Natural Environment Level 1 and 2 Report

Olalondo Gravel Pit

FINAL REPORT

Project Number:
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Prepared By:
EXP Services Inc.
1595 Clark Boulevard
Brampton, ON L6T 4V1
Canada
T: 905.793.9800
F: 905.793.0641
www.exp.com

Prepared For:
Municipality of Middlesex Centre
10227 Ilderton Road
Ilderton, ON
N0M 2A0

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Table of Contents

Page

Legal Notification ..... **i**
1 Introduction **1**
2 Study Methods **1**
2.1 Background Review 1
2.2 Agency Consultation 2
2.3 Field Surveys 2
2.3.1 Vegetation 3
2.3.2 Wildlife 3
2.3.3 Wildlife Habitat 4
2.3.4 Species At Risk 4
2.3.5 Surface Water 4
2.4 Significance Evaluation 5
2.5 Impact Assessment 5
3 Existing Conditions **5**
3.1 Site Description 5
3.2 Vegetation 5
3.3 Wildlife 7
3.4 Species At Risk 8
3.5 Surface Water 8
4 Significant Natural Features **8**
4.1.1 Habitat of Endangered and Threatened Species 9
4.1.2 Significant Woodlands 9
4.1.3 Significant Valleylands 9
4.1.4 Significant Wildlife Habitat 9
5 Description of Proposed Extraction **10**
6 Potential Impacts and Mitigation **11**
6.1 Habitat of Endangered and Threatened Species 11
6.2 Significant Woodlands 12
6.3 Significant Valleylands 12
6.4 Significant Wildlife Habitat 12
6.5 Surface and Ground Water 13
7 Conclusions and Recommendations **13**
8 General Limitations **14**
9 Closure **14**

10 References.....15

List of Tables

Table 1: Site Visit Details.....2
Table 2: Study Team Qualfications and Experience.....3
Table 3: Extraction Depth Below Existing Licence Limit and Water Table.....11

List of Appendices

Appendix A: Figures

Figure 1 – Site Location
Figure 2 – Wildlife Survey Locations
Figure 3 – Ecological Land Classification
Figure 4 – Significant Natural Features
Figure 5 – Proposed Area of Extraction

Appendix B: MNRF Comments

Appendix C: Species Lists

Appendix D: SAR Screening Table

Appendix E: Curriculum Vitae

1 Introduction

The Municipality of Middlesex Centre retained EXP Services Inc. (EXP) to complete a Natural Environmental Level 1 and 2 Report for the proposed gravel pit expansion located at 21515 Olalondo Road in the Township of Middlesex Centre, Ontario (hereafter referred to as 'Site') (**Figure 1 - Appendix A**).

The Site is approximately 24.6 hectares in size and is currently an operational gravel pit, referred to as the Olalondo Pit. The pit is currently extracting aggregate above the water table. A licence application for a Category 1: Class "A" Pit Below Water is being sought by the owner to allow aggregate extraction below the water table.

Under the Aggregates Resources Act (ARA), permit and license applications for aggregate extraction require completion of a Natural Environment Report. A Natural Environment Report is completed in two stages (or Levels). A Natural Environment Report Level 1 involves determining the presence of significant natural heritage features on or adjacent (120m) to a site. As defined in the Provincial Policy Statement (MMAH 2014), significant natural heritage features include:

- Significant Wetlands;
- Habitat of Endangered and Threatened Species;
- Areas of Natural and Scientific Interest;`
- Significant Woodlands (south and east of the Canadian shield);
- Significant Valleylands (south and east of the Canadian shield);
- Significant Wildlife Habitat; and,
- Fish habitat

If one or more significant natural heritage features are identified on or adjacent to the Site, then a subsequent Natural Environment Level 2 Report is required to assess potential negative impacts to the natural features and provide any required preventative and mitigation measures to protect the features from the proposed aggregate operation.

Based on the results of the Natural Environment Level 1 study for the Olalondo Gravel Pit, significant natural heritage features were identified on and adjacent to the Site. Resultantly, a Natural Environment Level 2 Report was required for the proposed aggregate expansion. This report specifically addresses the requirements of a Natural Environment Level 1 and 2 Report. It also can serve as an Environmental Impact Study (EIS) under the municipal planning process as required.

The Natural Environment Level 1 and 2 Report was prepared following the Aggregate Resources of Ontario Provincial Standards - Natural Environment Report Standards (Policy A.R. 2.01.07) for aggregate licence applications (MNR 2006). The Site is not located within the Oak Ridges Moraine Conservation Plan Area, the Greenbelt Plan Area or the Niagara Escarpment Plan Area, and therefore Provincial Standard policies A.R. 5.00.00, A.R. 5.00.01 and A.R. 5.00.02 do not apply to the Site.

2 Study Methods

2.1 Background Review

A review of available natural heritage information was conducted to assist with preparation of the Natural Environment Level 1 and 2 Report. The information was reviewed to determine if there were any existing designated natural features or rare species occurrences associated with the Site as well as to supplement field data collected for the Site. The information sources that were reviewed included the following:

- Middlesex County Official Plan
- Municipality of Middlesex Centre Official Plan
- Middlesex Natural Heritage Systems Study
- DFO Fish and Mussel Species at Risk Distribution Maps
- Government Species at Risk websites
- NHIC Natural Heritage Mapping Web Application
- Alymer MNRF Natural Heritage Records
- NatureCounts Database
- Ontario Reptile and Amphibian Atlas
- Ontario Butterfly Atlas
- Various Public / Citizen Science Databases (FishNet2, FrogWatch, eBird, eButterfly, etc.)

2.2 Agency Consultation

The Ministry of Natural Resources and Forestry (MNRF) Alymer District Office was consulted to obtain any records of rare species, fisheries, significant wildlife habitat and other natural heritage feature data associated with the Site. A copy of the comments received from the MNRF is included in **Appendix B.**

2.3 Field Surveys

Field surveys were conducted to identify, map and inventory existing natural features on the Site. The methods used to complete the field surveys for the study are described below. A summary of site visit details is provided in **Table 1**. Qualifications of the study team is provided in **Table 2**. The location of wildlife surveys is provided in **Figure 2 - Appendix A**.

Table 1: Site Visit Details

Date	Start / End Time	Field Surveys	Weather Conditions	Field Personnel
November 21, 2017	11:00 - 14:15	• Bat Maternity Roost Tree Survey • Migratory Birds • Incidental Wildlife Observations	Temperature: 10°C Wind (Beaufort Scale): 1 Cloud Cover: 50%	L. Misch, B.E.S., Env Tech.
May 30, 2018	9:55 - 13:30 and 19:30 - 21:30	• Breeding Bird Surveys • Snake searches • Amphibian Surveys • Migratory Birds • Incidental Wildlife Observations	Temperature: 26°C Wind (Beaufort Scale): 3 Cloud Cover: 30%	A. Zhou, B.E.S.
June 10, 2018	8:20 - 9:15 And 19:45 - 21:15	• Breeding Bird Surveys • Amphibian Surveys • Snake Encounter Surveys • Incidental Wildlife Observations	Temperature: 18°C Wind (Beaufort Scale): 3 Cloud Cover: 80%	A. Zhou, B.E.S.
July 3, 2018	13:00 - 17:29	• Vegetation Surveys • Incidental Wildlife Observations	Temperature: 29°C Wind (Beaufort Scale): 2 Cloud Cover: 0%	G. Reyes, Ph.D.

July 10, 2018	18:30 - 20:00	• Amphibian Surveys • Bat Detectors Deployment • Incidental Wildlife Observations	Temperature: 24°C Wind (Beaufort Scale): 1 Cloud Cover: 0%	L. Misch, B.E.S., Env Tech. A. Zhou, B.E.S.
July 19, 2018	11:00 - 2:30	• Bat Detectors Removal • Incidental Wildlife Observations	Temperature: 25°C Wind (Beaufort Scale): 2 Cloud Cover: 30%	G. Reyes, Ph.D. A. Zhou, B.E.S.

Table 2: Study Team Qualifications and Experience

Study Team	Credentials	Years of Experience	Training / Certifications
Les Misch Senior Ecologist	B.E.S., Env. Tech.	18	Ontario Wetland Evaluation System Ontario Butternut Health Assessor Ontario Stream Assessment Protocol Ontario Fisheries Specialist Protocol Terrestrial Monitoring Protocol Ontario Benthic Biomonitoring Network Marsh Monitoring Program Monitoring Ontario Bats
Gerardo Reyes Ecologist	Ph.D., M.Sc.	14	Class 2 Electrofishing Crew Leader Certification Ontario Benthic Biomonitoring Network
Angela Zhou Biologist	B.E.S.	2	OMNR Vegetation Sampling Protocol Ontario Benthic Biomonitoring Network Electrofishing Crew Member Pleasure Craft Operator

2.3.1 Vegetation

Distinct vegetation communities were mapped as polygons onto a 2015 aerial imagery of the Site and later verified in the field. A botanical inventory of each vegetation community was conducted on July 3 of 2018. Vegetation communities were defined according to the Ecological Land Classification (ELC) System for Southern Ontario (Lee et al. 1998). Methods from the draft Ecological Land Classification (ELC) System for Southern Ontario were applied when the 1998 version did not provide an ELC type for a vegetation community.

Vegetation communities and plants were summarized and checked for rarity and status. Plant species rarity and nomenclature was based on the Natural Heritage Information Centre (NHIC) Plant Community (MNR 2000a) and Vascular Plants (MNRF 2016a) Lists. Vegetation communities less than 0.5 hectares were not mapped unless they were provincially rare vegetation communities, contained rare plant species, or provided an important ecological function.

2.3.2 Wildlife

Breeding bird surveys were completed on May 30 and June 10, 2018 under suitable weather conditions and were undertaken following the Ontario Breeding Bird Atlas survey protocol (BSC 2001). Bird breeding calls as well as visual detection and signs of breeding evidence (e.g. egg shells, nest, etc.) were recorded.

Amphibian (frogs and toads) breeding call surveys were completed in the evenings of May 3 and June 10 of 2018 under suitable weather conditions following the Ontario Marsh Monitoring Program survey protocol (BSC 2008).

Visual encounter surveys for snakes and woodland salamanders were conducted on the mornings of May 30 and June 10 of 2018. Searches for snakes and salamanders included checking under suitable cover

objects (e.g. woody debris, plywood, sheet metal, boards, rocks, etc.). Searches for snakes also included open and semi-open areas such as forest openings, habitat edges and on top of logs, stumps and debris piles where basking snakes may appear. Snake surveys were completed based on the guidelines in the Survey Protocol for Ontario's Species at Risk Snakes (MNRF 2016b).

Surveys to assess the presence of bats in the forest adjacent to the Site were completed following the guidelines in the Survey Protocol for Species at Risk Bats within Treed Habitats (MNRF 2017). A search for suitable bat maternity roost trees was conducted on November 21, 2017 during the leaf-off season assisted with the use of binoculars to improve detection of tree cavities, crevices and other suitable roost features. The GPS location, roost characteristics and a photo record of each identified suitable tree was recorded in the field.

Bat acoustic surveys were then completed by deploying Song Meter (SM4BAT) full spectrum bat detectors equipped with SMM-U2 ultrasonic microphones (Wildlife Acoustics, Massachusetts, USA) within 10m of the best suitable bat maternity roost trees (**Figure 2 - Appendix A)**. Detectors were left deployed to remotely monitor and record bat echolocation calls for ten (10) survey nights starting a half hour after sunset for five hours from July 10 - 19, 2018. Recorded bat calls were analyzed using Kaleidoscope Viewer analysis software (Wildlife Acoustics, Massachusetts, USA) and bat identification was completed by comparing call characteristics and spectrograms with Thorne (2017) and Van Zyll de Jong (1990). Due to the difficulty of identifying calls of Myotis bats (Little Brown Myotis, Eastern Small-footed Myotis, Northern Myotis) to the species level with high confidence, all calls of this genus were grouped into a single Myotis group. Similarly, the calls of Big Brown Bat and Silver-haired Bat were grouped together if the calls could not be confidently identified to either species.

Incidental observations of other herpetofauna as well as mammals and invertebrates were recorded during the field surveys undertaken for the study. All wildlife (including tracks and other sign) were recorded according to the vegetation community where the animal was observed.

2.3.3 Wildlife Habitat

Wildlife habitat on the Site was identified and assessed based on ELC mapping, natural features mapping, wildlife habitat requirements and the field surveys. Localized wildlife habitat features (e.g. amphibian breeding pond, turtle nest site, fish spawning site, hibernation site, etc.) were mapped and the location recorded using GPS as required. Identification and classification of wildlife habitat followed the guidelines in the Significant Wildlife Habitat Technical Guide (MNR 2000) and Natural Heritage Reference Manual (MNR 2010) and supporting documentation. The presence of nests, dens, shelters or habitat that is protected under the federal Migratory Birds Convention Act and the provincial Fish and Wildlife Conservation Act was also inventoried.

Provincially rare species and vegetation communities with conservation status ranks of S1, S2 or S3 assigned by the NHIC were assessed. This information was used to determine the presence of significant wildlife habitat for species of conservation concern.

2.3.4 Species At Risk

The presence of species at risk (SAR) habitat within and adjacent to the Site was assessed based on information obtained from the background data review, agency consultation and the field surveys. SAR habitat included habitat of Endangered (END) and Threatened (THR) species protected under the Endangered Species Act (ESA) and fish and migratory birds protected under the Species At Risk Act (SARA). The presence of potential habitat for SAR was assessed by conducting a SAR screening that compared habitat requirements of SAR that have Ontario population distributions overlapping the Site with ELC habitat types identified on the and adjacent to the Site. Surveys were then completed to verify the presence of SAR in suitable habitats.

2.3.5 Surface Water

Surface water features on and adjacent to the Site were identified and assessed based on existing mapping, online data sources and the field surveys.

2.4 Significance Evaluation

Natural features identified during the field surveys (that are not currently designated by the municipality) were evaluated to determine their significance based on local municipal or provincial natural heritage criteria, policies and guidelines. Identification of significant wildlife habitat followed the guidance of the Significant Wildlife Habitat Technical Guide (MNR 2000) and SWH Criteria Schedules - Ecoregion 6E (MNRF 2015b) as well as habitat descriptions for species of conservation concern. Other natural heritage features were evaluated based on the Natural Heritage Reference Manual (MNR 2010) or local municipal environmental policies and guidelines where applicable. MNRF is responsible for determining provincially significant wetlands. Evaluating the significance of unevaluated wetlands, based on the criteria and procedures in the Ontario Wetland Evaluation System (OWES) Manual (MNR 2014), was outside the scope of work for the study.

2.5 Impact Assessment

Potential ecological impacts were evaluated by comparing natural features and functions with the proposed development. Measures to avoid or minimize adverse impacts as well as recommendations on ecological enhancement and monitoring were then considered. Guidance provided in MNR (2010) and the Significant Wildlife Habitat Mitigation Support Tool (MNRF 2014a) were used to assist with assessing potential impacts and mitigation options for natural heritage features and SWH.

3 Existing Conditions

3.1 Site Description

The Site is approximately 25 hectares in size and is located southwest of the corner of Medway Road (County Road 28) and Olalondo Road in Middlesex Centre (**Figure 1 - Appendix A**). Aggregate is currently being extracted and processed in the west central portion of the Site. The west edge of the Site has not been extracted and is currently being used for agriculture (cropland). An open pit face separates the active pit area from the agricultural lands to the west. A cultural meadow is established in the middle and along the east boundary of the Site as well as immediately south of the Site. The meadow portion east of the active pit area was previously mined and has been rehabilitated to some extent by placement of the overburden that had been cleared from the active gravel pit area. The meadow and forest directly south of the Site is privately owned. Meadow marsh and shrub wetland thicket have established in the east half of the Site.

An inactive rehabilitated gravel pit is located just north of the Site. A part of the rehabilitated pit has filled with water creating a large pond. Active pits are located immediately east of the Site. The Thames River and associated riparian forests are located approximately 200m south of the Site. The north side of the river contains a steep embankment. The elevation difference between the top and toe of the bank is approximately 15m.

3.2 Vegetation

The Site and adjacent area contain six (6) ELC (vegetation community) types, which include: Agriculture (AGR); Cultural Meadow (CUM1-1); Gravel Pit (PIT); Deciduous Swamp (SWD); Meadow Marsh (MAM2-10); and Sugar Maple Deciduous Forest (FOD5-1) (**Figure 3 - Appendix A**).

A description of each vegetation community type is provided below. A list of plant species recorded in each community as well as the rarity and status of each plant is presented in **Appendix C**. Definitions for the terms used in the plant list is provided at the end of species lists in the appendix.

Agriculture (AGR)

A fallow Agriculture field is located along the western edge of the property. The total area of this ecological community is approximately 3.5 ha. Various Grass Species dominate the community type while Goldenrods (*Solidago sp*) are also abundant. The Agriculture field adjacent to the western edge of the property is planted with Soy (*Glycine max*). Of the 38 plant species inventoried, 40% are non-native.

Cultural Meadow (CUM1-1)

There are four (4) distinct Cultural Meadow communities located on the Site. The westernmost Cultural Meadow is bordered by Agriculture to the west and the Gravel Pit to the east. The total area of this ecological community is approximately 1.1 ha. Goldenrods are the most abundant species while species characteristic of fallow fields such as Lamb's Quarters (*Chenopodium album* var. *album*), Knapweed (*Centaurea sp*), and Velvetleaf (*Abutilon theophrasti*) are occasionally found. A total of 42 plant species were inventoried from this feature. Twenty-three of the plant species in this community are non-native (55 %), one of which, Garlic Mustard (*Alliaria petiolata*), is considered invasive.

The Cultural Meadow in the middle of the Site is approximately 6.0 ha. It is dominated by Grasses while Goldenrods and Wild Carrot (*Daucus carota*) are also found in abundance. Asters (*Aster sp*), Field Cress (*Lepidium campestre*), Sow Thistle (*Sonchus sp*), and other species typically found in fallow fields are also scattered throughout. A total of 37 plant species were inventoried from this feature. Twenty-one of the plant species in this community are non-native (57%), one of which, Garlic Mustard, is considered invasive.

The easternmost Cultural Meadow occurs along the east boundary of the Site that is bordered by an active Gravel Pit to the east. The total area of the on-Site portion of the ecological community is approximately 3.2 ha. Reed Canary Grass (*Phalaris arundinacea*) dominates the vegetation community while Bird's-foot Trefoil (*Lotus corniculatus*), Goldenrods, Milkweed (*Asclepias syriaca*), and other Reed Grasses (*Calamagrostis sp*) are also abundant. Eastern Cottonwood (*Populus deltoides*), Norway Spruce (*Picea abies*), Willows (*Salix sp*), and other tree and shrub species are also more prevalent. Sixteen of the 34 plant species in this vegetation community are non-native (47%), one of which, Common Reed (*Phragmites australis* subsp*. australis*), is considered invasive.

Only a small portion (0.3 ha) of the southernmost Cultural Meadow is located on-Site, although it continues off-Site south and southeast towards the Deciduous Forest (FOD5-1). Goldenrods are the most abundant species while Asters, Grasses, Sow Thistle, Wild Carrot, and other species typically found in fallow fields are also littered throughout. Fourteen of the 32 plant species in this vegetation community are non-native (44%), one of which, Common Reed, is considered invasive.

Gravel Pit (PIT)

There is only sparse vegetation found along the edges of this active portion of the gravel pit on the Site. The total area of this land type is approximately 3.9 ha. The pit consists mostly of occasional patches of Coltsfoot (*Tussilago farfara*), Common Ragweed (*Ambrosia artemisiifolia*), Grasses, and Lamb's Quarters. Of the 31 plant species inventoried, 58% are non-native, one of which, Garlic Mustard (*Alliaria petiolata*), is considered invasive.

Deciduous Swamp (SWD)

A Deciduous Swamp is located along the eastern portion of the Site. This vegetation community type is approximately 1.5 ha in size. Eastern Cottonwood (*Populus deltoides*) and Willow (*Salix sp*) dominate the canopy and sub-canopy, respectively, while Reed Canary Grass, Goldenrods, and Mosses are important components of the herbaceous layer. Standing water was approximately 10 cm deep.

Eight of the 27 plant species documented are non-native (30%), two of which, Common Buckthorn (*Rhamnus cathartica*) and Common Reed, are considered invasive.

Meadow Marsh (MAM2-10)

There are two (2) Meadow Marsh communities within the Site boundaries. The Meadow Marshes are 2.5 (northeast site) and 0.9 (south site) ha in size, respectively. The northeastern Meadow Marsh is dominated by Reed Grasses while the Meadow Marsh to the south is dominated by Willows and the exotic Common

Reed (*Phragmites australis* subsp*. australis*). Other Reed Grasses and Broad-leaved Cattail (*Typha latifolia*) are also abundant there.

A total of 39 and 26 plant species were inventoried in the northeastern and southern Meadow Marshes, respectively. 46% and 27% of the inventoried plants, respectively, are considered non-native. Common Buckthorn and the exotic Common Reed are considered invasive.

Sugar Maple Deciduous Forest (FOD5-1)

This Dry-Fresh Sugar Maple Deciduous Forest borders the southwest edge of the Site and continues east south of the Site. The overstory is dominated by mature Sugar Maple (*Acer saccharum*), while White Ash (*Fraxinus americana*), Bitternut Hickory (*Carya cordiformis*), Eastern Cottonwood, Hackberry (*Celtis occidentalis*), and Cherry (*Prunus sp*) are occasionally found. Garlic Mustard was abundant in the understory while Gooseberries (*Ribes sp*), Red Osier Dogwood, and Virginia Creeper (*Parthenocissus quinquefolia*) were occasionally found.

A total of 21 plant species were documented. Two of the plants are non-native (10%), one of which, Garlic Mustard, is considered invasive.

Open Aquatic (OAO)

A pond is located north of the Site that was created around 2015 following closure and rehabilitation of a former active gravel pit on the lands. The pond lacks riparian vegetation and no floating-leaved aquatic macrophytes were observed during the field surveys. The pond may contain submerged plants but this was not assessed in detail as part of the vegetation surveys.

The Thames River is also an open water community located approximately 220m south of the Site. The river is outside the study area for the Level 1 study and vegetation surveys for the river was not undertaken.

3.3 Wildlife

The species groups and total number of wildlife in each group that were inventoried during the field surveys were as follows: 10 mammals; 25 birds; 1 amphibian; and, 8 invertebrates. A list of wildlife species and the location where they were observed on and adjacent to the Site is provided in **Appendix C**. Definitions for the terms used in the plant list is provided at the end of species lists in the appendix. No reptile or incidental observations of fish were observed.

Evidence of bird and amphibian breeding activity was confirmed on and adjacent to the Site. Breeding evidence documented for bird species was as follows: 21 Possible, 2 Probable and 1 Observed. Most of the breeding activity was observed in the cultural meadow (CUM1-1). In general, 14 of the 25 species (56%) of birds documented during the bird surveys were observed in the cultural meadow. Songs and calls of males were heard for a number of species including Killdeer, Field Sparrow, Song Sparrow, Red-winged Blackbird, American Robin, and American Goldfinch. Mating pairs were observed for Red-winged Blackbird and Bobolink as well. A large stick nest was observed near the top of a mature deciduous tree in the central part of the deciduous forest (FOD5-1). No nesting activity was observed in the stick nest, however a Red-tailed Hawk was perched in tree adjacent to the forest (along the Thames River) making frequent distress calls, indicating that the nest could be used by a mating pair of Red-tailed Hawk.

American Toad and Gray Treefrog breeding calls were documented from the meadow marsh (MAM2-10) and deciduous swamp (SWD). Water levels in these vegetation communities is low and appears to dry out by mid-summer. The deciduous forest (FOD5-1) contained depressions that formed vernal pools. No amphibian calls were recorded from the forest. The pools were dry during the site visits in May and June and the short hydroperiod could prevent the pools from being viable for woodland-breeding amphibians that require a sufficient period of time (2-3 months) for eggs to mature into the adult form.

White-tailed Deer were spotted throughout the Site during subsequent site visits. One was observed in the gravel pit area (PIT), the deciduous swamp (SWD), and in the cultural meadow (CUM1-1). Deer, Raccoon, and Wild Turkey tracks were also documented on the gravel road along the eastern boundary of the Site. The presence of deer and deer trails throughout the Site indicate that the Site provides suitable summer

foraging habitat for deer and other wildlife and/or provides cover for wildlife moving through the Site while migrating along the Thames River corridor.

Bat calls were recorded in the adjacent deciduous forest (FOD5-1). The forest is dominated by several large, mature deciduous trees which were identified as potential suitable roost trees for bat maternity colonies. Identification of the recorded bat calls showed that Big Brown Bat, Hoary Bat, and possibly Silver-haired Bat were present in the forest. Myotis species, which are protected under the ESA (2017), were also identified in the forest, which is discussed further in Section 4.1.1.

3.4 Species At Risk

Based on the SAR screening, potential suitable habitat for 13 SAR was identified on or adjacent to the Site. Habitat descriptions for the 13 SAR is provided in the SAR screening table in **Appendix D**. Field surveys were conducted to determine the presence of SAR in suitable habitats on and immediately adjacent to the Site. An overview of suitable habitat and the presence of SAR is discussed further in Section 4.1.1 and 4.1.4 (Habitat for Species of Conservation Concern).

3.5 Surface Water

The pond north of the Site and the Thames River are the main surface water features in proximity to the Site. As previously discussed, the pond was formed as a result of a former gravel pit filling in with water. There is no apparent surface drainage feature providing inflow or outflow from the pond and it is likely recharged from surface runoff and groundwater. The Thames River south of the Site flows from east to west. A dam is located approximately 400m down river from the Site that backs water up from the dam to the section of river south of the Site, which has created a lake feature referred to as Fanshawe Lake.

The meadow marsh (MAM2-10) in the northeast portion of the Site as well as the smaller marsh in the southeast portion contained pockets of shallow standing water. The northern marsh contained pockets of water mainly around a small patch of trees at the northeast corner of the marsh, with a depth of less than 10cm. The southern marsh had a small areas of standing water which ranged in depth from approximately 10-20cm. The deciduous swamp (SWD) on the east side of the Site also contained areas of standing water with a depth of less than 10cm but was otherwise dry.

4 Significant Natural Features

This section discusses significant natural heritage features on or adjacent (120m) to the Site that were identified from the background review, field surveys and evaluation of natural features based on local and provincial natural heritage policy and guidelines. The locations of the significant features are shown in **Figure 4 - Appendix A**. Significant features that were identified on or adjacent to the Site included the following:

- Habitat of Endangered and Threatened Species
- Significant Woodlands
- Significant Valleylands
- Significant Wildlife Habitat

The wetlands on the Site are unevaluated and were not included in any of the mapping from the background information that was reviewed. Determining if any of the wetlands on the Site are PSW, was outside the scope of work for the Level 1 study. However, the field survey data initially indicates that the wetlands on the Site are unlikely to be classified a PSW based on the criteria in the OWES (MNR 2014). The wetlands are also not within 750m of an existing PSW, and therefore would not be considered PSW based on the wetland complexing rule described in the OWES.

4.1.1 Habitat of Endangered and Threatened Species

The portion of the deciduous forest (FOD5-1) adjacent to the southwest corner of the Site provides suitable maternity roost/colony habitat for SAR bats. Myotis bat species were recorded in the forest during the acoustic surveys. Myotis bats include Little Brown Myotis (END), Northern Myotis (END) and Eastern Small-footed Myotis (END). This genus of bats have similar call characteristics and therefore the species of Myotis bat could not be confidently identified based on analysis of bat call data (see Section 2.3.2). The forest contains a high number of mature suitable cavity trees and snags and a moderately dense canopy with sparse understorey. The Thames River south of the forest provides a nearby drinking water source, which is necessary for bat maternity colonies. The river, forest openings and the forest-meadow edges would also serve as ideal foraging habitat for these and the other bat species identified in the forest.

The cultural meadow (CUM1-1) in the central portion of the Site (east of active gravel pit) provides suitable nesting habitat for Bobolink (THR). 6 Male and 2 female Bobolink were observed in the meadow during the breeding bird surveys. The cultural meadow south of the Site also appears to provide foraging habitat for Eastern Meadowlark (THR) based on observation records obtained from the background review. Field observations and background data revealed that the meadow on the Site as well as the pond (OAO) north of the Site also function as suitable foraging habitat for Barn Swallow (THR). Eastern Meadowlark was not identified during the breeding bird surveys and no Barn Swallow nest sites were observed on the Site. Approximately 15-20 Bank Swallow (THR) nests were observed along the open pit face of the gravel pit (PIT), however the nests were not active during the field surveys. The Bank Swallows may have recently abandoned the nest site due to the disturbance caused by the current aggregate extraction and processing that was occurring immediately adjacent to the nest site at the time of the field surveys.

The Thames River provides suitable habitat for aquatic SAR. Based on records obtained from the MNRF Aylmer District Office and background review, Spiny Softshell (END) and Wavy-rayed Lampmussel (THR) is known to occur in this waterbody. Based on NHIC mapping, Fanshawe Lake is also identified as a DFO Critical Habitat area for Federal Aquatic Species at Risk.

4.1.2 Significant Woodlands

The deciduous forest (FOD5-1) adjacent to the Site is identified as Significant Woodland in the Middlesex County Official Plan (OP) and Municipality of Middlesex Centre OP. The forest is part of the County's Natural System.

4.1.3 Significant Valleylands

The majority of the Thames River including the section adjacent to the Site is identified as Significant Valley System based on the mapping from the Middlesex Natural Heritage Systems Report (Middlesex County, 2014). The Middlesex Natural Heritage Systems report is endorsed by Middlesex County Council., but the significant valley system has not yet officially been incorporated into the County OP.

4.1.4 Significant Wildlife Habitat

As described in the Significant Wildlife Habitat Technical Guide (MNR 2000), there are four main categories of significant wildlife habitat (SWH):

- Seasonal Concentration Areas;
- Rare and Specialized Habitat;
- Habitat for Species of Conservation Concern (excluding Endangered or Threatened Species); and,
- Animal Movement Corridors

Within each main SWH category, there are specific wildlife habitat types (e.g. Waterfowl Stopover and Staging Areas, Turtle Nesting Areas, Bat Maternity Colonies, Marsh Bird Breeding Habitat, etc.). Development and site alteration is not permitted in SWH unless it can be demonstrated that there will be no negative impacts on the habitat feature or its ecological function.

Based on the criteria in MNR (2000) and supporting documents, confirmed SWH that was identified on or adjacent to the Site is discussed below.

Bat Maternity Colonies

The deciduous forest (FOD5-1) adjacent to the Site is expected to support one or more significant maternity colonies of Big Brown Bat and possibly Silver-haired Bat. The mature deciduous forest contains a high density (>21/ha) of large diameter (>25cm) cavity trees in early stages of decay, which provides optimal roost tree habitat. Echolocation calls of Big Brown Bat were recorded in the forest at suitable roost trees over the duration of the bat acoustic monitoring. A number of calls that could be Silver-haired Bat were also recorded. Bat roost exit surveys were not conducted to determine specific numbers of Big Brown Bat and Silver-haired Bat. However, the results from the searches of suitable bat maternity roost trees and acoustic monitoring in addition to presence of adjacent foraging habitat and water sources, indicates that the deciduous forest contains bat maternity colony SWH.

Habitat for Species of Conservation Concern

Species of conservation concern include wildlife species that are listed as Special Concern (SC) under the ESA (2017) and provincially rare plant and wildlife species (S1 - S3) ranked by the NHIC. Habitats of Species of Conservation Concern do not include habitats of Endangered or Threatened species listed in the ESA.

The cultural meadow (CUM1-1) provides habitat for Monarch (SC). The meadow contains a mixture of flowering plants that provides nectar for Monarch adults. The meadow also contains Milkweed species that are exclusively used for development of Monarch larvae.

5 Description of Proposed Extraction

The gravel pit is currently operating and extracting aggregate from above the water table. A licence application for a Category 1: Class “A” Pit Below Water is being sought by the proponent to allow aggregate extraction below the established water table.

A Geotechnical Investigation was undertaken to assess the general quantity and quality of available aggregate materials at the Site (EXP Services, 2018). Based on the results of the investigation, a proposed area of extraction was determined (**Figure 5 - Appendix A**). **Table 3** shows the depth that aggregates will be extracted below the existing licence limit and water table for different sections within the extraction area shown in **Figure 5 - Appendix A**. The values in **Table 3** are based on a groundwater elevation of ~96.5 m and a pit licence limit elevation of 98.0 m (1.5 m above the water table). Values are also based on the assumption that aggregate would only be extracted to a depth of 0.3 m above the elevation of natural silty clay till underlying the aggregate material. The active pit floor is currently very close to the current licence limit.

Referring to **Table 3** and **Figure 5 - Appendix A**, aggregate extraction will not go below the water table in sections 1, 2 and 3 but extraction will extend below the water table in sections 5 and 6. The depth of aggregate extraction in section 2 will conversely be 1.29 m above the current licence limit and 2.79 m above the water table and therefore was not included in the table.

The method for extracting the aggregate material below the water table in sections 5 and 6 will be wet extract with a dredge line. Some localized pumping will be required closer to the interface between the bottom of the available gravel/sand deposit and the underlying non-extractable silty clay layer. Resultantly, no major dewatering will be required for the below-water extraction process.

Table 3: Extraction Depth Below Existing Licence Limit and Water Table

Extraction Section	Depth Below Licence Limit (m)	Depth Below Water Table (m)
1	0.78	0
3	0.20	0
4	1.50	0
5	1.83	0.39
6	2.88	1.38

6 Potential Impacts and Mitigation

6.1 Habitat of Endangered and Threatened Species

Bat SAR Habitat

The significant woodland immediately southwest of the Site and extraction area (**Figures 4 and 5 - Appendix A**) contains tree roost habitat for bat SAR. The forest is outside of the Site and no loss of forest or tree roosting habitat will occur from the proposed aggregate extraction. Loss of foraging habitat provided by the cultural meadows on and adjacent to the Site will also be avoided.

Potential indirect impacts such as noise generated from the pit operation can cause a disturbance to and adversely impact bat SAR maternity colonies in the forest. The pit operation could also generate airborne dust that effects the health of cavity trees for bats along the forest margins. Some minor attenuation of noise and dust will be provided by the pit face in the extraction area, providing that aggregate extraction continues to progress in an east to west direction. Additional mitigation from noise disturbance can be provided by use of a buffer and construction of a vegetated earth berm to further minimize and deflect noise away from the forest. A 15-metre property line setback is expected to be required along the west boundary of the Site as part of the pit licence. This setback could also serve as the buffer. The noise berm (minimum 2 - 3m height) would be installed along the southwest corner of the proposed extraction area within the buffer. The proposed location and configuration of the noise berm is shown in **Figure 5 - Appendix A**. An alternating row of native coniferous trees (e.g. White Spruce) can be planted on the berm to provide additional buffering and a visual screen to further minimize wildlife disturbance. The buffer and berm would help to provide additional mitigation of potential dust impacts on roost trees and forest vegetation. Dust suppression is also expected to be a requirement of the approved pit licence application. As a final noise mitigation measure, the stone crusher should be positioned as far as possible away from the forest.

Bird SAR Habitat

The cultural meadow immediately east of the current active pit supports nesting pairs of Bobolink and provides foraging habitat for Barn Swallow. The meadow was previously mined and has been predominantly rehabilitated. The meadow will not be directly impacted from the proposed extraction and is not expected to be disturbed from future pit operations since it is a rehabilitated area and currently provides habitat for SAR and other wildlife.

Potential noise disturbance impacts from aggregate operations are not expected to interfere with use of the meadow by Bobolink and Barn Swallow; both species were present in the meadow and did not appear to be disturbed by the aggregate operation that was occurring in the adjacent active pit area. Additionally, the proposed extraction is expected to progress westerly from the current active pit area, which further minimizes the likelihood of potential noise disturbance impacts over time.

The cultural meadow south of the Site potentially provides nesting habitat for Eastern Meadowlark. The meadow will not be directly impacted by the proposed extraction and noise disturbances are unlikely to be an issue for similar reasons discussed above for Bobolink.

Aquatic SAR Habitat

The Thames River and Fanshawe Lake south of the Site provides habitat for aquatic SAR. The waterbodies will not be directly impacted by the aggregate operation.

The aggregate extraction will be occurring close to and within the groundwater on the Site. The groundwater on the Site may be hydrogeologically connected to the river / lake. Potential major chemical spills, such as from machinery and fuel storage / handling, within the extraction area could migrate over time into the river / lake resulting in contamination of surface waters and harmful effects on aquatic SAR and habitat in the waterbodies. Potential impacts from spills can be mitigated through implementation of a proper spill prevention and management plan, which is expected to be a required condition of the pit licence application approval. As a minimum, spill prevention measures should include: designated refuelling areas a safe distance from exposed groundwater and surface waters; using primary and secondary fuel storage containment; keeping spill clean-up kits on site; regular equipment maintenance, and, daily checks of heavy equipment for leaks prior to entering the extraction area.

6.2 Significant Woodlands

Direct impacts and loss of vegetation to the significant woodlands southwest of the Site will be avoided. The 15-meter property line setback will ensure the proposed extraction is outside of the forest drip line and protect tree roots along the woodland edge.

Potential indirect impacts from noise disturbances, dust and chemical spills on forest trees and other woodland features and functions will be addressed through the mitigation measures discussed in Section 6.1. No major dewatering is planned for the proposed below-water extraction and therefore, no significant drawdown of the water table and stress to trees along the forest margin is expected.

6.3 Significant Valleylands

No direct impacts to the significant valleyland associated with the Thames River and Fanshawe Lake will result from the proposed aggregate extraction. The separation distance (>10m) between the aggregate extraction and valley boundary is sufficient to avoid slope stability, erosion or other hazard issues.

It is assumed that as part of the pit licence application approval, discharge water from any minor dewatering activities will not be permitted to flow off the Site directly into the significant vallyland and therefore, no valley slope erosion or sedimentation into the river is expected to occur. No other potential indirect impacts to the valleyland are anticipated.

6.4 Significant Wildlife Habitat

Bat Maternity Colonies

The deciduous forest southwest of the Site provides bat maternity colony SWH for Big Brown Bat and possible Silver-haired Bat. No direct impacts to the forest and cavity trees containing bat maternity colonies will occur from the proposed aggregate extraction. The cultural meadows on and adjacent to the Site that provide foraging habitat for these bat species also will not be directly impacted.

Potential indirect impacts to bat SWH in the forest can be mitigated through implementation of the measures discussed in Section 6.1 for bat SAR habitat.

Habitat for Species of Conservation Concern

The cultural meadow east of the existing active pit on the Site provides habitat for Monarch butterfly. The meadow will not be directly impacted by the proposed aggregate extraction.

Potential noise disturbance impacts from aggregate operations are not expected to interfere with use of the meadow by Monarch; the species was present in the meadow and did not appear to be disturbed by the adjacent aggregate operation. Additionally, the proposed extraction is expected to progress westerly from the current active pit area, which further minimizes the likelihood of noise disturbance impacts over time.

6.5 Surface and Ground Water

Any dewatering activities involved with the proposed aggregate extraction should be directed away from the significant natural features shown in **Figure 5 - Appendix A**. In general, dewatering should be managed to avoid erosion and sedimentation of natural features. Discharged water should not require pre-treatment based on the assumption that the pumped water is clean and sediment-free groundwater. Water should be conveyed through pump hoses or temporary above-ground piping and not be permitted to flow overland. Measures (e.g. rip rap) should be installed at discharge outlets to ensure discharge water does not cause soil erosion and sedimentation.

Potential chemical spills during the duration of the aggregate operation can enter and accumulate in surface and ground water and adversely impact adjacent significant features. Potential impacts from spills can be mitigated through implementation of the measures discussed in Section 6.1 for aquatic SAR habitat.

7 Conclusions and Recommendations

Based on the background review, agency consultation and field surveys, significant natural heritage features are present on and adjacent to the Site. Resultantly, a Natural Environment Level 2 Report was required to assess potential impacts on significant natural features from the proposed aggregate expansion. The Level 2 report was completed in accordance with the Aggregate Resources of Ontario Provincial Standards.

Based on the planned aggregate extraction and impact assessment, the proposed pit expansion can occur without causing negative impacts to significant natural features and functions identified on and adjacent to the Site. This conclusion takes into consideration implementation of the recommendations and mitigation measures discussed in Sections 6, which are summarized as follows:

1. Construct an noise berm (minimum 2-3m height) along the southwest corner of the proposed extraction area to minimize noise disturbance to bat maternity colonies and other wildlife in the adjacent significant woodland southwest of the Site. Plant an alternating row of native coniferous trees (e.g. White Spruce) along the top of berm to provide a visual screen and additional noise / dust mitigation.
2. If feasible, continue to stage the aggregate extraction process in an east to west direction so that potential noise impacts on the significant woodland generated from the aggregate operation is partially attenuated by the gravel pit face.
3. Site dewatering activities involved with the proposed aggregate extraction should be directed away from significant natural features. In general, dewatering should be managed to avoid erosion and sedimentation of natural features. Water should be conveyed through pump hoses or temporary above-ground piping and not be permitted to flow overland. Measures (e.g. rip rap) should be installed at discharge outlets to ensure discharge water does not cause soil erosion and sedimentation.
4. Implement additional standard best management practices and erosion and sediment control measures to mitigate potential noise, dust, erosion and pollution impacts from aggregate operations (which is expected to be a required condition of approval for the pit licence). This should include a Spills Prevention and Management Plan to prevent contamination to the environment. The plan would lay out requirements for preventing and responding to spills and leaks (i.e. designated refuelling areas, primary and secondary fuel containment, spill clean-up kits, machinery maintenance program, spill absorption booms, etc.).

5. If possible, the existing active pit and/or proposed extraction area should be rehabilitated to grassland habitat as was done for the rehabilitated area containing the cultural meadow east of the current active pit area. Grassland habitat is becoming rare in Ontario and this proposed rehabilitation would provide additional nesting and foraging habitat for bats and grassland birds that are present on and adjacent the Site. A seed mix containing native grassland flowers and milkweed (i.e. Butterfly Milkweed) can be intermixed with the replaced topsoil to enhance naturalization of the rehabilitated area. Introducing native flowers and milkweed will also provide habitat for native insect pollinators and Monarch, which are decreasing in population across North America. The topsoil from the constructed noise berm (see Recommendation #1) can be reclaimed and used for the grassland rehabilitation.

The above listed recommendations and mitigation measures should be considered as conditions of approval for the pit licence to protect and conserve natural features on and adjacent to the Site, which form part of the natural heritage system within the County of Middlesex.

8 General Limitations

Information in this report is considered to be privileged and confidential and has been prepared exclusively for **Municipality of Middlesex Centre.** The Species at Risk (SAR) information in this report is highly sensitive and is not intended for any person or project unrelated to this undertaking. It is advised not to include any specific information on the location of SAR in reports or mapping that will be available for public review.

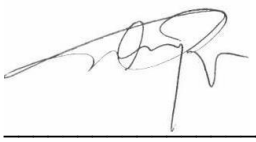
The information presented in this document is based on baseline data designed to provide ecological information to support the client in proceeding forward with their proposed development. The conclusions and recommendations presented within this report reflect Site conditions existing at the time of the investigation. Should changes occur that potentially impact the condition of the Site, the conclusions presented by EXP may require re-evaluation.

9 Closure

We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

EXP Services Inc.



Gerardo Reyes, Ph.D.
Ecologist
Environmental Division

Les Misch, B.E.S., Env. Tech.
Senior Ecologist, Team Lead
Environmental Division

10 References

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Appendix A: Figures

exp Services Inc.
t: +1.905.793.9800 | f: +1.905.793.0641
1595 Clark Boulevard
Brampton, ON L6T 4V1
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LEGEND:

SITE BOUNDARY

TITLE AND LOCATION:

SITE LOCATION

NATURAL ENVIRONMENT LEVEL 1 & 2 REPORT
OLALONDO GRAVEL PIT
MIDDLESEX CENTRE
ONTARIO, CANADA

PROJECT NO.:	DWN.:
LON-00015840-EN	AS
SCALE:	CK:
AS NOTED	LM
DATE:	FIG. NO.:
JANUARY 2019	1

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LEGEND:

- SITE BOUNDARY
- BAT DETECTOR
- BREEDING BIRD POINT COUNT SURVEY
- AMPHIBIAN CALL SURVEY

TITLE AND LOCATION:

WILDLIFE SURVEY LOCATIONS

NATURAL ENVIRONMENT LEVEL 1 & 2 REPORT
OLALONDO GRAVEL PIT
MIDDLESEX CENTRE
ONTARIO, CANADA

PROJECT NO.: LON-00015840-EN	DWN.: AS
SCALE: AS NOTED	CK: LM
DATE: JANUARY 2019	FIG. NO.: 2

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LEGEND:

	SITE BOUNDARY
	ELC BOUNDARY
AGR	AGRICULTURAL FIELD
CUM1-1	CULTURAL MEADOW
PIT	GRAVEL PIT
SWD	DECIDUOUS SWAMP
MAM2-10	FORB MEADOW MARSH
FOD5-1	MAPLE DECIDUOUS FOREST
OAO	OPEN AQUATIC

TITLE AND LOCATION:

ECOLOGICAL LAND CLASSIFICATION

NATURAL ENVIRONMENT LEVEL 1 & 2 REPORT
OLALONDO GRAVEL PIT
MIDDLESEX CENTRE
ONTARIO, CANADA

PROJECT NO.: LON-00015840-EN	DWN.: AS
SCALE: AS NOTED	CK: LM
DATE: JANUARY 2019	FIG. NO.: 3

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LEGEND:

- SITE BOUNDARY
- HABITAT OF ENDANGERED AND THREATENED SPECIES
- SIGNIFICANT WOODLANDS
- SIGNIFICANT VALLEYLANDS
- SIGNIFICANT WILDLIFE HABITAT

TITLE AND LOCATION:

SIGNIFICANT NATURAL HERITAGE FEATURES

NATURAL ENVIRONMENT LEVEL 1 & 2 REPORT
OLALONDO GRAVEL PIT
MIDDLESEX CENTRE
ONTARIO, CANADA

PROJECT NO.:	DWN.:
LON-00015840-EN	AS
SCALE: AS NOTED	CK: LM
DATE: JANUARY 2019	FIG. NO.: 4

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LEGEND:

- SITE BOUNDARY
- EXTRACTION AREA
- 1 EXTRACTION SECTIONS
- NOISE / EARTH BERM

TITLE AND LOCATION:

PROPOSED EXTRACTION AREA

NATURAL ENVIRONMENT LEVEL 1 AND 2 REPORT
OLALONDO GRAVEL PIT
MIDDLESEX CENTRE
ONTARIO, CANADA

PROJECT NO.:	DWN.:
LON-00015840-EN	AS
SCALE: AS NOTED	CK: LM
DATE: JANUARY 2019	FIG. NO.: 5

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Appendix B: MNRF Comments

From: ESA-Aylmer (MNRF) <ESA.Aylmer@ontario.ca>
Sent: Thursday, September 20, 2018 2:34 PM
To: Angela Zhou <Angela.Zhou@exp.com>
Subject: RE: Info Request - Olalondo Road, Middlesex County

Hi Angela,

Your list of species is extremely comprehensive and detailed and matches our records.

The only additional species that may occur in proximity to the proposed project include:
Spiny Softshell – Endangered – Known to occur within Fanshawe Lake
Greater Redhorse – S3 tracked – Known to occur within Fanshawe Lake

Hopefully this information is what you require.

Thanks,

ESA Aylmer

Appendix C: Species Lists

Plant Species Observed During Field Surveys*

#	Scientific Name	Common Name	Rarity/Status[1]			Vegetation Community[2]						WETNESS[3]	SENSITIVITY[4]	WEEDINESS[5]
			National	Provincial		AGR	CUM1-1	PIT	MAM2-10	SWD	FOD6-1			
			SARA	ESA	NHIC									
1	*Abutilon theophrasti*	Velvetleaf			SE5	O	O					4	0	
2	*Acer rubrum*	Red Maple			S5				O			0	4	
3	*Acer saccharinum*	Silver Maple			S5				O		O	-3	5	
4	*Acer saccharum ssp. saccharum*	Sugar Maple			S5	R	O		O		D	3	4	
5	*Achillea millefolium ssp. millefolium*	Common Yarrow			SE		O		O			3	0	
6	*Alliaria petiolata*	Garlic Mustard			SE5		O	R			A	0	0	-3
7	*Ambrosia artemisiifolia*	Common Ragweed			S5	O	O	O				3	0	
8	*Arctium minus ssp. minus*	Common Burdock			SE5		R		R			5		-2
9	*Asclepias syriaca*	Common Milkweed			S5		O	R	O	O		5	0	
10	*Asparagus officinalis*	Asparagus			SE5	R	R					3	0	
11	*Aster sp*	Aster Species					O							
12	*Atriplex sp*	Orach Species				R	R	R						
13	*Barbarea vulgaris*	Common Wintercress			SE5	R	O	R				0	0	
14	*Bidens frondosa*	Devil's Beggar-ticks			S5					O		-3	3	
15	*Boehmeria cylindrica*	False Nettle			S5	R						-5	4	
16	*Calamagrostis sp*	Reed Grass Species					A		A					
17	*Carex sp*	Sedge Species					O		O	O				
18	*Carya cordiformis*	Bitternut Hickory			S5						O	0	6	
19	*Celtis occidentalis*	Hackberry			S4						O	1	8	
20	*Centaurea sp*	Knapweed Species					O							
21	*Chenopodium album var. album*	Lamb's Quarters			SE5	O	O	O				1	0	
22	*Chrysanthemum leucanthemum*	Ox-eye Daisy			SE5	O	O	R	O	O		5	0	
23	*Cichorium intybus*	Chicory			SE5				O			5	0	
24	*Cirsium arvense*	Canada Thistle			SE5		O		R			3		-1
25	*Cirsium vulgare*	Bull Thistle			SE5	R	R	R				4	0	
26	*Conyza canadensis*	Horseweed			S5		O		R			1	0	
27	*Cornus foemina ssp. racemosa*	Red Panicled Dogwood			S5		O		O	O		-2	2	
28	*Cornus stolonifera*	Red-osier Dogwood			S5				O	O	O	-3	2	
29	*Daucus carota*	Wild Carrot			SE5	R	A		O	O		5	0	
30	*Digitaria sp*	Crabgrass Species				R	R	R						
31	*Dipsacus fullonum ssp. sylvestris*	Wild Teasel			SE5		O		O			5	0	
32	*Equisetum arvense*	Field Horsetail			S5		O					0	0	
33	*Equisetum hyemale ssp. affine*	Scouring Rush			S5				O	O		-2	2	
34	*Erigeron annuus*	Daisy Fleabane			S5	R	R	R	O			1	0	
35	*Euphorbia esula*	Hungarian Spurge			SE5			R				5	0	
36	*Fagus grandifolia*	American Beech			S5						R	3	6	
37	*Fraxinus americana*	White Ash			S5		O					3	4	
38	*Galium sp*	Bedstraw Species				R	O	R	O	O	O			
39	*Grass sp*	Grass species				D	O	O	O	O				
40	*Hypericum canadense*	Canadian St. John's-wort			S4?		O	R	R	O		-3	8	
41	*Impatiens capensis*	Spotted Touch-me-not			S5						O	-3	4	

#	Scientific Name	Common Name	Rarity/Status[1]			Vegetation Community[2]						WETNESS[3]	SENSITIVITY[4]	WEEDINESS[5]
			National	Provincial		AGR	CUM1-1	PIT	MAM2-10	SWD	FOD6-1			
			SARA	ESA	NHIC									
42	*Lactuca sp*	Lettuce Species					R	R						
43	*Leonurus cardiaca ssp. cardiaca*	Motherwort			SE5	R	R					5	0	
44	*Lepidium campestre*	Field Cress			SE5	O	O	R				5	0	
45	*Lonicera sp*	Honeysuckle Species					O		R					
46	*Lotus corniculatus*	Bird's-foot Trefoil			SE5		O		O			1	0	
47	*Lythrum salicaria*	Purple Loosestrife			SE5		O					-5	0	
48	*Medicago lupulina*	Black Medick			SE5	R	O	R	R	R		1	0	
49	*Medicago sativa ssp. sativa*	Alfalfa			SE5		O					5	0	
50	*Melilotus alba*	White Sweet-clover			SE5		O	R	R			3	0	
51	*Moss sp*	Moss Species							O	A				
52	*Oenothera biennis*	Common Evening-primrose			S5		O		R			3	0	
53	*Oxalis stricta*	Upright Yellow Wood-sorrel			S5	O		R			O	3	0	
54	*Panicum sp*	Panic Grass Species					O			O				
55	*Parthenocissus quinquefolia*	Virginia Creeper			S4?	R	R		O		O	1	6	
56	*Phalaris arundinacea*	Reed Canary Grass			S5		O		A	A		-4	0	
57	*Phragmites australis*	Common Reed			S5		O		O	O		-4	0	
58	*Picea abies*	Norway Spruce			SE3		O		O			5	0	
59	*Plantago major*	Common Plantain			SE5	O	O	R				-1	0	
60	*Poa sp*	Blue Grass Species				O	O							
61	*Polygonum persicaria*	Lady's Thumb			SE5		R	R				-3	0	
62	*Populus deltoides ssp. deltoides*	Eastern Cottonwood			S5		O		O	D	O	-1	4	
63	*Potentilla fruticosa ssp. floribunda*	Shrubby Cinquefoil			S5		O		R			-3	9	
64	*Prunus serotina*	Black Cherry			S5						O	3	3	
65	*Prunus virginiana ssp. virginiana*	Choke Cherry			S5				R		O	1	2	
66	*Rhamnus cathartica*	Common Buckthorn			SE5				O	R		3		-3
67	*Rhus typhina*	Staghorn Sumac			S5				O			5	1	
68	*Ribes sp*	Currant Species					O				O			
69	*Rubus idaeus ssp. idaeus*	Red Raspberry			SE1	R	R	R	R			5	0	
70	*Rumex crispus*	Curly Dock			SE5		R					-1	0	
71	*Salix bebbiana*	Bebb's Willow			S5		R		O	O		-4	4	
72	*Salix fragilis*	Crack Willow			SE5		O		O	A		-1	0	
73	*Salix sp*	Willow Species					O		O	D				
74	*Scirpus cyperinus*	Wool Grass			S5		R		O	O		-5	4	
75	*Senecio jacobaea*	Tansy Ragwort			SE1		O			O		5	0	
76	*Silene latifolia*	Bladder Campion			SE5		O	R	R			5	0	
77	*Solanum dulcamara*	Bittersweet Nightshade			SE5	R	R				R	0		-2
78	*Solidago sp*	Goldenrod Species				A	A	R	A	A	R			
79	*Sonchus sp*	Sow-thistle Species				O	O	R						
80	*Stellaria sp*	Chickweed Species						R						
81	*Streptopus roseus*	Rose Twisted Stalk			S5						R	0	7	
82	*Symplocarpus foetidus*	Skunk Cabbage			S5					R		-5	7	
83	*Tanacetum vulgare*	Tansy			SE5				R			5	0	

#	Scientific Name	Common Name	Rarity/Status[1]			Vegetation Community[2]						WETNESS[3]	SENSITIVITY[4]	WEEDINESS[5]
			National	Provincial		AGR	CUM1-1	PIT	MAM2-10	SWD	FOD6-1			
			SARA	ESA	NHIC									
84	*Taraxacum officinale*	Common Dandelion			SE5	O	O	R	R			3	0	
85	*Trifolium pratense*	Red Clover			SE5		O	R	O	O		2	0	
86	*Trifolium repens*	White Clover			SE5		O					2	0	
87	*Trillium grandiflorum*	White Trillium			S5						O	5	5	
88	*Tussilago farfara*	Coltsfoot			SE5		O	O	O			3	0	
89	*Typha latifolia*	Broad-leaved Cattail			S5		O		A	O		-5	3	
90	*Verbascum thapsus*	Common Mullein			SE5		O	R				5	0	
91	*Veronica officinalis*	Common Speedwell			SE5			R				5	0	
92	*Vicia cracca*	Cow Vetch			SE5		R		R			5	0	
93	*Viola sp*	Violet Species									O			
94	*Vitis riparia*	Riverbank Grape			S5	R	O		O		O	-2	0	

***Definition of terms used in table provided at end of species list in appendix**

Wildlife Species Observed During Field Surveys*

Common Name	Scientific Name	Rarity/Status[1]			Location Observed							BE[2]	Comments
		National	Provincial										
		SARA	ESA	NHIC	AGR	CUM1-1	PIT	SWD	MAM2-10	FOD6-1	OAO		
MAMMALS													
Eastern Chipmunk	*Tamias striatus*			S5						x		RS	
Grey Squirrel	*Sciurus carolinensis*			S5						x		RS	
Red Squirrel	*Tamiasciurus hudsonicus*			S5						x		RS	
Coyote	*Canis latrans*			S5		x						RS	Tracks observed
Raccoon	*Procyon lotor*			S5		x						RS	Tracks observed
White-tailed Deer	*Odocoileus virginianus*			S5		x	x	x				RS	
Big Brown Bat	*Eptesicus fuscus*			S5						x			Calls detected on bioacoustic monitor
Big Brown / Silver-haired Bat	*Eptesicus fuscus / Lasionycteris noctivagans*			S5/S4						x			Could not differentiate between the two bat species due to poor quality of recorded calls
Hoary Bat	*Lasiurus cinereus*			S4						x			Calls detected on bioacoustic monitor
Myotis sp.	*Myotis sp.*	END	END	S2/S3						x			Species can not be confidently identified due to similarity in call structure
BIRDS													
Wild Turkey	*Meleagris gallopava*			S4		x						OB	Tracks observed
Great Blue Heron	*Ardea herodias*			S5			x				x	PO	Observed by pond
Turkey Vulture	*Cathartes aura*			S4		x						NH	Fly over
Red-tailed Hawk	*Buteo jamaicensis*	NAR	NAR	S5						x		PO	Perched and calling continuously
Mourning Dove	*Zenaida macroura*			S5						x		SO	
Killdeer	*Charadrius vociferus*			S5		x						PO	
Eastern Kingbird	*Tyrannus tyrannus*			S4		x						PO	
Warbling Vireo	*Vireo gilvus*			S5				x				PO	
Red-eyed Vireo	*Vireo olivaceus*			S5				x				PO	
American Crow	*Corvus brachyrhynchos*			S5						x		PO	
Chipping Sparrow	*Spizella passerina*			S5				x				PO	
Baltimore Oriole	*Icterus galbula*			S4					x			PO	
Tree Swallow	*Tachycineta bicolor*			S4		x						PO	
Bank Swallow	*Riparia riparia*	THR	THR	S4		x	x					PO	15-20 inactive nests observed in pit face
Barn Swallow	*Hirundo rustica*	THR	THR	S4		x						PO	
White-breasted Nuthatch	*Sitta carolinensis*			S5						x		PO	
American Robin	*Turdus migratorius*			S5		x			x			PO	
Yellow Warbler	*Dendroica petechia*			S5					x			PO	
American Tree Sparrow	*Spizella arborea*			S4				x				PO	
Red-bellied Woodpecker	*Melanerpes carolinus*			S4						x		SO	
Field Sparrow	*Spizella pusilla*			S4		x		x				PO	
Song Sparrow	*Melospiza melodia*			S5		x		x				PO	
Bobolink	*Dolichonyx oryzivorus*	THR	THR	S4		x						PR	Observed. 6 male, 2 female
Red-winged Blackbird	*Agelaius phoeniceus*			S5		x		x	x			PR	Singing male, mating pairs
Brown-headed Cowbird	*Molothrus ater*			S5		x						PO	
American Goldfinch	*Spinus tristis*			S5		x		x	x			PO	
Canada Goose	*Branta canadensis*			S5							x	PO	Feeding along shoreline
Hooded Merganser	*Lophodytes cucullatus*			S5							x	PO	
Mallard	*Anas platyrhynchos*			S5							x	PO	Feeding in water
Common Goldeneye	*Bucephala clangula*			S5							x	PO	
Waterfowl sp.				S5							x	PO	
REPTILES													
No reptiles recorded													
AMPHIBIANS													
American Toad	*Bufo americanus*			S5					x			L2	
Gray Treefrog	*Hyla versicolor*			S5						x		L1	Observed in forest, calling
FISH													
No fish recorded													
BUTTERFLIES													
European Skipper	*Thymelicus lineola*			SE		x						RS	
Black Swallowtail	*Papilio polyxenes*			S5		x						RS	
Cabbage White	*Pieris rapae*			SE		x						RS	
Mourning Cloak	*Nymphalis antiopa*			S5						x		RS	
Monarch	*Danaus plexippus*	SC	SC	S4		x						RS	
Clouded Sulphur	*Colias philodice*			S5		x						RS	
Virginia Ctenucha Moth	*Ctenucha virginica*			S5		x						RS	
ODONATA													
Familiar Bluet	*Enallagma civile*			S5		x						RS	

***Definition of terms used in table provided at end of species list in appendix**

Total Number of Species | **Mammals: 10** | **Birds: 31** | **Reptiles: 0** | **Amphibians: 2** | **Fish: 0** | **Invertebrates: 8**

PLANT SPECIES LIST TERMS AND DEFINITIONS:

1 RARITY / POPULATION STATUS

National	Provincial		Regional
SARA	ESA	NHIC	
END - Endangered	**END** - Endangered	**S1** - Critically imperiled	**Municipal** - Rare in county or regional municipality as determined by the municipality
THR - Threatened	**THR** - Threatened	**S2** - Imperiled	
EXP - Extirpated	**EXP** - Extirpated	**S3** - Vulnerable	
SC - Special Concern	**SC** - Special Concern	**S4** - Apparently secure	**CA** - Rare in regional watershed as determined by the local conservation authority (CA)
NAR - Not at Risk	**NAR** - Not at Risk	**S5** - Secure	
DD - Data Deficient	**DD** - Data Deficient	**SE** - Exotic (non-native)	
		? - uncertain about status	

2 RELATIVE ABUNDANCE OF PLANT SPECIES ASSOCIATED WITH EACH VEGETATION COMMUNITY*

D - dominant	Represented by large numbers of individuals or clumps; visually more abundant than other plant species
A - abundant	Represented in the vegetation community by large numbers of individuals or clumps
O - occasional	Present as scattered individuals or represented by one or more large clumps of many individuals
R - rare	Represented in the vegetation community by less than three to five individuals or small clumps

** Based on Ecological Land Classificaton for Southern Ontario (MNR 1998)*

3 WETNESS*

-5	Obligate Wetland	occurs almost always in wetlands under natural conditions (>99% probability)
-2 to -4	Facultative Wetland	usually occurs in wetlands, but occasionally found in non-wetlands (67-99% probability)
1 to -1	Facultative	equally likely to occur in wetlands or non-wetlands (34-66% probability)
2 to 4	Facultative Upland	occasionally occurs in wetlands, but usually occurs in non-wetlands (1-33% probability)
5	Obligate Upland	occurs alomost never in wetlands under natural conditions (<1% probability)

** Based on Floristic Quality Assessment System (MNR 1995)*

4 PLANT SPECIES SENSITIVITY*

0 - 3	Plants found in a wide variety of communities, including disturbed sites
4 - 6	Plants typically associated with a specific plant community, but tolerate moderate disturbance
7 - 8	Plants associated with a community in an advanced successional stage that has undergone minor disturbance
9 - 10	Plants with a high degree of fidelity to a narrow range of specific habitats or ecological conditions

** Values and terminology derived from Floristic Quality Assessment (MNR 1995)*

5 WEEDINESS*

-1	Non-native plants with little or no impact on natural areas
-2	Non-native plants that sometimes cause problems, but only infrequently or in localized areas
-3	Non-native highly invasive plants that can become serious problems in natural areas by displacing native flora

** Based on Floristic Quality Assessment (MNR 1995)*

WILDLIFE SPECIES LIST TERMS AND DEFINITIONS:

[1] RARITY / POPULATION STATUS

National	Provincial		Regional
SARA	ESA	NHIC[a]	
END - Endangered	**END** - Endangered	**S1** - Critically imperiled	**Municipal** - Rare in county or regional municipality as determined by the municipality
THR - Threatened	**THR** - Threatened	**S2** - Imperiled	
EXP - Extirpated	**EXP** - Extirpated	**S3** - Vulnerable	**CA** - Rare in regional watershed as determined by the local conservation authority (CA)
SC - Special Concern	**SC** - Special Concern	**S4** - Apparently secure	
NAR - Not at Risk	**NAR** - Not at Risk	**S5** - Secure	
DD - Data Deficient	**DD** - Data Deficient	**SE** - Exotic (non-native)	
		? - uncertain about status	

[2] BE (BREEDING EVIDENCE)**

Anurans (Frogs and Toads) Breeding Call Levels:

L1 - Call Level 1	Calls of individual frogs or toads do not overlap and individuals can be counted
L2 - Call Level 2	Calls of individuals sometimes overlap but the number of individuals can reasonably be counted
L3 - Call Level 3	Calls are continous and overlapping and a count estimate is not possible

Birds:

OB - Observed	Species observed in its breeding season, but no breeding evidence observed
PO - Possible	Indicated by presence of species or singing male during the breeding season in suitable habitat
PR - Probable	Indicated by territorial/courtship displays, presence of mating pair, agitated behavior or nest building
C - Confirmed	Indicated by presence of eggs, fledlings, distraction displays, active nest, fecal/food carrying, etc.
NH - No Habitat	Species observed during breeding season, but no suitable breeding habitat in study area
SO - Outside Season	Species observed outside of the breeding season
NB - Non-breeding Migrant	Migrant species (breeds outside of region containing study area)

Other Wildlife:

CO - Confirmed	Indicated by presence of eggs, larvae, young, defensive behavior, food carrying, active nest/den/redd, etc.
RS - Resident Species	Species expected to be breeding within the study area due to localized territory

***** *Breeding evidence terminology for anurans is based on Marsh Monitoring Program and for birds is derived from Ontario Breeding Bird Atlas*

Appendix D: SAR Screening Table

Species At Risk Screening Table

Species Group	Scientific Name	Common Name	Status[1]		Habitat Description / Requirements[2]	Suitable Habitat on or Adjacent to Site	Species Observed on or Adjacent to Site[3]
			SARA	ESA			
Mammals	*Myotis lucifugus*	Little Brown Myotis	Endangered	Endangered	Little Brown Myotis often roost in large diameter trees in older forests, under tree bark, wood piles, crevices on cliffs, caves, in buildings, as well as other man-made structures such as bat boxes, bridges, and barns. Maternity roosts are often estabolished within tree cavities and under loose or exfoliating bark, especially in wooded areas located near water. They are insectivorous and forage during the night over water, along waterways, in forest gaps, and forest edges. Favoured prey consists of aquatic insects (e.g., mayflies, midges, mosquitos, caddisflies). In agricultural environments, Little Brown Myotis tend to follow linear wooded features, such as hedgerows, for commuting and foraging. The species overwinters in cold and humid hibernacula (usually caves/mines) that may be hundreds of kilometres from where they establish their summer colonies. This species, unlike the Northern Myotis and Tri-Coloured Bat, is also known to also hibernate in buildings.	Yes. Potential maternity roost trees present in adjacent forest.	Yes, however unable to identify species of Myotis based on bat call data.
	Myotis septentrionalis	Northern Myotis	Endangered	Endangered	Northern Myotis are generally associated with mature forests. They often roost under bark, in tree cavities and crevices, but have also been observed roosting in or on buildings (e.g. under shingles). Females prefer to roost in tall, large diameter trees in early- to mid-stages of decay. Unlike Little Brown Myotis, which most often forage over water and capture prey in flight, Northern Myotis forage more frequently along and within forests, and while they feed on flying insects, they also glean prey. Large open fields are generally avoided. Caves and underground mines are their prefrred sites for hibernating.	Yes. Potential maternity roost trees present in adjacent forest.	Yes, however unable to identify species of Myotis based on bat call data.
	Myotis leibii	Eastern Small-footed Myotis	No Status	Endangered	Eastern Small-footed Myotis appears to prefer open, sunny rocky habitats (rock barrens, karst areas) for summer roosting but may also occasionally utilize anthropogenic structures such as buildings, sheds and barns, as well as those that mimic natural rocky habitat (rip rap, waste rock piles, crevices in road-cuts, bridges, and other concrete structures, quarry rock faces and piles, cracks in old foundations and chimneys). They are insectivorous and primarily capture prey during flight. The species is known to forage in forests, but also over water-bodies and riparian forests and occasionally open fields. The species overwinters singly or in groups in cool caves and abandoned mines with low temperature and humidity. Hibernacula sites are generally believed to be located in close proximity to summer roosting habitat.	Yes. Potential maternity roost trees present in adjacent forest.	Yes, however unable to identify species of Myotis based on bat call data.
	Perimyotis subflavus	Tri-Coloured Bat	Endangered	Endangered	Tri-coloured Bats are known to roost in tree foliage as well as buildings, rock crevices, and in mosses and lichens. Most roost sites are found within forested habitats. They forage for insects over water, in riparian areas, forest edges, and in relatively open areas. This species may avoid landscapes that are cleared for agriculture, urban development, and forestry. They have been documented overwintering with other bat species in caves, tunnels, wells, and abandoned mines.	Yes. Potential maternity roost trees present in adjacent forest.	No
Birds	*Dolichonyx oryzivorus*	Bobolink	Threatened	Threatened	Bobolink are medium-sized songbirds that inhabit grasslands with dense cover, open meadows, marshes, fallow fields, and hayfields. They are generally associated with larger tracts of land (>50 ha) but have been observed in much smaller, fragmented sites. They are ground foragers of insects and seeds and establish nests on the ground.	Yes. Suitable grassland habitat present in meadow.	Yes
	Haliaeetus leucocephalus	Bald Eagle	No Status	Special Concern	The Bald Eagle is a large raptor with a striking white head and tail contrasting with a dark brown body and wings. Adults have a yellow bill and eyes. The species typically breeds in mature forest habitat with scattered supercanopy trees and in close proximity to large productive waterbodies. Nests in Ontario are frequently located near lakes and are often on found on peninsulas or islands. The availability of suitable prey (i.e., fish, waterfowl) is an important factor in nest site selection. Nests are built in living, large or supercanopy trees with appropriate structures and features for nest support (e.g., limb features, accessibility) and are typically in areas of low human disturbance. A variety of tree species are used (White Pine, Jack Pine, Trembling Aspen, Balsam Poplar, etc.) although in Ontario, coniferous trees appear to be used more frequently. Tall open area or supercanopy trees (coniferous or deciduous) for perching are also an important habitat attribute, as are roosting areas during the non-breeding season, which consist of large trees in areas of less dense canopy and in proximity to forest edges. Bald Eagles overwinter near open water habitats such as coastal areas and large rivers; inland birds concentrate around remaining areas of open water. In southern Ontario, Bald Eagles will often overwinter near open water below falls or dams where dead and injured fish and waterfowl are available. Ideal overwintering habitat consists of open water for foraging, perching sites, roost areas for protection from the elements and low human disturbance.	Yes. Potential suitable habitat present in adjacent river and riparian forest	Yes
	Hirundo rustica	Barn Swallow	Threatened	Threatened	Barn Swallows are a medium-sized songbird that historically have nested in caves, holes, crevices, and ledges associated with rocky cliff faces. They have adapted to living in association with humans, as they construct their cup-shaped mud nests on human-made structures such as open barns, under bridges and in culverts. Given that nests are constructed with mud pellets, wet sites that have a source of mud nearby are required. Nests are often used again over multiple breeding seasons. Nesting sites are usually close to open habitats such as farmlands, meadows, wetlands, road rights-of-way, large forest clearings, cottage areas, islands, sand dunes, or subarctic tundra. Post-breeding roost sites in Ontario are often associated with marshes (cattails, reeds) or shrub thickets in or near water.	Yes. Potential suitable foraging habitat present in meadow and pond	Yes
	Riparia riparia	Bank Swallow	Threatened	Threatened	The Bank Swallow is a small, insectivorous songbird that utilizes a variety of natural and artificial exposed vertical banks during the breeding season, including those found along rivers, lake bluffs, aggregate pits, road cuts, and piles of soil and other unconsolidated materials. They usually build nests in large colonies, in vertical banks and bluffs near large bodies of water. Bank Swallows forage in a variety of open terrestrial and aquatic habitats including wetlands, open water, riparian woodlands, grasslands, and agricultural areas, as well as shrubland. Regions with dense forest cover are generally avoided at all times of the year. Grassland habitat may be preferred foraging habitat when located in relatively close proximity to a breeding site. Communal roost sites are established in large wetlands and estuaries outside of the breeding season.	Yes. Potential suitable habitat present in active gravel pit.	No

Species Group	Scientific Name	Common Name	Status[1]		Habitat Description / Requirements[2]	Suitable Habitat on or Adjacent to Site	Species Observed on or Adjacent to Site[3]
			SARA	ESA			
	Sturnella magna	Eastern Meadowlark	Threatened	Threatened	The Eastern Meadowlark is medium-sized, migratory songbird that breeds primarily in moderately tall grasslands, such as pastures and hayfields, but are also found in alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, shrubby overgrown fields, or other open areas. Small trees, shrubs, or fence posts are used as elevated song perches. Nests are built in depressions on the ground, sometimes in hoof prints, in well-concealed areas of grasslands.	Yes. Potential suitable habitat in meadow.	Yes
Reptiles	*Apalone spinifera*	Spiny Softshell	Threatened	Endangered	Spiny Softshell primarily utilizes aquatic habitat such as rivers, streams or lakes, and uses terrestrial habitat only for nesting; marshes, ponds, oxbows and wetlands adjacent to large water bodies may also be used as aquatic habitat. The species is also commonly found using features such as sandbars, mudflats, aquatic vegetation and submerged logs. They generally stay close to shore in areas less than 3m in depth with soft mud or sand substrate and sparse aquatic vegetation. They overwinter from October to May in the waterbody they use during the active season in less than 5 to 10 cm of soft substrate.	Yes. Potential suitable habitat in Thames River	Yes
Fish and Mussels	*Moxostoma carinatum*	Greater Redhorse	Special Concern	Special Concern	The Greater Redhorse inhabits clear, medium to large-size rivers that have substantial flows. In May and June, adults migrate from deeper, slower moving pools and run habitats to shallow riffle-run habitats having coarse substrate and moderate to swift flow.	Yes. Potential suitable habitat in Thames River	Yes
	Lampsilis fasciola	Wavy-rayed Lampmussel	Special Concern	Threatened	The Wavy-rayed lampmussel is usually found in small to medium rivers with clear water. It lives in shallow riffle areas with clean gravel or sand bottoms. Like all mussels, this species filters water to find food, such as bacteria and algae. The Wavy-rayed lampmussel's fish hosts are the Largemouth bass and Smallmouth bass. The presence of fish hosts is one of the key features for an area to support a healthy mussel population.	Yes. Potential suitable habitat in Thames River	Yes
Insects	*Danaus plexippus*	Monarch Butterfly	Special Concern	Special Concern	Monarchs use three different types of habitat during their lifetime. Only the larva feed on milkweed plants (Asclepias syriaca) and are thus confined to meadows, fields, and other open areas where milkweed grows. Adult butterflies are found in more diverse habitats where they feed on nectar from a variety of wildflowers.	Yes. Potential suitable habitat present in meadow.	Yes

Information Sources

[1]Status:

Species at Risk Ontario List (SARO)
https://www.ontario.ca/environment-and-energy/species-risk-region?name=Lennox%20and%20Addington
Species at Risk Public Registry (SARA) - Schedule 1 Listed Species
https://www.registrelep-sararegistry.gc.ca

[2]Habitat Requirements:

Atlas of the Breeding Birds of Ontario (BSC, 2007)
http://www.birdsontario.org/atlas/maps.jsp?lang=en
Committee on the Status of Endangered Wildlife in Canada (COSEWIC)
http://www.cosewic.gc.ca/default.asp?lang=en&n=4E5136BF-1
Ontario Nature
https://www.ontarionature.org/protect/species/reptiles_and_amphibians
Species at Risk in Ontario List (SARO)
https://www.ontario.ca/environment-and-energy/species-risk-region?name=Lennox%20and%20Addington
Species at Risk Public Registry (SARA)
https://www.registrelep-sararegistry.gc.ca

[3]SAR Observation Records:

Species observed during EXP field invesigations completed for study
eBird Canada. 2016. http://ebird.org/ebird/canada/explore
Ministry of Natural Resources Aylmer District SAR Information Request Response
iNaturalist. 2018. https://www.inaturalist.org/

Appendix E: Curriculum Vitae

Gerardo Reyes, Ph.D.

Ecologist

Education + Training

- Ph.D Biology, University of Quebec, 2009
- M.Sc Biology, Dalhousie University, 2002
- Honours Ecology & Evolution, University of Western Ontario, 1999
- B.Sc Biology, University of Western Ontario, 1997
- Fish & Wildlife Technologist, Sir Sandford Fleming College, 1996
- Ontario Secondary School Honours Diploma, Brébeuf College School, 1991
- Class 2 Backpack Electrofishing Crew Leader Certification
- Ontario Benthos Biomonitoring Network Certificate

Affiliations + Memberships

- Member of the Comité de Usagers de Centre Sportif (2005 –present)

Languages Spoken

- English
- French

Gerardo Reyes is an ecologist with EXP with more than 16 years of experience in the ecology field. Gerardo has worked on an extensive list of projects in Ontario and throughout Canada that included completion of terrestrial, aquatic and wetland surveys; assessing development impacts on the natural environment; planning and implementing site remediation projects; reviewing forest management practices; and, carrying out biodiversity studies in natural, urban, and rural settings.

Project Experience

Ecological Land Classification, Ajax, Ontario

Vegetation, including Species At Risk, were inventoried, mapped, and classified into Ecological Land Classification units, so that the potential environmental impacts, options for impact avoidance, mitigation measures, as well as opportunities for enhancement could be determined for a wetland boardwalk repair and upgrade project at a highly utilized public space.

Aquatic Habitat Assessment, Whitney, Ontario

Wetland plants and natural shoreline features were inventoried, mapped, and evaluated for a site scheduled for dam repair. Potential impacts of the establishment of a berm on stream flow and turbidity were also documented.

Ecological Land Classification & Species At Risk Assessment, Pearson International Airport, Mississauga, Ontario

Vegetation, wildlife species, and natural features and functions were inventoried, mapped, and evaluated using established protocols for Ontario to provide an update of the state of the natural habitat features as well as document the presence of Species At Risk and/or their habitat located on and immediately surrounding the Greater Toronto Airports Authority property.

Environmental Impact Study, Ancaster, Ontario

Vegetation, including Species At Risk, were inventoried, mapped, and classified into Ecological Land Classification units, so that the potential environmental impacts, options for impact avoidance, mitigation measures, as well as opportunities for enhancement could be determined for a site being considered for a proposed retirement home development.

Gerardo Reyes *- continued*

Ecologist

Fish Species Capture & Release, Brantford, Ontario

Fish species inhabiting a tributary of D'Aubigny Creek were captured, identified, and released downstream from an area to be dewatered for culvert installation using standard backpack electrofishing methods for Ontario streams.

Environmental Impact Study, Angus, Ontario

Vegetation, wildlife species and natural features and functions were inventoried, mapped and evaluated using established protocols for Ontario, so that the potential environmental impacts, options for impact avoidance, mitigation measures, as well as opportunities for enhancement could be determined for a site being considered for a proposed subdivision development.

Multi-Year Biotic Monitoring, Welland, Ontario

Compensation for habitat loss associated with highway overpass construction was required to meet conditions of the Fisheries Act Authorization for the project. Walleye spawning shoals at the base of several piers in the Welland River were installed and monitored. In-stream fish habitat and shoreline plantings were also established and monitored. Annual reports were prepared as a condition of the FA Authorization.

Environmental Impact Assessment, Keswick, Ontario

Plants and wildlife were documented to assess potential environmental impacts for a proposed multi-residential complex adjacent to a Provincially Significant Wetland. Field studies included wetland boundary mapping and a detailed tree inventory to assist with preparation of a tree compensation plan. Field data was used to assess options for impact avoidance and mitigation measures.

Biomonitoring for Young's Creek Site Remediation Project, Deloro, Ontario

The clean-up of an abandoned mine and industrial area included establishing and implementing best management protocols to minimise impacts on fish and wildlife, particularly Species-At-Risk. This included the safe handling and transportation of amphibians, reptiles, and fish using various live-trapping techniques.

Beaver Dam Removal Assessment, Hilton Falls Conservation Area, Milton, Ontario

This project included the comparison of the efficacy of hand-removal versus the use of explosives to remove problem beaver dams, and the concomitant impacts on stream quality for downstream aquatic species. Turbidity, suspended sediments, and stream flow measurements were gathered and compared between the two removal techniques.

Sensitive and Endangered Plant Species Transplantation, Laval, Quebec

Maidenhair Fern (Adiatum pedatum) and Black Maple (Acer nigrum) are considered vulnerable species (Division III) in Quebec. An upland mature deciduous forest containing these species was scheduled to be cleared for a residential housing development. Work included the locating and transplanting of all populations of Maidenhair Fern as well as seedlings and saplings of Black Maple found within the woodlot to a suitable locale. A database with geo-referenced locations of transplanted populations was also developed to monitor population condition over time.

Installing a Constructed Wetland for a Suburban Housing Development Project, Laval, Quebec

A constructed wetland was created to both control surface water runoff during storms and to re-establish natural areas as compensation for those lost due to the housing development. Native wetland species were planted (both nursery stock and transplants from local wetlands) along the banks and within the basin itself. The system was monitored to ensure wetland function was maintained and to determine if immigration of other native flora and fauna occurred.

Gerardo Reyes *- continued*

Ecologist

Documenting Vegetation Diversity in Remnant Forest Stands in Farming Communities of Southern Quebec

Public and private woodlots were characterised to establish a database of species richness, condition, stand structure, and spatial distribution of remnant woodlots located near Saint-Bernard-de-Lacolle, Quebec. This involved digitising aerial photos using a geographic information systems software program, dialogue with local farmers, and ground-truthing of geo-referenced sites. Ultimately, this information would be used as baseline information to track any changes in cover and/or condition over time.

Examining Impacts of Road Construction on the Flora and Fauna, Rouyn-Noranda, Quebec

Lands projected to be impacted by the development of a highway bypass near Rouyn-Noranda were surveyed. Digitised aerial photos were used to select sites near and along the proposed autoroute. Open field, early and late-successional mixed woods, riparian systems, marshlands, plantations, alvars, and watercourses were surveyed for the presence/absence of plants, mammals, upland birds, and waterfowl using established protocols.

Small Mammal Population Study, Lachine Canal, Montreal, Quebec

Species richness and diversity of small mammals were examined along the Lachine canal using live-trapping techniques. Additionally, transects were established near each trapping station to search for signs of wildlife use (tracks, feces, fur, dens, middens, browsed vegetation, etc.).

Selected Publications

Peer Reviewed Articles

- Reyes, G.P., Kanavillil, N., & Stevens, R. (2019). Biological Conservation: can we break the inertia? In Environmental Sustainability Edited by R.A. Turvey and S. Kurissery. IGI Global, Hershey, PA. In Press.
- Turvey, R.A., Kanavillil, N., Murray, C., & Reyes, G. (2018). Creating sustainable communities: skills and learning in Ontario's small urban municipalities. Environment, Development, and Sustainability 20(3), 1173-1190.
- Reyes, G., Kneeshaw, D., and L. DeGrandpré. (2013). The relative importance of natural disturbances and local site factors on woody vegetation regeneration diversity across a large, contiguous forest region. Open Journal of Forestry 3(3): 88-98.

Les Misch, Env. Tech.

Senior Ecologist

Les Misch has over 17 years of work experience in the environmental sector and providing ecological consulting expertise in Ontario. Les has strong theoretical knowledge and experience in natural sciences and applied ecology obtained through personal, academic and consulting activities.

Field, project management and consulting experience includes undertaking ecological studies; impact assessments; biological surveys; species at risk (SAR) assessments; natural heritage planning; environmental permitting and approvals; habitat evaluations; wildlife studies; environmental inspections and monitoring; and, study peer review.

Les is experienced in the application of current environmental regulations, natural heritage policy, and assessment guidelines applied in Ontario.

Education + Training

- B.E.S, 1999, Environmental Studies (Honours) Major, Biology (Wildlife) Minor, University of Waterloo, Ontario
- Soil and Water Resources Technician Diploma, 1993, Sir Sandford Fleming College, Lindsay, Ontario
- Ontario Wetland Evaluation System Certificate
- Ontario Stream Assessment Protocol Certificate
- MTO/DFO/OMNR Fisheries Protocol Training
- Ontario Benthos Biomonitoring Network Certificate
- EMAN Terrestrial Monitoring Protocols Course
- Butternut Health Assessor Certificate
- Ontario Bat Monitoring Course
- Standard First Aid / CPR Level C
- Wilderness First Aid and Survival

Languages Spoken

- English

Project Experience

Land Development Projects

Completed numerous environmental effects and impact assessments for private and public sector land development projects under the *Ontario Planning Act* and *Canadian Environmental Assessment Act*. Sample projects include:

- Victoria Harbour Golf Course Community
- UPS Distribution Facility
- Angus Residential / Commercial Subdivision
- Huntington Road Event Centre
- Listowel South Master Servicing Plan
- Lake Huron Shores Residential Subdivision
- Greystone Estates Residential Subdivision
- St. Clements Industrial Subdivision
- Guelph Core Residential Subdivision
- Southgate Township Land Severances

Les Misch, Env. Tech. - *continued*

Senior Ecologist

Infrastructure Projects

Coordinated, managed and conducted environmental impact studies, eco-passage assessments, SAR permitting, environmental site inspections, fish salvages and biological surveys for preliminary and detailed design stages of Class EA infrastructure projects. Presenting at public information sessions was also undertaken. Sample projects include:

- Rainbow Creek Trunk Sanitary Sewer Class EA
- Caledon Roads Rehabilitation Project
- Hamilton Port - Pier 22 Fuel Transloading Operation
- CAFTA Burwash Causeway Upgrade
- Heatly Bridge Replacement
- Cambridge South Boundary Road Corridor
- Long Point Causeway Improvement
- Cottrelle Boulevard Extension Class EA
- Highway 24 Rehabilitation and Whiteman's Creek Bridge Replacement
- Countryside Drive Watermain Class EA
- Moffat Creek Trunk Sanitary Sewer Class EA

Aggregate and Renewable Energy Projects

Planned, managed and conducted natural environment / heritage studies and wildlife surveys (including bats and bat habitat) for a number of proposed aggregate and renewable energy projects in Ontario including:

- Olalondo Underwater Pit Extraction
- Willis Gravel Pit Expansion
- Golding Road Gravel Pit
- Ghent Gravel Pit
- Howick Pit Expansion
- Talbot Wind Farm
- Twenty-Two Degree Wind Energy Project
- Arran Wind Energy Project
- Ernestown Wind Project
- Pukwis Community Wind Park
- St. Agatha Wind Farm

Les Misch, Env. Tech. - *continued*

Senior Ecologist

Aquatic, Wetland and Water Quality Studies

Managed and conducted biophysical and water quality studies for a various waterbodies and wetlands in Ontario and Nunavut that involved biotic (fish, mammals, benthics, plants, habitat) and abiotic (sediments, channel morphology, water quality sampling) assessments for government and private sector projects. Sample studies include:

- Iqaluit New Solid Waste Landfill Site
- Taloyoak Wetland Assessment
- Kingston Airport Watercourse and Fisheries Act Assessment
- Ontario Place (Brigantine Cove) Fish Habitat Study
- Merrick Landfill Site Fish and Benthic Community Analysis
- CFB Trenton Watercourse Assessment
- Thunder Bay Airport Fish Survey
- Collins Bay Benthic Community Sampling and Analysis
- Gananoque River Baseline Benthic Community Survey
- Grand River Baseline Aquatic Assessment
- Middle Thames River Tributary Fish Survey
- Silani Cheese Wetland Characterization and Nutrient Impact Investigation

Species At Risk and Natural Heritage Studies

Coordinated and completed natural heritage studies as part of municipal planning projects and Species at Risk (SAR) studies as part of transportation, aggregate, land development and research projects throughout Ontario. Sample projects include:

- Delineation of Caledon Greenbelt Plan Key Natural Heritage and Hydrological Features
- SAR Screenings and Desktop Reviews for Public Works and Government Services projects
- SAR habitat assessment and targeted surveys for Toronto Pearson International Airport lands
- SAR habitat suitability assessment for Department of National Defence projects
- Notice of Activity and Mitigation Plan for Bird SAR under the Ontario Endangered Species Act (ESA)
- Plant SAR surveys (Butternut, Ginseng, Broad Beech Fern, Hart's-tongue Fern) and ESA authorizations
- Butternut Health Assessments and ESA Authorizations
- Multi-species surveys including Bobolink; Ribbon Snake, Blanding's Turtle and Jefferson Salamander for Cambridge South Boundary Road Corridor Class EA - Natural Environment Study
- Hibernacula surveys for Massasauga Rattlesnake as part of EIS for proposed subdivision in Bruce Peninsula
- Bat habitat and emergence surveys for Bat SAR
- Multi-year American Badger population distribution and ecology research project

Les Misch, Env. Tech. - *continued*

Senior Ecologist

Environmental Monitoring, Sampling and Inspections

Designed, managed and performed environmental monitoring, sampling and site inspections for land development, construction and research projects including:

- Arlington Estates Event Centre Barn Swallow Mitigation
- Isabella Ave Watermain Creek Crossing
- Countryside Drive Watermain Creek Crossings
- Arctic Sea-Ice Formation Sampling, Wellington Channel, Nunavut
- Heatly Bridge Replacement
- Moffat Creek Trunk Sanitary Sewer Class EA
- Morningside Heights Community Development
- Arkell Springs Residential Subdivision
- Pineridge East Residential Subdivision
- Coldpoint Industrial Subdivision

Presentations and Publications

- City of Kitchener Natural Areas Inventory
- 2011-13 Ontario Badger Project Overview
- Stream Systems and Ecology
- Environmental Planning, Complexity and Uncertainty in Aggregate Mining