (6) bird SAR and eight (8) bird SCC are reported from the vicinity of the Study Areas (Gartner Lee Ltd. 2004, BSC et al. 2006, MNRF 2023, eBird 2023, this study). The results of the Final Significant Species Screening are provided in **Appendix B.**

During 2022 field surveys, NRSI biologists observed three bird SAR, and six bird SCC. Bird SAR observed within the On-site Study Area included Chimney Swift (*Chaetura pelagica*), Bobolink (*Dolichonyx oryzivorus*), and Bank Swallow (*Riparia riparia*). No bird SAR were observed within the Off-site Study Area. Bird SCC observed within the On-site Study Area included Eastern Wood-Pewee (*Contopus virens*) and Barn Swallow (*Hirundo rustica*). Bird SCC observed within the Off-site Study Area included Eastern Wood-Pewee, Barn Swallow, Tufted Titmouse (*Baeolophus bicolor*), Canada Warbler (*Cardellina canadensis*), Bald Eagle (*Haliaeetus leucocephalus*), Wood Thrush (*Hylocichla mustelina*), and Purple Martin (*Progne subis*). A summary of the bird SAR and SCC observations made by NRSI biologists within the Study Areas in 2022 is provided in **Table 4-4**. Potential habitats of bird SAR are shown on **Figure 4-2.** Confirmed and candidate habitats of bird SCC are shown on **Figure 4-3.**

Table 4-3. Bird Species with Confirmed Breeding Habitat According to 2022 Breeding Bird Surveys

Scientific Name	Common Name	On-site Study Area	Off-site Study Area
Agelaius phoeniceus	Red-winged Blackbird	✓	
Branta canadensis	Canada Goose	✓	
Bubo virginianus	Great Horned Owl		✓
Contopus virens	Eastern Wood-Pewee		✓
Hirundo rustica	Barn Swallow		✓
Mergus merganser	Common Merganser	✓	
Molothrus ater	Brown-headed Cowbird	✓	
Passer domesticus	House Sparrow	✓	
Petrochelidon pyrrhonota	Cliff Swallow		✓
Quiscalus quiscula	Common Grackle	✓	
Sturnus vulgaris	European Starling	✓	✓
Turdus migratorius	American Robin	✓	✓
Tyrannus tyrannus	Eastern Kingbird	✓	

Table 4-4. Summary of 2022 Significant Bird Species Observations within the On-site and Off-site Study Areas

Scientific Name	Common Name	Observation Details and Habitat Analysis
Species at Risk		
Chaetura pelagica	Chimney Swift	1 adult was observed flying over BMB-18 in the southern portion of the On-site Study Area, on June 3, 2022. No evidence of breeding activity was observed, and suitable nesting habitat for the species is not present.
Dolichonyx oryzivorus	Bobolink	2 adult males were heard singing (indicating evidence of possible breeding) from suitable meadow habitat near BMB-015 on May 31, 2022. The species was not observed during subsequent breeding bird surveys or any other field surveys in 2022. The species may be breeding within the cultural meadow habitat (which is >10 ha) in the eastern portion of the On-site Study Area. However, the probability that the species is breeding within the On-site Study Area is considered low due to the absence of any further observations of Bobolink during the breeding bird season. The singing males observed on May 31, 2022 were most likely moving through the area while travelling to other breeding habitats, or had attempted to nest within the adjacent off-site hayfield and left the area following the spring harvest which occurred just prior to the May 31 survey. Observations of Bobolink requested from eBird (eBird Basic Dataset Version EBD_relMar-2023, Cornell Lab of Ornithology, Ithaca, New York, March 2023) within the On-site and Off-site Study Areas between 2021 and 2023 are limited. A single individual was observed on 2 dates along the southern edge of the TCEC: May 13 and August 25, 2021. There are no eBird records for the species within the Study Areas in 2022. The majority of eBird observations

Table 4-4. Summary of 2022 Significant Bird Species Observations within the On-site and Off-site Study Areas

Scientific Name	Common Name	Observation Details and Habitat Analysis
		are located more than 8 km away from the TCEC and are more abundant elsewhere in Lambton and Middlesex Counties where suitable breeding habitat is presumably more abundant.
Riparia riparia	Bank Swallow	2 adults were observed foraging over Pond 3 in the northwest corner of the On-site Study Area, on May 22, 2022. No evidence of breeding activity was observed, and suitable nesting habitat for the species is not present.
Species of Conservation Concern		
Baeolophus bicolor	Tufted Titmouse	1 adult male was heard singing (indicating evidence of possible breeding) from the deciduous woodland west of Nauvoo Road in the Off-site Study Area on May 17, 2022. The woodland where the singing male was heard provides suitable breeding habitat for the species. Although Tufted Titmouse was not subsequently detected during breeding bird surveys, nesting can begin in May and the species is considered to be potentially breeding in the Off-site Study Area.
Cardellina canadensis	Canada Warbler	1 adult male was heard singing (indicating evidence of possible breeding) from the deciduous woodlot immediately east of Underpass Road, in the western portion of the Off-site Study Area on June 3, 2022. The woodland in this location is smaller than the forested tracts usually preferred by the species, however the habitat in this woodland, as well as elsewhere within the Off-site Study Area, are suitable for Canada Warbler. The species is considered to be potentially breeding within the deciduous woodlot near Underpass Road.
Contopus virens	Eastern Wood-Pewee	During breeding bird surveys on May 31, June 3, and June 28, 2022, adult males were heard singing (indicating evidence of possible breeding) from several deciduous woodland areas within both the On-site and Off-site Study Areas, including BMB-01, -02, -05, -13, and -14. The species was observed occupying a permanent territory (indicating evidence of probable breeding) at BMB-03 and -12. An active Eastern Wood-Pewee nest was observed (indicating evidence of confirmed breeding) at BMB-04. The deciduous woodland west of Nauvoo Road in the Off-site Study Area is considered confirmed breeding habitat for Eastern Wood-Pewee, and the species is considered to be potentially breeding within other deciduous woodlands within the On-site and Off-site Study Areas.
Haliaeetus leucocephalus	Bald Eagle	A single adult was observed flying over the Off-site Study Area on October 24, 2022. Due to the absence of suitable mature forests adjacent to large lakes or rivers within the Off-site Study Area, this observation was likely an individual migrating or travelling to preferred habitats elsewhere. No evidence of breeding activity was observed, and suitable nesting habitat for the species is not present.
Hirundo rustica	Barn Swallow	Adult Barn Swallows were regularly observed foraging as individuals, in pairs, or in family groups over the sedimentation ponds and the small Reed Canary Grass Mineral Meadow Marsh (MAM2-2) within the On-site Study Area throughout the breeding season. Structures that may be used by Barn Swallow as nesting habitat are present within the On-site Study Area, however no nest cups or any other evidence of breeding were observed during 2022 field surveys.

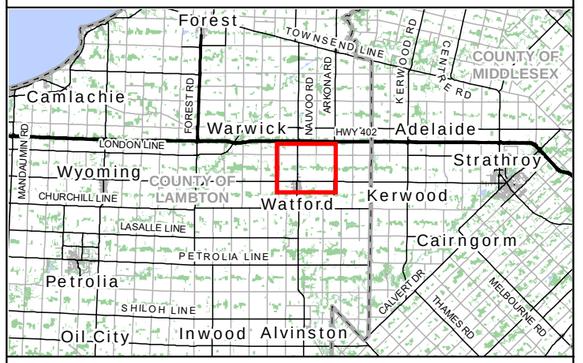
Table 4-4. Summary of 2022 Significant Bird Species Observations within the On-site and Off-site Study Areas

Scientific Name	Common Name	Observation Details and Habitat Analysis
		Adult Barn Swallows were also observed foraging over the agricultural fields within the Off-site Study Area, and two nest cups were documented on a small bridge across the Cameron Drain that is used by farming equipment to cross the watercourse east of the landfill. The Off-site Study area contains many barns, structures and bridges, and the availability of nesting habitat for Barn Swallow is high. The regular observations of Barn Swallows above the sedimentation ponds are consistent with individuals that are nesting within the Off-site Study Area and accessing foraging opportunities within the On-site Study Area.
Hylocichla mustelina	Wood Thrush	2 adult males were heard singing (indicating evidence of possible breeding) within the woodlot east of the landfill in the Off-site Study Area on June 28, 2022. Habitats in this location are consistent with the species' preferred undisturbed deciduous forest habitat with dense understorey growth. The deciduous swamp east of the landfill is considered potential breeding habitat for Wood Thrush.
Progne subis	Purple Martin	2 pairs of adults (indicating evidence of probable breeding) were observed at BMB-19 within the Off-Site Study Area on June 3, 2022. The species usually nests colonially in artificial, multi-compartment structures, which were not observed but may be present in the Off-site Study Area.

Figure 4-2

Twin Creeks Environmental Centre Optimization Project

Species at Risk- Potential Habitats



Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Railway
- Primary Road
- Secondary Road
- Ecological Land Classification (ELC) Polygon
- ELC Inclusion

Potential Species at Risk (SAR) Habitat

- Eastern Hog-nosed Snake *(Heterodon platirhinos)*
- Bobolink *(Dolichonyx oryzivorus)*

SAR Bats

- Eastern Small-footed Myotis *(Myotis leibii)*
- Little Brown Myotis *(Myotis lucifungus)*
- Tri-colored Bat *(Perimyotis subflavus)*
- Northern Myotis *(Myotis septentrionalis)*

- Wetland Boundary (NRSI 2022)
- Woodland Dripline (NRSI 2022)

Stream Network:

Department of Fisheries and Oceans (DFO) Drain Classification

- Closed/Tiled
- Not Rated
- Class E - Permanent Flows, Warmwater Thermal Regime
- Class F - Intermittent Flows
- Natural Watercourse (Not Rated)

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Project: 2538
Date: April 27, 2023

NAD83 - UTM Zone 17
Size: 11x17"
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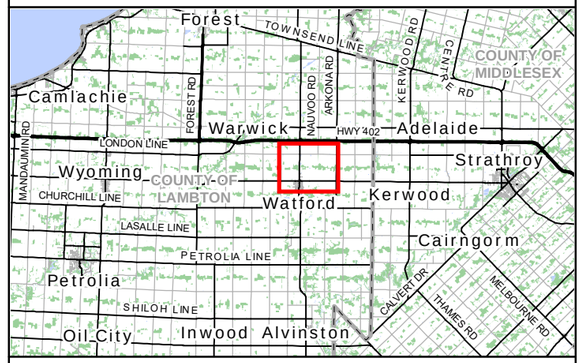
Figure 4-3

Twin Creeks Environmental Centre Optimization Project

Species of Conservation Concern - Confirmed and Potential Habitats



Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Railway
- Primary Road
- Secondary Road
- Ecological Land Classification (ELC)
- ELC Inclusion

Confirmed Breeding Habitat

- Eastern Wood-Pewee *(Contopus virens)*
- Western Chorus Frog - Great Lakes / St. Lawrence - Canadian Shield population *(Pseudacris triseriata pop. 2)*

Candidate Breeding Habitat

- Canada Warbler *(Cardellina canadensis)*
- Wood Thrush *(Hylocichla mustelina)*
- Tufted Titmouse *(Baeolophus bicolor)*
- Eastern Wood-Pewee *(Contopus virens)*

- Wetland Boundary (NRSI 2022)
- Woodland Dripline (NRSI 2022)

Stream Network:

Department of Fisheries and Oceans (DFO) Drain Classification

- Closed/Tiled
- Not Rated
- Class E - Permanent Flows, Warmwater Thermal Regime
- Class F - Intermittent Flows
- Natural Watercourse (Not Rated)

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Project: 2538
Date: November 24, 2023

NAD83 - UTM Zone 17
Size: 11x17"
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4.1.3.2 Herpetofauna

According to available data from background information sources and this study, 14 herpetofauna species (reptiles and amphibians) are reported from the vicinity of the Study Areas (Gartner Lee Ltd. 2004, Ontario Nature 2019, Zarkovich, pers. comm. 2021, iNaturalist 2023). In total, 10 herpetofauna species were observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. The majority of species observed are common in southern Ontario and have stable populations. A list of all herpetofauna species reported from the Study Areas is included in **Appendix F**.

Amphibians

During evening anuran call surveys, American Toad (*Anaxyrus americanus*), Gray Treefrog (*Dryophytes versicolor*), Green Frog (*Lithobates clamitans*), Northern Leopard Frog (*Lithobates pipiens*), Western Chorus Frog - Great Lakes / St. Lawrence - Canadian Shield population (*Pseudacris triseriata* pop. 2), Spring Peeper (*Pseudacris crucifer*), and American Bullfrog (*Lithobates catesbeianus*) were heard calling from the sedimentation ponds within the On-site Study Area (ANR-08, 09, 11,12, and 13 on **Figure 3-1**). Although the sedimentation ponds attract breeding anurans, the ponds are potential contaminant sinks that function to manage stormwater and provide irrigation for the lands within the TCEC. The ponds are not considered suitable amphibian breeding habitat for the purpose of this assessment.

Naturalized areas in the eastern portion of the On-site Study Area were also confirmed to support breeding anurans. During evening anuran call surveys, American Toad, Western Chorus Frog, Spring Peeper, Green Frog, Gray Tree Frog, and Wood Frog (*Lithobates sylvaticus*) were heard calling at stations ANR-14, 17, 18, and 19. During each survey, only a few individuals were heard calling; the maximum number of individuals recorded at these survey stations was four (Gray Treefrog at ANR-19 on June 13, 2022). The exception to this is for Western Chorus Frog. Daytime and evening anuran call surveys detected a full chorus of Western Chorus Frog calling from areas with standing water within the Swamp Maple Mineral Deciduous Swamp (SWD3-3) community at ANR-14, and within the Reed Canary Grass Mineral Meadow Marsh (MAM2-2) community at ANR-17. A few (six) Western Chorus Frogs were also heard calling from standing water near ANR-18 within the Mineral Cultural Meadow (CUM).

Within the Off-site Study Area, evening anuran call surveys also detected American Toad, Western Chorus Frog, Spring Peeper, Green Frog, Gray Tree Frog, and Wood Frog calling from stations ANR-01, 02, 03, 04, 05, 06, 07, 10, 15, and 16. For most species other than Western Chorus Frog and Spring Peeper, only a few individuals were heard; the maximum number of individuals recorded at these survey stations was seven (Green Frog at ANR-16 on June 13, 2022). A full chorus of Spring Peepers was heard calling from the Meadow Marsh/Cultural Meadow (MAM/CUM) area near ANR-06, and from the small Deciduous Swamp (SWD) near ANR-10. Daytime and evening anuran call surveys detected full choruses of Western Chorus Frog at several locations

throughout the Off-Site Study Area. As shown on **Figure 4-3**, seasonal standing water in several vegetation communities, both east and west of the On-site Study Area, was confirmed to support breeding populations of Western Chorus Frog (i.e., call code level 3, full chorus) in 2022. With reference to the vegetation community codes shown on **Figure 4-1**, Western Chorus Frog was breeding in the following areas:

- West of Nauvoo Road, Vegetation Communities (2), (3), (7), and (4) corresponding to Cultural Thicket (CUT), Red-osier Dogwood Mineral Thicket Swamp (SWT2-5 inclusion), Silky Dogwood Mineral Thicket Swamp (SWT2-8 inclusion) and Willow Mineral Thicket Swamp (SWT2-2 inclusion).
- Immediately east of Nauvoo Road, Vegetation Community (8) corresponding to Meadow Marsh/Cultural Meadow (MAM/CUM).
- East of the TCEC, Vegetation Community (18) corresponding to Swamp Maple Mineral Deciduous Swamp (SWD3-3).
- Along the eastern boundary of the TCEC, Vegetation Community (13) corresponding to Reed-Canary Mineral Meadow Marsh (MAM2-2).

An additional amphibian species, Spotted Salamander (*Ambystoma maculatum*) was also confirmed breeding within Vegetation Community (18), Swamp Maple Mineral Deciduous Swamp (SWD3-3) east of the TCEC. An egg mass of this species was observed in a vernal pool during surveys conducted on April 5, 2022.

Reptiles

NRSI biologists did not observe any turtles during emergence and basking surveys completed in the spring of 2022, or during any other field surveys. It is not anticipated that any turtle species are overwintering in any of the permanent waterbodies within the On-site and Off-site Study Areas.

While no individuals were observed, suitable summer foraging and thermoregulation habitat for Eastern Hog-nosed Snake was identified during habitat assessments in the woodlands within the On-site and Off-site Study Areas. In keeping with the recommendations outlined in the Survey Protocol for Ontario's Species at Risk Snakes (MNRF 2016a), Eastern Hog-nosed Snake is assumed present within the Study Areas for the purpose of this assessment.

NRSI biologists encountered a single reptile species during 2022 field surveys: Eastern Gartersnake (*Thamnophis sirtalis sirtalis*). A few individual Eastern Gartersnakes were observed in the woodland east of Nauvoo Road (Off-site Study Area), and in the vicinities of the sedimentation ponds and poplar systems (On-site Study Area).

Significant Herpetofauna Species

Based on available records and the results of 2022 field surveys, two reptile SAR, one reptile SCC, and one amphibian SCC are reported from the vicinity of the Study Areas

(Gartner Lee Ltd. 2004, Ontario Nature, MECP 2021, iNaturalist 2023, this study). The results of the Final Significant Species Screening are provided in **Appendix B**.

During 2022 field surveys, NRSI biologists observed one amphibian SCC, Western Chorus Frog, and identified candidate habitat for one reptile SAR, Eastern Hog-nosed Snake. Confirmed breeding habitat for Western Chorus Frog is present in both the On-site and Off-site Study Areas, as described in the section above. Candidate summer foraging and thermoregulation habitat for Eastern Hog-nosed Snake is identified in all forested habitats within the On-site and Off-site Study Areas (**Figure 4-2**).

4.1.3.3 Mammals

According to available data from background information sources and this study, 47 mammal species are reported from the vicinity of the Study Areas (Dobbyn 1994, Gartner Lee Ltd. 2004, iNaturalist 2023). In total, 13 mammal species were observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. All observed species are common in southern Ontario and have stable populations. A list of all mammal species reported from the Study Areas is included in **Appendix G.**

Mammal species observed most frequently by NRSI biologists within both the On-site and Off-site Study Areas in 2022 included Muskrat (*Ondatra zibethicus*), White-tailed Deer (*Odocoileus virginianus*), Coyote (*Canis latrans*), and Northern Raccoon (*Procyon lotor*). In addition to Coyote and Northern Raccoon, other predatory and/or omnivorous mammals observed included Striped Skunk (*Mephitis mephitis*), Virginia Opossum (*Didelphis virginiana*), American Mink (*Neovison vison*), and Red Fox (*Vulpes vulpes*).

Based on available records and the results of 2022 field surveys, five (5) mammal SAR and one (1) mammal SCC are reported from the vicinity of the Study Areas (Gartner Lee Ltd. 2004, Dobbyn 1994, Humphrey and Fotherby 2019, iNaturalist 2023, this study). The results of the Final Significant Species Screening are provided in **Appendix B**.

During 2022 field surveys, NRSI biologists identified candidate habitat for four (4) SAR bat species, including Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis lucifungus*), Northern Myotis (*Myotis septentrionalis*), and Tri-colored Bat (**Figure 4-2**). During the plot-based bat habitat assessments of the woodlands in the On-site and Off-site Study Areas, NRSI biologists documented candidate roost trees that may be used Little Brown Myotis, Northern Myotis, Tri-colored Bat, and non-SAR bats. The density of candidate roost trees in each surveyed vegetation community for Little Brown Myotis and Northern Myotis (candidate roost tree DBH >0 cm), as well as non-SAR bats (candidate roost tree DBH >25 cm), is shown in **Table 4-5**. Candidate roost trees for Tri-colored Bat include those with hanging live or dead leaf clusters and are most likely to be oaks (*Quercus* spp.) or maples (*Acer* spp.). Leaf clusters were observed on one Red Oak (*Quercus rubra*), and one Bur Oak (*Quercus macrocarpa*) within the woodland east of the TCEC, however additional trees with suitable leaf

Table 4-5. Density of Candidate Roost Trees for Little Brown Myotis, Northern Myotis, and Non-Species at Risk Bats within Each Surveyed Vegetation Community

Vegetation Community	Candidate Roost Tree Density (No. Candidate Roost Trees/ha)	
	DBH[1] >0cm	DBH[1] >25cm
On-site Study Area		
Vegetation Communities (9) and (11) Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) Mineral Cultural Woodland (CUW1)	1.6	1.6
Off-site Study Area		
East of the Landfill		
Vegetation Communities (15), (16), (17) Dry - Fresh Beech Deciduous Forest (FOD4-1) Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) Fresh - Moist Sugar Maple - Hardwood Deciduous Forest (FOD6-5)	7.9	4.7
Vegetation Community (18) Swamp Maple Mineral Deciduous Swamp (SWD3-3)	4.5	3.3
Vegetation Community (22) Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4)	6.1	5.6
West of the Landfill		
Vegetation Communities (4) and (6) Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) Fresh - Moist Sugar Maple - Hardwood Deciduous Forest (FOD6-5)	2.4	2.1

clusters for Tri-colored Bat are anticipated to be present within all woodlands in the On-site and Off-site Study Areas. No suitable roosting habitat for Eastern Small-footed Myotis was observed. However, all four SAR bats may forage and travel within both Study Areas along the edges of, and/or within, any of the deciduous woodlands. The sedimentation ponds within the On-site Study Area also provide foraging opportunities for SAR bats.

4.1.3.4 Insects

The results of the background information review (see below and **Section 3.1**) indicated the potential presence of insect SCC belonging to two (2) groups: butterflies and damselflies. Field surveys for insects were therefore scoped to focus on butterflies and odonates (dragonflies and damselflies). The following sections provide a summary of background review and field survey results for these groups.

Butterflies

According to available data from background information sources and this study, 12 butterfly species are reported from the vicinity of the Study Areas (Macnaughton et al. 2023, iNaturalist 2023). In total, seven (7) butterfly species were observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. The majority of species observed are common in southern Ontario and have stable populations. A list of all butterfly species reported from the Study Areas is included in **Appendix H.**

Based on available records and the results of 2022 field surveys, one (1) butterfly SCC, Monarch (*Danaus plexippus*), is reported from the vicinity of the Study Areas (iNaturalist 2023). NRSI biologists occasionally observed a few foraging adult Monarchs during 2022 field surveys. No Monarch caterpillars were observed, nor were there areas with high concentrations of milkweeds (*Asclepias* spp.), the species' larval food plant documented within the On-site or Off-site Study Areas. The results of the Final Significant Species Screening are provided in **Appendix B**.

Dragonflies and Damselflies

According to available data from background information sources and this study, 11 odonate species (dragonflies and damselflies) are reported from the vicinity of the Study Areas (OOAD 2021). A single common dragonfly species, Twelve-spotted Skimmer (*Libellula pulchella*) was observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. A list of all odonate species reported from the Study Areas is included in **Appendix I.**

Based on available records and the results of 2022 field surveys, one (1) damselfly SCC, Blue-tipped Dancer (*Argia tibialis*), is reported from the vicinity of the Study Areas (OOAD 2021). As summarized in the Final Significant Species Screening (**Appendix B**), suitable habitat for this species is absent from the On-site Study Area. The Kersey Drain/Brown Creek and the Gilliland-Geerts Drain may provide habitat for

the species within the Off-site Study Area; however, Blue-tipped Dancer was not observed by NRSI biologists during 2022 field surveys.

4.1.4 Significant Wildlife Habitat

Based on background information review, desktop analyses, and the results of 2022 field surveys, several confirmed and candidate SWH types are present within the On-site and Off-site Study Areas. The results of the Final SWH Screening are provided in **Appendix C**, and confirmed and candidate SWH types are mapped on **Figure 4-3** and **Figure 4-4**. The following sections summarize the characteristics and significance of the SWH types documented within the Study Areas.

4.1.4.1 Confirmed Significant Wildlife Habitat

'Confirmed' SWH means that the habitat has been subject to detailed study and assessed as significant based on meeting discrete significance criteria established by the MNRF for Ecoregion 7E where the Study Areas are located (OMNR 2000, MNRF 2015). To be confirmed as SWH, a habitat not only needs to meet the established criteria, but also qualify as providing important ecological function(s) on a landscape scale and be considered in the context of the abundance and availability of alternative habitats that may provide similar functions.

Amphibian Breeding Habitat (Woodland)

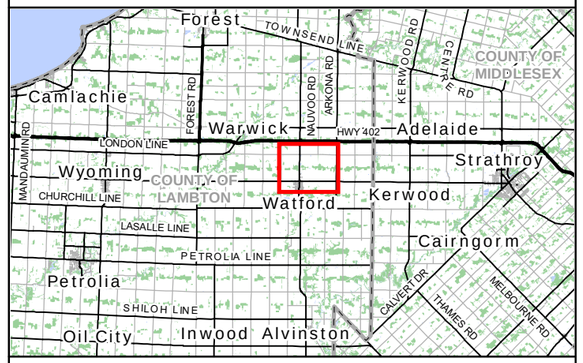
Wetlands, ponds, and vernal pools within or adjacent (within 120 m) to a woodland are important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations. Breeding pools within a woodland are more significant because they provide better cover and are more likely to be used due to reduced risk to migrating amphibians. Sites with several ponds and/or ponds close to watercourses are particularly valuable.

The criteria for confirming woodland amphibian breeding habitat includes documenting the presence of a breeding population of one or more of newt or salamander species as described in the Ecoregion 7E Criteria Schedule (MNRF 2015a). Spotted Salamander is one of the indicator species that, when present, confirms the SWH type. NRSI biologists observed a single Spotted Salamander egg mass on April 5, 2022 during general site reconnaissance surveys in Vegetation Community (18), Swamp Maple Mineral Deciduous Swamp (SWD3-3) east of the TCEC. The presence of this egg mass indicated that Spotted Salamander is using at least one vernal pool within the deciduous swamp community as breeding habitat. Based on the absence of any other wetland features that meet SWH criteria, the swamp community (present mostly within the Off-site Study Area but extending into the On-site Study Area) has been designated as confirmed Amphibian Breeding Habitat (Woodland) SWH. This designation is further supported by the location of the swamp near the Kersey Drain, and the confirmation of a breeding for a second indicator species for this SWH type, Western Chorus Frog, in the same vegetation community. The MNRF defines the

Figure 4-4

Twin Creeks Environmental Centre Optimization Project

Significant Wildlife Habitat



Legend

- Off-Site Study Area (1km) and Gilliland-Geerts Drain
- On-Site Study Area
- Railway
- Primary Road
- Secondary Road
- Ecological Land Classification (ELC) Polygon

Confirmed Significant Wildlife Habitat (SWH)

- Amphibian Breeding Habitat (Woodland)
- Terrestrial Crayfish

Candidate Significant Wildlife Habitat (SWH)

- Amphibian Breeding Habitat (Wetland)
- Bat Maternity Colonies
- Wetland Boundary (NRSI 2022)
- Woodland Dripline (NRSI 2022)

Stream Network:

Department of Fisheries and Oceans (DFO) Drain Classification

- Closed/Tiled
- Not Rated
- Class E - Permanent Flows, Warmwater Thermal Regime
- Class F - Intermittent Flows
- Natural Watercourse (Not Rated)

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Project: 2538
Date: November 24, 2023

NAD83 - UTM Zone 17
Size: 11x17"
1:19,000

0 200 400 600 800 1,000 1,200 Meters

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habitat as the suitable wetland ELC Ecosite area plus a 230 m radius of woodland (i.e., the SWD3-3 community plus 230 m).

Terrestrial Crayfish Habitat

Ontario has two species of burrowing crayfish, the Digger Crayfish (*Fallicambarus fodiens*) and the Meadow Crayfish (*Cambarus diogenes*). These crayfish live in wetlands, creek beds, ditches, and in dry areas where they can burrow below the water table. These species are found only in southwestern Ontario and are uncommon throughout their range. They often live in small patches of high-quality habitat. Terrestrial crayfish are threatened by habitat loss and competition with non-native crayfish.

The criteria for confirming terrestrial crayfish habitat includes documenting the presence of one or more individuals either species or their chimneys (burrows) in suitable marsh meadow or swamp habitats as described in the Ecoregion 7E Criteria Schedule (MNRF 2015a). NRSI biologists observed up to 11 terrestrial crayfish chimneys at a time in suitable habitats, including Vegetation Community (18), Swamp Maple Mineral Deciduous Swamp (SWD3-3) east of the TCEC and Vegetation Community (8) corresponding to Forb Mineral Meadow Marsh (MAM2-10). Suitable habitats appear limited at the landscape scale, and the listed vegetation communities are therefore considered SWH for terrestrial crayfish. The MNRF defines the habitat as the suitable wetland ELC Ecosite Area.

Habitat for Species of Conservation Concern, Special Concern, and Rare Wildlife Species

Important habitats of species designated as SCC are considered SWH. NRSI biologists observed several SCC during 2022 field surveys. Of these species, two were confirmed having important breeding habitat within the On-site and Off-site Study Areas: Western Chorus Frog and Eastern Wood-Pewee. For both species, the MNRF defines the habitat as the area of the finest ELC scale that protects the habitat form and function as delineated through detailed field studies. The designated area also needs to cover an important life stage component for the species, which in this case for Western Chorus Frog and Eastern Wood-Pewee, is their breeding habitat.

Western Chorus Frog (Great Lakes / St. Lawrence – Canadian Shield population) is an SCC species designated as Threatened on Schedule 1 of the federal *SARA*. This species occupies lowland habitats with open or discontinuous canopies where depressions support the formation of seasonal wetlands (Environment Canada 2015a). The On-site and Off-site Study Areas are located approximately 1 km north of the Carolinian faunal province where Western Chorus Frog has a provincial S-Rank of S4 (apparently secure) and is not designated as Threatened on Schedule 1 of the federal *SARA*. Despite the relatively close proximity of the Study Areas to the non-SCC population of Western Chorus Frog, habitats where the species was confirmed to be breeding are considered significant for the purpose of this assessment due to the generally limited availability of suitable breeding habitat at the landscape scale.

A few individual Western Chorus Frogs were heard calling in several locations throughout the On-site and Off-site Study Areas by NRSI biologists during spring surveys in 2022. However, only suitable wetland features supporting breeding populations, as evidenced by a full chorus (Call Code 3), are designated as confirmed SWH for the species. Western Chorus Frog breeding populations were confirmed in a total of seven (7) vegetation communities comprising four (4) general areas as shown on **Figure 4-3** and listed in **Section 4.1.3.2**.

Eastern Wood-Pewee is an SCC species designated as Special Concern under Ontario Regulation (O. Reg.) 230/08 of the *ESA*. Eastern Wood-Pewee breeds in intermediate-aged mature deciduous and mixed forest communities, and prefers forest stands with little understory vegetation (COSSARO 2013). An active nest, indicating evidence of confirmed breeding for the species, was documented by NRSI biologists in 2022 within the deciduous woodlot west of Nauvoo Road, within the Off-site Study Area (**Figure 4-3**). As shown on **Figure 4-3**, Eastern Wood-Pewee is also considered to have candidate breeding habitat in several other deciduous forest communities within the On-site and Off-site Study Areas.

4.1.4.2 Candidate Significant Wildlife Habitat

'Candidate' SWH means that suitable habitat has been detected, but additional studies or analyses are necessary to determine significance and the confirmed presence or absence of the ecological functions of the SWH type. In some cases, a SWH may meet some or all of the discrete significance criteria established by the MNRF for Ecoregion 7E (OMNR 2000, MNRF 2015a) but remain designated as candidate due to unknown factors or data gaps that prevent a confident determination of presence or absence.

Bat Maternity Colonies

Candidate Bat Maternity Colony SWH is typically identified in mature deciduous or mixed forested habitats when the density of large-diameter (>25 cm DBH) candidate roost trees exceeds a threshold of 10/ha. This SWH type is confirmed when studies document the presence of maternity colonies consisting of >10 Big Brown Bats (*Eptesicus fuscus*) or >5 Silver-haired Bats (*Lasionycteris noctivagans*) (MNRF 2015a).

Based on the results of the bat habitat assessments completed on lands where direct site access was available, none of the surveyed vegetation communities met the density target of at least 10 candidate roost trees >25 cm DBH per ha (see **Figure 3-1** for survey locations and **Table 4-5** for roost tree densities). The highest density of suitably large candidate roost trees was 5.6 trees/ha in Vegetation Community (22), the Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) within the Off-site Study Area. None of the surveyed vegetation communities meet criteria for designation as Bat Maternity Colony SWH. However, since direct site access was not available for all forested habitats within the Off-site Study Area, remaining deciduous

forests and swamps are considered candidate for this SWH type as shown on **Figure 4-4.**

Reptile Hibernaculum

In southern Ontario, snakes overwinter in subterranean habitats where areas below the frost line can be accessed. Reptile hibernacula can be accessed via features such as old mammal burrows, rock fissures, old wells, crumbling foundations or stone walls, rock piles or slopes, and bridge abutments. Wetlands can also be important overwintering habitat. Congregations of snakes emerge from hibernacula in the early spring and are typically found basking near the feature for a period following emergence.

Sites for hibernation possess specific habitat parameters (e.g., temperature, humidity) and are frequently used annually, often by many of the same individuals of a local population. Other critical life processes (e.g., mating) often take place near hibernacula. The feature in which the hibernacula is located plus a 30m buffer is the SWH.

This SWH type is confirmed when studies document the presence of a hibernaculum feature confirmed to be used by a minimum of five individuals of the same snake species, or individuals of two or more snake species (MNRF 2015a). Wildlife surveys within the On-site and Off-site Study Areas in 2022 did not uncover any potential hibernacula features (e.g., rock piles, wells, crumbling foundations), and only a few observations of Eastern Gartersnake were documented within the On-site and Off-site Study Areas. However, the absence of reptile hibernaculum SWH cannot be ruled out without extensive surveys, which were not undertaken as part of this study. Although absence cannot be ruled out completely, it is considered very unlikely that hibernacula are present within the On-site Study Area. Candidate Reptile Hibernaculum SWH is identified for the majority of ecosites (and forested swamp ecosites in particular) within the Off-site Study Area. This SWH type is not shown on **Figure 4-4** due to the potential for snake hibernaculum to occur in any southern Ontario ecosite other than very wet ones and the associated logistical constraints of demonstrating this on a map.

Amphibian Breeding Habitat (Wetland)

Like wetlands, ponds, and vernal pools within or adjacent to (<120 m) a woodland, swamps, marshes, fens, bogs, and open and shallow aquatic wetland ecosites separated from woodland ecosites by more than 120 m may also provide breeding habitat for amphibian species. These features are also important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations. Sites with abundant vegetation and woody debris (e.g., shrubs, fallen logs and branches) are particularly valuable for some species because of the availability of structure for calling, foraging, and avoiding predators. Some species, such as American Bullfrog, require permanent waterbodies with abundant emergent vegetation for breeding. When confirmed, the MNRF defines the habitat as the suitable wetland ELC Ecosite and its shoreline.

The criteria for confirming woodland amphibian breeding habitat includes documenting the presence of a breeding population of one or more of newt or salamander species as described in the Ecoregion 7E Criteria Schedule (MNRF 2015a). Wetlands with confirmed breeding American Bullfrog populations are significant. Breeding populations of Spring Peeper and Western Chorus Frog (Call Level 3 for each species) were documented by NRSI biologists during 2022 field surveys within Vegetation Community (8), a meadow marsh-cultural meadow complex (MAM/CUM), in the Off-site Study Area east of Nauvoo Road. The presence of a sufficiently-long hydroperiod within this feature that can support breeding amphibians has not been confirmed, and the overall abundance of similar habitats at the landscape scale is not well understood due to site access limitations. Therefore, although 2022 studies have confirmed breeding populations of two or more of the listed frog species, Amphibian Breeding Habitat (Wetland) is considered Candidate SWH in this feature as shown on **Figure 4-4** and is not confirmed within the Off-site Study Area.

No other wetlands within the On-site or Off-site Study Areas meet SWH criteria for wetland amphibian breeding. Although the sedimentation ponds in the On-site Study Area attract breeding anurans, and several indicator species (including American Bullfrog) were heard calling from these features during 2022 surveys, the ponds are potential contaminant sinks that function to manage stormwater and provide irrigation for the lands within the TCEC. The ponds are not considered suitable amphibian breeding habitat for the purpose of this assessment, and do not meet the criteria for designation as SWH.

Habitat for Species of Conservation Concern, Special Concern, and Rare Wildlife Species

NRSI biologists observed several SCC during 2022 field surveys. Of these species, Western Chorus Frog and Eastern Wood-Pewee were confirmed having important breeding habitat within the On-site and Off-site Study Areas. Three additional bird SCC were also observed and are considered to have candidate habitats within the On-site and Off-site Study Areas, including Canada Warbler, Wood Thrush, and Tufted Titmouse.

Canada Warbler is an SCC species designated as Special Concern under Ontario Regulation (O. Reg.) 230/08 of the *ESA*. Canada Warbler prefers to breed in large tracts of forest or thicket swamps, riparian woodlands, brushy ravines, and other mature forests with gaps in the canopy (Environment Canada 2015b). During 2022 field surveys, a single adult male was heard singing (indicating evidence of possible breeding) from the deciduous woodlot immediately east of Underpass Road, in the western portion of the Off-site Study Area (**Figure 4-3**). The woodland in this location is smaller than the forested tracts usually preferred by the species, however the habitat in this woodland, as well as elsewhere within the Off-site Study Area, may be suitable for Canada Warbler. The species is considered to be potentially breeding within the deciduous woodlot near Underpass Road.

Wood Thrush is an SCC species designated as Special Concern under Ontario Regulation (O. Reg.) 230/08 of the *ESA*. Wood Thrush prefers to nest in second-growth and mature deciduous and mixed forests with abundant sapling growth and well-developed understorey layers (COSEWIC 2012). Although the species prefers large forest mosaics, individuals have been reported to nest in smaller forest fragments. During 2022 field surveys, two adult males were heard singing (indicating evidence of possible breeding) within the woodlot east of the landfill in the Off-site Study Area. The Swamp Maple Mineral Deciduous Swamp (SWD3-3) communities in this location are consistent with the species' preferred undisturbed deciduous forest habitat with dense understorey growth. Vegetation growth in the understories of the upland forest communities in this location (e.g., FOD4-1, FOD9-4, FOD6-5) was not as dense as the swamp areas, and so only the SWD3-3 communities east of the landfill are considered potential breeding habitat for Wood Thrush (**Figure 4-3**).

Tufted Titmouse is an SCC species with a provincial S-Rank of S3 (Vulnerable) (MNRF 2022). Tufted Titmouse prefers to nest in deciduous or mixed deciduous woodlands in areas with a dense canopy and a diversity of tree species (Cornell Lab of Ornithology 2019). During 2022 field surveys, a single adult male was heard singing (indicating evidence of possible breeding) from the deciduous woodland west of Nauvoo Road in the Off-site Study Area. The woodland where the singing male was heard provides suitable breeding habitat for the species. Although the observation of Tufted Titmouse occurred relatively early in the breeding season (on May 17, 2022) and was not subsequently detected during breeding bird surveys, nesting can begin in May and the species is considered to be potentially breeding in the Off-site Study Area (**Figure 4-3**).

4.1.5 Habitat of Endangered and Threatened Species

Field surveys completed by NRSI biologists in 2022 identified potential habitat for six (6) SAR listed as Endangered or Threatened in O.Reg. 230/08: Species at Risk in Ontario List of the provincial *ESA*. Species include four (4) SAR bats, one (1) SAR snake, and one (1) SAR bird.

The MECP categorizes SAR habitat into three categories as follows:

- Category 1: highly sensitive habitats with low tolerance to alteration;
- Category 2: moderately sensitive habitats with moderate tolerance to alteration; and
- Category 3: habitats with high tolerance to alteration.

The following sections discuss the preferred habitats of SAR with the potential to occur within the Study Areas.

Species at Risk Bats

Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, and Tri-colored Bat are all listed as Endangered provincially and are afforded general habitat protection under the ESA (2007). The latter three species are also listed as Endangered on

Schedule 1 of the federal *SARA*. Category 1 (highly sensitive) habitats for these species include maternity colony, male, and/or dispersal/migratory day-roosts. Foraging habitats are considered Category 2 (moderately sensitive), and travel corridors or flyways are considered Category 3 (minimally sensitive).

Eastern Small-footed Myotis primarily roosts in open, sunny, rocky habitats, including cracks and crevices in cliffs and boulders, in talus slopes, beneath stones on rock barrens and in rock outcrops containing crevices (Humphrey 2017). Roosting habitat for this species is not present within the On-site or Off-site Study Areas. Little Brown Myotis and Northern Myotis typically roost in tree cavities, hollows, under loose bark, and in buildings (OMNR 2000; MNRF 2017). Tri-colored Bat roosts in clusters of live or dead tree foliage in or below the canopy; oak species are often preferred to other tree species, although maple species are also used.

Candidate roosting habitat (Category 1) is potentially present for Little Brown Myotis, Northern Myotis, and Tri-colored Bat within all deciduous forest and swamp ecosites in the On-site and Off-site Study Areas (**Figure 4-2**). In woodlots where site access was available and bat habitat assessments were completed in 2022, the density of candidate roost trees for Little Brown Myotis and Northern Myotis ranged between 1.6 and 7.9 candidate roost trees/ha (**Table 4-5**). These densities are lower than the 10 candidate roost trees/ha density that characterizes high quality, preferred maternity roosting habitat for bats (MNRF 2017); however, these features still have the potential to provide Category 1 roosting habitat for these species. Trees with suitable leaf clusters (Category 1 roosting habitat for Tri-colored Bat) are anticipated to be present throughout all deciduous forest and swamp ecosites in the On-site and Off-site Study Areas (**Figure 4-2**). The availability, location, and density of leaf clusters within a woodland can change on an annual basis.

Foraging (Category 2) and/or movement corridor (Category 3) habitat for Eastern Small-footed Myotis, Little Brown Myotis, Northern Myotis, and Tri-colored Bat may also be present within all deciduous forest and swamp ecosites in the On-site and Off-site Study Areas. All four species forage within or along the edges of forested vegetation communities, and may also forage over waterbodies such as the sedimentation ponds in the On-site Study Area. Forest edges and clearings may also be used as flyways by SAR bats travelling between roosting and foraging habitats.

In summary, candidate habitat for SAR bats within the On-site and Off-site Study Areas includes roosting (Category 1), foraging (Category 2), and flyway (Category 3) habitats.

Eastern Hog-nosed Snake

Eastern Hog-nosed Snake is listed as Threatened both provincially and federally (MECP 2023, Government of Canada 2022), and receives general habitat protection under the ESA. Category 1 (highly sensitive) habitats for these species include oviposition (i.e., nesting) and overwintering sites. Summer foraging and

thermoregulation habitats are considered Category 2 (moderately sensitive), and movement corridors are considered Category 3 (minimally sensitive).

In Ontario, Eastern Hog-nosed Snake uses a wide range of habitats, including open pine, deciduous and mixed forest, oak savanna, open meadow, and sandy shoreline (Kraus 2011). Regardless of habitat type, individuals show a preference for areas with sandy, well-drained soils (Rowell 2012). In southwestern Ontario, the species is often associated with areas underlain by glacial till or fluvial sand deposits. The species generally avoids areas with moist and poorly drained soil, but is often found in areas of dry habitat located near water or areas where their preferred amphibian prey, American and Fowler's (*Anaxyrus fowleri*) Toads, are abundant (Rouse 2006, Rowell 2012). Riparian corridors associated with watercourses and drains are also suitable for movement corridor habitat for the species.

Due to the cryptic nature of this species, when it is determined that habitat for Eastern Hog-nosed Snake is present, it is assumed that the species is present as best practice. Eastern Hog-nosed Snakes prefer open habitats, such as open woods, brushland or forest edges, with well-drained loose or sandy soils, well-drained substrates and uses rocks, logs, stumps, etc. as shelter (Kraus 2011). Loose sandy soils, which are necessary for oviposition and overwintering habitats, are not present in the On-site or Off-site Study Areas; substrates generally have a high clay content. Suitable oviposition and overwintering habitat (Category 1) for Eastern Hog-nosed Snake is therefore not present. The deciduous forest communities within the Study Areas have the potential to provide suitable summer foraging and thermoregulation habitat (Category 2). Field studies in 2022 identified the presence of abundant cover in the form of woody debris, leaf litter and vegetation from previous growing seasons, and gaps in the forest canopy provide suitable sun exposure and thermoregulation habitat for the species. American Toad, the primary prey species of Eastern Hog-nosed Snake, were also observed throughout the Study Areas. West of the TCEC, the Gilliland-Geerts Drain may provide a travel corridor (Category 3) for individuals moving from sandy overwintering and nesting habitats that could be present along Bear Creek approximately 7 km to the east. North of TCEC, the Isles Drain may provide a travel corridor for any individuals that may be overwintering or nesting at sandy sites north of the Off-site Study Area. The forested habitats to the east and west and the active landfill provide appropriate structure for movement corridors and summer foraging and thermoregulation (**Figure 4-2**). However, these features do not connect with one another due to the active landfill representing a general barrier to wildlife movement.

Bobolink

Bobolink is listed as Threatened both provincially and federally (MECP 2023, Government of Canada 2022), and receives general habitat protection under the *ESA*. The Committee on the Status of Endangered and Threatened Species in Canada (COSEWIC) has recently recommended that the federal status for Bobolink be revised to Special Concern (COSEWIC 2022). Category 1 (highly sensitive) habitat is any active nest and the area immediately around the nest (within 10 m). Category 2

(moderately sensitive) habitat includes the area between 10 m and 60 m of the nest (or centre of the approximated defended territory), and Category 3 (minimally sensitive) includes the area of continuous suitable habitat between 60 m and 300 m of the nest (or centre of the approximated defended territory).

Bobolink nests primarily in hayfields and pastures dominated by non-native herbaceous plants, and also in wet prairie, grassy peatlands, abandoned fields dominated by tall grasses, remnants of uncultivated native prairie, and small-grain fields. The species does not use row crops (e.g., corn, soybean), but will occasionally nest in wheat, rye, and alfalfa. Bobolink is sensitive to grassland patch size, and reproductive success is generally lower in small grassland habitats, and forest edges surrounding grasslands tend to be avoided (COSEWIC 2022).

Two adult male Bobolink were heard singing (indicating evidence of possible breeding) in Vegetation Community (12), a Mineral Cultural Meadow (CUM1), on May 31, 2022. The species was not observed during subsequent breeding bird surveys or any other field surveys in 2022. The meadow where the individuals were observed is a relatively small patch (<17 ha), and its proximity to the edge of a deciduous forest may decrease its suitability for Bobolink nesting. To complete a fulsome analysis, recent (2021-2023) observations of Bobolink in Lambton and Middlesex Counties were requested from eBird and analyzed. Single individuals were observed on two dates along the southern edge of the TCEC: May 13 and August 25, 2021. There were no eBird records for the species within the vicinity of the Study Areas in 2022. The majority of eBird observations of Bobolink are located more than 8 km away from the TCEC and are more abundant elsewhere in Lambton and Middlesex Counties where suitable breeding habitat is presumably more abundant.

Using a conservative approach, Bobolink has been identified as potentially breeding within the meadow vegetation community where males were heard singing by NRSI biologists (**Figure 4-2**). However, the probability that the species is actually breeding within the On-site Study Area is considered low due to the absence of any further observations of Bobolink during the breeding bird season. The singing males observed on May 31, 2022 were most likely moving through the area while travelling to other breeding habitats, or had attempted to nest within the adjacent off-site hayfield and left the area following the spring harvest which appeared to have occurred just prior to the May 31 survey.

4.2 Aquatic Ecosystems

4.2.1 Aquatic Species

4.2.1.1 Fish

According to available data from background information sources and this study, 16 fish species are reported from the vicinity of the Study Areas (Gartner Lee Ltd. 2004, Government of Ontario 2022, DFO 2022, iNaturalist 2023). In total, 11 fish species were observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. All species observed are common in southern Ontario and have stable populations. The most frequently-observed species during 2022 fish community assessments were Fathead Minnow (*Pimephales promelas*) and Green Sunfish (*Lepomis cyanellus*). The highest diversity of fish species was observed in the Kersey Drain/Brown Creek, where all 11 observed species were documented. A list of all fish species reported from each watercourse within the Study Areas is included in **Appendix J**.

Based on available records, one (1) fish SCC, Northern Sunfish - Great Lakes / Upper St. Lawrence populations (*Lepomis peltastes* pop. 2), is reported from the vicinity of the Study Areas (DFO 2022). As summarized in the Final Significant Species Screening (**Appendix B**), the Kersey Drain/Brown Creek and the Gilliland-Geerts Drain may provide habitat for the species within the Off-site Study Area. However, targeted electrofishing surveys undertaken by NRSI aquatic biologists during 2022 field surveys did not detect Northern Sunfish.

4.2.1.2 Mussels

According to available data from background information sources and this study, seven (7) native freshwater mussel species are reported from the vicinity of the Study Areas (iNaturalist 2023). In total, three (3) mussel species were observed by NRSI biologists during field surveys in 2022 throughout the Study Areas. Species included Cylindrical Papershell (*Anodontoides ferussacianus*), White Heelsplitter (*Lasmigona complanate*), and Giant Floater (*Pyganodon grandis*), all of which are common in southern Ontario and have stable populations. A list of all mussel species reported from the Study Areas is included in **Appendix K.**

Based on available records, three (3) mussel SAR are reported from the vicinity of the Study Areas (iNaturalist 2023). As summarized in the Final Significant Species Screening (**Appendix B**), suitable habitat for these species is not present within either the On-site or Off-site Study Areas.

4.2.1.3 Crayfish

Crayfish are included in the definition of ‘fish’ according to Section 34 of the federal *Fisheries Act* (1985). NRSI biologists observed terrestrial crayfish chimneys in a few locations within the Off-site Study Area during 2022 field surveys. With reference to

the vegetation community codes shown on **Figure 4-1**, terrestrial crayfish chimneys were documented in the following areas:

- West of Nauvoo Road, Vegetation Community (8) corresponding to Forb Mineral Meadow Marsh (MAM2-10); a grouping of 10 chimneys observed on May 17, 2022.
- East of the TCEC, Vegetation Community (18) corresponding to Swamp Maple Mineral Deciduous Swamp (SWD3-3); 1 chimney observed in distinct locations on each of April 20, May 19, and May 22, 2022, and a grouping of 11 chimneys observed on April 22, 2022.

4.2.2 Aquatic Resources

Natural watercourses within the On-site and Off-site Study Areas are limited to a small portion of Brown Creek south of Confederation Line. All other aquatic features within the Study Areas are constructed open or closed (i.e., tiled) municipal drains that have been historically modified to receive flow from tile drains. Information available from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) indicates that tile drain systems have been installed in most agricultural fields within the Study Areas (OMAFRA 2022).

The federal Department of Fisheries and Oceans (DFO) has mapped and classified municipal drains into categories (Classes A, B, C, D, E, F or Unrated) based on flow regime and fish species present. As shown on **Figure 3-2**, E- and F-class drains are present within the Study Areas, as well as unrated and closed/tiled drains. E-class drains are characterized by permanent flows and warmwater thermal regimes, with potential presence of sensitive fish species; F-class drains are characterized by intermittent flows, are typically dry for three or more months each year, and provide seasonal and/or indirect fish habitat (Kavanaugh et al. 2017).

4.2.2.1 Brown Creek Subwatershed Features

The southeastern portions of the Study Areas drain south towards the Sydenham River and are within the Brown Creek subwatershed. Brown Creek originates northeast of the Off-site Study Area as an agricultural drain referred to as the Isles Drain. The main stem of the creek flows generally south and is known as the Kersey Drain within the Off-site Study Area. Tributaries to Kersey Drain (Brown Creek) between Zion Line and Confederation Line include the Cameron and Burchill Drains (**Figure 3-2**). South of Confederation Line, Brown Creek receives inputs from the Aarts Drain and transitions to a naturalized watercourse.

Kersey Drain (Brown Creek)

Kersey Drain is a perennial drain that originates to the northeast of the landfill and flows generally south along the eastern boundary of the TCEC. Kersey Drain has been classified by the DFO as an E-class drain (OMAFRA 2022). NRSI biologists documented 11 species within Kersey Drain, comprised of species with both coolwater and warmwater thermal regime tolerances. None of the species listed by the DFO as

sensitive fish species (Kavanaugh et al. 2017) were observed during 2022 fish community assessments in Kersey Drain.

The channel of Kersey Drain has been straightened, containing a slight meander where it becomes more naturalized within the deciduous woodland (see AHA-002 on **Figure 3-2**). Within the channel, some evidence of erosion was observed with limited bank undercutting up to 0.25 m. The drain is characterized by a low gradient with run and pool habitats throughout. Riffle habitat was observed in limited areas restricted to the deciduous forest in the upper reaches (AHA-002). The wetted width at the time of survey ranged from 1.4 to 6.4 m with a narrower channel width on average within the upper reaches (AHA-002). Bankfull width remained consistent throughout the drain and ranged from 4.1 to 9.5 m.

Substrates throughout Kersey Drain were consistent, and was dominated primarily by clay, silt, and sand. Gravel, pebble, cobble, muck, and detritus were observed throughout the drain in varying quantities, with deposits of gravel and cobble underlying softer substrates throughout a large portion of the drain. Coarse woody debris was also present throughout various habitat types in the drain. In-stream aquatic vegetation consisted of emergent vegetation such as Broad-leaved Arrowhead (*Sagittaria latifolia*), Southern Water-Plantain (*Alisma subcordatum*), rushes (*Juncaceae* spp.) and grasses (*Poaceae* spp.) common throughout the drain. Additionally, Watercress (*Nasturtium officinale*) was observed in limited quantities in the lower reaches (AHA-001) along with a slight oily sheen which is indicative of groundwater inputs.

The extent of frequent flood ranged from 0 to 10 m on either side of the drain, limited by the steep, tall banks of the drain. The banks of the drain were vegetated by herbaceous plants and deciduous shrubs with moderate to high densities. The adjacent lands had a gentle slope, and in areas associated with the Cultural Plantation (CUP2) area and deciduous swamp and woodlands (SWD3-3, FOD9-4, FOD9-3 vegetation communities), natural vegetation extended 20 m or more from the watercourse (**Figure 4-1**). Where the channel passes through the deciduous swamp and woodland communities, vegetation was dominated by a canopy of deciduous trees and shrubs and an understory of herbaceous plants and grasses. In this location, shading was good quality provided by dense canopy of deciduous trees and shrubs providing 80-90% shade relief to aquatic habitats. Elsewhere, shading was generally poor throughout the majority of the drain, comprised of deciduous shrubs and isolated trees providing approximately 30% canopy cover. In areas adjacent to agricultural fields, natural vegetation on adjacent lands was generally limited to within 10 m of the watercourse and was dominated primarily by culturally-influences thicket and meadow communities.

Various inputs were observed within Kersey Drain, including numerous tile drains and open drain outlets. In total, four unrated drains, shown on **Figure 3-2**, are mapped as being connected to the Kersey Drain along the western side of the watercourse within the On-site and Off-site Study Areas (OMAFRA 2022). Between Zion Line and the woodland, two unrated drains (DFO Identifiers 81268 and 81269) periodically convey

surface runoff to the Kersey Drain from the adjacent agricultural fields. The northern-most feature (DFO Identifier 81269) originates within the agricultural fields as a swale with no standing water and only damp soils on the survey date. The feature lacked channel definition and is actively planted, containing corn in 2022. The other feature (DFO Identifier 81268) was observed to originate at the edge of the narrow Fresh-Moist Bur Oak Deciduous Forest (FOD9-3) vegetation community (no tile drain outlet was observed). Minimal standing water and a well-defined channel approximately 1 to 1.5 m in width was documented. The feature contained predominantly clay substrates with silt, detritus, and cobble present in lesser quantities. Approximately 250 m south of this feature, an anthropogenic pond containing soft substrates, limited aquatic vegetation and an abundance of algae is present. An overflow pipe at the southern end of the pond outlets into a dry channel containing clay substrates and limited cobble before connecting with Kersey Drain.

The third unrated drain (DFO Identifier 81267) is mapped within the woodland (**Figure 3-2**); however, no feature was apparent during the field assessment. It is anticipated that seasonal runoff stored in the Swamp Maple Mineral Deciduous Forest (SWD3-3) community in this area contributes recharge volumes to the Kersey Drain to an extent, however flows are diffuse through the woodland with no defined feature or noticeable flow path.

The fourth unrated drain (DFO Identifier 81266) is mapped as originating within the poplar plantation in the south portion of the On-site Study Area and connecting with the Kersey Drain across from the Burchill Drain (**Figure 3-2**). This feature conveys surface runoff from the southern portion of the TCEC to the Kersey Drain, and is generally characterized by a combination of poorly defined overland flow paths and a few areas where channel definition is apparent.

4.2.2.2 Cameron Drain

Cameron Drain originates to the east of the Off-site Study Area and flows generally west through agricultural lands and the woodland to the confluence with Kersey Drain (**Figure 3-2**). Cameron Drain has been classified by the DFO as an F-class drain (OMAFRA 2022). NRSI biologists documented four species in the Cameron Drain during fish community sampling on October 24, 2022 when flows were present. Based on the timing of the survey, it is expected that the feature would not contain flow during the dry summer months (July-August), and likely becomes intermittent with standing water.

The channel of Cameron Drain has been straightened, containing a slight meander throughout the assessed reach (see AHA-003 on **Figure 3-2**) which has likely been the result of naturalization through erosion. Evidence of erosion was observed in various locations along the banks of the drain. Erosion was extensive along the abutments of a bridge crossing upstream of the confluence with Kersey Drain, and significant erosion into the bank at the upper extent of the assessed reach (AHA-003) was observed. It is anticipated that the drain carries significant volumes of water during the spring freshet period and following major storm events. The drain is

characterized by a low gradient with riffle, run, and pool habitats throughout. The wetted width at the time of survey ranged from 0.8 to 1.1 m, while the bankfull width ranged from 2.6 to 6.7 m.

Substrates throughout Cameron Drain were consistent, dominated primarily by sand, clay, silt, and gravel. Pebble, cobble, and detritus were observed throughout the drain in varying quantities. Coarse woody debris was also present throughout various habitat types in the drain, in addition to abundant leaf-litter. The channel lacked any aquatic vegetation, and contained only limited submerged herbaceous, terrestrial vegetation.

The extent of frequent flood ranged from 0 to 10 m on either side of the drain. The banks of the drain were vegetated in moderate to high densities with herbaceous plants and deciduous shrubs. The adjacent lands had a gentle slope and contained natural vegetation ranging from 20 m to greater than 30 m from the drain. Fresh – Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Fresh - Moist Sugar Maple - Hardwood Deciduous Forest (FOD6-5) communities characterize the majority of the riparian corridor within the assessed reach. A small agricultural field planted with alfalfa (*Medicago sativa*) was observed on the northern side of the drain near the Kersey Drain confluence. The deciduous forest canopy provides good (80%) quality shading to the drain.

4.2.2.3 Burchill Drain

Burchill Drain originates to the southeast of the study area and flows generally northwest through agricultural lands to the confluence with Kersey Drain (**Figure 3-2**). Burchill Drain has been classified by the DFO as an F-class drain (OMAFRA 2022). NRSI biologists observed intermittent flow within the assessed reach of Burchill Drain (AHA-004 on **Figure 3-2**) during the October 24, 2022 survey, and did not detect any fish when electrofishing.

The channel of Burchill Drain has been straightened historically and is characterized by a low gradient. No evidence of riffle, run, or pool habitats were observed within the assessed segment of Burchill Drain. The wetted width at the time of survey ranged from 0.5 to 1.3 m, while the bankfull width ranged from 2.8 to 4.8 m.

Substrates throughout Burchill Drain were consistent, and were dominated primarily by clay overlain by deposits of silt, sand, and detritus. The channel lacked significant in-stream habitat and cover, and dense growth of Reed Canary Grass (*Phalaris arundinacea*) within the channel.

The extent of frequent flood and natural vegetation ranged from 0 to 10 m on either side of the drain. The banks of the drain were densely vegetated by herbaceous plants, grasses, and sporadic deciduous shrubs. Beyond the extent of natural vegetation, the surrounding landscape was gently sloped and characterized by agricultural fields planted with alfalfa. Due to the lack of an extensive naturalized vegetation buffer, the drain receives poor quality (20%) shading relief.

4.2.3 Bear Creek Headwaters Subwatershed Features

The majority of lands within the Study Areas drain southwest towards the St. Clair River and are within the Bear Creek Headwaters subwatershed. Bear Creek originates more than 10 km north of the Off-site Study Area, and flows generally southwest. Watercourses and drainage features within the On-site and Off-site Study Areas are tributaries that join the main stem of Bear Creek approximately 5 km west of Underpass Road. These tributaries are known as the Gilliland-Geerts Drain, Gilliland-Geerts Drain Branch, and the Brown-Jarriott Drain (**Figure 3-2**).

4.2.3.1 Gilliland-Geerts Drain

Gilliland-Geerts Drain originates within the On-site Study Area from the sedimentation pond system that manages stormwater runoff from the landfill facility. Prior to the Warwick Landfill Expansion in 2005, surface runoff was conveyed from the local agricultural fields via the now-closed Vankessel Drain. Gilliland Geerts Drain flows generally west through agricultural lands, along deciduous forest and residential properties, and has been classified by the DFO as an E-class drain for the majority of the reach between Nauvoo Road and Underpass Road as shown on **Figure 3-2** (OMAFRA 2022). Beginning approximately 700 m east of Underpass Road, Gilliland-Geerts Drain has been classified by the DFO as an F-class drain (OMAFRA 2022). The portion of the drain where aquatic habitat assessments and fish community sampling were completed correspond to the permanent E-class reaches (AHA-004 and AHA-005 on **Figure 3-2**). NRSI biologists documented two species in Gilliland-Geerts Drain during fish community sampling on October 24, 2022. Depths within the drain were observed to be quite shallow, with a maximum depth of 16 cm.

The channel of Gilliland-Geerts Drain has been historically straightened and is characterized by a low gradient. Limited evidence of riffle and pool habitat was observed within Gilliland-Geerts Drain. Instream habitat and cover consisted of woody debris, aquatic vegetation, and cobble and boulder deposits associated with culverts and crossings. Emergent vegetation was observed throughout the drain, dominated by cattails (*Typha* spp.) and Common Reed (*Phragmites australis*), with willows (*Salix* spp.) and dogwoods (*Cornus* spp.) growing within the main channel and dominating much of the banks. The wetted width at the time of survey ranged from 0.28 to 1.5 m, while the bankfull width ranged from 2.2 to 4.1 m. Substrates throughout Gilliland-Geerts Drain were consistent, and were dominated primarily by clay overlain by deposits of silt, cobble, muck, and detritus.

The extent of frequent flood and natural vegetation ranged from 0 to 10 m on either side of the channel and were generally contained within the historically-modified banks of the drain. The banks of the drain were densely vegetated by deciduous shrubs with an understory of herbaceous plants. The extent of natural vegetation was limited to 0 to 10 m in areas adjacent to agricultural fields, but exceeded 30 m along the southern bank adjacent to the woodland. Shading was generally poor (20%) throughout the majority of the assessed reach, but the deciduous forest provided good shade relief

(80%) where the drain runs adjacent to the feature. Various inputs from tile drains were observed throughout the lower reaches of the drain, including a large perched culvert conveying flows from Gilliland-Geerts Drain Branch (discussed further in the next section).

4.2.3.2 Gilliland-Geerts Drain Branch

Gilliland-Geerts Drain Branch originates from a series of drainage features conveying surface runoff from the agricultural fields east of Nauvoo Road (**Figure 3-2**). Gilliland-Geerts Drain Branch is mapped by the DFO as closed/tiled throughout the entire length (i.e., between the TCEC and its confluence with the main stem of Gilliland-Geerts Drain) (OMAFRA 2022). However, portions of the feature remain open outside of active agricultural fields. Surface runoff appears to collect in a depressional area immediately east of Nauvoo Road before flowing through a culvert under the road and northwest into the woodland feature before joining the main stem of the Gilliland-Geerts Drain (**Figure 3-2**). During the October 25, 2022 survey, water flow was absent, however areas of standing water indicated that Gilliland-Geerts Drain Branch had conveyed flows recently. NRSI biologists sampled the intermittent standing water in various locations with electrofishing, and did not document any fish species.

Within its upper reaches, Gilliland-Geerts Drain Branch exhibited shallow standing water (<10 cm), disorganized drainage patterns, and did not have a defined channel within the meadow marsh areas near Nauvoo Road. As the drain entered the deciduous woodland, the feature periodically developed defined bed and banks. Water depths remained shallow, although the limited establishment of vegetation within these locations indicates the presence of intermittent flows throughout the growing season. At the western edge of the woodland, the feature emptied into a small catchbasin. The flow path proceeded underground through tile drains in the agricultural field to the perched culvert outlet into the main stem of Gilliland-Geerts Drain. A newly-dug, dry channel was observed along the western edge of the woodland, which likely conveys seasonal overflow from the catchbasin north to Gilliland-Geerts Drain. The perched culvert outlet, >150 m of tile drained-length, and the catchbasin inlet at the edge of the woodland are significant barriers to the upstream migration of fish from the main stem of Gilliland-Geerts Drain. Together with the absence of fish during electrofishing surveys and the intermittent flow regime, Gilliland-Geerts Drain Branch provides indirect fish habitat only.

The channel of Gilliland-Geerts Drain Branch is characterized by a low gradient with a combination of straightened and meandering channel. In-stream vegetation consisted of a large patch of Common Reed near Nauvoo Road and other forbs within the meadow marsh area in the upstream reaches. Abundant woody debris was observed throughout the feature where it passed through the woodland, and deciduous trees and shrubs were rooted in the channel. Limited aquatic vegetation was observed throughout the drain, except for a few small patches of Watercress (*Nasturtium officinale*). The wetted width at the time of survey ranged from 0.5 to 3.0 m where it was feasible to measure, while the bankfull width ranged from 0.8 to 3.0 m where the

channel was defined. Substrates throughout Gilliland-Geerts Drain Branch were consistent, and dominated primarily by clay overlain by deposits of silt, cobble, muck, and detritus.

The extent of frequent flood ranged from 0 to 10 m on either side of the downstream, more defined reaches, and from 20 to 30 m on either side in the upstream areas where flows were diffuse through meadow marsh and thicket areas. The riparian corridor is densely vegetated by deciduous trees and shrubs with an understory of herbaceous plants. The extent of natural vegetation was limited to 0 to 10 m in areas adjacent to agricultural fields, but exceeded 30 m along the banks adjacent to the woodland. Shading was moderate to good quality (60-80%) throughout most of the feature.

4.2.3.3 Brown-Jarriott Drain

Brown-Jarriott Drain originates from a series of drainage features conveying surface runoff from the agricultural fields east of Nauvoo Road, south of the Gilliland-Geerts Drain Branch (**Figure 3-2**). East of Nauvoo Road, the feature is mapped by DFO as closed/tiled (OMAFRA 2022), however roadside investigations and aerial imagery review indicate that flows collect in a pond that presumably also manages stormwater for the adjacent light industrial properties on Industrial Drive. Flow direction is generally west through agricultural fields within the Off-site Study Area before turning south towards Confederation Line (**Figure 3-2**). Within the Off-site Study Area, Brown-Jarriott Drain has been classified by the DFO as an F-class drain (OMAFRA 2022). During the October 25, 2022 survey, depths within the drain were observed to be very shallow overall, with a maximum depth of 20 cm observed within a pool formed at the outlet of a tile drain due to erosion. Minimal flow (<0.5 L/s) was observed; however, it is anticipated that flow conditions are reduced to standing water or become dry during low-flow portions of the year. NRSI biologists did not document any fish species during electrofishing. At its upstream extent, the drain passes under Nauvoo Road through a concrete box culvert measuring approximately 1.5 m tall by 1.25 m wide. A deep pool is present within the culvert that may provide refuge for fish; however, due to the low ceiling of the box culvert, NRSI biologists were unable to safely electrofish in this area.

The channel of Brown-Jarriott Drain has been historically straightened and is characterized by a low gradient. No evidence of riffle, run, or pool habitat was observed within the assessed reach (AHA-008 on **Figure 3-2**). Instream habitat and cover consisted of woody debris from dead Common Buckthorn (*Rhamnus cathartica*) growing adjacent to the drain and abundant cattails (*Typha* spp.) growing within the channel. The wetted width at the time of survey ranged from 1.2 to 2.6 m, while the bankfull width ranged from 2.9 to 4.1 m. Substrates throughout Brown-Jarriott Drain were consistent, and dominated primarily by clay overlain by deposits of silt, sand, muck, and detritus.

The extent of frequent flood and natural vegetation ranged from 0 to 10 m on either side of the drain. The banks of the drain were densely vegetated by deciduous shrubs, including Common Buckthorn, hawthorns (*Crataegus* spp.), and Multiflora Rose (*Rosa*

multiflora) with an understory of herbaceous plants. Beyond the extent of natural vegetation, the surrounding landscape was gently sloped and characterized by agricultural fields planted with corn. Due to the lack of an extensive naturalized vegetation buffer, the drain receives poor quality (20%) shading relief.

4.2.4 Fish Habitat Summary and Significance

Within the Off-site Study Area, several watercourses are present that function as direct fish habitat. These features include Gilliland-Geerts Drain, Kersey Drain (Brown Creek), and Cameron Drain (**Figure 3-2**).

Gilliland-Geerts Drain provides perennial, direct fish habitat of marginal quality due to its historically-straightened channel form, the limited abundance of in-stream habitat features such as riffles, pools, and undercut banks, and the overall poor quality shade relief throughout the assessed reaches. Only two (2) common fish species were documented in Gilliland-Geerts Drain, suggesting low fish community diversity. The other two assessed features within the Bear Creek Headwaters subwatershed, Gilliland-Geerts Drain Branch and Brown-Jarriott Branch, were determined to provide indirect fish habitat only. In combination with limited and intermittent seasonal surface water flows, the absence of fish in these drains, and confirmed or potential barriers to the upstream migration of fish, direct fish habitat is unlikely. However, the features function to provide water flows, allochthonous inputs (nutrients and minerals), sediment and potential seasonal benthic invertebrate production to downstream reaches that may contain direct fish habitat.

Kersey Drain provides perennial, direct fish habitat of moderate to good quality. The majority of the feature within the Off-site Study area has been historically straightened, although some areas retain meanders and natural channel processes. Available in-stream habitats include pool and run sequences and a few riffles where the drain flows through the deciduous forest. Abundant woody debris and emergent aquatic vegetation provide cover opportunities for fish and structural complexity within the channel. Fish community diversity within Kersey Drain was relatively high during 2022 sampling, as indicated by 11 species with both coolwater and warmwater thermal regime tolerances. A few areas with evidence of groundwater inputs (e.g., Watercress, oily sheens produced by iron-metabolizing bacteria) were also observed, indicating that the hydrology of the watercourse may rely on inputs from both surface runoff and groundwater. The other two assessed features within the Brown Creek subwatershed, Cameron Drain and Burchill Drain are considered direct, seasonal fish habitat. Four (4) fish species were observed in Cameron Drain during 2022 fish sampling; however, fish were not detected in Burchill Drain. Barriers to the upstream migration of fish from Kersey Drain into these two tributaries were not observed, and during high flow periods of the year both these features are anticipated to support direct fish habitat. These features also support downstream fish habitats through the provision of water flows, allochthonous inputs, sediment and benthic invertebrate production.

Fish and fish habitat is protected by the federal *Fisheries Act* (1985), which prohibits the death of fish or the harmful alteration, disruption, or destruction (HADD) of fish habitat. Activities that have the potential to contravene the *Fisheries Act* require review by the DFO. Watercourses and associated floodplain areas are also regulated by the SCRCA through O. Reg. 171/06, under the provincial *Conservation Authorities Act*.

5 Summary of Ecological Environment Existing Conditions

Terrestrial and aquatic ecosystems within the On-site and Off-site Study Areas support important ecological functions at local and landscape scales. Although lands within the Study Areas are heavily influenced by historical and ongoing human activity, existing natural features provide habitat for a diversity of plant, fish, and wildlife species and underpin key ecological and hydrological processes such as primary and secondary production, energy and nutrient cycling, surface water storage, groundwater recharge, and water filtration.

To characterize the form, function, and significance of terrestrial and aquatic natural features and habitats within the On-site and Off-site Study Areas, NRSI biologists conducted comprehensive, multi-season field surveys in 2022. Available information from a variety of background sources (e.g., wildlife atlases, online community-based resources such as iNaturalist and eBird, the provincial Natural Heritage Information Centre, the St. Clair Region Conservation Authority, municipal official plans, previous ecological studies) was also reviewed and integrated with field survey results to provide a thorough understanding of the ecological environment existing conditions.

Terrestrial ecosystems within the On-site Study Area (i.e., the existing Twin Creeks Environmental Centre [TCEC] and lands owned by WM Canada) is characterized by active landfill areas, sedimentation ponds, poplar (*Populus* spp.) plantation phytoremediation systems, soil storage and maintenance facilities, a leachate storage area, and agricultural lands. Natural vegetation communities within the On-site Study Area are generally limited, but include forest, swamp, marsh, and culturally-influenced meadow communities. The Off-site Study Area (i.e., lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area and including the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road) is dominated by agricultural fields interspersed with residential and commercial properties, a cemetery, woodlots, and riparian areas surrounding municipal drains and watercourses. The On-site and Off-site Study Areas contain unevaluated wetlands, areas identified on Lambton County and Warwick Township Official Plans as Significant Woodland, and several species of vascular flora considered ‘Rare’ in Lambton County.

Confirmed Significant Wildlife Habitat (SWH) types that occur within both Study Areas include:

- Amphibian Breeding Habitat (Woodland);
- Terrestrial Crayfish Habitat; and
- Breeding habitat for the Species of Conservation Concern (SCC) species Western Chorus Frog (*Pseudacris triseriata* pop. 2).

Within the On-site Study Area, potential (but unconfirmed) breeding habitat may also be present for two other SCC, Eastern Wood-Pewee (*Contopus virens*) and Wood Thrush (*Hylocichla mustelina*); when confirmed, important habitats of SCC are considered SWH. Within the Off-site Study Area, breeding habitat for Eastern Wood-Pewee was confirmed, and potential habitat was identified for three (3) additional bird SCC: Wood Thrush, Canada Warbler (*Cardellina canadensis*), and Tufted Titmouse (*Baeolophus bicolor*). Candidate Amphibian Breeding Habitat (Wetland) and Bat Maternity Colony SWH may also be present within the Off-site Study Area (but not within the TCEC).

Natural features within the On-site and Off-site Study Areas have the potential to support habitat for Species at Risk (SAR) listed as Threatened or Endangered and protected under the provincial *Endangered Species Act, 2007 (ESA),* including:

- Eastern Hog-nosed Snake (*Heterodon platirhinos*);
- Little Brown Myotis (*Myotis lucifungus*);
- Northern Myotis (*Myotis septentrionalis*);
- Eastern Small-footed Myotis (*Myotis leibii*);
- Tri-colored Bat (*Perimyotis subflavus*); and
- Bobolink (*Dolichonyx oryzivorus*).

Aquatic ecosystems are mainly found within the Off-site Study Area; however, lands within the On-site Study Area drain to aquatic features within both the Brown Creek and Bear Creek Headwaters subwatersheds. Other than a small portion of Brown Creek present as a naturalized watercourse south of Confederation Line, all aquatic features within the Off-site Study Area are constructed open or closed (i.e., tiled) municipal drains with a history of channelization and other anthropogenic modifications. Open channel features include Kersey Drain (the channelized reach of Brown Creek), Cameron Drain, Burchill Drain, Gilliland-Geerts Drain, Gilliland-Geerts Drain Branch, and Brown-Jarriott Drain. Perennial or seasonal direct fish habitat of moderate to good quality is present within all features except for Gilliland-Geerts Drain Branch and Burchill Drain (which were determined to provide indirect fish habitat only). Kersey Drain was determined to provide the best quality habitat and support the most diverse fish community when compared with other assessed features. Aquatic ecosystems within the Off-site Study Area provide habitat for fish species with both coolwater and warmwater thermal regime tolerances. No aquatic SAR or SCC were documented during electrofishing surveys completed by NRSI biologists in 2022.

The form, function, and significance of terrestrial and aquatic ecosystems within the On-site and Off-site Study Areas will be considered, and appropriate mitigation measures will be recommended where necessary, during the evaluation of alterative methods phase of the TCEC Landfill Optimization Project Environmental Assessment.

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A

Approved Ecological Environment Work Plan

Ecological (Terrestrial and Aquatic) Work Plan

Twin Creeks Environmental Centre Landfill Optimization Project

Waste Management of Canada Corporation

Watford, Ontario

Revised on November 12, 2021

Prepared by:

Natural Resource Solutions Inc.
415 Phillip Street, Unit C, Waterloo, ON N2L 3X2

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Acronyms

Acronym	Definition
EA	Environmental Assessment
ELC	Ecological Land Classification
MECP	Ministry of Environment, Conservation and Parks
MNRF	Ministry of Natural Resources and Forestry
NRSI	Natural Resource Solutions Inc.
SAR	Species at Risk
SCC	Species of Conservation Concern
SCRCA	St. Clair River Conservation Authority
SWH	Significant Wildlife Habitat
TCEC	Twin Creeks Environmental Centre
ToR	Terms of Reference
WM	Waste Management of Canada Corporation

1 Introduction

This Ecological (Terrestrial and Aquatic) work plan has been prepared to support the environmental assessment (EA) for the Twin Creeks Environmental Centre Landfill Optimization Project (the Project) and will be appended to the Terms of Reference (ToR) for the EA to be submitted to the Ministry of Environment, Conservation and Parks (MECP) for approval.

The Ecological Environment considers both the terrestrial and aquatic ecosystems and includes vegetation communities and species, wildlife and wildlife habitat, aquatic organisms such as fish and aquatic habitat. Studying the Ecological Environment affords an opportunity to assess the species and communities present, as well as the abundance of these organisms.

Waste Management of Canada Corporation (WM), the owner and operator of the Twin Creeks Environmental Centre (TCEC) in Watford, Ontario, has initiated an EA seeking approval to optimize the landfill design and operation, maximizing the use of the constructed infrastructure and the significant investment made at the TCEC. The optimization could involve a vertical expansion of the landfill within the approved 101.8 ha Expansion Landfill footprint by modifying the side slopes and increasing the elevation of the landfill. This optimization could provide additional airspace of up to approximately 14M m^3, which could extend the site life by approximately 12 years (from 2032 to 2044). There would be no change to the current 101.8 ha landfill footprint area, the approved service area, or the annual fill rate.

The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation. The TCEC provides landfill gas, for heating, to the 40-acre greenhouse facility adjacent to the landfill property. Prior to this, all landfill gas was flared. The intent is for the landfill to supply gas for heating to the greenhouses for 25 years.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha poplar system planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

WM pays host community fees annually to the Township of Warwick. Since 2009, when the TCEC Expansion Landfill began receiving waste, WM has contributed over $23M in host community fees to the Township.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of

the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA will be carried out in accordance with the requirements of the *Ontario Environmental Assessment Act*.

2 Study Purpose and Objectives

This Ecological (Terrestrial and Aquatic) work plan outlines the tasks required to support the EA through the characterization of existing conditions and assessment of potential environmental effects of the project on the Terrestrial and Aquatic environment, including the evaluation of the various alternative methods and the identification and assessment of a preferred alternative. This work plan outlines the scope of the Ecological (Terrestrial and Aquatic) work, including protocols and/or standards to be adhered to while the work is undertaken. The specific evaluation criteria, indicators, and data sources to be used and the study areas to be considered are provided below. These items may be adjusted during the EA process.

In accordance with the *Ontario Environmental Assessment Act*, the objectives of the EA are as follows:

1. Describe the environment potentially affected by the proposed undertaking, including both the existing environment as well as the environment that would otherwise be likely to exist in the future without the proposed undertaking;
2. Carry out an evaluation of the environmental effects of the proposed undertaking, using the environmental assessment criteria and studies that have been established through the development of the ToR;
3. Undertake an evaluation of any additional actions that may be necessary to prevent, change or mitigate environmental effects;
4. Provide a description and evaluation of the environmental advantages and disadvantages of the proposed undertaking, based on the net environmental effects that will result following mitigation; and
5. Prepare monitoring, contingency and impact management plans to mitigate the environmental effects of the proposed undertaking.

3 Study Areas

During the EA, existing conditions and potential effects will be considered in the context of two study areas: on-site and off-site. The general study areas proposed for the purposes of the EA are (Figure 1):

- On-site Study Area: the existing TCEC.
- Off-site Study Area: the lands within the vicinity of the TCEC extending approximately 1 km out from the On-site Study Area.

- The Off-site Study Area will include the Gilliland-Geerts Drain downstream and westward of the TCEC to Underpass Road.

These study areas have been adopted for the Ecological Environment. The Off-site Study Area encompasses a 'primary zone of influence' extending 120m from the existing TCEC in keeping with the definition of 'adjacent lands' as set forth in the Natural Heritage Reference Manual (MNRF 2010).

4 Scope of Work

The scope of work for the Ecological (Terrestrial and Aquatic) work includes the development of evaluation criteria, indicators, and data sources, characterization of existing terrestrial and aquatic ecological conditions, assessment of the potential environmental effects of the alternative methods and the preferred alternative, development of mitigation measures and monitoring programs, and reporting as outlined below.

4.1 Evaluation Criteria, Indicators, and Data Sources

The environmental assessment criteria, indicators, and data sources for the terrestrial and aquatic ecological environment are provided in Table 1. The assessment criteria, indicators, and data sources will be used to assess the effects of the alternatives and the preferred alternative on the Terrestrial and Aquatic environment. These evaluation criteria and indicators will be finalized during the EA.

Table 1. Evaluation Criteria, Indicators, and Data Sources for the Ecological Environment

Evaluation Criteria	Rationale	Indicators	Data Sources
Ecological Environment			
Terrestrial Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural terrestrial habitats, including rare, threatened or endangered species.	• Predicted effects on vegetation communities and species including rare, threatened or endangered species • Predicted effects on wildlife and wildlife habitat including rare, threatened or endangered species	• Vegetation and wildlife data, including SAR data from previous studies • Terrestrial field studies • Aerial imagery • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas. • Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement (Ontario Ministry of Natural Resources 2010) • Significant Wildlife Habitat Technical Guide (Ontario Ministry of Natural Resources 2000)

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Significant Wildlife Habitat (Schedule Criteria for Ecoregion 7E (Ontario Ministry of Natural Resources and Forestry 2015) • MECP background data • MNRF background data • SCRCA background data • Natural Heritage Information Centre background data • Ontario Breeding Bird Atlas • Ontario Butterfly Atlas • Ontario Reptile and Amphibian Atlas • Ontario Odonata Atlas • Ontario Mammal Atlas • eBird • iNaturalist • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data • Results of other discipline assessments • Survey protocol for Ontario's Species at Risk Snakes (MNRF 2016a) • Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c) • Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF 2016b) • Ontario Wetland Evaluation System: Southern Manual (MNRF 2014)
Aquatic Ecosystems	Continued or expanded operation of the waste disposal facility may disturb the functioning of natural aquatic habitats and species, including rare, threatened or endangered species.	• Predicted effects on aquatic habitat, including fish habitat • Predicted effects on aquatic biota including rare, threatened or endangered species	• Fish and fish habitat survey data from previous studies • Aquatic field studies • Local and Indigenous sources of information on the ecological functions of features within the On-site and Off-site Study Areas. • MNRF review letters of previous existing conditions reports • MNRF aquatic resource data • Fisheries and Oceans Canada (DFO) Aquatic Species at Risk mapping • Annual monitoring report data • Proposed facility characteristics • Landfill design and operations data • Annual monitoring report data

Evaluation Criteria	Rationale	Indicators	Data Sources
			• Results of other discipline assessments • Observations obtained as part of interviews with riparian landowners

4.2 Characterization of Existing Conditions

In order to determine a study approach for the Ecological (Terrestrial and Aquatic) Environment component of the EA, existing natural heritage information was first gathered and reviewed to identify key natural heritage features and species that are reported from, or have potential to occur within the On-site and Off-site Study Areas.

4.2.1 Background Data Collection

Available background information pertaining to the biological resources within the On-site and Off-site Study Areas was collected and reviewed to inform this work plan. During the EA, additional information from various sources will be considered and incorporated into an updated Characterization of Existing Conditions as it becomes available. This information has included (or will include) file material from the St. Clair River Conservation Authority (SCRCA), MECP, Ministry of Northern Development, Mines, Natural Resources and Forestry (MNRF), Ontario Breeding Bird Atlas (BSC et al. 2006), Ontario Butterfly Atlas (Macnaughton et al. 2020), Ontario Reptile and Amphibian Atlas (Ontario Nature 2019), Ontario Mammal Atlas (Dobbyn 1994), and online databases, such as the Natural Heritage Information Centre (NHIC), SAR listings at the federal and provincial levels, and species of regional significance.

Previous reporting from the EA prepared in 2004 will be utilized, specifically the natural heritage reporting completed by Gartner Lee Ltd. (2004).

4.2.2 Species at Risk / Species of Conservation Concern Screening

A preliminary screening has been completed to determine the potential for SAR, SCC and their habitats to be present within the On-site and Off-site Study Areas. The habitats on the site, as derived from air photo interpretation and data from existing data sources (e.g., Gartner Lee Ltd. 2004), have been compared to the habitat requirements of SAR and SCC reported from the local area. See Appendix A for the preliminary SAR/SCC screening. Based on the results of the preliminary screening, 17 SAR and SCC were identified as having potentially suitable habitat within the study areas. Surveys for these species will be undertaken and the species will be addressed in the EA.

4.2.3 Significant Wildlife Habitat Screening

Potential Significant Wildlife Habitat (SWH) types were screened based on NRSI's knowledge of the natural heritage features within the study area and using discrete significance established by the MNRF (2015a). The results of the preliminary SWH screenings have informed the surveys required to determine if such habitats are present within the On-site and Off-site Study Areas.

Based on the preliminary screening, 14 Candidate SWH types were identified as potentially occurring within the On-site and Off-site Study Areas, pending further assessment during site investigations. Appendix B provides a summary of the SWH screening exercise, including rationale as to why SWH types are considered "Candidate SWH" or "Not SWH".

4.2.4 Field Surveys and Characterization

As outlined in Section 3 of this work plan, the Off-site Study Area extends to 1km from the perimeter of the On-site Study Area (Figure 1). Field surveys will be completed in the On-site Study area, and will also be completed in the Off-Site Study Area to the extent possible, subject to property access. Where property access is not available, surveys in the Off-site Study Area will focus on the lands that can be reviewed from the boundary of the On-site Study Area, as well as from road right of ways (ROWs).

The following field surveys will be completed to characterize the existing natural features and wildlife habitats according to standardized survey protocols:

Vegetation Surveys

- Mapping of vegetation communities using the Ecological Land Classification (ELC) methods for southern Ontario (Lee et al. 1998). Details on the vegetation communities will be recorded, including species composition, dominance, uncommon species or features;
- Three-season vascular flora inventory, consisting 3 visits: 1 each in the spring (early to mid-May), summer (late June to July), and late summer (late August to September) seasons. Any rare species or vegetation communities identified and their location(s) will be recorded with a handheld GPS;
    - Vascular flora inventories will also function to determine the presence of the SAR Butternut (*Juglans cinerea*) and SCC Green Dragon (*Arisaema dracontium*), Puttyroot (*Aplectrum hyemale*), and Black Ash (*Fraxinus nigra*) as identified in Appendix A;
- Wetland boundary and woodland dripline delineation and agency review to confirm boundaries of these features (this will be undertaken within the On-site Study Area only). Wetland boundary delineation will be completed in accordance with the Ontario Wetland Evaluation System (OWES; MNRF 2014). Woodlands will be delineated based on the dripline.

Avifaunal Surveys

- Breeding bird surveys, consisting of 3 visits in the early morning, spaced at least 1 week apart between May 25 and July 10. Point counts (10 min each), walking

transects, and area searches will be utilized. Standard breeding evidence will be recorded according to the Ontario Breeding Bird Atlas methodology (OBBA 2020). These surveys, along with habitat characterizations, will allow for the identification of any significant species and SWH that may be present;

  - Within appropriate open grassland habitats that have been identified in Appendix A as potential habitat for the SAR Eastern Meadowlark (*Sturnella magna*) and Bobolink (*Dolichonyx oryzivorus*), breeding bird surveys will follow the methodologies outlined in the Bobolink and Eastern Meadowlark Survey Methodology (MNRF 2015b).
  - In addition to Eastern Meadowlark and Bobolink, several other bird SAR and SCC have been identified in Appendix A; breeding bird surveys will also function to determine the presence of these species;

- During all site visits, including breeding bird surveys, general observations of the abundance and activity of gulls (*Laridae* family) will be documented specifically within the On-site Study Area.
  - Information on any site-specific bird management programs that are currently in place at the existing TCEC facility will be researched and documented as part of the EA.

Herpetofaunal Surveys

- Evening anuran call surveys during the amphibian breeding season, consisting of 3 visits: 1 each in April, May, and June when air temperatures are a minimum of 5°C, 10°C, and 17°C, respectively. Surveys will be completed during the first half of each month, and will follow the methodology outlined in the Marsh Monitoring Program protocol (BSC 2009);
- Daytime anuran call surveys during the breeding season for the SCC Western Chorus Frog (*Pseudacris triseriata* pop. 2), consisting of at least 2 visits at least 24h apart between mid-March and April when air temperature is at least 10°C. Surveys will follow the methodologies outlined in the Survey Protocol for 2020 Western Chorus Frog Long-Term Monitoring Program (Blazing Star Environmental 2020), and be conducted between 1000h and 1800h. Should Western Chorus Frog be detected at any survey location by the end of the 2nd survey, a 3rd survey will not be completed. Should Western Chorus Frog not be detected by the end of the 2nd survey, a 3rd survey will be completed.
- Reptile surveys following a phased approach:
  - Phase 1 will involve a reptile habitat assessment, consisting of 1 visit in late March (prior to the spring reptile emergence period) to determine if suitable habitat for significant snake and turtle species is present. Assessments will be completed by reviewing natural features and comparing available habitats with those preferred by the target species. As summarized in Appendix A of this work plan, target species include the SCC Snapping Turtle (*Chelydra serpentina*) and the SAR Eastern Hog-nosed Snake (*Heterodon platirhinos*);
  - Phase 2 will be initiated should the reptile habitat assessment indicate that suitable habitat is present. Should it be determined that habitat for Eastern Hog-nosed

Snake is present, it will be assumed that the species is present in keeping with the methods outlined in the Survey Protocol for Ontario's Species at Risk Snakes (MNRF 2016a) due to the cryptic nature of the species, and no further targeted surveys will be undertaken for this species. Should it be determined that habitat for Snapping Turtle is present, the following surveys will be completed in accordance with the methodologies outlined in the Survey Protocol for Blanding's Turtle in Ontario (MNRF 2015c) and the Blanding's Turtle Nest and Nesting Survey Guidelines (MNRF 2016b), which are also appropriate for assessing the presence of Snapping Turtle:

- Spring turtle emergence and basking visual encounter surveys, consisting of 5 visits spread over at least 3 weeks and beginning once ice cover has melted. Surveys will occur no later than June 15, and will be conducted during the daytime when weather conditions are suitable for turtle basking;
- Turtle nest and nesting surveys, consisting of 6 visits on suitable nights during a 3-week period following the first reports of Snapping Turtle nesting in the area. Surveys will consist of area searches for actively-nesting turtles, signs of turtle activity (e.g., tracks, test pits), and any identifiable nests;

- Reptile area searches will also be carried out in tandem with all other surveys listed in this work plan that are conducted during suitable weather conditions within the reptile active season (April to October). During peak reptile activity periods (e.g., spring emergence, nesting), searches will expand to include driving surveys that will document any reptiles on roadways in the Off-site Study Area. These area searches and driving surveys will inform the general abundance and diversity of reptile species in the On- and Off-site Study Areas;

Insect Surveys

- Insect area searches will be carried out as part of each of the visits listed above in order to determine if Monarch (*Danaus plexippus*) and its larval food plants (Milkweed, *Asclepias* spp.) are present. Surveys will be focused in summer (June, July and August);

Mammal Surveys

- Bat habitat assessments, consisting of 2 site visits: 1 each in leaf-off and leaf-on conditions according to the Survey Protocol for Species at Risk Bats within Treed Habitats (MNRF 2017). Surveys will assess the presence of suitable roosting habitat (e.g., cavity trees, leaf clusters) that may be used by SAR bats;

  - Acoustic surveys aimed at determining the bat species that are present are not included in this work plan. WM's preference is to develop additional disposal capacity through a vertical expansion of the approved landfill. Consequently, no woodland habitat will be removed. Determining the presence or absence of SAR bat species through acoustic surveys is not typically required if habitat removal is not proposed. An assessment of potential effects on any identified habitat is appropriate. It will be assumed that SAR bat species are present if suitable habitat is present. Should a different preferred alternative be identified during the EA that will result in the removal of treed habitats, survey requirements will be confirmed with the MECP at that time;

- During all site visits, general observations of the abundance and activity of all mammal species will be documented specifically within the On-site Study Area. A particular focus will be placed on identifying the presence and type of predatory mammals. Direct observations, as well as signs such as dens, tracks, scats, etc.

Aquatic Surveys

- Aquatic habitat assessments of watercourse features to characterize the current aquatic habitat conditions. This will include an assessment of the general morphology of the features (e.g., bankfull and wetted widths, bank height, riffle/pool characteristics), general flow conditions and water depths, substrate composition, available aquatic habitat and instream cover, riparian vegetation community conditions and adjacent land uses, and in situ water quality measurements (e.g., water temperature, conductivity, pH and turbidity). Surveys will be completed in the spring and summer. Primary focus will be on the Kersey Drain / Brown Creek, and the Gilliland-Geerts Drains and their headwater tributaries;
    - Flow conditions and water temperature in the watercourses of primary focus will be documented during the completion of other surveys throughout the field season, to provide information on the flow and thermal regimes of the features.
- Fish community surveys will be completed to assess the presence of direct fish habitat in the watercourses of primary focus. Surveys will be undertaken with a backpack electrofishing unit and will be conducted in accordance with the Ontario Stream Assessment Protocol (OSAP) single-pass electrofishing methodology (Stanfield 2017). Once collected, fish will be identified to species and released outside of the sampling area. The number of individual fish, and minimum and maximum lengths for each species, will be recorded along with representative photographs of each species. Water quality conditions, electrofisher settings, and number of shocking seconds for each pass will be documented. Due to the intermittent/ephemeral nature of the features, surveys will be conducted when flows are seasonally elevated in either the spring or fall;
    - While fish community assessments will provide information on the composition and diversity of resident fish populations, they will also function to determine the presence of the SCC Northern Sunfish (*Lepomis peltastes*) as identified in Appendix A;

Other Surveys

- In addition to targeted surveys noted above, all wildlife species will be recorded during field surveys. Any features that may be indicative of SWH or habitat for SAR will be documented in detail, photographed, and georeferenced. General assessments of habitat connectivity and ecological linkage areas will be also be completed during surveys.

4.3 Assessment of Potential Environmental Effects

Using the evaluation criteria, indicators, rationale, and data sources from Section 4.1 and the characterization of existing conditions as described in Section 4.2, the assessment of potential environmental effects will be carried out as follows:

- predict the potential environmental effects for each alternative method (Section 4.3.1);
- identify the preferred alternative based on a comparative evaluation of the potential environmental effects of each alternative method (Section 4.3.2); and
- conduct an effects assessment on the preferred alternative, including the identification of mitigation measures and monitoring programs (Sections 4.3.3).

4.3.1 Evaluation of Alternative Methods

The potential effects of each alternative method will be identified based upon application of the proposed evaluation criteria, indicators and data sources as outlined in Section 4.1. Potential effects can be positive or negative, direct or indirect, and short or long-term. Mitigation measures will be identified to minimize or mitigate the potential effects and then the net effects are evaluated taking into consideration the application of mitigation measures.

The analysis and evaluation of impacts will be divided into direct, indirect, induced, and cumulative impacts, which will be assessed in the short- and long-terms.

- Direct impacts associated with the disruption or displacement caused by the actual proposed footprint of the undertaking, such as direct impacts to wildlife and/or their habitats;
- Indirect impacts associated with changes in site conditions, such as indirect impacts to wildlife and modifications to drainage and water quantity and quality; and
- Induced impacts associated with impacts after the landfill expansion is in operation, such as the subsequent increase in landfill capacity and the increased demand on the resources by use of the area.

Recommendations with regard to mitigation of construction and residual effects will also be made and opportunities for enhancements will be highlighted. As part of the recommendations outlined, timing windows to avoid impacts will be included, such as tree removal (if required).

4.3.2 Identification of the Preferred Alternative

The alternative methods will be comparatively assessed and evaluated using the proposed evaluation criteria, indicators, and data sources to determine the preferred alternative. The differences in the potential environmental effects remaining following the implementation of mitigation/management measures (i.e., net effects) will be used to identify and compare the advantages and disadvantages of each alternative method. The comparison of alternative methods will include a clear rationale for the selection of the preferred alternative.

4.3.3 Effects Assessment of the Preferred Alternative

Following the identification of the preferred alternative, an effects assessment will be carried out on the preferred alternative considering the same evaluation criteria, indicators, and data sources, and additional studies as required, considering possible mitigation and/or management measures and cumulative effects. The potential effects of the

preferred alternative will be compared to the 'do nothing' alternative and will examine cumulative impacts associated with surrounding activities over time and space.

4.4 Reporting

Two separate reports will be prepared for the Ecological (Terrestrial and Aquatic) work in support of the EA:

1. A report providing a characterization of Existing Conditions; and
2. A report providing the Effects Assessment.

These reports will be appended to the EA Study Report and will be available for review during the EA. A summary of the existing conditions and effects assessment will be included in the EA Study Report.

The characterization of existing conditions will include details of completed field investigations, technical analyses, methods, results, maps of sensitive features within the On-site and Off-site Study Areas, conclusions, and recommendations.

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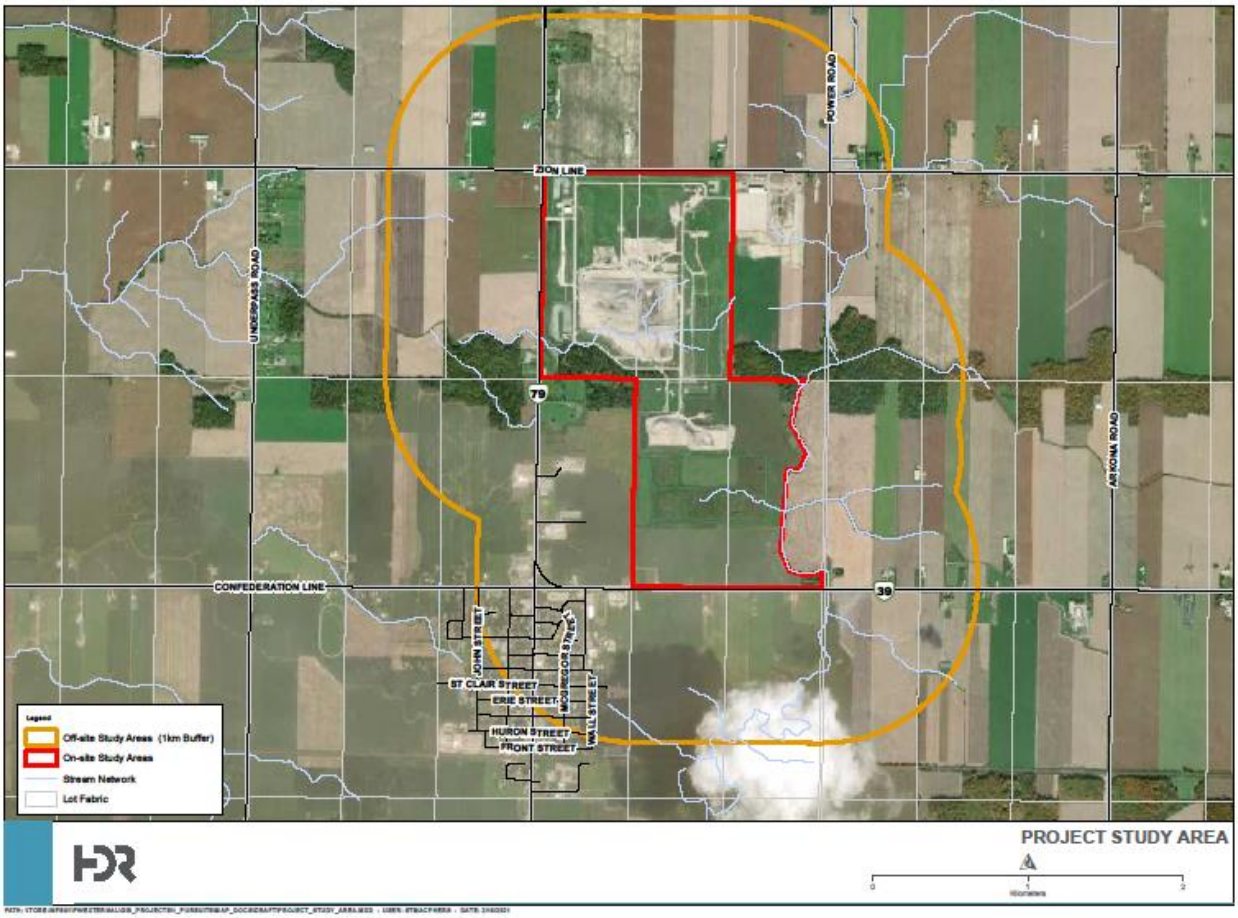
Figures

Figure 1. General On-site and Off-site Study Areas



A

Species at Risk / Species of Conservation Concern Screening Assessment

Preliminary Species at Risk and Species of Conservation Concern Screening - Twin Creeks Environmental Centre Landfill Optimization Project (Project #2538)

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	Suitable Habitat Within Study Areas?
Birds									
Chaetura pelagica	Chimney Swift	S3B	THR	T	T	Schedule 1	BSC et al. 2006	Commonly found in urban areas near buildings; nests in chimneys, hollow trees,and crevices of rock cliffs. Feeds over open water.[3,4]	Unlikely. Cultural woodlands and deciduous forests present within On- and Off-site Study Areas and may contain suitable cavity trees with diameter (dbh) > 50cm, however this species prefers to nest in uncapped chimneys which are rare within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Contopus virens	Eastern Wood-pewee	S4B	SC	SC	SC	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006	Mid-canopy layer of forest clearings and edges of deciduous and mixed forest. Abundant in intermediate-age mature forest stands with little understory vegetation.[3,4]	Yes. Deciduous forest and cultural woodland habitats are present within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Dolichonyx oryzivorus	Bobolink	S4B	THR	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; MNRF 2021b	Large (>10 ha), open expansive grasslands, pastures, hayfields, meadows or fallow fields with dense ground cover. Occassionally nest in large (>50 ha) fields of winter wheat and rye in southwestern Ontario. [3,4]	Yes. Suitable habitat consisting of cultural meadows is present within the On-site Study Area. Active agricultural lands, particularly row crops, found within the Off-site Study Area are not suitable for Bobolink. Breeding bird surveys will be completed to confirm presence / absence.
Hirundo rustica	Barn Swallow	S4B	THR	SC	T	Schedule 1	BSC et al. 2006	Farmlands, rural areas and other open or semi-open areas near body of water. Nests almost exclusively on human-made structures such as open barns, buildings, bridges and culverts.[3,4]	Yes. Suitable foraging and nesting habitat is likely present within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Hylocichla mustelina	Wood Thrush	S4B	SC	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006	Carolinian and Great Lakes-St. Lawrence forest zones. Undisturbed moist mature deciduous or mixed forest with deciduous sapling growth. Near pond or swamp. Must have some trees higher than 12 m.[3,4]	Yes. Deciduous forest and cultural woodland habitats are present within the On- and Off-Site Study Areas. Breeding bird surveys will be completed to confirm presence / absence.
Riparia riparia	Bank Swallow	S4B	THR	T	T	Schedule 1	BSC et al. 2006	Nests in burrows in natural and human-made settings with vertical faces in silt and sand deposits. Ususally on banks of river and lakes, but also found in sand and gravel pits.[3,4]	Possible. Suitable foraging habitat is present within the On- and Off-Site Study Areas. Suitable nesting habitat may be present within the On-site Study Area. Breeding bird surveys will be completed to confirm presence / absence.
Sturnella magna	Eastern Meadowlark	S4B, S3N	THR	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; MNRF 2021b	Open pastures, hayfields, grasslands or grassy meadows with elevated singing perches (small trees, shrubs or fence posts). Also weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields or other open areas. Generally prefers larger tracts of habitat >10 ha, but will sometimes use smaller tracts.[3,4]	Yes. Suitable habitat consisting of cultural meadows is present within the On-site Study Area. Active agricultural lands, particularly row crops, found within the Off-site Study Area are not suitable for Eastern Meadowlark. Breeding bird surveys will be completed to confirm presence / absence.
Herpetofauna									
Turtles									
Chelydra serpentina	Snapping Turtle	S4	SC	SC	SC	Schedule 1	Ontario Nature 2019	Slow-flowing rivers and streams, lakes, and permanent or semi-permanent wetlands with soft substrates and vegetation. Key habitat requirements: open areas with structures for basking, open sand or gravel areas for nesting, shallow areas with soft substrates to bury in, soft banks or substrates for hibernation.[3]	Yes. A reptile habitat assessment will be completed to confirm the presence of suitable habitat for the species. If suitable habitat is present, targeted surveys for turtles will be completed to confirm presence / absence.

Preliminary Species at Risk and Species of Conservation Concern Screening - Twin Creeks Environmental Centre Landfill Optimization Project (Project #2538)

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	Suitable Habitat Within Study Areas?
Snakes									
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	T	Schedule 1	MECP 2021	Open habitats, such as open woods, brushland or forest edges, with well-drained loose or sandy soils, well-drained substrates. Specializes in hunting and eating toads; occurs in habitats near or adjacent to wetland habitats where toads are present. Rocks, logs, stumps, etc. are used for shelter. Uses snout to dig nests as well as to dig burrows for overwintering.[5]	Yes. Suitable habitat is likely to be present within the On- and Off-Site Study Areas. A reptile habitat assessment will be completed to confirm the presence of suitable habitat for the species. Should it be determined that habitat for Eastern Hog-nosed Snake is present, it will be assumed that the species is present, and no further targeted surveys will be undertaken.
Anurans									
Pseudacris triseriata pop.2	Western Chorus Frog (Great Lakes - St. Lawrence - Canadian Shield population)	S4	NAR	T	T	Schedule 1	iNaturalist 2021	Moist forest, prairie, meadows, cultural meadows, or marshes. Breeds in shallow, temporary, fishless wetlands, including flooded ditches, marshes, flooded fields, pastures, temporary ponds, pools, and swamps. Hibernates in terrestrial habitats under rocks, logs, leaf litter, loose soil, or in animal burrows.[6]	Yes. Daytime anuran call surveys for breeding frogs and toads will be completed to confirm presence / absence.
Mammals									
Myotis lucifungus	Little Brown Myotis	S3	END	E	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 and forest edges.[3,4]	Yes. Bat habitat assessments will be conducted to confirm if suitable habitat is present. Should it be determined that habitat for Little Brown Myotis is present, it will be assumed that the species is present.
Myotis septentrionalis	Northern Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994	Roosts in houses and man-made structures but prefers hollow trees or under loose bark. Hibernates in mines or caves. Hunts within forest, below the canopy.[3,4]	Yes. Bat habitat assessments will be conducted to confirm if suitable habitat is present. Should it be determined that habitat for Northern Myotis is present, it will be assumed that the species is present.
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	E	Schedule 1	Dobbyn 1994	Roosts and maternity colonies in older forests and occassionally in barns or other sturctures. Forage over water and along streams in the forest. Hibernate in caves.[3,4]	Yes. Bat habitat assessments will be conducted to confirm if suitable habitat is present. Should it be determined that habitat for Tri-colored Bat is present, it will be assumed that the species is present.
Insects									
Butterflies									
Danaus plexippus	Monarch	S2N, S4B	SC	END	SC	Schedule 1	Macnaughton et al. 2020	Adults found in a diversity of habitats with a variety of wildflowers. Caterpillars are confined to meadows and open areas where milkweeds grow (larval food plants).[3]	Yes. Suitable habitat consisting of cultural meadows and cultural woodlands are present within the On-and Off-Site Study Areas. Insect surveys will be conducted within the study area to determine presence / absence.
Polystoechotes punctata	Speckled Giant Lacewing	SH	-	-	-	-	MNRF 2021b	Cultural and natural landscapes. Extirpated from Ontario by mid-1950s. Only present in western North America (M. Burrell, NHIC pers.comm).	No. Species extirpated from Ontario.
Fish									
Lepomis peltastes pop. 2	Northern Sunfish (Great Lakes - Upper St. Lawrence populations)	S3	SC	SC	SC	Schedule 1	DFO 2019	Shallow vegetated areas of quiet, slow-flowing rivers and streams, as well as warm lakes and ponds, with sandy banks or rocky bottoms.[7]	Yes. Based on past surveys, Kersey Drain / Brown Creek and the Gilliland-Geerts Drain are likely to provide suitable aquatic habitat that could support Northern Sunfish. Fish community assessments will be completed to confirm presence / absence.

Preliminary Species at Risk and Species of Conservation Concern Screening - Twin Creeks Environmental Centre Landfill Optimization Project (Project #2538)

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	Suitable Habitat Within Study Areas?
Plants									
Aplectrum hyemale	Puttyroot	S2	-	-	-	-	MNRF 2021b	Rich forests, both upland beech-maple and swamps in moist ground.[8]	Possible. Deciduous forests found within the On- and Off-Site Study Areas may provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.
Arisaema dracontium	Green Dragon	S3	-	SC	SC	Schedule 3	MNRF 2021b	Moist forests, especially along river banks and floodplains.[8]	Possible. Deciduous forests found within the On- and Off-Site Study Areas may provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.
Fraxinus nigra	Black Ash	S4	-	T	NS	No Schedule	Gartner Lee Ltd. 2004	Usually on mucky or peaty soils in swamps, such as river floodplains.[8]	Yes. Deciduous forests found within the On- and Off-Site Study Areas provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.
Juglans cinerea	Butternut	S2?	END	E	E	Schedule 1	Gartner Lee Ltd. 2004	Stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands.[8]	Yes. Deciduous forests found within the On- and Off-Site Study Areas provide suitable growing conditions. Vascular flora inventories will be conducted to determine presence / absence.

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B

Significant Wildlife Habitat Screening Assessment

Significant Wildlife Habitat Assessment Tables

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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 Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Lake. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	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[cxlviii] Information Sources • 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 (eg. 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[f] or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat[cxlviii]. • 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.	Study area highly disturbed, specifically the TCEC. Species are not tolerant to human disturbance. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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 (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 Green-winged Teal American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Blue-winged Teal Hooded Merganser Common Merganser Red-breasted Merganser Lesser Scaup Greater Scaup Common Goldeneye Bufflehead Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Canvasback Redhead Ruddy Duck Brant White-winged Scoter Black Scoter	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). Information Sources • 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 (eg. 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[i] or more of listed species for 7 days[i], 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[cxlviii] • 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.	Suitable habitat is not present within study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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					
Rationale: 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	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. Information Sources • 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[i] 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[i] 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[cxlviii] • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #8 provides development effects and mitigation measures.	Suitable habitat is not present within study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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: Raptor Wintering Area					
Rationale: 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 Special Concern: 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 Bald Eagle: Forest Community Series: FOD, FOM, FOC, SWD, SWM, or SWC, on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering (hawk/owl) sites need to be > 20ha[cxlviii, cxlix] 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[cxlix] Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water and large trees and snags aviable for roosting[cxlix] Information Sources • OMNRF Districts • Natural clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from CAs • Results of Christmas Bird Counts	Studies confirm the use of these habitats by: • One or more Short-eared Owls, or, One of 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)[cxlix] for a minimum of 20 days by the above number of birds[i]. • 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[cxlix] Index #10 and #11 provides development effects and mitigation measures.	Study area highly disturbed, specifically the TCEC. Species are not tolerant to human disturbance. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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					
Rationale: Bat hibernacula, are rare habitats in all Ontario landscapes.	Big Brown Bat Eastern Pipistrelle/Tri-colored 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 The locations of bat hibernacula are relatively poorly known. Information Sources • OMNRF for possible locations and contact for local experts • Natural Heritage Information Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts	• All sites with confirmed hibernating bats are SWH[i]. • The area includes 200m radius around the entrance of the hibernaculum[cxlviii, ccvii, í]. for the development types and 1000m for wind farms [ccv.] • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the[ccv]."Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv] • SWHMIST[cxlix] Index #1 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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 Maternity Colonies					
Rationale: Known locations of forested bat maternity colonies are 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 building [sxxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario[xxii]. • 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]. Information Sources • 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[i] • >5 Adult Female Silver-haired Bats[i] • The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colonies[i]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"[ccv]. • SWHMIST[cxlix] Index #12 provides development effects and mitigation measures.	Suitable habitat is present within the study area. Bat habitat surveys will be completed in 2021 to determine presence / absence of this feature. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle Special Concern: 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[cix, cx, cxi, cxviii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH Information Sources • EIS studies carried out by Conservation Authorities • Field naturalists clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant[i]. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant[í]. • 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. – Apr)[cvii]. Congregation of turtles is more common where wintering areas are limited and therefore significant[cix, cx, cxi, cxii]. • SWHMIST[cxiix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	Suitable habitat is present within the study area. Reptile surveys will be conducted in 2021 to determine presence, although absence cannot be ruled out without more extensive surveys. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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: Reptile Hibernaculum					
Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant	Snakes: Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake Special Concern: Milksnake Eastern Ribbonsnake	For all snakes, habitat may be found in any ecosite in southern Ontario 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. The existence of rock piles or slopes, stone fences, and crumbling foundations assist in identifying candidate SWH.	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line[xliv, l, li, lii, cxii]. 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. Information Sources • 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 available from CAs • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)[í]. • Note: If there are Special Concern Species present, then site is SWH • Note: 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[í]. • SWHMIST[cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula.	Suitable habitat may be present within the study area. Reptile surveys will be completed in 2021 to determine presence, although absence cannot be ruled out without more extensive surveys. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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)					
Rationale: 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 population 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. Information Sources • Reports and other information available from CAs • Ontario Breeding Bird Atlas[ccv]. • Bird Studies Canada: Nature Counts http://www.birdscanada.org/birdmon/ • Field Naturalist clubs	Studies confirming: • Presence of 1 or more nesting sites with 8[cxlvix] 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[cxlix] Index #4 provides development effects and mitigation measures.	Suitable habitat may be present within the study area. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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 (Tree/Shrubs)					
Rationale: 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 15 m from ground, near the top of the tree. Information Sources • Ontario Breeding Bird Atlas[ccv], colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from CAs • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other list species. • The habitat extends from the 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 colonies must 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[cxlix] Index #5 provides development effects and mitigation measures.	Marginal suitable habitat is present within the study area, however, criterion species are not tolerant of heavily industrial environment of the immediate study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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)					
Rationale: Colonies are important to local bird population, 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. Information Sources • Ontario Breeding Bird Atlas[ccv], rare/colonial species records. • Canadian Wildlife Service • Reports and other information available from CAs • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of >25 active nests for Herring Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[í]. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[í]. • Presence of 5 or more pairs for Brewer's Blackbird[í]. • The edge of the colony and a minimum 150m radius area of the 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"[ccxi]. • SWHMIST[cxlix] Index #6 provides development effects and mitigation measures.	Suitable habitat is not present within the study area. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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: Migratory Butterfly Stopover Areas					
Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter	Painted Lady Red Admiral Special Concern: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate sight for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10ha in size with a combination of field and forest habitat present, and will be located within 5km of Lake Ontario and Erie[cxlix]. • 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[xxxii, 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, xli]. Information Sources • MNRF District Offices • Natural Heritage Information Centre (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, xlii]. • 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 White Admiral's is to be considered significant[l]. • SWHMIST[cxlix] Index #16 provides development effects and mitigation measures.	Study area is located >5km from the Lake Ontario and Erie shoreline. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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					
Rationale: Sites with a high diversity of species as well as high numbers 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 >5 ha[i] in size and within 5km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat • If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie or 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 and Lake Erie are Candidate SWH[cxlviii]. Information Sources • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp. with at least 10 bird spp. recorded on at least 5 different survey dates[i]. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (March/May) and fall (Aug/Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #9 provides development effects and mitigation measures.	Study area is located >5km from the Lake Ontario and Erie shoreline. **Not SWH**

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E.

	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					
Rationale: Deer movement during winter in the southern areas of Ecoregion 7E 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 [cxlviii]	White-tailed Deer	All Forested Ecosites with these ELC Community Series: FOC FOM FOD SWC SWM SWD Conifer plantations (CUP) smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha[i]. • Deer movement during winter in Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands[cxlviii]. • 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[ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[i]. Information Sources • MNRF District Offices • LIO/NRVIS	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF[cxlviii]. • 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 MNRF[i]. • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques[ccxxiv], ground or road surveys, or a pellet count deer density survey[ccxxv]. • SWHMIST[cxlix] Index #2 provides development effects and mitigation measures.	The MNRF has not identified this SWH within the study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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. Information Sources • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes[lxxviii] • SWHMIST[cxlix] Index #21 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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
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%.	A sand barren area >0.5ha in size Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens[lxxviii] • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotics sp)[i]. • SWHMIST[cxlix] Index #20 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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					
Rationale: Alvars are extremely rare habitats in Ecoregion 7E	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 **Five Alvar Indicator Species:** 1) Carex crawei 2) Panicum philadelphicum 3) Eleocharis compressa 4) Scutellaria parvula 5) Trichostema brachiatum These indicator species are very specific to Alvars within Ecoregion 7E[cxlix]	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 zoogeographically 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[lxxviii].	An Alvar site > 0.5ha in size[lxxv]. Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie[cxcix]. Information Sources • Alvars of Ontario (2000), Federation of Ontario Naturalists[lxxvi]. • Ontario Nature – Conserving Great Lakes Alvars[ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Staff • Field Naturalist clubs • Conservation Authorities	Field studies identify four of the five **Alvar indicator species**[lxxv] at a candidate Alvar site is Significant • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses[lxxv]. • SWHMIST[cxlix] Index #17 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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
Old Growth Forest					
Rationale: Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old growth forests are characterized by heavy mortality or turnover of overstorey 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 area is >0.5ha Information Sources • OMNRF Forest Resource Inventory mapping • OMNRF Districts • Field naturalist clubs • Conservation Authorities • Sustainable Forestry Licence (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[cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present) • Determine ELC Vegetation Type for forest area containing the old growth characteristics[lxxviii]. • SWHMIST[cxlix] Index #23 provides development effects and mitigation measures.	Vegetation community is not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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%. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l] Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location data available on their website • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in[lxxv] Appendix N should be present[l]. Note: Savannah plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #18 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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
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. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources • Natural Heritage Information Centre (NHIC has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in[lxxv] Appendix N should be present[l]. Note: Prairie plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation Type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #19 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E.

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 OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources • Natural Heritage Information Centre (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[cxlix] Index #37 provides development effects and mitigation measures.	Based on preliminary ELC work, rare vegetation communities are not present within the study area. Ecological Land Classification surveys in 2021 will confirm presence/absence. **Unlikely SWH**

Significant Wildlife Habitat Assessment Tables

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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 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[cxlix] from a wetland (>0.5ha) or a wetland (>0.5ha) with 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[cxlix]. • Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites. Information Sources • 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[i], or, • Presence of 10 or more nesting pairs for listed species including Mallards[i]. • 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"[ccxi] • 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[cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHMIST[cxlix] Index #25 provides development effects and mitigation measures.	Suitable habitat may be present within study area. Breeding bird surveys will be completed in 2021 to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					
Rationale: Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey Special Concern: 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). Information Sources • 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 format and does not include all the habitat. • Nature Counts, Ontario Nest Records Scheme data • OMNRF Districts • 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[cxlviii]. • 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 SWH[ccvii], maintaining undisturbed shorelines with large trees within this area is important[cxlviii]. • For a Bald Eagle the active nest and a 400-800m radius around the nest is the SWH[cvi, ccvii]. Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat[cvi]. • 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"[ccxi] • SWHMIST[cxlix] Index #26 provides development effects and mitigation measures.	Suitable habitat not present within study area. **Not SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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 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 combined >30ha or with >4ha of interior habitat[lxxxviiii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii]. Interior habitat determined with a 200m buffer[cxlviii]. • 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 Coopers 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. Information Sources • OMNRF Districts • 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[cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha of habitat is the SWH[ccvii].(the 28ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • 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 early 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.	Suitable habitat not present within study area. **Not SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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 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 Special Concern: Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m)[cxlviii] 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. Information Sources • 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	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[l] • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH[i] • 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 dependant on slope, riparian vegetation and adjacent land use is the SWH[cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat[cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observation studies observing the turtles nesting is a recommended method. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	Suitable habitat is present within the study area. Reptile surveys will be conducted in 2021 to determine presence, although absence cannot be ruled out without more extensive surveys. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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: 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[cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species[cxix, cxx, cxxi, cxxii, cxiii, cxiv]. Information Sources • Topographical Map • Thermography • Hydrological surveys conducted by CAs and MOE • Field naturalists 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[í] 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 of the habitat[cxlviii]. • SWHMIST[cxlix] Index #30 provides development effects and mitigation measures.	Seeps or springs may be present within the study area. Field surveys will be conducted to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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 (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) [ccvii] within or adjacent (within 120m) to a woodland (no minimum size)[clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. 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[cxlviii]. Information Sources • 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 Districts and 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/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3. • A combination of observational study and call count surveys [cviii] 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 wetland area plus a 230m radius of woodland area[lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWHMIST[cxlix] Index #14 provides development effects and mitigation measures.	Suitable habitat is present within the study area. Field surveys will be completed in 2021 to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario Landscapes	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog 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 >500m^2 (about 25m diameter)[ccvii] supporting high species diversity are significant: some small or ephemeral habitats may not be identified on MNR mapping and could be important amphibian breeding habitats[clxxxiv]. • 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. Information Sources • 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 1or more of the listed newt/salamander species or 2 or more of the listed frog or toad species and with at least 20 breeding individuals (adults and eggs masses)[lxxi, lxxiii] or 2 or more of the listed frog/toad species with Call Level of 3. or; Wetland with confirmed breeding Bullfrogs are significant[i]. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys cviii to determine breeding/larval stages will be required during the spring (May March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/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[cxdix] Index #15 provides development effects and mitigation measures.	Suitable habitat may be present within the study area. Field surveys will be completed in 2021 to confirm presence/absence. **Candidate SWH**

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E.

	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 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 Pileated Woodpecker 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 >30ha[cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200m from forest edge habitat[clxiv]. Information Sources • Local birder 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 determine what forests were of greatest value to interior species. • Reports and other information available from CAs	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species[l]. • Note: any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH[l]. • Conduct field investigations in 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.	Suitable habitat not present within study area. **Not SWH**

Significant Wildlife Habitat Assessment Tables

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	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 Green Heron Trumpeter Swan Special Concern: 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[cxxiv]. • 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. Information Sources • OMNRF Districts and wetland evaluations • Field naturalist clubs • Natural Heritage Information Centre (NHIC) • 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 breeding by any combination of 4 or more of the listed species[i]. • Note: any wetland with breeding of 1 or more Trumpeter Swans, Black Terns, Green Heron or Yellow Rail is SWH[i]. • 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[cxlix] Index #35 provides development effects and mitigation measures	Suitable habitat may be present. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	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: 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 Special Concern: Short-eared Owl	CUM1 CUM2	Large grassland areas (includes natural and cultural fields and meadows) >30ha[clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. 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)[i]. 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. Information Sources • Agricultural land classification maps Ministry of Agriculture • Local birder clubs • Ontario Breeding Bird Atlas[ccv] • EIS Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species[l]. • A field with 1 or more breeding Short-eared Owls 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[cxlix] Index #32 provides development effects and mitigation measures	Suitable habitat may be present. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	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					
Rationale: 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.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of shrub ecosites can be complexed into a larger habitat such as woodland area for some bird species.	Large natural field areas succeeding to shrub and thicket habitats >10ha[clxiv] 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)[i]. Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species[clxxiii]. Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources • 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[i]. • A field with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat[i]. • 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[cxlix] Index #33 provides development effects and mitigation measures.	Suitable habitat may be present. Breeding bird surveys will be completed in 2021 to determine presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	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: Terrestrial Crayfish					
Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. [Ccii]	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crawfish or Meadow Crayfish (*Cambarus Diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish	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. Information Sources • 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 large ecosite area is the SWH • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult [cci] • SWHMIST[cxlix] Index #36 provides development effects and mitigation measures.	Suitable habitat may be present within mineral meadow marsh lands found within the study area. Area searches will be conducted to confirm presence/absence. **Candidate SWH**

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E.

	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					
Rationale: 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 (NHIC).	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[lxxviii]. Information Sources • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists and element occurrences for these species. • 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 neess to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	Special Concern and Provincially Rare plant and animal species are possible within the study area. Wildlife and vegetation surveys will be conducted within the study area to confirm presence/absence. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 7E.

	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 Movement Corridors					
Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Blue-spotted Salamander Spotted Salamander Four-toed Salamander Gray Treefrog Northern Leopard Frog Pickerel Frog Western Chorus Frog	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[clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi] Movement corridors must be considered when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule[i]. Information Sources • MNRF District Office • Natural Heritage Information Centre 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[cxlix]. • Corridors should have at least 15m of vegetation on both sides of waterway[cxlix] or be up to 200m wide[cxlix] of woodland habitat and with gaps <20m[cxlix] • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat[cxlix]. • SWHMIST[cxlix] Index #40 provides development effects and mitigation measures.	Amphibian Breeding Habitat may be present within the study area. If Amphibian Breeding Habitat - Wetland is confirmed, an Amphibian Movement Corridor will be identified. Anuran surveys are to be completed in 2021. **Candidate SWH**

Significant Wildlife Habitat Assessment Tables

Table 6. Exceptions for Ecodistricts within Ecoregion 7E.

	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						
7E-2	Bat Migratory Stopover Area Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types		• Long distance migratory bats typically migrate during late summer and early fall migrating summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas. • This is the only known bat migratory stopover habitats based on current information. <u>Information Sources</u> • OMNRF for possible locations and contact for local experts • University of Waterloo, Biology Department	• Long Point (42°35'N, 80°30'E, to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired bats, due to significant increases in abundance, activity and feeding that was documented during fall migration[ccxv]. • The confirmation criteria and habitat areas for this SWH are still being determined. • SWHMIST[cxlix] Index #38 provides development effects and mitigation measures	This study area does not fall within the Long Point area. **Not SWH**

B

Final Significant Species Screening

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	On-site Study Area	Off-site Study Area
Birds										
Asio flammeus	Short-eared Owl	S4?B,S2S3N	THR	T	SC	Schedule 1	eBird 2023	Grasslands, open areas or meadows that are grassy or bushy; marshes, bogs or tundra. Nests on the ground and requires 75-100 ha of contiguous open habitat.[4]	Open meadow habitats are present within the On-site Study Area, however suitable areas are too small and are unlikely to be used by the species. Short-eared Owl was not observed during breeding bird surveys or other field surveys in 2022.	Preferred, good quality habitat for Short-eared Owl is not likely present within the Off-site Study Area. eBird observations of the species within the vicinity of the landfill are generally made outside of the nesting season (April 15-August 15), and are most consistent with migrating individuals.
Baeolophus bicolor	Tufted Titmouse	S3					eBird 2023	Deciduous woodlands or mixed evergreen-deciduous woodlands with tall trees, typically in areas with a dense canopy and many tree species. Common in orchards, parks, and suburban areas. Generally found at low elevations.[9]	Suitable deciduous forest habitat is present within the On-site Study area, however the species was not observed in these habitats during breeding bird surveys or other field surveys in 2022. Tufted Titmouse was observed exhibiting possible breeding evidence in higher-quality habitat within the Off-site Study Area.	A single adult male was heard singing (indicating evidence of possible breeding) from the deciduous woodland west of Nauvoo Road in the Off-site Study Area on May 17, 2022. The woodland where the singing male was heard provides suitable breeding habitat for the species. Although Tufted Titmouse was not subsequently detected during breeding bird surveys, nesting can begin in May and the species is considered to be potentially breeding in the Off-site Study Area.
Cardellina canadensis	Canada Warbler	S5B	SC	SC	T	Schedule 1	NRSI Observations 2022	Moist, mixed coniferous and deciduous forests with well-developed, dense shrub layer and closed canopy; wet bottomlands of cedar or alder; shrubby undergrowth in cool moist mature woodlands; riparian habitat. Most often found in large forest tracks.[4,9]	The deciduous swamp that extends into the On-site property in the east may provide suitable habitat, however Canada Warbler was not observed in this location during 2022 breeding bird surveys. The species was observed by NRSI biologists only in the Off-site Study Area where preferred habitat is more abundant.	A single adult male was heard singing (indicating evidence of possible breeding) from the deciduous woodlot immediately east of Underpass Road, in the western portion of the Off-site Study Area. The woodland in this location is smaller than the forested tracts usually preferred by the species, however the habitat in this woodland, as well as elsewhere within the Off-site Study Area, are suitable for Canada Warbler. The species is considered to be potentially breeding within the deciduous woodlot near Underpass Road.
Chaetura pelagica	Chimney Swift	S3B	THR	T	T	Schedule 1	BSC et al. 2006; eBird 2023	Commonly found in urban areas near buildings; nests in chimneys, hollow trees, and crevices of rock cliffs. Feeds over open water.[3,4]	A single adult was observed flying over BMB-18 in the southern portion of the On-site Study Area, on June 3, 2022. However, no evidence of breeding activity was observed, and suitable nesting habitat for the species is not present within the On-site Study Area.	Cultural woodlands and deciduous forests present within the Off-site Study Area may contain suitable cavity trees with diameter (dbh) > 50cm, however this species prefers to nest in uncapped chimneys which are rare within the Off-site Study Area. The species was not observed during 2022 field surveys within the Off-site Study Area.
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC	SC	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; eBird 2023	Mid-canopy layer of forest clearings and edges of deciduous and mixed forest. Abundant in intermediate-age mature forest stands with little understory vegetation.[3,4]	A single adult male was heard singing (indicating evidence of possible breeding) at BMB-05 in suitable deciduous forest habitat. The species is considered to be potentially breeding in woodland located in the central-west portion of the On-site Study Area.	During breeding bird surveys at stations within the Off-site Study Area, adult males were heard singing (indicating evidence of possible breeding) at BMB-01, -02, -13, and -14. The species was observed occupying a permanent territory (indicating evidence of probable breeding) at BMB-03 and -12. An active Eastern Wood-Pewee nest was observed (indicating evidence of confirmed breeding) at BMB-04. All observations of the species were within suitable deciduous forest habitat. The deciduous woodland west of Nauvoo Road is considered confirmed breeding habitat for Eastern Wood-Pewee, and the species is considered to be potentially breeding within other deciduous woodlands throughout the Off-site Study Area.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	On-site Study Area	Off-site Study Area
Dolichonyx oryzivorus	Bobolink	S4B	THR	SC	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; MNRF 2023; eBird 2023	Large (>10 ha), open expansive grasslands, pastures, hayfields, meadows or fallow fields with dense ground cover. Occasionally nest in large (>50 ha) fields of winter wheat and rye in southwestern Ontario. [3,4]	Two males were heard singing (indicating evidence of possible breeding) within a meadow area near BMB-15 on May 31, 2022. The species was not observed during subsequent breeding bird surveys or any other field surveys in 2022. Bobolink is considered to be potentially breeding within the cultural meadow habitat (which is >10ha) in the eastern portion of the On-site Study Area. However, the probability that the species is actually breeding within the On-site Study Area is considered low due to the absence of any further observations of Bobolink during the breeding bird season. The singing males observed on May 31, 2022 were most likely moving through the area while travelling to other breeding habitats, or had attempted to nest within the adjacent off-site hayfield and left the area following the spring harvest which occurred just prior to the May 31 survey.	Active agricultural lands, particularly row crops, found within the majority of the Off-site Study Area are generally unsuitable for Bobolink. Based on a review of historical aerial imagery, hay is grown in some of the fields within the Off-site Study Area as part of a regular rotation with row crops. In years when hay is planted, Bobolink have the potential to breed within these fields, but when row crops (e.g., corn, soybean) are planted, habitat for the species will not be present. Whether a particular hayfield provides suitable breeding habitat for Bobolink also depends on the harvest schedule. When hay is cut early and/or regularly within the breeding season, these fields may act as an ecological "trap" by attracting Bobolink to nest in seemingly suitable habitat, but harvest activities may destroy nests or broods before they are fledged. The field immediately east of the On-site Study Area was planted with hay in 2022, which NRSI biologists observed had been cut as of the May 31, 2022 breeding bird survey. Given that Bobolink were heard singing on May 31 but not during any subsequent surveys within either Study Area, these observations are consistent with attempted nesting in unsuitable, agricultural conditions followed by the species leaving the area.
Euphagus carolinus	Rusty Blackbird	S4B,S3N	SC	SC	SC	Schedule 1	eBird 2023	Breeds in habitats dominated by coniferous forest with wetlands including bogs, marshes, swamps and beaver ponds.[4]	Coniferous forests with wetlands are not present in the On-site Study Area. The species was not observed during breeding bird surveys or other field surveys in 2022.	Coniferous forests with wetlands are not present in the Off-site Study Area. The species was not observed during breeding bird surveys or other field surveys in 2022.
Haliaeetus leucocephalus	Bald Eagle	S4	SC	NAR	NS	No schedule	eBird 2023	A variety of mature forest types adjacent to large lakes or rivers. Generally nest in tall supercanopy trees, a short distance from shore.[4]	Mature forests adjacent to large lakes or rivers are not present within the On-site Study Area. The species was observed once within the Off-site Study Area only during 2022 field surveys.	A single adult was observed flying over the Off-site Study Area on October 24, 2022. Due to the absence of suitable mature forests adjacent to large lakes or rivers within the Off-site Study Area, this observation was likely an individual migrating or travelling to preferred habitats elsewhere.
Hirundo rustica	Barn Swallow	S4B	SC	SC	T	Schedule 1	BSC et al. 2006	Farmlands, rural areas and other open or semi-open areas near body of water. Nests almost exclusively on human-made structures such as open barns, buildings, bridges and culverts.[3,4]	Adult Barn Swallows were regularly observed foraging as individuals, in pairs, or in family groups over the sedimentation ponds and the small Reed Canary Grass Mineral Meadow Marsh (MAM2-2) within the On-site Study Area. Structures that may be used by Barn Swallow as nesting habitat are present within the On-site Study Area, however no nest cups or any other evidence of breeding were observed during 2022 field surveys.	Adult Barn Swallows were observed foraging over the agricultural fields within the Off-site Study Area, and two nest cups were documented on a small bridge across the Cameron Drain that is used by farming equipment to cross the watercourse east of the landfill. The Off-site Study area contains many barns, structures and bridges, and the availability of nesting habitat for Barn Swallow is high.
Hylocichla mustelina	Wood Thrush	S4B	SC	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006	Carolinian and Great Lakes-St. Lawrence forest zones. Undisturbed moist mature deciduous or mixed forest with deciduous sapling growth. Near pond or swamp. Must have some trees higher than 12 m.[3,4]	The deciduous swamp that extends into the On-site property in the east may provide suitable habitat for Wood Thrush. 2 adult males were heard singing (indicating evidence of possible breeding) within the swamp on June 28, 2022.	Two singing males were heard on June 28, 2022 within suitable within the woodlot east of the landfill (indicating evidence of possible breeding). Habitats in this location are consistent with the species' preferred undisturbed, moist deciduous forest habitat with dense understorey growth. The deciduous woodland east of the landfill is considered potential breeding habitat for Wood Thrush.
Progne subis	Purple Martin	S3B					BSC et al. 2006; eBird 2023	Open, treed areas such as farmland, parks, yards, marshes; usually near large bodies of water; colonial; nests in tree cavities, cliff ledges; most common in nest boxes; requires open space for foraging; prefers trees >15 cm dbh.[4]	Suitable open, treed farmland and preferred colonial nesting structures are not present within the On-site Study Area. The species was observed within the Off-site Study Area only during 2022 field surveys.	2 pairs of adults (indicating evidence of probable breeding) were observed at BMB-19 within the Off-Site Study Area on June 3, 2022. The species usually nests colonially in artificial, multi-compartment structures, which were not observed but may be present in the Off-site Study Area. Open treed farmland, parks, and yards are also present in the Off-site Study Area.
Riparia riparia	Bank Swallow	S4B	THR	T	T	Schedule 1	BSC et al. 2006	Nests in burrows in natural and human-made settings with vertical faces in silt and sand deposits. Usually on banks of river and lakes, but also found in sand and gravel pits.[3,4]	Two adults were observed foraging over Pond 3 in the northwest corner of the On-site Study Area, on May 22, 2022. No evidence of breeding activity was observed, and suitable nesting habitat for the species is not present.	Suitable nesting habitat may be present within the Off-site Study Area where site access was not available to complete detailed investigations. However, Bank Swallow was not observed during breeding bird surveys or other field surveys within the Off-site Study Area.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	On-site Study Area	Off-site Study Area
Sturnella magna	Eastern Meadowlark	S4B, S3N	THR	T	T	Schedule 1	Gartner Lee Ltd. 2004; BSC et al. 2006; MNRF 2023	Open pastures, hayfields, grasslands or grassy meadows with elevated singing perches (small trees, shrubs or fence posts). Also weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields or other open areas. Generally prefers larger tracts of habitat >10 ha, but will sometimes use smaller tracts.[3,4]	Open meadow areas with elevated signing perches are present within the On-site Study Area. However, the species was not observed in these habitats during breeding bird surveys or other field surveys in 2022.	The majority of the lands within the Off-site Study Area are used for active agriculture, particularly row crops, and are not suitable for Eastern Meadowlark. The species was not observed during breeding bird surveys or other field surveys in 2022.
Tringa flavipes	Lesser Yellowlegs	S3S4B,S5M		T	NS	No schedule	eBird 2023	Use a wide variety of fresh and brackish wetlands, including mudflats, marshes, lake and pond edges, wet meadows, sewage ponds, and flooded agricultural fields during migration. During breeding season utilizes open or semi-open woodlands and wet meadows interspersed with marshes, bogs, and ponds. Nest in altered habitats such as gas line rights-of-way and mine clearings. Often found in vegetated wetlands and shallow, vegetation-filled ponds surrounded by trees or sedges.[9]	Suitable wetland habitats with preferred vegetation composition and structure are not present within the On-site Study Area. The species was not observed during breeding bird surveys or other field surveys in 2022.	Suitable wetland habitats with preferred vegetation composition and structure are not present within the Off-site Study Area. The species was not observed during breeding bird surveys or other field surveys in 2022.
Herpetofauna										
Turtles										
Apalone spinifera	Spiny Softshell	S2	END	E	E	Schedule 1	iNaturalist 2023	Large rivers and lakes, as well as seasonally in streams, creeks, marshes, ponds, and oxbows, especially those near large rivers or lakes. Key habitat requirements: open areas for basking with basking structures, open sand or gravel nesting areas, shallow muddy or sandy substrates to bury in, deep pools for hibernation. These habitats may be spread over a large area as long as the turtles can travel between them. [3,4]	Large rivers and lakes are not present, and suitable waterbodies near large rivers and lakes are not present within the On-site Study Area. The species was not observed during turtle emergence and basking surveys or other field surveys in 2022.	Large rivers and lakes are not present, and suitable waterbodies near large rivers and lakes are not present within the Off-site Study Area. The species was not observed during turtle emergence and basking surveys or other field surveys in 2022.
Chelydra serpentina	Snapping Turtle	S4	SC	SC	SC	Schedule 1	Ontario Nature 2019	Slow-flowing rivers and streams, lakes, and permanent or semi-permanent wetlands with soft substrates and vegetation. Key habitat requirements: open areas with structures for basking, open sand or gravel areas for nesting, shallow areas with soft substrates to bury in, soft banks or substrates for hibernation.[3]	Permanent waterbodies within the On-site Study Area are limited to sedimentation ponds, which are not considered suitable habitat for Snapping Turtle but were still investigated for their potential to support the species. The species was not observed during turtle emergence and basking surveys or other field surveys in 2022.	A man-made pond east of the TCEC was investigated for its potential to support the species, however no Snapping Turtles or other turtle species were observed during turtle emergence and basking surveys or other field surveys in 2022. Turtles have the potential to use the Kersey Drain/Brown Creek and the Gilliland-Geerts Drain as movement corridors, however no turtles were observed in these features during field surveys.
Snakes										
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	T	Schedule 1	MECP 2021	Open habitats, such as open woods, brushland or forest edges, with well-drained loose or sandy soils, well-drained substrates. Specializes in hunting and eating toads; occurs in habitats near or adjacent to wetland habitats where toads are present. Rocks, logs, stumps, etc. are used for shelter. Uses snout to dig nests as well as to dig burrows for overwintering.[5]	Loose, well-drained sandy soils are not present in the On-site Study Area; substrates generally have a high clay content based on surficial geology mapping from the Ontario Geological Survey (OGS 2010). Suitable nesting and overwintering habitat for Eastern Hog-nosed Snake is therefore not present. The upland Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Mineral Cultural Woodland (CUW1) communities within the On-site Study Area have the potential to provide suitable summer foraging and thermoregulation habitat. The Gilliland-Geerts Drain may provide a travel corridor for individuals moving from sandy overwintering and nesting habitats that could be present along Bear Creek approximately 7km to the east. American Toad (*Anaxyrus americanus*), the primary prey species of Eastern Hog-nosed Snake, were heard calling from sedimentation ponds within the TCEC and are expected to also be present in the on-site woodland. Due to its cryptic nature, targeted surveys for Eastern Hog-nosed Snake are not recommended, and so the species will be assumed present where its habitat is present.	Loose, well-drained sandy soils are not present in the Off-site Study Area; substrates generally have a high clay content based on surficial geology mapping from the Ontario Geological Survey (OGS 2010). Suitable nesting and overwintering habitat for Eastern Hog-nosed Snake is therefore not present. Deciduous forest communities have the potential to provide suitable summer foraging and thermoregulation habitat. Watercourses may provide travel corridors for individuals moving from sandy overwintering and nesting habitats that could be present outside of the Off-site Study Area, and the presence of this species cannot be ruled out entirely. American Toad (Anaxyrus americanus), the primary prey species of Eastern Hog-nosed Snake, are also abundant throughout the Off-site Study Area. Due to its cryptic nature, targeted surveys for Eastern Hog-nosed Snake are not recommended, and so the species will be assumed present where its habitat is present.
Anurans										
Pseudacris triseriata pop.2	Western Chorus Frog (Great Lakes - St. Lawrence - Canadian Shield population)	S4	NAR	T	T	Schedule 1	NRSI Observations 2022	Moist forest, prairie, meadows, cultural meadows, or marshes. Breeds in shallow, temporary, fishless wetlands, including flooded ditches, marshes, flooded fields, pastures, temporary ponds, pools, and swamps. Hibernates in terrestrial habitats under rocks, logs, leaf litter, loose soil, or in animal burrows.[6]	Daytime and evening anuran call surveys detected a full chorus of Western Chorus Frog calling from areas with standing water within the central-east portion of the On-site Study Area in 2022. The species is confirmed as breeding within the On-site Study Area.	Daytime and evening anuran call surveys detected full choruses of Western Chorus Frog at several locations throughout the Off-Site Study Area. Seasonal standing water in several vegetation communities, both east and west of the On-site Study Area, was confirmed to support breeding populations of Western Chorus Frog (i.e., call code level 3, full chorus) in 2022.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	On-site Study Area	Off-site Study Area
Mammals										
Bats										
Myotis leibii	Eastern Small-footed Myotis	S2S3	END				Dobbyn 1994; Humphrey 2017	Primarily roosts in open, sunny, rocky habitats, including cracks and crevices in cliffs and boulders, in talus slopes, beneath stones on rock barrens and in rock outcrops containing crevices. Occasionally roosts in buildings (including barns, sheds, and exterior walls). Maternity roosts have been documented in rocky habitats, on bridge structures, and in or on buildings. Overwinters in caves and abandoned mines. Hunts in forests.[10]	No maternity colony or roosting habitat is present for this species as the On-site Study Area lacks rocky cliffs, boulders, talus slopes and rock barren habitats. Suitable anthropogenic structures are also absent. The upland Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Mineral Cultural Woodland (CUW1) communities and the sedimentation ponds within the On-site Study Area are potential foraging habitat for this species. The forest edges and clearings, like the Mineral Cultural Meadow (CUM1) community and pedestrian trail within the on-site woodland, may be used as flyways between roosting and foraging habitats.	The Off-site Study Area lacks rocky cliffs, boulders, talus slopes and rock barren habitats, however there are numerous suitable buildings and bridge structures that have the potential to provide maternity roosting habitat for the species. Forested habitats also have the potential to be used by the species for foraging, and flyways may also be present.
Myotis lucifungus	Little Brown Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994, Humphrey and Fotherby 2019	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 and forest edges.[11]	The upland Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Mineral Cultural Woodland (CUW1) communities within the On-site Study Area are potential roosting and foraging habitat for this species. Bat habitat assessments in 2022 indicated a relatively low roost tree density of 1.6 candidate roost trees/ha in the on-site woodland, which suggests that the quality of potential roosting habitat is low. The forest communities and the sedimentation ponds in the On-site Study Area are also potential foraging habitat for this species. The forest edges and clearings, like the Mineral Cultural Meadow (CUM1) community and pedestrian trail within the subject woodland, may be used as flyways between roosting and foraging habitats. Buildings with dark warm areas that are preferred maternity sites are not present within the On-site Study Area.	All forested habitats within the Off-site Study Area are potential roosting and foraging habitat for this species; flyways may also be present. Bat habitat assessments in 2022 indicated a relatively low roost tree density of 2.4 candidate roost trees/ha in the woodland west of the TCEC which suggests that the quality of potential roosting habitat is low in this feature. In the woodland east of the TCEC, candidate roost tree density ranged between 4.5 and 7.9 trees/ha. A roost tree density of 10 trees/ha is considered high quality roosting habitat, and the results of 2022 field surveys indicate that the woodland east of the TCEC likely has the best quality bat habitat within the Study Areas.
Myotis septentrionalis	Northern Myotis	S3	END	E	E	Schedule 1	Dobbyn 1994, Humphrey and Fotherby 2019	Roosts in houses and man-made structures but prefers hollow trees or under loose bark. Hibernates in mines or caves. Hunts within forest, below the canopy.[11]	The upland Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Mineral Cultural Woodland (CUW1) communities within the On-site Study Area are potential roosting and foraging habitat for this species. Bat habitat assessments in 2022 indicated a relatively low roost tree density of 1.6 candidate roost trees/ha in the on-site woodland, which suggests that the quality of potential roosting habitat is low. The forest communities and the sedimentation ponds in the On-site Study Area are also potential foraging habitat for this species. The forest edges and clearings, like the Mineral Cultural Meadow (CUM1) community and pedestrian trail within the subject woodland, may be used as flyways between roosting and foraging habitats.	All forested habitats within the Off-site Study Area are potential roosting and foraging habitat for this species; flyways may also be present. Bat habitat assessments in 2022 indicated a relatively low roost tree density of 2.4 candidate roost trees/ha in the woodland west of the TCEC which suggests that the quality of potential roosting habitat is low in this feature. In the woodland east of the TCEC, candidate roost tree density ranged between 4.5 and 7.9 trees/ha. A roost tree density of 10 trees/ha is considered high quality roosting habitat, and the results of 2022 field surveys indicate that the woodland east of the TCEC likely has the best quality bat habitat within the Study Areas.
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	E	Schedule 1	Dobbyn 1994, Humphrey and Fotherby 2019	Roosts and maternity colonies in umbrella-shaped clusters of live or dead leaves, most often oaks (*Quercus* spp.) or maples (*Acer* spp.). Will occasionally roost in barns or other structures. Forages over water and along streams in the forest. Hibernate in caves.[11]	The upland Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Mineral Cultural Woodland (CUW1) communities within the On-site Study Area are potential roosting and foraging habitat for this species. Trees with suitable leaf clusters for Tri-colored Bat are anticipated to be present within the on-site woodland, however their location and density can change yearly and are not currently known. The forest communities and the sedimentation ponds in the On-site Study Area are also potential foraging habitat for this species. The forest edges and clearings, like the Mineral Cultural Meadow (CUM1) community and pedestrian trail within the subject woodland, may be used as flyways between roosting and foraging habitats.	All forested habitats within the Off-site Study Area are potential roosting and foraging habitat for this species; flyways may also be present. Trees with suitable leaf clusters for Tri-colored Bat are anticipated to be present within forested habitats in the Off-site Study Area, however their location and density can change yearly and are not currently known.
Other Mammals										
Microtus pinetorum	Woodland Vole	S3?	SC	SC	SC	Schedule 1	Dobbyn 1994	Mature deciduous forest in the Carolinian region where there is a deep litter layer that allows it to burrow.[3]	The upland Fresh - Moist Shagbark Hickory Deciduous Forest (FOD9-4) and Mineral Cultural Woodland (CUW1) communities within the On-site Study Area are young and mid-age forest communities. The forests are not mature enough to support habitat for Woodland Vole as they are lacking the deep litter layer needed by this species.	Mature deciduous forest is present within the Off-site Study Area, however a deep litter layer required by the species was not observed by NRSI biologists during field surveys. It is considered unlikely that the off-site woodland features are habitat for Woodland Vole.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	On-site Study Area	Off-site Study Area
Taxidea taxus jacksoni	American Badger (Southwestern Ontario population)	S1	END	E	E	Schedule 1	Dobbyn 1994	Open grasslands and oak savannahs; dens in new hole or enlarged existing hole; sometimes makes food caches.[4]	Suitable grassland and oak savannah habitat is not present within the On-site Study Area. No candidate den sites were observed during 2022 field surveys.	Suitable grassland and oak savannah habitat is not present within the Off-site Study Area. No candidate den sites were observed during 2022 field surveys.
Insects										
Butterflies										
Danaus plexippus	Monarch	S2N, S4B	SC	E	SC	Schedule 1	iNaturalist 2023	Adults found in a diversity of habitats with a variety of wildflowers. Caterpillars are confined to meadows and open areas where milkweeds grow (larval food plants).[3]	A few foraging adult Monarchs were occasionally observed during 2022 field surveys; however, no caterpillars were observed, nor were there areas with high concentrations of milkweeds (*Asclepias* spp.), the species' larval food plant documented within the On-site Study Area.	A few foraging adult Monarchs were occasionally observed during 2022 field surveys; however, no caterpillars were observed, nor were there areas with high concentrations of milkweeds (*Asclepias* spp.), the species' larval food plant documented within the Off-site Study Area.
Dragonflies and Damselflies										
Argia tibialis	Blue-tipped Dancer	S3					OOAD 2021	Flowing waters including fast or slow-flowing rivers and streams. Species also occurs at swamps and ponds with less frequency.[12]	Watercourse features are not present within the On-site Study Area. The sedimentation ponds within the On-site Study Area do not provide suitable habitat for the species.	Suitable habitat may be present within the Kersey Drain/Brown Creek and the Gilliland-Geerts Drain in the Off-site Study Area. Although targeted surveys were not completed, the species was not observed by NRSI biologists in 2022.
Aquatic Species										
Fish										
Lepomis peltastes pop. 2	Northern Sunfish (Great Lakes - Upper St. Lawrence populations)	S3	SC	SC	SC	Schedule 1	DFO 2019	Shallow vegetated areas of quiet, slow-flowing rivers and streams, as well as warm lakes and ponds, with sandy banks or rocky bottoms.[7]	Permanent watercourse features are not present within the On-site Study Area. The sedimentation ponds within the On-site Study Area do not provide suitable habitat for the species.	Suitable habitat may be present within the Kersey Drain/Brown Creek and the Gilliland-Geerts Drain in the Off-site Study Area. However, targeted electrofishing studies completed in 2022 did not detect Northern Sunfish.
Mussels										
Epioblasma rangiana	Northern Riffleshell	S1	END	E	E	Schedule 1	iNaturalist 2023	Riffle areas within rivers or streams with rocky, sand, or gravel bottoms. Host fish include; Blackside Darter, Fantail Darter, Iowa Darter, Johnny Darter, Rainbow Darter, Logperch, Brown Trout and Mottled Sculpin.[3]	Permanent watercourse features are not present within the On-site Study Area. The sedimentation ponds within the On-site Study Area do not provide suitable habitat for the species.	The Kersey Drain/Brown Creek and the Gilliland-Geerts Drain are permanent watercourses within the Off-site Study Area, however riffles are limited or absent and suitable rocky, sand, or gravel substrates are not present.
Lampsilis fasciola	Wavy-rayed Lampmussel	S2	THR	SC	SC	Schedule 1	iNaturalist 2023	Small to medium rivers with clear water. Shallow riffle areas with clean gravel or sand bottoms. Fish hosts include: Largemouth bass and Smallmouth bass.[3]	Permanent watercourse features are not present within the On-site Study Area. The sedimentation ponds within the On-site Study Area do not provide suitable habitat for the species.	The Kersey Drain/Brown Creek and the Gilliland-Geerts Drain are permanent watercourses within the Off-site Study Area, however water clarity is generally poor and shallow riffles are limited or absent. Suitable clean gravel or sand substrates are not present.
Ptychobranchus fasciolaris	Kidneyshell	S1	END	E	E	Schedule 1	iNaturalist 2023	Small to medium sized rivers. Prefers shallow, clear, swift-moving water with gravel and sand. Also used to occur on gravel shoals in the Great Lakes. Fish hosts include: Blackside Darter, Fantail Darter, and Johnny Darter.[3]	Permanent watercourse features are not present within the On-site Study Area. The sedimentation ponds within the On-site Study Area do not provide suitable habitat for the species.	The Kersey Drain/Brown Creek and the Gilliland-Geerts Drain are permanent watercourses within the Off-site Study Area, however water clarity is generally poor and shallow swift-flowing areas with gravel and sand substrates are not present.
Plants										
Aplectrum hyemale	Puttyroot	S2	-	-	-	-	MNRF 2023	Rich forests, both upland beech-maple and swamps in moist ground.[8]	The deciduous swamp that extends into the On-site property in the east may provide suitable growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.	Deciduous forest and swamp communities within the Off-site Study Area may provide suitbale growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.
Arisaema dracontium	Green Dragon	S3	SC	SC	SC	Schedule 3	MNRF 2023	Moist forests, especially along river banks and floodplains.[8]	The deciduous swamp that extends into the On-site property in the east may provide suitable growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.	Deciduous swamp communities within the Off-site Study Area may provide suitbale growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.
Asimina triloba	Pawpaw	S3					iNaturalist 2023	Deciduous forests; especially bottomlands along larger rivers; swamps, thickets along streams.[8]	The deciduous swamp that extends into the On-site property in the east may provide suitable growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.	Deciduous forest and swamp communities within the Off-site Study Area may provide suitbale growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.
Diarrhena obovata	Ovate Beak Grass	S1					iNaturalist 2023	Floodplain swamps, river banks.[8]	The deciduous swamp that extends into the On-site property in the east may provide suitable growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.	Deciduous swamp communities within the Off-site Study Area may provide suitbale growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.

Scientific Name	Common Name	S-RANK[1]	SARO[1]	COSEWIC[2]	SARA[2]	SARA Schedule[2]	Background Source	Habitat Requirements	On-site Study Area	Off-site Study Area
Fraxinus nigra	Black Ash	S4	END	T	NS	No Schedule	Gartner Lee Ltd. 2004	Usually on mucky or peaty soils in swamps, such as river floodplains.[8]	Black Ash was observed in the deciduous swamp (SWD3-3) that extends into the On-site property in the east during 1998 and 1999 surveys completed by Gartner Lee Ltd. to inform the Warwick Landfill Expansion EA. NRSI biologists did not observe the species in this area, or in any other vegetation communities within the On-site Study Area during comprehensive 3-season vascular flora inventories in 2022.	Black Ash was observed in the deciduous swamp (SWD3-3) in the east portion of the Off-site Study Area during 1998 and 1999 surveys completed by Gartner Lee Ltd. to inform the Warwick Landfill Expansion EA. NRSI biologists did not observe the species in this area, or in any other vegetation communities within the Off-site Study Area during comprehensive 3-season vascular flora inventories in 2022.
Fraxinus quadrangulata	Blue Ash	S2?	THR	T	SC	Schedule 1	iNaturalist 2023	Deciduous forests, usually on floodplains, occassionally on uplands.[8]	The deciduous swamp that extends into the On-site property in the east may provide suitable growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.	Deciduous swamp communities within the Off-site Study Area may provide suitbale growing conditions, however the species was not observed during comprehensive 3-season vascular flora inventories in 2022.
Juglans cinerea	Butternut	S2?	END	E	E	Schedule 1	Gartner Lee Ltd. 2004	Stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands.[8]	Deciduous forests within the On-site Study Area may provide suitable growing conditions, however NRSI biologists did not observe the species during comprehensive 3-season vascular flora inventories in 2022.	Deciduous forests within the Off-site Study Area may provide suitable growing conditions, however NRSI biologists did not observe the species during comprehensive 3-season vascular flora inventories in 2022.

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Final Significant Wildlife Habitat Screening

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Terrestrial)					Not Present	Not Present
Habitat important to migrating waterfowl	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 - Plus evidence of annual spring flooding from melt water or run-off within these Ecosites. - Fields with seasonal flooding and waste grain in the Long Point, Rondeau, Lake. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	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[cxlviii] <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 (eg. 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[i] or more individuals required. • The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat[cxlviii]. • 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.	There is no evidence of annual spring flooding in the agricultural fields, cultural meadows, or cultural thicket habitats within the On-site or Off-site Study Areas.	
Wildlife Habitat: Waterfowl Stopover and Staging Areas (Aquatic)					Not Present	Not Present
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 Green-winged Teal American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Blue-winged Teal Hooded Merganser Common Merganser Red-breasted Merganser Lesser Scaup Greater Scaup Common Goldeneye Bufflehead Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Canvasback Redhead Ruddy Duck Brant White-winged Scoter Black Scoter	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 (eg. 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[i] or more of listed species for 7 days[i], 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[cxlviii] • 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.	Suitable ponds, marshes, lakes, bays, coastal inlets, and watercourses are not present within the On-site or Off-site Study Areas.	

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Shorebird Migratory Stopover Area					Not Present	Not Present
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	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[i] 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[i] 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[cxlviii] • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi] • SWHMIST[cxlix] Index #8 provides development effects and mitigation measures.	Suitable shorelines of lakes, rivers and wetlands are not present within the On-site or Off-site Study Areas.	
Wildlife Habitat: Raptor Wintering Area					Not Present	Not Present
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	<u>Hawks/Owls:</u> 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 <u>Bald Eagle:</u> Forest Community Series: FOD, FOM, FOC, SWD, SWM, or SWC, on shoreline areas adjacent to large rivers or adjacent to lakes with open water (hunting area).	The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. Raptor wintering (hawk/owl) sites need to be > 20ha[cxlviii, cxlix] 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[cxlix] Field area of the habitat is to be wind swept with limited snow depth or accumulation. Eagle sites have open water and large trees and snags aviable for roosting[cxlix] <u>Information Sources</u> • OMNRF Districts • Natural clubs • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area • Data from Bird Studies Canada • Reports and other information available from CAs • Results of Christmas Bird Counts	Studies confirm the use of these habitats by: • One or more Short-eared Owls, or, One of 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)[cxlix] for a minimum of 20 days by the above number of birds[l]. • 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[cxlix] Index #10 and #11 provides development effects and mitigation measures.	Although large woodlands are present, naturalized upland communities are limited. Lands within the On-site and Off-site Study Areas are highly disturbed; indicator species are not tolerant of human disturbance.	

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Bat Hibernacula					Not Present	Not Present
Bat hibernacula, are rare habitats in all Ontario landscapes.	Big Brown Bat Eastern Pipistrelle/Tri-colored 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 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 Centre (NHIC) Bat Hibernaculum • Ministry of Northern Development and Mines for location of mine shafts • Clubs that explore caves (eg. Sierra Club) • University Biology Departments with bat experts	• All sites with confirmed hibernating bats are SWH[i]. • The area includes 200m radius around the entrance of the hibernaculum[cxlviii, ccvii, i]. for the development types and 1000m for wind farms [ccv]. • Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the[ccv]."Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv] • SWHMIST[cxlix] Index #1 provides development effects and mitigation measures.	The MNRF identifies bat hibernacula, and has not identified such from the On-site or Off-site Study Areas. Caves, mine shafts, and karst are not present.	
Wildlife Habitat: Bat Maternity Colonies					Not Present	Candidate
Known locations of forested bat maternity colonies are 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 building [sxxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario[xxii]. • 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[i] • >5 Adult Female Silver-haired Bats[i] • The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity colonies[i]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects"[ccv]. • SWHMIST[cxlix] Index #12 provides development effects and mitigation measures.	Big Brown Bat and Silver-haired Bat are reported from the vicininity of the Study Areas. Results of plot-based bat habitat assessments completed in woodlands where site access was available indicate that the density of large-diameter (>25cm dbh) candidate roost trees did not exceed the threshold of >10/ha. This SWH type is not present within the On-site Study Area. Suitable forested ecosites are present on properties within the Off-site Study Area where site access was not available, and plot-based habitat assessments could not be completed. These features are identified as Candidate Bat Maternity Colony SWH.	

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Turtle Wintering Area					Not Present	Not Present
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[cix, cx, cxi, 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 • Field naturalists clubs • OMNRF Ecologist or Biologist • Natural Heritage Information Centre (NHIC)	• Presence of 5 over-wintering Midland Painted Turtles is significant[l]. • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant[l]. • 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. – Apr)[cvii]. Congregation of turtles is more common where wintering areas are limited and therefore significant[cix, cx, cxi, cxii]. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	The sedimentation ponds within the On-site Study Area are not considered SWH. Turtle emergence and basking surveys undertaken in 2022 at these sedimentation ponds, and at the human-made pond in the eastern part of the Off-site Study Area, did not detect any overwintering turtles using these features. Deciduous swamp communities within the On-site and Off-site Study Areas did not contain permanent water of a sufficient depth to support overwintering turtles.	
Wildlife Habitat: Reptile Hibernaculum					Not Present	Candidate
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	For all snakes, habitat may be found in any ecosite in southern Ontario 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. The existence of rock piles or slopes, stone fences, and crumbling foundations assist in identifying candidate SWH.	For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural locations. Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line[xliv, l, li, lii, cxii]. 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. <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 available from CAs • Local naturalists and experts, as well as university herpetologists may also know where to find some of these sites. • Natural Heritage Information Centre (NHIC)	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp., or, individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)[l]. • Note: If there are Special Concern Species present, then site is SWH • Note: 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[l]. • SWHMIST[cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula.	Wildlife surveys in 2022 did not uncover any potential hibernacula features (e.g. rock piles, wells, crumbling foundations), and only a few observations of Eastern Gartersnake were documented within the On-site and Off-site Study Areas. However, the absence of reptile hibernaculum SWH cannot be ruled out without extensive surveys, which were not undertaken as part of this study. Although absence cannot be ruled out completely, it is considered very unlikely that hibernacula are present within the On-site Study Area. Candidate Reptile Hibernaculum SWH is identified for the majority of ecosites (and forested ecosites in particular) within the Off-site Study Area.	

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Bank and Cliff)					Not Present	Not Present
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 population 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: Nature Counts http://www.birdscanada.org/birdmon/ • Field Naturalist clubs	Studies confirming: • Presence of 1 or more nesting sites with 8[cxlvix] 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[cxlix] Index #4 provides development effects and mitigation measures.	Soil storage areas and berms within the On-site Study Area are not suitable for the listed colonially-nesting bird species. Eroding banks are present in some locations along the Kersy Drain, and Cliff Swallow was confirmed as breeding in the Off-site Study Area. However, Cliff Swallow nests were only ever observed by NRSI biologists on a bridge, and human-made structures are not considered SWH.	
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Tree/Shrubs)					Not Present	Not Present
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 15 m 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 (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony • Aerial photographs can help identify large heronries. • Reports and other information available from CAs • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of 2 or more active nests of Great Blue Heron or other list species. • The habitat extends from the 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 colonies must 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[cxlix] Index #5 provides development effects and mitigation measures.	Marginal suitable habitat may be present within deciduous swamps in the On-site and Off-site Study Areas, however, the indicator species are not tolerant of a heavily industrial environment such as an active landfill. No active or inactive nests of any of the indicator species were observed within the On-site or Off-site Study Areas.	

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Colonially - Nesting Bird Breeding Habitat (Ground)					Not Present	Not Present
Colonies are important to local bird population, 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 Centre (NHIC) Colonial Waterbird Nesting Area • MNRF District Offices • Field naturalist clubs	Studies confirming: • Presence of >25 active nests for Herring Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[í]. • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[í]. • Presence of 5 or more pairs for Brewer's Blackbird[í]. • The edge of the colony and a minimum 150m radius area of the 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"[ccxi]. • SWHMIST[cxlix] Index #6 provides development effects and mitigation measures.	Rocky islands or peninsulas are not present in the On-site or Off-site Study Areas.	
Wildlife Habitat: Migratory Butterfly Stopover Areas					Not Present	Not Present
<u>Rationale:</u> Butterfly stopover 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 landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	A butterfly stopover area will be a minimum of 10ha in size with a combination of field and forest habitat present, and will be located within 5km of Lake Ontario and Erie[cxlix]. • 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 [xxxii, 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, xli]. <u>Information Sources</u> • MNRF District Offices • Natural Heritage Information Centre (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, xlii]. • 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 White Admiral's is to be considered significant[í]. • SWHMIST[cxlix] Index #16 provides development effects and mitigation measures.	The On-site and Off-site Study Areas are not within 5km or Lake Ontario or Lake Erie.	

Table 1. Characteristics of Seasonal Concentration Areas for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Wildlife Habitat: Landbird Migratory Stopover Areas					Not Present	Not Present
Sites with a high diversity of species as well as high numbers 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 >5 ha[i] in size and within 5km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat • If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie or 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 and Lake Erie are Candidate SWH[cxlviii]. <u>Information Sources</u> • Bird Studies Canada • Ontario Nature • Local birders and naturalist clubs • Ontario Important Bird Areas (IBA) Program	Studies confirm: • Use of the habitat by >200 birds/day and with >35 spp. with at least 10 bird spp. recorded on at least 5 different survey dates[i]. This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (March/May) and fall (Aug/Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"[ccxi]. • SWHMIST[cxlix] Index #9 provides development effects and mitigation measures.	The On-site and Off-site Study Areas are not within 5km or Lake Ontario or Lake Erie.	
Wildlife Habitat: Deer Winter Congregation Areas					Not Present	Not Present
Deer movement during winter in the southern areas of Ecoregion 7E 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 [cxlviii]	White-tailed Deer	All Forested Ecosites with these ELC Community Series: FOC FOM FOD SWC SWM SWD Conifer plantations (CUP) smaller than 50 ha may also be used.	• Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha[i]. • Deer movement during winter in Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands[cxlviii]. • 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[ccxxiv]. • Woodlots with high densities of deer due to artificial feeding are not significant[i]. <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[cxlviii]. • 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 MNRF[i]. • Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniques[ccxxiv], ground or road surveys, or a pellet count deer density survey[ccxxv]. • SWHMIST[cxlix] Index #2 provides development effects and mitigation measures.	The MNRF has not identified deer winter congregation areas within the On-site or Off-site Study Areas.	

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	On-site Study Area	Off-site Study Area
Cliff and Talus Slopes					Not Present	Not Present
Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO TAS TAT CLO CLS 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 Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes[lxxviii] • SWHMIST[cxlix] Index #21 provides development effects and mitigation measures.	Cliff and talus slope habitat is not present within the On-site or Off-site Study Areas.	
Sand Barrens					Not Present	Not Present
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%.	A sand barren area >0.5ha in size <u>Information Sources</u> • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location information available on their website • Field naturalist clubs • Conservation Authorities	• Confirm any ELC Vegetation Type for Sand Barrens[lxxviii] • Site must not be dominated by exotic or introduced species (<50% vegetative cover are exotics sp)[i]. • SWHMIST[cxlix] Index #20 provides development effects and mitigation measures.	Sand barren habitat is not present within the On-site or Off-site Study Areas.	

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**ELC Ecosite Codes**	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Alvar					Not Present	Not Present
Alvars are extremely rare habitats in Ecoregion 7E	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) *Carex crawei* 2) *Panicum philadelphicum* 3) *Eleocharis compressa* 4) *Scutellaria parvula* 5) *Trichostema brachiatum* These indicator species are very specific to Alvars within Ecoregion 7E[cxlix]	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 zoogeographically 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[lxxviii].	An Alvar site > 0.5ha in size[lxxv]. Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie[cxcix]. <u>Information Sources</u> • Alvars of Ontario (2000), Federation of Ontario Naturalists[lxxvi]. • Ontario Nature – Conserving Great Lakes Alvars[ccviii]. • Natural Heritage Information Centre (NHIC) has location information available on their website • OMNRF Staff • Field Naturalist clubs • Conservation Authorities	Field studies identify four of the five **Alvar indicator species**[lxxv] at a candidate Alvar site is Significant • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses[lxxv]. • SWHMIST[cxlix] Index #17 provides development effects and mitigation measures.	Alvar habitat is not present within the On-site or Off-site Study Areas.	

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**ELC Ecosite Codes**	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Old Growth Forest					Not Present	Not Present
Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old growth forests are characterized by heavy mortality or turnover of overstorey 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 area is >0.5ha <u>Information Sources</u> • OMNRF Forest Resource Inventory mapping • OMNRF Districts • Field naturalist clubs • Conservation Authorities • Sustainable Forestry Licence (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[cxlviii]. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities [cxlviii] (cut stumps will not be present) • Determine ELC Vegetation Type for forest area containing the old growth characteristics[lxxviii]. • SWHMIST[cxlix] Index #23 provides development effects and mitigation measures.	The forest communities within the On-site and Off-site Study Areas do not contain old growth forest habitat.	
Savannah					Not Present	Not Present
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%. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[i] 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> • OMNRF Districts • Natural Heritage Information Centre (NHIC) has location data available on their website • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Savannah indicator species listed in[lxxv] Appendix N should be present[j]. Note: Savannah plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #18 provides development effects and mitigation measures.	Savannah habitat is not present within the On-site and Off-site Study Areas.	

Table 2. Characteristics of Rare Vegetation Communities for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**ELC Ecosite Codes**	**Habitat Description**	**Detailed Information and Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Tallgrass Prairie					Not Present	Not Present
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. In Ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario)[cc].	No minimum size to site[l]. 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 Centre (NHIC has location information available on their website • OMNRF Districts • Field naturalists clubs • Conservation Authorities	Field studies confirm one or more of the Prairie indicator species listed in[lxxv] Appendix N should be present[l]. Note: Prairie plant spp. list from Ecoregion 7E should be used. • Area of the ELC Vegetation Type is the SWH[lxxviii]. • Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). • SWHMIST[cxlix] Index #19 provides development effects and mitigation measures.	Tallgrass prairie habitat is not present within the On-site and Off-site Study Areas.	
Other Rare Vegetation Communities					Not Present	Not Present
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 OMNRF/NHIC will have up to date listing for rare vegetation communities. <u>Information Sources</u> • Natural Heritage Information Centre (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[cxlix] Index #37 provides development effects and mitigation measures.	No other rare vegetation communities were observed within the On-site and Off-site Study Areas.	

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Waterfowl Nesting Area					Not Present	Not Present
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[cxlix] from a wetland (>0.5ha) or a wetland (>0.5ha) with 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[cxlix]. • Upland areas should be at least 120m wide so that predators such as racoons, 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[l], or, • Presence of 10 or more nesting pairs for listed species including Mallards[l]. • 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"[ccxi] • 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[cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWHMIST[cxlix] Index #25 provides development effects and mitigation measures.	Upland areas adjacent to the swamp and marsh habitats within the On-site and Off-site Study Areas are not sufficiently wide. Nesting pairs of the listed indicator species were not observed by NRSI biologists during 2022 breeding bird surveys.	

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Bald Eagle and Osprey Nesting, Foraging and Perching Habitat					Not Present	Not Present
Nest sites are fairly uncommon in Ecoregion 7E and 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 format and does not include all the habitat. • Nature Counts, Ontario Nest Records Scheme data • OMNRF Districts • 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[cxlviii]. • 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 SWH[ccvii], maintaining undisturbed shorelines with large trees within this area is important[cxlviii]. • For a Bald Eagle the active nest and a 400-800m radius around the nest is the SWH[cvi, ccvii]. Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat[cvi]. • 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"[ccxi] • SWHMIST[cxlix] Index #26 provides development effects and mitigation measures.	Forest communities adjacent to suitable rivers, lakes, ponds and wetlands are not present within the On-site or Off-site Study Areas. Neither Osprey nor Bald Eagle were observed nesting within the Study Areas in 2022.	

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Woodland Raptor Nesting Habitat					Not Present	Not Present
Nests sites for these species are rarely identified; these area sensitive habitats 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 combined >30ha or with >4ha of interior habitat[lxxxviii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii]. Interior habitat determined with a 200m buffer[cxlviii]. • 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 Coopers 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 Districts • 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[cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha of habitat is the SWH[ccvii].(the 28ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) • 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 early 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 woodlands with interior habitat are present, however interior areas >100m from the edge are <4ha. None of the listed indicator species were observed nesting within the On-site or Off-site Study Areas in 2022.	
Wildlife Habitat: Turtle Nesting Area					Not Present	Not Present
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)[cxlviii] 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	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[f] • One or more Northern Map Turtle or Snapping Turtle nesting is a SWH[f] • 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 dependant on slope, riparian vegetation and adjacent land use is the SWH[cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30-100m area of habitat[cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observation studies observing the turtles nesting is a recommended method. • SWHMIST[cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	Areas with exposed mineral soils close to water and away from roads are not present within the On-site or Off-site Study Areas.	

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Seeps and Springs					Not Present	Not Present
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[cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species[cxix, cxx, cxxi, cxxii, cxiii, cxiv]. Information Sources • Topographical Map • Thermography • Hydrological surveys conducted by CAs and MOE • Field naturalists 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[f] 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 of the habitat[cxlviii]. • SWHMIST[cxlix] Index #30 provides development effects and mitigation measures.	Seeps or springs were not observed by NRSI biologists in any of the forested areas within the On-site or Off-site Study Areas.	
Wildlife Habitat: Amphibian Breeding Habitat (Woodland)					Confirmed	Confirmed
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) [ccvii] within or adjacent (within 120m) to a woodland (no minimum size)[clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. 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[cxlviii]. Information Sources • 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 Districts and 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/toad species with at least 20 individuals (adults or eggs masses) or 2 or more of the listed frog/toad species with Call Level Codes of 3. • A combination of observational study and call count surveys [cviii] 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 wetland area plus a 230m radius of woodland area[lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWHMIST[cxlix] Index #14 provides development effects and mitigation measures.	Breeding populations of Spotted Salamander and Western Chorus Frog were documented in vernal pools within the deciduous swamp community that extends into the On-site Study Area from the Off-site Study Area in the east.	

Table 3. Characteristics of Specialized Wildlife Habitat for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Amphibian Breeding Habitat (Wetland)					Not Present	Candidate
Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario Landscapes	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog 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 >500m^2 (about 25m diameter)[ccvii] supporting high species diversity are significant: some small or ephemeral habitats may not be identified on MNR mapping and could be important amphibian breeding habitats[clxxxiv]. • 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 1or more of the listed newt/salamander species or 2 or more of the listed frog or toad species and with at least 20 breeding individuals (adults and eggs masses)[lxxi, lxxiii] or 2 or more of the listed frog/toad species with Call Level of 3. or; Wetland with confirmed breeding Bullfrogs are significant[i]. • The ELC ecosite wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys cviii to determine breeding/larval stages will be required during the spring (May March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/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.	Breeding populations of Spring Peeper and Western Chorus Frog (Call Level 3 for each species) were documented within the meadow marsh-cultural meadow complex (MAM/CUM) in the Off-site Study Area east of Nauvoo Road. The presence of a sufficiently-long hydroperiod within this feature that can support breeding amphibians has not been confirmed, and the overall abundance of similar habitats at the landscape scale is unknown. Therefore, although 2022 studies have confirmed breeding populations of 2 or more of the listed frog species, Amphibian Breeding Habitat (Wetland) is considered Candidate SWH in this feature and is not confirmed within the Off-site Study Area. No other wetlands within the On-site or Off-site Study Areas meet SWH criteria.	
Wildlife Habitat: Woodland Area-Sensitive Bird Breeding Habitat					Not Present	Not Present
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 Pileated Woodpecker <u>Special Concern</u>: 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 >30ha[cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200m from forest edge habitat[clxiv]. <u>Information Sources</u> • Local birder 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 determine what forests were of greatest value to interior species. • Reports and other information available from CAs	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species[i]. • Note: any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH[i]. • Conduct field investigations in 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.	Woodlands with interior habitats >200m from the edge are not present. None of the listed indicator species were observed nesting within the On-site or Off-site Study Areas in 2022. Canada Warbler was observed exhibiting possible breeding evidence in the small (<4ha) decidous woodlot near Underpass Road, however habitat in this location is marginal and nesting was not confirmed. Canada Warbler was not heard elsewhere within the On-site or Off-site Study Areas during 2022 surveys.	

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Marsh Bird Breeding Habitat					Not Present	Not Present
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 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[cxxiv]. • 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> • OMNRF Districts and wetland evaluations • Field naturalist clubs • Natural Heritage Information Centre (NHIC) • 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 breeding by any combination of 4 or more of the listed species[i]. • Note: any wetland with breeding of 1 or more Trumpeter Swans, Black Terns, Green Heron or Yellow Rail is SWH[i]. • 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[cxlix] Index #35 provides development effects and mitigation measures	Suitable marsh habitat with shallow water and emergent aquatic vegetation is present in the On-site and Off-site Study Areas, however none of the listed indicator species were confirmed as nesting during 2022 breeding bird surveys.	
Wildlife Habitat: Open Country Bird Breeding Habitat					Not Present	Not Present
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) >30ha[clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. 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)[l]. 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 • Local birder clubs • Ontario Breeding Bird Atlas[ccv] • EIS Reports and other information available from CAs	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species[l]. • A field with 1 or more breeding Short-eared Owls 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[cxlix] Index #32 provides development effects and mitigation measures	Cultural meadow habitats within the On-site and Off-site Study Areas are generally small (<15ha), and do not have histories of longevity as naturalized grassland habitats. None of the listed indicator species were confirmed as nesting during 2022 breeding bird surveys anywhere within the On-site or Off-site Study Areas.	

Table 4. Characteristics of Habitat for Species of Conservation Concern for Ecoregion 7E (MNRF 2015)

	Candidate SWH			Confirmed SWH	Assessment Details	
Rationale	**Wildlife Species**	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Shrub/Early Successional Bird Breeding Habitat					Not Present	Not Present
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.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. 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 such as woodland area for some bird species.	Large natural field areas succeeding to shrub and thicket habitats >10ha[clxiv] 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)[i]. Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species[clxxiii]. 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[i]. • A field with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat[i]. • 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[cxlix] Index #33 provides development effects and mitigation measures.	Large (>10ha) natural field areas succeeding to shrub and thicket habitats are present in the southern portion of the On-site Study Area, where the decommissioned poplar system and cultural meadow are located. The anthropogenic origin of the poplar system does not support designation as SWH, and the results of 2022 breeding bird surveys did confirm any of the listed indicator or common species as nesting within the On-site Study Area.	
Wildlife Habitat: Terrestrial Crayfish					Confirmed	Confirmed
Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. [Ccii]	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crawfish or Meadow Crayfish (*Cambarus Diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above meadow marsh ecosites can be used by terrestrial crayfish.	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 large ecosite area is the SWH • Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult [cci] • SWHMIST[cxlix] Index #36 provides development effects and mitigation measures.	Terrestrial Crayfish chimneys were observed in the deciduous swamp community that extends into the On-site Study Area from the Off-site Study Area in the east, and in the meadow marsh community west of Nauvoo Road. Terrestrial Crayfish SWH is confirmed within both the On-site and Off-site Study Areas.	
Wildlife Habitat: Special Concern and Rare Wildlife Species					Confirmed	Confirmed
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 (NHIC).	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[lxxviii]. <u>Information Sources</u> • Natural Heritage Information Centre (NHIC) will have the Special Concern and Provincially Rare (S1-S3, SH) species lists and element occurrences for these species. • 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 neess to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWHMIST[cxlix] Index #37 provides development effects and mitigation measures.	Several Special Concern and Provincially Rare Species have candidate and/or confirmed habitat within the On-site and Off-site Study Areas: • Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population), confirmed breeding within both On-site and Off-site Study Areas • Eastern Wood-Pewee, candidate breeding within both On-site and Off-side Study Areas, confirmed breeding in the Off-site Study Area • Wood Thrush, candidate breeding within the Off-site Study Area • Canada Warbler, candidate breeding within the Off-site Study Area • Tufted Titmouse, candidate breeding within the Off-site Study Area	

Table 5. Characteristics of Animal Movement Corridors for Ecoregion 7E (MNRF 2015)

Rationale	Candidate SWH			Confirmed SWH	Assessment Details	
	Wildlife Species	**ELC Ecosite Codes**	**Habitat Criteria and Information Sources**	**Defining Criteria**	**On-site Study Area**	**Off-site Study Area**
Wildlife Habitat: Amphibian Movement Corridors					Not Present	Not Present
Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Blue-spotted Salamander Spotted Salamander Four-toed Salamander Gray Treefrog Northern Leopard Frog Pickerel Frog Western Chorus Frog	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[clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi] Movement corridors must be considered when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat – Wetland) of this Schedule[i]. <u>Information Sources</u> • MNRF District Office • Natural Heritage Information Centre 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[cxlix]. • Corridors should have at least 15m of vegetation on both sides of waterwaycxlix or be up to 200m widecxlix of woodland habitat and with gaps <20m[cxlix] • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat[cxlix]. • SWHMIST[cxlix] Index #40 provides development effects and mitigation measures.	Although Amphibian Breeding Habitat (Wetland) SWH is considered candidate within the Off-site Study Area, suitable movement corridor habitat with water connecting breeding and summer foraging habitats is not present.	

D

Vascular Flora Species Reported from the Vicinity of the Study Areas

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Lambton County Status	Natural Environment and Resource Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	NHIC Data*	NRSI Observed	FOD4-1	FOD6-5	SWT2-2 (Incl.)	CUM1 (Incl.)	FOD9-3	FOD9-4	MAM2-2	CUW1 (Incl.)	MAM2-10	SWT2-8 (Incl.)	SWT2-5	SWD3-3	CUM1	CUT1	CUW1	CUP2
												Vegetation Community Number on Figure 4-1															
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Oldham 2017	Gartner Lee Ltd. 2004	iNaturalist 2023	MNRF 2023	NRSI Results From 2022	(15)	(4), (5), (17), (21)	(4)	(4)	(19)	(1), (6), (9), (16), (22)	(13)	(13)	(7)	(7)	(3)	(18), (20), (23)	(10), (12)	(2)	(11)	(14)
Pteridophytes	**Ferns & Allies**																										
Dennstaedtiaceae	**Bracken Fern Family**																										
Pteridium aquilinum ssp. latiusculum	Eastern Bracken Fern	S5						X																			
Dryopteridaceae	**Wood Fern Family**																										
Athyrium filix-femina	Common Lady Fern	S5									X		X														
Athyrium filix-femina var. angustum	Northeastern Lady Fern	S5						X																			
Cystopteris fragilis	Fragile Fern	S4						X																			
Dryopteris carthusiana	Spinulose Wood Fern	S5					X	X			X		X				X										
Dryopteris cristata	Crested Wood Fern	S5					R				X		X														
Dryopteris marginalis	Marginal Wood Fern	S5					R				X		X				X										
Onoclea sensibilis	Sensitive Fern	S5					C	X			X	X		X			X			X		X			X		
Polystichum acrostichoides	Christmas Fern	S5					X				X	X	X				X										
Equisetaceae	**Horsetail Family**																										
Equisetum arvense	Field Horsetail	S5					X	X			X		X												X		
Thelypteridaceae	**Beech Fern Family**																										
Thelypteris palustris	Marsh Fern	S5					X	X																			
Gymnosperms	**Conifers**																										
Pinaceae	**Pine Family**																										
Picea abies	Norway Spruce	SE3									X																X
Pinus resinosa	Red Pine	S5					R				X																X
Pinus strobus	Eastern White Pine	S5					X				X																X
Dicotyledons	**Dicots**																										
Aceraceae	**Maple Family**																										
Acer negundo	Manitoba Maple	S5					X	X			X					X	X						X		X	
Acer nigrum	Black Maple	S4?					X	X			X		X				X								X		
Acer rubrum	Red Maple	S5					X	X			X												X				
Acer saccharinum	Silver Maple	S5					X	X			X																X
Acer saccharum	Sugar Maple	S5					X	X			X	X	X	X			X										X
Acer x freemanii	Freeman's Maple	SNA					hyb				X						X						X		X		X
Anacardiaceae	**Sumac or Cashew Family**																										
Rhus typhina	Staghorn Sumac	S5					X	X			X			X	X									X		X	
Toxicodendron radicans	Poison Ivy	S5						X			X	X					X						X			X	
Toxicodendron radicans var. radicans	Eastern Poison Ivy	S5					C				X		X				X										
Toxicodendron radicans var. rydbergii	Western Poison Ivy	S5					X				X						X						X				X
Annonaceae	**Custard-apple Family**																										
Asimina triloba	Pawpaw	S3					R		X																		
Apiaceae	**Carrot or Parsley Family**																										
Daucus carota	Wild Carrot	SE5					IX	X			X					X	X									X	X
Sanicula marilandica	Maryland Sanicle	S5					X	X																			
Apocynaceae	**Dogbane Family**																										
Apocynum androsaemifolium	Spreading Dogbane	S5					X	X			X						X										X
Apocynum cannabinum	Hemp Dogbane	S5									X						X										
Araliaceae	**Ginseng Family**																										
Aralia nudicaulis	Wild Sarsaparilla	S5					X	X																			
Asclepiadaceae	**Milkweed Family**																										
Asclepias exaltata	Poke Milkweed	S4					X				X						X										
Asclepias incarnata	Swamp Milkweed	S5					X	X			X						X			X		X					
Asclepias syriaca	Common Milkweed	S5					X	X			X														X		
Asteraceae	**Composite or Aster Family**																										
Achillea millefolium	Common Yarrow	SE5?						X			X					X										
Ambrosia artemisiifolia	Common Ragweed	S5					X	X			X															X	
Ambrosia trifida	Great Ragweed	S5					X	X			X					X									X	X	X
Antennaria neglecta	Field Pussytoes	S5					R	X																			
Arctium lappa	Great Burdock	SE5					IX				X		X							X					X		
Arctium minus	Common Burdock	SE5					IX	X			X														X	X	
Bidens cernua	Nodding Beggarticks	S5					X				X						X										
Bidens connata	Purple-stemmed Beggarticks	S4?									X						X							X			
Bidens frondosa	Devil's Beggarticks	S5					X	X			X	X					X			X		X		X	X		
Bidens vulgata	Tall Beggarticks	S5					R				X						X										
Centaurea jacea	Brown Knapweed	SE5					IX				X						X								X		
Cichorium intybus	Chicory	SE5					IX	X			X					X	X										X
Cirsium arvense	Creeping Thistle	SE5					IX	X			X														X	X	
Cirsium vulgare	Bull Thistle	SE5					IX	X			X			X	X										X		
Erigeron annuus	Annual Fleabane	S5					X	X																			
Erigeron canadensis	Canada Horseweed	S5					X				X																X
Erigeron hyssopifolius	Daisy Fleabane	S5									X															X	
Erigeron philadelphicus	Philadelphia Fleabane	S5					X	X			X						X										
Erigeron strigosus	Rough Fleabane	S5					X				X	X		X		X	X						X				X
Eupatorium perfoliatum	Common Boneset	S5					X	X			X									X			X		X		
Eurybia macrophylla	Large-leaved Aster	S5					X	X																			
Euthamia graminifolia	Grass-leaved Goldenrod	S5					X				X			X		X	X		X	X			X		X	X	X
Eutrochium maculatum var. maculatum	Spotted Joe Pye Weed	S5						X																			
Inula helenium	Elecampane	SE5					IX		X		X														X		
Lactuca biennis	Tall Blue Lettuce	S5					X	X																			
Leucanthemum vulgare	Oxeye Daisy	SE5					IX	X			X														X	X	
Matricaria discoidea	Pineappleweed	SE5					IX	X																			
Packera aurea	Golden Ragwort	S5					R				X						X							X			
Rudbeckia triloba	Brown-eyed Susan	SE4					IX	X			X					X											
Silybum marianum	Blessed Milk Thistle	SE1					IH				X								X								
Solidago altissima var. altissima	Eastern Tall Goldenrod	S5						X			X	X		X	X	X	X			X		X		X		X	X
Solidago caesia	Blue-stemmed Goldenrod	S5					X	X			X	X					X								X		
Solidago canadensis	Canada Goldenrod	S5						X			X														X		
Solidago flexicaulis	Zigzag Goldenrod	S5					R				X		X				X										
Solidago gigantea	Giant Goldenrod	S5					C				X		X				X						X				

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Lambton County Status	Natural Environment and Resource Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	NHIC Data*	NRSI Observed	FOD4-1	FOD6-5	SWT2-2 (Incl.)	CUM1 (Incl.)	FOD9-3	FOD9-4	MAM2-2	CUW1 (Incl.)	MAM2-10	SWT2-8 (Incl.)	SWT2-5	SWD3-3	CUM1	CUT1	CUW1	CUP2
												Vegetation Community Number on Figure 4-1															
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Oldham 2017	Gartner Lee Ltd. 2004	iNaturalist 2023	MNRF 2023	NRSI Results From 2022	(15)	(4), (5), (17), (21)	(4)	(4)	(19)	(1), (6), (9), (16), (22)	(13)	(13)	(7)	(7)	(3)	(18), (20), (23)	(10), (12)	(2)	(11)	(14)
Solidago juncea	Early Goldenrod	S5					X				X																
Sonchus arvensis	Field Sow-thistle	SE5					IX				X			X	X									X			X
Sonchus oleraceus	Common Sow-thistle	SE5					IX	X																			
Symphyotrichum ericoides	White Heath Aster	S5									X						X							X			X
Symphyotrichum firmum	Glossy-leaved Aster	S4?									X			X			X										
Symphyotrichum lanceolatum	Panicled Aster	S5					X	X			X	X	X	X		X	X			X	X	X	X	X		X	X
Symphyotrichum lateriflorum	Calico Aster	S5					X				X	X	X				X						X				X
Symphyotrichum novae-angliae	New England Aster	S5					X	X			X			X			X			X		X		X	X	X	X
Symphyotrichum pilosum var. pilosum	Old Field Aster	S5					X				X					X	X							X			X
Symphyotrichum puniceum	Swamp Aster	S5					R	X																			
Symphyotrichum x amethystinum	*(Symphyotrichum ericoides X Symphyotric*	SNA					hyb				X																X
Taraxacum officinale	Common Dandelion	SE5					IX	X			X			X	X	X	X					X				X	X
Tussilago farfara	Colt's-foot	SE5					IX				X	X															
Xanthium strumarium	Rough Cocklebur	S5					X	X			X													X			
Balsaminaceae	**Touch-me-not Family**																										
Impatiens capensis	Spotted Jewelweed	S5					X	X			X	X		X			X				X	X	X				
Berberidaceae	**Barberry Family**																										
Berberis thunbergii	Japanese Barberry	SE5					IX				X						X										
Berberis vulgaris	European Barberry	SE5					IX	X																			
Podophyllum peltatum	May-apple	S5					C	X			X						X										
Betulaceae	**Birch Family**																										
Betula alleghaniensis	Yellow Birch	S5					R				X						X										
Betula papyrifera	Paper Birch	S5					X	X																			
Carpinus caroliniana	Blue-beech	S5					X	X			X	X	X				X									X	
Corylus cornuta	Beaked Hazelnut	S5					R	X																			
Ostrya virginiana	Eastern Hop-hornbeam	S5					C	X			X	X	X				X		X								
Boraginaceae	**Borage Family**																										
Cynoglossum officinale	Common Hound's-tongue	SE5					IX	X																			
Echium vulgare	Common Viper's Bugloss	SE5					IX	X																			
Symphytum officinale	Common Comfrey	SE5					IX				X						X										
Brassicaceae	**Mustard Family**																										
Alliaria petiolata	Garlic Mustard	SE5					IX				X					X	X										
Barbarea vulgaris	Bitter Wintercress	SE5					IX	X			X							X				X					
Cardamine concatenata	Cut-leaved Toothwort	S5					X				X		X														
Cardamine douglassii	Limestone Bittercress	S4					X				X													X			
Erysimum cheiranthoides	Wormseed Wallflower	S5?					IX	X																			
Hesperis matronalis	Dame's Rocket	SE5					IX	X			X					X	X								X	X	X
Campanulaceae	**Bellflower Family**																										
Lobelia cardinalis	Cardinal Flower	S5					R		X		X											X					
Lobelia inflata	Indian-tobacco	S5					R				X													X			
Caprifoliaceae	**Honeysuckle Family**																										
Lonicera dioica	Limber Honeysuckle	S5					X	X																			
Lonicera tatarica	Tatarian Honeysuckle	SE5					IX	X			X	X	X				X								X		
Lonicera x bella	*(Lonicera morrowii X Lonicera tatarica)*	SNA					hyb				X			X													
Sambucus canadensis	Common Elderberry	S5					X	X			X						X							X			
Triosteum aurantiacum	Orange-fruited Horse-gentian	S4S5					X		X		X		X				X										
Viburnum lentago	Nannyberry	S5					X	X			X					X	X					X	X			X	
Viburnum opulus	Cranberry Viburnum	S5						X			X														X		
Viburnum opulus var. opulus	Cranberry Viburnum	SE4?									X						X							X			
Caryophyllaceae	**Pink Family**																										
Cerastium fontanum	Common Mouse-ear Chickweed	SE5					IX	X																			
Dianthus armeria	Deptford Pink	SE5					IX	X	X																		
Saponaria officinalis	Bouncing-bet	SE5					IX	X																			
Celastraceae	**Staff-tree Family**																										
Euonymus obovatus	Running Strawberry Bush	S4					X	X			X	X	X				X							X		X	
Clusiaceae	**St. John's-wort Family**																										
Hypericum perforatum	Common St. John's-wort	SE5					IX	X			X					X	X									X	
Hypericum punctatum	Spotted St. John's-wort	S5					R	X			X						X										
Convolvulaceae	**Morning-glory Family**																										
Convolvulus arvensis	Field Bindweed	SE5					IX	X																			
Cornaceae	**Dogwood Family**																										
Cornus alternifolia	Alternate-leaved Dogwood	S5					X	X																			
Cornus obliqua	Pale Dogwood	S5					X				X	X		X			X		X		X	X	X	X		X	
Cornus racemosa	Gray Dogwood	S5					X	X			X	X		X		X	X	X	X	X			X	X	X	X	X
Cornus sericea	Red-osier Dogwood	S5					X	X			X			X			X	X				X		X			
Crassulaceae	**Stonecrop Family**																										
Penthorum sedoides	Ditch-stonecrop	S5					X				X	X								X							
Cucurbitaceae	**Gourd Family**																										
Echinocystis lobata	Wild Mock-cucumber	S5					X	X																			
Dipsacaceae	**Teasel Family**																										
Dipsacus fullonum	Common Teasel	SE5					IX	X			X			X	X	X	X	X		X					X	X	X	X
Euphorbiaceae	**Spurge Family**																										
Acalypha rhomboidea	Common Three-seeded Mercury	S5					X	X			X													X			
Fabaceae	**Pea Family**																										
Lotus corniculatus	Garden Bird's-foot Trefoil	SE5					IX	X			X					X	X								X		X
Medicago lupulina	Black Medic	SE5					IX	X			X															X	
Melilotus albus	White Sweet-clover	SE5					IX	X			X														X		
Melilotus officinalis	Yellow Sweet-clover	SE5					IX	X			X															X	
Securigera varia	Common Crown-vetch	SE5									X														X		X
Trifolium campestre	Low Hop Clover	SE5					IX	X																			
Trifolium hybridum	Alsike Clover	SE5					IX	X																			
Trifolium pratense	Red Clover	SE5					IX	X			X															X	X
Trifolium repens	White Clover	SE5					IX	X			X														X		
Vicia cracca	Tufted Vetch	SE5					IX				X														X	X	X

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												Vegetation Community Number on Figure 4-1															
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Oldham 2017	Gartner Lee Ltd. 2004	iNaturalist 2023	MNRF 2023	NRSI Results From 2022	(15)	(4), (5), (17), (21)	(4)	(4)	(19)	(1), (6), (9), (16), (22)	(13)	(13)	(7)	(7)	(3)	(18), (20), (23)	(10), (12)	(2)	(11)	(14)
Fagaceae	**Beech Family**																										
Fagus grandifolia	American Beech	S4					X	X			X	X	X				X									X	
Quercus alba	White Oak	S5					X				X						X										
Quercus bicolor	Swamp White Oak	S4					X				X						X						X				
Quercus macrocarpa	Bur Oak	S5					C	X	X		X	X		X		X	X										X
Quercus muehlenbergii	Chinquapin Oak	S4					X	X			X						X									X	
Quercus rubra	Northern Red Oak	S5					X	X			X		X			X	X						X				X
Geraniaceae	**Geranium Family**																										
Geranium maculatum	Spotted Geranium	S5					C	X			X	X	X			X	X										
Geranium robertianum	Herb-Robert	S5					X	X			X	X					X						X			X	
Grossulariaceae	**Currant Family**																										
Ribes americanum	Wild Black Currant	S5					C	X			X		X	X		X	X					X	X		X	X	
Ribes cynosbati	Prickly Gooseberry	S5					C	X			X		X				X					X				X	
Ribes rubrum	Northern Red Currant	SE5					IX				X		X	X	X	X	X										
Haloragaceae	**Water-milfoil Family**																										
Proserpinaca palustris	Marsh Mermaid-weed	S4					R	X																			
Hydrophyllaceae	**Water-leaf Family**																										
Hydrophyllum virginianum	Virginia Waterleaf	S5					C	X			X						X										
Juglandaceae	**Walnut Family**																										
Carya cordiformis	Bitternut Hickory	S5					X	X			X	X	X				X		X			X	X			X	
Carya ovata	Shagbark Hickory	S5					X	X			X	X	X	X		X	X		X			X	X			X	
Juglans cinerea	Butternut	S2?	END	E	E	Schedule 1	X	X																			
Juglans nigra	Black Walnut	S4?					X	X			X			X									X	X		X	X
Lamiaceae	**Mint Family**																										
Clinopodium vulgare	Field Basil	S5					X				X		X	X	X	X	X						X	X			
Glechoma hederacea	Ground Ivy	SE5					IX	X																			
Lycopus americanus	American Water-horehound	S5					X	X			X			X			X			X		X	X	X			
Lycopus europaeus	European Water-horehound	SE5					IX				X											X					
Lycopus uniflorus	Northern Water-horehound	S5					X				X						X					X					
Mentha canadensis	Canada Mint	S5					X				X			X													
Nepeta cataria	Catnip	SE5					IX	X																			
Prunella vulgaris	Self-heal	S5						X			X						X										
Stachys palustris	Marsh Hedge-nettle	SE5					IX	X																			
Lauraceae	**Laurel Family**																										
Lindera benzoin	Northern Spicebush	S4					C				X												X				
Limnanthaceae	**False Mermaid Family**																										
Floerkea proserpinacoides	False Mermaidweed	S4					R				X						X						X				
Lythraceae	**Loosestrife Family**																										
Lythrum salicaria	Purple Loosestrife	SE5					IX	X			X						X							X		X	
Menispermaceae	**Moonseed Family**																										
Menispermum canadense	Canada Moonseed	S4					X				X						X						X				
Oleaceae	**Olive Family**																										
Fraxinus americana	White Ash	S4					X	X			X	X	X			X	X		X					X		X	
Fraxinus nigra	Black Ash	S4	END	T	NS	No schedule	X	X																			
Fraxinus pennsylvanica	Green Ash	S4					X	X			X		X	X		X	X	X				X	X		X	X	X
Fraxinus quadrangulata	Blue Ash	S2?	THR	T	SC	Schedule 1	R		X																		
Onagraceae	**Evening-primrose Family**																										
Circaea canadensis	Broad-leaved Enchanter's Nightshade	S5					X	X			X	X	X			X	X						X			X	
Epilobium ciliatum	Northern Willowherb	S5						X			X	X										X		X			
Epilobium coloratum	Purple-veined Willowherb	S5					R				X						X			X							
Epilobium hirsutum	Hairy Willowherb	SE5					IX	X																			
Oenothera biennis	Common Evening-primrose	S5					X	X			X						X						X				
Orobanchaceae	**Broom-rape Family**																										
Epifagus virginiana	Beechdrops	S5					R				X	X															
Oxalidaceae	**Wood Sorrel Family**																										
Oxalis corniculata	Creeping Wood-sorrel	SE1					?				X						X										
Oxalis stricta	Upright Yellow Wood-sorrel	SE5					X	X			X	X					X							X		X	
Papaveraceae	**Poppy Family**																										
Sanguinaria canadensis	Bloodroot	S5					X				X		X				X										
Plantaginaceae	**Plantain Family**																										
Plantago lanceolata	English Plantain	SE5					IX	X																			
Plantago major	Common Plantain	SE5					IX	X			X	X				X	X								X		
Plantago rugelii	Rugel's Plantain	S5					X				X					X	X										
Polygonaceae	**Smartweed Family**																										
Persicaria lapathifolia	Pale Smartweed	S5					X	X																			
Persicaria maculosa	Spotted Lady's-thumb	SE5					IX	X			X						X							X			
Persicaria sagittata	Arrow-leaved Smartweed	S4S5					R				X						X										
Persicaria virginiana	Virginia Smartweed	S4					C	X			X	X	X				X						X	X		X	
Rumex crispus	Curly Dock	SE5					IX	X			X			X	X	X	X			X			X			X	X
Portulacaceae	**Purslane Family**																										
Claytonia caroliniana	Carolina Spring Beauty	S5					R				X												X				
Claytonia virginica	Narrow-leaved Spring Beauty	S5					X				X		X				X										
Primulaceae	**Primrose Family**																										
Lysimachia ciliata	Fringed Loosestrife	S5					X	X			X						X							X		X	
Lysimachia nummularia	Creeping Jennie	SE5					IX	X	X		X					X	X							X			
Lysimachia thyrsiflora	Water Loosestrife	S5					R				X						X										
Ranunculaceae	**Buttercup Family**																										
Actaea rubra	Red Baneberry	S5					X	X																			
Anemonastrum canadense	Canada Anemone	S5						X			X					X											
Caltha palustris	Yellow Marsh Marigold	S5					X				X						X							X			
Coptis trifolia	Goldthread	S5					R				X						X							X			
Ranunculus abortivus	Kidney-leaved Buttercup	S5					C	X			X												X	X			

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												Vegetation Community Number on Figure 4-1															
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Ranunculus acris	Tall Buttercup	SE5					IX	X																			
Ranunculus caricetorum	Northern Swamp Buttercup	S5									X												X				
Ranunculus recurvatus	Hooked Buttercup	S5					X	X			X						X										
Ranunculus repens	Creeping Buttercup	SE5					IX	X			X															X	
Thalictrum dioicum	Early Meadow-rue	S5					X	X			X		X				X					X					
Thalictrum pubescens	Tall Meadow-rue	S5					X				X						X										
Rhamnaceae	**Buckthorn Family**																										
Frangula alnus	Glossy Buckthorn	SE5					IX				X						X										
Rhamnus cathartica	Common Buckthorn	SE5					IC	X			X	X	X			X	X		X			X	X		X	X	X
Rosaceae	**Rose Family**																										
Agrimonia gryposepala	Hooked Agrimony	S5					X	X			X	X	X	X	X		X			X		X	X				
Agrimonia parviflora	Swamp Agrimony	S4					R				X						X										
Agrimonia striata	Woodland Agrimony	S4									X						X										
Amelanchier arborea	Downy Serviceberry	S5					X				X						X										
Comarum palustre	Marsh Cinquefoil	S5					R	X																			
Crataegus sp.	Hawthorn sp.							X			X		X	X	X	X	X	X	X			X	X		X	X	X
Crataegus crus-galli	Cockspur Hawthorn	S4					X	X																			
Crataegus monogyna	English Hawthorn	SE4					IX	X			X															X	
Fragaria vesca	Woodland Strawberry	S5					R	X			X	X					X						X			X	
Fragaria virginiana	Wild Strawberry	S5					X	X			X		X			X	X						X		X		X
Geum aleppicum	Yellow Avens	S5					R	X			X						X						X			X	
Geum canadense	White Avens	S5					C	X			X						X						X				
Malus pumila	Common Apple	SE4					IX	X			X						X									X	
Potentilla recta	Sulphur Cinquefoil	SE5					IX	X																			
Potentilla reptans	Creeping Cinquefoil	SE2					IX				X														X	X	
Potentilla simplex	Old-field Cinquefoil	S5					X				X						X										
Prunus avium	Sweet Cherry	SE4					IX				X		X				X										
Prunus pensylvanica	Pin Cherry	S5					X				X																X
Prunus serotina	Black Cherry	S5					X	X			X	X	X			X	X							X			
Prunus virginiana	Choke Cherry	S5					C	X			X	X	X				X										
Rosa canina	Dog Rose	SE2					IX				X			X												X	
Rosa multiflora	Multiflora Rose	SE5					IX	X			X		X				X									X	
Rosa palustris	Swamp Rose	S5					X	X																			
Rubus allegheniensis	Allegheny Blackberry	S5					X				X		X				X										
Rubus idaeus	Common Red Raspberry	S5						X																			
Rubus idaeus ssp. strigosus	Wild Red Raspberry	S5					X				X	X				X	X							X	X	X	
Rubus occidentalis	Black Raspberry	S5					C	X			X						X								X		
Rubus odoratus	Purple-flowering Raspberry	S5					H	X																			
Rubus pubescens	Dewberry	S5					X				X		X				X										
Spiraea alba	White Meadowsweet	S5					X	X																			
Rubiaceae	**Madder Family**																										
Galium aparine	Cleavers	S5					X				X		X			X						X	X				
Galium triflorum	Three-flowered Bedstraw	S5					X	X																			
Salicaceae	**Willow Family**																										
Populus alba	White Poplar	SE5					IX	X																			
Populus deltoides	Eastern Cottonwood	S5					X	X			X		X	X			X								X	X	X
Populus grandidentata	Large-toothed Aspen	S5					X	X																			
Populus tremuloides	Trembling Aspen	S5					X	X			X			X			X						X		X	X	X
Salix amygdaloides	Peach-leaved Willow	S5					X				X			X													
Salix discolor	Pussy Willow	S5					X	X			X			X												X	
Salix eriocephala	Heart-leaved Willow	S5					X	X			X			X			X								X	X	
Salix interior	Sandbar Willow	S5					X	X			X			X										X			
Salix nigra	Black Willow	S4					R				X						X										
Salix purpurea	Purple Willow	SE4					IH				X			X													
Saxifragaceae	**Saxifrage Family**																										
Tiarella cordifolia	Heart-leaved Foam-flower	S5					X				X		X														
Scrophulariaceae	**Figwort Family**																										
Mimulus ringens	Square-stemmed Monkeyflower	S5					R				X											X					
Penstemon digitalis	Foxglove Beardtongue	S4S5					X				X						X									X	
Verbascum thapsus	Common Mullein	SE5					IX	X			X		X				X										
Veronica officinalis	Common Speedwell	SE5					IX	X			X						X										X
Veronica serpyllifolia	Thyme-leaved Speedwell	SU					IX	X			X						X										
Solanaceae	**Nightshade Family**																										
Solanum dulcamara	Bittersweet Nightshade	SE5					IX	X			X	X															
Tiliaceae	**Linden Family**																										
Tilia americana	American Basswood	S5					C	X			X	X	X	X		X	X										
Ulmaceae	**Elm Family**																										
Celtis occidentalis	Common Hackberry	S4					X				X																X
Ulmus americana	American Elm	S5					C	X			X		X	X		X	X	X	X			X	X		X	X	X
Ulmus pumila	Siberian Elm	SE3					IX	X																			
Urticaceae	**Nettle Family**																										
Boehmeria cylindrica	False Nettle	S5					X				X	X	X				X					X	X				
Laportea canadensis	Wood Nettle	S5					X	X																			
Pilea pumila	Dwarf Clearweed	S5					X	X			X	X					X					X					
Urtica dioica	Stinging Nettle	SE2									X												X				
Urtica gracilis	Slender Stinging Nettle	S5					X	X			X									X							
Verbenaceae	**Vervain Family**																										
Verbena hastata	Blue Vervain	S5					X	X			X															X	
Verbena urticifolia	White Vervain	S5					X				X			X										X			
Violaceae	**Violet Family**																										
Viola labradorica	Labrador Violet	S5					X				X						X										
Viola pubescens	Yellow Violet	S5					X	X			X						X										
Viola rostrata	Long-spurred Violet	S5					R				X		X														
Viola sororia	Woolly Blue Violet	S5					X	X			X		X				X					X	X				

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												Vegetation Community Number on Figure 4-1															
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Vitaceae	**Grape Family**																										
Parthenocissus quinquefolia	Virginia Creeper	S4?					X	X			X	X	X				X									X	
Parthenocissus vitacea	Thicket Creeper	S5					X				X	X	X			X	X						X				
Vitis riparia	Riverbank Grape	S5					C	X			X	X		X	X	X	X					X	X			X	X
Monocotyledons	**Monocots**																										
Alismataceae	**Water-plantain Family**																										
Sagittaria latifolia	Broad-leaved Arrowhead	S5					X				X												X				
Araceae	**Arum Family**																										
Arisaema dracontium	Green Dragon	S3	SC	SC	SC	Schedule 3	X			X																	
Arisaema triphyllum	Jack-in-the-pulpit	S5					X	X			X	X	X				X						X				
Cyperaceae	**Sedge Family**																										
Carex bebbii	Bebb's Sedge	S5					X	X			X	X											X				
Carex blanda	Woodland Sedge	S5					X	X			X	X	X	X	X		X										X
Carex bromoides	Brome-like Sedge	S5					R				X	X					X					X					
Carex canescens	Hoary Sedge	S5					H	X																			
Carex comosa	Bristly Sedge	S5					X	X																			
Carex crinita	Fringed Sedge	S5					X	X			X						X			X	X	X		X			
Carex cristatella	Crested Sedge	S5					X				X						X			X							
Carex digitalis	Slender Woodland Sedge	S4S5					R				X						X										
Carex gracillima	Graceful Sedge	S5					C	X			X	X	X				X					X					
Carex grayi	Gray's Sedge	S4					X				X						X										
Carex grisea	Gray Sedge	S4					X				X		X				X										
Carex hirtifolia	Pubescent Sedge	S4S5					X				X		X				X										
Carex hystericina	Porcupine Sedge	S5					X				X															X	
Carex intumescens	Bladder Sedge	S5					C				X						X										
Carex lacustris	Lake Sedge	S5					X	X			X							X						X			
Carex laxiflora	Loose-flowered Sedge	S5					R	X																			
Carex lupulina	Hop Sedge	S5					X	X			X		X				X			X		X					
Carex lurida	Sallow Sedge	S4S5					R		X		X						X			X		X					
Carex molesta	Troublesome Sedge	S4S5					X				X									X							X
Carex pallescens	Pale Sedge	S4									X															X	
Carex pedunculata	Long-stalked Sedge	S5					X				X													X			
Carex pensylvanica	Pennsylvania Sedge	S5					X	X			X		X														
Carex prasina	Drooping Sedge	S4					R				X	X															
Carex pseudocyperus	Cyperus-like Sedge	S5					R				X									X							
Carex radiata	Eastern Star Sedge	S5					X	X																			
Carex rosea	Rosy Sedge	S5					C				X	X	X				X					X	X				
Carex sprengelii	Sprengel's Sedge	S5					R	X																			
Carex stipata	Awl-fruited Sedge	S5					X	X			X						X	X				X	X			X	
Carex stricta	Tussock Sedge	S5					X				X						X										
Carex tribuloides	Blunt Broom Sedge	S4					X				X	X															
Carex vulpinoidea	Fox Sedge	S5					X	X			X			X		X	X			X		X		X		X	
Carex woodii	Wood's Sedge	S4					X				X		X				X										
Eleocharis erythropoda	Red-stemmed Spikerush	S5					R	X																			
Eleocharis obtusa	Blunt Spikerush	S5					X	X																			
Schoenoplectus tabernaemontani	Soft-stemmed Bulrush	S5					X				X						X			X				X		X	
Scirpus atrovirens	Dark-green Bulrush	S5					X	X			X	X		X		X	X			X		X				X	
Scirpus cyperinus	Cottongrass Bulrush	S5					X	X			X						X			X		X					
Iridaceae	**Iris Family**																										
Iris versicolor	Harlequin Blue Flag	S5					R				X												X				
Sisyrinchium montanum	Strict Blue-eyed-grass	S5					X	X																			
Juncaceae	**Rush Family**																										
Juncus dudleyi	Dudley's Rush	S5					X				X						X										
Juncus effusus	Soft Rush	S5									X						X			X							
Juncus nodosus	Knotted Rush	S5					X	X																			
Juncus tenuis	Path Rush	S5					X	X																			
Lemnaceae	**Duckweed Family**																										
Lemna minor	Lesser Duckweed	S5					X	X																			
Liliaceae	**Lily Family**																										
Allium tricoccum var. tricoccum	Wild Leek	S4					R				X						X							X			
Erythronium americanum	Yellow Trout-lily	S5					X				X					X	X										
Maianthemum canadense	Wild Lily-of-the-valley	S5					X	X			X															X	
Maianthemum racemosum	Large False Solomon's Seal	S5					X				X		X				X										
Maianthemum stellatum	Star-flowered False Solomon's Seal	S5					X	X			X						X										
Trillium erectum	Red Trillium	S5					X				X						X							X			
Trillium grandiflorum	White Trillium	S5					X				X		X				X							X			
Orchidaceae	**Orchid Family**																										
Aplectrum hyemale	Puttyroot	S2					R			X																	
Epipactis helleborine	Eastern Helleborine	SE5					IX	X			X		X				X										
Poaceae	**Grass Family**																										
Agropyron cristatum	Crested Wheatgrass	SE2					IR	X																			
Agrostis gigantea	Redtop	SE5					IX	X			X						X			X		X					
Alopecurus pratensis	Meadow Foxtail	SE5					IX	X																			
Bromus hordeaceus	Soft Brome	SE2?					IR				X															X	
Bromus inermis	Smooth Brome	SE5					IX	X			X															X	
Calamagrostis canadensis	Bluejoint Reedgrass	S5					X	X			X													X			
Cinna arundinacea	Stout Woodreed	S4					X				X												X				
Dactylis glomerata	Orchard Grass	SE5					IX	X			X																X
Diarrhena obovata	Ovate Beak Grass	S1					R		X																		
Dichanthelium linearifolium	Linear-leaved Panicgrass	S5					R	X																			
Elymus virginicus	Virginia Wildrye	S5						X			X									X		X	X				X
Glyceria striata	Fowl Mannagrass	S5					C	X			X	X					X					X	X			X	
Hordeum jubatum	Foxtail Barley	S5?						X	X																		
Leersia oryzoides	Rice Cutgrass	S5					X				X	X		X		X	X			X		X					
Leersia virginica	Virginia Cutgrass	S4					X				X						X									X	
Lolium pratense	Meadow Fescue	SE5					IX	X			X						X									X	

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Lambton County Status	Natural Environment and Resource Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	NHIC Data*	NRSI Observed	FOD4-1	FOD6-5	SWT2-2 (Incl.)	CUM1 (Incl.)	FOD9-3	FOD9-4	MAM2-2	CUW1 (Incl.)	MAM2-10	SWT2-8 (Incl.)	SWT2-5	SWD3-3	CUM1	CUT1	CUW1	CUP2
												Vegetation Community Number on Figure 4-1															
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Oldham 2017	Gartner Lee Ltd. 2004	iNaturalist 2023	MNRF 2023	NRSI Results From 2022	(15)	(4), (5), (17), (21)	(4)	(4)	(19)	(1), (6), (9), (16), (22)	(13)	(13)	(7)	(7)	(3)	(18), (20), (23)	(10), (12)	(2)	(11)	(14)
Muhlenbergia mexicana	Mexican Muhly	S5					X	X																			
Panicum capillare	Common Panicgrass	S5					X	X																			
Phalaris arundinacea	Reed Canary Grass	S5					X	X			X			X	X		X	X							X		X
Phleum pratense	Common Timothy	SE5					IX	X			X						X							X			
Phragmites australis	Common Reed	SU						X			X			X			X			X				X			
Poa annua	Annual Bluegrass	SE5					IX				X																X
Poa compressa	Canada Bluegrass	SE5					IX	X																			
Poa pratensis	Kentucky Bluegrass	S5									X			X	X												
Poa pratensis ssp. pratensis	Kentucky Bluegrass	SE5					IX	X																			
Typhaceae	**Cattail Family**																										
Typha angustifolia	Narrow-leaved Cattail	SE5					IX	X			X		X	X						X							
Typha latifolia	Broad-leaved Cattail	S5					X	X			X						X	X		X							
TOTAL								**216**	**11**	**2**	**278**	**56**	**70**	**50**	**15**	**49**	**181**	**11**	**11**	**34**	**4**	**57**	**78**	**45**	**18**	**78**	**52**

*NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, 17MH2858, 17MH2859, 17MH2956, 17MH2957, 17MH2958, 17MH2959

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E

Bird Species Reported from the Vicinity of the Study Areas

Bird Species Reported from the Vicinity of the Study Areas - Twin Creeks Environmental Centre Optimization Project

Project #2538

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resource Baseline - Warwick Landfill Expansion EA	eBird Hotspot: Watford--Twin Creeks Landfill and Surrounding Fields	iNaturalist Research-Grade Observations	OBBA*	NHIC Data**	NRSI Observed: Highest Level of Breeding Evidence	BMB-01	BMB-02	BMB-03	BMB-04	BMB-05	BMB-06	BMB-07	BMB-08	BMB-09	BMB-10	BMB-11	BMB-12	BMB-13	BMB-14	BMB-15	BMB-16	BMB-17	BMB-18	BMB-19	Other Observations
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	eBird 2023	iNaturalist 2023	BSC et al. 2006	MNRF 2023	NRSI Results from 2022																				
Anatidae	**Ducks, Geese & Swans**																														
Aix sponsa	Wood Duck	S5B,S3N						X		CO		**OB**																			OB
Anas platyrhynchos	Mallard	S5					B	X		CO		**CO**						PR	PR							PR					CO
Branta canadensis	Canada Goose	S5						X		CO		**CO**		OB				CO	CO		CO	OB	CO			OB	OB		OB		CO
Lophodytes cucullatus	Hooded Merganser	S5						X				**CO**																			CO
Mergus merganser	Common Merganser	S5										**CO**							CO		PO										PO
Spatula discors	Blue-winged Teal	S3B,S4M						X																							
Phasianidae	**Partridges, Grouse & Turkeys**																														
Meleagris gallopavo	Wild Turkey	S5						X				**OB**																			OB
Columbidae	**Pigeons & Doves**																														
Columba livia	Rock Pigeon	SNA						X	X	PR		**OB**																	OB		OB
Zenaida macroura	Mourning Dove	S5					B	X		PR		**PR**	PO				PR	PR	PR		PO		PO	PO	PO		PR		PR	PR	PR	PO
Cuculiformes	**Cuckoos & Anis**																														
Coccyzus americanus	Yellow-billed Cuckoo	S4B						X																							
Coccyzus sp.	Black/Yellow-billed Cuckoo	NP								PO																					
Apodidae	**Swifts**																														
Chaetura pelagica	Chimney Swift	S3B	THR	T	T	Schedule 1		X		PO		**OB**																		OB	
Trochilidae	**Hummingbirds**																														
Archilochus colubris	Ruby-throated Hummingbird	S5B						X		PR																					
Selasphorus rufus	Rufous Hummingbird	SNA							X																						
Charadriidae	**Plovers & Lapwings**																														
Charadrius vociferus	Killdeer	S4B					B	X		CO		**PR**	PO				OB	PR		PO	PR	PO	PR			PO		PR	PR		OB
Scolopacidae	**Sandpipers & Allies**																														
Actitis macularia	Spotted Sandpiper	S5B						X		PR		**PR**	OB								PR		PR								OB
Gallinago delicata	Wilson's Snipe	S5B						X																							
Scolopax minor	American Woodcock	S4B										**PO**																			PO
Tringa flavipes	Lesser Yellowlegs	S3S4B,S5M		T	NS	No schedule		X																							
Tringa melanoleuca	Greater Yellowlegs	S4B,S5M						X																							
Tringa solitaria	Solitary Sandpiper	S4B,S5M						X																							
Laridae	**Gulls, Terns & Skimmers**																														
Chroicocephalus philadelphia	Bonaparte's Gull	S5						X																							
Larus argentatus	Herring Gull	S4B,S5N						X																							
Larus delawarensis	Ring-billed Gull	S5					F	X				**OB**											OB								
Larus glaucoides	Iceland Gull	S4N						X																							
Larus hyperboreus	Glaucous Gull	S4N						X																							
Larus marinus	Great Black-backed Gull	S1B,S4N						X																							
Gaviidae	**Loons**																														
Gavia immer	Common Loon	S5	NAR	NAR	NS	No schedule		X																							
Phalacrocoracidae	**Cormorants**																														
Nannopterum auritum	Double-crested Cormorant	S5B,S4N	NAR	NAR	NS	No schedule		X																							
Ardeidae	**Herons & Bitterns**																														
Ardea herodias	Great Blue Heron	S4						X				**OB**																			OB
Butorides virescens	Green Heron	S4B						X																							
Cathartidae	**Vultures**																														
Cathartes aura	Turkey Vulture	S5B,S3N					F	X				**OB**						OB		OB	OB	OB	OB	OB		OB					OB
Accipitridae	**Hawks, Kites, Eagles & Allies**																														
Accipiter cooperii	Cooper's Hawk	S4	NAR	NAR	NS	No schedule		X				**OB**																			OB
Accipiter striatus	Sharp-shinned Hawk	S5	NAR	NAR	NS	No schedule		X		PO																					
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR	NS	No schedule	A	X		CO		**PO**				PO															OB
Buteo lagopus	Rough-legged Hawk	S1B,S4N	NAR	NAR	NS	No schedule		X																							
Circus hudsonius	Northern Harrier	S5B,S4N	NAR	NAR	NS	No schedule		X				**OB**																			OB
Haliaeetus leucocephalus	Bald Eagle	S4	SC	NAR	NS	No schedule		X				**OB**																			OB
Strigidae	**Typical Owls**																														
Asio flammeus	Short-eared Owl	S4?B,S2S3N	SC	T	SC	Schedule 1		X																							
Bubo scandiacus	Snowy Owl	S4N	NAR					X	X																						
Bubo virginianus	Great Horned Owl	S4					OB					**CO**			PO																CO
Megascops asio	Eastern Screech-Owl	S4	NAR	NAR	NS	No schedule				PR																					
Alcedinidae	**Kingfishers**																														
Megaceryle alcyon	Belted Kingfisher	S5B,S4N						X																							
Picidae	**Woodpeckers**																														
Colaptes auratus	Northern Flicker	S5					B	X		PR		**PR**	PO		PR	PO	PO			PR				PO		PO					OB
Dryobates pubescens	Downy Woodpecker	S5					B	X		PO		**PO**	PO		PO	PO									PO						PO
Dryobates villosus	Hairy Woodpecker	S5						X				**PR**	PR		PR																
Dryocopus pileatus	Pileated Woodpecker	S5										**OB**																			OB
Melanerpes carolinus	Red-bellied Woodpecker	S5						X		PO		**PO**			PO	PO									PO	PO					PO
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B,S3N						X				**OB**																			OB
Falconidae	**Caracaras & Falcons**																														
Falco columbarius	Merlin	S5	NAR	NAR	NS	No schedule		X		CO																					
Falco sparverius	American Kestrel	S4					B	X		PO																					
Tyrannidae	**Tyrant Flycatchers**																														
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC	SC	Schedule 1	A	X		PO		**CO**	PO	PO	PR	CO	PO							PR	PO	PO					PO
Empidonax alnorum	Alder Flycatcher	S5B										**PO**	PO																		
Empidonax minimus	Least Flycatcher	S5B						X				**PO**																PO			
Empidonax traillii	Willow Flycatcher	S4B						X		PO		**PR**															PR	PR			
Myiarchus crinitus	Great Crested Flycatcher	S5B					OB	X		PO		**PR**		PO	PR	PO	PR			PO					PO						PO
Sayornis phoebe	Eastern Phoebe	S5B					B	X				**OB**																			OB
Tyrannus tyrannus	Eastern Kingbird	S4B					B	X		CO		**CO**						CO	PR				PO				PR	PO			
Vireonidae	**Vireos**																														
Vireo flavifrons	Yellow-throated Vireo	S4B								PR																					
Vireo gilvus	Warbling Vireo	S5B					OB	X		PO		**PO**															PO	PO			PO
Vireo olivaceus	Red-eyed Vireo	S5B					A	X		PO		**PR**		PO	PR	PO	PO								PR	PR					OB
Vireo solitarius	Blue-headed Vireo	S5B						X																							
Corvidae	**Crows & Jays**																														
Corvus brachyrhynchos	American Crow	S5					B	X		PO		**PO**		PO	PO			OB		PO	PO					PO					OB
Corvus corax	Common Raven	S5						X																							
Cyanocitta cristata	Blue Jay	S5					B	X		PO		**PR**		PR	PO	PR				PR						PO					OB
Alaudidae	**Larks**																														
Eremophila alpestris	Horned Lark	S4						X		CO		**PR**	PO	PO						PR									PR		OB
Hirundinidae	**Swallows**																														
Hirundo rustica	Barn Swallow	S4B	SC	SC	T	Schedule 1		X		CO		**CO**						OB	OB	OB			OB				OB				CO
Petrochelidon pyrrhonota	Cliff Swallow	S4S5B						X		CO		**CO**																			CO
Progne subis	Purple Martin	S3B						X		CO		**PR**																		PR	
Riparia riparia	Bank Swallow	S4B	THR	T	T	Schedule 1		X				**OB**																			OB
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B						X		CO		**PR**						PO					PR				PO				OB
Tachycineta bicolor	Tree Swallow	S4S5B					B	X		CO		**PR**						PO			PR								PO	PO		OB
Paridae	**Chickadees & Titmice**																														
Baeolophus bicolor	Tufted Titmouse	S3						X				**PO**																			PO
Poecile atricapillus	Black-capped Chickadee	S5					B	X		PO		**PO**	PO	PO			PO							PO							OB
Sittidae	**Nuthatches**																														
Sitta canadensis	Red-breasted Nuthatch	S5						X				**PO**				PO															OB
Sitta carolinensis	White-breasted Nuthatch	S5						X		PR		**PR**			PR	PO									PO	PO					OB
Certhiidae	**Creepers**																														
Certhia americana	Brown Creeper	S5						X																							
Troglodytidae	**Wrens**																														
Troglodytes aedon	House Wren	S5B					B	X		PO		**PO**	PO											PO					PO	PO	PO

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resource Baseline - Warwick Landfill Expansion EA	eBird Hotspot: Watford--Twin Creeks Landfill and Surrounding Fields	iNaturalist Research-Grade Observations	OBBA*	NHIC Data**	NRSI Observed: Highest Level of Breeding Evidence	BMB-01	BMB-02	BMB-03	BMB-04	BMB-05	BMB-06	BMB-07	BMB-08	BMB-09	BMB-10	BMB-11	BMB-12	BMB-13	BMB-14	BMB-15	BMB-16	BMB-17	BMB-18	BMB-19	Other Observations
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	eBird 2023	iNaturalist 2023	BSC et al. 2006	MNRF 2023	NRSI Results from 2022																				
Regulidae	**Kinglets**																															
Corthylio calendula	Ruby-crowned Kinglet	S5B,S3N						X				**OB**																				OB
Regulus satrapa	Golden-crowned Kinglet	S5						X				**OB**																				OB
Turdidae	**Thrushes**																															
Hylocichla mustelina	Wood Thrush	S4B	SC	T	T	Schedule 1	A	X		PO		**OB**																				OB
Sialia sialis	Eastern Bluebird	S5B,S4N	NAR	NAR	NS	No schedule				PO		**OB**																				OB
Turdus migratorius	American Robin	S5					B	X		CO		**CO**	CO	PO	PO	PR	PR	PR	PO	PR	PR	PR		CO	CO	PR	PO	CO	PR	PR	CO	PR
Mimidae	**Mockingbirds, Thrashers & Allies**																															
Dumetella carolinensis	Gray Catbird	S5B,S3N					B	X		PR		**PR**	PO	PR						PR				PO	PO	PO		PO				OB
Toxostoma rufum	Brown Thrasher	S4B						X				**PO**	PO											PO								
Sturnidae	**Starlings**																															
Sturnus vulgaris	European Starling	SNA					B	X		CO		**CO**					PR	CO	CO	CO	CO	CO	PO	PO			PO	PO	CO	CO	PR	OB
Bombycillidae	**Waxwings**																															
Bombycilla cedrorum	Cedar Waxwing	S5					OB	X		PR		**PR**	PO		PO	PR	PO			PR									OB	PO	PO
Passeridae	**Old World Sparrows**																															
Passer domesticus	House Sparrow	SNA						X		CO		**CO**						PR		OB	PR	CO	PR						PR	PR	PR	OB
Motacillidae	**Pipits**																															
Anthus rubescens	American Pipit	S4B						X																								
Fringillidae	**Finches & Allies**																															
Acanthis flammea	Common Redpoll	S5						X																								
Haemorhous mexicanus	House Finch	SNA						X		PO																						
Haemorhous purpureus	Purple Finch	S5						X																								
Spinus tristis	American Goldfinch	S5						X		CO		**PR**	PO	PR		PO	PR		PO	PR	PO	PR	PO	PO	PO		PR	PR	PO	PO	PO	OB
Emberizidae	**New World Sparrows & Allies**																															
Junco hyemalis	Dark-eyed Junco	S5						X				**OB**																				OB
Melospiza georgiana	Swamp Sparrow	S5B,S4N						X				**OB**																				OB
Melospiza lincolnii	Lincoln's Sparrow	S5B						X																								
Melospiza melodia	Song Sparrow	S5					B	X		PR		**PR**	PO	PR	PR	PR	PR	PO	PR	PO	PO	PR	PO	PO	PO		PR	PR	PR	PR	PR	OB
Passerculus sandwichensis	Savannah Sparrow	S5B,S3N					B	X		CO		**PR**					PO				PR	PR	PR				PO	PR	PO	PR	PO	OB
Pooecetes gramineus	Vesper Sparrow	S4B						X		PO		**PO**		PO																		
Spizella passerina	Chipping Sparrow	S5B,S3N						X		CO		**PR**	PR		PO		PO	PO									PO		PO		PR	OB
Spizella pusilla	Field Sparrow	S4B,S3N						X		PO		**PO**															PO	PO				OB
Spizelloides arborea	American Tree Sparrow	S5										**OB**																				OB
Zonotrichia albicollis	White-throated Sparrow	S5						X				**OB**																				OB
Zonotrichia leucophrys	White-crowned Sparrow	S5B,S3N						X				**OB**																				OB
Icteridae	**Troupials & Allies**																															
Agelaius phoeniceus	Red-winged Blackbird	S5					B	X		CO		**CO**	PR	PR	PO	PR	PR	PR	PR	PR	PR	PR	CO	PO	PO	PO	PR	PR	PR	PR	PO	OB
Dolichonyx oryzivorus	Bobolink	S4B	THR	SC	T	Schedule 1	B	X		CO	X	**PO**															PO					
Euphagus carolinus	Rusty Blackbird	S4B,S3N	SC	SC	SC	Schedule 1		X																								
Icterus galbula	Baltimore Oriole	S4B					B	X		PR		**PR**	PO	PR	PO		PO							PO		PO	PR					OB
Icterus spurius	Orchard Oriole	S4B						X																								
Molothrus ater	Brown-headed Cowbird	S5					B	X		CO		**CO**	PO	PR	PO	PR	PR			PR	PR	PR				PO	PO	CO	PO	PR	PO	OB
Quiscalus quiscula	Common Grackle	S5					B	X		CO		**CO**	PR	PR	PR	PR	PO	CO	PR	PR	PR	PR	PO	OB	PR	PR		PO	CO	PR	PR	OB
Sturnella magna	Eastern Meadowlark	S4B,S3N	THR	T	T	Schedule 1	B			PR	X																					
Parulidae	**Wood Warblers**																															
Cardellina canadensis	Canada Warbler	S5B	SC	SC	T	Schedule 1						**PO**	PO																				
Geothlypis trichas	Common Yellowthroat	S5B,S3N						X		PO		**PR**	PO	PR	PO	PR							PO									OB
Leiothlypis peregrina	Tennessee Warbler	S5B						X																								
Leiothlypis ruficapilla	Nashville Warbler	S5B						X																								
Seiurus aurocapilla	Ovenbird	S5B						X		PO																						
Setophaga caerulescens	Black-throated Blue Warbler	S5B						X																								
Setophaga coronata	Yellow-rumped Warbler	S5B,S4N						X				**OB**																				OB
Setophaga magnolia	Magnolia Warbler	S5B						X																								
Setophaga petechia	Yellow Warbler	S5B					B	X		CO		**PR**	PO				PR			PO				PO				PR				OB
Setophaga pinus	Pine Warbler	S5B,S3N						X																								
Setophaga ruticilla	American Redstart	S5B								PO		**PO**	PO											PO								PO
Setophaga striata	Blackpoll Warbler	S5B						X																								
Setophaga tigrina	Cape May Warbler	S5B						X																								
Setophaga virens	Black-throated Green Warbler	S5B										**OB**																				OB
Cardinalidae	**Cardinals, Grosbeaks & Allies**																															
Cardinalis cardinalis	Northern Cardinal	S5					B	X		PO		**PR**	PR	PR		PR	PO	PO		PO				PO	PR		PO	PO	PO		PO	PO
Passerina cyanea	Indigo Bunting	S5B						X		CO		**PO**		PO	PO	PO						PO					PO	PO				OB
Pheucticus ludovicianus	Rose-breasted Grosbeak	S5B					OB	X		PO		**PO**		PO			PO															OB
Piranga olivacea	Scarlet Tanager	S5B								PO																						
Spiza americana	Dickcissel	S2M						X																								
Total							**37**	**115**	**3**	**64**	**2**	**84**	**27**	**21**	**21**	**19**	**22**	**18**	**12**	**20**	**17**	**13**	**17**	**15**	**16**	**14**	**22**	**18**	**17**	**16**	**15**	**72**

*OBBA Atlas Square: 17MH25

**NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, 17MH2858, 17MH2859, 17MH2956, 17MH2957, 17MH2958, 17MH2959

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F

Herpetofauna Species Reported from the Vicinity of the Study Areas

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resources Baseline - Warwick Landfill Expansion EA	MECP Background Information	iNaturalist Research-Grade Observations	ORAA*	NHIC Data**	NRSI Observed
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	MECP 2021	iNaturalist 2023	Ontario Nature 2019	MNRF 2023	NRSI Results from 2022
Turtles												
Apalone spinifera	Spiny Softshell	S2	END	E	E	Schedule 1			X			
Chelydra serpentina	Snapping Turtle	S4	SC	SC	SC	Schedule 1				X		
Snakes												
Heterodon platirhinos	Eastern Hog-nosed Snake	S3	THR	T	T	Schedule 1		X				
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5					X			X		X
Salamanders												
Ambystoma maculatum	Spotted Salamander	S4										X
Notophthalmus viridescens viridescens	Red-spotted Newt	S5								X		
Frogs and Toads												
Anaxyrus americanus	American Toad	S5								X		X
Dryophytes versicolor	Gray Treefrog	S5					X			X		X
Pseudacris triseriata pop. 2	Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population)	S4	NAR	T	T	Schedule 1						X
Pseudacris crucifer	Spring Peeper	S5										X
Lithobates catesbeianus	American Bullfrog	S4										X
Lithobates clamitans	Green Frog	S5					X			X		X
Lithobates pipiens	Northern Leopard Frog	S5	NAR	NAR	NS	No schedule	X			X		X
Lithobates sylvaticus	Wood Frog	S5										X
Total							**4**	**1**	**1**	**7**	**0**	**10**

*ORAA Atlas Square: 17MH25

**NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, 17MH2858, 17MH2859, 17MH2956, 17MH2957, 17MH2958, 17MH2959

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G

Mammal Species Reported from the Vicinity of the Study Areas

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resources Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	Ontario Mammal Atlas	NHIC Data**	NRSI Observed
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	iNaturalist 2023	Dobbyn 1994	MNRF 2023	NRSI Results from 2022
Didelphimorphia	**Opossums**										
Didelphis virginiana	Virginia Opossum	S4							X		X
Eulipotyphla	**Shrews, Moles, Hedgehogs, and Allies**										
Blarina brevicauda	Northern Short-tailed Shrew	S5						X	X		
Condylura cristata	Star-nosed Mole	S5							X		
Parascalops breweri	Hairy-tailed Mole	S4							X		
Sorex cinereus	Masked Shrew	S5							X		
Sorex fumeus	Smoky Shrew	S5							X		
Sorex hoyi	Pygmy Shrew	S4							X		
Sorex palustris	Water Shrew	S5							X		
Chiroptera	**Bats**										
Eptesicus fuscus	Big Brown Bat	S4							X		
Lasionycteris noctivagans	Silver-haired Bat	S4							X		
Lasiurus borealis	Eastern Red Bat	S4							X		
Lasiurus cinereus	Hoary Bat	S4							X		
Myotis leibii	Eastern Small-footed Myotis	S2S3	END						X		
Myotis lucifugus	Little Brown Myotis	S3	END	E	E	Schedule 1			X		
Myotis septentrionalis	Northern Myotis	S3	END	E	E	Schedule 1			X		
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	E	Schedule 1			X		
Lagomorpha	**Rabbits and Hares**										
Lepus americanus	Snowshoe Hare	S5							X		
Lepus europaeus	European Hare	SNA							X		
Sylvilagus floridanus	Eastern Cottontail	S5					X		X		X
Rodentia	**Rodents**										
Castor canadensis	Beaver	S5							X		
Erethizon dorsatum	Porcupine	S5							X		
Glaucomys volans	Southern Flying Squirrel (Great Lakes Plains population)	S4	NAR	NAR	NS	No schedule			X		
Marmota monax	Woodchuck	S5					X		X		
Microtus pennsylvanicus	Meadow Vole	S5					X		X		X
Microtus pinetorum	Woodland Vole	S3?	SC	SC	SC	Schedule 1			X		
Mus musculus	House Mouse	SNA							X		
Napaeozapus insignis	Woodland Jumping Mouse	S5							X		
Ondatra zibethicus	Muskrat	S5							X		X
Peromyscus leucopus	White-footed Mouse	S5							X		
Peromyscus maniculatus	Deer Mouse	S5							X		
Rattus norvegicus	Norway Rat	SNA							X		
Sciurus carolinensis	Eastern Gray Squirrel	S5					X	X	X		X
Synaptomys cooperi	Southern Bog Lemming	S4							X		
Tamias striatus	Eastern Chipmunk	S5							X		X
Tamiasciurus hudsonicus	Red Squirrel	S5							X		X
Zapus hudsonius	Meadow Jumping Mouse	S5							X		
Canidae	**Canines**										
Canis latrans	Coyote	S5							X		X
Vulpes vulpes	Red Fox	S5					X		X		X
Felidae	**Felines**										
Lynx canadensis	Canada Lynx	S5	NAR	NAR	NS	No schedule			X		
Mephitidae	**Skunks and Stink Badgers**										
Mephitis mephitis	Striped Skunk	S5					X		X		X
Mustelidae	**Weasels and Allies**										
Mustela frenata	Long-tailed Weasel	S4							X		
Mustela richardsonii	American Ermine	S5							X		
Neovison vison	American Mink	S4							X		X
Taxidea taxus jacksoni	American Badger (Southwestern Ontario population)	S1	END	E	E	Schedule 1			X		
Procyonidae	**Raccoons and Allies**										
Procyon lotor	Northern Raccoon	S5					X		X		X
Artiodactyla	**Deer and Bison**										
Cervus elaphus	Elk	SNA							X		
Odocoileus virginianus	White-tailed Deer	S5					X	X	X		X
Total							**8**	**3**	**47**	**0**	**13**

*Mammal Atlas Square Numbers: MT

**NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, , 17MH2858, 17MH2859, 17MH2956, , 17MH2957, 17MH2958, 17MH2959

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H

Butterfly Species Reported from the Vicinity of the Study Areas

Butterfly Species Reported from the Vicinity of the Study Areas - Twin Creeks Environmental Centre Landfill Optimization Project **Project #2538**

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resource Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	Ontario Butterfly Atlas*	NHIC Data**	NRSI Observed
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	iNaturalist 2023	Macnaughton et al. 2023	MNRF 2023	NRSI Results from 2022
Hesperiidae	**Skippers**										
Thymelicus lineola	European Skipper	SNA							X		
Pieridae	**Whites and Sulphurs**										
Colias eurytheme	Orange Sulphur	S5							X		
Colias philodice	Clouded Sulphur	S5							X		X
Pieris rapae	Cabbage White	SNA							X		X
Lycaenidae	**Harvesters, Coppers, Hairstreaks,**										
Celastrina sp.	Azure species	SNA							X		
Nymphalidae	**Brush-footed Butterflies**										
Cercyonis pegala	Common Wood-Nymph	S5							X		
Coenonympha california	Common Ringlet	S5							X		X
Danaus plexippus	Monarch	S2N,S4B	SC	E	SC	Schedule 1		X			X
Euphydryas phaeton	Baltimore Checkerspot	S4						X	X		
Limenitis archippus	Viceroy	S5									X
Megisto cymela	Little Wood-Satyr	S5							X		
Nymphalis antiopa	Mourning Cloak	S5						X	X		X
Polygonia comma	Eastern Comma	S5									X
Vanessa atalanta	Red Admiral	S5B							X		
Total							**0**	**3**	**11**	**0**	**7**

*Ontario Butterfly Atlas Square Numbers: 17MH25
**NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, , 17MH2858, 17MH2859, 17MH2956, , 17MH2957, 17MH2958, 17MH2959

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I

Odonata Species Reported from the Vicinity of the Study Areas

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resources Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	Odonate Atlas*	NHIC Data**	NRSI Observed
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	iNaturalist 2023	OOAD 2021	MNRF 2023	NRSI Results from 2022
Lestidae	**Spreadwings**										
Lestes rectangularis	Slender Spreadwing	S5							X		
Coenagrionidae	**Narrow-winged Damselflies**										
Argia apicalis	Blue-fronted Dancer	S4							X		
Argia tibialis	Blue-tipped Dancer	S3							X		
Enallagma exsulans	Stream Bluet	S5							X		
Ischnura verticalis	Eastern Forktail	S5							X		
Aeshnidae	**Darners**										
Aeshna constricta	Lance-tipped Darner	S5							X		
Anax junius	Common Green Darner	S5							X		
Libellulidae	**Skimmers**										
Celithemis elisa	Calico Pennant	S5							X		
Libellula pulchella	Twelve-spotted Skimmer	S5							X		X
Pantala flavescens	Wandering Glider	S4							X		
Sympetrum vicinum	Autumn Meadowhawk	S5							X		
Tramea lacerata	Black Saddlebags	S4							X		
Total							**0**	**0**	**11**	**0**	**1**

*Ontario Odonata Atlas Square Numbers: 17MH25
**NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, , 17MH2858, 17MH2859, 17MH2956, , 17MH2957, 17MH2958, 17MH2959

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J

Fish Species Reported from the Vicinity of the Study Areas

Fish Species Reported from the Vicinity of the Study Areas - Twin Creeks Environmental Centre Optimization Project **Project #2538**

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA	SARA Schedule	Natural Environment and Resources Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	Fisheries and Oceans SAR Data	Aquatic Resource Area Data	NRSI Observed	Kersey Drain		Cameron Drain	Burchill Drain	Gilliland-Geerts Drain	
												EMS-001	EMS-002	EMS-003	EMS-004	EMS-005	EMS-006
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	iNaturalist 2023	DFO 2022	Government of Ontario 2022	NRSI Results from 2022						
Cyprinidae	**Carps**																
Cyprinus carpio	Common Carp	SNA								X	X	X					
Leuciscidae	**Minnows**																
Luxilus cornutus	Common Shiner	S5									X	X	X				
Lythrurus umbratilis	Redfin Shiner	S4	NAR	NAR	NS	No schedule				X							
Pimephales notatus	Bluntnose Minnow	S5	NAR	NAR	NS	No schedule		X			X		X	X			
Pimephales promelas	Fathead Minnow	S5						X		X	X	X	X	X		X	X
Semotilus atromaculatus	Creek Chub	S5					X	X		X	X	X	X	X			
Catostomidae	**Suckers**																
Catostomus commersonii	White Sucker	S5								X	X		X				
Ictaluridae	**North American Catfishes**																
Ameiurus natalis	Yellow Bullhead	S4									X	X					
Umbridae	**Mudminnows**																
Umbra limi	Central Mudminnow	S5								X							
Gasterosteidae	**Sticklebacks**																
Culaea inconstans	Brook Stickleback	S5					X	X			X	X	X				
Cottidae	**Sculpins**																
Cottus bairdii	Mottled Sculpin	S5					X										
Centrarchidae	**Sunfishes and Basses**																
Lepomis cyanellus	Green Sunfish	S4	NAR	NAR	NS	No schedule					X	X	X			X	X
Lepomis gibbosus	Pumpkinseed	S5					X										
Lepomis peltastes pop. 2	Northern Sunfish (Great Lakes - Upper St. Lawrence populations)	S3	SC	SC	SC	Schedule 1			X								
Percidae	**Perches and Darters**																
Etheostoma microperca	Least Darter	S4	NAR	NAR	NS	No schedule		X			X	X	X				
Etheostoma nigrum	Johnny Darter	S5						X			X	X	X	X			
Total							**4**	**6**	**1**	**6**	**11**	**9**	**9**	**4**	**0**	**2**	**2**

*NHIC Atlas Square(s): 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, 17MH2858, 17MH2859, 17MH2956, 17MH2957, 17MH2958, 17MH2959

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Mussel Species Reported from the Vicinity of the Study Areas

Mussel Species Reported from the Vicinity of the Study Areas - Twin Creeks Environmental Centre Landfill Optimization Project **Project #2538**

Scientific Name	Common Name	SRANK	SARO	COSEWIC	SARA STATUS	SARA SCHEDULE	Natural Environment and Resources Baseline - Warwick Landfill Expansion EA	iNaturalist Research-Grade Observations	Fisheries and Oceans SAR Data	NHIC Data	NRSI Observed
		MNRF 2022	MECP 2022	Government of Canada 2022	Government of Canada 2022	Government of Canada 2022	Gartner Lee Ltd. 2004	iNaturalist 2023	DFO 2022	MNRF 2023	NRSI Results from 2022
Unionida	**Native Freshwater Mussels**										
Anodontinae											
Anodontoides ferussacianus	Cylindrical Papershell	S4									X
Lasmigona complanata	White Heelsplitter	S4									X
Pyganodon grandis	Giant Floater	S5									X
Strophitus undulatus	Creeper	S5						X			
Lampsilinae											
Epioblasma rangiana	Northern Riffleshell	S1	END	E	E	Schedule 1		X			
Lampsilis fasciola	Wavy-rayed Lampmussel	S2	THR	SC	SC	Schedule 1		X			
Ptychobranchus fasciolaris	Kidneyshell	S1	END	E	E	Schedule 1		X			
Total							**0**	**4**	**0**	**0**	**3**

*NHIC Atlas Squares: 17MH2657, 17MH2756, 17MH2855, 17MH2856, 17MH2857, 17MH2858, 17MH2859, 17MH2956, 17MH2957, 17MH2958, 17MH2959

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