

City of London

W12A Landfill Expansion Environmental Assessment – Biology

Existing Conditions and Impact Assessment Report

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Project #: 60556244

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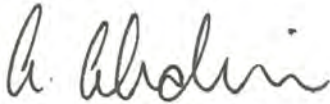
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1. Introduction

The City of London is proposing an expansion of the existing W12A Landfill site (the Project) located 3502 Manning Drive, part of Lots 18, 19 and 20 of Concession 6 in the former Township of Westminster, in the south end of the City of London, Ontario.

The environment is considered in broad terms to include the natural, social, cultural, and economic aspects of the environment. This document presents the *Biology* component existing conditions and impact assessment for the Environmental Assessment of the proposed W12A Landfill expansion. This work has been conducted in accordance with the requirements set out in the approved amended Terms of Reference, dated February 2019 and the work plan dated October 2019 prepared following commencement of the Environmental Assessment and circulated to the Ministry of Environment, Conservation and Parks, Ministry of Natural Resources and Forestry and Conservation Authority.

This report is a supporting document to the Environmental Assessment Study Report.

1.1 Background

AECOM was retained by the City of London (hereafter referred to as the City) to complete a Biology Study in support of an Individual Environmental Assessment for the proposed expansion of the W12A Landfill within the City of London, Ontario.

All residential residual waste (i.e., waste remaining after reduction, reuse, recycling, composting and resource recovery program) and some business residual waste from the City, is disposed of at the W12A Landfill site. At the current disposal rate, the W12A Landfill's existing approved capacity is expected to be depleted at the end of 2023. As such, the City is developing a Residual Waste Disposal Strategy to provide for the disposal of residual wastes generated from the City for the 25 year period 2024 through 2048.

A previous study (*W12A Landfill Area Plan*) looked at a number of alternatives for managing residual waste and concluded the preferred alternative was the expansion of the W12A Landfill.

The Existing Conditions and Impact Assessment Report for the W12A Landfill site has been prepared to document the existing conditions within and within the vicinity of the W12A landfill, as well as provide an impact assessment for the preferred expansion alternative from a biological perspective. The biology assessment will work to support the decision of the preferred alternative from an environmental perspective for the

expansion of the W12A landfill site. This report has been prepared as a requirement of the Individual Environmental Assessment in accordance with the requirements of The London Plan (2016) and London's Environmental Management Guidelines (2007). This report is consistent with the Provincial Policy Statement (2020), the Natural Heritage Reference Manual (Natural Heritage Reference Manual, 2010), and other relevant Provincial and Federal legislation, policies and regulations.

1.2 Study Area and Surrounding Land Use

The subject lands consist of 234 hectares of land which are bounded by Scotland Drive to the north, Manning Drive to the south, White Oak Road to the west, existing agricultural land to the east and includes the existing W12A Landfill located at 3502 Manning Drive, London, Ontario. For the purpose of this report, the Study Area includes a 500 metre area of investigation surrounding the subject property in order to capture natural heritage features and adjacent lands which may be affected by the proposed expansion.

The Study Area is located within the Ontario Ministry of Natural Resources and Forestry, Aylmer District and in both the Upper Thames Region Conservation Authority and Kettle Creek Conservation Authority watersheds.

Land Use within the Study Area is comprised predominantly of the existing landfill as well as agricultural lands to the east, west and south, with an aggregate facility and natural heritage features present north of the subject lands.

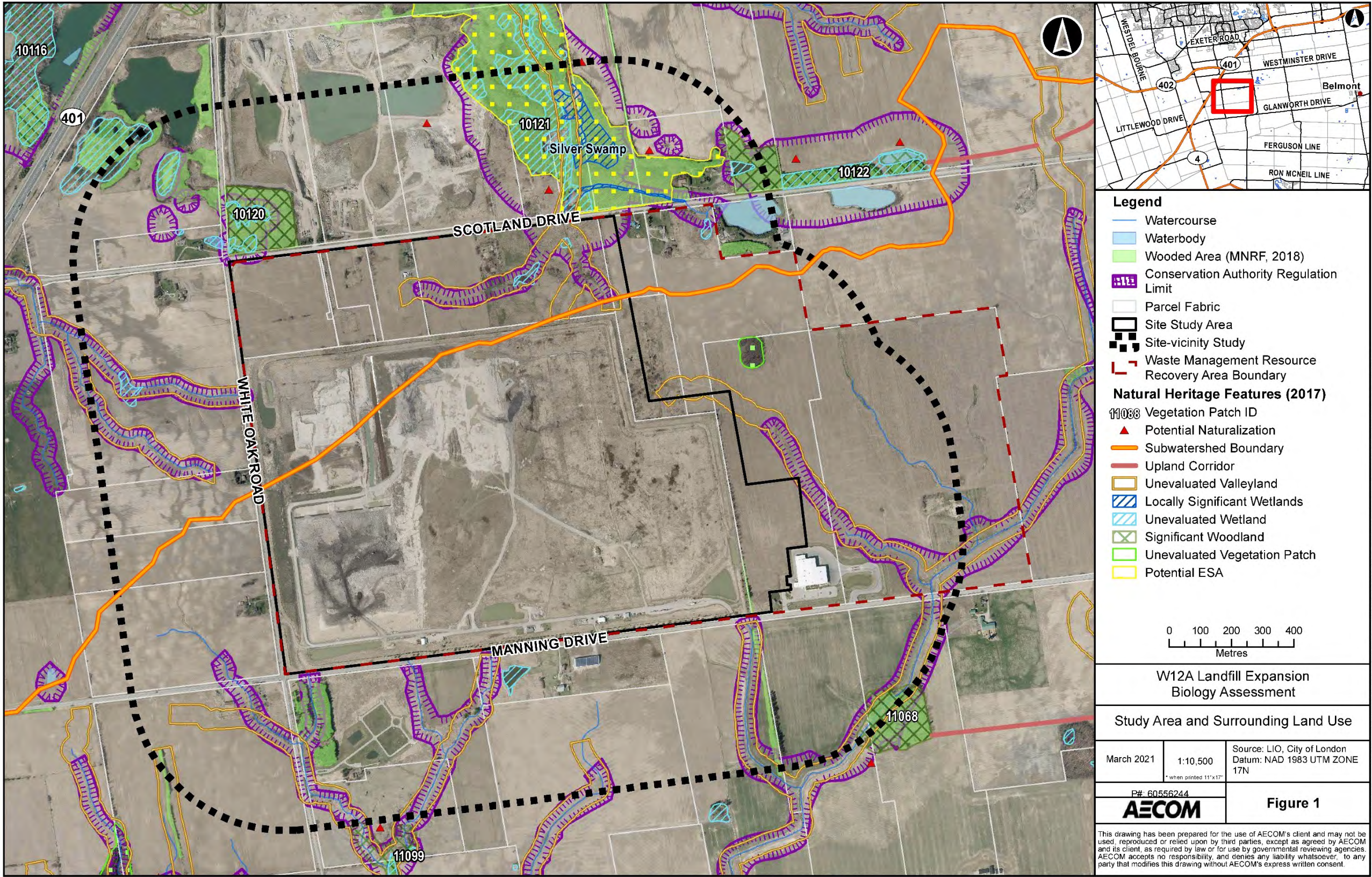
A review of Map 1 of The London Plan (2016) identifies land use within the Study Area as Waste Management Resource Recovery Area, Farmland, Green Space and Environmental Review. Map 5 of The London Plan (2016) further identifies the following Natural Heritage Features within the Study Area:

- Unevaluated Vegetated Patches
- Unevaluated Wetlands
- Wetlands (i.e., Locally Significant Wetlands)
- Potential Environmentally Significant Area
- Significant Woodlands

Figure 1 illustrates the Study Area in addition to land uses including natural heritage features identified in The London Plan (2016) and Ontario Ministry of Natural Resources and Forestry's Land Information Ontario mapping.

Maps 1 and 5 of The London Plan (2016) are provided in **Appendix A**.

Figure 1: Study Area and Surrounding Land Use



1.3 Background Information Review

A review of background information was completed to identify natural heritage features, as well as flora and fauna known within or in proximity to the Study Area. The following online databases and faunal atlases were reviewed for the W12A Landfill Study Area:

- Ontario Ministry of Natural Resources and Forestry's Make-a-Map: Natural Heritage Areas application (Natural Heritage Information Centre);
- Ontario Ministry of Natural Resources and Forestry Land Information Ontario geospatial database information;
- Fisheries and Oceans Canada Aquatic Species at Risk mapping;
- Ontario Ministry of Agriculture, Food and Rural Affairs' AgMaps online mapping tool;
- Ontario Breeding Bird Atlas (2006); and,
- Ontario Reptile and Amphibian Atlas (Ontario Nature 2015).

Additional studies and reports reviewed for relevant information include the following:

- W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study (Earth Tech, 2005);
- Natural Environment Assessment Report (BioLogic Incorporated, 2013);
- Middlesex Natural Heritage Systems Study (Middlesex Natural Heritage Systems Study; Middlesex County, 2014);
- The London Plan (2016);
- City of London Inventory and Evaluation of Woodlands (North-South Environmental Inc., 2009);
- Dingman Creek Watershed Report Card (2017); and,
- Kettle Creek Watershed Report Card (2013).

1.4 Relevant Legislation, Policies and Guidelines

Table 1 below provides a summary of the relevant legislation, policies and guidelines that may apply to the proposed expansion of the W12A Landfill site.

Table 1: Applicable Legislation, Regulations and Guidelines

Level of Governance	Legislation	Policies/Regulations	Guidelines	Applicability to W12A Landfill Project
Federal	<i>Fisheries Act (1985)</i>	Fish Protection Policy Statement	N/A	On June 21, 2019, Bill C-68 (An Act to amend the Fisheries Act and other Acts in consequence) was passed into law. This included several changes to the habitat provisions and associated sections. On August 28, 2019, the habitat provisions came into force. Any proposed work with the potential to cause Harmful Alteration, Disruption or Destruction of fish habitat or the death of fish needs to be assessed under the Fisheries Act and determination of the need for Fisheries and Oceans Canada review as per the Self-Assessment process currently in place.
Federal	<i>Migratory Bird Convention Act (1994)</i>	Regulations Respecting the Protection of Migratory Birds (1994)	N/A	The Migratory Bird Convention Act affords protection to Birds listed under Article 1 of the <i>Migratory Birds Convention Act</i> . “No person shall disturb, destroy or take a nest, egg [...] of a migratory bird.” (Migratory Bird Convention Act 1994). Bird nests that are destroyed during construction and/or related activities is referred to as incidental take and is illegal except under the authority of a permit obtained by Canadian Wildlife Services.
Federal	Species at Risk Act (2002)	N/A	N/A	The <i>Species at Risk Act</i> lists Species at Risk in Canada and affords protection to species listed as Threatened or Endangered, as well as their habitat, on federal land, which includes the internal waters of Canada.
Provincial	Planning Act (1990)	Provincial Policy Statement (2020)	Natural Heritage Reference Manual (2010) Ecoregion Criterion Schedule 7E (2015)	The Provincial Policy Statement, Natural Heritage Reference Manual and Ecoregion Criterion Schedule outline the protection of Natural Heritage Features within Ontario including Significant Wetlands, Woodlands and Wildlife Habitat.
Provincial	<i>Conservation Authorities Act (1990)</i>	Ontario Regulation 157/06 (Upper Thames River Conservation Authority) Ontario Regulation 97/04 Ontario Regulation 181/06 (Kettle Creek)	Environmental Planning Policy Manual for the Upper Thames River Conservation Authority (June 28, 2006).	The Study Area falls within lands that are regulated by the Kettle Creek Conservation Authority and the Upper Thames River Conservation Authority.
Provincial	<i>Fish and Wildlife Conservation Act (1997)</i>	N/A	N/A	The <i>Fish and Wildlife Act</i> affords protection to some species of birds, amphibians, reptiles and mammals in Ontario. Some bird species which are not afforded protection under the federal Migratory Bird Convention Act are afforded protection through this act (i.e., raptors).
Provincial	<i>Endangered Species Act (2007)</i>	Ontario Regulation 242/08 Ontario Regulation 230/08	N/A	The Endangered Species Act and its associated regulations list Species at Risk within Ontario and afford protection to species listed as Threatened or Endangered, as well as their habitats.
Municipal	City of London Official Plan (2006) The London Plan (2016) – currently under appeal	Environmental Policies (Section 15)	Environmental Management Guidelines (2007)	These documents outline the City’s objectives and policies to guide the physical development of all lands found within the boundaries of the municipality.
Municipal	City of London Tree Protection By-law (2016)	N/A	Tree Planting and Protection Guidelines (2015)	The City of London’s Tree Protection by-law outlines the requirements for a tree removal permit within the City of London. Note: The City of London is exempt from this by-law.

1.5 Study Scope

A work plan and description of existing conditions were prepared for this study on October 17, 2017 for inclusion in the Terms of Reference. The work plan was expanded upon in May 2019 for review by the Ontario Ministry of Natural Resources and Forestry. The work plan outlined the surveys to be completed during field investigations in order to characterize existing aquatic and terrestrial ecosystems within the Study Area.

The Terms of Reference was submitted to the Ministry of Environment, Conservation and Parks in October 2018, with an amended version submitted in February 2019 for Ministry of Environment, Conservation and Parks review and approval.

Appendix B provides a copy of the Terms of Reference for the Biology Assessment component of the Environmental Assessment.

1.6 Agency Consultation

On October 16th and 17th, 2017, information requests were sent to Kathleen Buck at the Aylmer District of the Ontario Ministry of Natural Resources and Forestry and Christine Creighton at the Upper Thames Region Conservation Authority, respectively. On October 30th, 2018, an information request was also sent to Joe Gordon at the Kettle Creek Conservation Authority requesting the following information:

- Presence of Natural Areas (Environmentally Significant Areas, Provincially Significant Wetlands, Areas of Natural and Scientific Interest, Provincial Parks, Conservation Reserves and Wildlife Management Areas);
- Natural Area Reports;
- Species at Risk Occurrences and potential to occur;
- Identification of Restricted species;
- Rare Species Occurrences (locally and provincially rare);
- In-water Timing Restrictions;
- Important Commercial or Recreation Fisheries;
- Water Quantity/Quality Data;
- Groundwater Discharge Areas;
- Watercourse Names, Thermal and Flow Regimes;
- Fish Habitat Sensitivity;
- Habitat Information and Location;

- Fisheries Management Objectives/plans;
- Fish Community Records;
- Benthic Invertebrate data;
- Known fish spawning;
- Aboriginal Fisheries; and,
- Significant Wildlife Habitat or Wildlife use of the area.

On December 15th, 2017 an email response was received from Kathleen Buck. A response was also received from Cari Ramsey of the Upper Thames Region Conservation Authority on October 30th, 2018 and on November 19th, 2018 a response was received from Jennifer Dow of the Kettle Creek Conservation Authority. Agency Correspondence can be found in **Appendix C**.

Additional information regarding natural heritage features for the Study Area is provided in the Middlesex Natural Heritage System Study prepared by the Upper Thames Region Conservation Authority. Relevant mapping of natural heritage features is provided in **Appendix D**.

2. Existing Conditions

The following sections provide a description of the existing physical and natural heritage features within the Study Area.

2.1 Physical Features and Functions

2.1.1 Terrain and Drainage

The northern portion of the W12A Landfill Study Area is located within the Dingman Creek subwatershed and the southern portion within the Dodd Creek subwatershed. The northern portion of the Study Area slopes gently towards the northwest where the Silver Swamp Locally Significant Wetland is located adjacent to the subject lands (see **Figure 2**). The southern portion of the Study Area slopes gently to the south. The highest elevation occurs within the subject lands on the landfill itself and slopes to the north and south to low points where tributaries of Dingman Creek and Dodd Creek drain to the northwest and south, respectively. The northwest flow passes through the Silver Swamp Locally Significant Wetland and continues to Dingman Creek. Cultivated agricultural lands occupy the majority of the Study Area, with the active W12A landfill, natural features, cemetery, material recovery facility, aggregate pits and rural residences occupying the remainder.

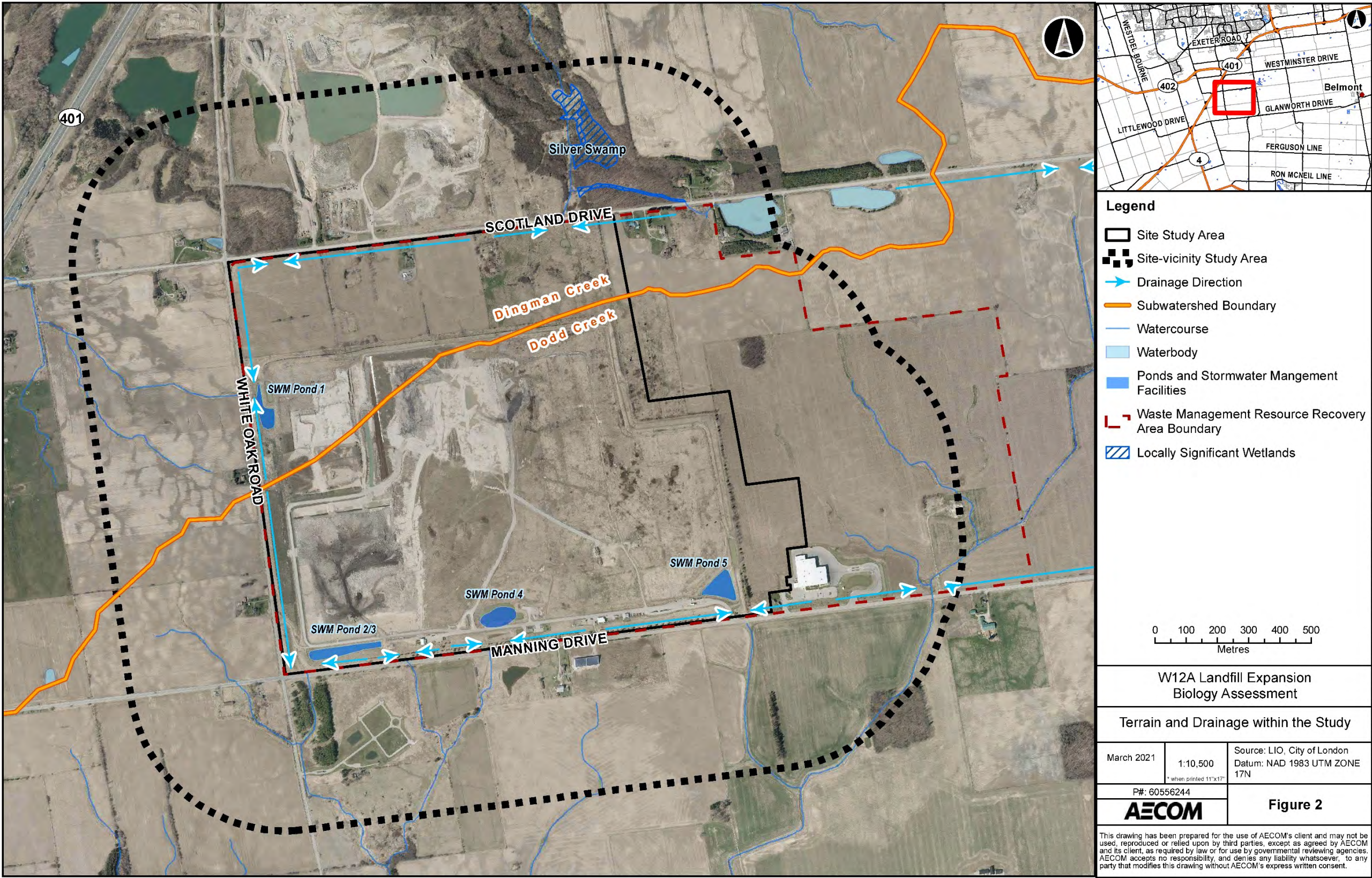
2.1.2 Soils

According to Middlesex County soils data (Hagerty and Kingston 1992), the following soil associations are noted for the site and surrounding area:

- The Muriel Association – Drainage is moderately well to imperfect. Textures range between silt loam, loam and silty clay loam. Parent material is clayey glacial till.
- The Burford Association – Drainage is rapid to imperfect. Textures range from loam to fine sandy loam. Parent material is glaciofluvial outwash.

Most slopes are mapped as simple and less than 5% with some complex slopes greater than 5%. These conditions were also observed during site investigations. In general, soils for this region are predominantly grey-brown podzols (Chapman and Putnam 1984).

Figure 2: Terrain and Drainage within the Study Area



The W12A landfill has a 15 to 20 metres underlay of low permeability clay till below which is a 2 to 8 metres sandy layer and then a 20 metre thick clayey till. The presence of these low permeable soils mean that the landfill footprint does not affect the groundwater flows or contributions to adjacent natural heritage features.

2.2 Natural Heritage Features

2.2.1 Field Investigations Summary

Field investigations for the Study Area were intended to provide a comprehensive inventory of ecological features, and local flora and fauna. Field investigations completed by AECOM included: aquatic habitat assessments, vegetation community (Ecological Land Classification) delineation, snake cover board surveys, floral species inventories, anuran call surveys, breeding bird surveys, bat habitat assessments, lepidoptera/odonata surveys, a vernal pools assessment as well as a Significant Wildlife Habitat assessment.

Benthic Invertebrate Surveys were completed by StraightUp Environmental in April 2018.

Prior to commencing field investigations, properties requiring Permission to Enter were identified using aerial photography and property parcel mapping. AECOM prepared notification letters to individual landowners, which described the nature of the studies (i.e., ecological field investigations), the anticipated timing of each investigation and request to enter their property. A total of thirty-one Permission to Enter letters were issued by the City of London for properties within the study area.

Twenty-five signed Permission to Enter letters granting property access were received from landowners. Where site access was not granted, field investigations were completed roadside or within an adjacent property with granted access. **Figure 3** displays the Permission to Enter status for the Study Area.

The location of the anuran call, aquatic habitat assessment, benthic invertebrate surveys, snake coverboard and breeding bird field investigation surveys completed within the Study Area can also be found on **Figure 4**.

Figure 3: Field Investigation Locations

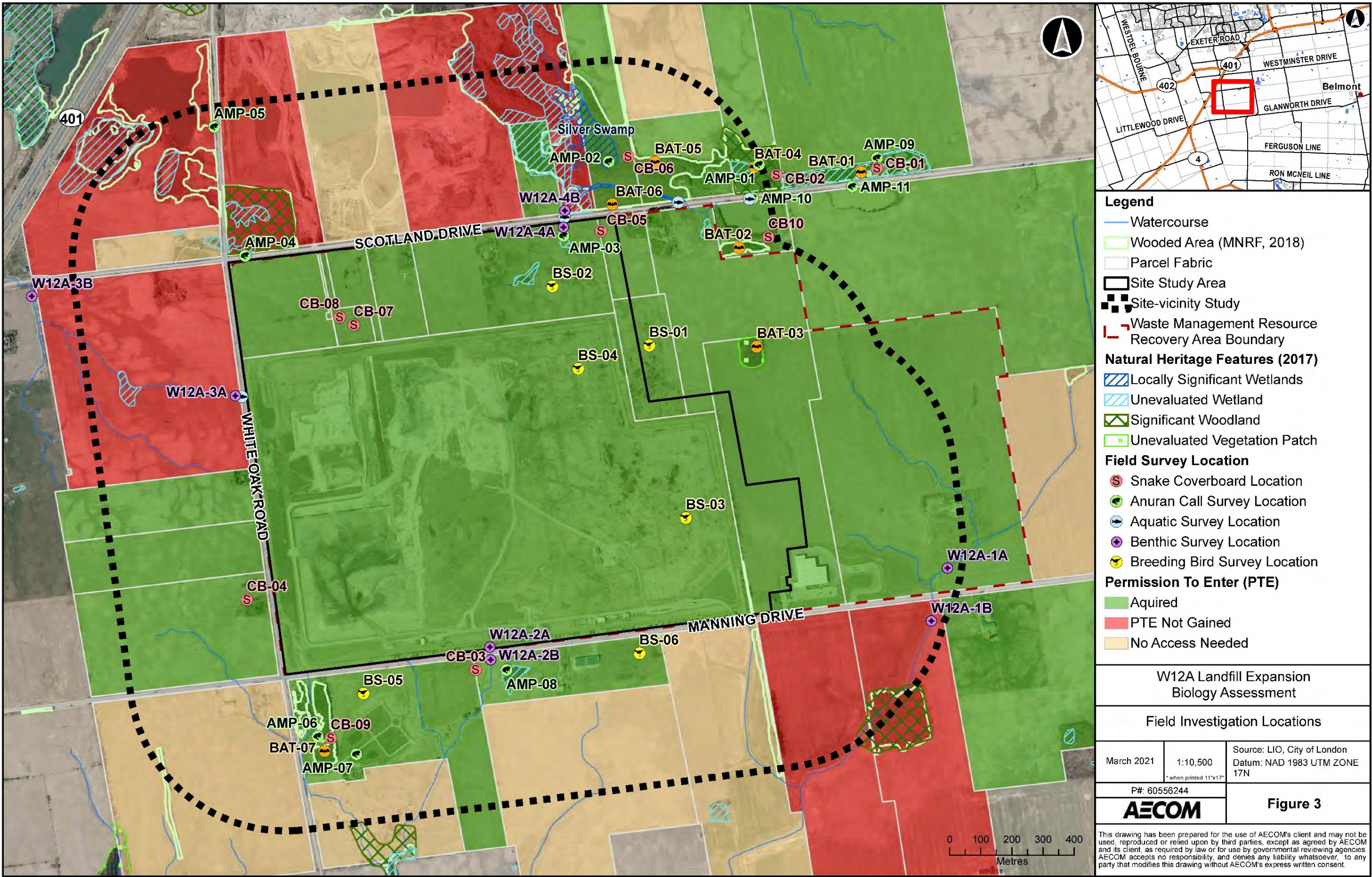
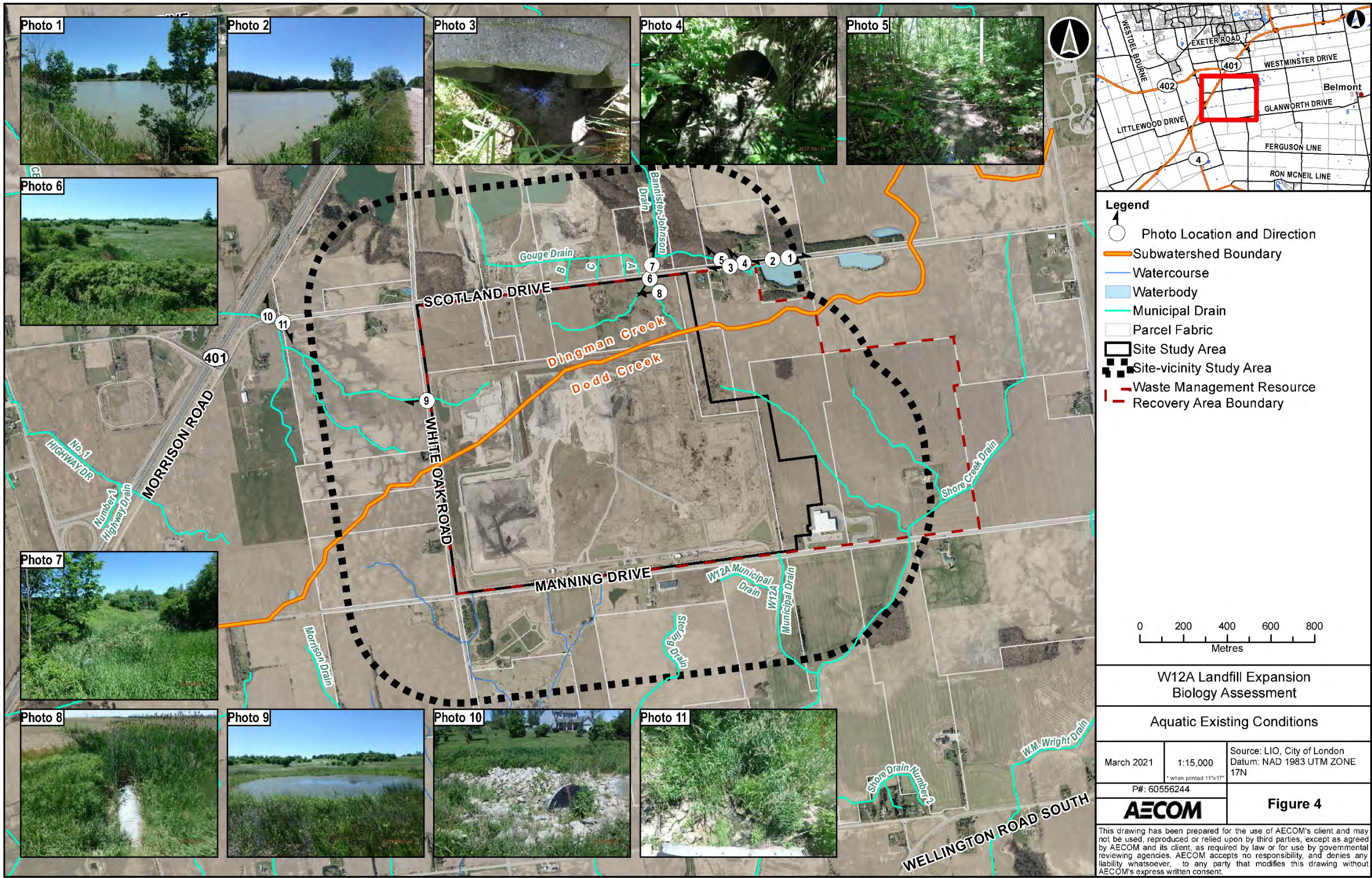


Figure 4: Aquatic Existing Conditions



The remaining surveys were not confined to a specific location and are therefore not displayed on this figure. **Table 2** summarizes all field investigations completed for the Study Area.

Table 2: Field Investigations Summary

Field Investigation/Survey	Date	Investigators
Anuran Call Surveys	April 23 rd 2018 May 9 th 2018 May 31 st 2018 July 3 rd 2018	Emily McNaughton and Alex McKinstry Emily McNaughton and Jack Brand Nataliya Simonova and Andrew Minielly Emily McNaughton and Jack Brand
Aquatic Habitat Assessments	June 14 th 2018	Olivia Butty and Andrew Aberdein
Benthic Invertebrate Surveys	June 5, 2018	StraightUp Environmental
Vernal Pool Surveys	April 24 th 2018	Nataliya Simonova and Emily McNaughton
Bat Habitat Assessment	April 23 rd 2018 April 24 th 2018 May 7 th 2018 May 31 st 2018	Emily McNaughton and Nataliya Simonova Emily McNaughton and Nataliya Simonova Emily McNaughton and Nataliya Simonova Andrew Minielly and Nataliya Simonova
Snake Cover Board & Area Searches	April 24 th , 2018 May 31 st 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018	Emily McNaughton and Nataliya Simonova Andrew Minielly and Nataliya Simonova Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova
Breeding Bird Surveys	June 7 th 2018 June 18 th 2018 June 28 th 2018	Matthew Ross and Nataliya Simonova Matthew Ross and Edyta Ratajczyk Matthew Ross and Emily McNaughton
Lepidoptera and Odonata Surveys	July 20 th 2018 July 27 th 2018 August 9 th 2018	Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova
Ecological Land Classification	April 23 rd 2018 May 7 th 2018 May 31 st 2018 June 7 th 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018 October 23 rd 2018	Nataliya Simonova and Emily McNaughton Nataliya Simonova and Emily McNaughton Nataliya Simonova and Andrew Minielly Nataliya Simonova and Matthew Ross Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova Nataliya Simonova and Matthew Ross
Floral Inventory	April 23 rd 2018 May 7 th 2018 May 31 st 2018 June 7 th 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018 October 23 rd 2018	Nataliya Simonova and Emily McNaughton Nataliya Simonova and Emily McNaughton Nataliya Simonova and Andrew Minielly Nataliya Simonova and Matthew Ross Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova Nataliya Simonova and Matthew Ross
Significant Wildlife Habitat Survey	April 23 rd 2018 May 7 th 2018 May 31 st 2018 June 7 th 2018 July 20 th 2018 July 27 th 2018 August 9 th 2018 October 23 rd 2018	Nataliya Simonova and Emily McNaughton Nataliya Simonova and Emily McNaughton Nataliya Simonova and Andrew Minielly Nataliya Simonova and Matthew Ross Matthew Ross and Emily McNaughton Matthew Ross and Kasey McKenzie Kasey McKenzie and Nataliya Simonova Nataliya Simonova and Matthew Ross

Methods for the investigations noted above are described in **Section 2.2.2** and **Section 2.2.3**.

2.2.2 Aquatic Ecosystems

The following section documents the existing aquatic conditions within the Study Area. Aquatic ecosystems are those associated with bodies of water such as, but not limited to, pools, ponds, lakes, rivers, streams and wetlands. Aquatic ecosystems provide habitat for a variety of wildlife species, some of which are rare or sensitive. Aquatic systems and the species which are known in the area were identified through background review of secondary sources and the completion of site investigations.

2.2.2.1 Background

A review of the background information as outlined in **Section 1.2** identified the following six Municipal Drains within the Study Area (Ontario Ministry of Agriculture, Food and Rural Affairs, 2019): Shore Drain, Sterling Drain, W12A Municipal Drain (all within the Dodd Creek subwatershed), Gouge Drain, Bannister-Johnson Drain, and C.B. Smith Drain (all within the Dingman Creek subwatershed). These watercourses have been altered (e.g., channelized) to facilitate drainage for surrounding land use.

The northern portion of the Study Area is located in the Dingman Creek subwatershed and within the jurisdiction of the Upper Thames River Conservation Authority. The Dingman Creek subwatershed is situated in the agricultural heartland of southwestern Ontario in close proximity to Lakes Huron, St. Clair and Erie. The subwatershed drains 176 square kilometres of land, and ultimately flows into the Thames River.

According to the Dingman Creek Watershed Report Card (2017), the watershed is comprised of 56% agricultural, 24% urban, 18% natural cover, 1% aggregates and 1% water. There are 46 fish species and 13 freshwater mussels recorded within the watershed, with specific gamefish including Smallmouth Bass (*Micropterus dolomieu*), Largemouth Bass (*Micropterus salmoides*), Black Crappie (*Pomoxis nigromaculatus*) Northern Pike (*Esox lucius*), and Brown Trout (*Salmo trutta*). The Report Card identifies one fish species at risk, Silver Shiner (*Notropis photogenis*), under the *Endangered Species Act* and one species at risk mussel species, Rainbow (*Villosa iris*), under the *Species at Risk Act* recorded within the watershed. A review of Fisheries and Oceans Canada Species at Risk Habitat Mapping indicates that no aquatic species at risk have been identified within the Study Area. The Ontario Ministry of Natural Resources and Forestry and the Upper Thames Region Conservation Authority did not have any fish, benthic or mussel data pertaining to the Study Area beyond those data reported in the Watershed Report Card. The Natural Environment Assessment Report completed by BioLogic Incorporated (2013) for Aaroc Aggregates Limited indicates that the Bannister-Johnson Drain provides warm water habitat for small-bodied fish species.

The southern portion of the Study Area is located within the Dodd Creek subwatershed, which is part of Kettle Creek watershed under the jurisdiction of the Kettle Creek Conservation Authority. According to the Kettle Creek Watershed Report Card (2013), the Dodd Creek subwatershed is the largest tributary of the main branch of Kettle Creek. It is located within an area of extensive agricultural land use with few natural areas and little wetland cover, disturbed riparian zones and altered stream reaches. These characteristics result in warm water temperatures, rapid water level fluctuation, and poor surface water quality. Thirty species of fish are found in the Dodd Creek subwatershed.

Fish community data collected on August 17, 2018 from Shore Creek Drain at Manning Drive provided by the Kettle Creek Conservation Authority (**Appendix C**) indicated the following small-bodied fish species were present: Johnny Darter (*Etheostoma nigrum*), Creek Chub (*Semotilus atromaculatus*), Brook Stickleback (*Culaea inconstans*), and Bluntnose Minnow (*Pimephales notatus*). Sampling at another site within Shore Creek Drain at Glanworth Drive south of the Study Area on August 30th, 2018 found the above species as well as White Sucker (*Catostomus commersonii*) and Blacknose Dace (*Rhinichthys atratulus*). Other sampling sites, including benthic and water quality sites, were located well outside of the Study Area. A review of Fisheries and Oceans Canada Species at Risk Habitat Mapping indicates that no aquatic species at risk have been identified within the Study Area.

2.2.2.2 Field Investigation Methods

Aquatic Habitat Assessment

Potential aquatic natural heritage features were identified within the Study Area from aerial photography and agency mapping. Detailed aquatic habitat assessments were undertaken on July 14, 2018 to confirm aquatic natural heritage features and document aquatic existing conditions. The location of aquatic surveys is shown on **Figure 3** and a photographic log of aquatic features is provided on **Figure 4**. Criteria recorded during the aquatic habitat assessment were:

- Documentation of surrounding natural features and land uses (e.g., wetland, agriculture, etc.);
- Channel dimensions, substrate composition, bank stability, and channel morphology including:
 - Runs – typically deep, fast moving water with little to no turbulence of water;
 - Riffles – shallow, fast moving water typically running over rocks; riffles providing areas of high oxygenation;
 - Flats – low flowing water with a smooth un-agitated surface;
 - Pools – are described as deep pockets of slow moving water that provide ideal habitat for fish;

- Substrate composition (i.e., clay, silt, sand, gravel, cobble, rock, boulder, muck and detritus);
- Indicators of water quality; water clarity, water colour, presence and type of macrophytes and algal growth, evidence of runoff;
- Basic field parameters such as pollution sources (i.e., tile drain discharges, other piped discharges and road runoff); and,
- Suitable fish habitat parameters.

2.2.2.3 Results and Discussion

Aquatic Habitat Assessment

Bannister-Johnson Drain

The Bannister-Johnson Drain crossing at 3713 Scotland Drive was assessed upstream (south) of the roadway crossing. The watercourse consisted of an intermittent channel with sloping valley topography surrounding the watercourse. The surrounding land use upstream was meadow and an agricultural drainage pond adjacent to the watercourse with agricultural land use beyond. Evidence of overland flow (bent grasses) providing inputs from additional drainage features was present. Channel dimensions were assessed to have a mean wetted width of 0.30 metre and mean wetted depth of 0.05 metres. The pond dimensions were approximately 21 metres wide by 21 metres long. Channel banks were well vegetated and stable. Substrate was composed predominantly of muck, with lesser amounts of detritus. Dense (90%) in-stream cover was provided by aquatic vegetation, both emergent and submergent. The channel morphology consisted of pools of standing water. Low flow barriers to fish passage were present in the form of intermittently dry sections of watercourse. The watercourse may provide marginal fish habitat and potential warm water refuge habitat within the agricultural drainage pond during high flow conditions, but connectivity downstream to fish bearing watercourses could not be assessed due to Permission to Enter restrictions. However, based on watercourse characteristics and aerial photo interpretation, the Bannister-Johnson Drain and the adjacent pond have the potential to support fish and fish habitat that are regulated under the *Fisheries Act*. No important or exceptional fish habitat was observed.

Unnamed Pond (3405 Scotland Drive)

The waterbody was a permanent offline pond with rolling hill topography surrounding the waterbody. The surrounding land use was residential southeast of the pond and a plantation tree-row along the southern bank and forest beyond. The pond dimensions were approximately 90 metres wide and 170 metres long. Water depth at the northern

bank was approximately 0.4 metres, but high turbidity prevented an estimation of water depth deeper in the pond. Inputs into the pond from roadside and residential drainage were present, as was a dry overflow drain crossing under Scotland Drive at the northeast portion of the pond. Waterbody banks were stable and sparsely vegetated with low (0% to 30%) cover provided predominantly (90%) by willow trees and small patches (10%) by herbaceous common reed (*Phragmites australis*). High turbidity prevented assessment of substrate composition. The pond has the capacity to support fish species, but none were observed. Furthermore, the pond is offline. Since the pond is offline, it does not have the potential to support fish and fish habitat that is regulated under the *Fisheries Act*.

Unnamed Drain (3502 Scotland Drive)

The watercourse upstream (south) of Scotland Drive was channelized for 10 metres leading from a buried plastic culvert and dry at the time of assessment, while downstream (north) the channel was intermittent and increasingly defined with more standing water further downstream away from the Study Area. The topography was rolling hills with surrounding land use of forest with residential and agricultural land beyond. The watercourse received roadside drainage inputs from ditches along Scotland Drive. The bankfull depth where the watercourse became more defined downstream was approximately 0.3 metres. The banks at this location were stable and had high (90 to 100%) canopy cover provided by trees and grasses. Substrate was composed entirely of muck within the channel. Low flow barriers to fish passage were present in the form of intermittently dry sections of watercourse. The watercourse may provide marginal fish habitat during high flow conditions, but connectivity downstream to fish bearing watercourses could not be assessed due to limited Permission to Enter. However, based on watercourse characteristics, the unnamed drain has the potential to support fish and fish habitat that is regulated under the *Fisheries Act*. No important or exceptional fish habitat was observed.

C.B. Smith Drain

The C.B. Smith Drain crossing under White Oaks Road from the W12A Landfill site downstream onto 4067 Scotland Drive was assessed from the road right-of-way. The watercourse was intermittent and dry at the time of assessment where it crosses White Oak Road, but flow was present further downstream where the watercourse crosses Scotland Drive outside the 500 metre area of investigation. Existing conditions within the watercourse on the property at 4067 Scotland Drive could not be assessed due to limited Permission to Enter. The topography was sloping toward the watercourse and surrounding land use was agricultural downstream at 4067 Scotland Drive and landfill upstream at the W12A Landfill site. Channel dimensions at the Scotland Drive crossing were a wetted width of 0.5 metres and wetted depth of 0.1 metres. In-stream cover was

provided by algae and aquatic vegetation. Substrate was composed of 60% muck, 30% silt, and 10% cobble. The channel morphology was 90% standing pool and 10% run. The watercourse may provide marginal fish habitat at the Scotland Drive crossing, but no fish were observed and this watercourse crossing was outside the 120 metre Study Area buffer; however, incidental observations of fish within the C.B. Smith Drain at the White Oak Road crossing were recorded during benthic sampling when a precipitation event provided flow in the channel (see the StraightUp Environmental Consulting W12A Landfill Benthic Water Quality Report in **Appendix E**). Since C.B. Smith Drain is connected to other fish bearing watercourses downstream and supports fish and fish habitat, it is regulated under the *Fisheries Act*. However, no important or exceptional fish habitat was observed.

Shore Creek Drain

Shore Creek Drain was assessed downstream of the Manning Drive crossing. Shore Drain was classified as a Type C municipal drain (Ontario Ministry of Agriculture, Food and Rural Affairs, 2019), which means it had a permanent flow regime and supported non-sensitive fish species. Surrounding land use was entirely agricultural fields. The channel morphology consisted entirely of a pool of standing water. Channel dimensions were a bankfull width of 1.9 metres and a wetted depth that ranged from 0.08 to 0.11 metres at the time of assessment. Substrate consisted of 55% silt, 25% gravel, 10% sand and 10% cobble. No impediments to fish movement were observed and, although no fish were observed at the time of assessment, there is high likelihood that fish are present and Shore Creek Drain provides fish habitat regulated under the *Fisheries Act*.

W12 Municipal Drain

W12 Municipal Drain was assessed upstream (north) of the culvert crossing Manning Drive east of the W12A Landfill entrance at the outlet of the stormwater management facility on the W12A Landfill site. Immediately downstream (south) of the culvert crossing Manning Drive the W12 Municipal Drain entered a tile drain inlet and was buried for the remainder of the length within the Study Area. The surrounding land use was the landfill and stormwater management facility upstream and agricultural fields downstream. The open channel morphology upstream of Manning Road consisted entirely of a pool of standing water. The bankfull width was 1.9 metres and the wetted depth was 0.1 metres at the time of assessment. Substrate was composed of 75% silt, 10% sand, 10% gravel and 5% clay. The buried tile drain downstream precluded fish movement upstream onto the W12A Landfill site, and as such there is low likelihood that W12 Municipal Drain provide fish habitat and would not be regulated under the *Fisheries Act*. No fish were observed at the time of assessment.

Unnamed Drain (Manning Drive)

The Unnamed Drain that originated from a Corrugated Steel Pipe culvert outlet from the stormwater management facility on the W12A Landfill site immediately north of Manning Drive was assessed in the reach south of the Manning Drive culvert crossing (Universal Transverse Mercator 0481295 East, 4746746 North). The channel morphology consisted entirely of a pool of standing water. Channel dimensions were a bankfull width ranging from 2.7 to 3.1 metres and a wetted depth ranging from 0.16 to 0.25 metres at the time of assessment. Substrate consisted of equal parts, cobble, gravel, sand, silt, and clay. Fish were observed at the time of assessment – species consisted of Bluntnose Minnow (*Pimephales notatus*), Brook Stickleback (*Culaea inconstans*), Common Shiner (*Luxilus cornutus*), and Fathead Minnow (*Pimephales promelas*) – and as such the Unnamed Drain provided fish habitat downstream (south) of Manning Drive and there is potential for fish passage upstream (north) onto the W12A Landfill site. As such the Unnamed Drain is regulated under the *Fisheries Act*.

Unknown Drain (Manning Drive)

The Unknown Drain crossing Manning Drive east of the intersection with White Oak Road (Universal Transverse Mercator 0480723 East, 4746895 North) was not mapped by Ontario Ministry of Agriculture, Food and Rural Affairs (2019). The channel was poorly defined, overgrown with vegetation, and dry at the time of assessment. The feature originated from the stormwater management facility north of Manning Drive on the W12A Landfill site and likely conveyed flow ephemerally following precipitation events downstream (south) of Manning Drive to the roadside drainage feature parallel to White Oak Road. There was low likelihood that the unknown drain provided fish habitat due to the ephemeral flow regime and lack of connectivity to fish bearing watercourses downstream and as such would not be regulated under the *Fisheries Act*.

Benthic Invertebrates

Water chemistry parameters measured during benthic invertebrate sampling documented high conductivity, total dissolved solids, and salinity in at least one sampling reach within each site (**Table 3**). The Provincial Water Quality Objectives do not provide specific guidance for these parameters. Additionally, the water quality measurements were taken during a precipitation event, which may have contributed to an increase in these parameters due to increased flow from surrounding roadways and agricultural runoff.

Table 3: Water Chemistry Parameter Results

Reach	Temperature (°C)	Conductivity (µS/cm)	Total Dissolved Solids (mg/L)	Salinity (Practical Salinity Units)	Dissolved Oxygen (mg/L)	pH	Turbidity	Algae
W12A-1A	15.85	649	0.422	0.32	5.82	7.44	Turbid	Sparse
W12A-1B	14.67	2013	1.311	1.04	7.21	7.48	Turbid	Sparse
W12A-2A	19.14	5791	3.81	3.23	5.94	6.80	Turbid	Sparse
W12A-2B	16.47	1701	1.106	0.87	5.89	7.27	Turbid	Sparse
W12A-3A	15.33	2156	1.403	1.11	3.78	6.97	Turbid	Sparse
W12A-3B	15.59	469	0.304	0.23	8.73	7.51	Turbid	Sparse
W12A-4A	14.56	651	0.423	0.32	6.39	7.06	Turbid	Sparse
W12A-4B	13.57	2048	1.329	1.05	7.12	7.30	Turbid	Sparse

All sites sampled had a BioMAP Water Quality Index rating less than 14, which indicated the water quality was impaired under the protocol (**Table 4**). Similarly, the Hilsenhoff Biotic Index rating was above 7.26 for all sites indicating very poor water quality and severe organic pollution was likely. The predominantly agricultural surrounding land use may have contributed to these indices scores and acted as a source of organic pollution. Complete benthic invertebrate sampling results are provided in the StraightUp Environmental Consulting W12A Landfill Benthic Water Quality Report in **Appendix E**.

Table 4: Benthic Water Quality Indices Results

Standard	Reach W12A-1A	Reach W12A-1B	Reach W12A-2A	Reach W12A-2B	Reach W12A-3A	Reach W12A-3B	Reach W12A-4A	Reach W12A-4B
Average BioMap Water Quality Index	1.36	2.46	1.29	1.11	1.722	3.449	2.69	3.09
Hilsenhoff Biotic Index	9.34	8.81	9.65	9.95	8.5	7.281	8.85	8.66

2.2.3 Terrestrial Ecosystems

The following sections document the existing terrestrial conditions within the Study Area. Terrestrial ecosystems are those associated with land including, but not limited to, forests, meadows, thickets and wetlands. Ecosystems and species identified within the Study Area during the background review and site investigations are described in detail below.

2.2.3.1 Vegetation Communities

Background

A review of the background information as outlined in **Section 1.3** identified the following natural heritage features within the Study Area:

- Potential Environmentally Significant Area on the north side of Scotland Drive (Vegetation Patch #10121);
- Unevaluated vegetation patches north of Scotland Drive (vegetation patches #10120 and #10122);
- Unevaluated vegetation patches south of Manning Drive (vegetation patch #11068);
- Unevaluated wetlands north of Scotland Drive;
- Locally Significant Wetland north of Scotland Drive (Silver Swamp); and,
- Significant Woodlands (vegetation patches #10120, #10122, and #11068) and an Unevaluated Vegetation Patch at the north end of the property at 3438 Manning Drive.

Field Investigation & Analysis Methods

The following section outlines the methods used to assess the vegetation communities within the Study Area.

Vegetation Community Classification & Delineation – Each vegetation community within the Study Area was assessed and classified into Ecological Land Classification units as per the Ontario Ministry of Natural Resources and Forestry guidelines (Lee et al., 1998). This system provides a standard for comparing similar communities across Ontario and classifies vegetation communities through the completion of a multilayer (canopy, sub-canopy, ground cover) vegetation inventory. A summary of disturbance factors, community conditions, plant species list and representative photographs were also recorded for each vegetation patch. The plant list was established through the completion of a three season floral species inventory completed in the spring, summer and fall of 2018. Where wetland communities were encountered, the wetland boundary delineation was refined using the 50/50 rule (i.e., 50% of plants were comprised of wetland plant species and 50% were comprised of upland plant species) as per the Ontario Ministry of Natural Resources and Forestry Wetland Evaluation Guidelines for Southern Ontario (Ontario Ministry of Natural Resources and Forestry 3rd Edition, 2013).

Where property access was not granted, communities were identified and delineated through a combination of roadside and aerial imagery interpretation or through the

review of previously completed reports. Species lists for these communities are truncated due to limited visibility and in some instances were limited to genus.

Variables captured in the field were used to determine numerous indices which provide insight into the vegetation community quality and sensitivity. The variables included species richness (i.e., the number of species within a community), Coefficient of Conservatism, Floristic Quality Index, Weediness Index and Wetness Index.

Vegetation community sensitivity was based on the Floristic Quality Assessments System for Southern Ontario (Oldham *et al.*, 1995) which included the calculation of the *Mean Coefficient of Conservatism*, the *Floristic Quality Index* and the *Weediness Index* for all wetland communities and quadrats located within the Study Area. These three parameters are intended to be used together in order to assign an ecological community sensitivity ranking based on plant species composition. The ranking is not intended to provide a measure of the overall value of a community, but rather reflects the sensitivity of the community to disturbance based on the grouping of plants present within the community. The following provides a summary of the parameters used to assess community sensitivity:

Coefficient of Conservatism

These values range from 0 (low) to 10 (high) and are based on species tolerance to disturbance and fidelity to a specific habitat. Vegetation species and community sensitivity were assessed through the application of Coefficient of Conservatism values, assigned to each native species in southern Ontario (Oldham *et al.*, 1995). The occurrence of species with a Coefficient of Conservatism of 9 or 10 can be indicators of undisturbed habitats such as mature forests, fens or bogs. General habitat values associated with Coefficient of Conservatism values are:

- 0 – 3** Species found in a wide variety of communities including disturbed sites.
- 4 – 6** Species associated with a specific community; tolerate to moderate disturbance.
- 7 – 8** Species associated with a community in an advanced successional stage, tolerant of minor disturbances.
- 9 – 10** Species with a high degree of fidelity to a narrow range of ecological parameters.

Floristic Quality Index

The floristic quality of an area is reflected in the mean value of Coefficient of Conservatism. The Floristic Quality Index is an indication of native vegetation

quality for a vegetation community area. The following summarizes the Floristic Quality Index rankings:

- 1-19** Indicates low vegetative quality
- 20-35** Indicates high vegetative quality and high-quality aquatic resources
- > 35** Indicate “Natural Area” quality.

$$\text{Floristic Quality Index} = \text{mean Coefficient of Conservatism} \times \sqrt{N}$$

Where $\sqrt{N}$ is the square root of the number of native species observed.

Weediness Index

The sensitivity of natural areas can be assessed through application of the Weediness Index. The Weediness Index quantifies the potential invasiveness of non-native plants. In combination with the percentage of non-native plants, this value can be used as an indicator of disturbance. Values ranging from -1 (low) to -3 (high) have been assigned to most non-native species based on the potential impact each species can have in natural areas:

- (-1)** Little or no impact on natural areas (most non-native plants fall into this category)
- (-2)** Occasional impacts on natural areas; generally infrequent or localized
- (-3)** Major potential impacts on natural areas; very invasive

Wetness Index

All plants in southern Ontario have been assigned a wetland category, based on the designations developed for use by the United States Fish and Wildlife Service. Plants are designated into the following categories:

- **OBL (Obligate Wetland)** occurs almost always in wetlands under natural conditions (estimated >99% probability)
- **FACW (Facultative Wetland)** usually occurs in wetlands, but occasionally found in non-wetlands (estimated 67-99% probability)
- **FAC (Facultative)** equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability)
- **FACU (Facultative Upland)** occasionally occurs in wetlands, but usually occurs in non-wetlands (estimated 1-33% probability)
- **UPL (Upland)** occurs almost never in wetlands under natural conditions (estimated <1% probability)

Further refinement of the Facultative categories is denoted by a “+” or “-” to express exaggerated tendencies for those species. The “+” denotes a greater estimated probability occurring in wetlands than species in the general indicator category, but a lesser probability than species occurring in the next higher category. The “-” denotes a lesser estimated probability of occurring in wetlands than species in the general indicator category, but a greater probability than species occurring in the next lower general category. Each wetland category has been assigned a numerical value to facilitate the quantification of the wetness index.

Natural Heritage Features Mapping – A mapping exercise was completed to identify and delineate natural heritage features within the Study Area. This exercise included a compilation of digital vegetation layers obtained through the background information review as well as Ecological Land Classification community identification and delineation through the completion of field investigations and aerial photo interpretation as described above. Mapping of natural heritage features within the Study Area was completed following the guidelines outlined in the Middlesex Natural Heritage System Study (Middlesex Natural Heritage Systems Study, 2014). To maintain a consistent approach with that undertaken during field investigations, Ecological Land Classification community terminologies were used in place of the Middlesex Natural Heritage Systems Study defined Vegetation Communities. Following the Middlesex Natural Heritage Systems Study (2014), Vegetation Groups were established by grouping vegetation communities of similar structure within 20 metres of each other. This assessment resulted in the identification of five Vegetation Groups within the Study Area consisting of woodlands, wetlands, thickets, meadows, connected vegetation features and water features. Vegetation patches were then delineated by combining one or more abutting (less than 20 metres apart) vegetation groups. Using criteria outlined in Table 9 of the Middlesex Natural Heritage Systems Study (2014), an assessment was completed to identify significant natural features. **Table 5** below summarizes the criteria used to assess the natural heritage features identified within the W12A Landfill Study Area.

Table 5: Summary of Criteria for Significant Natural Heritage Features as outlined in Table 9 of the Middlesex Natural Heritage Systems Study (2014)

Applied to Vegetation	Criterion #	Feature Type	Description	Meets Criteria for Provincial Significance
Groups	1	Significant Valleylands	Any Vegetation Group within or touching a Significant Valleyland	Yes

Applied to Vegetation	Criterion #	Feature Type	Description	Meets Criteria for Provincial Significance
Groups	2	Areas of Natural and Scientific Interest	Any vegetation Group located within or touching a provincial or regional Life Science Areas of Natural and Scientific Interest	Yes
Groups	3	Open Watercourse	Any Vegetation Group located within 30 metres of an Open Watercourse	Yes
Groups	4	Wetlands	All evaluated wetlands and all unevaluated Wetland Vegetation Groups greater than 0.5 hectares	No; unless identified by Ontario Ministry of Natural Resources and Forestry
Groups	5	Woodland Size	Any Woodland Vegetation Group greater than or equal to 4 hectares	Yes
Groups	6	Woodland Proximity	Any Woodland Vegetation Group within 100 metres of a greater than or equal to 4 hectares Woodland Vegetation Group	Yes
Groups	7	Thicket Size	Any Thicket Vegetation Group greater than or equal to 2 hectares	No
Groups	8	Meadow Size	Any Meadow Vegetation Group greater than or equal to 10 hectares	No
Groups	9	Meadow Proximity	Any Meadow Vegetation Group within 100 metres of a greater than or equal to 4 hectares Woodland or greater than or equal to 2 hectare Thicket Vegetation Group	No
Patches	10	Patches with Vegetation Group that meet a Group Criteria	Any Vegetation Patch that contains a Vegetation Group that meets a group of Criteria (i.e., Meets Criteria 1 to 9 above)	No
Patches	11	Diversity	Any Vegetation Patch that contains a diversity of Vegetation Communities, Groups or Ecosystems	No
Patches	12	Proximity	Any Vegetation Patch within 100 metres of a significant Vegetation Patch (i.e., meets Criteria 10 or 11 above)	No

Applied to Vegetation	Criterion #	Feature Type	Description	Meets Criteria for Provincial Significance
Patches	13	Significant Wildlife Habitat	Any Vegetation Group that contains Significant Wildlife Habitat	Yes
Patches	14	Groundwater Dependent Wetland	Any Vegetation Group that contains Groundwater Dependent Wetland	Yes
Patches	15	Bluff or Depositional Area	All Watercourse Bluff or Depositional Areas	No

Results and Discussion

Vegetation communities identified within the Study Area included meadows, forests, woodlands, thickets and wetlands. The majority of the Study Area includes agricultural lands and cultural meadow communities associated with the active W12A Landfill. Two more contiguous natural heritage features are present north of Scotland Drive and contain a mosaic of vegetation communities. Five Vegetation Patches were identified within the Study Area. **Table 6** below provides a summary of the Vegetation Community Series identified within each Vegetation Patch, as well as a brief description of the natural heritage features identified within the Study Area. Vegetation communities and patches are delineated on **Figure 5**.

A list of plant species observed during field investigations per community can be found in **Appendix F**.

A full description of Ecological Land Classification communities identified within the Study Area can be found in **Appendix G**.

2.2.3.2 Bat Habitat Assessment

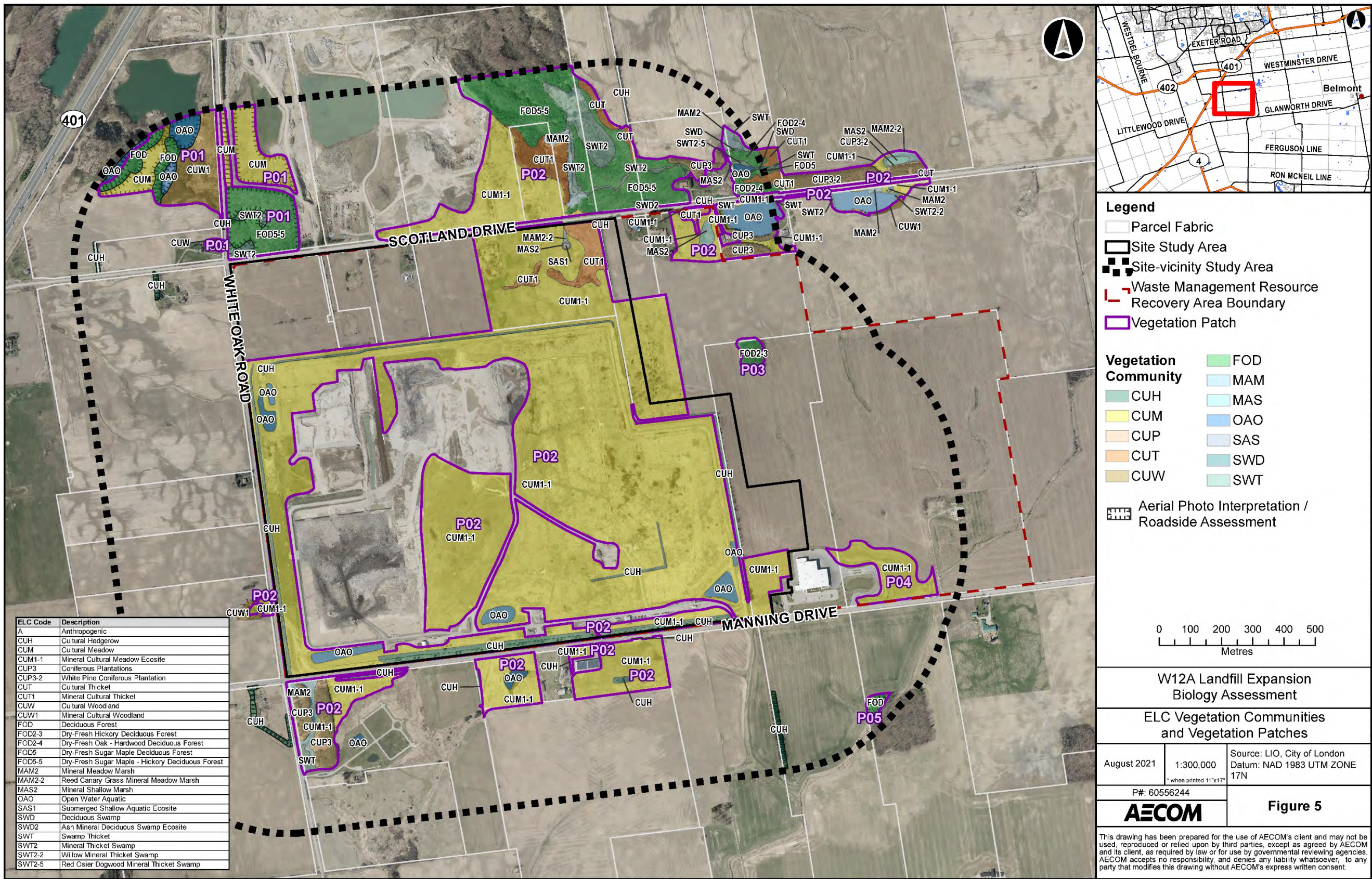
Background

During the background review and agency consultation as outlined in **Section 1.3** and **Section 1.6**, correspondence with the Ontario Ministry of Natural Resources and Forestry identified the potential for four species of Species at Risk bats to occur within the Study Area: Eastern Small-footed (*Myotis leibii*), Little Brown Myotis (*Myotis lucifugus*), Tri-coloured Bat (*Perimyotis subflavus*) and Northern Myotis (*Myotis septentrionalis*) (see **Appendix C**). These species are listed as Endangered provincially and are therefore afforded protection under the Endangered Species Act. As the Study Area contains treed forest and swamp communities, a bat habitat assessment was completed to determine the presence of maternity roosting habitat for Species at Risk and for Significant Wildlife Habitat (Bat Maternity Roosting Habitat).

Table 6: Vegetation Communities Summary for W12A Landfill Study Area

Vegetation Patch ID	Total Area	Ecological Land Classification Community Series Present	Ecological Land Classification Delineation Method	Patch Description	Natural Heritage Features Present
P01	16.00 hectares	<ul style="list-style-type: none"> ■ FOD – Deciduous Forest ■ OAO – Open Aquatic ■ CUW – Cultural Woodland ■ CUW1 – Mineral Cultural Woodland Ecosite ■ CUM – Cultural Meadow ■ SWT2 – Mineral Thicket Swamp ■ FOD5-5 – Dry-Fresh Sugar Maple – Hickory Deciduous Forest 	Aerial photo interpretation and roadside assessment	Patch P01 is located northwest of the subject lands and includes a mosaic of natural and cultural communities identified through field investigations.	Natural heritage features identified through review of Middlesex Natural Heritage Systems Study criteria (2014) and The London Plan (2016) include the following: <ul style="list-style-type: none"> ■ Significant Woodlands ■ Unevaluated Wetland The Significant Woodlands have the potential to provide suitable conditions for Significant Wildlife Habitat and/or Species at Risk habitat such as Bat Maternity Roosting Habitat and/or Species at Risk bat habitat.
P02	166.1 hectares	<ul style="list-style-type: none"> ■ A – Anthropogenic ■ CUH – Cultural Hedgerow ■ CUM1-1 – Mineral Cultural Meadow Ecosite ■ CUP3 – Coniferous Plantation ■ CUP3-2 – White Pine Coniferous Plantation ■ CUT – Cultural Thicket ■ CUT1 – Mineral Cultural Thicket Ecosite ■ FOD2-4 – Dry-Fresh Oak – Hardwood Deciduous Forest ■ FOD5 – Dry-Fresh Sugar Maple Deciduous Forest ■ FOD5-5 – Dry-Fresh Sugar Maple – Hickory Deciduous Forest ■ MAM2 – Mineral Meadow Marsh Ecosite ■ MAM2-2 – Reed Canary Grass Mineral Meadow Marsh ■ MAS – Shallow Marsh ■ OAO – Open Aquatic ■ SAS – Submerged Shallow Aquatic ■ SWD – Deciduous Swamp ■ SWD2 – Ash Mineral Marsh Deciduous Swamp Ecosite ■ SWT – Thicket Swamp ■ SWT2 – Mineral Thicket Swamp ■ SWT2-2 – Willow Mineral Thicket Swamp Type ■ SWT2-5 – Red Osier Dogwood Mineral Thicket Swamp 	Field investigations completed for W12A Landfill Expansion Environmental Assessment: Biology Assessment	Patch P02 is located south-southwest of the subject lands, within the subject lands, and north-northeast of the subject lands. The communities south and within the subject lands are primarily cultural communities, while the communities to the north of the subject lands are a mosaic of natural and cultural communities.	Natural heritage features identified through review of Middlesex Natural Heritage Systems Study criteria (2014) and The London Plan (2016) include the following: <ul style="list-style-type: none"> ■ Significant Woodlands ■ Locally Significant Wetlands (Silver Swamp) ■ Unevaluated Wetland ■ Valleyland ■ Potential Environmentally Significant Areas Additionally, Species at Risk habitat has been confirmed within the vegetation patch for the following species: <ul style="list-style-type: none"> ■ Bobolink ■ Eastern Meadowlark Vegetation groups within this patch have been confirmed as Significant Wildlife Habitat for the following: <ul style="list-style-type: none"> ■ Eastern Wood-pewee ■ Monarch ■ Terrestrial Crayfish ■ Amphibian Breeding (Woodland) Vegetation groups within this patch have also been identified as Candidate Significant Wildlife Habitat for the following: <ul style="list-style-type: none"> ■ Bat Maternity Colonies (Little Brown Myotis/Northern Myotis) ■ Turtle Overwintering Treed communities within this patch also have the potential to provide suitable bat Species at Risk habitat.
P03	0.694 hectares	<ul style="list-style-type: none"> ■ FOD2-3 – Dry-Fresh Hickory Deciduous Forest 	Field investigations completed for W12A Landfill Expansion Environmental Assessment: Biology Assessment	Patch P03 is located in the eastern portion of the subject lands and consists entirely of a single natural deciduous forest community.	Vegetation groups within this patch have been confirmed as Significant Wildlife Habitat for the following: <ul style="list-style-type: none"> ■ Other Rare Vegetation Communities Vegetation groups within this patch have also been identified as Candidate Significant Wildlife Habitat for the following: <ul style="list-style-type: none"> ■ Bat Maternity Colonies (Little Brown Myotis/Northern Myotis) This community may also provide suitable bat Species at Risk habitat.
P04	3.263 hectares	<ul style="list-style-type: none"> ■ CUM1-1 – Mineral Cultural Meadow Ecosite 	Field investigations completed for W12 Landfill Expansion Environmental Assessment: Biology Assessment	Patch P04 is located immediately southeast of the subject lands and consists entirely of a single cultural meadow community.	Natural heritage features identified through review of Middlesex Natural Heritage Systems Study criteria (2014) and The London Plan (2016) include the following: <ul style="list-style-type: none"> ■ Valleyland
P05	0.365 hectares	<ul style="list-style-type: none"> ■ FOD – Deciduous Forest 	Field investigations completed for W12A Landfill Expansion Environmental Assessment: Biology Assessment	Patch P05 is located southeast of subject lands and south of P04. This patch consists entirely of a single natural deciduous forest community.	Natural heritage features identified through review of Middlesex Natural Heritage Systems Study criteria (2014) and The London Plan (2016) include the following: <ul style="list-style-type: none"> ■ Significant Woodlands ■ Valleyland The Significant Woodlands have the potential to provide suitable conditions for Significant Wildlife Habitat and/or Species at Risk habitat such as Bat Maternity Roosting Habitat and/or Species at Risk bat habitat.

Figure 5: Ecological Land Classification Vegetation Communities and Vegetation Patches



Field Investigation Methods

Trees within the Study Area were assessed for candidate bat habitat according to the Ontario Ministry of Natural Resources and Forestry guidelines outlined in the Survey Protocol for Species at Risk Bats within Treed Habitats (Ontario Ministry of Natural Resources and Forestry, 2017a). Surveys included area searches within suitable ecosites less than 10 hectares in size (properties at 3298 Scotland Drive, 3405 Scotland Drive, 6100 White Oak Road) and plot surveys in those ecosites greater than 10 hectares (properties at 3502 Scotland Drive and 3483 and 3583 Westminster Drive). The surveys were conducted during the leaf-off period to assess trees with a diameter at breast height greater than 10 cm for cavities, cracks, loose bark, or knot holes in addition to leaf clusters that provide maternity roosting habitat for Species at Risk bats. Dates of the bat habitat assessments are provided in **Section 2.2.1**. The location of the surveys is presented on **Figure 3**.

Results and Discussion

Eighty-nine trees were observed that showed suitable characteristics for Little Brown Myotis/ Northern Myotis bats. Twenty-seven trees were identified within the FOD2-3 at 3438 Manning Drive, twelve within the FOD5-5 at 3502 Scotland Drive, twenty-eight within the FOD5-5 at 3483 Westminster Drive, eight within the FOD5-5 at 3583 Westminster Drive, three within the CUP3 at 3298 Scotland Drive, and eleven within the CUP3 at 6100 White Oak Road. No suitable leaf clusters were observed. **Appendix H** provides the results of the bat habitat assessment.

According to the Survey Protocol for Species at Risk Bats within Treed Habitats (Ontario Ministry of Natural Resources and Forestry, 2017a), there is no minimum threshold for snags/ha to be considered suitable maternity roost habitat, although Ecological Land Classification ecosites with 10 or more snags/ha may be considered high quality habitat. Based upon the results of the bat habitat assessment, candidate habitat for Species at Risk bats and corresponding Significant Wildlife Habitat may be present within the Study Area. Further acoustic monitoring would be required to confirm the presence of Species at Risk bats and/or Significant Wildlife Habitat for Bat Maternity Roosting Habitat in the identified candidate habitat within the Study Area. If Species at Risk bats are recorded during acoustic monitoring and impacts to these features were anticipated, these data can be used to calculate snag densities to determine the quality of bat habitat present, which would then be used in consultation with Ministry of Environment, Conservation and Parks to determine requirements under the Endangered Species Act.

Since the identified bat cavity trees are outside of the Subject Lands, there will be no loss of bat cavity trees from landfill expansion within the subject lands.

Additional details on Species at Risk bats and Significant Wildlife Habitat for bats can be found in **Section 2.3.4** and **Section 2.3.5**, respectively.

2.2.3.3 Breeding Birds

Background

A review of background information outlined in **Section 1.3** identified ninety-one species of birds with various levels of breeding evidence within the 10 kilometres by 10 kilometres square (17MH84) that encompasses the Study Area (BSC *et al.*, 2016). Of these species, four were listed as provincially Threatened and four were listed as Special Concern under the Species at Risk in Ontario List (Ontario Regulation 230/08) (see **Table 7**). **Appendix I** presents a list of Breeding Birds within the Study Area. Breeding bird surveys were completed to determine the presence of Species at Risk and Species of Conservation Concern birds within the Study Area.

Table 7: Ontario Breeding Bird Atlas Significant Species Records Within or in the Vicinity of the Study Area

Common Name	Scientific Name	S-Rank	Endangered Species Act Status	Breeding Evidence
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	S4B – Apparently Secure Breeding Population	Special Concern	Confirmed
Bank Swallow	<i>Riparia riparia</i>	S4B – Apparently Secure Breeding Population	Threatened	Confirmed
Barn Swallow	<i>Hirundo rustica</i>	S4B – Apparently Secure Breeding Population	Threatened	Confirmed
Bobolink	<i>Dolichonyx oryzivorus</i>	S4B – Apparently Secure Breeding Population	Threatened	Confirmed
Eastern Meadowlark	<i>Sturnella magna</i>	S4B – Apparently Secure Breeding Population	Threatened	Confirmed
Eastern Wood-pewee	<i>Contopus virens</i>	S4B – Apparently Secure Breeding Population	Special Concern	Probable
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	S4B – Apparently Secure Breeding Population	Special Concern	Possible
Wood Thrush	<i>Hylocichla mustelina</i>	S4B – Apparently Secure Breeding Population	Special Concern	Confirmed

Field Investigation Methods

Due to the size and diversity of habitats within southern Ontario, several bird monitoring protocols have been developed that focus on targeting groups of birds including the Forest Bird Monitoring Program developed by the Environment Canada – Canadian Wildlife Service (Environment Canada-Canadian Wildlife Service, 2009) and the Marsh Monitoring Program (Bird Studies Canada *et al.* 2009). Similarly, the Ontario Breeding Bird Atlas *Guide for Participants* (2001) provides additional methods for conducting breeding bird surveys throughout Ontario. These protocols outline the methods to be conducted in order to obtain representative and unbiased data. The methods listed below outline proper site selection, timing including time of day and time of year to

conduct the surveys and suitable weather conditions (Environment Canada-Canadian Wildlife Service, 2009; Ontario Breeding Bird Atlas, 2001).

Under the Canadian Wildlife Service Forest Bird Monitoring Program, survey stations should typically occur within an individual community that is characterized by uniform community structure. Within these communities, stations should be located at least 250 metres apart and 100 metres from the edge (Environment Canada-Canadian Wildlife Service, 2009). Survey stations were situated in natural areas that occur within the Study Area boundary. These natural areas were comprised predominantly of cultural meadow communities. Each station was located at least 200 metres apart to maintain a degree of separation and reduce the chances of double counting individual birds. Six stations were established within natural features located in the subject lands. Locations of breeding bird survey stations are shown on **Figure 3**.

Due to the presence of Bobolink and Eastern Meadowlark, as determined during the first visit conducted on June 7th, 2018, three point-count surveys were completed at each station during the breeding bird period between May 24 and July 10 in order to confirm breeding evidence for these species (Ontario Breeding Bird Atlas, 2001; Ontario Ministry of Natural Resources and Forestry, 2012). The separate surveys are recommended as they typically provide data that more accurately reflects the number of species and birds utilizing the habitat at each station (Environment Canada-Canadian Wildlife Service, 2009). Surveys were completed between 5:00 am and 10:00 am under appropriate weather conditions (i.e., no precipitation, calm to light wind) (Environment Canada-Canadian Wildlife Service, 2009). Each point-count consisted of a ten minute survey during which time, species, breeding evidence and individual bird movement within a 100 metre radius was recorded. Species heard outside of the 100 metre radius or that were observed outside of their breeding habitat within the 100 metre radius (i.e., flyovers) were recorded separately.

Results and Discussion

Forty-three bird species, included in **Table 8**, were identified within the subject lands during field investigations. Of these species, four were recorded as ‘confirmed’, eleven as ‘probable’ and eighteen as ‘possible’ breeders within the subject lands. Ten species were observed but were not exhibiting breeding evidence. Additionally, five provincially listed species under the Endangered Species Act were observed within the subject lands, including four Threatened species - Bank Swallow (*Riparia riparia*), Barn Swallow (*Hirundo rustica*), Bobolink (*Dolichonyx oryzivorus*), and Eastern Meadowlark (*Sturnella magna*), and one Special Concern species - Eastern Wood-pewee (*Contopus virens*).

Table 8: Summary of Breeding Bird Evidence Recorded within the W12A Landfill Study Area

Common Name	Scientific Name	AECOM Observations (see Figure 3 locations) BS-01	AECOM Observations (see Figure 3 locations) BS-02	AECOM Observations (see Figure 3 locations) BS-03	AECOM Observations (see Figure 3 locations) BS-04	AECOM Observations (see Figure 3 locations) BS-05	AECOM Observations (see Figure 3 locations) BS-06	AECOM Observations (see Figure 3 locations) Incidental
Green Heron	<i>Butorides virescens</i>	-	-	-	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)
Canada Goose	<i>Branta canadensis</i>	-	-	-	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)
Mallard	<i>Anas platyrhynchos</i>	-	-	-	-	-	-	Possible: H - Species observed in its breeding season in suitable habitat
Turkey Vulture	<i>Cathartes aura</i>	-	-	-	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)
Sharp-shinned Hawk	<i>Accipiter striatus</i>	-	-	-	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)
Red-tailed Hawk	<i>Buteo jamaicensis</i>	-	-	-	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)
Wild Turkey	<i>Meleagris gallopavo</i>	-	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Killdeer	<i>Charadrius vociferus</i>	-	-	Probable: A - Agitated behaviour or anxiety calls of an adult	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Confirmed: FY - Recently fledged young or downy young, including young incapable of sustained flight
Spotted Sandpiper	<i>Actitis macularia</i>	-	-	-	-	-	-	Confirmed: FY - Recently fledged young or downy young, including young incapable of sustained flight
Mourning Dove	<i>Zenaida macroura</i>	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Eastern Wood-Pewee	<i>Contopus virens</i>	-	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Alder Flycatcher	<i>Empidonax alnorum</i>	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Willow Flycatcher	<i>Empidonax traillii</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Eastern Kingbird	<i>Tyrannus tyrannus</i>	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	Probable: P - Pair observed in their breeding season in suitable nesting habitat.	Observed: X – Species observed in its breeding season (no evidence of breeding)	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Horned Lark	<i>Eremophila alpestris</i>	-	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat

Common Name	Scientific Name	AECOM Observations (see Figure 3 locations) BS-01	AECOM Observations (see Figure 3 locations) BS-02	AECOM Observations (see Figure 3 locations) BS-03	AECOM Observations (see Figure 3 locations) BS-04	AECOM Observations (see Figure 3 locations) BS-05	AECOM Observations (see Figure 3 locations) BS-06	AECOM Observations (see Figure 3 locations) Incidental
Tree Swallow	<i>Tachycineta bicolor</i>	Observed: X – Species observed in its breeding season (no evidence of breeding)	-	Observed: X – Species observed in its breeding season (no evidence of breeding)	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)	-
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)	-	Observed: X – Species observed in its breeding season (no evidence of breeding)	-
Bank Swallow	<i>Riparia riparia</i>	Observed: X – Species observed in its breeding season (no evidence of breeding)	Observed: X – Species observed in its breeding season (no evidence of breeding)	-	-	-	-	-
Barn Swallow	<i>Hirundo rustica</i>	Observed: X – Species observed in its breeding season (no evidence of breeding)	-	Observed: X – Species observed in its breeding season (no evidence of breeding)	-	Observed: X – Species observed in its breeding season (no evidence of breeding)	Observed: X – Species observed in its breeding season (no evidence of breeding)	Observed: X – Species observed in its breeding season (no evidence of breeding)
American Crow	<i>Corvus brachyrhynchos</i>	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-
Black-capped Chickadee	<i>Poecile atricapillus</i>	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
House Wren	<i>Troglodytes aedon</i>	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
American Robin	<i>Turdus migratorius</i>	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	Probable: A - Agitated behaviour or anxiety calls of an adult	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Gray Catbird	<i>Dumetella carolinensis</i>	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-
Cedar Waxwing	<i>Bombycilla cedrorum</i>	-	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Red-eyed Vireo	<i>Vireo olivaceus</i>	-	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Yellow Warbler	<i>Dendroica petechia</i>	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Common Yellowthroat	<i>Geothlypis trichas</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Northern Cardinal	<i>Cardinalis cardinalis</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: A - Agitated behaviour or anxiety calls of an adult	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat

Common Name	Scientific Name	AECOM Observations (see Figure 3 locations) BS-01	AECOM Observations (see Figure 3 locations) BS-02	AECOM Observations (see Figure 3 locations) BS-03	AECOM Observations (see Figure 3 locations) BS-04	AECOM Observations (see Figure 3 locations) BS-05	AECOM Observations (see Figure 3 locations) BS-06	AECOM Observations (see Figure 3 locations) Incidental
Indigo Bunting	<i>Passerina cyanea</i>	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-
Chipping Sparrow	<i>Spizella passerina</i>	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Clay-coloured Sparrow	<i>Spizella pallida</i>	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	-	-	-	-
Field Sparrow	<i>Spizella pusilla</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	-	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Savannah Sparrow	<i>Passerculus sandwichensis</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: A - Agitated behaviour or anxiety calls of an adult	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: A - Agitated behaviour or anxiety calls of an adult	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Song Sparrow	<i>Melospiza melodia</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: A - Agitated behaviour or anxiety calls of an adult	Probable: A - Agitated behaviour or anxiety calls of an adult
Bobolink	<i>Dolichonyx oryzivorus</i>	-	Confirmed: CF - Adult carrying food for young.	Probable: A - Agitated behaviour or anxiety calls of an adult	Probable: P - Pair observed in their breeding season in suitable nesting habitat.	Probable: P - Pair observed in their breeding season in suitable nesting habitat.	-	Confirmed: CF - Adult carrying food for young.
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	-	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Confirmed: CF - Adult carrying food for young.	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Probable: A - Agitated behaviour or anxiety calls of an adult	Probable: A - Agitated behaviour or anxiety calls of an adult	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Eastern Meadowlark	<i>Sturnella magna</i>	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: P - Pair observed in their breeding season in suitable nesting habitat.	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	Probable: T - Permanent territory presumed through registration of territorial song on at least 2 days, a week or more apart at the same place	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Common Grackle	<i>Quiscalus quiscula</i>	-	-	-	-	-	-	Observed: X – Species observed in its breeding season (no evidence of breeding)
Brown-headed Cowbird	<i>Molothrus ater</i>	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	-	-	Possible: H - Species observed in its breeding season in suitable habitat	-
Orchard Oriole	<i>Icterus spurius</i>	-	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat
Baltimore Oriole	<i>Icterus galbula</i>	-	-	-	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-
American Goldfinch	<i>Carduelis tristis</i>	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	-	-	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat	Possible: S - Singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat

Note: Breeding Bird Evidence (Ontario Breeding Bird Atlas, 2001)

Bank Swallows (*Riparia riparia*) were observed foraging over cultural meadow at BS-01 and BS-02 during breeding bird surveys completed in 2018. This species builds their nests within burrows dug into natural (e.g., banks of rivers or lakes) and human-made vertical surfaces (i.e., active sand and gravel pits where banks remain stable) made of silt and sand deposits (Ontario Ministry of Natural Resources and Forestry, 2018). Bank swallows are considered colonially nesters which can range in size from several to a few thousand pairs (Ontario Ministry of Natural Resources and Forestry, 2018). This species is designated as Threatened provincially and will be discussed in more detail in **Section 2.2.4** and **Section 2.2.8** below. Although no nesting habitat for Bank Swallow was observed during field investigations, it is anticipated that the species is utilizing potential habitat provided by the aggregate facility located north of Scotland Drive. Access to this property was not granted at the time of investigations and, therefore, habitat for the species could not be confirmed.

Similar to Bank Swallow, Barn Swallows (*Hirundo rustica*) were observed foraging over agricultural fields and cultural meadow at BS-01, BS-03, BS-05 and BS-06 during breeding bird surveys completed in 2018. Barn Swallow habitat consists almost exclusively of human-made structures including barns, bridges and culverts which provide ledges on which they can build their cup-shaped nests out of mud (Ministry of Environment, Conservation and Parks, 2019). Barn Swallows are aerial-insectivores which are frequently observed foraging over open areas including pastures, meadows, wetlands, agricultural fields and parks. No nesting was observed during site investigations; however, it is anticipated that the species is nesting in structures present within the Study Area. Barn Swallow is listed as Threatened in Ontario –protection for this species, along with its habitat is afforded protection under the Endangered Species Act. This species will be discussed in more detail in **Section 2.2.4** and **Section 2.2.8** below.

Bobolink (*Dolichonyx oryzivorus*) was observed within cultural meadow communities in the Study Area during breeding bird surveys (BS-02, BS-03, BS-04, BS-05). This species breeds in a variety of natural and anthropogenic grasslands such as meadows, pastures and hayfields where small trees, shrubs and fence posts are used as elevated song perches (Ontario Ministry of Natural Resources and Forestry, 2018). This species was confirmed breeding within the Study Area. Bobolink is designated as Threatened provincially and is afforded protection under the Endangered Species Act. This species will be discussed further in **Section 2.2.4** and **Section 2.2.8** below.

Eastern Meadowlark (*Sturnella magna*) was also observed within cultural meadow communities (BS-01, BS-02, BS-03, BS-04 and BS-06) throughout the Study Area during breeding bird surveys. Similar to Bobolink, Eastern Meadowlark primarily breeds in tall grasslands including pastures and hayfields, but they can also be observed in

alfalfa fields, weedy borders or croplands, roadsides, orchards, airports, overgrown fields and other open areas (Ontario Ministry of Natural Resources and Forestry, 2018). This species is designated as Threatened under the Species at Risk in Ontario List (Ontario Regulation 230/08); this species and its habitat is therefore afforded protection under the Endangered Species Act.

Eastern Wood-pewee (*Contopus virens*) was observed within the Dry-Fresh Sugar Maple – Hickory Deciduous Forest (FOD5-5) located at the northeast portion of the Study Area. This species commonly nests in the mid-canopy of forest clearings and edges of deciduous and mixed forests, commonly with little understorey vegetation (Ontario Ministry of Natural Resources and Forestry, 2018). A singing male was observed during field investigations completed during the breeding bird season. Eastern Wood-pewee is designated as Special Concern provincially. Although this species is not afforded protection under the Endangered Species Act, the species is considered a Species of Conservation Concern – habitat for this species is considered Significant Wildlife Habitat as defined by the Significant Wildlife Habitat Ecoregion 7E Criterion Schedule (Ontario Ministry of Natural Resources and Forestry, 2015). This species and its habitat are discussed further in **Section 2.2.5** below.

In addition to Bobolink and Eastern Meadowlark, two area-sensitive bird species were also observed during the breeding bird surveys or incidentally:

- Sharp-shinned Hawk (*Accipiter striatus*)
- Savannah Sparrow (*Passerculus sandwichensis*)

These species require larger areas of suitable habitat for successful breeding and, in turn, sustain populations. As such, these species can provide an indicator of habitat quality and availability within the Study Area.

All other bird species observed are fairly common to abundant and widespread in southern Ontario. The majority of native bird species and their active nests are protected under the federal *Migratory Birds Convention Act, 1994*. Some bird species which are not under federal jurisdiction, such as raptors, are protected under Ontario's *Fish and Wildlife Conservation Act, 1997*. Nests of these species can only be removed if a permit is obtained from the Ministry of Natural Resources

2.2.3.4 Amphibians

Background

A review of the background information as outlined in **Section 1.3** identified no significant amphibian species within the Study Area (Ontario Nature, 2017). The

potential presence of other species such as gray treefrog (*Hyla versicolor*), spring peeper (*Pseudacris crucifer*), western chorus frog (*Pseudacris triseriata*), and wood frog (*Rana (Lithobates) sylvatica*) indicate the potential for Significant Wildlife Habitat. Therefore, surveys were conducted to determine the presence and populations of anuran species within the Study Area and determine the presence of Significant Wildlife Habitat including Amphibian Breeding Habitat.

Field Investigation Methods

Anuran call surveys were conducted at eleven wetland communities within the Study Area. The location of each anuran call survey can be found on **Figure 3**. These surveys were conducted following the Ontario Marsh Monitoring Program (Bird Studies Canada 2008).

In order to detect both early and late anuran breeders, three site visits were conducted during the breeding season (April to July). In accordance with the protocol, surveys did not begin until at least one-half hour after sunset and were completed before midnight. In addition, surveys were only conducted during suitable weather conditions which included winds less than 19 kilometres per hour (0-4 on the Beaufort wind scale) and minimum night-time air temperatures of at least 5 degree Celsius for the first survey, 10 degree Celsius for the second survey and 17 degree Celsius for the third survey. It should be noted that surveys can be conducted at lower temperatures if there is strong calling activity observed. Species observed and call frequency were recorded by biologists during each three-minute point count. The frequency categories of anuran calls are as follows:

- 0 – None heard.
- 1 – Individuals can be counted, calls not overlapping. Abundance is recorded with this call code (e.g., SPPE1-1; Call Code -1, Count 1)
- 2 – Numbers of some individuals can be estimated or counted, others overlapping. Abundance is recorded with this call code (e.g., SPPE2-5; Call Code – 2, Count - 5)
- 3 – Full chorus, calls continuous and overlapping, and individuals not distinguishable. Abundance is not recorded with this call as it cannot be reliably estimated (e.g., SPPE3).

Results and Discussion

The results of anuran call surveys are summarized in **Table 9**. Species observed within the Study Area during field investigations include spring peeper, wood frog, American toad (*Anaxyrus americanus*), northern leopard frog (*Lithobates pipiens*), gray tree frog and green frog (*Rana clamitans*).

Table 9: Anuran Call Survey Results

Round	Station Name	Date	Start Time	End Time	Temperature (C)	Beaufort Scale	Precipitation	Background Noise	Species Observed Within 100 metre Station (code/count)	Species Observed Outside 100 metre Station
1	AMP-01	23-Apr-18	21:43	21:46	14	3	None	0	None	None
1	AMP-02	23-Apr-18	20:33	20:36	20	1	None	0	SPPE3 – Spring Peeper WOFR3 – Wood Frog	None
1	AMP-03	23-Apr-18	20:50	20:53	20	1	None	0	SPPE3 – Spring Peeper	WOFR1-1 – Wood Frog SPPE3 – Spring Peeper
1	AMP-04	23-Apr-18	20:59	21:02	20	1	None	0	SPPE3 – Spring Peeper WOFR1-1 – Wood Frog	None
1	AMP-05	23-Apr-18	21:12	21:15	15	3	None	1	None	None
1	AMP-06	9-May-18	21:22	21:25	14	2	None	2	None	None
1	AMP-07	9-May-18	21:32	21:36	14	2	None	2	AMTO1-1 – American Toad SPPE2-4 – Spring Peeper	None
1	AMP-08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	AMP-09	23-Apr-18	21:28	21:31	14	2	None	1	SPPE3 – Spring Peeper NLFR1-1 – Northern Leopard Frog	None
1	AMP-10	23-Apr-18	21:55	21:58	12	2	None	0	SPPE3 – Spring Peeper	SPPE3 – Spring Peeper
1	AMP-11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	AMP-01	31-May-18	21:29	21:32	23	1	None	2	GRTR1-3– Gray Tree Frog GRFR1-1 – Green Frog	SPPE1-2 – Spring Peeper
2	AMP-02	31-May-18	21:07	21:10	24	3	None	1	None	None
2	AMP-03	31-May-18	22:53	22:56	23	3	None	1	GRTR2-6– Gray Tree Frog	None
2	AMP-04	31-May-18	22:10	22:13	23	3	None	2	GRTR2-3– Gray Tree Frog	None
2	AMP-05	31-May-18	22:22	22:25	23	3	None	3	GRTR2-3– Gray Tree Frog	None
2	AMP-06	31-May-18	22:38	22:41	23	2	None	2	None	None
2	AMP-07	31-May-18	22:31	22:35	23	2	None	2	GRFR1-1 – Green Frog	None
2	AMP-08	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2	AMP-09	31-May-18	21:45	21:48	23	2	None	1	GRFR1-1 – Green Frog GRTR2-7– Gray Tree Frog	None
2	AMP-10	31-May-18	22:02	22:05	24	2	None	2	GRTR1-1– Gray Tree Frog GRFR1-1 – Green Frog	None
2	AMP-11	31-May-18	21:54	21:58	23	3	None	1	None	None
3	AMP-01	3-Jul-18	21:50	21:53	29	1	None	1	GRFR1-1 – Green Frog GRTR1-1– Gray Tree Frog	None
3	AMP-02	3-Jul-18	22:06	22:09	23	1	None	2	None	None
3	AMP-03	3-Jul-18	22:24	22:27	23	1	None	1	GRFR1-1 – Green Frog	GRTR2-3 – Gray Tree Frog
3	AMP-04	3-Jul-18	22:35	22:38	22	0	None	2	GRFR1-1 – Green Frog	GRTR1-1 – Gray Tree Frog
3	AMP-05	3-Jul-18	22:45	22:48	20	2	None	3	GRTR3	None
3	AMP-06	3-Jul-18	22:59	22:02	20	0	None	1	None	GRFR1-1 – Green Frog
3	AMP-07	3-Jul-18	23:08	23:11	19	2	None	2	GRFR1-1 – Green Frog	GRFR1-2 – Green Frog GRTR1-1 – Gray Tree Frog
3	AMP-08	3-Jul-18	23:18	23:21	19	1	None	2	GRFR1-5 – Green Frog	GRTR2-3 – Gray Tree Frog
3	AMP-09	3-Jul-18	23:31	23:34	19	2	None	2	NLFR1-1 – Northern Leopard Frog GRFR1-3 – Green Frog GRTR1-1 – Gray Tree Frog	None
3	AMP-10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3	AMP-11	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

No amphibian Species at Risk were recorded during field investigations conducted by AECOM staff in 2018. However, calling activity documented at AMP-02 met criteria for Amphibian Breeding (Woodland) Significant Wildlife Habitat. Therefore, the Mineral Thicket Swamp (SWT2) which is part of the Silver Swamp Locally Significant wetland, is considered Significant Wildlife Habitat. This habitat will be discussed in more detail in **Section 2.2.5** below.

2.2.3.5 Reptiles

Background

A review of the background information, as outlined in **Section 1.3**, identified two reptile species within the 10 kilometres square by 10 kilometres square (17MH84) that overlaps the Study Area (Ontario Nature, 2017). These species included two provincially listed Special Concern species. These species are presented in **Table 10**.

Table 10: Ontario Reptile and Amphibian Atlas Significant Reptile Records Within or in the Vicinity of the Study Area

Common Name	Scientific Name	Species at Risk Act Status	Committee on the Status of Endangered Wildlife in Canada Status	Endangered Species Act Status	S-rank
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	Special Concern Schedule 1	Special Concern	Special Concern	S3 – Vulnerable
Snapping Turtle	<i>Chelydra serpentina</i>	Special Concern Schedule 1	Special Concern	Special Concern	S3 – Vulnerable

Field Investigation Methods

During initial site investigations, AECOM staff recorded potential snake habitat/hibernacula within the Study Area. Dimensions of any rock or debris piles observed were recorded as well as a description of surrounding habitat conditions, slope and likelihood of the observed piles extending below frost line. The type of material and approximate size of the hibernacula was also recorded. These observations were used to inform the placement of cover boards for Artificial Cover Surveys within the Study Area.

Snake surveys included both Visual Encounter Surveys and Artificial Cover (e.g., cover board) surveys following the Survey Protocol for Ontario's Species at Risk Snakes (Ontario Ministry of Natural Resources and Forestry, 2016). Five Visual Encounter Surveys and four cover board surveys were conducted under ideal weather conditions including, calm, clear or partly cloudy days and with a temperature range of 10 degree Celsius to 25 degree Celsius (on very warm days, surveys were conducted in the

morning). Where large stones or other cover objects were observed, they were slowly and carefully overturned and checked for the presence of snakes. Cover boards were also overturned and gently replaced to check for the presence of snakes. Any snake species observed was visually identified; the estimated length and any other visible distinguishing characteristics were recorded. Locations of snake cover boards are shown on **Figure 3**. A description of cover board locations can also be found in **Table 11** below.

Table 11: Snake Cover Board Locations

Cover Board Name	GPS Location	Description
CB-01	E. 482550 N. 4748521	At edge of coniferous plantation within cultural meadow
CB-02	E. 482228 N. 4748500	In clearing within a cultural thicket
CB-03	E. 481265 N. 4746917	Within cultural meadow adjacent to tree row
CB-04	E. 480533 N. 4747141	Within cultural meadow adjacent to old house foundation
CB-05	E. 481666 N. 4748321	Within cultural meadow adjacent to tree row
CB-06	E. 481753 N. 4748559	In clearing within cultural thicket near edge of deciduous forest
CB-07	E. 480874 N. 4748019	In cultural meadow adjacent to old house foundation
CB-08	E. 480829 N. 4748044	In cultural meadow adjacent to old house foundation
CB-09	E. 480801 N. 4746699	At edge of coniferous plantation within cultural meadow
CB-10	E. 482203 N. 4748301	At edge of coniferous plantation within cultural meadow

Results and Discussion

Three potential hibernacula sites were observed during field investigations. **Table 12** summarizes the potential hibernacula location and brief description of each feature.

Table 12: Potential Snake Hibernacula Locations

Hibernacula	GPS Location	Description
Hibernacula 1	E. 482223 N. 4748312	Concrete debris pile adjacent to coniferous plantation
Hibernacula 2	E. 480872 N. 4748017	Residential building debris in cultural meadow
Hibernacula 3	E. 480527 N. 4747150	Rock pile and old residence debris/foundation adjacent to small woodland and agricultural field

Table 13 below presents the results of cover board surveys and **Table 14** presents the results of the area searches.

Table 13: Summary of Snake Cover Board Surveys within the Study Area

Visit	Cover Board	Temperature (degrees Celsius)	Species Observed
Visit 1 – May 31 st	CB-01	28	None
Visit 1 – May 31 st	CB-02	28	None
Visit 1 – May 31 st	CB-03	28	None
Visit 1 – May 31 st	CB-04	28	None
Visit 1 – May 31 st	CB-05	28	None
Visit 1 – May 31 st	CB-06	28	None
Visit 1 – May 31 st	CB-07	28	None
Visit 1 – May 31 st	CB-08	28	None
Visit 1 – May 31 st	CB-09	28	None
Visit 1 – May 31 st	CB-10	28	None
Visit 2 – July 20 th	CB-01	24	None
Visit 2 – July 20 th	CB-02	24	None
Visit 2 – July 20 th	CB-03	24	None
Visit 2 – July 20 th	CB-04	24	None
Visit 2 – July 20 th	CB-05	24	None
Visit 2 – July 20 th	CB-06	24	None
Visit 2 – July 20 th	CB-07	24	Boards Buried
Visit 2 – July 20 th	CB-08	24	Boards Buried
Visit 2 – July 20 th	CB-09	24	None
Visit 2 – July 20 th	CB-10	24	None
Visit 3 – July 27 th	CB-01	17	None
Visit 3 – July 27 th	CB-02	17	None
Visit 3 – July 27 th	CB-03	17	None
Visit 3 – July 27 th	CB-04	17	None
Visit 3 – July 27 th	CB-05	17	None
Visit 3 – July 27 th	CB-06	17	None
Visit 3 – July 27 th	CB-07	17	Boards Buried
Visit 3 – July 27 th	CB-08	17	Boards Buried
Visit 3 – July 27 th	CB-09	17	None
Visit 3 – July 27 th	CB-10	17	None
Visit 4 – August 9 th	CB-01	19-31	None
Visit 4 – August 9 th	CB-02	19-31	None
Visit 4 – August 9 th	CB-03	19-31	None
Visit 4 – August 9 th	CB-04	19-31	None
Visit 4 – August 9 th	CB-05	19-31	None
Visit 4 – August 9 th	CB-06	19-31	None
Visit 4 – August 9 th	CB-07	19-31	Boards Buried
Visit 4 – August 9 th	CB-08	19-31	Boards Buried
Visit 4 – August 9 th	CB-09	19-31	None
Visit 4 – August 9 th	CB-10	19-31	None

Table 14: Summary of Visual Encounter Surveys within the Study Area

Visit	Temperature (degrees Celsius)	Species	GPS Location
Visit 1	19	Eastern Gartersnake	E. 482571 N. 4748516
Visit 2	N/A	None	N/A
Visit 3	N/A	None	N/A
Visit 4	N/A	None	N/A

No significant snake species were observed during area searches or cover board surveys. One species, Eastern Gartersnake (*Thamnophis sirtalis*) was observed during Visual Encounter Surveys. This species is common and widespread throughout Ontario.

2.2.3.6 Lepidoptera and Odonata

Background

A review of the background information as outlined in **Section 1.3** identified thirteen (13) butterfly species as potentially present within the square (17MH84) that encompasses the Study Area (**Table 15**). All species identified during the background review as potentially occurring within the Study Area are common and widespread species within Ontario. No Species at Risk butterflies, dragonflies or damselflies were identified during background review.

Table 15: Butterfly Atlas Records Within or in the Vicinity of the Study Area

Common Name	Scientific Name	S-rank
Fiery Skipper	<i>Hylephila phyleus</i>	SNA – Not Applicable
Tawny-edged Skipper	<i>Polites themistocles</i>	S5 – Secure
Northern Broken-Dash	<i>Wallengrenia egeremet</i>	S5 – Secure
Mulberry Wing	<i>Poanes massasoit</i>	S4 – Apparently Secure
Hobomok Skipper	<i>Poanes hobomok</i>	S5 – Secure
Black Dash	<i>Euphyes conspicua</i>	S3 – Vulnerable
Banded Hairstreak	<i>Satyrium calanus</i>	S4 – Apparently Secure
Striped Hairstreak	<i>Satyrium liparops</i>	S5 – Secure
Great Spangled Fritillary	<i>Speyeria cybele</i>	S5 – Secure
Meadow Fritillary	<i>Boloria bellona</i>	S5 – Secure
Baltimore Checkerspot	<i>Euphydryas phaeton</i>	S4 – Apparently Secure
Viceroy	<i>Limenitis archippus</i>	S5 – Secure
Eyed Brown	<i>Lethe eurydice</i>	S5 – Secure

Field Investigation Methods

All observations of butterflies, damselflies and dragonflies were recorded during the completion of other field surveys.

Results and Discussion

Eight odonatan species and six lepidopteran species were observed within the Study Area during field investigations. **Table 16** below presents the results of Lepidoptera and Odonata observations.

Table 16: Summary of Lepidoptera & Odonata Results

Common Name	Scientific Name	S-Rank
White-faced Meadowhawk	<i>Sympetrum obtrusum</i>	S5 – Secure
Eastern Forktail	<i>Ishnura verticalis</i>	S5 – Secure
Black Saddlebags	<i>Tramea lacerate</i>	S4 – Apparently Secure
Calico Pennant	<i>Celithemis elisa</i>	S5 – Secure
Widow Skimmer	<i>Libellula luctuosa</i>	S5 – Secure
Common Whitetail	<i>Plathemis Lydia</i>	S5 – Secure
Cabbage White	<i>Pieris rapae</i>	SNA – Not Applicable
Giant Swallowtail	<i>Papilio cresphontes</i>	S4 – Apparently Secure
Common Wood-nymph	<i>Cercyonis pegala</i>	S5 – Secure
Ebony Jewelwing	<i>Calopteryx maculata</i>	S5 – Secure
Viceroy	<i>Limenitis archippus</i>	S5 – Secure
Slender Spreadwing	<i>Lestes rectangularis</i>	S5 – Secure
Monarch	<i>Danaus plexippus</i>	S2N – Imperiled Nonbreeding Population S4B – Apparently Secure Breeding Population
Eastern Tailed Blue	<i>Cupido comyntas</i>	S5 – Secure

Monarch (*Danaus plexippus*) was observed within cultural meadow communities throughout the Study Area. This species is listed as Special Concern provincially and is therefore considered a Species of Conservation Concern. Habitat for this species is considered Significant Wildlife Habitat and will be discussed in more detail in **Section 2.2.5**.

All other species observed during field investigations are considered common and widespread within Ontario.

2.2.4 Species at Risk Assessment

2.2.4.1 Background

The status of species within Ontario is determined by the Committee on the Status of Species at Risk in Ontario and Schedule 1 of the Species at Risk Act (as recommended by the Committee on the Status of Endangered Wildlife in Canada. The four categories of species classification within Species at Risk Act and the Endangered Species Act include (terms in brackets apply solely to the province):

- Extirpated: no longer lives within a certain region (of Ontario), although still lives somewhere in the world;
- Endangered: lives in the wild (in Ontario) but is facing imminent extinction or extirpation;

- Threatened: lives in the wild (in Ontario), is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it; and
- Special concern: lives in the wild (in Ontario), is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats.” (Ontario Ministry of Natural Resources and Forestry, 2014d; Species at Risk Act, 2002).

For the purpose of this report, Species at Risk are defined as species that are listed as either Threatened or Endangered provincially or federally (in the case of aquatic organisms). These species, as well as their habitat, are afforded protection under the Endangered Species Act (2007) and Species at Risk Act. Species listed as Special Concern are not subject to the prohibitions under the Endangered Species Act or Species at Risk Act, but have been included in the Species at Risk screening to avoid future implications should the status of these species change under the Endangered Species Act (2007) or Species at Risk Act, and to recognize that in some cases (i.e., aquatic species at risk) they are protected under other legislation. Furthermore, species listed as Special Concern are considered Species of Conservation Concern in the Natural Heritage Reference Manual. As such, habitat for these species is considered Significant Wildlife Habitat. These species and their habitats are discussed in detail in **Section 2.2.5**.

A preliminary Species at Risk screening exercise was completed to determine the number of Species at Risk within potentially suitable habitat within the W12A Landfill Study Area.

2.2.4.2 Methods

A list of Species at Risk which have the potential to occur within the Study Area was compiled based on a review of background information as described in **Section 1.3** as well as input provided by agency correspondence as outlined in **Section 1.6**. Habitat preferences of the listed terrestrial Species at Risk were then compared to onsite habitat characteristics to determine if the Study Area contained potential habitat for Species at Risk. The potential for species to occur was then determined through a probability of occurrence whereby the following rankings were applied:

- **Low Probability:** suitable habitat for the species is not likely present within the study area;
- **Moderate Probability:** potentially suitable Species at Risk habitat may be present within the study area; and,
- **High Probability:** preferred habitat conditions for Species at Risk are likely present within the study area.
- **Confirmed:** species were observed within the Study Area during field investigations.

The Species at Risk screening was refined, where feasible, using the results of the Ecological Land Classification community delineation and taxa specific surveys completed during field investigations as described in **Section 2.2.1**.

2.2.4.3 Results and Discussion

A review of background information and input from agency correspondence identified seventy-six Species at Risk have the potential to occur within the Study Area. Of these species, thirty-seven species are listed as Endangered, nineteen (19) species are listed as Threatened, and twenty (20) species are listed as Special Concern.

Based on the results of the Species at Risk Screening, two Species at Risk have a low probability of occurrence within the Study Area, as suitable habitat conditions are not likely present. Twelve (12) were determined to have at least a moderate probability of occurrence within the Study Area as potentially suitable habitat was identified during the review of existing conditions. Of these twelve, four Species at Risk have a high potential for occurrence within the Study Area as preferred habitat conditions were identified during the review of existing conditions. Candidate and confirmed Species at Risk within the Study Area are summarized in **Table 17** below.

Table 17: Potential & Confirmed Species at Risk Within the Study Area

Common Name	Scientific Name	Endangered Species Act Status	Candidate	Confirmed
Bank Swallow	<i>Riparia riparia</i>	Threatened	Yes	-
Barn Swallow	<i>Hirundo rustica</i>	Threatened	Yes	-
Bobolink	<i>Dolichonyx oryzivorus</i>	Threatened	-	Yes
Eastern Meadowlark	<i>Sturnella magna</i>	Threatened	-	Yes
Eastern Wood-pewee	<i>Contopus virens</i>	Special Concern	-	Yes
Little Brown Myotis	<i>Myotis lucifugus</i>	Endangered	Yes	-
Eastern Small-footed Myotis	<i>Myotis leibii</i>	Endangered	Yes	-
Northern Myotis	<i>Myotis septentrionalis</i>	Endangered	Yes	-
Tri-colored Bat	<i>Perimyotis subflavus</i>	Endangered	Yes	-
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	Special Concern	Yes	-
Snapping Turtle	<i>Chelydra serpentina</i>	Special Concern	Yes	-
Monarch	<i>Danaus plexippus</i>	Special Concern	-	Yes

Six of these species were observed during field investigations. As summarized in **Section 2.2.3**, Bobolink and Eastern Meadowlark were confirmed breeding within cultural meadow habitats within the Study Area including the current Landfill property. These species are both listed as Threatened provincially and are afforded protection under the Endangered Species Act. Therefore, any impacts to this species or its habitat

will require further considerations under the Endangered Species Act. Habitat for these species is delineated on **Figure 7**.

Although nesting was not observed for Barn Swallow and Bank Swallow, these species were observed foraging within the Study Area during field investigations. Potential suitable habitat for Barn Swallow and Bank Swallow is present within the Study Area; however, as no nests were found in the landfill footprint, direct habitat under the General Habitat Description for each species is considered absent (Ontario Ministry of Natural Resources and Forestry, 2015a; Ontario Ministry of Natural Resources and Forestry, 2015b). These species are listed as Threatened provincially. These species, as well as their habitat are afforded protection under the Endangered Species Act.

Eastern Wood-Pewee and Monarch were also observed within the Study Area during field investigations. These species are listed as Special Concern provincially and are therefore considered Species of Conservation Concern. These species do not receive habitat protection the Endangered Species Act; however, their habitat is considered Significant Wildlife Habitat which is should be protected in accordance with the *Provincial Policy Statement* (2020). These species are further addressed in **Section 2.2.5**.

The full Species at Risk Screening is provided in **Appendix J**.

2.2.5 Significant Wildlife Habitat Assessment

2.2.5.1 Background

Significant Wildlife Habitat is defined by the Natural Heritage Reference Manual (2010) as “areas where plants, animals and other organisms live, and find adequate amounts of food, water, shelter and space needed to sustain their populations”. This includes areas where species concentrate at a vulnerable point in their life cycle or areas important for migratory species. The Significant Wildlife Habitat Technical Guide (2000) which supports the Natural Heritage Reference Manual provides detailed information on the identification, description and prioritization of Significant Wildlife Habitat. The Significant Wildlife Habitat Technical Guide (2000) divides wildlife habitat into four categories including Seasonal Concentration Areas, Rare Vegetation Communities or Specialized Habitats for Wildlife, Habitat of Species of Conservation Concern and Animal Movement Corridors. Additionally, due to Ontario’s vast size and biodiversity, the Ontario Ministry of Natural Resources and Forestry created draft Ecoregion Criterion Schedules that support the Significant Wildlife Habitat Technical Guide and provide significance criteria that are reflective of geographic differences. The Ecoregion criteria schedules provide guidance for Significant Wildlife Habitat designation for the four categories of Significant Wildlife Habitat outlined in the Significant Wildlife Habitat

Technical Guide and its appendices. The schedules provide information including descriptions of wildlife habitat, wildlife species, and the criteria required to determine Significant Wildlife Habitat.

The following section outlines the methods completed to determine the presence of candidate and/or confirmed Significant Wildlife Habitat within the Study Area.

2.2.5.2 Methods

A Significant Wildlife Habitat screening exercise was completed using the Wildlife Habitat Ecoregion Criteria Schedule (Ontario Ministry of Natural Resources and Forestry, 2012) to determine the presence of candidate Significant Wildlife Habitat within the Study Area.

The probability of occurrence of candidate Significant Wildlife Habitat for all four categories was determined by comparing existing conditions determined through aerial photo-interpretation and field investigations, to criterion listed in the schedules. A background review, as described in **Section 1.3**, was conducted to determine the presence of Species of Conservation Concern within the Study Area. The potential for Significant Wildlife Habitat to occur was determined through a probability of occurrence whereby the following rankings were applied:

- **No Probability:** Conditions for Candidate Significant Wildlife Habitat are not present within the Study Area.
- **Low Probability:** suitable conditions to meet criteria for Confirmed Significant Wildlife Habitat is not likely present within the study area;
- **Moderate Probability:** Candidate Significant Wildlife Habitat may be present within the study area;
- **High Probability:** Candidate Significant Wildlife Habitat is likely present within the study area; and,
- **Confirmed:** Defining Criteria for Confirmed Significant Wildlife Habitat were observed/met within the Study Area during field investigations.

Where feasible, the results of field investigations were used to confirm the presence of Significant Wildlife Habitat within the Study Area.

2.2.5.3 Results and Discussion

Based on the Significant Wildlife Habitat screening completed for the Study Area, conditions for candidate habitat were not met for seventeen (17) habitats. Fourteen (14) habitats had low to moderate probability of occurrence as suitable conditions are not

likely present or may be present within the Study Area. Six habitats had a high probability of occurrence within the Study Area including:

- Bat Maternity Colonies;
- Turtle Wintering Areas;
- Colonially-Nesting Bird Breeding Habitat (Trees/Shrubs);
- Amphibian Breeding Habitat (Wetlands);
- Marsh Breeding Bird Habitat; and,
- Special Concern and Rare Wildlife Species.

During field investigations completed in 2018, four Significant Wildlife Habitat were confirmed within the Study Area:

1. **Amphibian Breeding Habitat** (Woodland) was identified within the Silver Swamp Locally Significant Wetland;
2. **Terrestrial Crayfish Significant Wildlife Habitat** was identified within the Silver Swamp Locally Significant Wetland; and, Terrestrial Crayfish was confirmed within the cultural thicket habitat in the north of the subject lands;
3. **Special Concern and Rare Wildlife Species Habitat** for Monarch was identified within cultural meadow throughout the Study Area, while habitat for Eastern Wood-pewee was identified within FOD5-5 Dry-Fresh Sugar Maple – Hickory Deciduous Forest Type in P02 north of the subject lands within the potential Endangered Species Act shown on **Figure 1**.
4. **Other Rare Vegetation Communities** was identified within P03. The FOD2-3 -Dry – Fresh Hickory Deciduous is has an S-Rank of S3S4 as per the NHIC indicating that the community type is considered vulnerable in Ontario.

The Provincial Policy Statement states that development and site alteration is not permitted in Significant Wildlife Habitat unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Two candidate Significant Wildlife Habitats were also identified within the Study Area during field investigation in 2018. **Candidate habitat for Bat Maternity Colonies** was identified within deciduous forest (FOD5-5) and cultural thicket (CUT) communities north of the subject lands, the cultural plantation communities northeast (CUP3-2) and southwest (CUP3) of the subject lands, and the deciduous forest (FOD2-3) community within the subject lands. Full bat habitat assessments would be required to confirm the presence of Bat Maternity Colonies. **Candidate habitat for Turtle Wintering Areas** was identified in the open aquatic (OAO) community within the deciduous forest community (FOD2-4) northeast of the subject lands.

The full Significant Wildlife Habitat Screening for the Study Area is provided in **Appendix K**. Locations of confirmed and candidate Significant Wildlife Habitat are identified on **Figure 6**.

2.2.6 Significant Natural Heritage Features & Species

The following section provides a summary of significant features present within the Study Area as identified by federal, provincial and municipal evaluation and ranking systems including the Fisheries Act, the Committee on the Status of Endangered Wildlife in Canada, the Ontario Ministry of Natural Resources and Forestry, Committee on the Status of Species at Risk in Ontario, Upper Thames Region Conservation Authority, Kettle Creek Conservation Authority and The London Plan (2016) and the Middlesex Natural Heritage Systems Study (2014).

2.2.7 Federally Recognized Features & Species

There are no federally owned lands present within the Study Area. As such, there are no federal implications related to terrestrial Species at Risk. Although several species discussed within this report have been designated Threatened or Endangered on Schedule 1 of the *Species at Risk Act*, protection of these species is afforded at the provincial level and therefore will be discussed in **Section 2.2.8**.

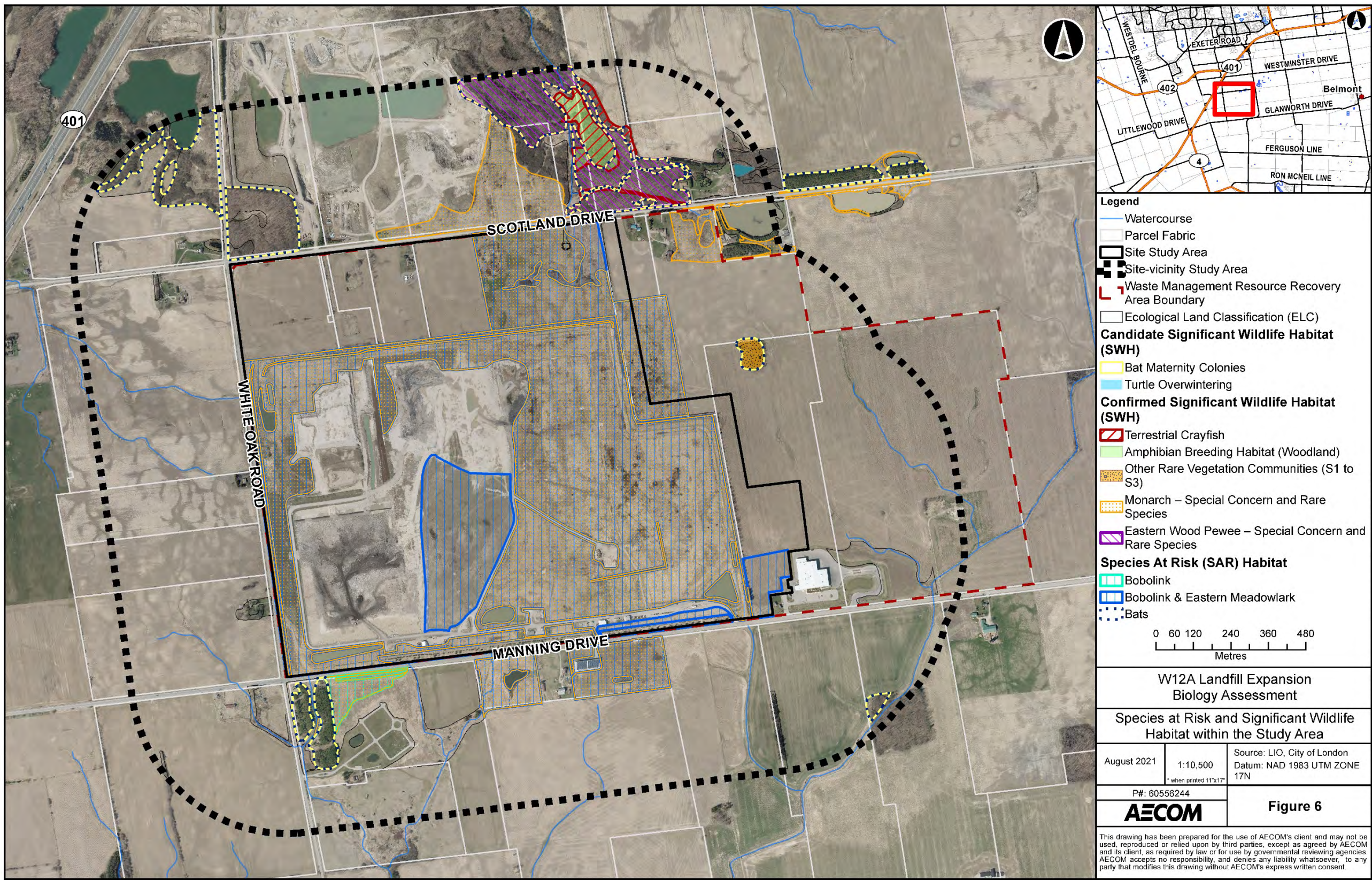
Background data indicate that several water features (e.g., watercourses and waterbodies) support, or are likely to support fish and fish habitat that is regulated under the *Fisheries Act*. Therefore, future work proposed in or near these features must be assessed for the potential to result in Harmful Alteration, Disruption, or Destruction as defined by the federal *Fisheries Act*. If proposed work has the potential to cause serious harm, a Request for Review form must be submitted to Fisheries and Oceans Canada to determine permitting requirements under the *Fisheries Act*.

It should be noted that although there are no federally owned lands present within the Study Area, the Migratory Bird Convention Act still applies.

2.2.8 Provincially Recognized Features & Species

As outlined in **Section 2.2.3**, methods employed in the Middlesex Natural Heritage Systems Study (2014) were utilized to identify and delineate natural heritage features within the W12A Landfill Study Area. Using Criteria outlined in Table 9 of the Middlesex Natural Heritage Systems Study (Middlesex County, 2014) and criteria outlined in the Natural Heritage Reference Manual (Ontario Ministry of Natural Resources and Forestry, 2010), an assessment was completed to identify natural heritage features

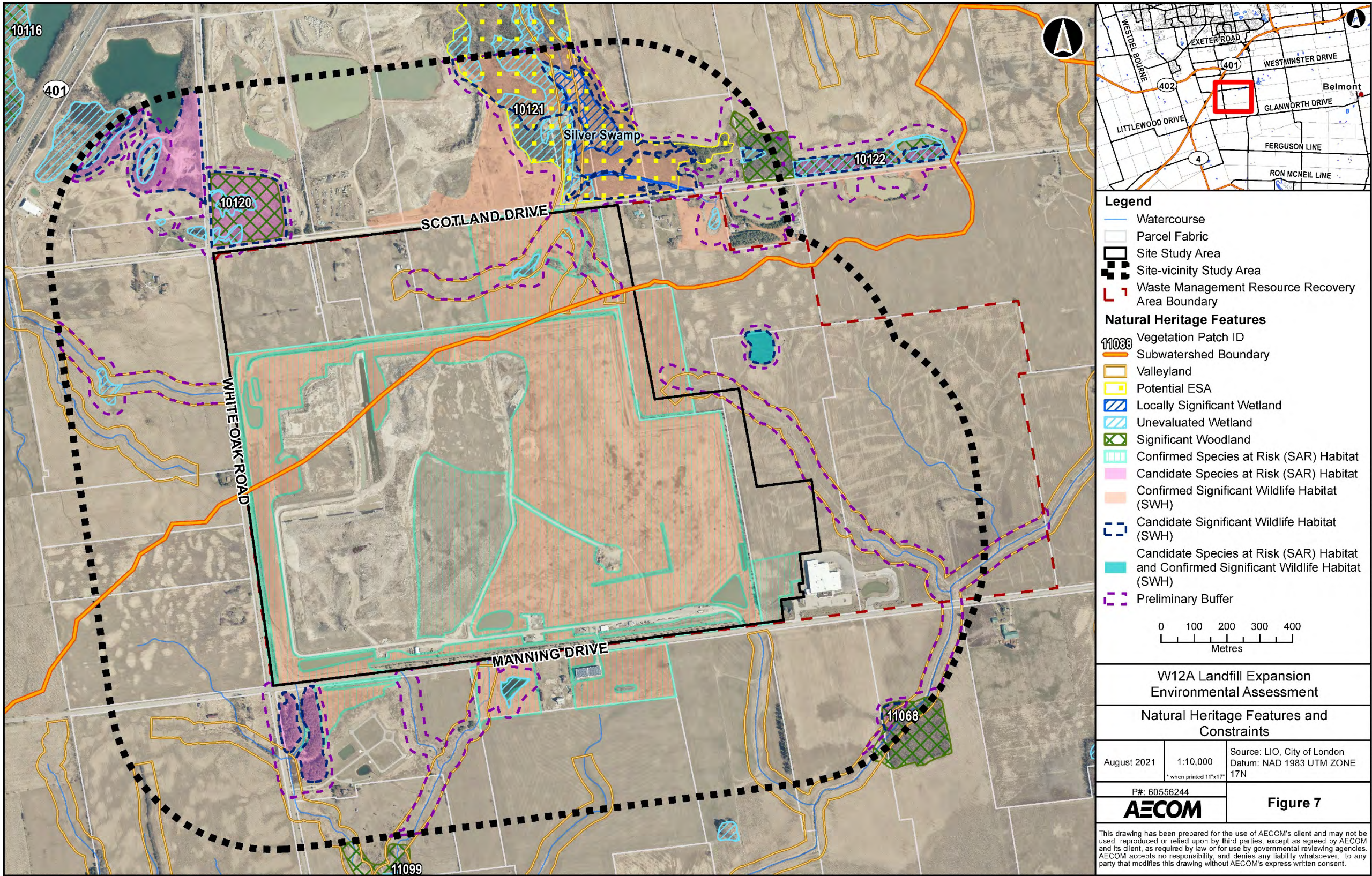
Figure 6: Species at Risk and Significant Wildlife Habitat within the Study Area



including Significant Woodlands and Significant Wildlife Habitat. Additionally, field investigations further identified habitat for species listed as Threatened under the Endangered Species Act. The following summarizes the provincially recognized features and species that are present or have the potential to occur within the Study Area:

- **Significant Woodlands** – Where woodland cover is between 5% and 15% in the county, all woodlands greater than 4 hectares in area should be considered significant (Ontario Ministry of Natural Resources and Forestry, 2010). Similarly, where land cover is less than 15%, woodlands with any interior habitat (i.e., 100 metres from the edge of the feature) should be considered Significant. Therefore, all woodlands which meet Criteria 5 were designated as Significant Woodlands within the W12A Landfill Study Area. These features include Significant Woodlands as delineated on Map 5 of The London Plan (2016) are identified on **Figure 7**.
- **Significant Wildlife Habitat** – As identified in **Section 2.2.5**, three Significant Wildlife Habitat were confirmed within the W12A Landfill Study Area – Terrestrial Crayfish Habitat, Amphibian Breeding Habitat (Woodlands), Special Concern and Rare Species Habitat and Other Rare Vegetation Communities. Two species of Special Concern were observed within the Study Area during field investigations: Eastern Wood-pewee within the FOD5-5 community in Patch P02, as well as Monarch which was observed in the multiple cultural meadow communities throughout Patch P02. Terrestrial Crayfish were observed within Silver Swamp and adjacent cultural thicket within Patch P02. One rare vegetation community (FOD2-3) was observed within Patch P03. Additionally, Patches P01, P03, P04 and P05 have the potential to support Significant Wildlife Habitat such as Bat Maternity Roosting Habitat, Turtle Overwintering Habitat or Habitat for Special Concern and Rare Species. Confirmed and Candidate Significant Wildlife Habitat can be seen on **Figure 7**.
- **Species at Risk Habitat** – Bobolink and Eastern Meadowlark were confirmed breeding within the cultural meadows in Patch P02. These species are listed as Threatened under the Species at Risk in Ontario list. These species and their habitat are therefore afforded protection under the Endangered Species Act. Although nesting was not observed for Barn Swallow and Bank Swallow, these species were observed foraging within the Study Area during field investigations. Potential suitable habitat for Barn Swallow and Bank Swallow is present within the Study Area; however, as no nests were found in the landfill footprint, direct habitat under the General Habitat Description for each species is considered absent (Ontario Ministry of Natural Resources and Forestry, 2015a; 2015b). All wooded habitats provide potential suitable habitat for Species at Risk bat species. Confirmed and Candidate Species at Risk habitat can be seen on **Figure 7**.

Figure 7: Natural Heritage Features and Constraints



2.2.9 Municipally Recognized Features & Species

Provincially recognized features outlined in **Section 2.2.8** above, are designated as Green Space Place Type within The London Plan (2016) and as shown on Map 1. In addition to these features, the following section summarizes the municipally recognized features identified through a review of Map 5 of the City of London's Plan and field investigations.

- **Potential Environmentally Significant Area** – The larger, contiguous natural feature located north of Scotland Drive and associated with Silver Swamp has been identified as a potential Environmentally Significant Area.
- **Significant Woodlands** - in addition to Significant Woodlands identified through desktop analysis in **Section 2.3.3**, Vegetation Patches #10120, #10122 and #11068 have also been identified as Significant Woodlands as shown on Map 5 of The London Plan (2016).
- **Locally Significant Wetland** - Silver Swamp Locally Significant Wetland is present north of Scotland Drive.
- **Unevaluated Wetlands** – unevaluated wetlands identified on Map 5 of The London Plan (2016) as well as wetland communities identified during field investigations require an evaluation in accordance with the Ontario Wetland Evaluation System (Ontario Ministry of Natural Resources and Forestry, 2013).

These features are designated as Environmental Review Place Type on Map 1 of The London Plan (2016) and may require further study to determine their level of significance, should additional studies be required in consultation with the City of London. These features are delineated on **Figure 7**.

2.2.10 Natural Heritage Features & Constraints

Natural Heritage features identified within the Study Area, as shown on **Figure 7**, were based on the review of applicable background information, field investigations and desktop analysis based on technical criteria outlined in the Ontario Ministry of Natural Resources and Forestry's Natural Heritage Reference Manual (Ontario Ministry of Natural Resources and Forestry, 2010) and are consistent with policies set out in the Provincial Policy Statement Natural Heritage policies (Ministry of Municipal Affairs and Housing, 2020), as well as through The London Plan (2016) Natural Heritage policies. Natural Heritage features included in the Green Space Place Type and identified within the Study Area include:

- Locally Significant Wetlands – Silver Swamp,
- Significant Woodlands,

- Significant Wildlife Habitat,
- Species at Risk Habitat,

These natural heritage components pose various degrees of environmental constraint to development, including landfill expansion. Environmental constraints generally refer to areas where development is precluded or limited, based on the significance or sensitivity of the natural heritage features(s) and/or their functions. In some cases, the constraint to development is absolute (no development or site alteration is permitted); in other cases, development may be permitted if it can be demonstrated that the proposed development will not have a significant negative impact on the feature, and or, its functions. In the latter case, permitting with associated mitigation or compensation may be required.

The following section outlines the degree of constraint for development for each natural heritage feature identified within the W12A Landfill Study Area.

2.2.11 Development Constraints for Natural Heritage Features & Adjacent Lands

Development within and adjacent to natural heritage features identified within the W12A Landfill Study Area should be consistent with the policies outlined in The London Plan (2016) which adhere to the Provincial Policy Statement (2020). **Table 18** below summarizes the level of protection required for natural heritage features identified within the Study Area, including preliminary buffer requirements and the development distance from a natural feature that would trigger an Environmental Impact Study as outlined in The London Plan (2016) and its associate Environmental Management Guidelines. As it is not common practice for a municipality to complete an Environmental Impact Study for a landfill or landfill expansion, the City of London will determine whether an Environmental Impact Study will be required further to the completion of the Environmental Assessment.

Table 18: Summary of Development Constraints for Natural Heritage Features identified within the W12A Landfill Study Area

Natural Heritage Feature	Adjacent Lands	Development Constraints as per the Provincial Policy Statement (2020) and The London Plan (2016)	Recommended Preliminary Buffers
Provincially Significant Wetlands, Wetlands and Unevaluated wetlands.	120 metres	Development and site alteration shall not be permitted within a Provincially Significant Wetland or Locally Significant Wetland (evaluated as not Provincially Significant).	30 metres from the outer boundary of the wetland or individual units in the case of complexes.

Natural Heritage Feature	Adjacent Lands	Development Constraints as per the Provincial Policy Statement (2020) and The London Plan (2016)	Recommended Preliminary Buffers
		Development and site alteration shall not be permitted within and/or adjacent to an unevaluated wetland identified on Map 5 and/or if an Ecological Land Classification identifies a community as a wetland.	
Significant Woodlands	120 metres	Development and site alteration shall not be permitted in Significant Woodlands unless it has been demonstrated that there will be no negative impacts on the natural heritage features or their ecological functions.	15 metres from the woodland dripline.
Significant Wildlife Habitat	120 metres	Development and site alteration shall not be permitted in and adjacent to Significant Wildlife Habitat unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological function.	5 metres to 30 metres depending on the type of Significant Wildlife Habitat identified: <ul style="list-style-type: none"> ▪ 5 metres for habitats associated with early successional habitats ▪ 15 metres for habitats associated with woodlands ▪ 30 metres for habitats associated with wetlands.
Significant Valleylands	120 metres	Development and site alteration shall not be permitted in or adjacent to Significant Valleylands unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological function.	To be determined through correspondence with the relevant Conservation Authorities at the site development stage.
Habitat for Threatened or Endangered Species (Species at Risk habitat)	120 metres	Development and site alteration shall not be permitted in the habitat of Endangered Species and Threatened species, except in accordance with provincial and federal requirements. Development and site alteration shall not be permitted on adjacent lands unless it has been demonstrated that there will be no negative impacts on natural heritage features or their ecological functions.	Buffers will depend on the type of habitat and species identified within the study area. Habitat for Threatened or Endangered Species was not identified within the Study Area. Therefore, no preliminary buffers are recommended at this time.
Fish Habitat	120 metres	Development and site alteration shall not be permitted in Fish Habitat except in accordance with relevant provincial and federal requirements. Development and site alteration shall not be permitted on adjacent lands unless it has been demonstrated that there will be no negative impacts on the natural heritage feature or their ecological function.	30 metres from watercourses and waterbodies

Natural heritage features identified as part of the Green Space Place Type, through background review and field investigations are delineated on **Figure 7**. Recommended preliminary buffers are based on standard practices for each natural heritage feature.

Natural heritage features which are included in the Environmental Review Place Type designation and that are found within the Study Area include:

- Unevaluated wetlands,
- Valleylands, and
- Potential Environmental Significant Areas.

These features designations are considered to be interim in nature until the significance of these patches can be confirmed through further investigations and the application of evaluation criteria. Some of these unevaluated features could not be evaluated due to lack of property access. Nevertheless, these features are well outside of the proposed expansion area and will not be affected by the proposed expansion. Evaluation of these patches is, therefore, not required.

3. Project Description

The landfill expansion consists of a vertical expansion over the existing landfill footprint to provide 13.8 million m³ of airspace for waste and daily cover. To accommodate ancillary features and provide additional on-Site buffer width compared to the existing landfill, the northern boundary of the landfill property will be adjacent to Scotland Drive and a 100 metre buffer width will be provided on the east side of the landfill footprint and some additional area in the southeast corner to tie into the adjacent Materials Recovery Facility property line. This results in a 106.3 hectare landfill footprint within a 192.4 hectare landfill property, with a highest ridge elevation of waste of 318.43 metres above sea level.

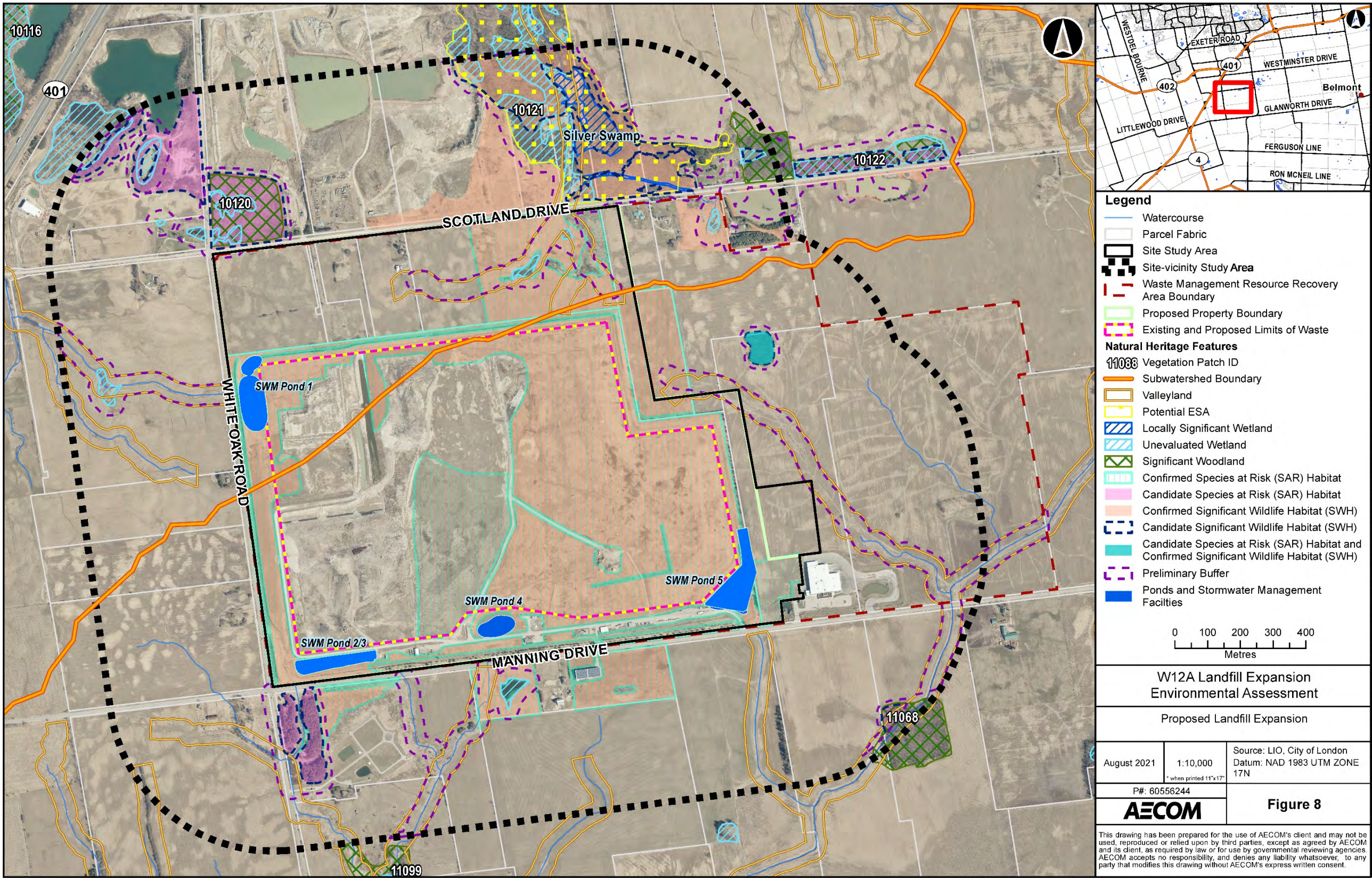
The W12A Landfill Expansion Environmental Assessment report (Golder, 2020a) provides the plans for landfill expansion phasing, drainage areas, stormwater management and ancillary facilities in relation to the descriptions in the following sections.

Figure 8 shows the landfill expansion area in relation to natural heritage features and existing infrastructure.

3.1 Landfill Phasing and Development

The landfill expansion will be developed sequentially in eight Phases, 1E through 8E, progressing from the west side of the landfill towards the east. Landfilling in each Phase will be approximately 2.5 to 3.5 years based on an expected typical annual air space consumption of 500,000 m³ per year, which corresponds to an average annual waste receipt of 370,000 tonnes per year over the 25-year planning period. A separate cell dedicated for disposal of the non-decomposable portion of the waste stream will be provided in the southeastern area of the landfill expansion. Filling in this non-decomposable waste cell will take place in lifts over the 25-year expansion period and will be blended in to meet the temporary side slopes in the adjacent Phases 7E and 8E as they are developed. Because this waste is non-decomposable, it would not receive daily cover; however, if it is observed that specific materials are generating odours or are otherwise of concern if left uncovered, daily cover material would be placed. This fill area would receive final cover consistent with that on the remainder of the landfill, but it is not proposed to install a landfill gas collection system in this area as part of the final cover construction.

Figure 8: Proposed Landfill Expansion



To commence filling in each Phase, the existing cover material would be progressively stripped from an area large enough to accommodate the year's disposal, which is estimated to average approximately 4 hectares. The area of exposed waste would be limited to that needed to spread, compact and cover the waste received on a daily basis, and will range from about 40 metres by 25 metres typically (1,000 m²) to 50 metres by 30 metres (1,500 m²). The waste will be spread and compacted in lifts of about 0.6 metres to a height of approximately 3 metres. All waste will be covered daily.

For the southern Phases 1E, 3E, 5E and 7E the waste would be placed initially to build a berm along the south side of the Phase and will be covered with final cover soil and seeded to establish vegetation; the berm will screen the view of subsequent filling operations north of the berm from off-Site vantage points to the south. The south side perimeter waste berm would be raised sequentially and filled in behind until the peak elevation is reached. The Phase boundaries have been designed (offset) such that the completed southern Phases (1E, 3E, 5E, 7E) will effectively screen the view of landfilling operations in the northern Phases (2E, 4E, 6E, 8E) from off-Site vantage points to the south.

Temporary soil berms, and if necessary shallow swales, would be provided to direct surface water runoff from existing covered upslope areas around the active fill areas / Phases to the stormwater management system since this runoff has not been in contact with waste.

On an annual or biannual basis, final cover would then be constructed over areas reaching final grade and permanent vertical landfill gas wells will be installed and connected to the landfill gas collection system.

For the portion of the proposed vertical expansion that will involve placement of additional waste above the Phase 2 area, the existing leachate collection system will continue to be used to collect and remove leachate from the area.

3.2 Leachate Control and Management

Phase 2 utilizes the clay till as a natural low permeability liner and has a continuous granular drainage blanket and piping system over a shaped subgrade to collect leachate and direct it by gravity to the north end of the Phase 2 area where the collected leachate is removed for subsequent off-site treatment. The waste in the Phase 1 area rests directly on the underlying low permeability clay till and has a perimeter leachate collection system around the north, east and south sides to intercept leachate seepage at the base of the waste. Collected leachate either drains into the Phase 2 collection system or into a separate storage from where it is removed for subsequent off-site treatment.

For the portion of the proposed vertical expansion that will involve placement of additional waste above the Phase 2 area, the existing leachate collection system will continue to be used to collect and remove leachate from the area. For the vertical expansion above the Phase 1 area, it is proposed to replace the existing perimeter leachate collection system with a new perimeter leachate collection system that will more effectively serve the same functions as the existing system. To control the potential for leachate seeps along the perimeter side slopes that could occur as a result of leachate mounding and/or perched leachate in Phase 1, it is proposed to construct granular finger drains around the north, east and south sides of the exterior perimeter of the Phase 1 area and connect them into the replacement Phase 1 perimeter leachate collection system.

The leachate collected from the Phase 1 and Phase 2 leachate collection system will continue to be routed through on-Site piping to the main leachate pumping station located at the southeast corner of the Site. From here, the leachate will be pumped off-Site through a leachate forcemain to the Dingman Road pump station, where combined with municipal sewage it will enter the municipal sanitary sewer system to treatment at the Greenway Wastewater Treatment Plant.

3.3 Landfill Gas Generation and Control

It is estimated that the total expanded landfill will theoretically generate a maximum of 4,395 standard cubic feet per minute of landfill gas in 2049 (the year following completion of filling of the expansion), of which typically 50% is methane. Landfill gas is collected from completed areas of the landfill using a vertical well system that is connected to an enclosed flare; the existing flare is sized to combust a maximum of approximately 1,700 standard cubic feet per minute of landfill gas. Considering the actual extent of the landfill gas well extraction system and its collection efficiency, analysis indicates that the capacity of the existing flare may be exceeded around year 2027. The timing for installation of additional flare capacity will depend on the actual operation of the existing flare and its ability to handle the collected gas flow rate. It is proposed to utilize vertical landfill gas extraction wells to be progressively installed with the construction of final cover following placement of waste to final contours in each Phase. To reduce air emissions (for odour control purposes during landfilling operations and to increase the overall collection of landfill gases), it is proposed that a number of horizontal landfill gas collection pipes will also be installed progressively as waste is placed.

3.4 Stormwater Management

The on-site drainage network is currently divided into four general areas with a system of berms, slopes and perimeter drainage ditches directing runoff generated within the

W12A Landfill property envelope to four separate stormwater management ponds. Under the proposed vertical expansion, the peak of the landfill mound will shift to the south and side slopes of the mound will be longer and somewhat steeper in places, resulting in changes of the drainage boundaries to each of the ponds and, in general, reduced times to peak runoff. To address these changes in surface water runoff, some modifications to the existing stormwater management ponds will be required.

Under current conditions, Ponds 2/3, 4 and 5 collect an area of 130 hectares of surface water runoff and provide treatment and attenuation prior to discharge off-Site to the south, to the Dodd Creek Watershed. The proposed landfill expansion and mound configuration will result in a reduction of the drainage area being collected and treated by these ponds and discharged to Dodd Creek subwatershed to 95.3 hectares. Under current conditions Pond 1 collects a drainage area of 14.4 hectares of surface water runoff and discharges off-Site to the north, to the Dingman Creek subwatershed. The proposed landfill expansion would result in an increased drainage area of 34.4 hectares to Pond 1. The outlet structure for Pond 1 will be designed such that discharge will match or be below pre-expansion peak flows for the 1:2 year through 1:100-year design storm events.

Stormwater runoff from the proposed expansion will continue to be managed in terms of both quality (80% Total Suspended Solids removal) and quantity (to match post-expansion flows to pre-expansion conditions for the 1:2 year through the 1:100-year return period design storm). The 1:250-year return period design storm was also assessed to predict conditions during such an event to accommodate climate change.

The proposed pond modifications are as follows:

- Pond 1 – to accommodate an increased contributing drainage area and reduction in time to peak, the pond will be expanded to the north, increasing the size of the main pond and forebay. The outlet structure will be modified with an appropriately sized orifice to meet discharge requirements.
- Pond 2/3 – the landfill expansion will result in a decreased drainage area to this pond; however, to meet the Enhanced Level Protection (80% Total Suspended Solids removal) the permanent pool depth will be increased, and some modifications will be made to the existing outlet structure.
- Pond 4 – this pond will receive stormwater runoff from a smaller total drainage area. The existing permanent pool and active storage is sufficiently sized to meet the 80% Total Suspended Solids removal requirements. The existing outlet structure will be modified to control discharge; an overflow weir will be added and the existing double inlet catchbasin maintained for larger storm events.

- Pond 5 – this pond will receive stormwater runoff from a larger total drainage area. The pond will be expanded to the east and north to increase both the permanent pool and active storage capacities. The existing outlet structure will be modified with an appropriately sized orifice and a weir.

3.5 Site Operations and Ancillary Components

The expanded landfill will operate, at the maximum, from 7:00 a.m. to 5:00 p.m., Monday through Saturday plus one hour before, i.e., 6:00 a.m. to 7:00 a.m., for site preparations and one hour after, i.e., 5:00 p.m. to 6:00 p.m. to complete placement of daily cover. The Site will be closed on Sundays; on statutory holidays site operations will be as required to accommodate hauling contracts.

It is proposed that the maximum annual receipt of waste for the expanded landfill will be 500,000 tonnes per year, reduced from the 650,000 tonnes/year allowed for the existing landfill.

The expanded landfill will also need to continue to occasionally operate 24 hours per day, 7 days per week when lime stabilized dewatered biosolids (dewatered sewage sludge) from the Greenway Wastewater Treatment Plant are being received and disposed at the landfill. This is typically required for three weeks per year; however, some years this period could be extended. In addition, re-builds or major equipment repairs typically occur approximately every five years or longer and can take up to two to three months to complete. The landfill may receive a load of biosolids (approximately 15 tonnes) every 75 to 90 minutes. Disposal of the biosolids involves excavating a hole in the existing waste in the active area (when practical) prior to the load arriving and covering the biosolids with daily cover soil as soon as the load has been dumped.

The main site access for the expansion will be at the same location as for the existing site, off Manning Drive at the southeast corner of the Site. The main ancillary facilities are located along the perimeter road across the south side of the Site. It is proposed that many of the existing ancillary facilities at the site will be progressively upgraded or replaced during the expansion at or close to their existing location, except for a new site office / administration building to be located close to the site entrance. These facilities consist of the contractor's office and garage; administration building; flare and control system; weigh scales and scale house and leachate pump station; and small vehicle waste drop-off. A new enclosed night waste storage facility for receipt and temporary storage of three to five loads of waste may also be constructed; access to the landfill at night will be done using card key access and automatic gates. In addition, in the vacant southeast corner area between the landfill and the Materials Recovery Facility there will be a new scale and scale house, a grade-separated small vehicle drop-off for waste, a

grade-separated small vehicle drop-off for recyclable materials, an area for drop-off of brush, tires and large items, and a new Household Special Waste depot.

The source of heating for all site buildings will be natural gas.

The existing paved roads on the south and west sides of the landfill are paved and will remain paved for the expansion. It is proposed that the perimeter access road around the north and east sides of the landfill will also be asphalt surfaced, as will the vehicle access roads for the proposed recycling drop-off facilities in the southeast corner between the landfill facilities and the Materials Recovery Facility will also be paved. Access for collection vehicles to the expansion Phases will be mainly from the south side perimeter road, and for Phases 1E and 2E from the west

side perimeter road. From the south side it is anticipated that the two existing granular surfaced haul roads will continue to be utilized.

A secondary site access off Scotland Drive will be used as a secondary site access and service road for operations and maintenance vehicles to the north part of the landfill property and as an emergency access/exit. The secondary access will have a locked gate to prevent unauthorized usage and will be gravel surfaced.

3.6 Closure and Post-closure

The landfill Phases will be progressively closed after the final waste contours have been reached in each Phase and landfill operations have proceeded into the next Phase(s). The final cover on the landfill will consist of a permeable cover design, comprised of 600 mm of soil topped with 150 mm of topsoil or similar and vegetated. The vertical landfill gas extraction wells will be installed to collect gas from within the expanded waste mass as part of the progressive construction of the final cover system.

Post-closure activities will involve continued operation and maintenance of the leachate collection and removal system, the landfill gas control system and the stormwater management system. In addition to general inspection of the site, there will be inspection of the landfill cover for evidence of erosion, leachate seeps or instability, and maintenance / repair as required.

3.7 Description of Activities

The time frames over which there will be activities on the Site associated with the proposed vertical expansion can be divided into three: initial construction, operations and post-closure. Following is a general description of the activities that are expected to take place during each of these periods.

Initial Construction: It is anticipated that the initial construction activities associated with the expansion will take place in the 2023 to 2025 period. Because the expansion will be a vertical expansion above the existing footprint, there will be no large-scale excavation required to construct a new cell. Construction of the replacement perimeter leachate collection system immediately adjacent to the existing toe of the landfill around the north, east and south perimeter of Phase 1 will involve conventional trenching and pipe installation; trenches into the waste will also be extended up the existing landfill side slopes to install finger drains. The modifications / enlargements to the existing stormwater management system ponds and their outlet controls will also be completed, involving relatively shallow excavation and soil berm construction in the immediate area of the existing ponds; no construction or alterations are proposed for the existing structures that convey the pond discharge below the adjacent roadways to the downstream watercourses or in the downstream watercourses themselves. Site roads will be constructed/upgraded adjacent to the north and east sides of the existing landfill. Construction of other infrastructure upgrades, i.e., main pump station, some of the buildings and some of the ancillary facilities, will take place along the south side of the Site that is already occupied by Site infrastructure. Construction of the new diversion and drop-off facilities in the southeast corner of the expanded site adjacent to the Materials Recovery Facility will involve stripping of existing vegetation and then conventional construction for these types of facilities. Surplus soil resulting from this initial construction will either be temporarily stockpiled on the landfill for re-use in ongoing operations or stockpiled for future use in the on-Site buffer area to the north of the landfill footprint where soil stockpiles already exist.

Operations: Operation of the expanded landfill is expected to be ongoing between 2024 and 2048. The expansion will commence in Phase 1E in the southwest and in the non-decomposable cell in the southeast, which will involve progressive stripping of the existing cover material from the active area and the placement and compaction of waste and spreading of daily cover soil, compaction and daily covering of the waste. The daily cover will be mostly suitable types of materials incoming to the site on an ongoing basis, supplemented as needed by material from on-Site soil stockpiles. After completion of a cell and moving to the next disposal area (as per the phasing plan), final cover soil will be placed over the waste and revegetated and the landfill gas collection system progressively installed with the final cover. During operations, vehicles will travel on the on-Site perimeter roads and on the haul roads located on the landfill, as well as to and from the soil stockpiles in the north buffer area. There will be ongoing maintenance and monitoring activities. The operations activities during the expansion will basically be a continuation of current site activities both on and adjacent to the existing landfill footprint, with raising of the landfill to reach the design configuration.

Post-Closure: When the approved capacity of the expanded landfill is reached at the end of the 25 year planning period at the end of 2048, the final cover will be placed on the last landfill Phase. After disposal operations cease, it is expected that the diversion activities may continue at the site using the established infrastructure. The activities associated with operation and maintenance of the leachate collection and pumping systems, the conveyance of collected leachate off-Site for treatment, the stormwater management ponds and the operation and maintenance of the landfill gas collection and flaring system will continue. Post-closure groundwater and surface water monitoring programs will continue. The leachate and landfill gas management system operations will extend for many decades post-closure.

4. Impact Assessment

The following impact assessment considers the potential direct and indirect impacts of the W12A Landfill expansion preferred alternative on the aquatic and terrestrial ecosystems within the Study Area for the construction, operations and closure stages of the project as outlined in **Section 3**.

Potential direct impacts to natural heritage features and functions are those that result in an immediate loss of the feature or function as a consequence of the project works. This may include the removal of a vegetation community or habitat within the area of expansion or ancillary facilities and related works or work areas. Potential indirect impacts are those whereby the project works cause impacts to an adjacent or downstream feature or function through the alteration of the project site.

When considering and assessing the potential environmental impacts of a project on natural heritage features and functions, the first approach is to avoid potential impacts through layout and design of the project. Where impacts cannot be avoided, then mitigation of those impacts should be implemented to reduce the severity of those impacts. If mitigation measures are not possible or sufficient to mitigate potential impacts, then compensation for the loss of features and/or functions is required.

The proposed expansion of the W12A Landfill avoids many potential impacts by situating the future expansion on the existing landfill fill area.

Figure 8 shows the limits of the proposed landfill expansion overlaid with the natural heritage features.

4.1 Construction Stage

4.1.1 Aquatic Ecosystems

4.1.1.1 Direct Impacts

Since all aquatic habitat for both Dingman Creek and Dodd Creek are outside of the proposed expansion area, no direct impacts to aquatic species or habitat are anticipated.

The proposed modification to stormwater management facilities' weirs and outlets will all occur within the landfill area. As there are no physical alterations to the downstream stormwater management facilities infrastructure including the ditches, culverts, or other

downstream watercourses, no direct impacts to aquatic species or habitat are anticipated from the proposed modifications to stormwater management facilities system.

4.1.1.2 Indirect Impacts

As described above, construction and alterations associated with the proposed modification to the stormwater management facilities weirs and outlets are not proposed for existing structures that convey pond discharge to downstream watercourses. As such, no indirect impacts to aquatic species or habitat are anticipated during the Construction Stage.

4.1.2 Terrestrial Ecosystems

4.1.2.1 Direct Impacts

While the preferred alternative avoids areas of natural heritage features and functions by restricting the landfill expansion to the existing landfill footprint, direct impacts are anticipated. These impacts are based on the occurrence of Confirmed Significant Wildlife Habitat for Monarch and Species at Risk Habitat for grassland birds that overlaps with the existing landfill. The habitat for Eastern Meadowlark and Bobolink within the Study Area includes the existing landfill due to the grassland habitat characteristics of the vegetation cover over the existing landfill area and adjacent lands. The direct impacts to these areas during the Construction Stage are not considered to be significant and may be avoided based on the specific location of trenching activities.

Should stripping of existing vegetation for the new diversion and drop-off facilities in the southeastern corner occur during the breeding bird window (April 1st to August 31st), there is potential for impacts to nesting birds and may contravene the *Migratory Birds Convention Act*. Often during the construction phase of projects involving the excavation/stripping and stockpiling of soil there are unintended impacts related to the creation of environments suitable for the nesting of breeding birds or other species (nesting turtles). Should stockpiling of stripped soil or fill be conducted during the breeding bird window, there is a potential for birds such as Banks Swallows or Cliff Swallows to establish nests in newly exposed slopes that are greater than 3:1 in inclination. Once established, the nests cannot be disturbed until the young have fledged from the nests.

Other potential direct impacts may include incidental injury or mortality of common wildlife species that may occupy areas of the existing landfill site; these may include groundhogs, Killdeer, common snake species, etc.

4.1.2.2 Indirect Impacts

Potential indirect impacts of the construction phase include typical construction-related impacts including:

- Dust deposition on vegetation in adjacent vegetation communities;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment; and,
- Accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and vehicles.

These indirect impacts are not considered significant and are mitigatable with standard measures.

4.2 Operations Stage

4.2.1 Aquatic Ecosystems

4.2.1.1 Direct Impacts

During the Operations Stage of the expansion of the W12A Landfill direct impacts to aquatic ecosystems are not anticipated.

4.2.1.2 Indirect Impacts

While the proposed works associated with the Operations Stage for the preferred alternative are not expected to result in direct impacts to aquatic ecosystems, there will be changes to drainage areas and the resulting water balance. These changes are outlined in the *Stormwater Management Report –W12A Landfill Expansion* (Golder, 2020b) and include the following:

1. The reduction of surface water drainage to Dodd Creek from Stormwater Management Ponds 2/3, 4 and 5. The reduction in drainage area from pre-expansion to post-expansion is estimated to be 20.1 hectares, from 127.6 hectares to 106.5 hectares.
2. The increase in surface water drainage to Dingman Creek from Pond 1. The increase in drainage area from pre-expansion to post-expansion is estimated to be 20 hectares, from 14.5 hectares to 34.5 hectares.

The alteration to drainage areas for Dingman and Dodd Creek occur in the upper reaches of the subwatershed and represent a 0.12% decrease and 0.20% increase

in overall subwatershed area, respectively. Additionally, discharge from the Site to the Dingman Creek subwatershed will be attenuated by Pond 1 to below pre-development flows up to and including the 1:100-year return period design storm under the proposed design (Golder, 2020b). As such, these changes in drainage area are expected to have a negligible effect on runoff and drainage downstream of the Site in both the Dingman and Dodd Creek subwatersheds. Further, modifications to the existing Stormwater Management infrastructure, along with mitigation measures (i.e., erosion and sediment control), are expected to result in surface water quality conditions that are comparable to existing conditions and meet the Ministry of Environment, Conservation and Parks Provincial Water Quality Objectives (Golder, 2020b).

As described in the *Groundwater Impact Assessment – W12A Landfill Expansion EA* (Golder, 2020c). The existing landfill is located overlying a surficial aquitard of low permeability clayey till (15 to 20 metres thick) and will not affect recharge of the groundwater system or groundwater levels/quantity. Therefore, the proposed vertical expansion is not anticipated to have any direct impacts downgradient groundwater levels or quantity off-site.

The above indirect impacts are not considered significant and are mitigatable with standard measures.

4.2.2 Terrestrial Ecosystems

4.2.2.1 Direct Impacts

During the Operations Stage of the Landfill Expansion, potential direct impacts to terrestrial features and functions are anticipated from the progressive removal of grassland cover to facilitate the vertical expansion. These impacts are based on the Confirmed Significant Wildlife Habitat for Monarch and Species at Risk Habitat for grassland birds as described in **Section 4.1.2**. Although the aforementioned habitat will be removed for the proposed landfill expansion, these impacts will be temporary in nature as they will be revegetated when vertical capacity is reached to mimic habitat conditions currently present (e.g., grassland species, common milkweed). In addition to temporary habitat removal, accidental destruction of nests, stockpiling of stripped material creating nesting opportunities for birds, or wildlife mortality may occur as part of the Operations Stage (as outlined for the Construction Stage in **Section 4.1.2**). These occurrences can be avoided through the implementation of standard operational measures, the continuation of measures implemented during the Construction Stage, and potential compensation for Species at Risk Habitat (as described in **Section 5.1**).

4.2.2.2 Indirect Impacts

During the Operations Stage of the expansion of the W12A Landfill, potential indirect impacts to terrestrial ecosystems are likely to be limited to the following types of impacts:

- Dust and airborne waste deposition in natural habitat;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment; and,
- Accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and/or vehicles.

4.3 Closure and Post-Closure

4.3.1 Aquatic Ecosystems

4.3.1.1 Direct Impacts

Potential direct impacts to aquatic systems are not anticipated during closure and post-closure activities.

4.3.1.2 Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to the management of leachate and stormwater management within the landfill. With the continued operation of the leachate control system and the proposed stormwater management system, indirect impacts as a result of landfill closure are not anticipated.

4.3.2 Terrestrial Ecosystems

4.3.2.1 Direct Impacts

Activities associated with landfill closure include the addition of topsoil and plantings of native vegetation; as such, the project closure will result in no net loss of natural heritage features and functions despite short term impacts to natural communities during construction and operations.

4.3.2.2 Indirect Impacts

Potential indirect impacts associated with closure and post-closure activities are limited to the management of leachate and stormwater management within the landfill. With the continued operation of the leachate control system and the proposed stormwater management system, indirect impacts as a result of landfill closure are not anticipated.

5. Mitigation and Compensation

5.1 Construction Stage

5.1.1 Mitigation of Direct Impacts to Species at Risk and Wildlife

Natural heritage features and habitat are most susceptible during the construction stage of any project as site conditions are most substantially altered during this stage. Therefore, construction activities need to be mitigated and controlled to avoid significant adverse effects.

To avoid or minimize impacts related to the construction stage (as outlined in **Section 4.1**), a detailed Environmental Mitigation and Monitoring Plan (EMMP) will be developed. It is recommended that the EMMP be developed prior to the issuance of engineering drawings to allow for mitigation measures to be incorporated into contract drawings for future planning. The contents of the EMMP will be determined at Detailed Design, but may include typical construction mitigation measures such as erosion and sediment control, work area delineation, construction timing windows, etc.

Based on the proposed expansion, vegetation removal associated with the construction stage will be required. In order to avoid direct impacts to the Species at Risk Birds, including Bobolink and Eastern Meadowlark, all habitat removal should occur outside of the bird nesting season (April 1 to August 31). This also avoids potential incidental take and therefore contravention of the *Migratory Bird Convention Act*. Should vegetation clearing be required during the nesting period, a nest search may be completed by a quality ecologist. Once the ecologist has confirmed no active nests are present, clearing may take place up to 24 hours after completion of the inspection. Nest searches should only be completed within simple habitats or where nests are conspicuous.

Although bank swallow habitat protected under the ESA is not present within the Site Study Area (as outlined in **Section 2.2.4**), bank swallows can adapt to anthropogenically disturbed sites including using vertical slopes from excavation and stockpiling for nesting (Ontario Ministry of Natural Resources and Forestry, 2017b). Mitigation measures to prevent bank swallow nesting (e.g., slope management) will be included within the EMMP and will follow guidance outlined in the Best Management Practices for the Protection, Creation, and Maintenance of Bank Swallow Habitat in Ontario (Ontario Ministry of Natural Resources and Forestry, 2017b).

Based on the preferred alternative and its proximity to natural heritage features and significant species, the preparation and implementation of a Species at Risk and Wildlife Observation Protocol will be required. This protocol will outline the steps to take in the event of an encounter with wildlife, including Species at Risk, during the construction stage. Detailed information and specific requirements related to wildlife and Species at Risk encounters will be incorporated in the protocol including proper species identification, taxa- or species-specific handling methods, and reporting of wildlife and Species at Risk as required by provincial legislation.

Along with the Species at Risk and Wildlife Observation Protocol, further mitigation related to potential wildlife and Species at Risk encounters during the construction stage will include the following items:

- Species Fact Sheets for Species at Risk that may be encountered on-site during the construction stage will be posted on-site in the site office or trailer where it is visible to workers for review. These fact sheets will outline Species at Risk identification and species-specific protocols in the event they are encountered.
- To ensure compliance with policy and the Species at Risk and Wildlife Observation Protocol, all persons entering the site will receive staff training outlining the proper identification, handling methods, any associated reporting of wildlife and/or Species at Risk encounters, and steps to take to ensure compliance with the in the event of wildlife and Species at Risk encounters.

Wildlife exclusionary fencing around the landfill, or portions of the landfill should be considered at Detailed Design to mitigation wildlife encounters on site during construction and operations.

5.1.2 Compensation Mitigation of Potential Impacts to Species at Risk and Wildlife

As habitat for Species at Risk grassland birds cannot be avoided within the proposed expansion alternative, compensation for habitat loss will be required as regulated under the Endangered Species Act (Ontario Regulation 242/08). Consultation with the Ministry of Environment, Conservation and Parks will be required to determine appropriate compensation measures for Bobolink and Eastern Meadowlark. These measures may include enhancing existing grasslands in adjacent habitats or creating additional grassland habitats within the same eco-region. Further details on permitting requirements for Species at Risk birds can be found in **Section 7.2**.

Compensation for Significant Wildlife Habitat for Monarch will be achieved at project closure with the implementation of native plantings which are recommended to include common milkweed (*Asclepias syriaca*), a host plant for the species.

5.2 Operations Stage

During the Operations Stage, standard mitigation measures for erosion and sediment control, dust suppression, timing of operations (e.g., 7:00 am to 7:00 pm), maintenance of the stormwater management system and facilities, and maintenance of the leachate treatment system will be required.

Based on the proposed expansion, vegetation removal associated with the operations stage will be required. To avoid direct impacts to the Species at Risk Birds, including Bobolink and Eastern Meadowlark, all habitat removal should occur outside of the bird nesting season (April 1 to August 31). Further, mitigation measures outlined in **Section 5.1** should be implemented related to vegetation removal and nest searches. Although the vegetation removal during this stage will be progressive, with revegetation upon vertical landfill capacity for a given area, compensation (as described in **Section 5.1**) for the removal of Species at Risk Habitat and Significant Wildlife Habitat may be required as determined through consultation with Ministry of Environment, Conservation and Parks and other applicable regulatory agencies.

Mitigation measures will be implemented throughout the Operations Stage with regards to bank swallow nesting within the Site Study Area following guidance in the EMMP and Best Management Practices for the Protection, Creation, and Maintenance of Bank Swallow Habitat in Ontario (Ontario Ministry of Natural Resources and Forestry, 2017b), as outlined in **Section 5.1**.

As heavy machinery activity will continue throughout the operations phase, considerations for wildlife exclusionary fencing and implementation of The Species at Risk and Wildlife Observation Protocol developed for the Construction Stage (as outlined in **Section 5.1**) should occur.

5.3 Closure and Post-Closure Stage

The Closure and Post-Closure stage of the project is self mitigating, as the site will be progressively top soiled and vegetated as landfilling is completed in the expansion phases. It is recommended that all plantings include native species that are known to occur within the region and may include compensation plantings as determined through consultation with the Ministry of Environment, Conservation and Parks for Bobolink and Eastern Meadowlark habitat compensation.

6. Monitoring

6.1 Construction Stage

As mentioned in **Section 5.1**, an EMMP will be developed and will include a Construction Monitoring Plan that will outline monitoring activities to be completed during construction. These activities will include, but are not limited to, the following:

- Pre-construction inspection to confirm proper installation of Erosion and Sediment Control and any recommended wildlife exclusionary measures;
- Regular Erosion and Sediment Control fencing monitoring and any exclusionary fencing measures; and,
- Training session for on-site personnel which summarizes mitigation measures.

6.2 Operations Stage

Monitoring during operations may include monitoring of any compensation measures necessary to meet Ministry of Environment, Conservation and Parks permitting or approval requirements for Bobolink and Eastern Meadowlark as well as standard water quality and quantity monitoring necessary to meet relevant provincial permitting and approvals. Monitoring requirements for Operations will be determined at the Detailed Design stage.

6.3 Closure and Post-Closure Stage

Monitoring of compensation plantings and Species at Risk habitat will likely be required to meet requirements under the Endangered Species Act (Ontario Regulation 242/08). The closure and post-closure monitoring efforts will be determined at the Detailed Design Stage.

7. Other Approvals

The proposed expansion for the W12A Landfill will require approvals other than the acceptance and approval of the Environmental Assessment. Based on the layout, design and operation of the proposed expansion, approvals may be required under the following legislation:

1. Provincial: Endangered Species Act
2. Provincial: Planning Act
3. Provincial: Conservation Authorities Act
4. Municipal: The London Plan (2016)

The triggers for these legislation and general permit requirements are outlined in the following sections.

Note that the approvals outlined below all require specific information that can only be determined at the detailed design stage of planning and engineering.

7.1 Provincial

7.1.1 Endangered Species Act

The confirmed presence and breeding of two Species at Risk birds, Bobolink and Eastern Meadowlark, in the cultural meadow habitats (Patch P02) within the proposed expansion area of the W12A Landfill will require review and determination of permitting requirements under the *Endangered Species Act*. Direct loss and/or damage of Bobolink and Eastern Meadowlark habitat is likely to occur during site preparation (e.g., vegetation stripping and site grading), construction of temporary stockpile areas, transportation of equipment and materials, and excavation. These activities may negatively affect Bobolink and Eastern Meadowlark habitat through direct removal of habitat, increased erosion and sedimentation; soil removal / disturbance and compaction; and accidental soil or water contamination by oils, gasoline, grease and other materials from construction equipment and materials storage or handling. It is possible that mitigation can be put into place to avoid or minimize the effects to the species. The proposed annual removal of habitat for these species is approximately 4 hectares per year with a totally removal of 63.19 hectares. Consultation with the Ministry of Environment, Conservation and Parks will be required to determine whether the proposed works require a Notice of Activity or Overall Benefit Permit.

7.1.2 Planning Act – Provincial Policy Statement

The presence of Significant Wildlife Habitat within and adjacent to the W12A Landfill expansion area triggers the requirement for an Environmental Impact Study under the *Planning Act* *vis a vis* the *Provincial Policy Statement*. These policies include the exclusion of development within Provincially Significant Wetlands, habitat of Endangered or Threatened species, fish habitat, as well as within Significant Wildlife Habitat, significant woodlands, significant valley lands, Areas of Natural and Scientific Interests or adjacent lands “...unless it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions” (Ministry of Municipal Affairs and Housing, 2020).

The requirement for an Environmental Impact Study as it relates to Significant Wildlife Habitat may be met by the similar requirement under municipal policies, as noted in the next section (**Section 7.2**). This report is considered to meet the requirements for an Environmental Impact Study under the Provincial Policy Statement.

7.1.3 Conservation Authorities Act

While the proposed expansion area for the preferred alternative does not directly overlap with the Regulation Limits for the Upper Thames River Conservation Authority and the Kettle Creek Conservation Authority, it does immediately abut limits for both authorities. It will, therefore, be prudent to engage both the Upper Thames Region Conservation Authority and Kettle Creek Conservation Authority in discussions to determine the potential requirements for a Section 28 Permit under the *Ontario Regulation 157/06* (Upper Thames Region Conservation Authority) and *Ontario Regulation 181/06* (Kettle Creek Conservation Authority) under the *Conservation Authorities Act*.

7.2 Municipal

7.2.1 The London Plan (2016)

The London Plan (2016) requires an Environmental Impact Study for any proposed works involving development and site alteration within or adjacent to the Natural Heritage System such that they will only be permitted after ecological functions have been evaluated and it is demonstrated that there will be no negative impacts to the Natural Heritage System. While not identified on The London Plan (2016) Natural Heritage Features mapping (Map 5), the presence of Species at Risk Habitat and Significant Wildlife Habitat within and adjacent to the proposed landfill expansion area triggers the requirement for an Environmental Impact Study.

As noted above, the preparation of an Environmental Impact Study can meet the requirements under the Provincial Policy Statement (2020) and The London Plan (2016). The requirement for any additional work to meet the requirements for an Environmental Impact Study will be determined in consultation with the City of London (as outlined in **Section 2.2.11** and **7.1**).

8. Conclusion

The Biology Existing Conditions and Impact Assessment Report for the W12A Landfill Expansion provides documentation of aquatic and terrestrial ecology field investigations, assessment of natural heritage features, an impact assessment for the proposed expansion, recommended mitigation measures, monitoring requirements, and other approval requirements.

8.1 Existing Conditions

The following existing natural heritage features and functions were identified for the Site Study Area and Site-vicinity Study Area:

Aquatic Habitat & Fisheries

- The Site Study Area and Site-vicinity Study Area contain three watercourses (Bannister-Johnston Drain, Unnamed Drain, and C.B. Smith Drain) that have the potential to support fish and fish habitat that are regulated under the *Fisheries Act*. However, no important or exceptional fish habitat was observed during field investigations.
- All sites sampled for benthic invertebrates had impaired to very poor water quality based on a BioMAP Water Quality Index rating less than 14, and a Hilsenhoff Biotic Index rating was above 7.26.

Terrestrial Ecosystems and Species

- Identified Natural Heritage Features in the Site Study Area and Site-vicinity Study Area included Significant Woodlands, Unevaluated Wetlands, Locally Significant Wetland (Silver Swamp), Valleylands, and a Potential Endangered Species Act based on the review of Middlesex Natural Heritage Systems Study criteria (2014) and The London Plan (2016).
- Candidate habitat for Species at Risk bats and Bat Maternity Colonies Significant Wildlife Habitat was identified within the Site Study Area and Site-vicinity Study Area.
- Bobolink and Eastern Meadowlark were confirmed breeding within the Site Study Area and Site-vicinity Study Area during field investigations. Further, Bank Swallow and Barn Swallow were observed foraging within the Study Area; however, no nests were observed, and direct habitat was considered absent.

- Special Concern and Rare Wildlife Species Habitat for Eastern Wood-Pewee and Monarch was confirmed within the Site Study Area and Site-vicinity Study Area.
- The FOD2-3 -Dry – Fresh Hickory Deciduous Forest community, located within the Site-Vicinity Study Area was identified as Significant Wildlife Habitat for Other Rare Vegetation Communities.
- Additionally, Terrestrial Crayfish Significant Wildlife Habitat was confirmed and Candidate habitat for Turtle Wintering Areas was identified within the Site Study Area and Site-vicinity Study Area.

Within the area of the proposed expansion only the following were confirmed:

- Bobolink and Eastern Meadowlark breeding (Species at Risk) habitat was confirmed within the proposed expansion area.
- Special Concern and Rare Species Habitat for Monarch was identified within the proposed expansion area.

8.2 Impacts of the Preferred Alternative

With the selection of the Preferred Expansion Alternative involving a vertical lift on the existing landfill area, many potential impacts to adjacent natural heritage features are avoided. However, with the presence of Species at Risk habitat for Bobolink and Eastern Meadowlark and Significant Wildlife Habitat for Monarch on the existing landfill, certain impacts are unavoidable.

During the Construction Phase, the following potential impacts can be anticipated:

Potential Impacts to Aquatic Habitat & Fish:

- No direct impacts to fish or fish habitat are anticipated as all aquatic habitat is outside of the area of the proposed expansion;

Potential Impacts to Terrestrial Habitat & Species

- Loss of Species at Risk Habitat for Eastern Meadowlark and Bobolink related to the clearing of existing vegetation cover to excavate trenches, construct the Materials Recovery Facility, and add finger drains;
- Loss of Significant Wildlife Habitat for Monarch;
- Dust deposition on vegetation in adjacent vegetation communities;
- Noise related impacts to wildlife in adjacent habitat;
- Introduction of invasive plant species via construction equipment;
- Disturbance, accidental injury or mortality of wildlife or vegetation (i.e., adjacent trees) from construction equipment and vehicles

8.3 Mitigation & Compensation

The following mitigation and compensation measures will be required for the Construction and Operations Stages:

- Preparation and implementation of an Environmental Mitigation and Monitoring Plan (EMMP);
- Preparation and implementation of a Species at Risk and Wildlife Handling Protocol;
- Restriction of vegetation clearing to periods outside of the breeding bird timing window (April 1st to August 31st); clearing may only take place from September 1st to March 31st;
- To avoid birds such as Banks Swallows from nesting in topsoil or excavated material piles, the slopes of piles should be less than 70 degrees;
- Compensation for the loss of Eastern Meadowlark and Bobolink habitat will be required as part of the conditions of a permit under the *Endangered Species Act*. While the details of compensation are subject to a submission and proposal for compensation at the Detailed Design stage, it can be expected that some measures may include enhancement of existing habitats on adjacent lands, or creation of new habitat within the same EcoRegion; and
- Compensation for loss of Significant Wildlife Habitat for Monarch will also be required. Compensation measures may include the enhancement of habitats (planting of common milkweed, butterfly weed, etc.) within or adjacent to the site, or the creation of new meadow habitat with native plant species including common milkweed.

Each of the above noted mitigation or compensation measures will need to be developed at the Detailed Design stage of planning and engineering, and hence are provided herein as general requirements.

8.4 Other Approvals

The preferred expansion alternative for the W12A Landfill will require approvals other than the acceptance and approval of the Environmental Assessment. Based on the layout, design and operation alternative approvals may be required under the following legislation:

- Provincial: Endangered Species Act
- Provincial: Planning Act

- Provincial: Conservation Authorities Act
- Municipal: The London Plan (2016)

The triggers for these legislation and general permit requirements are outlined in **Section 7**. Specific permitting requirements will require specifications that will be determined at the Detailed Design stage of planning and engineering. At that stage, and with further consideration of specific mitigation measures, it is possible that not all of the above approvals are required.

8.5 Conclusion

The proposed expansion of the W12A Landfill is expected to result in several impacts to natural heritage features and functions. Overall, the impacts are considered to be low and can be mitigated with the implementation of the mitigation measures identified in this report. With enhanced mitigation and compensation measures there is potential for a net benefit. The details of the mitigation measures and confirmation of net benefit will require additional development at the Detailed Design stage.

9. References

BioLogic Incorporated, 2013:

Natural Environment Assessment Report: Level 1&2 Assessment Report.

Prepared for AAROC Aggregates Ltd. January 14, 2013. 75 pp.

Bird Studies Canada in co-operation with Environment Canada and the

US Environmental Protection Agency, February 2008:

Marsh Monitoring Program Participant's Handbook Surveying Amphibians. 2008 Edition. 20 Pages.

Bird Studies Canada, Environment Canada's Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources, 2006:

Ontario Breeding Bird Atlas Website. <http://www.birdsontario.org/atlas/index.jsp>

Chapman, L.J. and D.F. Putnam, 1984:

The Physiography of Southern Ontario. Ontario Ministry of Natural Resources. 270 pp.

City of London, 2016:

The London Plan (2016). Available at: <https://www.london.ca/business/Planning-Development/Official-Plan/Pages/The-London-Plan.aspx>

Earth Tech, 2005:

W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study. Prepared for the City of London.

Environment Canada – Canadian Wildlife Service, 2009:

Forest Bird Monitoring Program Survey Instructions & Codes. May 2009 Edition.

Environment Canada - Canadian Wildlife Services, 2019:

Guidelines to reduce risk to migratory birds. Environment Canada. Available at: <https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html>

Fisheries and Oceans Canada, 2018:

Aquatic Species at Risk Map tool. Accessed March, 2019. Available:

<http://www.dfo-mpo.gc.ca/species-especes/sara-lep/map-carte/index-eng.html>

Golder, 2020a:

Volume I Environmental Assessment of the Proposed W12A Landfill Expansion, City of London.

Golder, 2020b:

Stormwater Management Report – W12A Landfill Expansion, City of London, Ontario.

Golder, 2020c:

Groundwater Impact Assessment – W12A Landfill Expansion EA, City of London, Ontario.

Government of Canada, 2002:

Species at Risk Act. Accessed March 2019 from: <https://laws-lois.justice.gc.ca/PDF/S-15.3.pdf>

Hagerty, T.P. and M.S. Kingston, 1992:

The soils of Middlesex County. Ontario Centre for Soil Resource Evaluation Report No. 56. Ontario Ministry of Agriculture and Food, Resource Management Branch, Guelph, ON, Canada.

Kettle Creek Conservation Authority, 2013:

Kettle Creek Watershed Report Card.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurry, 1998:

Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Middlesex County, 2014:

Middlesex Natural Heritage Systems Study: A study to identify natural heritage systems in Middlesex County. Project management by Upper Thames River Conservation Authority in co-operation with Middlesex County Conservation Authorities.

Ministry of Municipal Affairs and Housing, 2020:

2020 Provincial Policy Statement. Provincial Planning Policy Branch. Queen's Printer for Ontario.

Ministry of Natural Resources and Forestry, Guelph District, 2012:

Bobolink Survey Methodology.

North-South Environmental Inc., 2009:

City of London Inventory and Evaluation of Woodlands. Prepared for the City of London.

- Oldham, M.J., W.D. Bakowsky and D.A. Sutherland, 1995:
Floristic quality assessment system for Southern Ontario. Ontario Ministry of Natural Resources, Natural Heritage Information Centre. Peterborough, Ontario.
- Ontario Breeding Bird Atlas, 2001:
Guide for Participants. Atlas Management Board, Federation of Ontario Naturalists, Don Mills.
- Ontario Ministry of Agriculture, Food, and Rural Affairs, 2019:
AgMaps online mapping tool. Accessed March 2019 at:
<https://www.gisapplication.lrc.gov.on.ca/AIA/index.html?viewer=AIA.AIA&locale=en-US>
- Ontario Ministry of Natural Resources and Forestry, 2000:
Significant Wildlife Habitat Technical Guide. October. Queen's Printer for Ontario. 151 pp.
- Ontario Ministry of Natural Resources and Forestry, 2010:
Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement 2005. Queen's Printer for Ontario.
- Ontario Ministry of Natural Resources and Forestry, 2013:
Ontario Wetland Evaluation System Southern Manual. 3rd Edition, Version 3.3. Queen's Printer for Ontario.
- Ontario Ministry of Natural Resources and Forestry, 2014:
Species at Risk in Ontario. Accessed March 2019 at:
<https://www.ontario.ca/environment-and-energy/species-risk-ontario-list>
- Ontario Ministry of Natural Resources and Forestry, 2014a:
Species at Risk – Barn Swallow. © Queen's Printer for Ontario, 2012-14.
Available on the internet at: <http://www.ontario.ca/environment-and-energy/barn-swallow>
- Ontario Ministry of Natural Resources and Forestry, 2014b:
Species at Risk – Little Brown Myotis. © Queen's Printer for Ontario, 2012-14.
Available on the internet at: <http://www.ontario.ca/environment-and-energy/little-brown-bat>
- Ontario Ministry of Natural Resources and Forestry, 2014c:
Species at Risk – Northern Myotis. © Queen's Printer for Ontario, 2012-14.
Available on the internet at: <http://www.ontario.ca/environment-and-energy/northern-long-eared-bat>

Ontario Ministry of Natural Resources and Forestry, 2015:
Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E. January 2015.

Ontario Ministry of Natural Resources and Forestry, 2015a:
General Habitat Description for the Bank Swallow (*Riparia riparia*). July 2015.
Available on the internet at:
https://ossga.com/multimedia/0/bank_swallow_ghd_en.pdf

Ontario Ministry of Natural Resources and Forestry, 2015b:
General Habitat Description for the Barn Swallow (*Hirundo rustica*). 2015.
Available on the internet at: https://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_ghd_brn_swllw_en.pdf

Ontario Ministry of Natural Resources and Forestry, 2016:
Survey Protocol for Ontario's Species at Risk Snakes. Ontario Ministry of Natural Resources and Forestry, Species Conservation Policy Branch. Peterborough, Ontario. ii + 17 pp.

Ontario Ministry of Natural Resources and Forestry, 2017a:
Survey Protocol for Species at Risk Bats within Treed Habitats. Ministry of Natural Resources and Forestry – Guelph District. April 2017.

Ontario Ministry of Natural Resources and Forestry, 2017b:
Survey Protocol for Species at Risk Bats within Treed Habitats. Ministry of Natural Resources and Forestry – Guelph District. April 2017.

Ontario Ministry of Natural Resources and Forestry, 2018:
Make a Map: Natural Heritage Areas Application. Accessed December 2018 from:
http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US

Ontario Nature, 2009:
Ontario Nature's Ontario Breeding Bird Atlas. Accessed January, 2019.

Ontario Nature, 2015:
Ontario Reptile and Amphibian Atlas Program. Accessed January 2019 from:
<https://ontarionature.org/oraa/maps/>

Ontario Nature, 2017:
Ontario Reptile and Amphibian Atlas Program. Accessed January 2019 from:
<https://ontarionature.org/oraa/maps/>

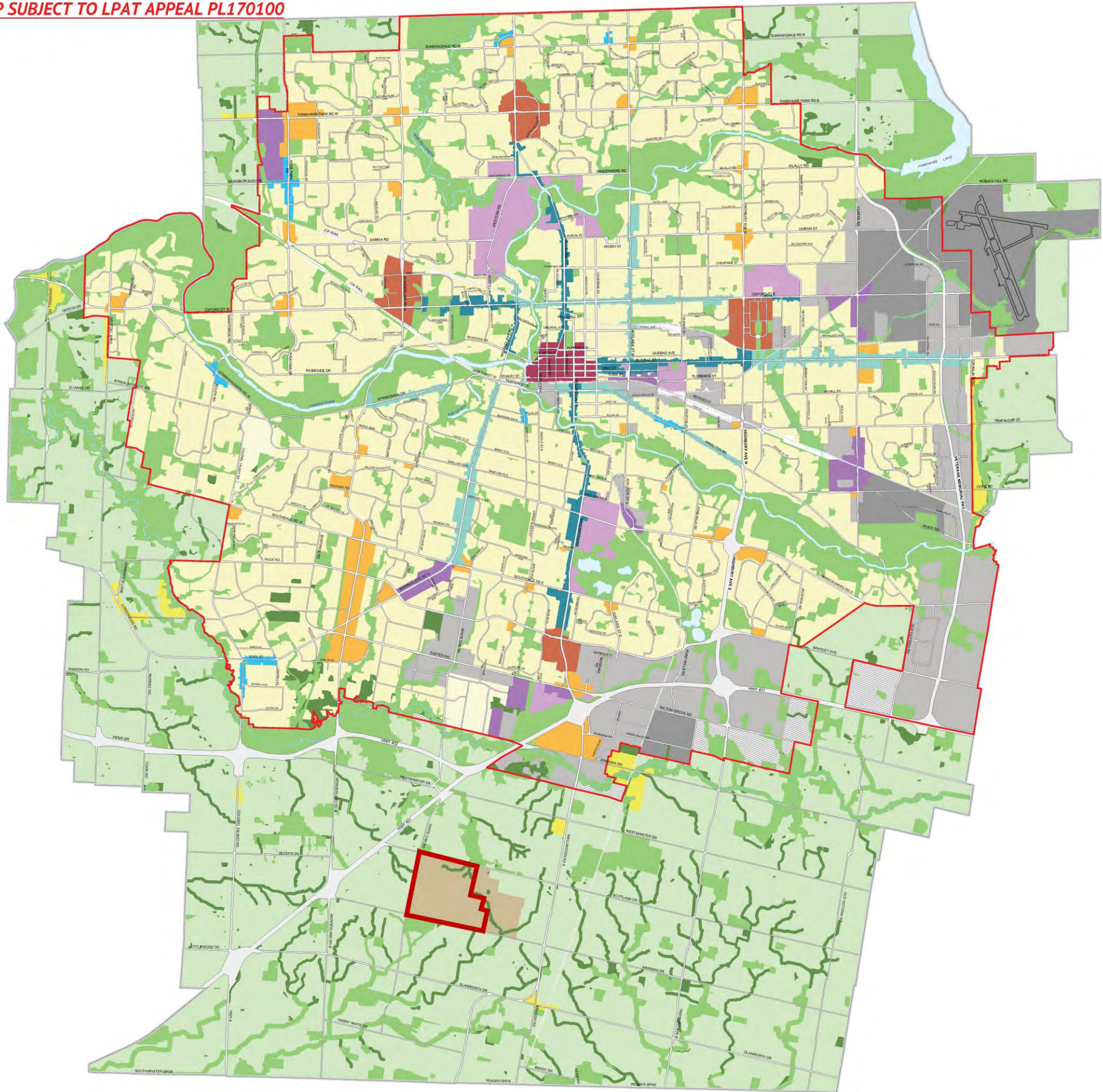
Upper Thames River Conservation Authority, 2017:
Dingman Creek Watershed Report Card.

Appendix A

The London Plan (2106) – Maps 1 & 5

MAP 1 - PLACE TYPES

MAP SUBJECT TO LPAT APPEAL PL170100



LEGEND

PLACE TYPES

- | | |
|------------------------|---|
| Green Space | Heavy Industrial |
| Environmental Review | Light Industrial |
| Downtown | Commercial Industrial |
| Transit Village | Future Community Growth |
| Rapid Transit Corridor | Future Industrial Growth |
| Urban Corridor | Farmland |
| Shopping Area | Rural Neighbourhoods |
| Main Street | Waste Management Resource Recovery Area |
| Neighbourhoods | Urban Growth Boundary |
| Institutional | |

BASE MAP FEATURES

- Streets (See Map 3)
- Railways
- Water Courses/Ponds
- Approximate Site Study Area



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Metres
1:30,000

ADOPTED BY COUNCIL ON JUNE 23, 2016

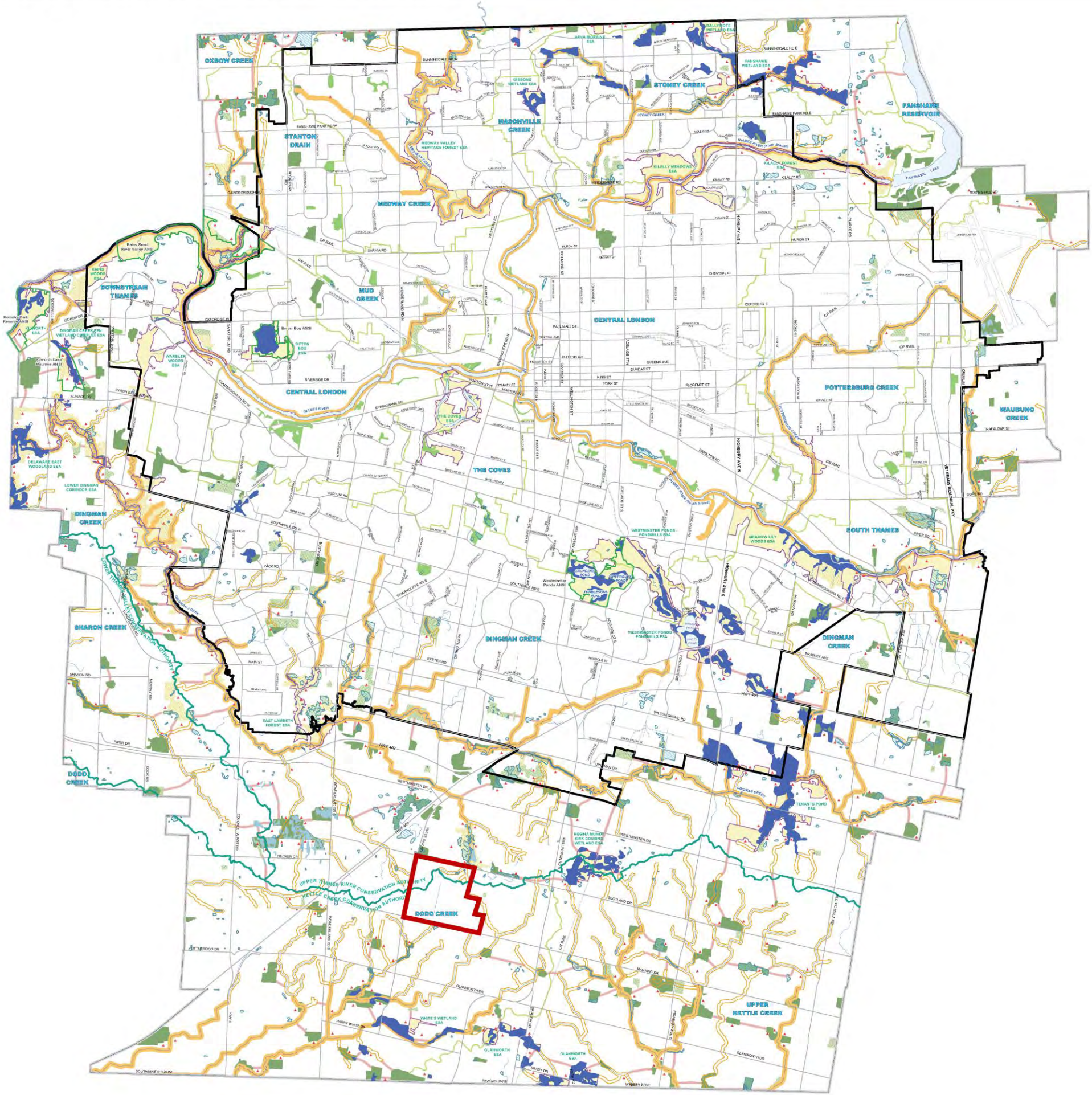
APPROVED BY THE PROVINCE ON DECEMBER 28, 2016

THIS MAP MUST BE READ IN CONJUNCTION
WITH THE TEXT OF THE LONDON PLAN

NOTE: At the time of the printing of this map, the Rapid Transit EA is in progress. It is expected that a rapid transit alignment will be known before *The London Plan* is approved. This map shows the Rapid Transit Corridors and Urban Corridors to recognize potential alignments. These Place Types will be modified to align with the results of the EA process for the final version of *The London Plan*.

While every effort has been made to ensure that the mapping is accurate, a reader should verify all information contained in this map before acting upon it by contacting the City Clerk's Office, Suite 308, 300 Dufferin Avenue, London, Ontario, N6B 1Z2 or by calling (519) 661-2500 extension 4939.

MAP 5 - NATURAL HERITAGE



LEGEND

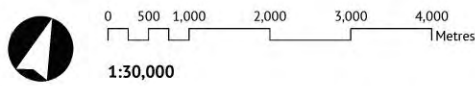
NATURAL HERITAGE SYSTEM

Provincially Significant Wetlands	Areas of Natural and Scientific Interest
Wetlands	Environmental Significant Areas (ESA)
Unevaluated Wetlands	Potential ESAs
Significant Woodlands	Upland Corridors
Woodlands	Potential Naturalization Areas
Significant Valleylands	Unevaluated Vegetation Patches
Valleylands	

BASE MAP FEATURES

Streets (See Map 3)	Water Bodies
Railways	Conservation Authority Boundary
Urban Growth Boundary	Subwatershed Boundary
Water Courses/Ponds	Subwatershed Name

Approximate Site Study Area



ADOPTED BY COUNCIL ON JUNE 23, 2016

UNDER REVIEW BY THE PROVINCE

THIS MAP MUST BE READ IN CONJUNCTION
WITH THE TEXT OF THE LONDON PLAN

While every effort has been made to ensure that the mapping is accurate, a reader should verify all information contained in this map before acting upon it by contacting the City Clerk's Office, Suite 308, 300 Dufferin Avenue, London, Ontario, N6B 1Z2 or by calling (519) 661-2500 extension 4939

Appendix B

**W12A Landfill Expansion Biology
Report Terms of Reference**

City of London

Request for Proposal – Consultant Services for Biology Study for the W12A Landfill Site Expansion Environmental Assessment

Prepared by:

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Prepared for:

Wesley Abbott, P.Eng.
Project Manager
Corporation of the City of London
300 Dufferin Ave
London, ON N6A 4L9

Date: June 30, 2017

Project #: 04001749.4050

1. Introduction

AECOM is pleased to submit our proposal to undertake a Biology Study for the Environmental Assessment for the Proposed Expansion of the City of London's W12A Landfill. Our proposal fully addresses the requirements of the RFP letter dated June 20, 2017 issued by the City of London. This proposal outlines our understanding of the assignment, our proposed work plan, our proposed project team roles and responsibilities of key staff, complete with their related knowledge and expertise.

2. Our Understanding and Approach

It is our understanding that the City of London is seeking to obtain services for the completion of a Biology Study in support of the Individual Environmental Assessment (EA) of the proposed expansion of the W12A Landfill. The project is currently in the EA Terms of Reference phase led by Golder Associates Ltd. and City of London staff.

The study area for the Biology Study portion of the EA includes the site which consists of the existing W12A Landfill site at 3502 Manning Drive and adjacent lands where landfill expansion is complemented. This includes lands to the north and the east of the existing landfill site. The Site-vicinity study area includes lands 500m from the landfill Site. An area 500m from the site is deemed be suitable to assess potential natural heritage impacts of the proposed expansion.

Our Project team has an intimate understanding of the study area and regulatory requirements for this assignment gained through our experience on numerous projects in the City of London including the W12 Landfill Area Plan Study Ecological Background Study and Natural Heritage Study (2005). The AECOM project team proposed for this study has over 22 years of experience working on Area Studies, Natural Heritage Studies, Environmental Impact Studies and Subject Lands Status Reports in the City of London for the City and private sector clients. We have an intimate working knowledge of the City of London's Official Plan and The London Plan environmental policies, the City's Environmental Management Guidelines (2007), and have an excellent working relationship with City and conservation authority staff (UTRCA & KCCA).

Within the study area, there are portions of three subwatersheds; Dodds Creek Subwatershed, Kettle Creek Subwatershed and Dingman Creek Subwatershed. The

existing landfill site and property owned by the City of London lies mostly within the Dodds Creek Subwatershed.

Based on a preliminary review completed in support of this proposal, natural features in the Site and Site-vicinity Study Area include watercourses, wooded areas including Significant Woodlands and unevaluated woodlands as mapped on Schedule B-1 of the City of London's Official Plan, known records of several plant, bird, snake, and mammal Species at Risk and Species of Conservation Concern (SOCC), and potential Significant Wildlife Habitat including features supporting bat maternity colonies, amphibian breeding, and habitat for SOCC.

Integration of the Biology Study with other EA Study components will be extremely important to the successful preparation of the EA Terms of Reference and the Final EA reporting. We are allowing for four (4) study team meetings with the prime consultant for the purposes of study component coordination, exchange of information, and evaluation of alternatives.

3. Project Team

AECOM's highly qualified professionals have the ability to undertake the work required for this project. An Organizational Chart has been provided in **Appendix A** and Curriculum Vitae for each team member are included in **Appendix B**.

Gary Epp, M.Sc., Ph.D. - Practice Area Lead, Water and Natural Resources

Dr. Epp is the Practice Area Lead for Water & Natural Resources for AECOM in Ontario and a Senior Ecologist, with the overall responsibility for providing comprehensive and integrated ecological assessment services to our clients. As Practice Area Lead, he is directly responsible for the management and coordination of a team of terrestrial ecologists, aquatic biologists, wetland specialists, arborists, wildlife biologists, ornithologists, fluvial geomorphologists and environmental monitoring specialists. He also manages and provides expertise to a wide range of ecological assessment assignments including natural heritage studies, environmental impact studies, watershed management plans, wetland evaluations and assessments, revegetation plans, aquatic and terrestrial habitat studies, natural resources screening, and bio-monitoring studies. Gary lead the W12 Landfill Area Plan Study Ecological Background Study and Natural Heritage Study (2005) and has a wide range of experience with landfill studies. *Gary will act as overall Project Manager and Quality Reviewer.*

Shari Muscat, B.A., B.E.S. – Environmental Planner

Ms. Muscat has over 18 years of experience in environmental resource planning and management and has successfully managed or participated in more than 150 projects. Shari is responsible for planning and coordinating environmental impact assessments, natural environment field programs and biological inventories in support of development, transportation, renewable energy and watershed restoration projects. Shari has been involved in the implementation of the natural heritage and natural hazards policies of the Provincial Policy Statement, Conservation Authorities Regulations, Greenbelt Act, Niagara Escarpment Act, Municipal planning documents and the Renewable Energy Act. *Shari will act as Project Coordinator and primary liaison with EA Team Members.*

Jill deMan, H.B.Sc. - Senior Terrestrial and Wetland Ecologist/Ecology Manager

Ms. deMan is a senior terrestrial and wetland ecologist with AECOM's Environmental Division based out of Kitchener, Ontario. With the company for 20 years, her expertise has a wide range of scope within the environmental field enabling her to be involved with numerous types of projects that incorporate natural heritage issues/planning and restoration. She provides senior review and has experience in small to large-scale natural heritage baseline, environmental assessment, impact analysis, peer review, monitoring and restoration work where she co-ordinates multi-disciplinary teams for projects across Canada. She has considerable experience in facilitation of approvals under the *Species at Risk Act*, *Fisheries Act*, *Endangered Species Act*, and the *Conservation Authorities Act*. *Jill will act as Species at Risk advisor.*

Jessica Piette, H B.ES, Terrestrial Ecologist

Ms. Piette is a Terrestrial Ecologist with over 10 years of experience. She has participated in a diverse range of projects with a focus on environmental assessments, environmental impact studies, ecological restoration and renewable energy. Her technical skills include Species at Risk surveys, wetland boundary delineation and evaluations, soil identification, air-photo interpretation, vegetation inventories, ELC community descriptions, herpetofauna, Odonata, and Lepidoptera surveys, active nest searches, bat and bat habitat surveys and woodland evaluations. She is trained and experienced in the application of Ecological Land Classification (ELC) of Southern Ontario, and the Ministry of Natural Resources Wetland Evaluation guidelines. *Jessica will act as Terrestrial Lead and coordinate completion of the Terrestrial Field Program.*

Michael Godard, B.Sc. Hon, Fisheries Biologist

Mr. Godard is an intermediate fisheries biologist with over 14 years of experience in the fisheries field in both the private and public sector. Michael is part of the Environmental Division and is based out of the Kitchener Office. He has worked on a diverse range of projects including environmental assessments, environmental baseline studies, environmental monitoring projects, Renewable Energy projects, transportation projects, environmental impact studies, construction monitoring projects, and Species at Risk screenings and surveys. *Michael will act as Aquatics Lead and will coordinate completion of the Aquatic Habitat Assessment and Benthic survey.*

3.1 Sub Consultants

In addition to the expertise and experience provided by our AECOM team members, we have included **StraightUp Environmental** to undertake the benthic macro invertebrate sampling program.

4. Scope of Work

4.1 Task 1 – Preparation of a Work Plan for Inclusion in the EA Terms of Reference (TOR)

A Work Plan for the Biological Study will be developed for inclusion within the TOR. The Work Plan will describe the methodology for understanding the existing conditions, compare alternative methods of landfill expansion and assess the potential impacts of the preferred the landfill expansion on natural heritage features within the Site and Site-vicinity Study Area.

4.2 Task 2 – Prepare Description of Existing Conditions for Inclusion in TOR

An existing conditions summary will be prepared for inclusion within the TOR. The existing conditions will be based on a desktop review of existing background information including, but not limited to, the following documents:

- W12A Landfill Area Plan Study – Ecological Background Study and Natural Heritage Study (Earth Tech, 2005)
- Middlesex Natural Heritage Systems Study (UTRCA, 2014)

- The London Plan (2016)
- City of London Inventory and Evaluation of Woodlands (North-South Environmental Inc. (2009)
- Dingman Creek Subwatershed Study (1996) and Dingman Creek Subwatershed Study Update (2006)
- Dingman Creek Watershed Report Card (2012)
- Dodd Creek Subwatershed Strategy (2005)
- DFO Drain Classification and Fish Habitat Data from the UTRCA and KCCA

Background Information Requests & Review – AECOM will conduct a comprehensive review of background information and available documentation regarding natural heritage and environmental features within the Study Area. Information requests will be forwarded to the City of London E&PP Department, UTRCA, to Fisheries and Oceans Canada (DFO), and the Ministry of Natural Resources and Forestry (MNRF). AECOM will also search the MNRF Natural Heritage Information Center (NHIC) data base and Land Information System.

Species at Risk Screening - To determine the potential for Species at Risk (SAR) within the study area, a habitat screening will be conducted whereby AECOM will review all available background documents such as MNRF's online database, Amphibian and Reptiles Atlas, the Ontario Breeding Bird Atlas, Agency correspondence etc. to create a complete list of potential SAR within the area. The listed species habitat preferences will then be compared to onsite habitat characteristics to determine if the study area may potentially contain preferred habitat for the listed SAR. The results of the SAR Screening will provide the rationale for either clearance with respect to SAR, or recommendations for species-specific surveys. Species-specific surveys and permits under the Provincial *Endangered Species Act* (ESA, 2007), should they be required, are not included in this work program and would require a Scope Change.

4.3 Task 3 – Field Surveys – Biology Assessment

A biology assessment will be undertaken to fully describe the existing conditions within the Site and Site-vicinity Study Area. Although a significant amount of fieldwork has been completed within the Site and Site-vicinity Study Area, the information is dated and requires updating. In addition, previous studies did not include habitat assessments and surveys for Species at Risk.

This work will be completed in 2018 in accordance with the approved work plan developed as part of the TOR and will consist of three (3) season inventory of the natural heritage features within the Site and Site-vicinity Study Area and will follow City

of London data collection guidelines as per the City of London Environmental Management Guidelines (2007).

a) Herpetofauna Surveys

Vernal Pools Surveys (late March to May) – To survey for the presence of breeding amphibians and salamanders, a daytime site visit will be conducted to examine the suitability of vegetation communities present within the Site and Site-vicinity Study Area for the presence of vernal pools. The following parameters will be used to identify potential viable vernal pools:

- Small, isolated pools (lacking the presence of fish populations);
- The identified pools must have the potential to hold water at least until July or
- Have water depths of at least 30cm in early spring to be considered suitable amphibian breeding habitat. The 30 cm depth criterion is consistent with the recommendations of Calhoun and deMaynadier (2004);
- Good surrounding upland forested habitat;
- Each viable vernal pool will be mapped and marked using a GPS, as the identified pools will serve as the amphibian/salamander survey stations;
- Water depth, classification of surrounding vegetation, in water characteristics (i.e. %vegetation vs % open water), evidence of breeding amphibians (egg masses) will be recorded.

Following the identification of viable vernal pools the following additional amphibian and salamander surveys will be conducted.

Auditory Amphibian Surveys will follow the protocols as outlined in the Marsh Monitoring Protocol, the standardized field methodology for audio-surveying breeding frogs and toads. Amphibian surveys will be completed at each of the pre-determined survey stations established during the amphibian/salamander habitat surveys. Based on a preliminary review of site aerial photography AECOM has identified four (4) suitable survey locations. The number of locations will be confirmed during the vernal pool surveys. Three locations have been identified within the Site Area and one (1) within the Site Vicinity Area in order to identify potential movement corridors.

Visual Amphibian/Salamander surveys will be conducted within suitable habitat identified during the vernal pool surveys. Area searches will be conducted in

conjunction with other surveys completed for the Site and Site-vicinity Study Area.

- b) ***Aquatic Habitat Assessments*** – AECOM aquatic biologists will conduct aquatic habitat assessments of the four (4) watercourses within the Site Vicinity Study Area. Investigations will include the determination of drainage patterns within the study area and determination of the status of watercourses. Data collection in will include:
- Channel type (natural or channelized)
 - Channel morphology (width, depth)
 - Flow characteristics
 - Substrates
 - Instream cover
 - Specialized habitat present
 - Bank and riparian community characteristics
 - Valley form characteristics
- c) ***Benthic (macro) Invertebrate Surveys*** will be completed at four primary sites within the Site and Site-vicinity Study Area. Benthic monitoring will be conducted following protocols established by Dr. Bob Baily (University of Western University, 2001) and involve transverse sweeps or ‘kicks’ across suitable habitats (i.e. riffles). Sampling will be done during the period between early June to late September avoiding spring and fall spawning activity.
- d) ***Bat Habitat Suitability Assessment*** – In order to survey for the presence of bat habitat, a bat habitat suitability assessment will be completed within the Site and Site-vicinity Study Area during the leaf-off and leaf on period. This assessment will be conducted within identified candidate habitat (CUW, FOD, FOM, FOC, SWD, SWM and SWC) following the MNRF Survey Protocol for Species at Risk within Treed Habitats – Little Brown, Northern Myotis, and Tri-Colored Bat (April 2017). Based on a preliminary review of the Site and Site-vicinity Study Area, AECOM has identified five (5) features which will require bat habitat assessments. Acoustic monitoring has not been included within this work plan. *Should cavity tree assessments determine the need for the completion of Acoustic Monitoring this will be addressed under a separate scope of work and associated fees.*

- e) ***Snake Cover Board and Area Searches*** – In order to survey for the presence of snakes and identify candidate habitat within the Site Area, a combination of cover board surveys and area searches will be completed. These surveys will be completed during daytime bat habitat assessments, ELC investigations, as well as breeding bird surveys. Approximately 5 daytime searches will be conducted, to survey potential habitat including: hibernacula (rock or debris piles) and installed cover boards.
- f) ***Breeding Bird Surveys*** – Breeding bird surveys will be conducted over a minimum of two (2) site visits during peak calling season and peak calling hours. However, given the identification of grassland Species at Risk (SAR) species during the preliminary SAR Screening, and the presence of candidate habitat, three rounds of surveys may be necessary to satisfy survey requirements for SAR grassland birds (i.e. Bobolink and Eastern Meadowlark). For the majority of Ontario's breeding birds this occurs between a half-hour before sunrise to approximately 10:00 a.m. from May 24th to July 10th. Birds observed exhibiting various breeding behaviors in suitable habitat on or adjacent to the site will be recorded. Incidental observations of other wildlife, including amphibians and mammals, will be recorded on each field visit.
- g) ***Ecological Land Classification Confirmation & Floral Inventory*** – Vegetation communities will be delineated and assessed according to the protocols outlined in the Ecological Land Classification system for Southern Ontario (Lee et al., 1998) to Vegetation Community Type where possible. A three-season plant inventory will also be completed to ensure that spring ephemerals and seasonally significant species are documented. Vegetation communities will be mapped and used to further refine the results of the SAR and SWH screening exercises.
- h) ***Wetland Community Boundary Delineation*** – When wetland communities are observed, wetland community boundaries and descriptions will follow protocols outlined in the Ontario Ministry of Natural Resources Ontario Wetland Evaluation System (OWES) for Southern Ontario (3rd edition, 2014).
- i) ***Lepidoptera and Odonata Surveys*** – Butterfly, dragonfly and damselfly surveys will be conducted in conjunction with ELC and SWH surveys within the study area. These will be conducted by walking the entire site capturing and identifying species as they are seen. Once identified, the species will be released.
- j) ***Significant Wildlife Habitat Surveys*** – A Significant Wildlife Habitat screening exercise will be conducted using the Wildlife Habitat Ecoregion Criteria Schedule 7E (OMNR 2015) to determine the presence of Candidate SWH within the Site

and Site-vicinity Study Area. The presence of candidate habitat for all five SWH categories will be determined by comparing existing conditions, based on ELC site investigations, to criterion listed within the 7E schedule. This assessment will be completed to help inform the need to conduct additional species specific surveys not captured within this work plan.

4.4 Task 4 - Reporting

Reporting will include the preparation of a “stand-alone” Natural Heritage Assessment Report (Draft and Final) for inclusion as an Appendix to the Environmental Assessment Report. The report will include results of the biology field program and a qualitative comparison and ranking of alternative methods of landfill expansion. In order to assess the significance of unevaluated features, AECOM will apply the City’s evaluation criteria for ESAs, Significant Valleylands, and Significant Woodlands in accordance with City of London’s Environmental Management Guidelines.

An assessment of the potential impacts of the preferred alternative on terrestrial vegetation communities, aquatic habitat, and wildlife, including rare, threatened or endangered species on Site and within the Site-vicinity will be included. The report will identify recommended mitigation measures as well as any monitoring and/or contingency plans for operation of the preferred landfill expansion.

5. Study Schedule

The schedule for the Biology Study would extend from early July 2017 to Summer/Fall 2019. The completion of the Work Plan and existing conditions summary draft and final report is to be completed in September and November 2017 respectively. Field work would commence in March 2018 and extend until September 2018. The EA process is scheduled to start in the Spring of 2019 and will include the evaluation and ranking of alternatives, impacts assessment, identification of mitigation and monitoring plans and completion of the Natural Heritage Report.

6. Assumptions/Exceptions

Several assumptions and exceptions have been made in the preparation of this proposal:

- It is assumed that property access will be made available for the required surveys. Where property access is not available, surveys will be completed from the road side or from where access is available.
- Any additional surveys or effort that are required as a result of agency consultation as part of the Terms of Reference stage will require a scope change and will be quoted separately
- A detailed Tree Inventory has not been included in this work program
- Species at Risk permitting or registration under the *Endangered Species Act* (ESA) has not been included in this work program. Should ESA permits or registration be required, they will be provided as part of a scope change.

7. References

Robert Sutton, Director of Engineering, City of Barrie. 70 Collier St., P.O. Box 400, Barrie, Ontario. L4M 4T5. (705) 739-4220 ext. 4551. Robert.Sutton@barrie.ca (former Manager of Engineering, City of London)

Maureen Zunti, Senior Planner, Sifton Properties Limited. 1295 Riverbend Road, Suite 300, London, Ontario. N6K 0G2. (519) 434-3622 x3238. maureen.zunti@sifton.com

8. Project Costs

AECOM's budget estimate for the Biology Study for the Proposed Expansion of the W12A Landfill Environmental Assessment is **\$ 90,463.80**. This fee is exclusive of HST.

City of London

Request for Proposal – Consultant Services for Biology Study for the
W12A Landfill Site Expansion Environmental Assessment

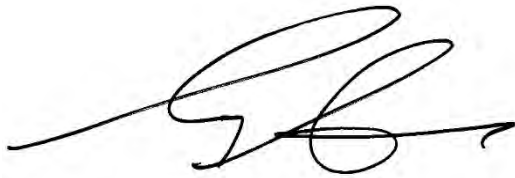
As per the RFP, time has not been allocated to attend Open House #2, however, provisional costs have been provided for one member of the biology team to attend two 5 hour open house sessions. In addition, a provisional cost of \$5,000 has been included to respond to comments from stakeholders and the MOECC and a 15% contingency allowance has been provided.

The Detailed Time-Task Breakdown is included in **Appendix C**.

We appreciate the opportunity to submit this proposal for the services as listed above. If you have any questions, please do not hesitate to contact the undersigned.

Sincerely,

AECOM Canada Ltd.

A handwritten signature in black ink, appearing to be 'G. Epp', with a long horizontal line extending to the left and a loop at the end.

Gary A. Epp, B.Sc. (Hons.), M.Sc., Ph.D.
Practice Lead
Water & Natural Resources, Environment
gary.epp@aecom.com

Encl. Appendix A. Project Team Organization
 Appendix B. Project Team CVs
 Appendix C. Fee Matrix

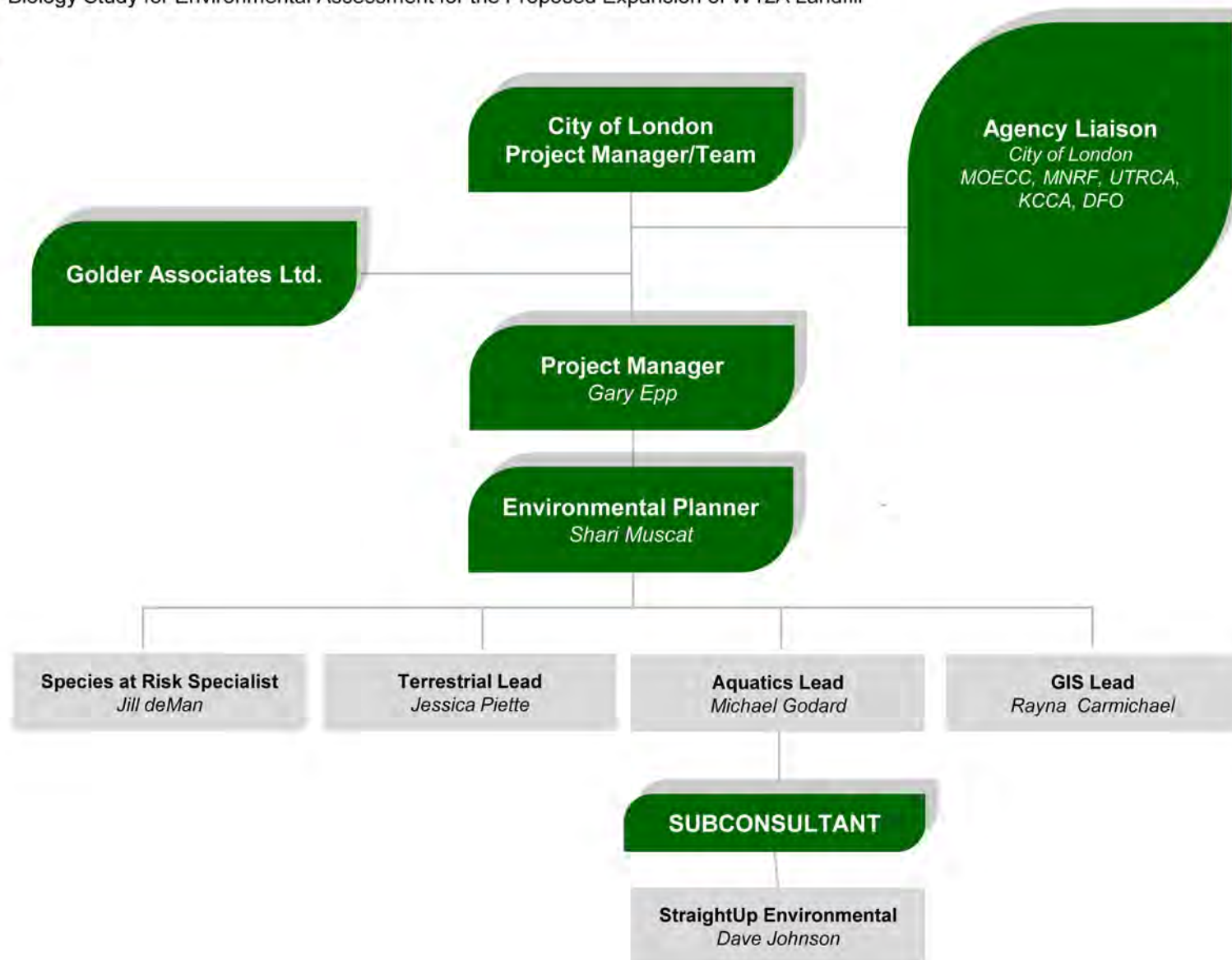
Appendix A

Project Team Organization



London
CANADA

The Corporation of The City of London
Request for Proposal
Biology Study for Environmental Assessment for the Proposed Expansion of W12A Landfill



Appendix B

Project Team CVs

Gary Epp, MSc, PhD

Senior Ecologist & Practice Area Lead, Water and Natural Resources

Education

PhD, Biology, Queen's University, 1989

MSc, Biology, Queen's University, 1986

BSc, Science, University of Western Ontario, 1984

Years of Experience

With AECOM: 24

With Other Firms: 4

Areas of Expertise

Natural Heritage Studies, Environmental Impact Assessment, Ecological Restoration, Approvals & Permitting, Ecological Investigations

Professional Affiliations

Ecological Society of America

International Association for Impact Assessment

Society for Ecological Restoration

Training and Certifications

Project Management Certification

Summary

Dr. Epp is the Practice Area Lead for Water & Natural Resources for AECOM in Ontario and a Senior Ecologist, with the overall responsibility for providing comprehensive and integrated ecological assessment services to our clients. As Practice Area Lead, he is directly responsible for the management and coordination of a team of terrestrial ecologists, aquatic biologists, wetland specialists, arborists, wildlife biologists, ornithologists, fluvial geomorphologists and environmental monitoring specialists. He also manages and provides expertise to a wide range of ecological assessment assignments including natural heritage studies, environmental impact studies, watershed management plans, wetland evaluations and assessments, revegetation plans, aquatic and terrestrial habitat studies, natural resources screening, and bio-monitoring studies. Dr. Epp's clients range from municipal and government agencies to land development, mining, and industrial clients throughout Ontario, Canada and various international sectors. His experience has frequently involved an integrated approach where ecological studies have been strategically coordinated with a variety of other scientific, engineering, and planning disciplines. Dr. Epp has extensive experience negotiating with a wide range of review and approval agencies, naturalist groups, and the public. He is recognized as an expert in ecological assessment before the Ontario Municipal and Environmental Assessment Boards.

Project Experience

Waste Management Studies & Master Plans

City of London, W12A Landfill Site Area Study – Ecological Resources Background Study, London, Ontario. Directed and reviewed studies for the future planning of the landfill site. Ecological studies included vegetation surveys and analysis, fisheries surveys and habitat assessment, benthic invertebrate surveys and assessments, evaluation of constraints and opportunities, and the development of recommendations for the protection of Natural Heritage features and functions. [01/01/2005-12/31/2005]

City of Peterborough, Bensfort Road Landfill Site Expansion, Peterborough, Ontario. Supervised ecological studies of lands within and adjacent to the landfill site to determine the effects of a future expansion of the landfill footprint. Studies involved wetland evaluations and fisheries surveys. [01/01/1998-12/31/1998]

City of North Bay, Merrick Landfill Biological Monitoring Program Protocols, North Bay, Ontario. Developed the protocol for monitoring program sampling, analysis, and data interpretation for ecological resources in watercourses adjacent to the proposed Merrick Landfill site. Protocol preparation included the development of trigger mechanisms and contingencies. [01/01/1997-12/31/1997]

Township of Asphodel, Township of Asphodel Landfill Sediment and Biological Monitoring Program, Ontario. Conducted a monitoring program involving sampling and analysis of sediments and biological tissue for accumulation of mercury, cadmium, and organochlorine compounds. The study report addressed bioaccumulation of contaminants and potential for food-chain effects. [01/01/1996-12/31/1996]

Town of Lindsay, Ops Landfill Bio-monitoring Program, Ontario. Designed and conducted a bio-monitoring program to investigate the impact of landfill-derived contamination on benthic communities and on the potential bioaccumulation of PCBs and metals in blackfly larvae. [01/01/1995-12/31/1997]

County of Victoria, Waste Management Master Plan, Level Four Ecological Assessment, Ontario. Supervised and conducted a resource screening and ecological net effects analysis for Level Four candidate landfill sites. On-site investigations included aquatic and terrestrial surveys and boundary delineations. Used information from field investigations to conduct a comparative evaluation of sites and to provide recommendations for protection and mitigation of impacts. [01/01/1995-12/31/1996]

Region of Sudbury, High Cliff Lake Wetland Assessment Study, Ontario. Conducted a wetland evaluation for habitats in High Cliff Lake adjacent to the Onaping Falls landfill site. Assessed potential impacts of site expansion for the wetland resources. [01/01/1996-12/31/1996]

Region of Sudbury, Sudbury Landfill Site Wetland Assessment and Enhancement Study, Ontario. Assessed the Romford Creek wetland to determine whether any landfill-derived impacts to sediments and biota existed. As a contingency measure, developed a wetland enhancement strategy to increase the attenuation potential of the Romford Creek wetland in the event of surface water contamination. [01/01/1995-12/31/1995]

Center and South Hastings Waste Management Board, Master Plan, Level Four Ecological Assessment, Ontario. Supervised and conducted a resource screening and ecological net effects

analysis for two Level Four candidate landfill sites. On-site investigations included aquatic and terrestrial surveys and boundary delineations. Used information from field investigations to conduct a comparative evaluation of sites and to provide recommendations for protection and mitigation of impacts.

[01/01/1995-12/31/1995]

Town of Lindsay, Lindsay/Ops Landfill Part V Expansion Biological Impact Assessment, Lindsay, Ontario. Conducted and supervised the completion of a biological impact assessment study for the expansion of the town's landfill site adjacent to the Scugog River. [01/01/1992-12/31/1992]

Township of Charlottenburgh, North Landfill Expansion Biological Impact Assessment, Charlottenburgh, Ontario. Supervised and conducted a biological impact assessment of the existing North Landfill site for a Part V expansion. Key issues were the potential impacts on features and functions of the adjacent swamp communities and provincially rare bird species. [01/01/1992-12/31/1992]

Advisory Committees and Working Groups

City of London, Ecological Buffer Guidelines Working Committee, London, Ontario. Participated in a working group organized to develop guidelines for the establishment of ecological buffers for environmentally significant areas and other natural areas in the city. [01/01/1999-12/31/1999]

Ministry of Natural Resources, Natural Heritage Manual Review Team, Ontario. Participated as a key member of the working group reviewing and revising MNR's "Natural Heritage Reference Manual" for Policy 2.3 of the Provincial Policy Statement (1998). The manual provides reference for the implementation of provincial policy with regard to the protection of natural heritage resources and the assessment of impact on natural resources in the province of Ontario. [01/01/1997-12/31/1997]

City of London, Environmentally Significant Areas Criteria Working Group, London, Ontario. Worked on behalf of the London Development Institute as a key member of a technical working group reviewing and revising the city's ESA criteria and application guidelines. The working group provided expertise and advice regarding the identification and delineation of ESAs within London. [01/01/1996-12/31/1996]

Urban Development Institute, Conservation Authorities Committee, Ontario. Provided expert advisory services and liaison with regard to the revision of the Toronto Region Conservation Authority's ESA criteria and guidelines. [01/01/1998-12/31/1998]

Bio-Monitoring Studies

The Airport Authority, Nassau International Airport – Airside Improvements Environmental Monitoring, Nassau, Bahamas. Supervised and coordinated an environmental monitoring program, which involved regular visual inspections of monitoring stations in aquatic, mangrove swamp, and sawgrass vegetation communities. Monitoring was conducted cooperatively with the contractor and the Bahamas Environment Science and Technology Commission. [01/01/2003-12/31/2006]

Sifton Properties Limited, RiverBend Golf Course Community - Environmental Monitoring Protocol and Baseline Study, London, Ontario. Developed and directed the initiation of an

environmental monitoring program to track potential impacts of a newly developed golf course community on an adjacent ESA and the Thames River. [01/01/1999-12/31/2005]

Georgia-Pacific, Fox Creek Benthic Monitoring Program, Ontario. Directed completion of annual bio-monitoring of mine wastewater effluent that discharges into the Fox Creek watershed. Monitoring involves collection and analysis of benthic invertebrates in Fox Creek and the Grand River. [01/01/1999-12/31/1999]

Ecological Restoration and Revegetation

Goal Ventures/PenEquity Corporation, Gateway London Ecosystem Creation Plan. Dr. Epp developed and directed the completion of an ecosystem creation plan designed to compensate for the loss of a small wetland and upland vegetation complex in London. The plan included the integration of wetland communities with upland and meadow vegetation communities. Habitat features such as vernal pools, debris piles, and cavity trees were included to enhance wildlife habitat. A critical component to the success of this project included negotiations with the Ministry of Natural Resources and Forestry, the Upper Thames River Conservation Authority and the City of London.

Sifton Properties Limited. Victoria Ridge Ecological Restoration Plan & Detailed Design. Dr. Epp developed a restoration plan for lands within the Meadowlily Woods Environmentally Significant Area along the Thames River in London, Ontario. The restoration plan included meadow plantings, nuclear plantings of native trees and shrubs, woody debris piles and snake hibernacula. [01/01/2013-08/01/2013]

Niagara Peninsula Conservation Authority, 12 Mile Creek Fish Habitat Restoration Plan, St. Catharines, Ontario. Supervised and coordinated the preparation of detailed design plans for the restoration of two ponds along 12 Mile Creek. Plans for Glenridge Pond and the Riverview Pond involved the preparation of goals and objectives, and selection of concepts that met the goals and objectives of the conservation authority and Ontario Hydro Power Generation.

Toyota Motor Engineering & Manufacturing North America, Proposed Woodstock Manufacturing Facility Ecological Restoration Plan, Ontario. Managed and led a team of ecologists in preparation of a restoration plan for the new manufacturing facilities lands. Areas disturbed by the construction of the facility and areas lost through design and layout of the facility required restoration and compensation. The final restoration plan included native meadow plantings, pit-and-mound restoration of areas adjacent to wetlands, tree planting and transplanting, fish habitat enhancement, fish habitat compensation, and channel realignment design. [01/01/2006-12/31/2006]

City of Stratford, TJ Dolan Natural Area Environmental Management and Restoration Plan, Stratford, Ontario. Directed and coordinated the study and report preparation for the restoration and management of a natural reserve park. An ecological restoration and management plan was required for the TJ Dolan Natural Area as part of the design and construction of a trunk sewer being planned for an alignment through the natural area. The final plan was developed in consultation with a working committee made up of city staff, city councillors, and members of public interest groups. The final plan has been implemented with the planting of \$200,000 of native vegetation and the installation of passive trails. [01/01/2004-12/31/2004]

The Hampton Group, Hunt Club West Community – Environmental Management Plan, London, Ontario. Coordinated and prepared an EMP for a buffer area situated between the Kains Woods

environmentally significant area (ESA) and a new housing development. The EMP involved restoration of natural a pine plantation through selective thinning and planting, and the thinning and re-planting of native plant communities. Construction mitigation and monitoring by qualified ecologists and a professional forester were key to successful implementation. The EMP also included the development of a stewardship and public education program that involved the adjacent residents in management and monitoring of the Kains Woods ESA. [01/01/2003-12/31/2003]

Auburn Developments, Stoney Creek Marsh Replication, London, Ontario. Coordinated and prepared an implementation plan for the removal and transplanting of a meadow marsh community, which involved the development of a soils-based approach to the transplanting of a marsh community from its existing location to a new site in association with stormwater management facilities. [01/01/2001-12/31/2001]

City of Sault Ste. Marie, Fort Creek Rehabilitation, Sault Ste. Marie, Ontario. Directed and coordinated the completion of a restoration plan for the clean-up and habitat enhancement of a section of Fort Creek. Negotiated habitat compensation measures and timing of construction works with the Casino Corporation and the Department of Fisheries and Oceans. [01/01/2002-12/31/2002]

Canadian Waste Services, Little Bear Creek Relocation, Ontario. Directed the preparation and supervision of an implementation plan for the relocation of Little Bear Creek at the Petrolia Landfill site. Relocation of the creek channel required Fisheries Act approvals and the development of a native planting plan. [01/01/2001-12/31/2001]

City of London, Pottersburg Creek Storm Drainage and Creek Restoration Study, London, Ontario. Provided senior advisory input regarding ecological constraints and opportunities for the development and evaluation of restoration alternatives for a degraded portion of the creek. [01/01/2001-12/31/2001]

Metro Toronto Parks & Property, Old Cummer Road Naturalization Management Study, Toronto, Ontario. Coordinated the development of revegetation and naturalization strategy that was applied to abandoned lands along the Don Valley at Old Cummer Road. [01/01/1996-12/31/1996]

Metropolitan Toronto Parks & Culture, Pottery Road, Forks of the Don River Naturalization Strategy and Plan, Toronto, Ontario. Developed a plan and strategy for the re-vegetation of parkland areas. Recommendations were consistent with ongoing efforts to revitalize and restore the Don River Valley and its ecosystems. [01/01/1995-12/31/1995]

Ecological Risk Assessment

Haastown Development Corporation, Cambridge Site Risk Assessment, Cambridge, Ontario. Coordinated and conducted an ecological risk assessment for a former coal gasification plant situated along the Grand River in the Galt portion of Cambridge. The ERA involved determination of the level of contamination in earthworms and plants on the site in an attempt to develop site cleanup and mitigation measures. [01/01/2006-12/31/2006]

IPL, Enbridge Pipeline Spill Impact Assessment and Ecological Risk Assessment, Ontario. Supervised and coordinated the assessment of environmental impact of an oil spill on features and

functions within a wetland complex and aquatic habitat. Studies included benthic invertebrate and fisheries sampling programs. [01/01/1999-12/31/1999]

Historic Chippawa Battlefields, Soil-Borne Arsenic and Lead Ecological Risk Assessment, Niagara Region, Ontario. Supervised a screening level site-specific human health and ecological risk assessment at an historical smelting and refining site in accordance with provincial and federal risk assessment guidelines. The study was designed to evaluate risks associated with elevated levels of arsenic and lead in surface soils, and to assess alternative remediation options. The identification of potential receptors, exposure pathways, and end-points was conducted at the biological community level. [01/01/1997-12/31/1997]

Energy Projects

Pattern Renewable Holdings Canada and Nigig Power Corp., Henvey Inlet Wind Project, Henvey Inlet, Ontario. As Water & Natural Resources Director, Dr. Epp provided senior oversight and quality assurance of technical work and deliverables for the natural environment component of an environmental assessment for a proposed wind power project, to be completed in accordance with the requirements of the provincial REA process, *Canadian Environmental Assessment Act*, and provincial *Electricity Act*. [2014-present]

NextEra Energy Canada, Bluewater, Goshen and Jericho Wind Energy Centres, Numerous Municipalities, Ontario. As Water & Natural Resources Director, Dr. Epp provided senior oversight and quality assurance of technical work and deliverables during construction, responsible for managing on site environmental monitors to ensure compliance with permit conditions and effective implementation of mitigation measures, technical review of weekly compliance monitoring reports, client and agency consultation, and oversight of the implementation of and adherence to health and safety, quality assurance and quality control requirements. [2013-present]

NextEra Energy Canada, Bluewater, Goshen and Jericho Wind Energy Centres, Numerous Municipalities, Ontario. As Water & Natural Resources Director, Dr. Epp provided senior oversight and quality assurance of technical work and deliverables for the Natural Heritage Assessments, Environmental Impact Studies, and Natural Heritage Environmental Effects Monitoring Plans (EEMPs) in accordance with the requirements of the Renewable Energy Approval (REA) process under the *Environmental Protection Act*. [2011-2014]

Environmental Impact Studies

City of London, Forest City Industrial Lands – Baker Lands Environmental Impact Study. Dr. Epp directed and provided strategic environmental advice in the preparation of an Environmental Impact Study (EIS) for lands proposed for industrial development in the south of London, ON. The EIS issues centered on protection of an Environmentally Significant Area (ESA), Provincially Significant Wetland (PSW), Significant Wildlife Habitat (SWH), Species at Risk (SAR), and management of storm water from the proposed development. The Environmental Management Plan (EMP) developed as part of the EIS included designation of natural heritage features, development of ecological buffers, mitigation for the removal of Barn Swallow habitat, and restoration of previous agricultural lands.

City of London, Old Victoria SWMF No. 1 Environmental Impact Study. Dr. Epp directed and reviewed the required work for the completion of the Old Victoria Stormwater Management Facility No. 1 EIS. AECOM's EIS focused on avoiding potential impacts on the Meadowlily Woods Environmentally Significant Area. Specifically the areas of concern included ESA edge trees, protection of seepage areas, reducing impacts from the SWM outlet and the provision of ecological buffers. [01/01/2015- 06/08/2015]

Glenview Estates. Phase IVB Development Environmental Impact Study. Dr. Epp directed and supervised the preparation of an EIS for a small plan of subdivision for an expansion to the Glenview Estates Golf Community. [02/30/2014-09/01/2014]

Sifton Properties Limited. Riverbend South. Environmental Impact Study. Dr. Epp directed and prepared an EIS for a Secondary Plan and Plan of Subdivision for the Riverbend South development in London, Ontario. The issues associated with the site included protection of the Warbler Woods ESA, protection of the Hickory Woods Significant Woodland, maintenance of water balance within natural areas, and provision of ecological restoration areas. [2006-2014]

Tridon Properties Ltd. 161 Windermere Road Vacant Land Condominium. Dr. Epp directed the investigations and preparation of an Environmental Impact Study for a 5-6 lot vacant land condominium in London, Ontario. The issues addressed in the EIS included: delineation of the Medway Valley Heritage Forest ESA, protection of seepage areas, provision of wildlife passage, and restoration of native vegetation along the table lands of the Medway Valley. [09/01/2013-09/01/2014]

City of London, Stormwater Management Facilities Spring Ecological Inventories. Dr. Epp managed and co-ordinated the spring inventories for three (3) future stormwater management facility sites: Old Victoria SWMF No.1, Murray Marr SWMF No. 4, and Dingman SWMF P9. Inventories included: amphibian surveys, breeding bird surveys, spring vegetation surveys, Ecological Land Classification and delineation, and fish habitat assessments. [03/20/2013-06/06/2014]

City of London, Kiwanis Park Pedestrian Connection Class EA & Environmental Impact Study. Dr. Epp directed a team of AECOM ecologists in the preparation of natural heritage input to the EA process for a pedestrian crossing of a CN railway corridor. AECOM's ecologists also conducted the EIS for the preferred alternative. Significant issues included the identification of a large wetland area, prairie vegetation communities, and groundwater seepage areas.

City of London, Wickerson Stormwater Management Facility Environmental Impact Study. Dr. Epp co-ordinated and prepared the final EIS document in support of the functional design for the Wickerson SWMF in the west part of London. Key issues in the EIS were the determination of an appropriate buffer to Environmentally Significant Area lands and the sensitive design and siting of an outlet to the adjacent stream situated within the ESA.

City of London, Tributary 'C' Storm/Drainage & Stormwater Management, Transportation & Sanitary Trunk Servicing Works – Environmental Impact Study. Dr. Epp was the lead ecologist for the EA study and the EIS for the preferred alternative for Tributary 'C'. Significant issues associated with the proposed works included a sensitive brook trout coldwater fishery, a Provincially Significant Wetland, and the requirement for appropriate ecological buffers.

City of London, Stanton Drain Remediation and Hyde Park SWMF No. 4 Detailed Design & Construction – Scoped Environmental Impact Study. Dr. Epp provided direction and project oversight

for the Scoped EIS and Construction Monitoring for the Stanton Drain Remediation Works and SWMF No. 4 project. The Stanton Drain project involved consideration of wetlands and wildlife associated with lands being remediated and constructed for a new SWM facility. Construction monitoring included fish and wildlife rescues and implementation of mitigation measures.

Sifton Properties Limited, 277 Hardy Rd Plan of Subdivision, Natural Heritage Study and Environmental Impact Study, Brantford, Ontario. Dr. Epp was responsible for directing a team of ecologists tasked with completing comprehensive ecological inventories and assessments for lands along the Grand River in Brantford, Ontario. Site features included an Earth Science Area of Natural and Scientific Interest (ANSI), a Provincially Significant Wetland (PSW), Species at Risk, significant woodlands, wildlife habitat, a coldwater brook trout stream, and Six Nations interests.

Sifton Properties Limited, Fanshawe Ridge Environmental Impact Study, London, Ontario. Directed a team of ecologists in the completion of an EIS for a small plan of subdivision along Stoney Creek in London. The study area had numerous natural heritage features including a provincially significant wetland, fish habitat, species at risk, and significant waterfowl. [01/01/2008-12/31/2011]

City of London, City Wide Sports Park Environmental Impact Study, London, Ontario. Directed and coordinated the EIS work program, agency consultation, and preparation of final EIS document for the resurfacing and enhancement of the City Wide Sports park soccer and baseball facilities. [01/01/2010-12/31/2010]

Regional Municipality of Waterloo, Waterloo Light Rail Transit Environmental Impact Study, Kitchener and Waterloo, Ontario. Provided senior ecologist overview and direction on ecological impact assessment and field program. [01/01/2009-12/31/2010]

Sifton Properties Limited, RiverBend South Area Study & Plan of Subdivision Environmental Impact Study, London, Ontario. Provided senior direction and coordination for the scoping, planning, and implementation of an EIS for the development plan for a property in the northwest part of London. Relevant issues for the subject lands included protection of the Warbler Woods environmental significant area, identification of a significant woodland, and the provision of appropriate environmental management recommendations. [01/01/2009-12/31/2009]

Sifton Properties Limited, Victoria Ridge Plan of Subdivision Environmental Impact Study, London, Ontario. Managed and provided senior direction and review for the scoping, planning, and implementation of an EIS for development plan for a property in the southeast part of London. The recommended environmental management plan developed as part of the EIS ensured the protection of an environmentally significant area, provincially significant wetland, and conservation priority bird species habitat through natural areas designation and ecological buffer development. [01/01/2009-12/31/2009]

City of Woodstock, BB2D Wetland Environmental Impact Study, Woodstock, Ontario. Supervised and provided senior review and quality assurance/quality control for an impact assessment of a proposed stormwater management facility layout and design for lands immediately adjacent to the BB2D wetland.

City of London, 3989 Commerce Road Industrial Development Scoped Environmental Impact Study, London, Ontario. Scoped and prepared a scoped environmental impact study report for a parcel of land proposed for industrial development in proximity to a local wetland. [01/01/2008-12/31/2008]

Kenmore Homes, Bierens Lands Plan of Subdivision Environmental Impact Study, London, Ontario. Coordinated a team of ecologists for the conduct and completion of an EIS for lands in the northwest part of London. The EIS studies included an evaluation of significant woodland, birds surveys, and an aquatic habitat assessment. The EIS report prepared for the site was approved based on the recommended protection of the woodland and the ecological buffers developed for the plan.

[01/01/2008-12/31/2008]

Sifton Properties Limited, Denfield Road Single Residential Development Assessment Report, Ontario. Supervised a team of ecologists for the completion of studies and report preparation for a DAR for a single residential property development outside of the city of London. The proposed site was of particular interest as it contained a significant woodland, significant valleylands, amphibian habitat, and unique butterfly habitat. [01/01/2007-12/31/2007]

First Gulf Development Corporation, First CommerceWay Industrial Development – Environmental Impact Study, Woodstock, Ontario. Supervised and negotiated approval of an EIS for an industrial development proposal. The EIS involved delineation of a locally significant wetland, determination of appropriate buffer zones, and assessment of a drainage channel. [01/01/2006-12/31/2006]

Toyota Motor Manufacturing and Engineering North America, Environmental Impact Study, Woodstock, Ontario. Coordinated and supervised the completion, submission, and approval of an environmental impact study for a new motor manufacturing facility. The EIS involved the identification of protection areas, buffer zone recommendations to protect natural areas, and restoration plans to enhance and compensate for loss of natural areas within a 1000-acre property. Natural protection areas included the Van Sittart provincially significant wetland, the Lampman Lock drain with Type 1 fish habitat, and locally significant woodland. Approval of the EIS and the plan for the manufacturing facility depended on sensitive negotiation with the city of Woodstock, the Upper Thames River Conservation Authority, and the Department of Fisheries and Oceans. [01/01/2005-12/31/2006]

City of London, Innovation Industrial Park Phase 3 & 4 Environmental Impact Studies, London, Ontario. Coordinated a team of ecologists in the conduct and completion of two EISs for industrial lands development proposals for areas adjacent to wetlands. Each EIS required the accurate delineation of locally significant wetlands, the identification of environmental issues, and the provision of appropriate ecological buffers. [01/01/2006-12/31/2006]

Glenview Estates Properties, Phases 4 & 5 Environmental Impact Study, Petrolia, Ontario. Coordinated and supervised the completion of an environmental impact study for a golf course community housing development. The EIS involved vegetation community assessments, aquatic evaluations, and consideration of specimen trees within a remnant oak savanna landscape. [01/01/2006-12/31/2008]

Hyde Construction Ltd., Proposed Industrial Development Environmental Impact Study, Ontario. Supervised and provided senior direction for the completion of an environmental impact study for a proposed industrial development for land adjacent to the Stratford wetland complex. The EIS investigations for the subject lands included vegetation surveys, fisheries surveys, and field investigations to determine development limits. [01/01/2005-12/31/2005]

Z Group, Uplands North Subdivision Environmental Impact Study, London, Ontario. Directed and prepared an environmental impact study and environmental management plan for a plan of subdivision in the Uplands Area of north London. The management plan for the subdivision included protection of a significant woodland, development of buffer areas, and enhancement of a degraded portion of the Powell Drain locally significant wetland. [01/01/2005-12/31/2005]

Sifton Properties Limited, Bostwick East Environmental Impact Study, London, Ontario.

Conducted an EIS for a residential and commercial subdivision for an area in southwest London along the Pincombe Drain. [01/01/2005-12/31/2005]

The Airport Authority, Nassau International Airport Airside Improvements Environmental Impact Study, Nassau, Bahamas. Coordinated and conducted an environmental impact study for the relocation and reconstruction of runways and taxiways at the Nassau International Airport. The study involved assessment of the impact of taxiway relocation into a portion of adjacent mangrove swamp and coppice shrubland communities. Environmental management recommendations included uncommon plant transplants, surface water flow enhancements, and construction mitigation measures. [01/01/2004-12/31/2004]

Sifton Properties Limited, RiverBend Phase 2 Community Environmental Impact Study, London, Ontario. Coordinated and prepared an EIS for a housing community adjacent to the Kains Woods environmentally significant area (ESA). The EIS involved protection of a rare sedge community and an uncommon white cedar swamp community. Also prepared an environmental management plan that integrated a stormwater management facility within a portion of the Kains Woods ESA. [01/01/2003-12/31/2003]

City of London, Forest City Industrial Lands Environmental Impact Study, London, Ontario.

Coordinated and prepared an environmental impact study for a proposed automotive manufacturing facility. The EIS involved the development of a buffer zone and restoration plan for the protection of an uncommon lichen community adjacent to the subject property. [01/01/2000-12/31/2000]

City of London, Forest City Industrial Park Stormwater Works Environmental Impact Study, London, Ontario. Coordinated and prepared an environmental impact study and management plan for a proposed stormwater management facility to be integrated with an adjacent provincially significant wetland. The quantity control component of a stormwater management facility was to use capacity within a wetland marsh community linked with the Westminster provincially significant wetland in London. [01/01/2002-12/31/2002]

St. Joseph's Health Care Centre, Parkwood Hospital, Scoped Environmental Impact Study, London, Ontario.

Completed an EIS for the development of a brain injury neurobehavioural rehabilitation facility to be situated in the vicinity of the Westminster Ponds/Pond Mills environmentally significant area (ESA). Evaluated potential impacts to the ESA and its communities and provided ecological buffer recommendations, mitigation and protection measures, and recreation opportunities. [01/01/2002-12/31/2002]

DLN Group Inc., Huron Shores Estates Environmental Evaluation Report, Ontario. Directed and conducted an environmental impact study and management plan for a condominium housing development planned for a property adjacent to remnant Great Lakes forest communities along the Lake

Huron shoreline. Recommendations included the protection of a majority of the property, with provisions for conservation easements, buffer zones, and a large restoration area. [01/01/2003-12/31/2005]

Fieldgate Developments, Tresstown Subdivision, Environmental Impact Study, Whitchurch-Stouffville, Ontario. Directed and conducted the preparation of an environmental impact study for the development of a parcel of land within the southeast quadrant of Stouffville-Whitchurch. [01/01/2002-12/31/2002]

Sifton Properties Limited, Kains South Development, Environmental Impact Study, London, Ontario. Directed and conducted an environmental impact study and management plan for a housing development planned for a property adjacent to the Warbler Woods environmentally significant area, and significant woodland. Environmental management recommendations included protection of environmentally significant area communities, provision of interior habitat, buffer zones, and trail locations. [01/01/2002-12/31/2002]

Sifton Properties Limited, Park Hill Equestrian Community, Development Assessment Report, Ontario. Directed and conducted an impact assessment study for the development of an equestrian condominium community for a property along the Ausable River. Environmental management recommendations included protection of riparian and ravine natural areas, buffer zones, and equestrian trail locations. [01/01/2001-12/31/2001]

Sifton Properties Limited, Poplar Hill Equestrian Community, Development Assessment Report, Ontario. Directed and conducted an impact assessment study for the development of an equestrian condominium community for a property along the Sydenham River. Environmental management recommendations included protection of a provincially significant wetland and slope communities, buffer zones and equestrian trail locations. [01/01/2001-12/31/2001]

City of London, Dearness Home Redevelopment Environmental Impact Study, London, Ontario. Directed and conducted the preparation of an environmental impact study for the redevelopment of the Dearness Home for seniors, situated adjacent to the Westminster Ponds – Pond Mills environmentally significant area. The EIS was prepared with input from, and coordination with an architectural team, development engineers, and landscape architects. [01/01/2001-12/31/2001]

Sifton Properties Limited, RiverBend Community Phase 1, Environmental Impact Study, London, Ontario. Conducted an environmental impact study for the development of a golf course community adjacent to the Kains Woods environmentally significant area. Identified short-term and long-term impacts and developed avoidance, mitigation, and compensation measures for the plan area. The resulting environmental management plan provided recommendations for ecological buffers, restoration initiatives, a tree preservation plan, environmental guidelines for golf course operation, and an environmental monitoring program. [01/01/2000-12/31/2000]

Norwest Land Corporation, Kains Road East Development, Environmental Impact Study, London, Ontario. Directed the completion of an EIS for a two phased housing development situated adjacent to and incorporating part of an environmentally significant area. The EIS resulted in a plan that provided ecological buffers for forested and ravine communities, restoration and revegetation plans, and long term recreation opportunities. [01/01/2001-12/31/2001]

Westhill Redevelopment Company (Lebovic Enterprises), Aurora Golf Course Community, Environmental Impact Study, Ontario. Completed an EIS for a golf course community adjacent to the Bloomington environmentally significant area situated in the Oak Ridges Moraine. The EIS dealt with the need for ecological preservation and protection as well as landform conservation and groundwater protection. The EIS resulted in an environmental management plan that provided recommendations for ecological buffers, revegetation opportunities, and guidelines for golf course management and operation. [01/01/2000-12/31/2000]

St. Joseph's Health Care Centre , Parkwood Hospital, Scoped Environmental Impact Study, London, Ontario. Completed an EIS for the development of a brain injury neurobehavioural rehabilitation facility to be situated in the vicinity of the Westminster Ponds Pond Mills environmentally significant area (ESA). Evaluated potential impacts to the ESA and its communities and provided ecological buffer recommendations, mitigation and protection measures, and recreation opportunities. [01/01/2002-12/31/2002]

Town of Bradford, West Gwillimbury, WPCP Aquatic Baseline and Impact Assessment Study, Bradford, Ontario. Directed a baseline surface water quality and aquatic invertebrate monitoring program to assess existing and future impacts of water pollution control plant discharge to an adjacent aquatic environment and the Holland River. The study included aquatic habitat assessment, benthic invertebrate monitoring, and recommendations for future monitoring requirements. [01/01/1996-12/31/1996]

City of London, Uplands North Stormwater Management Facility Environmental Impact Study, London, Ontario. Project manager and technical lead for an environmental impact study to assess potential impacts of the construction and implementation of a stormwater management facility immediately adjacent to a provincially significant wetland. Significant issues related to project success included assurance that post-development water levels, duration of inundation, and frequency of inundation would not result in negative impacts to the wetland's ecological features and habitat functions. Project approvals obtained as a result of the EIS submission included conservation authority permits, Ministry of the Environment CofA, and city of London planning approval. [09/15/2010-09/11/2011]

Royal Bank of Canada, Environmental Impact Study, Stratford, Ontario. Senior technical review and advisory services related to completion and approval of an environmental impact study for RBC's new data center development. Development of the site was contingent on provision of appropriate buffers and implementation of a 3-year ecological monitoring program. [09/21/2009-04/19/2010]

Upper Thames River Conservation Authority, Administration Building Development Environmental Impact Study, London, Ontario. Managed and provided senior technical oversight for preparation of an environmental impact study for approval and construction of a new administration building for the authority. Important considerations for development of the new LEEDS-certified building included provisions of appropriate buffers from the adjacent Fanshawe Reservoir, woodland patches, and a downstream environmentally significant area (ESA). [06/18/2009-09/08/2011]

ORE Development Corporation, Ferguson Lands Forest City Industrial Park Environmental Impact Study, London, Ontario. Project manager and senior ecologist responsible for completion of an environmental impact study for planning and development of a new industrial warehouse complex in the

Forest City Industrial Park. Negotiated compensation for loss of wetland and woodland area adjacent to the proposed building and parking areas. [02/28/2006-12/14/2007]

Expert Witness Testimony

Settlers Landing Nominee Ltd., Settlers Landing Windfarm, Pontypool, Ontario. Dr. Epp provided expert witness testimony regarding the potential impacts and mitigation plans for a 5 wind turbine energy center near Pontypool, Ontario. His testimony was focused on the proposed Remedy Plan to compensate for loss of woodland area within the subject lands of the wind energy center. The Remedy Plan was an innovative multi-component restoration plan that included: transplanting of trees, Planting large numbers of new tree and shrub stock, native seeding of ground cover, construction of pits and mounds, and the installation of woody debris piles.[1/12/2015-6/6/2016]

Sifton Properties Ltd., 277 Hardy Rd Plan of Subdivision – Natural Heritage Study & EIS. Dr. Epp provided expert witness testimony providing evidence in support of Sifton Properties proposed land development proposal in the City of Brantford, Ontario. Issues relevant to Dr. Epp's testimony included Provincially Significant Wetlands, Species at Risk, coldwater fish habitat, significant woodlands and potential impacts from development.

Kettle Creek Conservation Authority, Dalewood Meadows Development Application, Ontario.

Conducted a peer review and provided expert advisory services regarding a land development application for lands within the conservation authorities regulation limits and lands adjacent to conservation authority property. Managed preparation of a peer review report and development of an environmental management plan report for the subject lands and the development application. [01/01/2008-12/31/2008]

City of London, Ayerswood vs. City of London, Ontario. Provided peer review and expert witness testimony for the defense of the protection of a significant woodland. [01/01/2001-12/31/2001]

City of London, OPA 88 Environmental Policies, London, Ontario. Provided expert witness and advisory services to successfully support the environmental policies for the city's OPA 88. Assisted with land use impacts, bio-monitoring, and environmentally significant area boundaries. [01/01/1999-12/31/1999]

RiverBend Landowners Group, Expert Witness Testimony, London, Ontario. Provided expert witness testimony in defense of boundaries established for the Kains Woods environmentally significant area. [01/01/1999-12/31/1999]

City of Vaughan, R.V. City of Vaughan, Fisheries Act Charge, Vaughan, Ontario. Provided expert witness advisory services related to water quality impacts on fish and fish habitat. Services provided were instrumental in the Crown dropping charges against the city. [01/01/1998-12/31/1998]

Township of Charlottenburgh, North Landfill Part V EPA Hearing, Charlottenburgh, Ontario. Provided expert testimony regarding impacts of landfill activities on aquatic and wetland biological communities. Testimony provided support for the interim expansion of the municipal landfill site. [01/01/1993-12/31/1993]

Town of Lindsay, Lindsay/Ops Landfill, Part V EPA Hearing, Lindsay, Ontario. Provided expert witness testimony on biological assessment studies of potential impacts of landfill operation on adjacent

lands and a Class 1 wetland along the Scugog River, which led to the development of a unique biomonitoring program requirement as part of the landfill's certificate of approval. [01/01/1994-12/31/1994]

Fisheries and Aquatic Habitat Investigations and Approvals

Hamilton Port Authority, Sherman Inlet Remediation and Fish Habitat Compensation Plan, Hamilton, Ontario. Managed the fish habitat compensation component of the remediation plans to clean up contaminated sediment within Sherman Inlet in Hamilton Harbour. [01/01/2006-12/31/2006]

Loblaw Properties, Fortinos Grimsby Aquatic Habitat Assessment & Approvals, Grimsby, Ontario. Directed and coordinated the completion of aquatic habitat studies and approval negotiations for the construction of a new food store at Casablanca Boulevard and South Service Road. [01/01/2005-12/31/2005]

Municipality of West Nipissing, Pike River Aquatic Impact Assessment, Ontario. Coordinated the completion of an aquatic habitat assessment for a small sewage treatment facility situated along the Pike River in Field, Ontario. The study included fisheries surveys, benthic invertebrate sampling, and habitat assessment. The study was completed to the satisfaction of the Ministry of the Environment to meet requirements of the facility's certificate of approval. [01/01/2004-12/31/2004]

Niagara Parks Commission, Willoughby Golf Course Development, Environmental Approvals, Chippewa/Niagara Falls, Ontario. Procured environmental approvals for the development of a 54-hole championship golf course. Prepared environmental recommendations regarding course holes siting, buffer requirements, mitigation measures, and compensation requirements. Obtained Fisheries Act approvals for this project within record short time and satisfaction of agencies and the client. [01/01/2000-12/31/2000]

Region of Halton, Bronte Harbour Waterfront Park, Fish Habitat Compensation Agreement & Monitoring, Ontario. Negotiated and obtained the necessary fish habitat compensation agreement for the successful completion of a new waterfront park. Conducted a pre and post construction fish habitat and water quality monitoring program. [01/01/1996-12/31/1996]

Region of Sudbury, High Cliff Lake Fisheries Study, Ontario. Conducted a fisheries study for habitats in High Cliff Lake adjacent to the Onaping Falls landfill site. Potential impacts of site expansion were assessed for the fisheries resources. [01/01/1995-12/31/1995]

Mining

Labrador Iron Mines, Schefferville Iron Ore Environmental Baseline Studies, Labrador, Newfoundland and Labrador. Provided project management, coordination, and senior review for a comprehensive multi-disciplinary baseline study for numerous iron ore sites within the Schefferville area. Senior review was provided for Labrador Iron Mines' project registration. [01/01/2006-12/31/2010]

Noront Resources, Environmental Baseline Studies, Ontario. Provided senior/director oversight for the environmental baseline program for water quality, sediment, benthic, hydrology, wildlife, and fish community for their Ring of Fire discovery in the James Bay Lowlands. [01/01/2010-12/31/2011]

Freewest Resources, Environmental Baseline Studies, Ontario. Provided senior/director oversight for the environmental baseline program for water quality, sediment, benthic, hydrology, wildlife, and fish community for their Ring of Fire discovery in the James Bay Lowlands. [01/01/2010-12/31/2010]

Liberty Mines Ltd., McWatters Mine Cycle 1 Environmental Effects Monitoring, Timmins, Ontario. Provided senior/director oversight for Cycle 1 requirements (site characterization, study design, and interpretive report) for the mine operation for the environmental effects monitoring program. [01/01/2010-12/31/2011]

FNX Mining, Podolsky Mine Cycle 1 Environmental Effects Monitoring, Sudbury, Ontario. Provided senior/director oversight for the completion of Cycle 1 requirements (site characterization, study design, and interpretive report) for the environmental effects monitoring program. [01/01/2010-12/31/2010]

San Gold Corporation, Rice Lake Gold Operation Cycle 1 Environmental Effects Monitoring, Bissett, Manitoba. Provided senior/director oversight for the completion of Cycle 1 requirements (site characterization, study design, and interpretive report) for the environmental effects monitoring program. [01/01/2009-12/31/2009]

St. Andrew Goldfields, Taylor Mine Cycle 1 Environmental Effects Monitoring, Northeastern Ontario. Provided project management and senior/director review for the completion of Cycle 1 requirements (site characterization, study design, and interpretive report) for the environmental effects monitoring program. [01/01/2009-12/31/2009]

Natural Heritage Studies

Sifton Properties, Riverbend South Natural Heritage Study, London, Ontario. Dr. Epp was the technical lead and project manager for the natural heritage study that served as the framework for the development of an environmentally sound development plan for Riverbend South in London. Principal issues for the project included the provision of comprehensive ecological inventories and determination of the limits of the Warbler Woods Environmentally Significant Area (ESA).

City of London, Meadowlily Woods Area Plan Natural Heritage Study, London, Ontario. Dr. Epp was the technical lead for the natural heritage investigations for the most westerly portion of the Meadowlily Woods ESA in relation to the development of land use concepts for the Meadowlily Woods Area Plan. Dr. Epp coordinated field teams and directed the assessment and evaluation of natural heritage features including the delineation of the Meadowlily Woods ESA boundaries. [2011]

City of London, Southwest Area Plan Natural Heritage Study, London, Ontario. Coordinated a team of ecologists in the preparation of a natural heritage study for the city's southwest area plan. The study consisted of the identification of a natural heritage strategy through the completion of assessments based on background review and detailed field investigations of over 20 patches within an urbanizing landscape. The final natural heritage strategy identified environmentally significant areas, significant woodlands, wetlands, and natural corridors for the area along the northern boundaries of Dingman Creek. [01/01/2010-12/31/2010]

Sifton Properties Limited, RiverBend South Area Plan Natural Heritage Study, London, Ontario. Coordinated a team of ecologists in the preparation of the study. Features identified for protection

included the Warbler Woods environmentally significant area, as significant woodland, and provincially rare tree species. Managed preparation of a natural heritage strategy for the protection and management of natural heritage resources through the appropriate designation, buffering, and restoration of areas within the plan. [01/01/2008-01/31/2013]

Central Longwoods Landowners Group, Central Longwoods Area Natural Heritage Study, London, Ontario. Directed a team of terrestrial and aquatic ecologists in a natural heritage study for the Central Longwoods area of London. Natural heritage studies included vegetation classification, delineation, surveys, birds surveys, amphibian surveys, woodland evaluations, and aquatic habitat assessments. The study report provided constraints to future development for the area and opportunities for environmental protection. [01/01/2008-12/31/2008]

City of Woodstock, East Woodstock Lands Secondary Plan and Design Study – Natural Heritage Study, Woodstock, Ontario. Supervised and conducted the preparation of a natural heritage strategy and recommendations for the secondary plan for the East Woodstock lands. The study report recommended wetlands, woodlands, and watercourses for protection in addition to buffer zone and environmental management recommendations. [01/01/2006-12/31/2006]

Sifton Properties Limited, Bostwick East Area Plan Natural Heritage Study, London, Ontario. Coordinated and prepared a natural heritage study report for the Bostwick East area in southwest London. The study involved determination of constraints to development of the area for residential and commercial land uses. [01/01/2004-12/31/2004]

Tricar Group/Colehill Enterprises, Uplands North Area Plan Natural Heritage Study, London, Ontario. Directed and prepared a natural heritage study and environmental management plan (EMP) for the Uplands North area. Managed detailed ecological studies of locally significant wetlands, significant woodlands, and watercourses. The success of the EMP and the area plan was a function of the facilitation of landowner participation and public consultation. [01/01/2002-12/31/2002]

City of London, Wilton Grove Road Industrial Lands Subject Lands Status Report, London, Ontario. Directed and completed a subject lands evaluation for proposed industrial lands in the south of London. Managed evaluation of woodland patches using the city's significant woodland evaluation guidelines. [01/01/2000-12/31/2000]

Sifton Properties Limited, RiverBend Area, Natural Heritage Study and Environmental Management Plan, London, Ontario. Conducted a study composed of ecological assessment, hydrological and hydrogeological background studies, and an environmental management plan as a component of the area planning process for the area. Used a functional approach to determine natural community boundaries and the delineation of an environmentally significant area. Studies were coordinated with input from the city of London, the Upper Thames River Conservation Authority, the Ministry of Natural Resources, and a local advisory committee. [01/01/1997-12/31/1997]

City of Windsor, Environmental Evaluation for Candidate Natural Heritage Site #38, Windsor, Ontario. Prepared an environmental evaluation report (EER) as part of the community improvement plan for the Ojibway-Yawkey industrial area. The EER presented a net effects analysis for future development adjacent to candidate natural heritage site #38. Recommendations included site buffer zones, development guidelines, and recommendations for planning policies. [01/01/1996-12/31/1996]

City of Windsor, Environmental Evaluation for Candidate Natural Heritage Site #32, Oakwood Woodlot, Windsor, Ontario. Prepared an environmental evaluation report that addressed the potential impacts of development on the Oakwood Woodlot Candidate Natural Heritage Site. The report also provided recommendations regarding the extent of development permitted, protection measures, development guidelines, and planning policies designed to reduce impacts on ecologically sensitive features of the site. [01/01/1997-12/31/1997]

Natural Resources Screening

Hamilton Port Authority, Pier 22 Preliminary Ecological Investigations, Hamilton, Ontario. Developed terms of reference, and coordinated and delivered an ecological inventory report for the Pier 22 lands at Hamilton Harbour. Investigations included vegetation, fish habitat, and rare species screening to identify any concerns prior to purchase of the lands by the HPA. [01/01/2006-12/31/2006]

City of London, London North Route Planning Assessment, London, Ontario. Directed the completion of a screening and alternative routes assessment for the location of a freeway north of London. Assessed wetlands, woodlands, and other vegetation patches. [01/01/2000-12/31/2000]

Ministry of Transportation Ontario, Highway 423: Highway 401-407 Link Study, Natural Resources Analysis & Evaluation, Ontario. Senior ecologist responsible for overall coordination of natural environment analysis and evaluation for the Highway 401-407 Pickering, Ajax, and Whitby freeway link environmental assessment. Natural environment investigations included wetland assessments, woodlot assessments, and fish habitat evaluations for a wide range of sites. [01/01/1995-12/31/1995]

Center and South Hastings Waste Management Board, Center and South Hastings Waste Management Master Plan, Level Four Ecological Assessment, Trenton, Ontario. Supervised and conducted a resource screening and ecological net effects analysis for two Level Four candidate landfill sites. On-site investigations included aquatic and terrestrial surveys and boundary delineations. Used information from field investigations to conduct a comparative evaluation of sites and to provide recommendations for protection and mitigation of impacts. [01/01/1995-12/31/1995]

Peer Reviews

Kettle Creek Conservation Authority, Dalewood Meadows Development Application, Ontario. Conducted a peer review and provide expert advisory services to the Kettle Creek Conservation Authority regarding a land development application for lands within the conservation authorities regulation limits and lands adjacent to conservation authority property. Provided a peer review report and developed an environmental management plan report for the subject lands and the development application. [01/01/2008-12/31/2008]

Sifton Properties Limited, Old Victoria Road Area Plan, London, Ontario. Provided peer review services to Sifton Properties as part of their due diligence process for the purchase of development lands in the southwest part of London. Reviewed the work of environmental consultants responsible for the preparation of a natural heritage study and area plan for the Old Victoria Road area. Instrumental in negotiation of a scientifically defensible development limit boundary for the area in accordance with the city's environmental policies and the provincial policy statement. [01/01/2007-12/31/2007]

Sifton Properties Limited, Ingersoll Lands Peer Review, Ontario. Reviewed an environmental impact statement prepared in support of an application for lands to be purchased by Sifton Properties. The review involved site investigations, development of mitigation measures, and negotiations with the review agencies. [01/01/2007-12/31/2007]

Sydney Tar Ponds Agency, Peer Review of “Remediation of Sydney Tar Ponds and Coke Ovens Sites Environmental Impact Study”, Sydney, Nova Scotia. Reviewed the terrestrial component of a 64-page environmental impact study document for the clean-up of coal-based contaminants/sludge from a tidal estuary at the mouth of Muggah Creek. A comprehensive team was organized for the review including the completion of status reports and a presentation to the client. [01/01/2007-12/31/2007]

City of Woodstock, Sally Creek Golf Course Expansion Environmental Issues Peer Review, Woodstock, Ontario. Conducted a peer review of work conducted in support of a development application for a golf course along the Thames River. The review included the preparation of a checklist, field investigations, and interviews of the principal consultant. [01/01/2007-12/31/2007]

TriCar Group - Colehill Enterprises, Uplands North Area Natural Heritage Study & Area Plan, London, Ontario. Provided peer review and advisory services for the environmental work conducted for an area plan being conducted for their lands in the north of the city. [01/01/2007-12/31/2007]

Z Group, Parker Jackson Lands Environmental Impact Study Peer Review, London, Ontario. Reviewed and provided expertise regarding the future development of lands in the southeast part of London. Conducted a peer review for an EIS prepared for Z Group in support of their future development application for lands containing a woodland patch and locally significant wetland. [01/01/2006-12/31/2006]

City of London, Ayerswood vs. City of London, Ontario. Conducted a peer review of an environmental impact study conducted in support of an apartment complex development application for lands within a significant woodland and natural corridor. The peer review included field investigations, application of woodland guidelines, and interviews with the primary consultant. [01/01/2001-12/31/2001]

Secondary/Community Plans

Tricar Group/Colehill Enterprises, Uplands North Area Plan, London, Ontario. Provided expert advisory services to the area plan consulting team with regard to natural heritage planning. [01/01/2002-12/31/2002]

Lebovic Enterprises and Fieldgate Developments, Southeast Stouffville Functional Servicing Study, Stouffville, Ontario. Provided an ecological and environmental management plan for the southeast quadrant of the town. An environmental impact study provided direction for the identification of areas requiring varying levels of protection and management. Recommendations included guidelines for the establishment of ecological buffers, development guidelines, and the identification of protection measures. [01/01/1999-12/31/1999]

City of London, River Bend Community Plan, Natural Heritage Study and Environmental Management Plan, London, Ontario. Responsible for the completion of a natural heritage study and an environmental management plan as a major component of the area planning process for the River Bend area. The study formed the basis for an environmental management strategy and plan that identified natural areas for protection, areas where development could proceed, buffers for protection of

natural areas, and management guidelines for areas adjacent to environmentally significant areas. [01/01/1997-12/31/1997]

Town of Pelham, Urban Boundary Expansion Study, Ecological Resources, Pelham, Ontario.

Supervised ecological investigations for an expansion study on behalf of the town in response to the town's growing need for additional urban area. As a component of the study, investigated ecological resources in order to determine constraints to development and needs for protection and preservation. The ecological resources study identified environmentally significant areas and on-site aquatic resources and provided guidelines for future development. [01/01/1998-12/31/1998]

City of Brantford, Shellard Lane Draft Secondary Plan, Ecological Resources Assessment,

Brantford, Ontario. Coordinated ecological studies for a draft secondary plan for the Shellard Lane area. A major component of the study involved the assessment and determination of a development limit line based on ecologically sensitive features, slope stability, and drainage. To determine appropriate setbacks from an adjacent wetland, conducted an environmental impact study as part of the overall study. [01/01/1996-12/31/1996]

Transportation Studies

Ministry of Transportation Ontario, GTA West Transportation Corridor Environmental

Assessment. Dr. Epp is the lead for the Terrestrial Ecosystems component of the GTA West Transportation Corridor EA, leading a team of ecologists responsible for ecological surveys and analysis of existing conditions within several route alternatives and the evaluation of those route alternatives for the purpose of determining a preferred route. The proposed highway corridor extends from Highway 401 at Milton, Ontario to north of Vaughan, Ontario at Highway 400. Detailed route assessment, including site investigations, of the preferred route will be conducted in 2016. [08/2014-12/2015]

Region of Waterloo Rapid Transit System Natural Heritage Approvals. Dr. Epp was responsible for the direction of a team of ecologists tasked with the successful acquisition of all natural heritage approvals required for the construction of the Region's new Rapid Transit System. This involved consultation with Grand River Conservation Authority, Ministry of Natural Resources, Department of Fisheries and Oceans and Environment Canada; provision of comprehensive Environmental Impact Studies specific to certain areas where natural features were affected along the route; presentation of data to the agencies at various project meetings and co-ordination of construction monitoring related to breeding birds, fisheries and tree preservation.

Ottawa 174/ Prescott-Russell County Road 17 Environmental Assessment Natural Environment

Report. Dr. Epp was the director for the completion of the natural environment report which documented existing aquatic, terrestrial and wildlife conditions along alternative routes. AECOM's fieldwork encompassed aquatic habitat assessments, vegetation community delineation, identification of wetland areas, turtle basking surveys and auditory amphibian surveys. Effects to aquatic habitat, wetland, woodland, Species at Risk habitat, Significant Wildlife Habitat and natural corridors were determined for each alternative.

City of Ottawa, Light Rail Transit System. Dr. Epp directed the natural heritage component of the Environmental Assessment conducted to determine a preferred route and mitigation strategy. He directed staff and co-ordinated the collection of natural heritage baseline data including vegetation community delineation, fish habitat assessment, floral species inventories and incidental wildlife.

Ministry of Transportation Ontario, Highway 401 Widening Credit River to Mavis Road, Mississauga, Ontario. Dr. Epp was the Natural Sciences and Fisheries lead for AECOM's team. He directed, supervised and provided senior review of technical work conducted in relation to highway widening and associated culvert replacements and mitigation measures.

Canadian Pacific Railway, Proposed Woodstock Rail Spur – Ecological Inventories, Woodstock, Ontario. Directed surveys and inventories of terrestrial and aquatic habitats within a proposed alignment for a new railway spur designed to service a new Toyota manufacturing facility. [01/01/2005-12/31/2005]

Ministry of Transportation Ontario, Highway 8 Dublin – Liffy Drain Bridge Replacement Detail Design, Ontario. Provided environmental monitoring services during bridge improvement works. Periodically assessed and monitored sediment and erosion control measures including silt fencing, straw bale, and rock check dams. Also, monitored and maintained bird nest prevention devices throughout the project. Observations and recommendations were summarized in regular monitoring reports. [G.W.P. 426-97-00] [01/01/2004-12/31/2004]

City of London, London North Route Planning Assessment, London, Ontario. Directed the completion of a screening and alternative routes assessment for the location of a freeway north of London. Screening involved the assessment of wetlands, woodlands, and other vegetation. [01/01/2002-12/31/2002]

City of London, Transportation Corridor Protection Study, London, Ontario. Provided senior ecological advisory input into the selection and evaluation of long range transportation corridors across the city of London. [01/01/2001-12/31/2001]

Ministry of Transportation Ontario, Highway 101 TPM, Wawa, Ontario. Provided senior direction for the preparation of documentation for obtaining Fisheries Act authorization and fish habitat compensation planning. [W.P. 532-89-00]

Canadian National Railway, Mile 119.6 Kingston Bridge Widening, Ontario. Directed and supervised the preparation of documentation for obtaining Fisheries Act authorization and fish habitat compensation planning and construction monitoring for the widening of a railway bridge.

City of London, East Boroughs Bridge Replacement, London, Ontario. Directed and supervised the preparation of documentation for obtaining Fisheries Act authorization and fish habitat compensation planning for the replacement of the bridge.

Ministry of Transportation Ontario, Highway 423: Highway 401-407 Link Study, Natural Resources Analysis & Evaluation, Ontario. Senior ecologist responsible for overall coordination of natural environment analysis and evaluation for the Pickering, Ajax, and Whitby freeway link environmental assessment. Natural environment investigations included wetland assessments, woodlot assessments, and fish habitat evaluations for a wide range of sites.

Ministry of Transportation Ontario, Various Projects, Ontario. Supervised the preparation of fisheries reports and natural environment reports related to assessment of potential impacts and the development of mitigation measures for MTO highway improvement projects, including Highway 6 (Flamborough), Highway 26 (Owen Sound), Highway 6 By-pass (Caledonia), Highways 17 & 531 (North Bay), Highway 7 (Marmora), Highway 63 (North Bay), Highway 7 (Peterborough), Highway 401 (Windsor), Highway 7A/28/115 (Peterborough), and Highway 401 (Mississauga).

Water and Sewage Facilities and Infrastructure

Region of York, YDSS Interceptor Sewer Class Environmental Assessment Peer Review, Ontario.

Conducted a technical peer review of natural heritage and ecological studies and mitigation measures for the design and construction of a new interceptor sewer along 19th Avenue and Leslie Street.

[01/01/2005-12/31/2005]

Region of Peel, Peel–West Brampton Water Main Class Environmental Assessment, West

Brampton, Ontario. Coordinated field assessment and evaluation of alternative route alignments for a new water main. [01/01/2004-12/31/2004]

City of Barrie, New Surface Water Treatment Plant and Low Lift Pumping Station Environmental

Evaluation Study, Barrie, Ontario. Directed the field, assessment, and management plan preparation for the design and construction a new water treatment facility. Assessed the potential impacts of locating a pumping station and water intake pipe within an ecologically significant area along Kempenfeldt Bay on Lake Simcoe. [01/01/2004-12/31/2004]

Watershed and Subwatershed Planning Studies

City of London, Pincombe Drain Subwatershed Master Plan, London, Ontario. Coordinated the completion of the natural heritage study and aquatic habitat components of the subwatershed master plan. [01/01/2004-12/31/2004]

North Bay-Mattawa Conservation Authority, Chippewa Creek Watershed Management Study,

North Bay, Ontario. Project leader for an integrated watershed management study that included ecological assessment, hydrology, geomorphology, water quality assessment, and planning. A phased approach allowed for a multi-stakeholder steering committee and public input. [01/01/1996-12/31/1996]

Township of Scugog, Cawker's Creek Subwatershed Study, Port Perry, Ontario.

Conducted ecological studies for a comprehensive multidisciplinary subwatershed study to plan and promote responsible development. The plan addressed ecological resources, flooding and erosion, water quality, and land use planning requirements. [01/01/1997-12/31/1997]

Otonabee Region Conservation Authority/City of Peterborough, Cavan Creek and Otonabee River

Subwatershed Plan, Peterborough, Ontario. Senior ecologist responsible for the ecological studies for a three phase subwatershed management study for the Cavan Creek and Otonabee River subwatershed. Investigations included ecological assessment, fluvial geomorphology, hydrology, and planning components. [01/01/1998-12/31/1998]

City of North Bay, Parks Creek Watershed Study, North Bay, Ontario. Conducted the water quality and ecological components of the study and provided input to planning and engineering concepts for the watershed. [01/01/1993-12/31/1993]

City of Oshawa, Oshawa Creek Watershed Study, Oshawa, Ontario. Conducted the water quality study component of the study and provided senior expert advisory review for the ecological component of the study. Conducted a detailed water quality survey and assessment of contaminant loadings throughout the watershed. [01/01/1993-12/31/1993]

Shari L. Muscat, B.A., B.E.S.

Project Manager/Environmental Planner

Education

Bachelor of Environmental Studies, Urban and Regional Planning, University of Waterloo

Bachelor of Arts, Honours, Carleton University

Years of Experience

With AECOM: <1

With Other Firms: 19

Summary

Shari Muscat has over 18 years of experience in environmental resource planning and management and has successfully managed or participated in more than 150 projects. Shari is responsible for planning and coordinating environmental impact assessments, natural environment field programs and biological inventories in support of development, transportation, renewable energy and watershed restoration projects. Shari has been involved in the implementation of the natural heritage and natural hazards policies of the Provincial Policy Statement, Conservation Authorities Regulations, Greenbelt Act, Niagara Escarpment Act, Municipal planning documents and the Renewable Energy Act. Shari has developed a thorough understanding of the complex and evolving policy framework in the Province and a comprehensive understanding of the interconnections between the physical and the natural environment, and maintains a good working relationship with the review and approval agencies.

Project Experience

Environmental Assessments

King and Fountain Streets Class EA, Cambridge, Ontario (Natural Environment Lead).

Responsible for the completion of a Natural Environment Report in support of a Class Environmental Assessment for the selection of a roadway alignment for King and Fountain Streets to alleviate road congestion.

Weber Street Upgrades Class EA, Waterloo (Natural Environment Lead).

Responsible for the completion of a Natural Environment Report in support of a Class Environmental Assessment for the selection of a roadway improvements.

Laurel Creek and Sanitary Sewer EA, Waterloo, Ontario (Natural Environment Lead). Responsible for the completion of a Natural Environment Report in support of a Class Environmental Assessment for the selection of a preferred route for the construction of a trunk sanitary sewer alignment.

Beaver Creek Road and Conservation Drive Sewage/Pumping Station EA (Natural Environment Lead). Responsible for the completion of a Natural Environment Report and field studies including

studies for Species at Risk in support of a Class Environmental Assessment for the selection of a preferred route for the construction of a trunk sanitary sewer alignment and roadway improvements.

Contract Administration

Gordie Howe International Bridge Early Works Project, Windsor, Ontario (Natural Heritage Lead).

Responsible for providing natural heritage advise and ongoing support to the contractor and WDBA to manage species at risk and aquatic habitat obligations during construction, including the submission of reporting to Infrastructure Canada.

Environmental Impact Assessments

Activa Weiss Environmental Impact Study, City of Kitchener, Ontario (Environmental Planner).

Responsible for the completion of an Environmental Impact Study in support of a residential Plan of Subdivision.

Huron Woods Environmental Implementation Report, Kitchener, Ontario (Environmental Planner).

Responsible for the completion of an Environmental Implementation Report in support of a residential Plan of Subdivision.

Tutela Heights Subdivision Environmental Impact Study, Brantford, Ontario (Environmental Planner). Responsible for the completion of an Environmental Impact Study in support of a residential Plan of Subdivision and the Tutela Heights Area Study.

20 Vic Developments Franklin and Main Environmental Impact Study, Cambridge, Ontario (Environmental Planner). Responsible for the completion of an Environmental Impact Study in support off future commercial development. An EIS was prepared that considered the proposed plan of development, the potential environmental impacts and discussed mitigation measures for each potential impact.

Hearthwood Subdivision Environmental Impact Study, Kitchener, Ontario (Environmental Planner). Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential plan of subdivision.

Winzen Developments on Myers Rd. Environmental Impact Study, Cambridge, Ontario (Environmental Planner). Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential plan of subdivision. An EIS was prepared that considers the proposed plan of development adjacent to a significant woodlot and wetland, consolidates field investigation results pertaining to vegetation and wildlife assessments.

Clerview Stables Environmental Impact Study, Guelph, Ontario (Environmental Planner).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential site plan of subdivision.

Sunningdale Meadows Scope Environmental Impact Study, London, Ontario (Project Manager/ Environmental Planner).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential site plan of subdivision. An EIS was prepared that considered the proposed plan of development

adjacent to a an Environmentally Sensitive Area, wetland and aquatic habitat features, identified the potential environmental impacts and discussed mitigation measures for each potential impact.

Safety Kleen Site Expansion, Township of Woolwich, Ontario (Environmental Planner).

Responsible for the completion of an Environmental Impact Study recommending measures to protect the natural features and functions in the area to support the expansion of an industrial use adjacent to wetland and aquatic habitat features.

938 Sager Road Environmental Impact Study, Flamborough, Ontario (Environmental Lead).

Responsible for the coordination of the completion and quality review of an EIS report in support of residential development.

Bridgeport Industrial Subdivision Environmental Impact Study, Kitchener, Ontario (Environmental Planner). Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a commercial plan of subdivision. An EIS was prepared that considered the proposed plan of development, the potential environmental impacts and discussed mitigation measures for each potential impact.

Activa St. George Environmental Impact Study, St. George, Ontario. Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential site plan of subdivision. An EIS was prepared that considered the proposed plan of development adjacent to a Provincially Significant wetland and woodland features.

Huron Woods Stages 4, 5, and 6 Environmental Impact Study Addendum, Kitchener, Ontario (Environmental Planner). Responsible for the completion of an Environmental Impact Study addendum to recommend measures to protect the natural features and functions in the area including Significant Woodlands, Wetland and Cold Water fish species. An EIS was prepared that considered the proposed plan of development, the potential environmental impacts and discussed mitigation measures for each potential impact.

1498 Bishop Street, Cambridge, Ontario (Project Manager/ Environmental Lead). Responsible for the completion of an Environmental Impact Study to assess the impacts associated with development in a locally significant wetland.

Moffat Creek Subdivision Environmental Impact Study, Cambridge, Ontario (Environmental Planner). Environmental Planner responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area including Significant Woodlands, Wetland and Ontario Species at Risk. An EIS was prepared that considered the proposed plan of development, the potential environmental impacts and discussed mitigation measures for each potential impact.

1989 and 2009 Ottawa Street South Environmental Impact Study, Kitchener, Ontario. Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential site plan of subdivision. An EIS was prepared that considered the proposed plan of development adjacent to a significant woodland feature and identified the potential environmental impacts and discussed mitigation measures for each potential impact.

Black Creek Developments, Port Dover, Ontario (Project Manager/ Environmental Lead).

Responsible for the completion of an Environmental Impact Study to assess impacts for the installation of a boardwalk network in a Provincially Significant Wetland and potential impacts associated with a new dock installation.

Flamborough Power Centre Environmental Impact Study, Hamilton, ON (Project Manager/ Environmental Lead)

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the significant natural features and functions in the area including significant woodland, habitat for species at risk and aquatic habitat, to support a residential site plan of subdivision

781 Victoria Road Environmental Impact Study, Guelph, Ontario (Environmental Planner).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential site plan of subdivision. An EIS was prepared that considered the proposed plan of development adjacent to a Provincially Significant wetland and identified the potential environmental impacts and discussed mitigation measures for each potential impact.

905 Sarnia Road Environmental Impact Study, London, ON (Project Manager/Environmental Planner).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions and compensation for the loss of wetland habitat. Development included the creation of amphibian and crayfish habitat and the relocation of species.

3680 Wonderland Road Environmental Impact Study, London, ON (Environmental Lead).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions, including indirect fish habitat, in support of a residential plan of subdivision.

Richardson Farms Scoped Environmental Impact Study, London, ON (Environmental Planner).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the significant natural features and functions in the area including significant woodland, habitat for species at risk, wetlands and aquatic habitat, in support of a residential plan of subdivision

Courtney Subdivision Environmental Impact Study, London, ON (Environmental Planner).

Responsible for the completion of an Environmental Impact Study to recommend measures to protect the significant natural features and functions in the area including significant woodland, Environmentally Sensitive Areas, wetland, and aquatic habitat, in support of a residential site plan of subdivision

Victoria Park Village Environmental Impact Study Addendum and Environmental Implementation Report, Guelph, ON (Project Manager/ Environmental Lead).

Responsible for the completion of an Environmental Implementation Report (EIR) to ensure the protection of adjacent natural features, including significant wetlands, woodlands, habitat for species at risk, fish habitat improvement, to support a residential plan of subdivision.

West Waterloo Commercial Centre Environmental Impact Study, Waterloo, Ontario (Environmental Planner).

Responsible for the completion of an Environmental Impact Study in support of future commercial development. An EIS was prepared that considered the proposed plan of development, the potential environmental impacts and discussed mitigation measures for each potential impact.

Sherman Pit Environmental Impact Study, Region of Halton (Environmental Lead). Responsible for coordinating the completion and quality review of an EIS for Conservation Halton to support a rehabilitation project on Limestone Creek to be completed by Conservation Halton.

1291 Gordon Street Condominiums Environmental Implementation Report, Guelph, Ontario (Environmental Planner). Responsible for the completion of an Environmental Implementation Report (EIR) to ensure the protection of adjacent natural features and functions to support a residential site plan.

Fairway Road/Lackner Boulevard (WRDSB Property) Environmental Impact Study, Kitchener, Ontario. Responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area to support a residential site plan of subdivision. The assessment included an assessment of habitat for Blandings Turtle.

Union Gas Bright Compressor Station, Bright, Ontario (Environmental Lead). Responsible for coordinating the completion and quality review of an EIS to support an expansion of the Union Gas Bright Compression Station.

1885 Gordon Street, Guelph, Ontario (Environmental Lead). Responsible for coordinating the completion and quality review of an EIS to support a proposed residential plan of subdivision

140 Garner Road, Hamilton, Ontario (Environmental Lead). Environmental Planner responsible for the completion of an Environmental Impact Study to recommend measures to protect the natural features and functions in the area including Significant Woodlands, Wetland and Ontario Species at Risk.

Kortright Phase 4, Guelph, ON (Environmental Planner). Responsible for quality review of an Environmental Implementation Report (EIR) to ensure the protection of adjacent natural features, including significant wetlands, woodlands, and habitat for species at risk, to support a residential plan of subdivision.

Cambridge Landfill, Cambridge, Ontario (Environmental Lead). Responsible for the coordination and senior review of an EIS for the construction of a system forcemain and electrical conduit for the Cambridge Landfill site.

Opportunity / Constraint Analysis

Sharp Road Lands Environmental Constraints Assessment, Paris, Ontario. Performed a preliminary environmental constraints analysis for the subject lands, using published resources and initial field investigations to identify constraints to development. Information was presented to the client in report format.

North Powerline Group, Brantford, Ontario. Performed a preliminary environmental constraints analysis for a group of landowners using published resources and initial field investigations to identify constraints to development. Information was presented to the client in report format.

Fairway Road Trail Assessment, City of Kitchener (Project Manager/ Environmental Lead). Responsible for coordinating the completion of field studies to inform the future location for a proposed trail alignment adjacent to wetland and a cold water creek.

Renewable Energy

Fairview Wind Project, Stayner, Ontario (Environmental Planner). Environmental Planner responsible for the completion of a Natural Heritage Assessment and Environmental Impact Study for review and approval by MNR in support of an application to MOE under the Renewable Energy Act. The assessment included evaluating the proposed impacts of wind turbine components adjacent to natural heritage features.

Grand Renewable Energy Project, Haldimand County, Ontario (Environmental Planner). Environmental Planner responsible for assisting with the completion of a Natural Heritage Assessment and Environmental Impact Study for review by MNR in support of an application to MOE under the Renewable Energy Act. The assessment included evaluating the proposed impacts of wind turbine components adjacent to natural heritage features.

Niagara Region Wind Farm, West Lincoln, Ontario (Natural Environment Lead). Natural Environment Lead responsible for the completion of a Renewable Energy Approval (REA) submission to the Ministry of the Environment (MOE) for a proposed 230 MW wind farm project on behalf of NRWC. As a member of the multi-disciplinary project team, Shari was responsible for completing the Natural Heritage Assessment (NHA) and Environmental Impact Study (EIS) in accordance with the Ministry of Natural Resources (MNR) standards and procedures and to secure a letter of confirmation from the MNR as part of the REA application.

David Brown Solar Project, Cornwall, Ontario (Natural Environment Lead). Natural Environment Lead responsible for the completion of a Renewable Energy Approval (REA) submission to the Ministry of the Environment (MOE) for a proposed 10MW solar farm project. As a member of the multi-disciplinary project team, Shari was responsible for completing the Natural Heritage Assessment (NHA) and Environmental Impact Study (EIS) in accordance with the Ministry of Natural Resources (MNR) standards and procedures and to secure a letter of confirmation from the MNR as part of the REA application.

Jillian deMan, H.B.Sc.

Senior Terrestrial and Wetland Ecologist/Ecology Manager

Education

Honours Bachelor of Science in Biology and Earth Science, 2003

Years of Experience

In Current Role: 15

With AECOM: 20

Specialties

- Environmental Permitting through federal and provincial processes
- Environmental Monitoring and Mitigation
- Scheduling/ Surveying
- Baseline environmental data collection

Training and Certifications

- Amphibian and Reptile Survey Techniques, Nature Conservancy Canada/Ontario Ministry of Natural Resources, 2013
- Butternut Health Assessor, Ontario Ministry of Natural Resources and Forestry, 2011; re-cert: 2014
- PSMJ Project Management Boot Camp, 2005
- Temperate Wetlands Restoration Course, Ontario Ministry of Natural Resources, 2005
- Wetlands Evaluation Restoration Training Course, Ontario Ministry of Natural Resources, 2004
- Ecological Land Classification for Southern Ontario Training Course, Ontario Ministry of Natural Resources, 2003
- Animal Care and Use, Brock University, 2002

Summary

Jillian deMan is a senior terrestrial and wetland ecologist with AECOM's Environmental Division based out of Kitchener, Ontario. With the company for 20 years, her expertise has a wide range of scope within the environmental field enabling her to be involved with numerous types of projects that incorporate natural heritage issues/planning and restoration. She provides senior review and has experience in small to large-scale natural heritage baseline, environmental assessment, impact analysis, peer review, monitoring and restoration work where she co-ordinates multi-disciplinary teams for projects across Canada. She also has considerable experience in facilitation of project approvals with respect to the Species at Risk Act, Fisheries Act, Endangered Species Act, and Conservation Authorities Act. Her

technical skills include; wetland and woodland systems assessment, evaluation, delineation and restoration; Species at Risk habitat assessment and species inventories; amphibian and reptile surveys; multi-scale floral inventories; vegetation community delineation; soils analysis and identification; air-photo interpretation and biomass fish sampling through seine net, minnow trap or electrofishing methods.

Jillian is recognized as an expert in woodland ecology and restoration through the Environmental Review Tribunal.

Project Experience

Renewable Energy Projects

Henvey Inlet Wind LP, Henvey Inlet Wind Energy Centre (HIWEC), Parry Sound District, Ontario.

Lead co-ordination and conducted fieldwork for terrestrial site investigations including ELC, vascular plant inventories, bat cavity tree surveys, turtle and snake basking turtles, vernal pool assessments, breeding bird surveys, old growth tree assessments and rare plant surveys in the project Study Area. Collected data with respect to vegetation delineation and old growth assessments. Lead the completion of four separate wetland evaluations. Reviewed survey data and other sections relating to wildlife/terrestrial habitat for the NHA and EIS. Prepared mitigation sections in Volume A: HIWEC EA. Species at Risk associated with project include: Blanding's Turtle, Eastern Musk Turtle, Eastern Whip-poor-will, Canada Warbler, Common Nighthawk, Olive-sided Flycatcher, Kirtland's Warbler, Little Brown Bat, Northern Myotis, Tri-coloured Bat, Massasauga Rattlesnake, Eastern Foxsnake, and Hognose Snake [ongoing].

Settlers Landing Wind Park, Capstone, Manvers, Ontario. Lead the completion of a comprehensive survey of over 1,500 trees including health and dendrochronological analysis. This provided the rationale for the development of a comprehensive woodland compensation plan where 1,576 trees were transplanted/planted. This plan was successful at the Environmental Review Tribunal where Jillian presented as an expert witness.

NextEra Energy Canada, Solar Energy Projects, numerous municipalities, Ontario. Completed natural heritage constraints analysis and prepared relevant sections of reports for five proposed solar wind energy projects in Ontario.

NextEra Energy Canada, Summerhaven Wind Energy Centre, Haldimand County, Ontario.

Assisted in conducting wetland Surveys using methods as per the MNRF protocols in the Summerhaven Wind Energy Centre. Species at Risk associated with project include: Bobolink.

NextEra Energy Canada, Bluewater and Goshen Wind Energy Centre, Haldimand County, Ontario.

Completed detailed tree inventories in road right-of-ways and on private property. Prepared report summarizing and analyzing the results of the tree inventory to be used for a replanting plan. Species at Risk associated with project include: Butternut, Bobolink, Barn Swallow, Little Brown Bat, Northern Myotis, and American Badger.

NextEra Energy Canada, Goshen Wind Energy Centre, Huron County, Ontario. Managed and analyzed ecological data in preparation of the Natural Heritage Assessment (NHA) and Environmental Impact Study (EIS) Report. Prepared a woodland compensation plan with respect to removal/replanting

of Butternut specimens. Species at Risk associated with project include: Butternut, Bobolink, Barn Swallow, Little Brown Bat, Northern Myotis, and American Badger.

Wetland and Species at Risk Projects

GE Canada, Welland Forefront Site, Welland, Ontario. Lead ecologist for completion of an overall benefit permit associated with species confirmed on site. Negotiated overall benefit items with MNRF, provided oversight of construction activities and trained staff with respect to Species at Risk.

Victoria Street Improvements, Region of Durham, Whitby, Ontario. Jillian has successfully negotiated approvals with the Ministry of Natural Resources and Forestry, Central Lake Ontario Conservation Authority and Department of Fisheries and Oceans for the widening of Victoria Street within the Region of Durham. Approvals are required due to the presence of Eastern Pondmussel and Lynde Creek Marsh Provincially Significant Wetland. Permits were acquired for the undertaking of Ontario's first mussel relocation program within marsh habitats. Jillian co-ordinated required documentation between the agencies, project engineers, aquatic experts and the Region of Durham. She also lead the development of the mussel relocation protocols as the current protocols written by Mackie *et al.* are focused on riverine habitats. Additional mitigation includes a series of relocation plans for potential plants and fish specimens and wetland restoration/creation. Overall the project will improve wildlife connectivity across the road thereby resulting in a significant reduction of wildlife road mortality.

Highway 401 Road Widening between Credit River and 403/410 Interchange, Ministry of Transportation, Ontario. Co-ordinated and conducted terrestrial assessments for the widening of Highway 401. She negotiated approvals with MNRF due to the presence of Jefferson Salamander and Redside Dace.

Valley Inn Wildlife Monitoring, CN Rail, Burlington, Ontario. Jillian has been co-ordinating and undertaking wildlife monitoring for CN's Valley Inn adjacent to Carroll's Bay in Burlington, Ontario. This site is immediately adjacent to Carroll's Bay, which contains one of the largest Map Turtle populations in Canada. To isolate the site, a series of turtle barrier fencing was installed and monitored over the nesting period from June to July.

Sydney Tar Ponds Agency, Peer Review of "Remediation of Sydney Tar Ponds and Coke Ovens Sites Environmental Impact Study", Sydney, Nova Scotia. Reviewed the terrestrial/wetland component of a 642 page Environmental Impact Study document for the clean-up of coal-based contaminants/sludge from a tidal estuary at the mouth of Muggah Creek. A comprehensive team was organized for the review including the completion of status reports and a presentation to the client.

Wetland Evaluation System Review, New Brunswick. Provided technical review for New Brunswick's provincial wetland evaluation system. Jillian provided recommendations for overall improvement of the system.

DEVCO, Baseline and Effects Assessment, Nova Scotia. Conducted baseline data collection for several closed coal mines. Determined potential effects of stockpiled coal fines on the ability of the surrounding environment to naturally re-establish. Current literature was researched and reviewed, and vegetation/soils analyses were conducted for the completion of this project.

Niagara Peninsula Conservation Authority, Fish Habitat and Wetland Enhancement Strategy, St. Catharines, Ontario. Aided in the completion of a Fish Habitat and Wetland Enhancement Strategy for two old oxbows along Twelve Mile Creek. The general goal for this Strategy was to facilitate an economically feasible, self sustaining wetland and recreational fishery (panfish and smallmouth bass) within the Glenridge and Riverview Ponds. Specific tasks included aiding in the creation of three remedial design options for a new bathymetric profile and new outlet structure and/or retrofit of the existing structures for both of the ponds, development of a cost analysis for each design option and recommending appropriate wetland plantings within a detailed planting plan.

Hamilton Port Authority, Randle Reef Risk Assessment, Hamilton Harbour, Ontario. Determined the potential associated risks for the confinement of Randle Reef, an underwater coal tar deposit of 630,000 cubic metres. As part of this task, the surrounding fisheries, wetlands, forests and Species at Risk were assessed and described including conditions of Cootes Paradise. Through this assessment, it was determined how these features could be potentially affected through the confinement of Randle Reef. A cumulative impact assessment was also conducted in accordance with the "Cumulative Effects Practitioners Guide." Species at Risk associated with project include: Peregrine Falcon, Map Turtle, Blanding's Turtle, and Eastern Musk Turtle.

City of Sudbury, Frobisher Works Yard Wetland Evaluation, City of Sudbury, Ontario. Lead and completed a wetland evaluation of a portion of a wetland surrounding the City of Sudbury Works Yard. Wetland community boundaries were delineated and a vegetation survey was completed using the Ministry of Natural Resources Wetland Evaluation System (Northern Edition). Tasks included: wetland community mapping, vegetation inventories, background review and documentation, completion of wetland evaluation score sheet and consultation with the City of Sudbury, Ministry of Natural Resources and Nickel District Conservation Authority.

Airport Road Phase 3 & 4 Environmental Impact Study and Wetland Evaluations, London, Ontario. Aided in the completion of two Environmental Impact Studies and two wetland evaluations for terrestrial and wetland communities along Airport Road within Phases 3 & 4 of Innovation Industrial Park. Tasks include: 1) agency consultation, 2) background data collection, 3) field investigations comprised of floral and faunal inventories, 3) assessment of significance of habitat and identified species, 4) development of constraints and opportunities mapping and 5) development of an environmental management plan including buffer recommendations.

Tributary "C" Wetland Evaluation, City of London, Ontario. As part of an overall Environmental Assessment and Environmental Impact Study, Jillian conducted a wetland evaluation for wetland communities found along Tributary "C" in the City of London, Ontario. The wetland evaluation was accepted by Ontario Ministry of Natural Resources as Provincially Significant due to a high level of biodiversity, presence of regionally and provincially rare plants and occurrence of brook trout spawning grounds.

Niagara Peninsula Conservation Authority, Duffin Property Wetland Rehabilitation Plan, Welland, Ontario. Lead the completion of a wetland rehabilitation plan for a portion of the Singer's Drain and Niagara Street -Cataract Road Provincially Significant Wetland Complex that had been illegally cleared. The approach to developing the rehabilitation plan was to recommend the most ecologically and economically feasible plan to return the site back to a functioning slough-prairie wetland

community. Tasks included the completion of an; excavation plan, planting plan, cost estimate and implementation recommendations. Special regard had to be taken for the surrounding communities within the remaining PSW and for project scheduling since the project had to be complete at a specific time as a condition of a court order.

Wetland Effects Assessments, Delineation and Evaluation City of Kitchener, Blockline Road Extension, Kitchener, Ontario (in progress). Jillian led the completion of an Environmental Impact Study considering the preferred design of the Blockline Road extension and its effects to the natural environment. She ensured that existing aquatic and terrestrial conditions within the study area were collected in a comprehensive manner and that design measures integrated aspects of the natural system.

Windsor Essex Parkway Wetlands Review, Ministry of Transportation, Windsor, Ontario. As one of AECOM's wetlands specialists, Jillian is responsible for reviewing wetlands related documentation for the Windsor Essex Parkway extension on behalf of the Ministry of Transportation. This includes documents pertaining to wetlands delineation, evaluation and compensation.

Improvements to Victoria Street, Region of Durham. Jillian has successfully negotiated approvals with the Ministry of Natural Resources and Forestry, Central Lake Ontario Conservation Authority and Department of Fisheries and Oceans for the widening of Victoria Street within the Region of Durham. Approvals are required due to the presence of Eastern Pondmussel and Lynde Creek Marsh Provincially Significant Wetland. Permits were acquired for the undertaking of Ontario's first mussel relocation program within marsh habitats. Jillian co-ordinated required documentation between the agencies, project engineers, aquatic experts and the Region of Durham. She also lead the development of the mussel relocation protocols as the current protocols written by Mackie *et al.* are focused on riverine habitats. Additional mitigation includes a series of relocation plans for potential plants and fish specimens and wetland restoration/creation. Overall the project will improve wildlife connectivity across the road thereby resulting in a significant reduction of wildlife road mortality.

Schedule B Class EA / Detailed Design study for the Kitchener WWTP Phase 3 Upgrades, Ontario. An overall benefit permit is currently underway with MNRF for Wavy-rayed Lampmussel, Black Redhorse and Silver Shiner for the installation of a new outfall. Part of this has been the development and co-ordination of mussel relocation activities. Mussel relocation works will begin this July 1st, 2016. Jillian will be responsible for ensuring these activities are in accordance with the Overall Benefit permit.

Natural Heritage Studies and Impact Analysis

Schedule B Class EA / Detailed Design study for the Kitchener WWTP Phase 3 Upgrades, Ontario. Jillian led the completion of the natural heritage component of the Schedule B Class EA and Detailed Design components. This included the successful completion of a comprehensive Environmental Impact Study accepted by both GRCA and MNRF. An overall benefit permit is currently underway with MNRF for Wavy-rayed Lampmussel, Black Redhorse and Silver Shiner for the installation of a new outfall.

Upper Hannon Creek Master Drainage and Servicing Study, City of Hamilton, Ontario. Jillian is currently leading the completion of the aquatic and terrestrial studies in order to finalize reach management recommendations for the headwaters of Upper Hannon Creek. Investigations undertaken included breeding bird, amphibian call, refinement of Ecological Land Classification, aquatic assessment

and electrofishing surveys. Species at Risk associated with project include: Barn Swallow and American Badger.

Probe Mines, Terrestrial Baseline, Chapleau, Ontario. Lead the completion of the aquatic, wildlife and terrestrial baseline reports to be incorporated into an overall Environmental Impact Study. Field investigations included vegetation community delineation, botanical surveys, basal area calculations, aquatic assessments, fish community determination through electrofishing /netting and wildlife inventories including breeding bird surveys, amphibian surveys and large mammal surveys, soil profile analysis and air-photo interpretation.

Labrador Iron Mines, Terrestrial Baseline for Twelve Properties, Schefferville, Quebec and Labrador. Lead the completion of the aquatic, wildlife and terrestrial baseline reports to be incorporated into an overall Environmental Impact Study for twelve potential iron mine sites. Field investigations included vegetation community delineation, botanical surveys, basal area calculations, aquatic assessments, fish community determination through electrofishing /netting and wildlife inventories including breeding bird surveys, amphibian surveys and large mammal surveys with a focus on caribou habitat, soil profile analysis and air-photo interpretation. Traditional knowledge was also obtained from members of the local Cree and Inu communities. Species at Risk include: Woodland Caribou.

Labrador Iron Mines, Terrestrial Baseline for Redmond, James and Silveryards Properties, Schefferville, Quebec and Labrador. Lead the completion of the terrestrial baseline report to be incorporated into an overall Environmental Impact Study for the re-opening of an iron ore open pit mining operation. Field investigations focused on identifying vegetation communities within three proposed sites and included botanical surveys, basal area calculations, soil profile analysis and air-photo interpretation. Traditional knowledge was also obtained from members of the local Cree and Inu communities. Species at Risk include: Woodland Caribou.

Public Works Canada, Bear Island Vegetation Assessment, Nunavut. Completed an assessment of the natural features on Bear Island in James Bay, Nunavut. This was required to determine the impacts of a proposed landfill to be located on the Island. Tasks include: vegetation species inventories, wildlife habitat assessments and vegetation community delineation. Traditional knowledge was obtained from members of the local Cree community. Species at Risk associated with project include: Polar Bear and Arctic Fox.

City of Sudbury, Frobisher Works Yard Wetland Evaluation, City of Sudbury, Ontario. Lead and completed a wetland evaluation of a portion of a wetland surrounding the City of Sudbury Works Yard. Wetland community boundaries were delineated and a vegetation survey was completed using the Ministry of Natural Resources Wetland Evaluation System (Northern Edition). Tasks included: wetland community mapping, vegetation inventories, background review and documentation, completion of wetland evaluation score sheet and consultation with the City of Sudbury, Ministry of Natural Resources and Nickel District Conservation Authority.

Ottawa 174/ Prescott-Russell County Road 17 Environmental Assessment Natural Environment Report. Jillian led the completion of the natural environment report which documented existing aquatic, terrestrial and wildlife conditions along alternative routes. Fieldwork encompassed aquatic habitat assessments, vegetation community delineation, identification of wetland areas, turtle basking surveys and auditory amphibian surveys. Effects to aquatic habitat, wetland, woodland, Species at Risk habitat,

Significant Wildlife Habitat and natural corridors were determined for each alternative. Species at Risk associated with project: Blanding's Turtle.

Rehabilitation of Muskoka Road 169 Underpass (42-139), Hawk Rock Creek Culvert (42-203/C) and two Kabshe River Culverts (42-105/C, 42-197/C) in Huntsville Area, Ministry of Transportation, Ontario. Provided senior review for the completion of the Terrestrial Ecosystems Existing Conditions and Impact Assessment Report. Tasks included guidance and oversight of fieldwork, review of the report and determination of appropriate mitigation measures with respect to Species at Risk.

City of London, Kiwanis Pedestrian Path Environmental Impact Study, London, Ontario. Led the completion of an impact analysis for a new pedestrian path through Kiwanis Park and over CN Rail tracks. Studies included breeding birds, amphibian call surveys, aquatic habitat assessments and floral species inventories, a wetland evaluation, Environmental Significant Area evaluation and species specific surveys within a remnant prairie.

Sifton Properties, Development Assessment Report, Middlesex Centre, Ontario. Completed an evaluation of existing natural heritage features and net effects assessment for a single residential development along the Thames River within Middlesex Centre.

City of London, Southwest Area Plan, London, Ontario. Aided in the completion of the Southwest Area Plan for the City of London. Main tasks completed comprised of the development of a Natural Heritage Strategy for the natural features within the study area.

City of London, W12 Landfill Area Plan, London, Ontario. Aided in the completion of an ecological resources and natural heritage study. This Ecological Resources Background Report was prepared as background technical support for the London W12A Landfill Area Plan. The Ecological Resources Background Report and its Natural Heritage Strategy provided the framework for environmentally sound planning decisions and reasoned management of the natural resources for the area. The Ecological Resources Study and Natural Heritage Strategy report provided: a description of the existing natural heritage features, an assessment of ecosystem function, evaluation of significant features, recommendations regarding development constraints and opportunities and an outline of the requirements for more detailed environmental impact studies.

City of Welland, Northwest Area Master Servicing Plan, Welland, Ontario. Aided in the preparation of an environmental impact study for an area within Welland. Conducted vascular plant inventories, assessed potential fish habitat along a watercourse, defined specific vegetation communities using ELC codes, and provided recommendations with regards to possible impacts to these vegetation communities.

County/City of Peterborough, Peterborough County/City Waste Management Facility Final North Fill Area Site Design, Peterborough, Ontario. Updated the EIS for the final design of the north fill area. Conducted plant and bird surveys, defined vegetation communities into ELC units and consulted with various ministry officials.

DLN Group, Huron Shores Estates, Environmental Impact Study, Lambton County, Ontario. Aided in the preparation of an EIS for a property, located along the shores of Lake Huron, that contained provincially significant wetland elements and old growth dune forest stands. A detailed environmental management plan was prepared for the EIS to ensure that all the sensitive elements of this property were protected.

Z Group, Uplands North Residential Development. Constraints and Opportunities Report, London, Ontario.

Aided in the preparation of the report for a property that contained a locally significant wetland and a locally significant woodland and bordered a woodland designated as an environmentally significant area. prepared a detailed account of existing constraints, recommending areas for development and areas for protection and restoration.

Sifton Properties Ltd., Wickerson Road Environmental Impact Study, London, Ontario. Conducted an EIS to determine potential impacts from a proposed residential strip along a woodlot with wetland pockets. Delineated vegetation communities into ELC units, conducted plant and amphibian surveys, located on-site drainage routes, and provided construction recommendations to mitigate potential impacts.

D&B Development/Green Lane Environmental Group Ltd., Environmental Investigations, St. Thomas, Ontario. Aided in the preparation of a constraints and opportunities report for a proposed residential area. Conducted vascular plant surveys, defined vegetation communities into suitable ELC units, provided an assessment of the significance of environmental features and functions of the site and provided recommendations with regards to possible impacts to the vegetation.

Sifton Properties Ltd., River Bend Community Phases 1 & 2, Environmental Impact Study, London, Ontario. Participated in a study to determine potential impacts from an adjacent housing and golf course community and stormwater management pond to invertebrate communities in the Thames River. Aided in collecting invertebrate samples along the Thames River and adjoining tributaries.

Municipality of West Nipissing, Aquatic Impact Assessment, Field, Ontario. Participated in a study to determine potential impacts of a culvert to the aquatic community of Sturgeon Creek. Conducted fish and aquatic invertebrate and benthic sediment sampling of the creek.

Transportation

Region of Waterloo Rapid Transit System Natural Heritage Approvals. Jillian was responsible and successful in the acquirement of all natural heritage approvals required for the construction of the Region's new Rapid Transit System. This involved consultation with Grand River Conservation Authority, Ministry of Natural Resources, Department of Fisheries and Oceans and Environment Canada; provision of comprehensive Environmental Impact Studies specific to certain areas where natural features were affected along the route; presentation of data to the agencies at various project meetings and co-ordination of construction monitoring related to breeding birds, fisheries and tree preservation.

Region of Waterloo, Rapid Transit Initiative Environmental Impact Study. Lead the completion of an environmental impact study for the proposed light rail transit route from Conestoga Mall to Fairview Mall in Waterloo and Kitchener respectively. Baseline ecological data was collected and consisted of fish composition studies, floral species surveys, vegetation community classification, wildlife surveys and fish habitat assessments.

Valley Inn Wildlife Monitoring, CN Rail, Burlington, Ontario. Jillian has been co-ordinating and undertaking wildlife monitoring for CN's Valley Inn site in Burlington, Ontario where rail improvements are currently underway. This site is immediately adjacent to Carroll's Bay, which contains one of the largest Map Turtle populations in Canada. To isolate the site, a series of turtle barrier fencing was installed and

monitored over the nesting period from June to July. Jillian kept in contact with staff from Royal Botanical Gardens as well as the contractor to ensure turtles were kept safe and off the project site during construction.

City of Ottawa Light Rail Transit System. To determine a preferred route and mitigation strategy, Jillian co-ordinated the collection of natural heritage baseline data including vegetation community delineation, fish habitat assessment, floral species inventories and incidental wildlife.

City of Kitchener, Blockline Road Extension, Kitchener, Ontario. Jillian led the completion of an Environmental Impact Study considering the preferred design of the Blockline Road extension and its effects to the natural environment. She ensured that existing aquatic and terrestrial conditions within the study area were collected in a comprehensive manner and that design measures integrated aspects of the natural system.

Maltby Road Improvements, City of Guelph, Ontario. Co-ordinated natural heritage work for the improvement of Maltby Road in the City of Guelph, Ontario. Natural heritage work comprised of wetland delineation surveys, providing input to wildlife crossings for Jefferson Salamander (a species considered Endangered under the Endangered Species Act) and tree surveys. Considering the occurrence of Jefferson Salamander, there was a high degree of agency consultation to ensure the project mitigated all potential negative effects towards the species.

Region of Waterloo, Rapid Transit Initiative EA Environmental Impact Study. Lead the completion of an environmental impact study for the proposed light rail transit route from Conestoga Mall to Fairview Mall in Waterloo and Kitchener respectively. Baseline ecological data was collected and consisted of fish composition studies, floral species surveys, vegetation community classification, wildlife surveys and fish habitat assessments. Wetland features within proximity to the Transit alignment were delineated and an effects assessment was completed.

City of Hamilton, Culvert Replacement Master Plan Class EA, Hamilton, Ontario. Participated in a master plan Class EA for four culverts and two bridges including Valens Road-Spencer Creek, Mud Street - Three Mile Creek, Guyatt Road - Twenty Mile Creek, Studimon Road - Fairchild Creek, and Alberton Road - Big Creek. Assisted in a study of consolidation of culverts, sizing and impacts to aquatic resources. Participated in biomass surveys involving back pack electrofishing.

Highway 401 Road Widening between Credit River and 403/410 Interchange, Ministry of Transportation, Ontario. Co-ordinated and conducted terrestrial assessments for the widening of Highway 401. Fieldwork included botanical surveys, vegetation community delineation, wetland assessment, bird surveys and amphibian habitat assessments. Determined overall constraints and provided recommendations for mitigation. Currently negotiating approvals with MNRF due to the presence of Jefferson Salamander and Redside Dace.

GO Transit Wetland Creation, Eastern Rail Maintenance Facility, Whitby, Ontario. Provided technical review for a wetland creation project for GO Transit in Whitby, Ontario. Reviewed wetland bathymetric profile, recommended plantings and implementation sequence.

Bracebridge Transportation EA. Jillian led and co-ordinated the collection of baseline data along alternative routes for a new inner-city highway system for the Town of Bracebridge. Fieldwork comprised of woodland and wetland assessment, vegetation community delineation, refinement of deer wintering yards through fieldwork and consultation with MNRF and fish habitat assessment.

Windsor Essex Parkway Wetlands Review, Ministry of Transportation, Windsor, Ontario. As one of AECOM's wetlands specialists, Jillian is responsible for reviewing wetlands related documentation for the Windsor Essex Parkway extension on behalf of the Ministry of Transportation. This includes documents pertaining to wetlands delineation, evaluation and compensation.

CP Rail, Spring Investigations for a Full Environmental Impact Study, Woodstock, Ontario.

Completed a spring inventory of existing vegetation within communities along a proposed alignment of a new rail spur. Undertook detailed vegetation surveys within each delineated ELC unit.

Rehabilitation of Muskoka Road 169 Underpass (42-139), Hawk Rock Creek Culvert (42-203/C) and two Kabshe River Culverts (42-105/C, 42-197/C) in Huntsville Area, Ministry of Transportation, Ontario. Provided senior review for the completion of the Terrestrial Ecosystems Existing Conditions and Impact Assessment Report. Tasks included guidance and oversight of fieldwork, review of the report and determination of appropriate mitigation measures with respect to Species at Risk.

Ottawa 174/ Prescott-Russell County Road 17 Environmental Assessment Natural Environment Report. Jillian led the completion of the natural environment report which documented existing aquatic, terrestrial and wildlife conditions along alternative routes. Fieldwork encompassed aquatic habitat assessments, vegetation community delineation, identification of wetland areas, turtle basking surveys and auditory amphibian surveys. Effects to aquatic habitat, wetland, woodland, Species at Risk habitat, Significant Wildlife Habitat and natural corridors were determined for each alternative.

Private Client, Russ Road Extension Class Environmental Assessment, Grimsby, Ontario.

Collected terrestrial habitat information along a proposed road extension extending to two private residences. Environmental issues included the occurrence of a protected wetland to the south of the proposed road extension. Detailed terrestrial information was collected for areas within 30 metres of either side of the road extension documenting hedgerows, residential trees and potential occurrence of species at risk.

County of Peterborough/ City of Peterborough, Parkhill Road and Sherbrooke Street Road Widening Class EA, Peterborough, Ontario. Completed a terrestrial inventory of street trees, woodlands and hedgerows along Parkhill Road and Sherbrooke Street. Provided recommendations for the protection of street trees. No significant woodlands/wetlands occurred within the immediate study area of both road widening EAs.

Tree Preservation Plans and Inventories

City of Kitchener, Rothsay Park Enhancements, Kitchener, Ontario. Lead the completion of a tree inventory and assessment for the siting of a trail and wetland enhancements.

Region of Waterloo Rapid Transit System Tree Inventory and Assessment. Jillian lead the completion of a full tree inventory for the entire LRT alignment. Trees were surveyed, tagged, identified to species assessed for health conditions. This informed the team with respect to effects to adjacent private trees, removal efforts for trees within the ROW as well as replacement recommendations.

NextEra Energy Canada, Bluewater and Goshen Wind Energy Centre, Haldimand County, Ontario. Completed detailed tree inventories in road right-of-ways and on private property. Prepared report summarizing and analyzing the results of the tree inventory to be used for a replanting plan.

City of London, Kiwanis Park Pedestrian Path, Ontario. Conducted a tree inventory to inform the project team location of a new pedestrian path. Documented tree species, health and location.

Sifton Properties, Riverbend Heights Phase 1, London. Prepared a tree preservation plan according to the City of London's Tree Preservation Guidelines for a Plan of Subdivision adjacent to Warbler Woods. Trees were geo-referenced, identified to species with health assessed.

City of Guelph, Maltby Road Reconstruction, Ontario. Conducted a tree inventory for the reconstruction of Maltby Road. Documented tree species, health, location and recommendation for removal/replacement.

Sifton Properties, Hopedale Tree Preservation Plan, London, Ontario. Prepared a tree preservation plan according to City of London's Tree Preservation Guidelines for a Plan of Subdivision adjacent to significant woodland patch no. 07041. Ninety-three trees within and adjacent to the development envelope were surveyed, identified, assessed and measured to provide rationale for preservation recommendations.

Z Group, Glasgow Tree Preservation Plan, Kitchener, Ontario. Prepared a tree preservation plan according to City of Kitchener's Tree Preservation Guidelines for a Plan of Subdivision along Glasgow Street. A total of three hundred trees were flagged, surveyed, identified, measured and assessed in terms of their health.

Future Streets, Future Streets Tree Preservation Plan, London, Ontario. Prepared a tree preservation plan according to City of London's Tree Preservation Guidelines for a Plan of Subdivision adjacent to natural features. A total of forty trees were assessed.

Peer Reviews

Métis Nation of Ontario, Peer Review of "Hydro One's Draft Environmental Assessment Report of a Transmission Reinforcement Project from Bruce to Milton", Ontario. Reviewed the terrestrial component of the Draft Environmental Assessment Report for a Transmission Reinforcement Project from Bruce to Milton. The review focused on how the MNO's harvesting rights and species of concern would be affected by the proposed transmission reinforcement.

Kettle Creek Conservation Authority, Peer Review of "Dalewood Meadows Environmental Impact Study", St. Thomas, Ontario. Lead the completion of a peer review of an Environmental Impact Study completed for lands adjacent to a significant valleyland and Kettle Creek Woods Provincially Significant Wetland owned by Kettle Creek Conservation Authority. Peer review methods were based on Environmental Impact Study guidelines developed by the KCCA, City of St. Thomas and the Provincial Policy Statement. To keep an unbiased opinion, reconnaissance terrestrial and aquatic investigations were completed prior to reviewing the EIS document. Proponents from the City, conservation authority, Ministry of Natural Resources, developer and the consultant who prepared the original EIS were also contacted.

Region of Peel, Peer Review of YDSS Interceptor Sewer (19th Avenue-Leslie Street) Design, Peel, Ontario. Reviewed the terrestrial component of natural environment reports/maps for the design of a sewer alignment along 19th Avenue and Leslie Street. The intent of this review was to ensure that mitigation recommendations were carried forward to the final design.

City of Woodstock, Peer Review of “Sally Creek Development Environmental Impact Study”, Woodstock, Ontario. Lead the completion of a peer review of an Environmental Impact Study completed for lands adjacent to a provincially significant wetland owned by Upper Thames River Conservation Authority. Peer review methods were based on Environmental Impact Study guidelines developed by UTRCA, the City of Woodstock and the Provincial Policy Statement. To keep an unbiased opinion, reconnaissance terrestrial and aquatic investigations were completed prior to reviewing the EIS document. Proponents from the City, conservation authority, Ministry of Natural Resources, developer and the consultant who prepared the original EIS were also contacted.

Z Group, Peer Review of “Parker Jackson Lands Environmental Impact Study”, London, Ontario. Lead the completion of a peer review of an Environmental Impact Study completed for lands containing a woodland and headwaters of Dingman Creek. Peer review methods were based on Environmental Impact Study guidelines developed by Upper Thames River Conservation Authority, City of London and the Provincial Policy Statement. Prior to reviewing the document, reconnaissance terrestrial and aquatic investigations were completed prior to reviewing the EIS document.

Publications

Digital analysis of lichen abundance testing EMAN’s Lichen Monitoring Protocol Leading Edge: The Working Biosphere, 2004.

Jessica Piette

Terrestrial Ecologist

Education

H. B.ES., Environmental Studies, University of Waterloo

Dipl. Environmental Assessment, University of Waterloo

Years of Experience

With AECOM: 10

Training and Certifications

Bat Conservation Management – Acoustic Software Training Workshop, 2014

Ministry of Natural Resources – Ontario Bird and Bat Mortality Monitoring Workshop for Wind Power Projects, 2014

Amphibian and Reptile Survey Techniques, Nature Conservancy Canada/Ministry of Natural Resources, 2014

University of Guelph Arboretum – Butterflies Identification Course, 2012

University of Guelph Arboretum – Dragonflies and Damselflies Identification Course, 2012

Royal Botanical Gardens – Goldenrods and Asters Identification Course, 2011

Ontario Wetland Evaluation Training Course, Ministry of Natural Resources, 2008

Ecological Land Classification for Southern Ontario Training Course, Ministry of Natural Resources, 2007

First Aid Certification, St. John's Ambulance, 2007

Summary

Ms. Piette is a terrestrial ecologist with AECOM's Ecological Services Group working in Kitchener, Ontario. She received her Honors Bachelor of Environmental Studies – Environment & Resource Studies from the University of Waterloo and has completed a Diploma in Environmental Impact Assessment. Her technical skills include vegetation inventories, woodland evaluations, vegetation community descriptions, wetland boundary delineation and evaluations, soils identification, air-photo interpretation, Species at Risk Screenings, amphibian and reptile surveys, Butterfly, Dragonfly & Damselfly surveys, and bat and bat habitat surveys.

She is trained and experienced in the application of Ecological Land Classification (ELC) of Southern Ontario, and the Ministry of Natural Resources and Forestry Wetland Evaluation guidelines. Ms. Piette has attended several other training courses to enhance her technical skills such as: the Ontario Bird and Bat Mortality Monitoring Workshop held by the MNR and attended the Acoustic Software Training Workshop held by Bat Conservation Management and attended the reptile and amphibian workshop held

by the MNRF, Ontario Nature and the Nature Conservancy of Canada. Together, these skills facilitate in the preparation and data collection to complete environmental impact studies, constraints and opportunity reports, subject land status reports, tree preservation reports, environmental assessment evaluations, renewable energy projects, and natural heritage studies.

Ms. Piette also has 10 years of experience in Habitat restoration projects which relate to the creation of restoration and compensation plans. These plans include, but are not limited to the creation of additional wildlife habitat through the installation of bird and bird boxes; sentinel rocks/perch posts, brush piles, vernal pools and shrub thicket. Additionally these plans provide recommendations for woodland enhancement, edge management and woodland creation. Additionally she has experience in habitat restoration for Species at Risk species including bats, Barn Swallow and Bobolink.

Experience

Habitat Restoration

City of London, Kiwanis Pedestrian Path Environmental Impact Study, London, Ontario.

Completed a restoration plan for lands associated with a new pedestrian trail. Restoration included the creation of new prairie habitat, oak savannah habitat as well as woodland edge enhancement.

Region of Waterloo, Waterloo Stage 1 Light Rail Transit Project, Waterloo, Ontario: Completed a restoration and compensation plan for the lands associated with the Maintenance Facility. The plan included recommendations for the creation of additional wildlife habitat through the installation of bird and bird boxes; sentinel rocks/perch posts, brush piles, vernal pools and shrub thicket. Additionally, the plan, provided recommendations for woodland enhancement, edge management and woodland creation.

City of London, Old Victoria Stormwater Management Facility No. 1: Assisted in the selection of plant species to be planted within the proposed buffer and restoration and compensation areas. As well as, selected plant material to be planted within and adjacent to the stormwater management facility.

ORE Development, Highbury Business Park Wetland Creation, London, Ontario: Aided with the vegetation inventory and monitoring of the area.

Wetland Monitoring

City of London, Uplands North Storm Water Management – Wetland Monitoring Program – Baseline Data, London, Ontario: Completed baseline data collection for a 3 year monitoring program within a wetland located adjacent to a storm water management pond. This included the selection and establishment of 5 permanent monitoring quadrats within the study area as well as a tree health assessment for existing trees within the wetland. Conducted amphibian surveys following the Marsh Monitoring Protocol for inclusion into the baseline report. Following data collection completed Baseline Wetland Monitoring Report.

City of London, Forest City Wetland Forest City Stormwater Management Facility Westminster Wetland Complex Assessment of Reported Die-back: Conducted wetland assessment of Westminster Wetland complex including boundary delineation and a detailed floral species list for insertion into the final document.

City of London, Uplands North Storm Water Management – Wetland Monitoring Program – Year 1 Monitoring, London, Ontario: Completed Year 1 data collection for a 3 year monitoring program within a wetland located adjacent to a storm water management pond. This included vegetation monitoring within the 5 permanent monitoring quadrats within the study area as well as a tree health assessment for existing trees within the wetland.

Environmental Impact Studies (EIS)

City of London, Old Victoria Stormwater Management Facility No. 1 – Functional Design EIS: Completed terrestrial field investigations, including aerial photography interpretation, the delineation of vegetation into ELC units, the collection of a comprehensive floral species list and the delineation of on-site wetland communities following the Ministry of Natural Resources Wetland Evaluation Protocol for insertion into the final EIS. Completed a Species at Risk (SAR) as well as Significant Wildlife Habitat Screenings to identify any potential SAR and SWH and their associated habitat located within the study area.

City of Kitchener, Blockline Road Extension, Kitchener, Ontario: Conducted terrestrial field investigations, including aerial photography interpretation, the application of ELC, the collection of a comprehensive floral species list and the delineation of on-site wetland communities following the Ministry of Natural Resources Wetland Evaluation Protocol for insertion into the final Environmental Impact Study document.

Regional Municipality of Waterloo, Rapid Transit Initiative, Transit Project Assessment Process, EIS: Carried out terrestrial field investigations, including aerial photography interpretation, the application of ELC and the collection of a comprehensive floral species list along the proposed Light Rail Transit (LRT) Route. This was completed in order to assess the significance of the existing natural heritage features, to present potential development constraints, as well as, provide direction for specific design considerations of the LRT.

City of London, Old Victoria Stormwater Management Facility No. 1: Functional Design Environmental Impact Study. Completed terrestrial field investigations, including aerial photography interpretation, the delineation of vegetation into ELC units, the collection of a comprehensive floral species list and the delineation of on-site wetland communities following the Ministry of Natural Resources Wetland Evaluation Protocol for insertion into the final EIS. Completed a Species at Risk (SAR) as well as Significant Wildlife Habitat Screenings to identify any potential SAR and SWH and their associated habitat located within the study area.

City of London, Pedestrian Pathway Connection Across CNR Lands in Kiwanis Park: Environmental Impact Study. Completed terrestrial field investigations, including aerial photography interpretation, the delineation of vegetation into ELC units, the collection of a comprehensive floral species list for insertion into the final EIS. Completed a Species at Risk (SAR) as well as Significant Wildlife Habitat Screenings to identify any potential SAR and SWH and their associated habitat located within the study area.

Orfus Realty, King Township Property – Natural Heritage Constraints & Opportunities Report, King Township, Region of York: Completed terrestrial field investigations including aerial photography interpretation, the delineation of vegetation into ELC units, the collection of a comprehensive floral

species list and the delineation of on-site wetland communities following the Ministry of Natural Resources Wetland Evaluation Protocol for insertion into the final Natural Heritage C&O document.

Bat and Bat Habitat Assessments

Ministry of Transportation, Highway 401 Road Widening between Credit River and 403/410

Interchange, Ontario: Bat and Bat Habitat Surveys were completed by conducting snag density calculations following the Ministry of Natural Resources Bat and Bat Habitat Survey of Treed Habitats Protocols. Completed a Habitat Management Plan relating to Species at Risk bats. This included the completion of Bat Acoustic monitoring and data analysis using Sonobat software, as well as the recommendation for habitat compensation.

City of London, Old Victoria No. 1 Stormwater Management Facility, London, Ontario (January 2014 to December 2015):

Completed Bat and Bat Habitat Surveys by conducting snag density calculations following the Ministry of Natural Resources Bat and Bat Habitat Survey of Treed Habitats Protocols. This consisted of selecting random plots across all represented ELC communities and surveying a minimum of ten, 12.6m plots to determine snag density. Additionally completed a bat and bat habitat impact analysis to determine the level of impacts to the onsite of bat habitat.

City of Kitchener, Detailed Design and Construction Monitoring for Kitchener WWTP, Kitchener, Ontario: Completed snag density calculations to determine the quality of bat habitat. Additionally, completed Bat Acoustic monitoring and data analysis using Sonobat software.

City of Kitchener, Detailed Design and Construction Monitoring for Kitchener WWTP, Kitchener, Ontario: Completed Bat and Bat Habitat Surveys by conducting snag density calculations following the Ministry of Natural Resources Bat and Bat Habitat Survey of Treed Habitats Protocols. This consisted of selecting random plots across all represented ELC communities and surveying a minimum of ten, 12.6m plots to determine snag density. This was completed in support of the construction of a proposed outfall along the Grand River, which will require vegetation removal within potential bat habitat.

Region of Waterloo, Waterloo Stage 1 Light Rail Transit Project, Waterloo, Ontario: Conducted a rapid cavity tree assessment, in consultation with the Ministry of Natural Resources for the Operation Maintenance Facility. Conducted night exit surveys to determine presence/absence of bats within the study area.

NextEra Energy Canada, Bluewater Wind Energy Centres and Transmission Line Renewable Energy Project, Grand Bend, Ontario: Conducted research into bat ecology, biology and monitoring for the completion of the Newly Listed Species Mitigation Plan for Little Brown and Northern Myotis.

NextEra Energy Canada, Goshen Wind Energy Centres and Transmission Line Renewable Energy Project, Grand Bend, Ontario: Conducted research into bat ecology, biology and monitoring for the completion of the Newly Listed Species Mitigation Plan for the Little Brown and Northern Myotis to be submitted to MNR for review and approval.

City of London, Kiwanis Park Pedestrian Pathway Connection, London, Ontario: Bat and Bat Habitat Surveys were completed by conducting snag density calculations following the Ministry of Natural Resources Bat and Bat Habitat Survey of Treed Habitats Protocols. This consisted of selecting random

plots across all represented ELC communities and surveying a minimum of ten, 12.6m plots to determine snag density.

Class Environmental Assessments

Ottawa LRT EA, Ottawa, ON. Conducted terrestrial field investigations to aid in the assessment of potential effects of road widening and bridge replacements for the LRT project in Ottawa. Investigations completed included aerial photography interpretation, the application of ELC, and the collection of a comprehensive floral species list along the proposed Routes. Completed a Species at Risk Screening based on existing habitat characteristics as determined through field investigations as well as a high level application of potential Significant Wildlife Habitat.

United Counties of Prescott and Russell in partnership with the City of Ottawa, Natural Environment Report, Ottawa Road 174 / Prescott-Russell County Road 17 Environmental Assessment: Completed terrestrial field investigations, including aerial photography interpretation, the application of ELC, and the collection of a comprehensive floral species list along the proposed Light Rail Transit (LRT) Routes. Completed a Species at Risk Screening based on existing habitat characteristics as determined through field investigations as well as a high level application of potential Significant Wildlife Habitat. This was completed in order to assess the significance of the existing natural heritage features, to present potential development constraints, as well as, provide direction for specific design considerations of the LRT.

Michael Godard, B. Sc. Hon.

Fisheries Biologist

Education

Aquaculture Technology Diploma, (Letter of Academic Achievement), Sir Sandford Fleming College, Lindsay, ON 1999-2001

Environmental Science (Honours), Open University, England, 2008 - 2011

Years of Experience

With AECOM: 3

With Other Firms: 11

Training and Certifications

DFO SAR Mussel Identification

ROM Fish identification

MTO RAQ's Certification

Canadian Pleasure Craft Operator

WHMIS Training

Fall Arrest Training

Electrofishing Certification Level 2 Backpack Crew Leader

Standard First Aid with CPR Level A

Summary

Mr. Godard is an intermediate fisheries biologist with over 14 years of experience in the fisheries field in both the private and public sector. Michael is part of the Environmental Division and is based out of the Kitchener Office. He has worked on a diverse range of projects including environmental assessments, environmental baseline studies, environmental monitoring projects, Renewable Energy projects, transportation projects, environmental impact studies, construction monitoring projects, and Species at Risk screenings and surveys. Michael has co-ordinated and implemented a variety of ecological and water resource monitoring activities for various projects and also has experience collecting benthic invertebrates, fish sampling and conducting detailed fish habitat information. He has experience in the collection and analysis of water quality data, stream assessments, various lake sampling techniques, installation of a variety of surface water field equipment, and report writing. Michael has published research papers on a multitude of factors affecting fisheries such as hybridization with non-natives, predicting changes to fish populations based on climate change scenarios, density dependent growth and diel patterns of diet and habitat usage.

Michael has much practical experience in fisheries management and in the techniques used to assess and monitor habitat and fish populations, including studies using acoustic telemetry to determine habitat utilization of the European Eel (*Anguilla anguilla*) as well as PIT (Passive Integrated Transponder) studies on eels to determine microhabitat preferences for this species. He is also experienced in the micro-tagging of Atlantic Salmon (*Salmo salar*) and Sea Trout (*Salmo trutta*) for long term studies on the migratory behaviour of these species.

Project Experience

MTO Projects

Highway 17 Bonfield Easterly, Ministry of Transportation: Conducted fisheries inventories and aquatic habitat assessments on 5+ watercrossings within the Hwy 17 project limits including: Electrofishing (backpack); Trap netting, fyke netting, seine netting, minnow traps

MTO - Highway 17 Widening, North Bay, ON: Completed aquatic habitat investigations and assessment of alternative routes for widening of Highway 17. Detailed background review and fish habitat mapping was conducted.

Highway 427 Expansion + Extension Owner's Engineer Assignment: Conducted fisheries inventories and aquatic habitat assessments on watercrossings within the Hwy 427 project limits including: Electrofishing (backpack); Seine netting, minnow traps;

MTO - Leamington Breakwater, Leamington, ON, Environmental Assessment: Field data collection and reporting for fisheries assessment of the Leamington Breakwater to assess options for reconstruction or removal. Fisheries assessment consisted of diver-assisted video documentation and sediment sampling with dredge-type sampler.

MTO - Queen Elizabeth Way/Dixie Road Improvements: Field data collection and reporting for fisheries assessment of the QEW Bridge over Etobicoke Creek for reconstruction or removal.

Fisheries Act Approvals

Kitchener Wastewater Treatment Plant Upgrades: Prepared and submitted a *Fisheries Act* "request for review for the installation of a water treatment plant outfall in the Grand River. A Letter of Advice (LOA) was received for the outfall reconstruction.

Waterloo LRT, Waterloo, ON. Prepared and submitted *Fisheries Act* "requests for reviews for Cedar and Laurel Creek crossings in Waterloo.

NextEra Wind Energy. Jericho and Goshen. Prepared and submitted *Fisheries Act* "requests for reviews" for 50+ culvert installations throughout the study areas.

Middle Abutment Stabilization Works at Bridge CP#8304, French River, ON. Completed fish habitat assessments on areas surrounding a bridge abutment within the French River to assess risk to fish and fish habitat to submit "Request for Review" for the proposed works to the DFO.

Species at Risk Permitting

Schedule B Class EA / Detailed Design study for the Kitchener WWTP Phase 3 Upgrades, Ontario.

Michael successfully negotiated approvals with the Ministry of Natural Resources and Forestry for the construction of a new wastewater outfall within the Grand River. Approvals were required due to the presence of Black Redhorse, Wavy-rayed Lampmussel and Silver Shiner. Michael co-ordinated required documentation between the agencies, and project engineers. He also coordinated the mussel and fish relocation teams to ensure compliance with the Overall Benefit Permit.

Fisheries and Fish Habitat Assessments

Tributary “C” Wetland Evaluation, City of London, Ontario. As part of an overall Environmental Assessment and Environmental Impact Study, Michael conducted fisheries habitat assessments as well as Brook Trout spawning surveys within Tributary “C” in the City of London, Ontario.

Ottawa LRT EIS, Ottawa, ON. Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacements and road widening for the LRT project in Ottawa. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol. This also included the screening of SAR habitat within the study area.

Waterloo LRT EIS, Waterloo, ON. Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacements and road widening for the LRT project in Kitchener and Waterloo. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol. This also included the screening of SAR habitat within the study area.

Williams Parkway Road Widening, Brampton, ON. Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge replacements and road widening along Williams Parkway between McLaughlin Road to North Park Drive. Detailed background review and fish habitat mapping was conducted using a standardized AECOM assessment protocol.

Ottawa Road 174-CR 17 Class EA Study from Highway 417 to Landry Road, City of Ottawa, ON. Completed aquatic habitat investigations and assessment of alternatives for the proposed alternate Highway 417 routes along the entire study area for existing aquatic habitat conditions. This also included the screening of SAR habitat within the study area.

Parkway Corridor Class EA, City of Peterborough, ON. Completed aquatic habitat investigations and assessment of alternatives for Parkway Corridor including aquatic habitat mapping and fish community surveys.

Middle Abutment Stabilization Works at Bridge CP#8304, French River, ON. Completed fish habitat assessments on areas surrounding a bridge abutment within the French River to assess risk to fish and fish habitat.

Indian Creek, Milton, ON. Completed aquatic habitat investigations including aquatic habitat mapping and fish community surveys

Victoria Street Widening, Whitby, ON. Aquatic investigations were undertaken to aid in the assessment of potential effects of bridge and culvert replacements and road widening along Victoria

Street between Halls Road and Seaboard Gate in Whitby, ON. Detailed background review, fish habitat mapping and Species at Risk investigations were conducted.

GO Transit East Rail Maintenance Facility, Whitby ON. Completed aquatic habitat investigations including aquatic habitat mapping and fish community surveys.

Mineola Gardens, Mississauga, ON. Completed aquatic habitat investigations including aquatic habitat mapping relating to alleviating existing erosion issues in a reach of Cooksville Creek.

Environmental and Construction Monitoring

Sideroad 27, Halton Hills, ON. Coordinating and implementing the long-term monitoring program which monitored the impacts from a bridge widening over a coldwater Brook Trout stream. Daily, and then weekly construction monitoring and water quality sampling. Also responsible for data collection and organization and preparing reports for the client.

Mining and Minerals

Probe Mines Limited. Borden Lake, ON. Environmental baseline studies (hydrology, hydrogeology, ecology, water quality). Completed an adult fish survey and detailed habitat mapping (shoreline and transects) in support of a proposed open pit gold mine in northern Ontario.

Peer Reviewed Publications

Tarkan, A.S., Copp, G.H., Zięba, G., **Godard**, M.J. & Cucherousset, J. 2009. Growth and reproduction of threatened native crucian carp *Carassius carassius* in small ponds of Epping Forest, southeast England. *Aquatic Conservation: Marine & Freshwater Ecosystems* **19**, 797–805.

Copp, G.H., Vilizzi, L., Mumford, J.D., Fenwick, G.V., **Godard**, M.J. & Gozlan, R.E. 2009. Calibration of FISK, an invasive-ness screening tool for non-native freshwater fishes. *Risk Analysis* **29**, 457–467.

Britton, J.R., Cucherousset, J., Davies, G.D., **Godard**, M.J. & Copp, G.H. 2010. Non-native fishes and climate change: predicting species responses to warming temperatures in a temperate region. *Freshwater Biology* **55**, 1130–1141.

Tarkan, A.S., Cucherousset, J., Zięba, G., **Godard**, M.J. & Copp, G.H. 2010. Growth and reproduction of introduced goldfish *Carassius auratus* in small ponds of southeast England with and without native crucian carp *Carassius carassius*. *Journal of Applied Ichthyology* **26** (Supplement 2), 102–108.

Copp, G.H., Tarkan, A.S., **Godard**, M.J., Edmonds, N.J. & Wesley, K.J. 2010. A preliminary assessment of feral goldfish impacts on ponds, with particular reference to native crucian carp. *Aquatic Invasions* **5**, 413–422.

Tarkan, A.S., Gaygusuz, O., **Godard**, M.J. & Copp, G.H. 2011. Density-dependent basis of long-term growth patterns in a pond-dwelling population of crucian carp *Carassius carassius*. *Fisheries Management & Ecology* **18**, 375–383.

Masson, L., Almeida, D., Tarkan, A.S., Önsoy, B. Miranda, R., **Godard**, M.J. & Copp, G.H. 2011. Diagnostic features and biometry of head bones for identifying *Carassius* species in faecal and archaeological remains. *Journal of Applied Ichthyology* **27**, 1286–1290.

Sayer, C.D., Copp, G.H., Emson, D., Zięba, G., **Godard**, M.J. & Wesley, K.J. 2011. Towards the conservation of crucian carp *Carassius carassius*: understanding the extent and causes of decline within part of its native English range. *Journal of Fish Biology* **79**, 1608–1624.

Fobert, E., Zięba, G., Vilizzi, L., **Godard**, M.J., Fox, M.G., Stakėnas, S. & Copp, G.H. 2013. Predicting non-native fish dispersal under conditions of climate change: case study in England of dispersal and establishment of pumpkinseed *Lepomis gibbosus* in a floodplain pond. *Ecology of Freshwater Fish* **22**, 106–116.

Godard, M.J., Almeida, D., Zięba, G. & Copp, G.H. 2013. Diel patterns of diet and habitat use of a feral, non-native, pond-dwelling population of fathead minnow *Pimephales promelas* in England. *Hydrobiologia* **701**, 149–158.

Walker, A.M, **Godard**, M.J. & Davison, P. 2014. The home range and behaviour of yellow-stage European eel *Anguilla anguilla* in an estuarine environment. *Aquatic Conservation: Marine and Freshwater Ecosystems*

Rees, E.M.A., Britton, J.R., **Godard**, M.J., Miller, J.I., Wesley, K.J. & Copp, G.H. 2014. Efficacy of tagging European catfish *Silurus glanis*. *Journal of Applied Ichthyology* **30**, 127–129.

Zięba, G., Stakėnas, S., **Godard**, M.J., Ives, M., Seymour, J., Carter, M.G. & Copp, G.H. 2014. Long-term decline of barbel *Barbus barbus* in a highly urbanised river of southeastern England, with particular reference to the survival and movements of tagged fish during a water pollution incident. *Fundamental & Applied Limnology* **185**, 43–53.

Tarkan, A.S., Almeida, D., **Godard**, M.J., Gaygusuz, Ö., Rylands, M.S., Sayer, C.D., Zięba, G. & Copp, G.H. 2016. A review and meta-analysis of growth and life-history traits of a declining European freshwater fish, crucian carp *Carassius carassius*. *Aquatic Conservation: Marine & Freshwater Ecosystems* **26**, 212–224.

Copp, G.H., **Godard**, M.J., Russell, I.C., Peeler, E.J., Gherardi, F., Tricarico, E., Moissac, L. Goulletquer, P., Almeida, D., Britton, J.R., Vilizzi, L., Mumford, J.D., Williams, C., Reading, A., Rees, E.M.A. & Merino, R. 2016. A preliminary evaluation of the European Non-native Species in Aquaculture Risk Assessment Scheme applied to species listed on Annex IV of the EU Alien Species Regulation. *Fisheries Management & Ecology* **23**, 12–20.

Jackson, M.C., Britton, J.R., Cucherousset, J., Guo, Z., Stakėnas, S., Gozlan, R.E., **Godard**, M.J., Roussel, J.M. & Copp, G.H. 2016. Do non-native pumpkinseed *Lepomis gibbosus* affect the growth, diet and trophic niche breadth of native brown trout *Salmo trutta*? *Hydrobiologia* **772**, 63–75.

Copp, G.H., Tarkan, A.S., Masson, G., **Godard**, M.J., Koščo, J., Novomeská, A., Miranda, R., Cucherousset, J., Pedicillo, G. & Blackwell, B. 2016. A review of growth and life-history traits of native and non-native European populations of black bullhead *Ameiurus melas*. *Reviews in Fish Biology & Fisheries* **26**, 441–469.

Online Publications

Godard, M.J. & Copp, G.H. 2010. CABI- Invasive species compendium - *Lepomis gibbosus* datasheet: <http://www.cabi.org/isc/?compid=5&dsid=77080&loadmodule=datasheet&page=481&site=144>

Godard, M.J. & Copp, G.H. 2011. CABI- Invasive species compendium - *Salvelinus fontinalis* datasheet:
<http://www.cabi.org/isc/?compid=5&dsid=65325&loadmodule=datasheet&page=481&site=144>

Godard, M.J. & Copp, G.H. 2012. CABI- Invasive species compendium – *Aspius aspius* datasheet:
<http://www.cabi.org/isc/?compid=5&dsid=92623&loadmodule=datasheet&page=481&site=144>

Godard, M.J. & Copp, G.H. 2012. CABI- Invasive species compendium – *Sander lucioperca* datasheet:
<http://www.cabi.org/isc/?compid=5&dsid=65338&loadmodule=datasheet&page=481&site=144>

Godard, M.J. & Copp, G.H. 2012. CABI- Invasive species compendium – *Carassius carassius* datasheet: submitted, and awaiting online publication.

Rayna Carmichael, H.BA

GIS Manager, Water & Natural Resources

Education

Bachelor of Arts in Geography, Minor in Environmental GIS University of Guelph, 2006

Advanced Diploma in Digital Geography and GIS, Ryerson University, 2012

Years of Experience

With AECOM: 10

With Other Firms: 2

Training and Certifications

ESRI Certificates: Building Geodatabases

Publications

Rayna Carmichael, Wolter, W., Using Geographic Information Systems (GIS) to Identify Utilities Vulnerable to Erosion from Natural Watercourses, AWRA, Mar/Apr 2010.

Summary

Ms. Carmichael is the GIS Manager for AECOM's Water and Natural Environment department. She has + ten years of experience with ArcGIS, MapInfo, Idrisi (Raster), AutoCAD, and database management systems providing support for wind infrastructure, floodplain analysis and mapping, subwatershed planning, stormwater management, and water/wastewater infrastructure-related project. Ms. Carmichael's background in Environmental Geography also provides her with a solid proficiency in land use analysis mapping and environmental classification systems, policies and analysis.

Relevant Experience

Environmental

Henvey Inlet Wind Energy Centre (HIWEC), Henvey Inlet, Ontario. HIWEC is a 300 MW wind energy center situated solely on Henvey Inlet First Nation's Reserve. GIS data collection on First Nation reserves is not part of MNRF's work plan; as such a large data collection program was developed between 2011 and 2015. Baseline analysis was conducted by AECOM in accordance with EA documentation to design and assess the HIWEC to avoid, minimize, or mitigate adverse effects on the environment. A full scale GIS analysis of all field data was conducted to support the EA guidelines.

North Kent Wind, REA, Chatham, Ontario. SP Ontario is constructing a 100 MW wind project within the Municipality of Chatham-Kent. The role as GIS lead dealt with layout creation and placement analysis of turbines, construction disturbance areas, and the development of all linear infrastructure.

Belle River Wind Energy Centre REA Permitting, Lakeshore, Ontario. SP Ontario is constructing a 180 MW wind project within the Lakeshore Township. The role as GIS lead dealt with layout creation and placement analysis of turbines, construction disturbance areas, and all linear infrastructure. Setbacks and allowances were incorporated through communication with the client.

Nextera Wind Energy, Ontario. Using GIS to find most suitable location for the placement of wind turbines and their interconnecting routes, while adhering to the rules and regulations of approval agencies. All terrestrial and aquatic features were mapped analysed and evaluated based on field reconnaissance.

Ontario Solar CIA, Ontario. Assessed the validity of specific parcels for the development of solar energy. Implemented constraints analysis to verify their environmental social and economic impact on the landscape.

Ottawa Road 174/17 Environmental Assessment, Ottawa, Ontario. Developed master database to house multiple sources of GIS information. Completed environmental spatial analysis on three route alternatives to help analyses the preferred route. Delivered mapping for public meetings, and analysis based on environmental and water quality data.

Kanata South (Hope Side Road) Environmental Assessment Study, Ottawa, Ontario. Managed multiple data sources and clients effectively, to build a database of support information. Maps and analysis provided to aid road reconstruction.

Probe Gold Mine, Borden Lake, Ontario. Helped coordinate multiple filed programs, preparing survey equipment and managed all collected and designed GIS / GPS data. Permit to take water applications and supporting map documents were also developed.

Labrador Iron Mines, 2011 Baseline Work, Labrador. Conducted a detailed land classification assessment via aerial photography with the aid of multivariate GIS analysis to establish existing terrestrial conditions. Visited the sites to assess accuracy of GIS analysis. Prepared base mapping for environmental, avifauna, and aquatic programs. Managed GIS databases for Ontario & Quebec offices.

City of Windsor, Windsor Essex Parkway, Windsor, Ontario. Evaluated parcel fabric to determine the distribution of species at risk within the study area. This process identified which parcels should be left alone due to species sensitivity.

Billiken, Thierry Mine, Pickle Lake, Northern Ontario. Identified through air photo interpretation proper water quality sampling locations for field reconnaissance. Mapped local aboriginal communities in proximity to mining site and evaluated the land use capabilities of the abandoned mine.

Water / Water Resources

Infrastructure Updates Project Lower Sackville, Halifax, Ontario. AECOM provided GIS digitization of existing infrastructure for the community of Sackville. Updates were verified by GPS surveys, and brought into Halifax Waters schema. This project provided data warehousing, as-built digitization and attribution, survey data consolidation and map/figure production.

Hannon Creek Subwatershed Study, Hamilton, Ontario. Senior analyst in charge of all analysis, mapping and data management. Tasks include the amalgamation of all past project work into concise

GIS files for future planning and development analysis. Subwatershed development and analysis, and field/report mapping.

Offshore Energy Environmental Research Association, Strategic Environmental Assessment, Bay of Fundy. To update the technical, legislative, environmental and community knowledge base associated with potential in-stream and tidal range projects in the Bay of Fundy. Supporting the project with GIS mapping and database Using GIS analysis to offer guidance on whether, where and under what circumstances to permit tidal energy development in the Bay of Fundy (2013).

Halifax Regional Municipality, Subwatershed study, Halifax. Aiding in the development of a new watershed / subwatershed boundary, including identification of vernal ponds wetlands and intermittent streams with the use of LiDAR data. Analyzed pre and post development analysis of impervious surface effects; and pre and post development watercourse sediment loads (2012-2013).

Parks Canada, Trent Severn Waterways, Ontario. In charge of acquiring all GIS information necessary to run a full subwatershed study on the Trent River system. Digital elevation models were used to assess overland flows into and out of reservoir lakes & dams. Fish species maps were created for illustrative purposes.

Transportation

Region of Waterloo, 2014 Light Rail Transit, Waterloo, Ontario. As GIS lead for the LRT project, tasks included handling all incoming GIS data from multiple sources. Assessing relevance, proper filing and formatting of the information. Transformation of all GIS infrastructure layers into AutoCAD. Compressing and mosaic ortho imagery for CAD users. Analysis of flood line models and their interpretation into GIS interface. Mapping support and analysis for all field related sampling. Upon project close all the files created and/or modified will be returned to the client.

Rio Tinto, Simandou Rail / Mine, Conakry, Guinea. Simandou is a world-class iron ore mining project located in South Eastern Guinea. AECOM in partnership with Fluor designed a 700km trans-Guinean railway and newly develop deep water port. GIS support was provided for the rail initiative through mapping and analysis. Working collectively with multiple GIS sources to create an ArcSDE server to house and provide security for multiple data sources. Development of a web based mapping application (Geocrotex) for real time updates for internal and external client use (2011 – 2013).

DAVE JOHNSON

192 King Street, Glencoe Ontario, N0L 1M0

Phone: (226) 373-3380

Email: Dave@StraightUpEnvironmental.com

SKILLS AND ABILITIES

- Knowledge of the Environmental Protection Act
- Knowledge of the Occupational Health and Safety Act
- Knowledge of the Canadian Environmental Assessment Act
- Knowledge of the Fisheries Act
- Performed hundreds of Fish and Fish Habitat Assessments with the UTRCA
- Over a thousand hours of Electrofishing
- Gathered and Identified hundreds of Benthic Samples (family, genus and species level) specializing in the BioMap, OBBN and CABIN Protocol
- Familiar with stream remediation and restoration techniques
- Familiar with all species of fish, macroinvertebrates and species at risk in Ontario
- Able to perform manipulation of test samples using various instruments
- Excellent analytical and critical thinking skills
- Ability to write clear and concise lab reports and notes
- Proficient in Microsoft Word and Excel

EDUCATION/TRAINING

Environmental Technology Advanced Diploma (3 year program)

FANSHAW COLLEGE, London, Ontario

2010 – 2013

CERTIFICATIONS/LICENSES

Electrofishing Certification 2014-2017

Upper Thames River Conservation Authority

Ontario Benthos Bio-monitoring Network (O.B.B.N.) Certificate of Training 2012

University of Waterloo

Ichthyology Certificate of Completion 2012

Royal Ontario Museum

Certified Family Level Taxonomist for Aquatic Invertebrates 2014

The Society of Freshwater Science

Certified Genus Level Eastern EPT Taxonomist 2014

The Society of Freshwater Science

Canadian Aquatic Biomonitoring Information Network (CABIN) certified 2015

Standard First Aid CPR Level C 2016

Red Cross

DAVE JOHNSON

EMPLOYMENT HISTORY

StraightUp Environmental Consulting, London, Ontario

2011-Present

- Aquatic Biomonitoring, Benthic Sampling and Identification
- Specializing in BioMap, OBBN and CABIN Protocols
- Electrofishing, Identification and Enumeration
- Stream Assessments, Fish Habitat Studies, Drain Classifications
- Fresh Water Mussel Studies
- Report Writing and Proposals

Upper Thames River Conservation Authority, London, Ontario

2014-Present

Planning and Research dept. Volunteer Watershed Monitoring Technician

- Benthic sampling, identification and Data entry
- Fish sampling and habitat assessments

Upper Thames River Conservation Authority, London, Ontario

2011- 2013

Planning and Research dept. Aquatic Biologist Assistant Volunteer

- Performed stream assessments, water testing with Sonde, Benthic sampling and identification to family level, fish sampling and identification; worked with the Endangered Species Department to gather and incubate Spiny Soft Shell Turtle eggs; worked with the Thames River Angling Society to tag Steel Head Trout; data entry.

Elrus Aggregate Systems, Aylmer, Ontario

2007-2009

Fitter/Welder

- Layout and weld from blueprints various equipment for the rock crushing, gravel making industries

Timberland Equipment Ltd. Woodstock, Ontario

2006-2007

Certified Flux Core Welder

- Welded various frames and weldments for heavy equipment and heavy duty winches for the oil and forestry industries

Thyssen Krupp Budd Canada, Kitchener, Ontario

1999-2006

Assembly Line Welder

- Welded frames for sport utility vehicles, perform various quality checks, and form various steel parts in the press shop

North American Automation Ltd., Cambridge, Ontario

1998-1999

Welder/Fitter/ Fabricator

- Layout and weld from blueprints various frames, bases, weldments and fixtures for automated tooling systems; designed and built safety guarding out of steel mesh and tubing and/or Lexan sheets and Item; assembled conveyors and gantry's, and assisted in the installation of various robotic cells



Department of Natural History

Ichthyology

Certificate of Completion

This is to certify that

Dave Johnson

has successfully completed a three-day workshop on the
Identification of Ontario Fishes in April 2012

Mary E. Burridge

Mary Burridge

Erling Holm

Erling Holm

Certificate of Training

Having demonstrated competence with
sampling methods, this certifies

Dave Johnson

as an *Ontario Benthos Biomonitoring Network*
Participant



Chris Jones, OBBN
Coordinator



24 June 2013

Date

TAXONOMIC CERTIFICATION

This five year certification is awarded to

DAVID JOHNSON

In recognition of Image Identification to Family Level for

Aquatic Insects

SOCIETY FOR FRESHWATER SCIENCE


Dr. Murray Colbo

April, 2019
Date of expiry



Class 2 Electrofishing Training Course

Date: April 28, 2014

Dear Dave Johnson,

Congratulations on the successful completion of your Class 2 Electrofishing Training Course. As noted in OMNR Policy No. F1.3.01.01, re-certification is required every 3 years. You must also have valid and up to date CPR and Emergency First Aid certification to act as a Class 2 Crew Leader.

An apprenticeship period is not required for Class 2 Crew Leaders who have just re-certified. If this is the first time you have taken a Backpack Crew Leader Electrofishing Course, an apprenticeship period is required before you can be considered a Class 2 Crew Leader. Under the supervision of a Class 1 or Class 2 Crew Leader you must complete and log 3 days (12 hours) of electrofishing experience, with one of these days as crew leader, to be considered a qualified Class 2 Crew Leader. You are responsible for having a record of this training in a personal log, which has been signed and witnessed, and kept on file. As a Class 2 Crew Leader, you may train your own electrofishing crew, but are unable to train other personnel to the Class 2 level. Only Class 1 Certified personnel may train Class 2 Crew Leaders.

You received a grade of 99% on the exam portion of the electrofishing course. The mean mark for the exam was 96%. To ensure that you are passing on accurate and relevant information, please review your course materials before training your electrofishing crews. This letter serves as proof of training as a Class 2 Crew Leader for backpack electrofishing.

Sincerely,


John Schwindt,
Aquatic Biologist

TAXONOMIC CERTIFICATION

This five year certification is awarded to

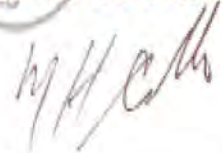
DAVE JOHNSON

In recognition of Image identification to Genus for

Eastern

Ephemeroptera, Plecoptera & Trichoptera

SOCIETY FOR FRESHWATER SCIENCE



Dr. Murray Colbo

August, 2019

Date of Expiry



ONTARIO COLLEGE ADVANCED DIPLOMA

The President and the Board of Governors
grant this award to

David Alan Johnson

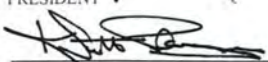
in recognition of successful completion of the
requirements of this co-operative education program

Environmental Technology

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Fanshawe College of Applied Arts and Technology dated
this day in London, Ontario, Canada



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Similar Projects

Recent Benthic Biomonitoring Projects

- **Trib-C**, Spring 2017, Aecom and the City of London. **BioMap** Benthic Water Quality study of the effects of a SWMP on Trib-C
- **Chippewa of the Thames First Nations**, September 2016 and the Spring of 2017. Benthic Water Quality Study on the Chippewa Watershed.
- **Bostwich E. A.** September 2016, Tisha Doucette, Parsons London and the City of London. **BioMap** Benthic Water Quality Study on the effect of the Bradley Ave. extension and Bostwich Rd. realignment.
- **Trib-C E. A.** July 2016, Aecom and the City of London. **BioMap** Benthic Water Quality Study. Study the effects of a SWMP on Trib C
- **Dingman S-4**, 2015, Tisha Doucette, Parsons London and the City of London. **BioMap** Benthic Water Quality Study of the effects of a SWMP on a Dingman Creek Tributary.
- **Chippewa of The Thames First Nations**, June-September 2016, Mary Alikakos, Benthic Water Quality, Fish Sampling, and Freshwater Mussel Studies
- **The DFO and Lower Thames Valley Conservation Authority**, Fish Sampling and Drain Classification, 2015, Jessica Schnaithmann LTVCA
- **Ausable Bayfield Conservation Authority, 2014, 2015 and 2016.** Benthic Identification.
- **Lower Thames River Conservation Authority, 2014.** Benthic Identification and Water Quality Report
- **Upper Thames River Conservation Authority, 2010-2017** Benthic Identification, Water Quality Assessments, Fish Population Studies and Fresh Water Mussel Studies.

Appendix C

Agency Correspondence

Ross, Matthew

From: Jennifer Dow <jennifer@kettlecreekconservation.on.ca>
Sent: Monday, November 19, 2018 4:21 PM
To: Ross, Matthew
Cc: Joe Gordon
Subject: RE: Natural Heritage data request for W12 landfill EA
Attachments: In-Water Work Timing Window Guidelines.pdf; 20181119_141513.jpg; Shore Creek Drain_Manning_95375.JPG; Shore Creek Drain_Glanworth_95373.JPG; Water Quality Site_Site#6_CL.JPG; Benthic Site_Harry White_B2.JPG; WM White Drain_Harry White_95348_95349.JPG; 2004 Middlesex-Elgin Groundwater Study_Dillon.pdf

Hello Ross,

Thank you for allowing KCCA to provide natural heritage information for the proposed W12A Landfill Expansion EA. While KCCA does not have any long term monitoring sites within the study area or 500m buffer, KCCA does have some information near the study area that might be helpful for your review. For your reference, I have attached a copy of the in-water work timing window guidelines.

Additional Study Report:

Northeast of the study area is located the Kirk-Cousins Management Area (KCMA) (located on Scotland Drive, just east of Wellington Road S.) Attached is a photo of the front cover of an October 2000 report of a three-year study completed at the KCMA on flora and fauna. This report can be made available if you think it would be useful for natural heritage review. There are several hard copies here at the main KCCA office if you would like to borrow one, or alternatively, I can make a PDF copy.

Fish Community:

As part of KCCA's environmental monitoring program, staff have been collecting fish data as part of a drain classification program for Fisheries and Oceans Canada. In 2018, one site (95375) was sampled that is located within the buffer of the study site and one site (95373) was sampled downstream of the study area. Number in brackets is the total number of that species collected during the sampling events.

Site 1: Shore Creek Drain @Manning Drive (see map—I also circled the location of the KCMA in blue)

Drain Segment ID: 95375

Sample Date: August 17, 2018

Species collected: Johnny Darter (17), Creek Chub (2), Brook Stickleback (12), Bluntnose Minnow (14)

Site 2: Shore Creek Drain @Glanworth Drive (see map)

Drain Segment ID: 95373

Sample Date: August 30, 2018

Species collected: Bluntnose Minnow (5), Creek Chub (16), White Sucker (18), Blacknose Dace (2), Johnny Darter (4), Brook Stickleback (3)

2016 Sites on W.M White Drain @Harry White Drive (see map, these sites are near the study site)

Drain Segment ID: 95348

Sample Date: October 11, 2016

Species collected: Blacknose Dace (11), Bluntnose Minnow (15), Common Shiner (25), Creek Chub (90), Johnny Darter (5), Least Darter (8), Brook Stickleback (14), White Sucker (58)

Drain Segment ID: 95349

Sample Date: October 11, 2016

Species collected: Blacknose Dace (2), Common Shiner (3), Creek Chub (9), Johnny Darter (6), Least Darter (16), Brook Stickleback (19), White Sucker (7)

Water Quality:

There is a long-term surface water quality monitoring site on Clinton Line (see attached map) which is downstream of your study site. Surface water samples are collected at this site during the ice-free months, generally March to November for a suite of parameters (general chemistry, bacteria, nutrients and metals). This site has water quality data from 2006 to present. This data can be made available if you think it would be useful for natural heritage review, however it is well outside of your study area.

Benthic Invertebrate data:

There is one long-term benthic invertebrate monitoring station located downstream of the study site on Harry White Drive just west of White Oak (Site B2), (see attached map). Benthic samples have been collected at this site every year in the fall since 2006. Data was collected using the BioMap protocol from 2006 to 2009 and OBBN from 2010 to present. This data can be made available if you think it would be useful for natural heritage review, however it is well outside of your study area.

Groundwater:

While KCCA does not have any groundwater monitoring wells located in or near the study site, there is a 2004 Dillon Consulting/Golder Associates report on Middlesex-Elgin Groundwater that might be useful (Project No. 02-0394). I have attached a copy of the report.

Should you have any questions, or require any additional information, please feel free to contact me.

Thank you,
Jennifer Dow

Water Conservation Supervisor
Kettle Creek Conservation Authority
Tel: (519) 631-1270 ext.228
Fax: (519) 631-5026
www.kettlecreekconservation.on.ca



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From: Ross, Matthew [<mailto:Matthew.Ross@aecom.com>]
Sent: October-30-18 1:40 PM
To: Joe Gordon <joe@kettlecreekconservation.on.ca>
Subject: Natural Heritage data request for W12 landfill

Hello Joe,

Please see the attached natural heritage data information request and location map for a project site at the W12 landfill in London, Ontario.

Regards,

Matthew Ross, B.Sc.

Terrestrial Ecologist, Water & Natural Resources, Environment

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This message has been scanned for viruses and dangerous content by [E.F.A. Project](#), and is believed to be clean.

From: ESA-Aylmer (MNRF) <ESA.Aylmer@ontario.ca>
Sent: Friday, December 15, 2017 10:30 AM
To: Ross, Matthew
Subject: RE: Natural heritage information request for W12 landfill EA
Attachments: 2017-04_SAR Screening Process_Technical Bulletin.pdf

Good morning Matthew,

The Ministry of Natural Resources and Forestry (MNRF) understands that AECOM is conducting an Information Request for the City of London's W12A Landfill Expansion EA proposed at Lots 18-20, Concession 6 in the City of London, as identified in the information provide.

MNRF provides the following natural heritage information in response to your request.

Species at Risk (SAR)

The Species at Risk in Ontario (SARO) List (<https://www.ontario.ca/laws/regulation/080230>) is Ontario Regulation 230/08 issued under the *Endangered Species Act, 2007* (ESA). The ESA came into force on June 30, 2008, and provides both species protection (under section 9) and habitat protection (under section 10) to species listed as endangered or threatened on the SARO List.

An initial SAR (Endangered and Threatened species) screening has been completed for the above-noted property.

There are known occurrences of SAR on the property, including:

- Barn Swallow (threatened) – receives species and general habitat protection;
- Bobolink (threatened) – receives species and general habitat protection; and
- Eastern Meadowlark (threatened) – receives species and general habitat protection.

There are also known occurrences of SAR in the general project area that may occur on-site, including

- Butternut (endangered) – receives species and general habitat protection;
- Eastern Flowering Dogwood (endangered) – receives species and regulated habitat protection; and
- SAR Bats (endangered) – receives species and general habitat protection.

Please note that this is an initial screening for SAR and the absence of an element occurrence does not indicate the absence of species. The province has not been surveyed comprehensively for the presence or absence of SAR and MNRF data relies on observers to report sightings of SAR. Field assessments by a qualified professional may be necessary if there is a high likelihood for SAR species and/or habitat to occur within the project footprint and potentially be impacted.

MNRF recommends that field assessments are undertaken by a qualified biologist to determine whether the proposed project may contravene the ESA. If the project has the potential to contravene the ESA, an Information Gathering Form (IGF) should be submitted to ESA.Aylmer@Ontario.ca and no on-site activity (i.e. site alteration, vegetation/debris removal, etc.) should occur until a Stage 2 Screening is complete to ensure compliance with the Act. Please see our attached Technical Bulletin regarding the Aylmer District Species at Risk Screening Process for more information.

- The Committee on the Status of Species at Risk in Ontario (COSSARO) meets regularly to evaluate new species for listing and/or re-evaluate species already on the SARO List.
- As a result, species designations may change and changes may occur in both species and habitat protection which could affect the level of protection they receive under the ESA 2007 and whether proposed projects may have adverse effects on SAR.
- Habitat protection provisions for a species may change if a species-specific habitat regulation comes into effect.

If an activity or project will result in adverse effects to endangered or threatened species and/or the habitat, additional action would need to be taken in order to remain in compliance with the ESA. Additional action could be applying for an authorization under section 17(2)(c) of the ESA, or completing an online registry for an ESA regulation and following the rules in regulation if the project is eligible (<http://www.ontario.ca/environment-and-energy/natural-resources-approvals>).

Questions about the registry process should be directed to MNRF's Registry and Approval Services Centre at 1-855-613-4256 or at mnr.rasc@ontario.ca. Please be advised that applying for an authorization does not guarantee approval and the process can take several months.

Significant Wildlife Habitat (SWH)

Significant wildlife habitat (SWH) may be present on or adjacent to the above-noted subject lands (within 120 m). Please consult the Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000), the Natural Heritage Reference Manual (NHRM) and the Ecoregion Criteria Schedules for criteria on identifying and determining significance of wildlife habitat. SWH is identified by planning authorities using the criteria and processes recommended in the SWHTG and Ecoregion Criteria Schedules.

Link to the SWHTG: <https://www.ontario.ca/environment-and-energy/guide-significant-wildlife-habitat>

Link to Ecoregion 7E criteria schedule: http://publicdocs.mnr.gov.on.ca/View.asp?Document_ID=21843&Attachment_ID=45645

Habitat of species of special concern (not legally protected under the ESA) and those ranked S 1 to 3 receives consideration for SWH of Special Concern and Rare Wildlife Species. The following species are known to occur in the area for your information:

- Eastern Wood-pewee (Special Concern), last observed date: 2002
- Snapping Turtle (Special Concern), last observed date: 2013
- Yellow Bunting (S2), last observed date: 1932
- Slender Bluet (S2) last observed date: 2000
- Double-striped Bluet (S3) last observed date: 2000

Areas of Natural and Scientific Interest (ANSIs)

There are no Provincially or Regionally Significant Earth or Life Science ANSI's within or adjacent to the proposed subject lands.

Significant Wetlands

There are no Provincially Significant Wetlands (PSWs) present within or adjacent to the above-noted subject lands. However, there is an evaluated wetland (Non PSW), Silver Swamp, located immediately adjacent to the project area, north of Scotland Dr. Wetland shapefiles can be downloaded from Land Information Ontario (LIO) or viewed on our Make a Natural Heritage Map tool (<https://www.ontario.ca/page/make-natural-heritage-area-map>).

Significant Valleylands

MNRF does not possess significant valleylands mapping. The NHRM provides guidance and evaluation criteria for determining significant valleylands. Conservation authorities should be contacted to inquire about information pertaining to significant valleylands if they have not been identified in the applicable Official Plan.

Fish and Fish Habitat

There appear to be watercourses within and adjacent to the project area; however, no information on fish and fish habitat or mussel and mussel habitat is available.

MNRF recommends you contact the appropriate conservation authority and DFO for up-to-date fisheries, mussel, and drain information.

- Conservation Authorities and Official Plans may provide additional natural heritage information for this study.

Please be advised that it is your responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals.

If you have any questions or require additional information, please feel free to contact me.

Kind regards,

Kathleen Buck
Management Biologist

MNRF Aylmer District

615 John St. N.

Aylmer, ON N5H2S8

P (519)773-4785

F (519)773-9014

Kathleen.Buck@ontario.ca

As part of providing [accessible customer service](#), please let me know if you have any accommodation needs or require communication supports or alternate formats.

From: Ross, Matthew [<mailto:Matthew.Ross@aecom.com>]

Sent: October-17-17 3:02 PM

To: ESA-Aylmer (MNRF)

Subject: Natural heritage information request for W12 landfill EA

To whom it may concern,

Please see the attached information request and project location map for the W12 landfill Environmental Assessment in London, Ontario.

Regards,

Matthew Ross, B.Sc.

Terrestrial Ecologist, Water & Natural Resources, Environment

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From: Cari Ramsey <ramseyc@thamesriver.on.ca>
Sent: Tuesday, October 30, 2018 1:24 PM
To: Ross, Matthew
Subject: W12 Landfill Site
Attachments: Scotland.pdf

Hi Matthew;

My apologies on this one. I thought I sent the info, but apparently it was a different site and this one got lost in the shuffle. I have attached the mapping for this area and you will notice that only half the subject area is within the UTRCA watershed. The additional area will be within the Kettle Creek CA jurisdiction so you should contact them for any additional information. For the rest of the info I have the following:

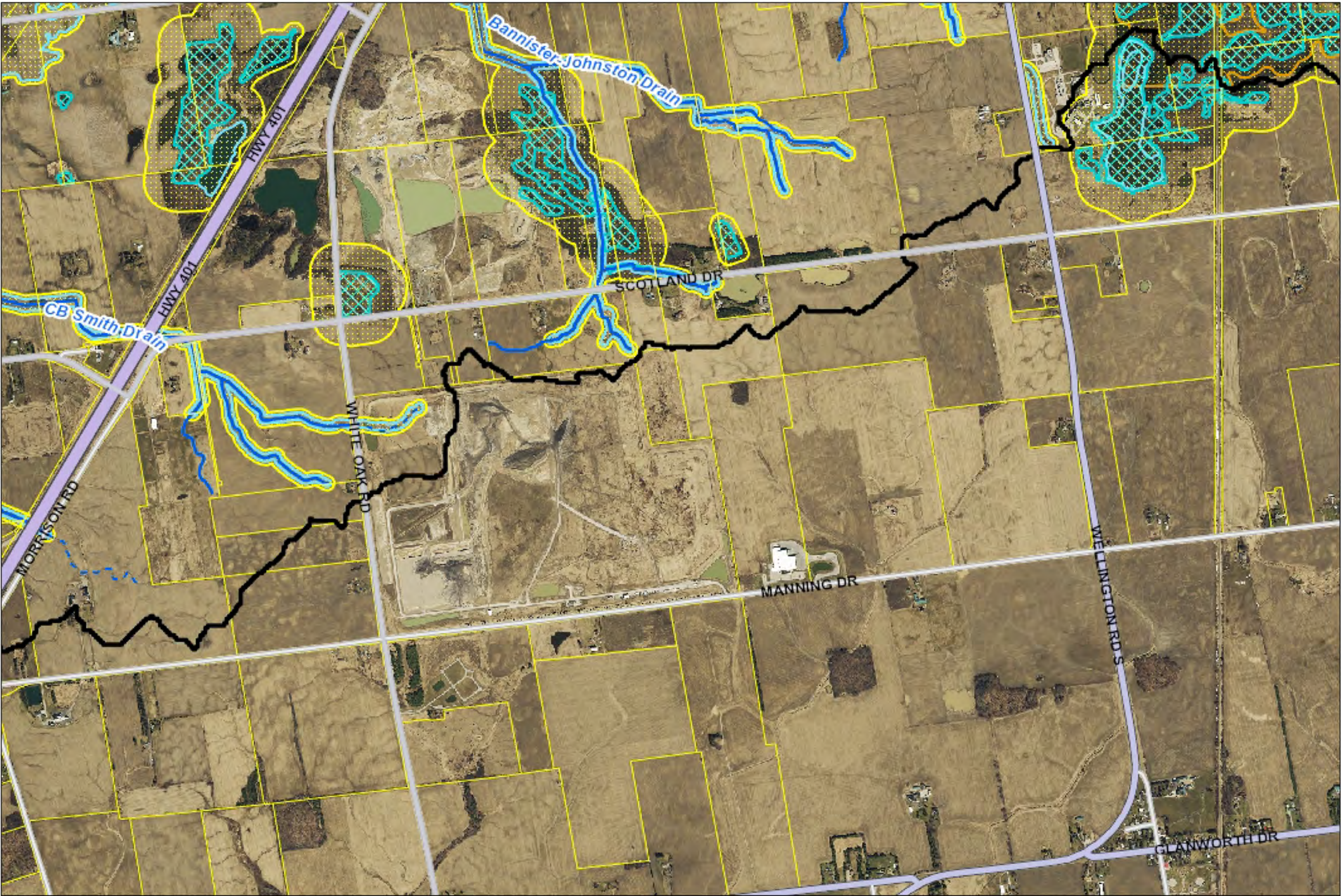
- *No SARA species within the area
- *Warm water watercourses therefore the timing windows would be No In-Water Work from March 15th to July 15th
- *Water quality and quantity information would come from Ministry of the Environment, Conservation and Parks (MECP)
- * We do not have any fish, benthic or mussel information for that area

Sorry it took that long to not have that much info, but if you have any questions please feel free to contact me.

Thanks!
Cari

Cari Ramsey
Environmental Regulations Technician/ Health and Safety Specialist
UTRCA
1424 Clarke Side Road
London, ON
N5V 5B9
(519)451-2800 ext. 289
ramseyc@thamesriver.on.ca

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Regulation Limit

Regulation under s.28 of the *Conservation Authorities Act*
Development, interference with wetlands, and alterations
to shorelines and watercourses. O.Reg 157/06, 97/04.

Legend

- UTRCA Watershed (1:10K)
- Assessment Parcel (MPAC)
- Watercourse
 - Open
 - Tiled
- Wetland Hazard
- Flooding Hazard
- Erosion Hazard
- Regulation Limit 2015

The Regulation Limit depicted on this map schedule is a representation of O.Reg 157/06 under O.Reg 97/04.

The Regulation Limit is a conservative estimation of the hazard lands within the UTRCA watershed. In the case of discrepancies between the mapping and the actual features on a property, the text of Ontario Regulation 157/06 prevails and the jurisdiction of the UTRCA may extend beyond areas shown on the maps.

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The UTRCA assumes no liability for any errors, omissions or inaccuracies in the information provided herein and further assumes no liability for any decisions made or actions taken or not taken by any person in reliance upon the information and data furnished hereunder.

This map is not a substitute for professional advice. Please contact UTRCA staff for any changes, updates and amendments to the information provided.

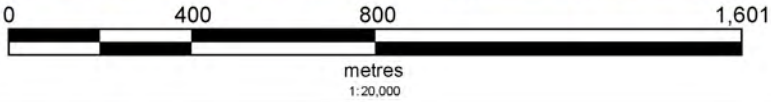
This document is not a Plan of Survey.

Sources: Base data, 2015 Aerial Photography used under licence with the Ontario Ministry of Natural Resources Copyright © Queen's Printer for Ontario; City of London.

Notes:
Scotland/White Oak

Created By: cr October 30, 2018

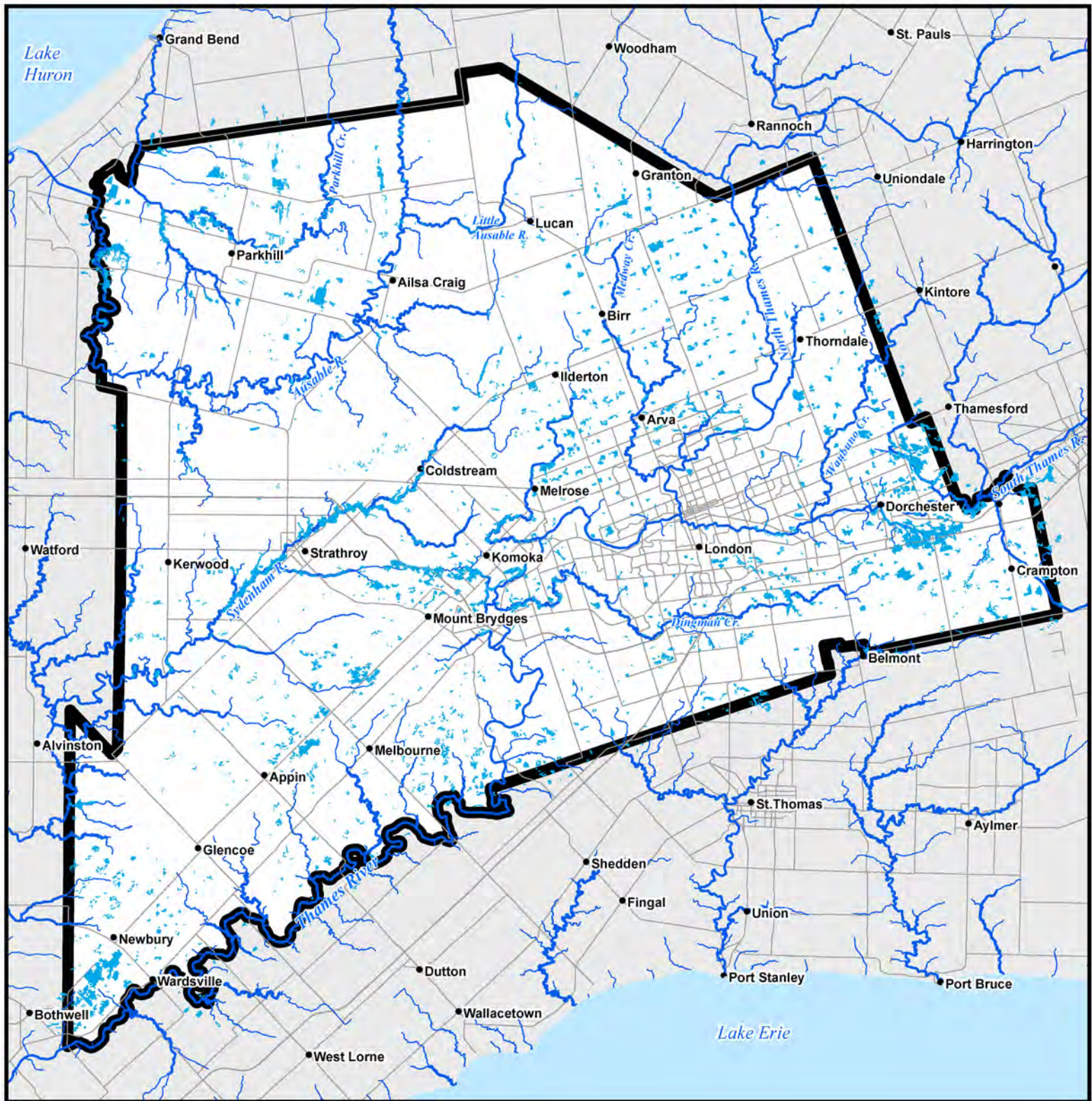
* Please note: Any reference to scale on this map is only appropriate when it is printed landscape on legal-sized (8.5" x 14") paper.



UPPER THAMES RIVER
CONSERVATION AUTHORITY
Copyright ©2018 UTRCA.

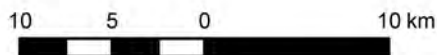
Appendix D

**Middlesex Natural Heritage
System Study Mapping**



Middlesex Natural Heritage Systems Study 2014

Wetland Group

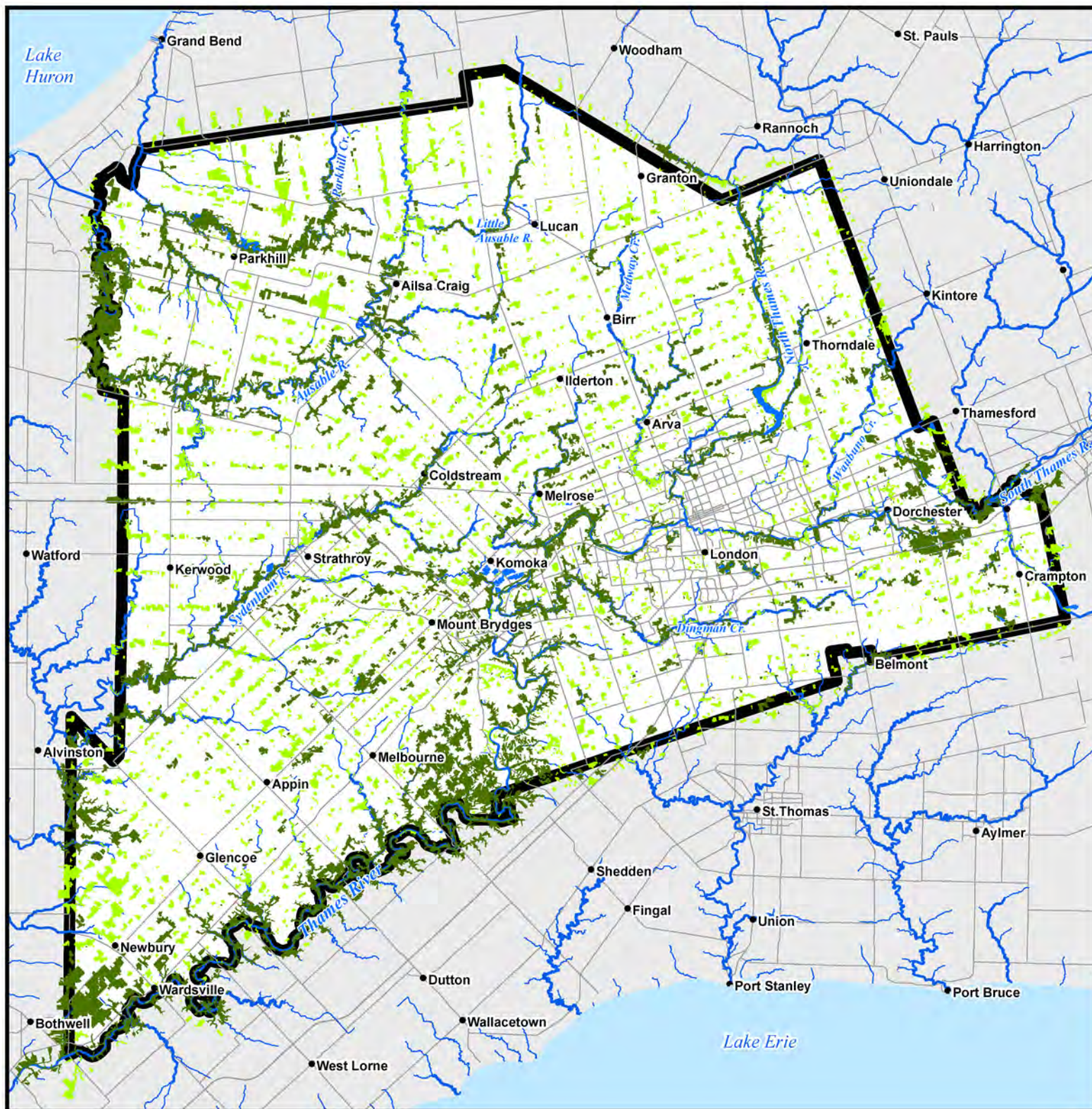


Legend

- Wetland Group
- Study Boundary

Produce by Upper Thames River Conservation Authority, July 2014, Basemapping: Land Information Ontario, Copyright © Queens Printer, 2014.

Wetland Boundaries: Ontario Ministry of Natural Resources, Copyright © Queens Printer, 2014 and Conservation Authorities: Ausable Bayfield, St. Clair Region, Upper Thames River, based on 2010 imagery.

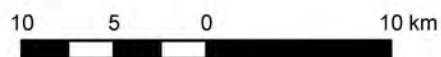


Middlesex Natural Heritage Systems Study 2014



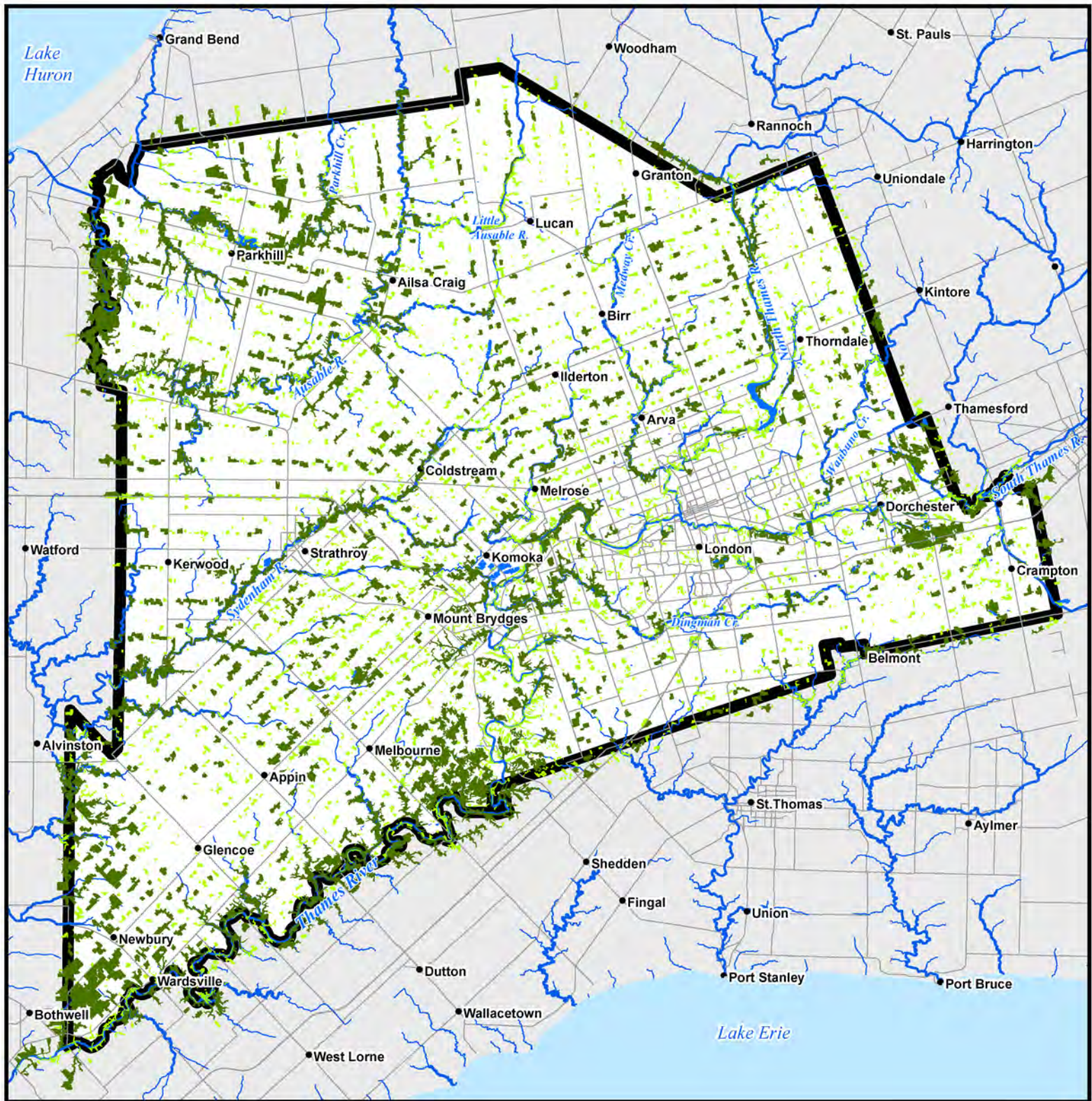
Produce by Upper Thames River Conservation Authority, July 2014,
Basemapping :Land Information Ontario, Copyright © Queens Printer, 2014.

Woodlands defined by Conservation Authorities Ausable Bayfield, St. Clair
Region, Upper Thames River, based on 2010 imagery.



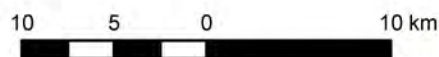
Legend

- Not Within 100m of
Another Woodland >4ha
- Within 100m of Another
Woodland >4ha
- Study Boundary



Middlesex Natural Heritage Systems Study 2014

Woodland Group



Legend

- Woodland Group no Interior
- Woodland Group with Interior
- Study Boundary

Produce by Upper Thames River Conservation Authority, July 2014, Basemapping :Land Information Ontario, Copyright © Queens Printer, 2014.

Woodlands defined by Conservation Authorities Ausable Bayfield, St. Clair Region, Upper Thames River, based on 2010 imagery.

Appendix E

W12A Landfill Benthic Water Quality Report



W12A Landfill Benthic Water Quality Report

June 5, 2018

Submitted on July 04, 2018

Prepared for: AECOM and the City of London Ontario

Prepared by: Dave Johnson, Principal, StraightUp Environmental Consulting

Executive Summary

On June 5, 2018, StraightUp Environmental collected Benthic samples from eight sites around the W12A landfill site as part of the environmental study for the proposed landfill expansion (Table 2). Along with the Benthic samples, water chemistry with a Sonde and substrate characteristics were also recorded (Table 3).

Aquatic invertebrates have the longest history of use in biomonitoring programs. In typical unpolluted temperate streams of North America, certain insect taxa predominate. Mayflies (Ephemeroptera), caddisflies (Trichoptera), and stoneflies (Plecoptera) are the most common insects in these undisturbed streams. In rivers disturbed by urbanization, agriculture, forestry, and other perturbations, flies (Diptera), and especially midges (family Chironomidae) predominate.

Traditionally, water quality monitoring actions have focused on physical and chemical measurements. It is widely recognized that the use of other indicators, in addition and complimentary to traditional chemical and physical water quality monitoring techniques, can greatly enhance the assessment and management of aquatic ecosystems.

Consequently, biological monitoring, or biomonitoring, is an important tool in assessing the condition of aquatic ecosystems. Information on and understanding of environmental change is necessary to allow for the protection and remediation of ecosystems. The best way to identify measurement parameters that can serve as vital signs of ecosystems, and define the limits of their variation, is through long term biomonitoring. The resulting data sets are analyzed to provide the basis for defining normal limits of variation or diagnosing ecosystem impairment.

The City of London requested that StraightUp Environmental follow the BioMAP protocol to assess the current water quality. This protocol uses a biotic Water Quality Index ($WQI_{(d)}$) as well as a set of summary metrics to determine the condition of the health of the watercourse (Table 1.0).

All of the sites sampled are classified as Creeks; less than 4m bank full width. All sites on these Creeks seem to be rain dependant with the exception of site W12A-3B. The Creek was dry in-between Site W12A-3A and W12A-3B. Site W12A-3B has other feeder Creeks and appears to have year round flow.

If the WQI rating falls below 14, then the Creek is considered impaired. (Table 1) **All of the sites sampled scored way below 14 and are considered impaired.** The highest score recorded was at site **W12A-3B** and only had a **WQI rating of 3.45**, the lowest score recorded was at site **W12A-2B**, it had a **WQI rating of 1.11**.

StraightUp Environmental chose to use the Hilsenhoff Biotic Index (Genus-Species level) instead of the Family Biotic Index (FBI) as it is obviously more accurate and taxon are already taken to the lowest level. This index was developed by Hilsenhoff (1988).

This index is based on the taxon's tolerance to organic pollution. Each of the taxon are assigned a number from 0-10 for its tolerance to organic pollution, 0 being intolerant to organic pollution and 10 being very tolerant to organic pollution. **All of the sites sampled indicate "severe organic pollution likely"** with the best rating at site **W12A-3B**, it had an **HBI rating of 7.28** and the worst rating was at site **W12A-2B**, its rating was **9.95**.

Conductivity, TDS and Salinity levels were extremely high at sites W12A-1B, W12A-2A, W12A-2B, W12A-3A and W12A-4B with **conductivity reaching 5791uS/cm, TDS 3.81 and Salinity of 3.23 at site W12A-2A.** (Table 3) These sites are impacted by the existing Landfill site through drainage or tile coming from within the existing landfill.

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1. Introduction

On June 5, 2018, StraightUp Environmental collected benthic macroinvertebrate samples from the area around the current W12A Landfill site. Four Creeks/Drains were chosen for this study and samples were taken from two sites per watercourse.

In addition to the biological monitoring; water temperature, conductivity, TDS, salinity, dissolved oxygen, pH levels along with the substrate characteristics were recorded.

The City of London requested that StraightUp Environmental follow the BioMAP protocol to assess the current water quality. This protocol uses a biotic Water Quality Index ($WQI_{(d)}$) as well as a set of summary metrics to determine the condition of the health of the watercourse (Table 1.1).

Table 1.1: Classification of Water Quality Based on the BioMAP

BioMAP WQI_d	Unimpaired	Impaired
Creeks	>16	<14
Streams	>12	<10
Rivers	>9	<7

(Griffiths, 1999)

2. Methods

2.1 Sample Collection

In June of 2018, benthic invertebrate samples were collected from 8 sites on the W12A Landfill site location as part of the Environmental Studies for the proposed Expansion of W12A Landfill (Table 2.1). All samples from sites were collected on June 05, 2018.

Two quantitative samples were collected at each site using a Surber Sampler with an enclosed area of 0.05 m². One qualitative sample was also collected at each site using a 500µm D-Net and the “kick and sweep” method, sampling through the different habitat and substrate at each site location.

For each sample, the sediment, debris and organisms were immediately placed into one litre mason jars, preserved with 10% formalyn solution, and labelled with the site code, stream name and date.

Along with the benthic sampling, the following information was provided from each site:

- substrate characteristics
- water depth
- velocity
- temperature
- conductivity
- pH
- DO
- TDS
- algae

Table 2.1: Location of Benthic Sampling Sites On W12A

Site Code	UTM east	UTM north	Description
W12A-1A	467681	4744858	Approx. 100 meters upstream of Manning Drive at 2 nd culvert
W12A-1B	482712	4746915	Downstream of the culvert on Manning Drive
W12A-2A	481291	4746760	Upstream of Culvert on Manning Drive

Site Code	UTM east	UTM north	Description
W12A-2B	481295	4746746	Downstream of Culvert on Manning Drive
W12A-3A	480500	4747572	Downstream of Culvert on White Oak Rd.
W12A-3B	479820	4747952	Upstream of Culvert on Scotland Drive, West of White Oak Road
W12A-4A	481525	4748129	South of the Culvert on Scotland Drive
W12A-4B	479820	4747952	North of the Culvert on Scotland Drive

2.2 Sample Processing

Benthic macroinvertebrate samples were processed by StraightUp Environmental. Our lab received the samples and examined the submission sheet to match the number of jars for each sample and confirmed the samples received. Our taxonomists ensured that the correct number of jars and labels matched the submission sheets. The samples were washed free of the ethanol through a 500µm sieve prior to sorting and identification.

2.3 Subsampling

Subsampling is accomplished by stacking 3 sieves'; 4mm, 2mm and a 500mic. on top of each other and flushing thoroughly with running water. Both the 4mm and the 2mm sieve have all bugs counted and the 500mic sieve was 25% sampled and multiplied by four.

2.4 Detailed Identification

All of the benthic macroinvertebrates were identified to the lowest practical level (Table 2.1). Taxonomic resolution was dependent upon the condition and maturity of the specimen. A list of the taxonomic keys used is identified in Appendix A.

2.5 Quality Assurance and Quality Control Measures

StraightUp Environmental incorporates a list of QA/QC procedures for all of its benthic projects to ensure the accuracy of all data:

- Samples were inspected, enumerated and logged upon arrival
- Taxonomic identifications are based on the most updated taxonomic keys
- Sorted specimens are preserved in 70% ethanol, labelled and stored at StraightUp's laboratory indefinitely

- Sediments and debris are preserved with 70% ethanol, labelled and stored for up to 3 months
- To ensure the accuracy of the data entry, the spreadsheets are compared to the field and bench sheets by a second person

2.6 Data Interpretation and Reporting

The identification and enumeration of the benthic macroinvertebrates was performed by StraightUp Environmental. The detailed list summarizing the density and taxa for each of the samples using an Excel spreadsheet was reported per 0.05m² as shown in Appendix B and a list of taxonomic keys used is in Appendix A.

2.7 BioMAP Water Quality Index (WQI_d)

The BioMAP WQI_d is an abundance-weighted mean sensitivity value of the benthic organisms occurring at a site. The required taxonomic resolution from (Table 2.2) is used to determine the quality of the water. Each of the taxa is given sensitivity values from 0-4 with 4 being the most sensitive to anthropological changes.

The WQI_d was calculated as follows:

$$\left[\sum_{i=1}^n e^{sv_i} * \ln(x_i + 1) \right] \div \left[\sum_{i=1}^n \ln(x_i + 1) \right]$$

Where,
 sv_i is the sensitivity value of the i^{th} taxon
 x_i is the density of the i^{th} taxon
 n is the total number of taxa in the sample

For streams, bank full widths of less than 4 meters such as the monitoring sites on TribC, a WQI_(d) >16 would indicate unimpaired and <14 would indicate impaired water quality (Griffiths, 1999)

If the index falls between 14 and 16, the water quality cannot be classified solely by using this index and therefore a weight of evidence approach is used including Simpson's Indices (family level) and Hilsenhoff's modified biotic index.

Table 2.2: BioMAP's Required Taxonomic Resolution for the Identification of Benthic Macroinvertebrates (Griffiths, 1993)

Taxon	Required Taxonomic Resolution
Insects	Genus
Beetles	Genus
Elmidae	Species (adults)
Caddisflies	Genus
Dragonflies	Species
Mayflies	Genus
Baetis	Species
Stenonema	Species
Stoneflies	Genus/Species
Capniidae	Genus
True Flies	Genus
Chironomidae	Genus
Simuliidae	Family
Mites	Family
Crustaceans	Genus
Amphipods	Genus
Gammarus	Species
Crayfish	Genus
Molluscs	Genus
Annelids	Species
Flatworms	Genus

2.8 Hilsenhoff's Modified Family Level Biotic Index (Bode et al., 1991, 1996; Mandaville 2002)

This index was developed by Hilsenhoff (1988). Each taxa has a tolerance to organic pollution value ranging from 0 (intolerant) to 10 (tolerant), (Table 2.3). Its intent is for rapid field assessment of organic pollution. Tolerance values used are from

<http://lakes.chebucto.org/ZOOBENTH.BENTHOS/tolerance.html>

The Modified Family Biotic Index was calculated as follows:

$$(\sum x_i t_i) \div n$$

where, x_i is the number of individuals within a taxon
 t_i is the tolerance value of the taxon
 n is the total number of organisms in the sample

Table 2.3: Hilsenhoff's Family Level Biotic index

Family Biotic Index	Water Quality	Degree of Organic Pollution
0.00-3.50	Excellent	No apparent organic pollution
3.51-4.25	Very good	Possible slight organic pollution
4.26-5.00	Good	Some organic pollution probable
5.01-5.75	Fair	Fairly substantial pollution likely
5.76-6.50	Fairly poor	Substantial pollution likely
6.51-7.25	Poor	Very substantial pollution likely
7.26-10.00	Very poor	Severe organic pollution likely

(Hilsenhoff, 1988)

3. Results

3.1 Watercourse Characteristics

Canopy coverage was close to 50% for sites W12A-3B and W12A-4B. All other sites had zero canopy coverage. All of the sites sampled had no riffle or run and consisted mainly of still water pools

The forecast in the morning was sunny with highs of 22°C and clouded over in the afternoon with a few showers.

Conductivity at site W12A-2A was 5791us/cm, which is extremely high, the TDS was 3.81 and salinity was 3.23, these are also very high and would obviously contribute to the high continuity. TDS refers to the total dissolved solids and the salinity refers to the amount of salt in the water. Five out of the eight sites had extremely high levels of TDS and salinity. (Table 3.1)

Table 3.1: Summary of the Physical Data and Chemistry from Trib C

Reach	Boulder %	Cobble %	Gravel %	Sand %	Silt %	Clay %	Riffle (%)	Run (%)	Pool (%)
W12A-1A	0	0	10	10	75	5	0	0	100
W12A-1B	0	10	25	10	55	0	0	0	100
W12A-2A	0	20	20	20	20	20	0	0	100
W12A-2B	10	30	30	10	10	10	0	0	100
W12A-3A	0	5	10	30	50	5	0	0	100
W12A-3B	25	25	20	10	15	5	0	0	100
W12A-4A	0	0	20	25	50	5	0	0	100
W12A-4B	0	20	40	10	30	0	10	10	80

Reach	Bank Full Width (m)	Depth (cm)	Velocity (cm/s)
W12A-1A	-	-	-
• Centre point	1.9	10	0
• Downstream	1.7	10	0
• Upstream	1.9	10	0
W12A-1B	-	-	-
• Centre point	1.9	11	0
• Downstream	1.9	9	0
• Upstream	1.9	8	0
W12A-2A	-	-	-
• Centre point	3.1	25	0
• Downstream	3.1	20	0

Reach	Bank Full Width (m)	Depth (cm)	Velocity (cm/s)
• Upstream	2.7	18	0
W12A-2B	-	-	-
• Centre point	3.1	20	0
• Downstream	2.9	18	0
• Upstream	2.9	16	0
W12A-3A	-	-	-
• Centre point	3.3	13	0
• Downstream	2.4	15	0
• Upstream	2.7	12	0
W12A-3B	-	-	-
• Centre point	2.1	10	0
• Downstream	2.2	8	0
• Upstream	2.0	9	0
W12A-4A	-	-	-
• Centre point	0.8	10	0
• Downstream	0.9	11	0
• Upstream	0.7	12	0
W12A-4B	-	-	-
• Centre point	3.3	120	0
• Downstream	3.0	110	0
• Upstream	3.4	100	0

Reach	Temperature (°C)	Conductivity (µS/cm)	TDS	Salinity	Dissolved Oxygen	pH	Turbidity	Algae
W12A-1A	15.85	649	0.422	0.32	5.82	7.44	Turbid	Sparse
W12A-1B	14.67	2013	1.311	1.04	7.21	7.48	Turbid	Sparse
W12A-2A	19.14	5791	3.81	3.23	5.94	6.80	Turbid	Sparse
W12A-2B	16.47	1701	1.106	0.87	5.89	7.27	Turbid	Sparse
W12A-3A	15.33	2156	1.403	1.11	3.78	6.97	Turbid	Sparse
W12A-3B	15.59	469	0.304	0.23	8.73	7.51	Turbid	Sparse
W12A-4A	14.56	651	0.423	0.32	6.39	7.06	Turbid	Sparse
W12A-4B	13.57	2048	1.329	1.05	7.12	7.30	Turbid	Sparse

3.2 Benthic Water Quality Results

All of the watercourses sampled are dependant on rainfall and all contained dry spots except for site 3B. **All of the sites** sampled have a **WQI** rating of **IMPAIRED** and all have a **Hilsenhoff Biotic Index** rating of **VERY POOR QUALITY (SEVERE ORGANICPOLUTION LIKELY)**. The watercourses are all classified as Creeks according to Griffith and WQI readings of less then 14 would indicate impaired.(Table 3.2)

Site 2B had the worst ratings with the **WQI being 1.11** and the **BIOTIC INDEX of 9.95**.This site was dry downstream and contained many Bluntnose minnows, Fathead minnows,

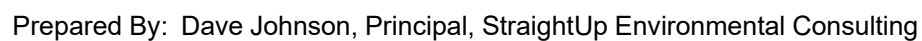
Common shiners and Brook Sticklebacks which contributed to the lack of insects in the three samples taken.

Hilsenhoff's Biotic Index was used instead of the Family Biotic Index as the bugs are already taken to the Genus-Species Level and is obviously more accurate.

Table 3.2: Results

Site:	W12A-1A	W12A-1B	W12A-2A	W12A-2B	W12A-3A	W12A-3B	W12A-4A	W12A-4B
Total Taxa	10	27	8	7	11	11	19	18
Average BioMap WQI	1.36	2.46	1.29	1.11	1.722	3.449	2.69	3.09
Hilsenhoff Biotic Index	9.34	8.81	9.65	9.95	8.5	7.281	8.85	8.66
EPT Richness (%)	0.126	0.195	0.265	0	0.5	0.151	0	0
Percentage Oligochaetes	4.79	35.28	22.22	18.64	65.5	6.184	55.93	33.17
Percentage Chironomidae	86.76	41.33	75.40	81.36	0	20.06	27.12	45.19
Percentage Insects	94.70	59.84	69.84	81.36	1.5	23.53	28.47	73.08
Simpsons diversity	0.760	0.309	0.336	0.083	0.071	0.431	0.13	0.217
Simpsons index of diversity	0.240	0.690	0.664	0.917	0.929	0.569	0.87	0.783

4. Site Map



5. Site Photo

Site W12A-4B-downstream



Site: W12A-4B-upstream



Site: W12A-4A-upstream



Site: W12A-4A-downstream



Site: W12A-3A-downstream



Site: W12A-3A-upstream



Site: W12A-2B-downstream



Site: W12A-2A-upstream



Site: W12A-1A-downstream



Site: W12A-2B-downstream



Site: W12A-1B-upstream



Site W12A-1A: Upstream



6. References

Brown, H.P. 1972. Aquatic Dryopoid Beetles (Coleoptera) of the United States. Biota of Freshwater Ecosystems Identification Manual No. 6. Water Pollution Control Research Series 18050 ELD04/72. U.S. Environmental Protection Agency, Cincinnati, Ohio.

Griffiths, R.W. 1999. BioMAP: Bioassessment of Water Quality. The Centre for Environmental Training, Niagara College: Niagara-on-the-Lake, Ontario.

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family-level biotic index. Journal of the North American Benthological Society 7: 65-68.

Hitchcock, S.W. 1974. Guide to the Insects of Connecticut. Part VH: The Plecoptera of Stoneflies of Connecticut. Bull. State Geol. Nat. Hist. Surv. Conn. No. 107. New Haven, Connecticut.

Larson, D. J. Y. Alarie, & R. E. Roughley. 2000. Predacious diving beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with emphasis on the fauna of Canada and Alaska. NRC Press. Ottawa. 982 pp

M. A. Penton, and D. J. Conklin, Jr. 1990. Freshwater macroinvertebrates of Northeastern North America. Cornell University Press, Ithaca, NY.

Merritt, R. W. & K. W. Cummins (eds.). 1996. An introduction to the aquatic insects of North America. 3rd ed. Kendall/Hunt Publishing Company, Dubuque, Iowa.

Smith, Cook and Smith on Arachnida in Thorp, J. H. and A.P. Covich (eds.). 2001. Ecology and classification of North American freshwater invertebrates. Second Edition, Academic Press, San Diego.

Stoneflies: Nymphs of North America, 2nd ed. Kenneth W Stewart Bill P Stark, Caddis Press, Columbus OH 2002.

<http://portal.ncdenr.org/web/wq/taxonmanual>

<http://www.execulink.com/~bugman/>

http://insects.ummz.lsa.umich.edu/~ethanbr/aim/Keys/Ephemeroptera/id_eom.html

http://zookeys.pensoft.net/articles.php?id=2630&display_type=element&element_type=7&element_id=0&element_name=Elmidae

Bode, R.W., Novak, M.A., and Abele, L.E. 1991. Methods for Rapid Biological Assessment of Streams. NYS Department of Environmental Conservation, Albany, NY. 57p.

Bode, R.W., Novak, M.A., and Abele, L.E. 1996. Quality Assurance Work Plan for Biological Stream Monitoring in New York State. NYS Department of Environmental Conservation, Albany, NY. 89p.

Griffiths, R.W. 1999a. BioMAP: A How to Manual. Ministry of Municipal Affairs and Housing, Policy Planning Branch, Toronto, ON.

Griffiths, R.W. 1999b. BioMAP: Bioassessment of Water Quality. The Centre for Environmental Training, Niagara College, Glendale Campus, Niagara-on-the-Lake, Ontario. 110 pp.

Griffiths, R.W. 1996. A Biological Measure of Water Quality for Creeks, Streams and Rivers. BioMAP: Report SWR-4. Ministry of Environment and Energy, Southwestern Region. 40 pp.

Griffiths, R.W. 1993. BioMAP: Concepts, Protocols and Sampling Procedures for the Southwestern Region of Ontario, Water Resources Assessment Unit, Southwestern Region, Report SWR-1. 30 pp.

Hilsenhoff, W.L. 1982. Using a biotic index to evaluate water quality in streams. Tech Bull. Wisconsin Dept. Nat. Resour. 132. 22pp.

Hilsenhoff, W.L. 1988. Rapid field assessment of organic pollution with a family-level biotic index. J.N. Am Benthol Soc., 7(1):65-68.

Mandaville, S.M. 2002. Benthic macroinvertebrates in freshwaters – taxa tolerance values, metrics, and protocols. Soil & Water Conservation Society of Metro Halifax. 128 pp.

Simpson, E.H. (1949) Measurement of diversity. Nature 163:688

7. Benthic Data

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-1A	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	chauliodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabates				0
	agabus				2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterosus				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae				
	ancyrionxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	macronychus galbratus				2
	microcyllopus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	haliphus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa	x	4	2	1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Aquarius				3
	Gerris				1
	Limnopus				1
	Metrobates				2
	Neogerris				0
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovalia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4
	Leucotrichia				3
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cymellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile				1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthoplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centroptilum				3
	Diphetor				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentroptiloides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis				1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoidea				4
	Serratella				3
	Ephemeridae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucrocota				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:		1		
	Allocapnia granulata				2
	allocapnia minima				2
	Allocapnia pygmaea				3
	Allocapnia recta				4
	Allocapnia rickeri				3
	Allocapnia vivpara				2
	Capnia				4
	Paracapnia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae	x	22	34	0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanypus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Chernovskia				1
	Chironomus	x	134	242	0
	Cladopelma				1
	Cladotanytarsus				2
	Clinotanypus				1
	Coelotanypus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes	x	42	56	0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	x	74	82	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterbouriella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanypus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes				2
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius	x	34	24	0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius				1
	Psectrotanypus				0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus	x			1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus				2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae				1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae				0
	Syrphidae				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Tabanidae:				
	Chrysops				2
	Tabanus				0
	Tipulidae:				
	Antocha				3
	Cryptolabis				4
	Dactylolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx				2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyallelidae:				
	Hyallela	x	2	2	2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes				2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea				1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium				1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum				2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranthus fasciolaris				3
	Pyganodon (=Anodonta,in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria				1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella				0
	Planorbidae:				
	Gyraulus				1
	Helisoma				1
	Planorbella				0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nepheleopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis				2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	Lumbriculidae				0
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	x	22	16	0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejdoskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeochoela				1
	Tricladida				3
	Total sum/0.05m2		331	456	
	Total Taxa	10			
	BioMap WQI		1.373292815	1.345766854	
	Avareage	1.359529834			
	Hilsenhoff Biotic Index	9.340479193			
	EPT Richness (%)	0.126103405			
	Percentage Oligochaetes	4.791929382			
	Percentage Chironomidae	86.7591425			
	Percentage Insects	94.703657			
	Simpsons diversity	0.760082309			
	Simpsons index of diversity	0.239917691			
	Simpsons reciprocal	1.315646987			

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-1B	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	Chauliodes				1
	Corydalis				2
	Nigronia				3
	SIALIDAE				
	Sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	Petrophila				2
	Other				0
	BEETLES:				
	DYROPIDAE:				
	Helichus				2
	DYTISCIDAE:				
	Acilius				0
	agabates				0
	agabus				2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2	X		4	2
	nebrioporus				2
	neoporus				2
	neoscutopterous				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae		1		
	dubiraphia larvae	X	29	16	
	ancyronxy variegata				2
	dubiraphia bivittata		3		0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	haliphus	X			1
	peltodytes		3		2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa	X	15	18	1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnoporus				1
	Metrobates				2
	Neogerris				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovalia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4
	Leucotrichia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cynellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile				1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria		1		2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthoplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centropetrum				3
	Dipheter				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentropetroides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis				1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4
	Serratella				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ephemeraidae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucocuta				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:			1	
	Allocaupnia granulata				2
	allocaupnia minima				2
	Allocaupnia pygmaea				3
	Allocaupnia recta				4
	Allocaupnia rickeri				3
	Allocaupnia vivpara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae				0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanytus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskia				1
	Chironomus	X	54	62	0
	Cladopelma				1
	Cladotanytus				2
	Clinotanytus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Coelotanytus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes		2		0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	X	38	38	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanytus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius	X	3		
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes	X			2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius				0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius				1
	Psectrotanypus	X			0
	Pseudochironomus	X	12	3	1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus	X			1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus				2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae		1		0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae	X	1	1	1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae	X			0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus	X		1	0
	Tipulidae:				
	Antocha				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cryptolabis				4
	Dactylolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx				2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyallellidae:				
	Hyallela	X	8	6	2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes	X		7	2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea				1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium				1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum				2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranhus fasciolaris				3
	Pyganodon (=Anodonta, in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria	X	1		1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella			2	0
	Planorbidae:				
	Gyraulus				1
	Helisoma				1
	Planorbella				0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nephelopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis			1	2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	Lumbriculidae				0
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	X	78	103	0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejdoskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeocoela				1
	Tricladida				3
	Total sum/0.05m2		235	245	
	Total Taxa	27			
	BioMap WQI		2.226431242	2.68476166	
	avareage	2.455596451			
	HBI rate	8.812865497			
	EPT Richness (%)	0.194931774			
	Percentage Oligochaetes	35.28265107			
	Percentage Chironomidae	41.32553606			
	Percentage Insects	59.84405458			
	Simpsons diversity	0.309588135			
	Simpsons index of diversity	0.690411865			
	Simpsons reciprocal	3.230097945			

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-2A-2018	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	chauiodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabates				0
	agabus				2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterous				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae				
	ancyronxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	halipus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa				1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnoporus				1
	Metrobates				2
	Neogerris				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovalia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4
	Leucotrichia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cyrnellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile				1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthroplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centropetrum				3
	Dipheter				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentropetroides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis		1		1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4
	Serratella				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ephemeraidae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucocuta				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:				
	Allocapnia granulata				2
	allocapnia minima				2
	Allocapnia pygmaea				3
	Allocapnia recta				4
	Allocapnia rickeri				3
	Allocapnia vivpara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae	x	2	3	0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanytus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskii				1
	Chironomus	x	84	82	0
	Cladopelma				1
	Cladotanytus				2
	Clinotanytus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Coelotanytus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes				0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	x	28	22	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanytus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius				0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius	x	27	13	1
	Psectrotanypus	x	12	17	0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus				1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus				2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae				1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae				0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus	x	2	1	0
	Tipulidae:				
	Antocha				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cryptolabis				4
	Dactylolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx				2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyallellidae:				
	Hyallela				2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes				2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea				1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium				1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum				2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranhus fasciolaris				3
	Pyganodon (=Anodonta,in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria				1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella				0
	Planorbidae:				
	Gyraulus				1
	Helisoma				1
	Planorbella				0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nephelopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis				2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	Lumbriculidae				0
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	x	36	48	0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejdoskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeocoela				1
	Tricladida				3
	Total sum/0.05m2		192	186	
	Total Taa	8			
	BioMap WQI		1.342268159	1.237976286	
	avareage	1.290122223			
	HBI rate	9.645502646			
	EPT Richness (%)	0.264550265			
	Percentage Oligochaetes	22.22222222			
	Percentage Chironomidae	75.3968254			
	Percentage Insects	69.84126984			
	Simpsons diversity	0.335586638			
	Simpsons index of diversity	0.664413362			
	Simpsons reciprocal	2.979856425			

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-2B	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	chauiodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabates				0
	agabus				2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterus				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae				
	ancyronxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	haliphus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa				1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnoporus				1
	Metrobates				2
	Neogerris				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovalia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4
	Leucotrichia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cyrnellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile				1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthoplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis	x			2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centropetium				3
	Dipheter				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentropetiloides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis				1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4
	Serratella				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ephemeraidae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucocuta				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:				
	Allocapnia granulata				2
	allocapnia minima				2
	Allocapnia pygmaea				3
	Allocapnia recta				4
	Allocapnia rickeri				3
	Allocapnia vivpara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae				0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanytus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskia				1
	Chironomus	x	29	48	0
	Cladopelma				1
	Cladotanytus				2
	Clinotanytus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Coelotanytus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes				0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	x	12	51	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanytus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius				0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius	x		4	1
	Psectrotanypus	x			0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus				1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus				2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae				1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae				0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus				0
	Tipulidae:				
	Antocha				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cryptolabis				4
	Dactyolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx				2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyallellidae:				
	Hyallela				2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes				2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea				1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium				1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum				2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranhus fasciolaris				3
	Pyganodon (=Anodonta, in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria				1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella				0
	Planorbidae:				
	Gyraulus				1
	Helisoma				1
	Planorbella				0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nephelopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis	x			2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	Lumbriculidae				0
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	x	10	23	0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejdoskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloecoela				1
	Tricladida				3
	Total sum/0.05m2		51	126	
	Total Taxa	7			
	BioMap WQI		1	1.218950612	
	avareage	1.109475306			
	HBI rate	9.95480226			
	EPT Richness (%)	0			
	Percentage Oligochaetes	18.6440678			
	Percentage Chironomidae	81.3559322			
	Percentage Insects	81.3559322			
	Simpsons diversity	0.0829315			
	Simpsons index of diversity	0.9170685			
	Simpsons reciprocal	12.05814433			
W12A-3A-2018	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	Chauliodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabetes				0
	agabus				2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterous				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae				
	ancyrionxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	halipus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa				1
	Palmacorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnporus				1
	Metrobates				2
	Neogerris				0
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovelia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	lthytrichia				4
	Leucotrichia				3
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Theliopsycha				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsycha				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cymellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile	x			1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthroplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centroptilum				3
	Dipheter				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentroptiloides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis			1	1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4
	Serratella				3
	Ephemeridae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucrocuta				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:				
	Allocaenia granulata				2
	allogapnia minima				2
	Allocaenia pygmaea				3
	Allocaenia recta				4
	Allocaenia rickeri				3
	Allocaenia vivpara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae	x		2	0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanypus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskia				1
	Chironomus				0
	Cladopelma				1
	Cladotanytarsus				2
	Clinotanypus				1
	Coelotanypus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes				0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes				0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanytus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes				2
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius				0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius				1
	Psectrotanypus				0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus				1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus				2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae				1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae				0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus				0
	Tipulidae:				
	Antocha				3
	Cryptolabis				4
	Dactyolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx				2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyallellidae:				
	Hyallela	x			2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes			1	2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea	x	12	9	1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium			1	1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum				2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranhus fasciolaris				3
	Pyganodon (=Anodonta,in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria				1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella	x		17	0
	Planorbidae:				
	Gyraulus	x	3	4	1
	Helisoma				1
	Planorbella	x	6	13	0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nepheleopsis				2
	Hirudinidae:				
	Haemopsis				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batracobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis				2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	Lumbriculidae				0
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	x	53	78	0
	Potamothenrix bavaricus				2
	Potamothenrix moldaviensis				2
	Potamothenrix vejdvskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeocoela				1
	Tricladida				3
	Total sum/0.05m2		74	126	
	Total Taxa	11			
	BioMap WQI		1.686754559	1.757344314	
	avareage	1.722049436			
	HBI rate	8.5			
	EPT Richness (%)	0.5			
	Percentage Oligochaetes	65.5			
	Percentage Chironomidae	0			
	Percentage Insects	1.5			
	Simpsons diversity	0.070578222			
	Simpsons index of diversity	0.929421778			
	Simpsons reciprocal	14.16867664			

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-3B-2018	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	chauiodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabates				0
	agabus	x	12	8	2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterous				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae				
	ancyronxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	haliphus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa				1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnoporus				1
	Metrobates				2
	Neogerris				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovalia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4
	Leucotrichia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cyrnellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile				1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthoplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centropetrum				3
	Dipheter				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentropetroides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis		2		1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4
	Serratella				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ephemeraidae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucocuta				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:				
	Allocapnia granulata				2
	allocapnia minima				2
	Allocapnia pygmaea				3
	Allocapnia recta				4
	Allocapnia rickeri				3
	Allocapnia vivpara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae				0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanytus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskia				1
	Chironomus	x	18	16	0
	Cladopelma				1
	Cladotanytarsus				2
	Clinotanytus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Coelotanytus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes				0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	x	37	42	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanytus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius	x	7	13	0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius				1
	Psectrotanypus				0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus				1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus				2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae				1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae		1		2
	Stratiomyidae				0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus				0
	Tipulidae:				
	Antocha				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Cryptolabis				4
	Dactylolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx	x	123	143	2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyallellidae:				
	Hyallela				2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes				2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea				1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium				1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum				2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranthus fasciolaris				3
	Pyganodon (=Anodonta,in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria	x	5	3	1
	Lymnaea				1
	Pseudosuccinea	x	25	29	0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella	x	75	63	0
	Planorbidae:				
	Gyraulus				1
	Helisoma				1
	Planorbella				0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nephelopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis				2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	Lumbriculidae				0
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus				0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejovskyi	x	23	18	2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeocoela				1
	Tricladida				3
	Total sum		328	335	
	Total Taxa	11			
	BioMap WQI		3.529334961	3.367681375	
	avareage	3.448508168			
	HBI rate	7.280542986			
	EPT Richness (%)	0.150829563			
	Percentage Oligochaetes	6.184012066			
	Percentage Chironomidae	20.06033183			
	Percentage Insects	23.52941176			
	Simpsons diversity	0.430974013			
	Simpsons index of diversity	0.569025987			
	Simpsons reciprocal	2.320325519			

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-4A-2018	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	chauiodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabates				0
	agabus			1	2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus	x			1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus				1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterous				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae			1	
	ancyronxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	halipus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa				1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others	x			0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnoporus				1
	Metrobates				2
	Neogerris				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovelia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protoptila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Leucotrichia				3
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cynellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rhyacophila				4
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagron				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile				1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epithea				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Stylurus				3
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthroplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centropilum				3
	Diphetor				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentropiloides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis				1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Serratella				3
	Ephemeridae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucrocota				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Stenonema vicarium				3
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parameletus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:				
	Allocaupnia granulata				2
	allocaupnia minima				2
	Allocaupnia pygmaea				3
	Allocaupnia recta				4
	Allocaupnia rickeri				3
	Allocaupnia vivpara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Sweltsa				4
	Leuctridae:				
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae	x	2		0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanytus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskii				1
	Chironomus	x	31	16	0
	Cladopelma				1
	Cladotanytarsus				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Clinotanyus				1
	Coelotanyus				1
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes				0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	x	17	12	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanyus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Paratendipes				2
	Pentaneura				2
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius				0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius				1
	Psectrotanypus				0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus				1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus	x		4	2
	Xylotopus				2
	Zalutschia				0
	Zavrelimyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae				1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae	x			0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus				0
	Tipulidae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Antocha				3
	Cryptolabis				4
	Dactylobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula	x			
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx	x	16	8	2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyalellidae:				
	Hyalella				2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes	x			2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea	x		8	1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium		2		1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum		4		2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Lampsilis cardium				3
	Lampsilis fasciola				3
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranhus fasciolaris				3
	Pyganodon (=Anodonta,in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria				1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella				0
	Planorbidae:				
	Gyraulus	x		1	1
	Helisoma				1
	Planorbella	x	4	4	0
	Planorbula				1
	Promenetus				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Erpobdellidae:				
	Dina dubia				1
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nephelopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis				2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	enchytraeidae	x	17	24	1
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	x	48	76	0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejovskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeocoela				1
	Tricladida				3
	Total sum		141	155	
	Total Taxa	19			
	BioMap WQI		2.643788232	2.732480815	
	avareage	2.688134524			
	HBI rate	8.85084758			
	EPT Richness (%)	0			
	Percentage Oligochaetes	55.93220339			
	Percentage Chironomidae	27.11864407			
	Percentage Insects	28.47457627			
	Simpsons diversity	0.130604288			
	Simpsons index of diversity	0.869395712			
	Simpsons reciprocal	7.656716418			

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
W12A-4B-2018	Insects:				
	ALDERFLIES:				
	CORYDALIDAE:				
	chauiodes				1
	corydalis				2
	nigronia				3
	SIALIDAE				
	sialis				2
	AQUATIC MOTHS:				
	PYRALIDAE:				
	petrophila				2
	other				0
	BEETLES:				
	DYROPIDAE:				
	helichus				2
	DYTISCIDAE:				
	acilius				0
	agabates				0
	agabus				2
	bidessonotus				1
	celina				0
	colymbetes				1
	copelatus				3
	coptotomus lenticus				1
	coptotomus longulus				1
	coptotomus loticus				2
	cybister				0
	desmopachria				0
	dytiscus				1
	graphoderus				0
	heterosternuta				3
	hydrocolus				1
	hydroporus	x			1
	hydrovatus				0
	hygrotus				0
	illybius				2
	laccophilus				0
	laccornis				1
	liodessus				2
	lioporeus				3
	matus2				2
	nebrioporus				2
	neoporus				2
	neoscutopterous				0
	oreodytes				2
	rhantus				0
	sanfilippodytes				3
	stictotarsus				2
	uvarus				2
	ELMIDAE:				
	Optioservus larvae				
	Stenelmis larvae				
	dubiraphia larvae				
	ancyronxy variegata				2
	dubiraphia bivittata				0
	dubiraphia minima				1
	dubiraphia quadrinotata				1
	dubiraphia vittata				2
	macronychus galbratus				2
	microcylloepus pusillus				3
	optioservus fastiditus				2
	optioservus ovalis				2
	optioservus trivittatus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	promoresia elegans				3
	promoresia tardella				4
	stenelmis bicarinata				2
	stenelmis crenata				2
	stenelmis musgravei				1
	stenelmis quadramaculata				0
	stenelmis sandersoni				2
	stenelmis vittipennis				2
	GYRINIDAE:				
	dineutes				2
	gyrinus				1
	HALIPLIDAE:				
	haliphus				1
	peltodytes				2
	HYDROPHILIDAE:				
	anacaena				2
	berosus				0
	crenitis				2
	cymbiodyta				1
	enochrus				0
	helochares				
	helocombus				0
	helophorus				1
	hydrobius				1
	Hydrochara				0
	Hydrochus				1
	Hydrophilus				3
	Laccobius				1
	Paracymus				2
	Sperchopsis				3
	Tropisternus				0
	Lampyridae				1
	Limnichidae:				
	Lutrochus				3
	Psephenidae:				
	Ectopria				3
	Psephenus				3
	Ptilodactylidae:				
	Anchytarsus				3
	Scirtidae				
	Micrasema				4
	BUGS:				
	Belostomatidae:				
	Belostoma				0
	Lethocerus				0
	Corixidae:				
	Callicorixa				2
	Corisella				0
	Hesperocorixa		2	2	1
	Palmarcorixa				2
	Sigara grossolineata				2
	Sigara lineata				2
	Sigara mathesoni				3
	Sigara trilineata				2
	Sigara others				0
	Trichocorixa calva				3
	Trichocorixa others				1
	Gerridae:				
	Aquarius				3
	Gerris				1
	Limnoporus				1
	Metrobates				2
	Neogerris				0

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Rheumatobates				1
	Trepobates				1
	Mesoveliidae:				
	Mesovelia				1
	Nepidae:				
	Nepa				1
	ranatra				0
	Notonectidae:				
	Buenoa				0
	Notonecta				0
	Pleidae:				
	Neoplea				0
	Veliidae:				
	Microvelia				0
	Rhagovelia				2
	CADDISFLIES:				
	Apataniidae:				
	Apatania				4
	Beraeidae:				
	Beraea				4
	Brachycentridae:				
	Brachycentrus				3
	micrasema				4
	Calamoceratidae:				
	Heteroplectron				3
	Dipseudopsidae:				
	Phylocentropus				2
	Glossosomatidae:				
	Agapetus				4
	Glossosoma				4
	Protophila				2
	Goeridae:				
	Goera				3
	Helicopsychidae:				
	Helicopsyche				2
	Hydropsychidae:				
	Arctopsyche				4
	Cheumatopsyche				1
	Diplectrona				4
	Homoplectra				4
	Hydropsyche alhedra				3
	Hydropsyche alvata				1
	Hydropsyche betteni				2
	Hydropsyche bronta				3
	Hydropsyche cuanis				2
	Hydropsyche dicantha				2
	Hydropsyche hageni				2
	Hydropsyche morosa				2
	Hydropsyche immature				
	Hydropsyche placoda				2
	Hydropsyche scalaris				2
	hydropsyche slossonae				3
	Hydropsyche sparna				3
	Hydropsyche ventura				4
	Hydropsyche welkeri				3
	Macrostemum				2
	Parapsyche				4
	Potamyia				1
	Hydroptilidae:				
	Agraylea				1
	Hydroptila				2
	Ithytrichia				4
	Leucotrichia				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Mayatrichia				2
	Neotrichia				2
	Ochrotrichia				2
	Orthotrichia				
	Oxyethira				1
	Stactobiella				4
	Lepidostomatidae:				
	Lepidostoma				4
	Theliopsyche				4
	Leptoceridae:				
	Ceraclea				1
	Leptocerus				0
	Mystacides				1
	Nectopsyche				1
	Oecetis				2
	Setodes				2
	Trienodes				1
	Limnephilidae:				
	Anabolia				1
	Asynarchus				1
	Chyranda				4
	Frenesia				4
	Glyphopsyche				1
	Hesperophylax				4
	Hydatophylax				4
	Ironoquia				2
	Lenarchus				1
	Limnephilus moestus				3
	Limnephilus				1
	Nemotaulius				1
	Onocosmoecus				4
	Platycentropus				2
	Pseudostenophylax				4
	Psychoglypha				4
	Pycnopsyche				3
	Molannidae:				
	Molanna				2
	Odontoceridae:				
	Marilia				3
	Psilotreta				4
	Philopotamidae:				
	Chimarra				3
	Dolophilodes				4
	Wormaldia				4
	Phryganeidae:				
	Agrypnia				1
	Banksiola				0
	Fabria				1
	Oligostomis				3
	Phryganea				1
	Ptilostomis				2
	Polycentropodidae:				
	Cyrnellus				1
	Neureclipsis				2
	Nyctiophylax				2
	Polycentropus				
	Psychomyiidae:				
	Lype				3
	Psychomyia				3
	Rhyacophilidae:				
	Rhyacophila fenestra				3
	rhyacophila lobifera				3
	Rhyacophila				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Sericostomatidae:				
	Agarodes				3
	Uenoidae:				
	Neophylax				4
	DAMSELFLIES:				
	Calopterygidae:				
	Calopteryx aequabilis				2
	Calopteryx maculata				3
	Hetaerina				2
	Coenagrionidae:				
	Amphiagrion				1
	Argia apicalis				1
	Argia fumipennis				3
	Argia moesta				2
	Argia sedula				2
	Argia tibialis				3
	Argia translata				1
	Chromagrion				2
	Coenagrion				0
	Enallagma antennatum				1
	Enallagma aspersum				0
	Enallagma basidens				0
	Enallagma boreale				1
	Enallagma carunculatum				1
	Enallagma civile			1	1
	Enallagma clausum				0
	Enallagma cyathigerum				1
	Enallagma ebrium				1
	Enallagma exsulans				3
	Enallagma geminatum				2
	Enallagma hageni				0
	Enallagma signatum				1
	Enallagma vesperum				1
	Ischnura				1
	Nehalennia				1
	Lestidae:				
	Archilestes				2
	Lestes				1
	DRAGONFLIES:				
	Aeshnidae:				
	Aeshna				2
	Anax				0
	Basiaeschna				1
	Boyeria				2
	Nasiaeschna				1
	Cordulegastridae:				
	Cordulegaster				3
	Corduliidae:				
	Cordulia				1
	Epiptera				1
	Helocordulia				2
	Neurocordulia				2
	Somatochlora				3
	Gomphidae:				
	Arigomphus				1
	Dromogomphus				2
	Gomphurus				2
	Gomphus				3
	Hagenius				2
	Ophiogomphus				3
	Phanogomphus				1
	Stylogomphus				3
	Stylurus				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Libellulidae:				
	Erythemis				1
	Ladona				0
	Leucorrhinia				0
	Libellula				1
	Perithemis				1
	Plathemis				0
	Sympetrum				1
	Tramea				1
	Macromiidae:				
	Didymops				2
	Macromia				2
	MAYFLIES:				
	Ameletidae:				
	Ameletus				4
	Arthropleidae:				
	Arthoplea				3
	Baetidae:				
	Acentrella				3
	acerpenna macdunnoughi				3
	Acerpenna pygmaea				2
	Baetis brunneicolor				3
	Baetis flavistriga				1
	Baetis intercalaris				2
	Baetis				2
	baetis rusticans				
	Baetis tricaudatus				4
	Callibaetis				0
	Centropetium				3
	Dipheter				3
	Heterocloeon				2
	Plauditus armillatus				2
	Plauditus cestus				3
	Plauditus cingulatus				2
	Plauditus dubius				1
	Plauditus punctiventris				3
	Plauditus virilis				1
	Procloeon				2
	Pseudocentropetiloides				3
	Pseudocloeon frondalis				2
	Pseudocloeon longipalpus				1
	Pseudocloeon propinquus				2
	Baetiscidae:				
	Baetisca				2
	Caenidae:				
	Brachycercus				2
	Caenis anceps				2
	Caenis				1
	Ephemerellidae:				
	Attenella				2
	Dannella				3
	Dentatella bartoni				1
	Drunella				4
	Ephemerella aurivillii				4
	Ephemerella				3
	Eurylophella aestiva				1
	Eurylophella bicolor				3
	Eurylophella coxalis				3
	Eurylophella funeralis				4
	Eurylophella lutulenta				1
	Eurylophella temporalis				1
	Serratella serratoides				4
	Serratella				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Ephemeraidae:				
	Ephemera guttulata				3
	Ephemera simulans				2
	Ephemera varia				3
	Hexagenia atrocauda				3
	Hexagenia				1
	Litobrantha				3
	Pentagenia				3
	Heptageniidae:				
	Anepeorus				1
	Epeorus				4
	Heptagenia				3
	Leucocuta				3
	Nixe				3
	Rhithrogena				4
	Stenacron				2
	Stenonema exiguum				1
	Stenonema femoratum				1
	Stenonema ithaca				2
	Stenonema luteum				2
	Stenonema mediopunctatum				3
	Stenonema modestum				2
	Stenonema pulchellum				1
	Stenonema terminatum				2
	Isonychiidae:				
	Isonychia				2
	Leptohyphidae:				
	Tricorythodes				2
	Leptophlebiidae:				
	Choroterpes				3
	Habrophlebia				
	Habrophlebiodes				2
	Leptophlebia				1
	Paraleptophlebia				3
	Metretopodidae:				
	Siphloplecton				2
	Oligoneuriidae:				
	Homoeoneuria				2
	Polymitarcyidae:				
	Ephoron				3
	Potamanthidae:				
	Anthropotamus				2
	Pseudironidae:				
	Pseudiron				2
	Siphonuridae:				
	Parametetus				3
	Siphonurus				2
	STONEFLIES:				
	Capniidae:				
	Allocapnia granulata				2
	allocapnia minima				2
	Allocapnia pygmaea				3
	Allocapnia recta				4
	Allocapnia rickeri				3
	Allocapnia vivipara				2
	Capnia				4
	Paracapnia				3
	Chloroperlidae:				
	Alloperla				4
	Haploperla				3
	Suwallia				4
	Sweltsa				4
	Leuctridae:				

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Leuctra				4
	Paraleuctra				4
	Nemouridae:				
	Amphinemura				4
	Nemoura				3
	Ostrocerca				4
	Paranemoura				4
	Podmosta				4
	Prostoia				3
	Shipsa				3
	Soyedina				4
	Peltoperlidae:				
	Peltoperla				3
	Tallaperla				3
	Perlidae:				
	Acroneuria abnormis				2
	Acroneuria carolinensis				3
	Acroneuria evoluta				2
	Acroneuria lycorias				2
	Agnetina				3
	Attaneuria				2
	Neoperla				3
	Paragnetina				3
	Perlesta				2
	Perlinella				3
	Perlodidae:				
	Arcynopteryx				4
	Clioperla				3
	Cultus				4
	Helopicus				
	Isogenoides				4
	Isoperla bilineata				2
	Isoperla nana				2
	Isoperla				4
	Malirekus				4
	Pteronarcyidae:				
	Pteronarcys				3
	Taeniopterygidae:				
	Oemopteryx				4
	Strophopteryx				4
	Taeniopteryx burksi				2
	Taeniopteryx				3
	TRUE FLIES:				
	Athericidae:				
	Atherix				3
	Ceratopogonidae	x			0
	Chaoboridae:				
	Chaoborus				0
	Chironomidae:				
	Ablabesmyia				2
	Acricotopus				1
	Apsectrotanytus				4
	Brillia parva				4
	Brillia				2
	Brundiniella				4
	Cardiocladius				2
	Chaetocladius				1
	Chernovskia				1
	Chironomus	x	58	46	0
	Cladopelma				1
	Cladotanytus				2
	Clinotanytus				1
	Coelotanytus				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Conchapelopia				2
	Corynoneura				2
	Cricotopus (C.) tremulus-gp				3
	Cricotopus (C.) trifascia				3
	Cricotopus (C.) others				2
	Cricotopus(Isocladius)				0
	Cryptochironomus				1
	Cryptotendipes				2
	Demicryptochironomus				1
	Diamesa				3
	Dicrotendipes				0
	Diplocladius				3
	Doncricotopus				3
	Einfeldia				0
	Endochironomus				0
	Epoicocladius				2
	Eukiefferiella claripennis-gp				1
	Eukiefferiella				3
	Glyptotendipes	x	36	16	0
	Harnischia				1
	Heleniella				4
	Helopelopia				3
	Heterotanytarsus				0
	Heterotrissocladius hirtapex				2
	Heterotrissocladius				1
	Hydrobaenus				1
	Labrundinia				1
	Larsia				1
	Lauterborniella				0
	Limnophyes				1
	Lipiniella				1
	Macropelopia				3
	Meropelopia				3
	Metriocnemus				3
	Microchironomus				1
	Microcricotopus				1
	Micropsectra				3
	Microtendipes				2
	Monodiamesa				1
	Nanocladius				3
	Natarsia				3
	Nilotanytus				2
	Nilothauma				1
	Odontomesa				2
	Orthocladius				
	Pagastia				3
	Pagastiella				0
	Parachaetocladius				3
	Parachironomus				1
	Paracladopelma doris				3
	Paracladopelma doris-gp				2
	Paracladopelma galaptera				0
	Paracladopelma nais				2
	Paracladopelma nereis				3
	Paracladopelma undine				2
	Paracladopelma winnelli				2
	Parakiefferiella				2
	Paralauterborniella				0
	Paramerina				
	Parametriocnemus				3
	Paratanytarsus				1
	Paratendipes				2
	Pentaneura				2

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Phaenopsectra				1
	Polypedilum albicorne				3
	Polypedilum angulum				
	Polypedilum aviceps				3
	Polypedilum fallax				1
	Polypedilum flavum (convictum)				2
	Polypedilum halterale				0
	Polypedilum illinoense				1
	Polypedilum laetum				2
	Polypedilum nubeculosum				2
	Polypedilum scalaenum				1
	Polypedilum trigonus				0
	Polypedilum tritum				0
	Potthastia				1
	Procladius				0
	Prodiamesa				3
	Protanypus				0
	Psectrocladius	x			1
	Psectrotanypus	x		4	0
	Pseudochironomus				1
	Rheocricotopus				2
	Rheopelopia				3
	Rheotanytarsus				3
	Robackia				2
	Saetheria				2
	Stempellina				2
	Stempellinella				3
	Stenochironomus				2
	Stictochironomus				2
	Stilocladius				3
	Sublettea				2
	Sympotthastia				3
	Syndiamesa				3
	Synorthocladius				3
	Tanypus				1
	Tanytarsus				2
	Thienemanniella				2
	Thienemannimyia				2
	Tribelos				1
	Trissopelopia				2
	Tvetenia				2
	Unniella				
	Xenochironomus	x	24	4	2
	Xylotopus				2
	Zalutschia				0
	Zavreliomyia				2
	Culicidae				0
	Dixidae				1
	Dolichopodidae				2
	Empididae				2
	Ephydriidae			1	1
	Muscidae				1
	Psychodidae				0
	Ptychopteridae				1
	Simuliidae				2
	Stratiomyidae				0
	Syrphidae				0
	Tabanidae:				
	Chrysops				2
	Tabanus				0
	Tipulidae:				
	Antocha				3
	Cryptolabis				4

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Dactylolobis				3
	Dicranota				3
	Erioptera				1
	Helius				1
	Hexatoma				2
	Limnophila				2
	Limonia				2
	Ormosia				3
	Pedicia				3
	Pilaria				1
	Pseudolimnophila				3
	Tipula				
	Crustaceans:				
	AMPHIPODS:				
	Crangonyctidae:				
	Crangonyx gracilis-cmpx				3
	Crangonyx rivularis				3
	Crangonyx	x	42	6	2
	Gammaridae:				
	Gammarus fasciatus				2
	Gammarus lacustris				3
	Gammarus pseudolimnae				3
	Hyalellidae:				
	Hyalella				2
	CRAYFISHES:				
	Cambaridae:				
	Cambarus				1
	Orconectes				2
	Palaemonetidae:				
	Palaemonetes				3
	ISOPODS:				
	Asellidae:				
	Caecidotea	x	12		1
	Lirceus				2
	Molluscs:				
	BIVALVES:				
	Dreissenidae:				
	Dreissena				1
	Sphaeriidae:				
	musculium lacustre				1
	Musculium partumeium				1
	Musculium securis				1
	musculium transversum				2
	Pisidium				1
	Sphaerium fabale				3
	Sphaerium occidentale				0
	Sphaerium rhomboideum				1
	Sphaerium simile				1
	Sphaerium striatinum	x	6	6	2
	Unionidae:				
	Actinonaias carinata				2
	Actinonaias ligamentina				3
	Alasmidonta marginata				3
	Alasmidonta viridis				3
	Amblema plicata				2
	Anodontoides ferussacianus				3
	Carunculina parva				1
	Cyclonaias tuberculata				2
	Elliptio dilatata				1
	Epioblasma(=Dysnomia)				2
	Fusconaia flava				1
	Lampsilis cardium				3
	Lampsilis fasciola				3

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Lampsilis radiata siliquoidea				1
	Lampsilis ventricosa				1
	Lasmigona complanata				1
	Lasmigona compressa				3
	Lasmigona costata				2
	Leptodea fragilis				1
	Ligumia nasuta				0
	Ligumia recta				2
	Obliquaria reflexa				1
	Obovaria subrotunda				2
	Pleurobema coccineum				1
	Proptera alata				0
	Ptychobranthus fasciolaris				3
	Pyganodon (=Anodonta, in part)				1
	Quadrula pustulosa				1
	Quadrula quadrula				2
	Simpsoniconcha ambigua				2
	Strophitus undulatus				3
	Truncilla				2
	Villosa fabalis				2
	Villosa iris				2
	SNAILS:				
	Ancylidae:				
	Ferrissia fragilis				0
	Ferrissia parallela				1
	Ferrissia rivularis				2
	Bithyniidae:				
	Bithynia				1
	Hydrobiidae:				
	Amnicola				2
	Birgella (=Somatogyrus)				2
	Cincinnatia				1
	Fontigens				3
	Potamopyrgus				1
	Probythinella				2
	Lymnaeidae:				
	Bulimnea				1
	Fossaria				1
	Lymnaea				1
	Pseudosuccinea				0
	Radix				1
	Stagnicola				0
	Physidae:				
	Physella	x		6	0
	Planorbidae:				
	Gyraulus			2	1
	Helisoma				1
	Planorbella	x		4	0
	Planorbula				1
	Prometis				2
	Pleuroceridae:				
	Elimia (=Goniobasis)				2
	Pleurocera				1
	Valvatidae:				
	Valvata				2
	Viviparidae:				
	Campeloma				1
	Cipangopaludina				1
	Viviparus				1
	Annelids:				
	LEECHES:				
	Erpobdellidae:				
	Dina dubia				1

	Macroinvertebrate	Qualitative	Quantitative 1	Quantitative 2	BioMAP Sensitivity Value
	Dina parva				0
	Erpobdella				1
	Mooreobdella				2
	Nephelopsis				2
	Hirudinidae:				
	Haemopsis				1
	Macrobdella				0
	Glossiphoniidae:				
	Alboglossiphonia				2
	Batrachobdella				2
	Glossiphonia				2
	Helobdella elongata				1
	Helobdella fusca				2
	Helobdella papillata				1
	Helobdella stagnalis				2
	Helobdella triserialis				2
	Placobdella				1
	Theromyzon				
	WORMS:				
	enchytraeidae	x	10	8	1
	Tubificidae:				
	Aulodrilus				2
	Bothrioneurum				2
	Branchiura				0
	Ilyodrilus				0
	Isochaetides curvisetosus				3
	Isochaetides freyi				1
	Limnodrilus	x	60	60	0
	Potamothenix bavaricus				2
	Potamothenix moldaviensis				2
	Potamothenix vejdoskyi				2
	Quistadrilus				0
	Rhyacodrilus				3
	Spirosperma				1
	Tasserkidrilus				2
	Tubifex				0
	Oligochaete				
	no cheate				0
	Platyhelminthes:				0
	FLATWORMS:				
	Alloeocoela				1
	Tricladida				3
	Total sum/0.05m2		248	164	
	Total Taxa	18			
	BioMap WQI		3.517806795	2.65488626	
	avareage	3.086346528			
	HBI rate	8.658653846			
	EPT Richness (%)	0			
	Percentage Oligochaetes	33.17307692			
	Percentage Chironomidae	45.19230769			
	Percentage Insects	73.07692308			
	Simpsons diversity	0.216856849			
	Simpsons index of diversity	0.783143151			
	Simpsons reciprocal	4.611336955			

Appendix F

Plant Species List

Appendix F. Plant Species List

P02 3666 Scotland FOD5-5

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Berberidaceae		Barberry Family								
Podophyllum	peltatum	May-apple	5	3		S5			G5	X
Caprifoliaceae		Honeysuckle Family								
Viburnum	rafinesquianum	Downy Arrow-wood	7	5		S5			G5	X
Fagaceae		Beech Family								
Quercus	alba	White Oak	6	3		S5			G5	C
Juglandaceae		Walnut Family								
Carya	cordiformis	Bitternut hickory	6	0		S5			G5	X
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
Agrimonia	pubescens	Hairy Agrimony	5	5		S4			G5	VU
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								
Cyperaceae		Sedge Family								
Carex	sp.	Sedge species								

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	7	
Native Species	6	85.71%
Exotic Species	1	14.29%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.07%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	1	
S5 Species	5	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	5.50	
CC 0 to 3 – Lowest Sensitivity	0	0.00%
CC 4 to 6 – Moderate Sensitivity	5	83.33%
CC 7 to 8 – High Sensitivity	1	16.67%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	13.47	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-3.00	
Weediness = -1 – Low Potential Invasiveness	0	0.00%
Weediness = -2 – Moderate Potential Invasiveness	0	0.00%
Weediness = -3 – High Potential Invasiveness	1	100.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	3.14	
Upland	2	28.57%
Facultative Upland	4	57.14%
Facultative	1	14.29%
Facultative Wetland	0	0.00%
Obligate Wetland	0	0.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>PTERIDOPHYTES</u>		<u>FERNS & ALLIES</u>								
Equisetaceae		Horsetail Family								
<i>Equisetum</i>	<i>arvense</i>	Field Horsetail	0	0		S5			G5	C
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
Pinaceae		Pine Family								
<i>Picea</i>	<i>abies</i>	Norway Spruce		5	-1	SE3			G?	I
<i>Pinus</i>	<i>strobus</i>	Eastern White Pine	4	3		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Apocynaceae		Dogbane Family								
<i>Vinca</i>	<i>minor</i>	Periwinkle		5	-2	SE5			G?	IR
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>incarnata ssp. incarnata</i>	Swamp Milkweed	6	-5		S5			G5T5	C
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Arctium</i>	<i>minus</i>	Common Burdock		5	-2	SE5			G?T?	IC
<i>Symphyotrichum</i>	<i>cordifolium</i>	Heart-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>ericoides</i>	Heath Aster	4	4		S5			G5T?	
<i>Symphyotrichum</i>	<i>lanceolatum</i>	Tall White Aster	3	-3		S5			G5T?	C
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	C
<i>Centaurea</i>	<i>biebersteinii</i>	Spotted Knapweed		5	-3	SE5			G?	I
<i>Leucanthemum</i>	<i>vulgare</i>	Ox-eye Daisy		5	-1	SE5			G?	
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	I
<i>Erigeron</i>	<i>philadelphicus ssp. philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	C
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>flexicaulis</i>	Zig-zag Goldenrod	6	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>junceae</i>	Early Goldenrod	3	5		S5			G5	X
<i>Solidago</i>	<i>nemoralis ssp. nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	X
<i>Sonchus</i>	<i>arvensis ssp. arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	IC
Brassicaceae		Mustard Family								
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	IC
Caprifoliaceae		Honeysuckle Family								
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	I

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Silene</i>	<i>vulgaris</i>	Catchfly		5	-1	SE5			G?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Dipsacaceae		Teasel Family								
<i>Dipsacus</i>	<i>fullonum ssp. sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	IC
Elaeagnaceae		Oleaster Family								
<i>Elaeagnus</i>	<i>angustifolia</i>	Russian Olive		4	-1	SE3			G?	
Fabaceae		Pea Family								
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	I
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Trifolium</i>	<i>repens</i>	White Clover		2	-1	SE5			G?	I
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	I
Guttiferae		St. John's-wort Family								
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	IC
Lamiaceae		Mint Family								
<i>Prunella</i>	<i>vulgaris ssp. vulgaris</i>	Common Heal-all		0	-1	SE3			G5T?	
Lythraceae		Loosestrife Family								
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	IC
Oleaceae		Olive Family								
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	C
Onagraceae		Evening-primrose Family								
<i>Circaea</i>	<i>lutetiana ssp. canadensis</i>	Enchanter's Nightshade	3	3		S5			G5T5	X
Oxalidaceae		Wood Sorrel Family								
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3		S5			G5	X
Plantaginaceae		Plantain Family								
<i>Plantago</i>	<i>major</i>	Common Plantain		-1	-1	SE5			G5	IC
Polygonaceae		Smartweed Family								
<i>Polygonum</i>	<i>persicaria</i>	Lady's-thumb		-3	-1	SE5			G?	I
Primulaceae		Primrose Family								
<i>Lysimachia</i>	<i>nummularia</i>	Moneywort		-4	-3	SE5			G?	I
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Crataegus</i>	<i>species</i>	Hawthorn species								
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	C
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Physocarpus</i>	<i>opulifolius</i>	Ninebark	5	-2		S5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	C
<i>Prunus</i>	<i>virginiana</i>	Choke Cherry	2	1		S5			G5T?	C
<i>Rosa</i>	<i>multiflora</i>	Multiflora Rose		3	-3	SE4			G?	I
<i>Rubus</i>	<i>idaeus</i>	Red Raspberry	0		-2	SE1			G5T5	
Scrophulariaceae		Figwort Family								
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	I

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	IC
Ulmaceae		Elm Family								
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	X
Vitaceae		Grape Family								
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>pensylvanica</i>	Pennsylvania Sedge	5	5		S5			G5	C
<i>Carex</i>	<i>spicata</i>	Spiked Sedge		5	-1	SE5			G?	IC
Poaceae		Grass Family								
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Hordeum</i>	<i>jubatum ssp. jubatum</i>	Squirrel-tail Grass		-1	-1	SE5			G5T?	I
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	X
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C
<i>Setaria</i>	<i>pumila</i>	Yellow Foxtail		0	-1	SE5			G?	I
Typhaceae		Cattail Family								
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	74	
Native Species	36	48.65%
Exotic Species	38	51.35%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.74%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	34	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.36	
CC 0 to 3 – Lowest Sensitivity	26	72.22%
CC 4 to 6 – Moderate Sensitivity	10	27.78%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	14.17	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.82	
Weediness = -1 – Low Potential Invasiveness	18	47.37%
Weediness = -2 – Moderate Potential Invasiveness	9	23.68%
Weediness = -3 – High Potential Invasiveness	11	28.95%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.52	
Upland	19	25.68%
Facultative Upland	22	29.73%
Facultative	13	17.57%
Facultative Wetland	14	18.92%
Obligate Wetland	3	4.05%

Appendix F. Plant Species List
P02 3298 Scotland Dr MAM2-2 with inclusion MAS2

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Asclepiadaceae		Milkweed Family								
Asclepias	incarnata ssp. incarnata	Swamp Milkweed	6	-5		S5			G5T5	C
Asteraceae		Composite or Aster Family								
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Cornaceae		Dogwood Family								
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Lamiaceae		Mint Family								
Lycopus	americanus	Cut-leaved Water-horehound	4	-5		S5			G5	C
Lythraceae		Loosestrife Family								
Lythrum	salicaria	Purple Loosestrife		-5	-3	SE5			G5	IC
Polygonaceae		Smartweed Family								
Polygonum	persicaria	Lady's-thumb		-3	-1	SE5			G?	I
Rumex	crispus	Curly-leaf Dock		-1	-2	SE5			G?	IC
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
Rosa	multiflora	Multiflora Rose		3	-3	SE4			G?	I
Salicaceae		Willow Family								
Salix	species	Willow species								
Salix	discolor	Pussy Willow	3	-3		S5			G5	X
Salix	exigua	Sandbar Willow	3	-5		S5			G5	C
Verbenaceae		Vervain Family								
Verbena	hastata	Blue Vervain	4	-4		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								
Alismataceae		Water-plantain Family								
Alisma	plantago-aquatica	Common Water-plantain	3	-5		S5			G5	C
Cyperaceae		Sedge Family								
Cyperus	odoratus	Fragrant Umbrella Sedge	5	-3		S5			G5	R5
Scirpus	cyperinus	Wool-grass	4	-5		S5			G5	C
Juncaceae		Rush Family								
Juncus	effusus var. solutus	Soft Rush	4	-5		S5			G5T?	X
Juncus	tenuis	Path Rush	0	0		S5			G5	X
Lemnaceae		Duckweed Family								
Lemna	minor	Lesser Duckweed	2	-5		S5			G5	X
Lemna	trisulca	Star Duckweed	4	-5		S5			G5	X
Poaceae		Grass Family								
Agrostis	stolonifera	Redtop		-3		S5			G5	C
Phalaris	arundinacea	Reed Canary Grass	0	-4		S5			G5	X
Phleum	pratense	Timothy		3	-1	SE5			G?	IC
Phragmites	australis	Common Reed	0	-4		S5			G5	X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Typhaceae		Cattail Family								
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	X
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	25	
Native Species	19	76.00%
Exotic Species	6	24.00%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.25%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	20	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.79	
CC 0 to 3 – Lowest Sensitivity	12	63.16%
CC 4 to 6 – Moderate Sensitivity	7	36.84%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	12.16	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.17	
Weediness = -1 – Low Potential Invasiveness	2	33.33%
Weediness = -2 – Moderate Potential Invasiveness	1	16.67%
Weediness = -3 – High Potential Invasiveness	3	50.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	-2.81	
Upland	0	0.00%
Facultative Upland	4	16.00%
Facultative	2	8.00%
Facultative Wetland	9	36.00%
Obligate Wetland	11	44.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Equisetaceae		Horsetail Family								
<i>Equisetum</i>	<i>arvense</i>	Field Horsetail	0	0		S5			G5	C
GYMNOSPERMS		CONIFERS								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
Pinaceae		Pine Family								
<i>Picea</i>	<i>abies</i>	Norway Spruce		5	-1	SE3			G?	I
DICOTYLEDONS		DICOTS								
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>incarnata</i> ssp. <i>incarnata</i>	Swamp Milkweed	6	-5		S5			G5T5	C
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Symphyotrichum</i>	<i>ericoides</i>	Heath Aster	4	4		S5			G5T?	
<i>Symphyotrichum</i>	<i>lanceolatum</i>	Tall White Aster	3	-3		S5			G5T?	C
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	X
<i>Symphyotrichum</i>	<i>puniceum</i> var. <i>puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	I
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	C
<i>Erigeron</i>	<i>philadelphicus</i> ssp. <i>philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	I
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>juncea</i>	Early Goldenrod	3	5		S5			G5	X
<i>Tanacetum</i>	<i>vulgare</i>	Common Tansy		5	-1	SE5			G?	IC
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	X
<i>Silene</i>	<i>vulgaris</i>	Catchfly		5	-1	SE5			G?	X
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Dipsacaceae		Teasel Family								IC
<i>Dipsacus</i>	<i>fullonum</i> ssp. <i>sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	
Elaeagnaceae		Oleaster Family								
<i>Elaeagnus</i>	<i>angustifolia</i>	Russian Olive		4	-1	SE3			G?	
Fabaceae		Pea Family								I
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	IC
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	
Guttiferae		St. John's-wort Family								IC

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	
Lamiaceae		Mint Family								I
<i>Prunella</i>	<i>vulgaris ssp. vulgaris</i>	Common Heal-all		0	-1	SE3			G5T?	
Lythraceae		Loosestrife Family								IC
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	
Onagraceae		Evening-primrose Family								X
<i>Oenothera</i>	<i>biennis</i>	Common Evening-primrose	0	3		S5			G5	
Oxalidaceae		Wood Sorrel Family								X
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3		S5			G5	
Plantaginaceae		Plantain Family								IC
<i>Plantago</i>	<i>lanceolata</i>	Ribgrass		0	-1	SE5			G5	IC
Polygonaceae		Smartweed Family								I
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
<i>Frangula</i>	<i>alnus</i>	Glossy Buckthorn		-1	-3	SE5			G?	
Rosaceae		Rose Family								C
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	X
<i>Malus</i>	<i>pumila</i>	Common Crabapple		5	-1	SE5			G5	X
Salicaceae		Willow Family								X
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	X
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	IR
<i>Salix X</i>	<i>rubens</i>	Reddish Willow		-4	-3	SE4			HYB	X
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	C
MONOCOTYLEDONS		MONOCOTS								C
Poaceae		Grass Family								C
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	C
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	I
<i>Setaria</i>	<i>pumila</i>	Yellow Foxtail		0	-1	SE5			G?	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	51	
Native Species	24	47.06%
Exotic Species	27	52.94%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.51%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	22	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.08	
CC 0 to 3 – Lowest Sensitivity	18	75.00%
CC 4 to 6 – Moderate Sensitivity	6	25.00%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	10.21	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.78	
Weediness = -1 – Low Potential Invasiveness	14	51.85%
Weediness = -2 – Moderate Potential Invasiveness	5	18.52%
Weediness = -3 – High Potential Invasiveness	8	29.63%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.14	
Upland	12	23.53%
Facultative Upland	14	27.45%
Facultative	12	23.53%
Facultative Wetland	8	15.69%
Obligate Wetland	5	9.80%

Appendix F. Plant Species List
P02-3137 Scotland Dr CUM1-1 with inclusion MAM2

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>PTERIDOPHYTES</u>		<u>FERNS & ALLIES</u>								
Equisetaceae		Horsetail Family								
<i>Equisetum</i>	<i>arvense</i>	Field Horsetail	0	0		S5			G5	C
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>incarnata ssp. incarnata</i>	Swamp Milkweed	6	-5		S5			G5T5	C
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Symphyotrichum</i>	<i>ericoides</i>	Heath Aster	4	4		S5			G5T?	
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	X
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	I
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	C
<i>Erigeron</i>	<i>philadelphicus ssp. philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	I
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>juncea</i>	Early Goldenrod	3	5		S5			G5	X
<i>Tanacetum</i>	<i>vulgare</i>	Common Tansy		5	-1	SE5			G?	IC
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	I
Fabaceae		Pea Family								I
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	IC
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
Guttiferae		St. John's-wort Family								IC
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	
Lamiaceae		Mint Family								I
<i>Prunella</i>	<i>vulgaris ssp. vulgaris</i>	Common Heal-all		0	-1	SE3			G5T?	
Lythraceae		Loosestrife Family								IC
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	
Onagraceae		Evening-primrose Family								X
<i>Oenothera</i>	<i>biennis</i>	Common Evening-primrose	0	3		S5			G5	
Oxalidaceae		Wood Sorrel Family								X
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3		S5			G5	
Polygonaceae		Smartweed Family								I
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	
Rosaceae		Rose Family								C
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	X
Salicaceae		Willow Family								X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	X
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	IR
Vitaceae		Grape Family								C
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	
MONOCOTYLEDONS		MONOCOTS								C
Poaceae		Grass Family								C
<i>Bromus</i>	<i>inermis</i> ssp. <i>inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	C
<i>Poa</i>	<i>pratensis</i> ssp. <i>pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	I
<i>Setaria</i>	<i>pumila</i>	Yellow Foxtail		0	-1	SE5			G?	
Typhaceae		Cattail Family								X
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	37	
Native Species	22	59.46%
Exotic Species	15	40.54%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.37%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	20	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	1.59	
CC 0 to 3 – Lowest Sensitivity	19	86.36%
CC 4 to 6 – Moderate Sensitivity	3	13.64%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	7.46	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.80	
Weediness = -1 – Low Potential Invasiveness	7	46.67%
Weediness = -2 – Moderate Potential Invasiveness	4	26.67%
Weediness = -3 – High Potential Invasiveness	4	26.67%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	0.68	
Upland	7	18.92%
Facultative Upland	10	27.03%
Facultative	9	24.32%
Facultative Wetland	5	13.51%
Obligate Wetland	6	16.22%

Appendix F. Plant Species List

3405 Scotland Dr CUP3 complex with OAO/CUM1-1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
<i>Thuja</i>	<i>occidentalis</i>	Eastern White Cedar	4	-3		S5			G5	X
Pinaceae		Pine Family								
<i>Picea</i>	<i>abies</i>	Norway Spruce		5	-1	SE3			G?	I
<i>Pinus</i>	<i>banksiana</i>	Jack Pine	9	3		S5			G5	I
<i>Pinus</i>	<i>sylvestris</i>	Scotch Pine		5	-3	SE5			G?	IR
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Anacardiaceae		Sumac or Cashew Family								
<i>Toxicodendron</i>	<i>radicans</i> ssp. <i>negundo</i>	Poison-ivy	5	-1		S5			G5T	X
<i>Rhus</i>	<i>hirta</i>	Staghorn Sumac	1	5		S5			G5	C
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>incarnata</i> ssp. <i>incarnata</i>	Swamp Milkweed	6	-5		S5			G5T5	C
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Achillea</i>	<i>millefolium</i> var. <i>millefolium</i>	Common Yarrow		3	-1	SE?			G5T?	
<i>Arctium</i>	<i>minus</i>	Common Burdock		5	-2	SE5			G?T?	IC
<i>Artemisia</i>	<i>vulgaris</i>	Common Mugwort		5	-1	SE5			G?	IR
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
<i>Centaurea</i>	<i>jacea</i>	Brown Knapweed		5	-1	SE5			G?	I
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	I
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	C
<i>Erigeron</i>	<i>philadelphicus</i> ssp. <i>philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	I
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>juncea</i>	Early Goldenrod	3	5		S5			G5	X
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	I
Brassicaceae		Mustard Family								IC
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	X
<i>Silene</i>	<i>vulgaris</i>	Catchfly		5	-1	SE5			G?	X
<i>Viburnum</i>	<i>acerifolium</i>	Maple-leaved Viburnum	6	5		S5			G5	C
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Cucurbitaceae		Gourd Family								X
<i>Echinocystis</i>	<i>lobata</i>	Prickly Cucumber	3	-2		S5			G5	
Fabaceae		Pea Family								I
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	IC
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Trifolium</i>	<i>repens</i>	White Clover		2	-1	SE5			G?	I
Guttiferae		St. John's-wort Family								IC
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	
Juglandaceae		Walnut Family								X
<i>Juglans</i>	<i>nigra</i>	Black Walnut	5	3		S4			G5	X
Lamiaceae		Mint Family								I
<i>Glechoma</i>	<i>hederacea</i>	Creeping Charlie		5	-2	SE5			G?	IC
<i>Prunella</i>	<i>vulgaris</i> ssp. <i>vulgaris</i>	Common Heal-all		0	-1	SE3			G5T?	
Lythraceae		Loosestrife Family								IC
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	
Oleaceae		Olive Family								C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
<i>Syringa</i>	<i>vulgaris</i>	Common Lilac		5	-2	SE5			G?	
Onagraceae		Evening-primrose Family								X
<i>Oenothera</i>	<i>biennis</i>	Common Evening-primrose	0	3		S5			G5	
Papaveraceae		Poppy Family								I
<i>Chelidonium</i>	<i>majus</i>	Celandine		5	-3	SE5			G?	
Plantaginaceae		Plantain Family								IC
<i>Plantago</i>	<i>lanceolata</i>	Ribgrass		0	-1	SE5			G5	IC
<i>Plantago</i>	<i>major</i>	Common Plantain		-1	-1	SE5			G5	
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
<i>Frangula</i>	<i>alnus</i>	Glossy Buckthorn		-1	-3	SE5			G?	
Rosaceae		Rose Family								C
<i>Potentilla</i>	<i>norvegica</i> ssp. <i>norvegica</i>	Cinquefoil	0			SU			G5T?	C
<i>Potentilla</i>	<i>simplex</i>	Old-field Cinquefoil	3	4		S5			G5	C
<i>Rosa</i>	<i>multiflora</i>	Multiflora Rose		3	-3	SE4			G?	X
Rubiaceae		Madder Family								I
<i>Galium</i>	<i>aparine</i>	Cleavers	4	3		S5			G5	X
<i>Galium</i>	<i>mollugo</i>	White Bedstraw		5	-2	SE5			G?	
<i>Galium</i>	<i>triflorum</i>	Sweet-scented Bedstraw	4	2		S5			G5	C
Salicaceae		Willow Family								X
<i>Populus</i>	<i>balsamifera</i> ssp. <i>balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	X
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	X
<i>Salix</i> X	<i>rubens</i>	Reddish Willow		-4	-3	SE4			HYB	X
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	C
Ulmaceae		Elm Family								X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	IR
Verbenaceae		Vervain Family								X
<i>Verbena</i>	<i>hastata</i>	Blue Vervain	4	-4		S5			G5	
Vitaceae		Grape Family								C
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	
MONOCOTYLEDONS		MONOCOTS								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>vulpinoidea</i>	Fox Sedge	3	-5		S5			G5	VU
<i>Eleocharis</i>	<i>acicularis</i>	Needle Spike-rush	5	-5		S5			G5	C
<i>Scirpus</i>	<i>atrovirens</i>	Dark-green Bulrush	3	-5		S5			G5?	C
Juncaceae		Rush Family								X
<i>Juncus</i>	<i>effusus var. solutus</i>	Soft Rush	4	-5		S5			G5T?	
<i>Juncus</i>	<i>tenuis</i>	Path Rush	0	0		S5			G5	X
Poaceae		Grass Family								C
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	IC
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	X
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	I
<i>Glyceria</i>	<i>striata</i>	Fowl Meadow Grass	3	-5		S5			G5	X
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	X
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	C
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	I

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	76	
Native Species	41	53.95%
Exotic Species	35	46.05%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.76%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	1	
S5 Species	40	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.68	
CC 0 to 3 – Lowest Sensitivity	26	63.41%
CC 4 to 6 – Moderate Sensitivity	14	34.15%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	1	2.44%
Floral Quality Index (FQI)	17.18	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.94	
Weediness = -1 – Low Potential Invasiveness	14	40.00%
Weediness = -2 – Moderate Potential Invasiveness	9	25.71%
Weediness = -3 – High Potential Invasiveness	12	34.29%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	0.96	
Upland	19	25.00%
Facultative Upland	21	27.63%
Facultative	13	17.11%
Facultative Wetland	15	19.74%
Obligate Wetland	8	10.53%

Appendix F. Plant Species List
3438 Manning Dr FOD2-3

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Anacardiaceae		Sumac or Cashew Family								
<i>Toxicodendron</i>	<i>radicans ssp. negundo</i>	Poison-ivy	5	-1		S5			G5T	X
Asteraceae		Composite or Aster Family								
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
Brassicaceae		Mustard Family								IC
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	X
Celastraceae		Staff-tree Family								C
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5		S5			G5	
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicled Dogwood/Gray Dogwood	2	-2		S5			G5?	C
Elaeagnaceae		Oleaster Family								
<i>Elaeagnus</i>	<i>angustifolia</i>	Russian Olive		4	-1	SE3			G?	
Grossulariaceae		Currant Family								C
<i>Ribes</i>	<i>rubrum</i>	Red Currant		5	-2	SE5			G4G5	X
Juglandaceae		Walnut Family								X
<i>Carya</i>	<i>cordiformis</i>	Bitternut hickory	6	0		S5			G5	X
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	
<i>Juglans</i>	<i>nigra</i>	Black Walnut	5	3		S4			G5	x
Oleaceae		Olive Family								C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
Onagraceae		Evening-primrose Family								X
<i>Circaea</i>	<i>lutetiana ssp. canadensis</i>	Enchanter's Nightshade	3	3		S5			G5T5	X
Oxalidaceae		Wood Sorrel Family								X
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3		S5			G5	
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	I
<i>Prunus</i>	<i>virginiana</i>	Choke Cherry	2	1		S5			G5T?	I
<i>Rubus</i>	<i>idaeus</i>	Red Raspberry	0		-2	SE1			G5T5	
Scrophulariaceae		Figwort Family								IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	
Vitaceae		Grape Family								
<i>Parthenocissus</i>	<i>inserta</i>	Inserted Virginia-creeper	3	3		S5			G5	

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>pensylvanica</i>	Pennsylvania Sedge	5	5		S5			G5	C
Liliaceae		Lily Family								X
<i>Erythronium</i>	<i>americanum ssp. americanum</i>	Yellow Dog's-tooth Violet	5	5		S5			G5T5	
Poaceae		Grass Family								IC
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	C
<i>Poa</i>	<i>palustris</i>	Fowl Meadow Grass	5	-4		S5			G5	I
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	32	
Native Species	23	71.88%
Exotic Species	9	28.13%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.32%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	1	
S5 Species	21	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.91	
CC 0 to 3 – Lowest Sensitivity	14	60.87%
CC 4 to 6 – Moderate Sensitivity	9	39.13%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	13.97	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.22	
Weediness = -1 – Low Potential Invasiveness	2	22.22%
Weediness = -2 – Moderate Potential Invasiveness	3	33.33%
Weediness = -3 – High Potential Invasiveness	4	44.44%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.90	
Upland	6	18.75%
Facultative Upland	13	40.63%
Facultative	6	18.75%
Facultative Wetland	5	15.63%
Obligate Wetland	0	0.00%

Appendix F. Plant Species List
3465 Scotland Dr CUM1-1 complex with MAS2/CUT1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
Asclepias	syriaca	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
Achillea	millefolium var. millefolium	Common Yarrow		3	-1	SE?			G5T?	
Ambrosia	artemisiifolia	Common Ragweed	0	3		S5			G5	C
Arctium	minus	Common Burdock		5	-2	SE5			G?T?	IC
Symphyotrichum	cordifolium	Heart-leaved Aster	5	5		S5			G5	C
Symphyotrichum	ericoides	Heath Aster	4	4		S5			G5T?	
Symphyotrichum	lanceolatum	Tall White Aster	3	-3		S5			G5T?	C
Symphyotrichum	lateriflorum	Calico Aster	3	-2		S5			G5T5	C
Symphyotrichum	novae-angliae	New England Aster	2	-3		S5			G5	X
Symphyotrichum	puniceum var. puniceum	Purple-stemmed Aster	6	-5		S5			G5T?	X
Centaurea	jacea	Brown Knapweed		5	-1	SE5			G?	I
Cichorium	intybus	Chicory		5	-1	SE5			G?	IC
Cirsium	arvense	Canada Thistle		3	-1	SE5			G?	I
Erigeron	annus	Eastern Daisy Fleabane	0	1		S5			G5	C
Lactuca	serriola	Prickly Lettuce		0	-1	SE5			G?	C
Solidago	altissima	Tall Goldenrod	1	3		S5				X
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	gigantea	Giant Goldenrod	4	-3		S5			G5	X
Solidago	juncea	Early Goldenrod	3	5		S5			G5	X
Solidago	nemoralis ssp. nemoralis	Gray Goldenrod	2	5		S5			G5T?	I
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Taraxacum	officinale	Common Dandelion		3	-2	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
Viburnum	opulus	Guelder Rose		0	-1	SE4			G5	X
Cornaceae		Dogwood Family								X
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	
Dipsacaceae		Teasel Family								IC
Dipsacus	fullonum ssp. sylvestris	Wild Teasel		5	-1	SE5			G?T?	
Fabaceae		Pea Family								I
Lotus	corniculatus	Bird's-foot Trefoil		1	-2	SE5			G?	IC
Vicia	cracca	Tufted Vetch		5	-1	SE5			G?	
Guttiferae		St. John's-wort Family								IC
Hypericum	perforatum	Common St. John's-wort		5	-3	SE5			G?	
Juglandaceae		Walnut Family								X
Juglans	nigra	Black Walnut	5	3		S4			G5	x
Lythraceae		Loosestrife Family								IC
Lythrum	salicaria	Purple Loosestrife		-5	-3	SE5			G5	
Oleaceae		Olive Family								C
Fraxinus	americana	White Ash	4	3		S5			G5	X
Polygonaceae		Smartweed Family								I

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
<i>Crataegus</i>	<i>species</i>	Hawthorn species								I
<i>Crataegus</i>	<i>monogyna</i>	English Hawthorn		5	-1	SE5			G5	X
<i>Malus</i>	<i>pumila</i>	Common Crabapple		5	-1	SE5			G5	X
Salicaceae		Willow Family								X
<i>Populus</i>	<i>deltoides ssp. deltoides</i>	Eastern Cottonwood	4	-1		SU			G5T?	X
<i>Salix</i>	<i>eriocephala</i>	Missouri Willow	4	-3		S5			G5	X
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	X
Scrophulariaceae		Figwort Family								IC
<i>Linaria</i>	<i>vulgaris</i>	Butter-and-eggs		5	-1	SE5			G?	
MONOCOTYLEDONS		MONOCOTS								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>spicata</i>	Spiked Sedge		5	-1	SE5			G?	VU
Poaceae		Grass Family								IC
<i>Agrostis</i>	<i>gigantea</i>	Red-top		0	-2	SE5			G4G5	IC
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	X
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	I
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	X
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	C
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	
Typhaceae		Cattail Family								
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	50	
Native Species	24	48.00%
Exotic Species	26	52.00%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.50%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	1	
S5 Species	22	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.54	
CC 0 to 3 – Lowest Sensitivity	16	66.67%
CC 4 to 6 – Moderate Sensitivity	8	33.33%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	12.45	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.62	
Weediness = -1 – Low Potential Invasiveness	15	57.69%
Weediness = -2 – Moderate Potential Invasiveness	6	23.08%
Weediness = -3 – High Potential Invasiveness	5	19.23%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.59	
Upland	16	32.00%
Facultative Upland	13	26.00%
Facultative	8	16.00%
Facultative Wetland	8	16.00%
Obligate Wetland	4	8.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>PTERIDOPHYTES</u>		<u>FERNS & ALLIES</u>								
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
Pinaceae		Pine Family								
<i>Picea</i>	<i>abies</i>	Norway Spruce		5	-1	SE3			G?	I
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Asteraceae		Composite or Aster Family								
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
Betulaceae		Birch Family								C
<i>Ostrya</i>	<i>virginiana</i>	Hop Hornbeam - Ironwood	4	4		S5			G5	
Brassicaceae		Mustard Family								IC
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	X
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Paniced Dogwood/Gray Dogwood	2	-2		S5			G5?	C
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Fagaceae		Beech Family								C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	
Juglandaceae		Walnut Family								X
<i>Juglans</i>	<i>nigra</i>	Black Walnut	5	3		S4			G5	x
Oleaceae		Olive Family								C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
<i>Ligustrum</i>	<i>vulgare</i>	Common Privet		1	-2	SE5			G?	I
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
<i>Crataegus</i>	<i>species</i>	Hawthorn species								I
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	X
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	I
Ulmaceae		Elm Family								
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>pensylvanica</i>	Pennsylvania Sedge	5	5		S5			G5	C
Liliaceae		Lily Family								X
<i>Erythronium</i>	<i>americanum ssp. americanum</i>	Yellow Dog's-tooth Violet	5	5		S5			G5T5	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	21	
Native Species	16	76.19%
Exotic Species	5	23.81%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.21%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	1	
S5 Species	14	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	3.50	
CC 0 to 3 – Lowest Sensitivity	8	50.00%
CC 4 to 6 – Moderate Sensitivity	8	50.00%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	14.00	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.40	
Weediness = -1 – Low Potential Invasiveness	1	20.00%
Weediness = -2 – Moderate Potential Invasiveness	1	20.00%
Weediness = -3 – High Potential Invasiveness	3	60.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.86	
Upland	4	19.05%
Facultative Upland	9	42.86%
Facultative	4	19.05%
Facultative Wetland	4	19.05%
Obligate Wetland	0	0.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>PTERIDOPHYTES</u>		<u>FERNS & ALLIES</u>								
Dryopteridaceae		Wood Fern Family								
<i>Dryopteris</i>	<i>cristata</i>	Crested Wood Fern	7	-5		S5			G5	X
<i>Polystichum</i>	<i>acrostichoides</i>	Christmas Fern	5	5		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Asteraceae		Composite or Aster Family								
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
Betulaceae		Birch Family								C
<i>Carpinus</i>	<i>caroliniana ssp. virginiana</i>	Blue Beech	6	0		S5			G5T	C
Brassicaceae		Mustard Family								IC
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	X
Celastraceae		Staff-tree Family								C
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5		S5			G5	
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C
Fagaceae		Beech Family								C
<i>Fagus</i>	<i>grandifolia</i>	American Beech	6	3		S5			G5	C
<i>Quercus</i>	<i>alba</i>	White Oak	6	3		S5			G5	C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	
Juglandaceae		Walnut Family								X
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	
Oleaceae		Olive Family								C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
<i>Amelanchier</i>	<i>arborea</i>	Downy Juneberry		3		S5			G5	
<i>Malus</i>	<i>pumila</i>	Common Crabapple		5	-1	SE5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	I
Scrophulariaceae		Figwort Family								IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	
Tiliaceae		Linden Family								X
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3		S5			G5	X
Ulmaceae		Elm Family								
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>pensylvanica</i>	Pennsylvania Sedge	5	5		S5			G5	C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Liliaceae		Lily Family								X
<i>Erythronium</i>	<i>americanum ssp. americanum</i>	Yellow Dog's-tooth Violet	5	5		S5			G5T5	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	22	
Native Species	17	77.27%
Exotic Species	5	22.73%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.22%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	18	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	4.82	
CC 0 to 3 – Lowest Sensitivity	4	23.53%
CC 4 to 6 – Moderate Sensitivity	12	70.59%
CC 7 to 8 – High Sensitivity	1	5.88%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	19.89	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.40	
Weediness = -1 – Low Potential Invasiveness	1	20.00%
Weediness = -2 – Moderate Potential Invasiveness	1	20.00%
Weediness = -3 – High Potential Invasiveness	3	60.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	2.30	
Upland	7	31.82%
Facultative Upland	10	45.45%
Facultative	2	9.09%
Facultative Wetland	3	13.64%
Obligate Wetland	1	4.55%

Appendix F. Plant Species List
3483 Westminster Dr FOD2-4

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Pinaceae		Pine Family								
Picea	abies	Norway Spruce		5	-1	SE3			G?	I
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Asteraceae		Composite or Aster Family								
Eurybia	macrophylla	Large-leaved Aster	5	5		S5			G5	C
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	flexicaulis	Zig-zag Goldenrod	6	3		S5			G5	X
Betulaceae		Birch Family								C
Carpinus	caroliniana ssp. virginiana	Blue Beech	6	0		S5			G5T	C
Ostrya	virginiana	Hop Hornbeam - Ironwood	4	4		S5			G5	
Caprifoliaceae		Honeysuckle Family								I
Lonicera	tatarica	Tartarian Honeysuckle		3	-3	SE5			G?	X
Cornaceae		Dogwood Family								X
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	
Gleditsia	triacanthos	Honey Locust	3	0		S2			G5	I
Fagaceae		Beech Family								C
Fagus	grandifolia	American Beech	6	3		S5			G5	C
Quercus	alba	White Oak	6	3		S5			G5	C
Quercus	macrocarpa	Bur Oak	5	1		S5			G5	C
Quercus	rubra	Red Oak	6	3		S5			G5	
Juglandaceae		Walnut Family								X
Carya	cordiformis	Bitternut hickory	6	0		S5			G5	X
Oleaceae		Olive Family								C
Fraxinus	americana	White Ash	4	3		S5			G5	X
Rhamnaceae		Buckthorn Family								IC
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
Crataegus	punctata	Large-fruited Thorn	4	5		S5			G5	C
Geum	aleppicum	Yellow Avens	2	-1		S5			G5	X
Prunus	serotina	Black Cherry	3	3		S5			G5	I
Scrophulariaceae		Figwort Family								IC
Veronica	officinalis	Common Speedwell		5	-2	SE5			G5	
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								C
Cyperaceae		Sedge Family								C
Carex	pensylvanica	Pennsylvania Sedge	5	5		S5			G5	C
Liliaceae		Lily Family								X
Erythronium	americanum ssp. americanum	Yellow Dog's-tooth Violet	5	5		S5			G5T5	
Typhaceae		Cattail Family								

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	26	
Native Species	22	84.62%
Exotic Species	4	15.38%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.26%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	21	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	4.14	
CC 0 to 3 – Lowest Sensitivity	8	36.36%
CC 4 to 6 – Moderate Sensitivity	14	63.64%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	19.40	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.25	
Weediness = -1 – Low Potential Invasiveness	1	25.00%
Weediness = -2 – Moderate Potential Invasiveness	1	25.00%
Weediness = -3 – High Potential Invasiveness	2	50.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.88	
Upland	6	23.08%
Facultative Upland	11	42.31%
Facultative	5	19.23%
Facultative Wetland	2	7.69%
Obligate Wetland	2	7.69%

Appendix F. Plant Species List
3483 Westminster Dr SWD with inclusion SWT2-5

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharinum</i>	Silver Maple	5	-3		S5			G5	C
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Asteraceae		Composite or Aster Family								
<i>Symphyotrichum</i>	<i>lanceolatum</i>	Tall White Aster	3	-3		S5			G5T?	C
<i>Symphyotrichum</i>	<i>puniceum</i> var. <i>puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>flexicaulis</i>	Zig-zag Goldenrod	6	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
Brassicaceae		Mustard Family								IC
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	I
Celastraceae		Staff-tree Family								C
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5		S5			G5	
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicled Dogwood/Gray Dogwood	2	-2		S5			G5?	C
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Grossulariaceae		Currant Family								C
<i>Ribes</i>	<i>americanum</i>	Wild Black Currant	4	-3		S5			G5	IR
Hamamelidaceae		Witch-hazel Family								X
<i>Hamamelis</i>	<i>virginiana</i>	Witch-hazel	6	3		S5			G5	
Lamiaceae		Mint Family								I
<i>Lycopus</i>	<i>americanus</i>	Cut-leaved Water-horehound	4	-5		S5			G5	
Oleaceae		Olive Family								C
<i>Fraxinus</i>	<i>nigra</i>	Black Ash	7	-4		S5			G5	C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
<i>Frangula</i>	<i>alnus</i>	Glossy Buckthorn		-1	-3	SE5			G?	
Rosaceae		Rose Family								C
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	X
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Rubus</i>	<i>allegheniensis</i>	Alleghany Blackberry	2	2		S5			G5	C
<i>Rubus</i>	<i>idaeus</i>	Red Raspberry	0		-2	SE1			G5T5	
Rubiaceae		Madder Family								I
<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5		S5			G5	X
Salicaceae		Willow Family								X
<i>Populus</i>	<i>balsamifera</i> ssp. <i>balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
<i>Salix</i>	<i>fragilis</i>	Crack Willow		-1	-3	SE5			G?	IR
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	
Solanaceae		Nightshade Family								C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	
MONOCOTYLEDONS		MONOCOTS								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>intumescens</i>	Bladder Sedge	6	-4		S5			G5	
<i>Carex</i>	<i>pensylvanica</i>	Pennsylvania Sedge	5	5		S5			G5	C
Poaceae		Grass Family								IC
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	32	
Native Species	26	81.25%
Exotic Species	6	18.75%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.32%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	24	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	3.81	
CC 0 to 3 – Lowest Sensitivity	11	42.31%
CC 4 to 6 – Moderate Sensitivity	13	50.00%
CC 7 to 8 – High Sensitivity	2	7.69%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	19.42	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.67	
Weediness = -1 – Low Potential Invasiveness	0	0.00%
Weediness = -2 – Moderate Potential Invasiveness	2	33.33%
Weediness = -3 – High Potential Invasiveness	4	66.67%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	-1.06	
Upland	2	6.25%
Facultative Upland	6	18.75%
Facultative	7	21.88%
Facultative Wetland	12	37.50%
Obligate Wetland	4	12.50%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>incarnata ssp. incarnata</i>	Swamp Milkweed	6	-5		S5			G5T5	C
Asteraceae		Composite or Aster Family								
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
Caprifoliaceae		Honeysuckle Family								I
<i>Sambucus</i>	<i>nigra ssp. canadensis</i>	Common Elderberry	5	-2		S5			G5	X
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Oleaceae		Olive Family								C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
Polygonaceae		Smartweed Family								I
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
<i>Rosa</i>	<i>multiflora</i>	Multiflora Rose		3	-3	SE4			G?	X
<i>Spiraea</i>	<i>alba</i>	Narrow-leaved Meadow-sweet	3	-4		S5			G5	X
Rubiaceae		Madder Family								I
<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5		S5			G5	X
Salicaceae		Willow Family								X
<i>Populus</i>	<i>balsamifera ssp. balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	X
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	
MONOCOTYLEDONS		MONOCOTS								C
Poaceae		Grass Family								IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	I
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	18	
Native Species	15	83.33%
Exotic Species	3	16.67%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.18%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	14	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	3.27	
CC 0 to 3 – Lowest Sensitivity	8	53.33%
CC 4 to 6 – Moderate Sensitivity	6	40.00%
CC 7 to 8 – High Sensitivity	1	6.67%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	12.65	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.67	
Weediness = -1 – Low Potential Invasiveness	0	0.00%
Weediness = -2 – Moderate Potential Invasiveness	1	33.33%
Weediness = -3 – High Potential Invasiveness	2	66.67%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	-2.17	
Upland	0	0.00%
Facultative Upland	3	16.67%
Facultative	2	11.11%
Facultative Wetland	9	50.00%
Obligate Wetland	4	22.22%

Appendix F. Plant Species List

3485 Westminster Dr OAO with complex MAS2/SWT2-5

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Asteraceae		Composite or Aster Family								
Bidens	frondosa	Devil's Beggar-ticks	3	-3		S5			G5	X
Balsaminaceae		Touch-me-not Family								C
Impatiens	capensis	Spotted Touch-me-not	4	-3		S5			G5	
Cornaceae		Dogwood Family								X
Cornus	racemosa	Red Panicle Dogwood/Gray Dogwood	2	-2		S5			G5?	C
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	
Lamiaceae		Mint Family								I
Lycopus	americanus	Cut-leaved Water-horehound	4	-5		S5			G5	
Lythraceae		Loosestrife Family								IC
Lythrum	salicaria	Purple Loosestrife		-5	-3	SE5			G5	
Polygonaceae		Smartweed Family								I
Polygonum	persicaria	Lady's-thumb		-3	-1	SE5			G?	IC
Rubiaceae		Madder Family								I
Cephalanthus	occidentalis	Eastern Buttonbush	7	-5		S5			G5	X
MONOCOTYLEDONS		MONOCOTS								C
Juncaceae		Rush Family								X
Juncus	articulatus	Jointed Rush	5	-5		S5			G5	
Lemnaceae		Duckweed Family								
Lemna	minor	Lesser Duckweed	2	-5		S5			G5	X
Lemna	trisulca	Star Duckweed	4	-5		S5			G5	X
Poaceae		Grass Family								IC
Phalaris	arundinacea	Reed Canary Grass	0	-4		S5			G5	X
Typhaceae		Cattail Family								
Typha	angustifolia	Narrow-leaved Cattail	3	-5		S5			G5	
Typha	latifolia	Broad-leaved Cattail	3	-5		S5			G5	

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	14	
Native Species	12	85.71%
Exotic Species	2	14.29%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.14%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	12	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	3.25	
CC 0 to 3 – Lowest Sensitivity	7	58.33%
CC 4 to 6 – Moderate Sensitivity	4	33.33%
CC 7 to 8 – High Sensitivity	1	8.33%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	11.26	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.00	
Weediness = -1 – Low Potential Invasiveness	1	50.00%
Weediness = -2 – Moderate Potential Invasiveness	0	0.00%
Weediness = -3 – High Potential Invasiveness	1	50.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	-4.14	
Upland	0	0.00%
Facultative Upland	0	0.00%
Facultative	0	0.00%
Facultative Wetland	6	42.86%
Obligate Wetland	8	57.14%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Pinaceae		Pine Family								
<i>Picea</i>	<i>abies</i>	Norway Spruce		5	-1	SE3			G?	I
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
<i>Acer</i>	<i>platanoides</i>	Norway Maple		5	-3	SE5			G?	IU
<i>Acer</i>	<i>saccharinum</i>	Silver Maple	5	-3		S5			G5	C
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
<i>Acer X</i>	<i>freemanii</i>	Freeman's Maple								
Anacardiaceae		Sumac or Cashew Family								
<i>Toxicodendron</i>	<i>radicans ssp. negundo</i>	Poison-ivy	5	-1		S5			G5T	X
<i>Rhus</i>	<i>hirta</i>	Staghorn Sumac	1	5		S5			G5	C
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Artemisia</i>	<i>vulgaris</i>	Common Mugwort		5	-1	SE5			G?	IR
<i>Symphyotrichum</i>	<i>cordifolium</i>	Heart-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>ericoides</i>	Heath Aster	4	4		S5			G5T?	
<i>Symphyotrichum</i>	<i>lanceolatum</i>	Tall White Aster	3	-3		S5			G5T?	C
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	X
<i>Symphyotrichum</i>	<i>puniceum var. puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Centaurea</i>	<i>jacea</i>	Brown Knapweed		5	-1	SE5			G?	I
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	I
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	C
<i>Erigeron</i>	<i>philadelphicus ssp. philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	I
<i>Lactuca</i>	<i>serriola</i>	Prickly Lettuce		0	-1	SE5			G?	C
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>nemoralis ssp. nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	I
<i>Xanthium</i>	<i>strumarium</i>	Tumor-curing Cocklebur	2	0		S5			G?	
Chenopodiaceae		Goosefoot Family								I
<i>Chenopodium</i>	<i>album var. album</i>	Lamb's Quarters		1	-1	SE5			G5T5	
Convolvulaceae		Morning-glory Family								I
<i>Convolvulus</i>	<i>arvensis</i>	Field Bindweed		5	-1	SE5			G?	

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	C
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Cucurbitaceae		Gourd Family								X
<i>Echinocystis</i>	<i>lobata</i>	Prickly Cucumber	3	-2		S5			G5	
Dipsacaceae		Teasel Family								IC
<i>Dipsacus</i>	<i>fullonum ssp. sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	
Fabaceae		Pea Family								I
<i>Coronilla</i>	<i>varia</i>	Variable Crown-vetch		5	-2	SE5			G?	I
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Melilotus</i>	<i>officinalis</i>	Yellow Sweet-clover		3	-1	SE5			G?	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Trifolium</i>	<i>repens</i>	White Clover		2	-1	SE5			G?	I
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	
Fagaceae		Beech Family								C
<i>Quercus</i>	<i>alba</i>	White Oak	6	3		S5			G5	C
<i>Quercus</i>	<i>macrocarpa</i>	Bur Oak	5	1		S5			G5	C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	
Lythraceae		Loosestrife Family								IC
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	
Onagraceae		Evening-primrose Family								X
<i>Epilobium</i>	<i>ciliatum ssp. ciliatum</i>	Ciliate Willow-herb	3	3		S5			G5T?	I
<i>Epilobium</i>	<i>hirsutum</i>	Great Hairy Willow-herb		-4	-2	SE5			G?	R1
Plantaginaceae		Plantain Family								IC
<i>Plantago</i>	<i>major</i>	Common Plantain		-1	-1	SE5			G5	
Polygonaceae		Smartweed Family								I
<i>Polygonum</i>	<i>persicaria</i>	Lady's-thumb		-3	-1	SE5			G?	IC
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
<i>Potentilla</i>	<i>norvegica ssp. norvegica</i>	Cinquefoil	0			SU			G5T?	C
<i>Potentilla</i>	<i>recta</i>	Rough-fruited Cinquefoil		5	-2	SE5			G?	I
<i>Potentilla</i>	<i>simplex</i>	Old-field Cinquefoil	3	4		S5			G5	C
Salicaceae		Willow Family								X
<i>Populus</i>	<i>balsamifera ssp. balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	X
MONOCOTYLEDONS		MONOCOTS								C
Cyperaceae		Sedge Family								C
<i>Cyperus</i>	<i>odoratus</i>	Fragrant Umbrella Sedge	5	-3		S5			G5	C
Juncaceae		Rush Family								X
<i>Juncus</i>	<i>tenuis</i>	Path Rush	0	0		S5			G5	X
Poaceae		Grass Family								IC
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	IC

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	X
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	I
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	X
<i>Hordeum</i>	<i>jubatum ssp. jubatum</i>	Squirrel-tail Grass		-1	-1	SE5			G5T?	X
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	C
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	I
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	
<i>Setaria</i>	<i>viridis</i>	Green Foxtail			-1	SE5			G?	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	69	
Native Species	36	52.17%
Exotic Species	33	47.83%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.69%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	36	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.50	
CC 0 to 3 – Lowest Sensitivity	24	66.67%
CC 4 to 6 – Moderate Sensitivity	12	33.33%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	15.00	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.61	
Weediness = -1 – Low Potential Invasiveness	19	57.58%
Weediness = -2 – Moderate Potential Invasiveness	8	24.24%
Weediness = -3 – High Potential Invasiveness	6	18.18%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.16	
Upland	16	23.19%
Facultative Upland	20	28.99%
Facultative	13	18.84%
Facultative Wetland	16	23.19%
Obligate Wetland	3	4.35%

Appendix F. Plant Species List
P01-3202 Scotland Dr CUP3

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Equisetaceae		Horsetail Family								
Equisetum	arvense	Field Horsetail	0	0		S5			G5	C
GYMNOSPERMS		CONIFERS								
Pinaceae		Pine Family								
Picea	abies	Norway Spruce		5	-1	SE3			G?	I
Pinus	strobus	Eastern White Pine	4	3		S5			G5	X
Pinus	sylvestris	Scotch Pine		5	-3	SE5			G?	IR
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	negundo	Manitoba Maple	0	-2		S5			G5	C
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asteraceae		Composite or Aster Family								
Symphyotrichum	cordifolium	Heart-leaved Aster	5	5		S5			G5	C
Solidago	altissima	Tall Goldenrod	1	3		S5				X
Solidago	juncea	Early Goldenrod	3	5		S5			G5	X
Brassicaceae		Mustard Family								IC
Alliaria	petiolata	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
Lonicera	tatarica	Tartarian Honeysuckle		3	-3	SE5			G?	X
Silene	vulgaris	Catchfly		5	-1	SE5			G?	X
Dipsacaceae		Teasel Family								IC
Dipsacus	fullonum ssp. sylvestris	Wild Teasel		5	-1	SE5			G?T?	
Fabaceae		Pea Family								I
Vicia	cracca	Tufted Vetch		5	-1	SE5			G?	
Grossulariaceae		Currant Family								C
Ribes	americanum	Wild Black Currant	4	-3		S5			G5	IR
Ribes	triste	Wild Red Currant	6	-5		S5			G5	
Oleaceae		Olive Family								C
Fraxinus	pennsylvanica	Red Ash	3	-3		S5			G5	I
Onagraceae		Evening-primrose Family								X
Circaea	lutetiana ssp. canadensis	Enchanter's Nightshade	3	3		S5			G5T5	X
Rhamnaceae		Buckthorn Family								IC
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IU
Rosaceae		Rose Family								C
Fragaria	virginiana	Virginia Strawberry	2	1		SU			G5T?	X
Prunus	serotina	Black Cherry	3	3		S5			G5	I
Prunus	virginiana	Choke Cherry	2	1		S5			G5T?	I
Rubus	idaeus	Red Raspberry	0		-2	SE1			G5T5	
Salicaceae		Willow Family								X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
Scrophulariaceae		Figwort Family								IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	
Ulmaceae		Elm Family								
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	
Violaceae		Violet Family								
<i>Viola</i>	<i>sororia</i>	Woolly Blue Violet	4	1		S5			G5	C
Vitaceae		Grape Family								
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>spicata</i>	Spiked Sedge		5	-1	SE5			G?	VU

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	31	
Native Species	19	61.29%
Exotic Species	12	38.71%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.31%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	17	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.58	
CC 0 to 3 – Lowest Sensitivity	13	68.42%
CC 4 to 6 – Moderate Sensitivity	6	31.58%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	11.24	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.92	
Weediness = -1 – Low Potential Invasiveness	5	41.67%
Weediness = -2 – Moderate Potential Invasiveness	3	25.00%
Weediness = -3 – High Potential Invasiveness	4	33.33%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.97	
Upland	10	32.26%
Facultative Upland	7	22.58%
Facultative	6	19.35%
Facultative Wetland	5	16.13%
Obligate Wetland	1	3.23%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Dryopteridaceae		Wood Fern Family								
<i>Polystichum</i>	<i>acrostichoides</i>	Christmas Fern	5	5		S5			G5	X
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Asteraceae		Composite or Aster Family								
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	X
<i>Symphyotrichum</i>	<i>puniceum</i> var. <i>puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				X
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
Balsaminaceae		Touch-me-not Family								C
<i>Impatiens</i>	<i>capensis</i>	Spotted Touch-me-not	4	-3		S5			G5	
Berberidaceae		Barberry Family								X
<i>Caulophyllum</i>	<i>thalictroides</i>	Blue Cohosh	6	5		S5			G	X
<i>Podophyllum</i>	<i>peltatum</i>	May-apple	5	3		S5			G5	
Betulaceae		Birch Family								C
<i>Carpinus</i>	<i>caroliniana</i> ssp. <i>virginiana</i>	Blue Beech	6	0		S5			G5T	C
Brassicaceae		Mustard Family								IC
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	I
Caprifoliaceae		Honeysuckle Family								I
<i>Sambucus</i>	<i>nigra</i> ssp. <i>canadensis</i>	Common Elderberry	5	-2		S5			G5	X
Celastraceae		Staff-tree Family								C
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5		S5			G5	
Cornaceae		Dogwood Family								X
<i>Cornus</i>	<i>racemosa</i>	Red Panicled Dogwood/Gray Dogwood	2	-2		S5			G5?	C
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	
Fagaceae		Beech Family								C
<i>Fagus</i>	<i>grandifolia</i>	American Beech	6	3		S5			G5	C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	
Grossulariaceae		Currant Family								C
<i>Ribes</i>	<i>americanum</i>	Wild Black Currant	4	-3		S5			G5	IR
<i>Ribes</i>	<i>triste</i>	Wild Red Currant	6	-5		S5			G5	
Hydrophyllaceae		Water-leaf Family								C
<i>Hydrophyllum</i>	<i>virginianum</i>	Virginia Water-leaf	6	-2		S5			G5	
Juglandaceae		Walnut Family								X
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	
Lamiaceae		Mint Family								I
<i>Lycopus</i>	<i>americanus</i>	Cut-leaved Water-horehound	4	-5		S5			G5	
Oleaceae		Olive Family								C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Fraxinus</i>	<i>nigra</i>	Black Ash	7	-4		S5			G5	C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	I
Rhamnaceae		Buckthorn Family								IC
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IU
<i>Frangula</i>	<i>alnus</i>	Glossy Buckthorn		-1	-3	SE5			G?	
Rosaceae		Rose Family								C
<i>Amelanchier</i>	<i>arborea</i>	Downy Juneberry		3		S5			G5	
<i>Fragaria</i>	<i>vesca</i> ssp. <i>americana</i>	Woodland Strawberry	4	4		S5			G5T?	C
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	X
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Malus</i>	<i>pumila</i>	Common Crabapple		5	-1	SE5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	I
<i>Prunus</i>	<i>virginiana</i>	Choke Cherry	2	1		S5			G5T?	I
<i>Rubus</i>	<i>allegheniensis</i>	Alleghany Blackberry	2	2		S5			G5	C
<i>Rubus</i>	<i>idaeus</i>	Red Raspberry	0		-2	SE1			G5T5	
Rubiaceae		Madder Family								I
<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5		S5			G5	X
Salicaceae		Willow Family								X
<i>Populus</i>	<i>balsamifera</i> ssp. <i>balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	
Scrophulariaceae		Figwort Family								IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	
Solanaceae		Nightshade Family								C
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	
Tiliaceae		Linden Family								X
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3		S5			G5	X
Ulmaceae		Elm Family								
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	
Violaceae		Violet Family								
<i>Viola</i>	<i>pubescens</i>	Downy Yellow Violet	5	4		S5			G5	X
<i>Viola</i>	<i>sororia</i>	Woolly Blue Violet	4	1		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								C
Cyperaceae		Sedge Family								C
<i>Carex</i>	<i>communis</i>	Fibrous Rooted Sedge	6	5		S5			G5	C
<i>Carex</i>	<i>intumescens</i>	Bladder Sedge	6	-4		S5			G5	
<i>Carex</i>	<i>spicata</i>	Spiked Sedge		5	-1	SE5			G?	VU
<i>Carex</i>	<i>vulpinoidea</i>	Fox Sedge	3	-5		S5			G5	C
Liliaceae		Lily Family								X
<i>Erythronium</i>	<i>americanum</i> ssp. <i>americanum</i>	Yellow Dog's-tooth Violet	5	5		S5			G5T5	
<i>Maianthemum</i>	<i>racemosum</i> ssp. <i>racemosum</i>	False Solomon's Seal	4	3		S5			G5T	IC
<i>Trillium</i>	<i>grandiflorum</i>	White Trillium	5	5		S5			G5	C
Poaceae		Grass Family								IC
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	IC
<i>Glyceria</i>	<i>striata</i>	Fowl Meadow Grass	3	-5		S5			G5	IC

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	55	
Native Species	47	85.45%
Exotic Species	8	14.55%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.55%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	46	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	4.13	
CC 0 to 3 – Lowest Sensitivity	16	34.04%
CC 4 to 6 – Moderate Sensitivity	29	61.70%
CC 7 to 8 – High Sensitivity	2	4.26%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	28.30	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.13	
Weediness = -1 – Low Potential Invasiveness	2	25.00%
Weediness = -2 – Moderate Potential Invasiveness	3	37.50%
Weediness = -3 – High Potential Invasiveness	3	37.50%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	0.40	
Upland	10	18.18%
Facultative Upland	15	27.27%
Facultative	9	16.36%
Facultative Wetland	14	25.45%
Obligate Wetland	7	12.73%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>PTERIDOPHYTES</u>		<u>FERNS & ALLIES</u>								
Dryopteridaceae		Wood Fern Family								
<i>Dryopteris</i>	<i>carthusiana</i>	Spinulose Wood Fern	5	-2		S5			G5	X
<i>Dryopteris</i>	<i>cristata</i>	Crested Wood Fern	7	-5		S5			G5	X
<i>Polystichum</i>	<i>acrostichoides</i>	Christmas Fern	5	5		S5			G5	X
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Anacardiaceae		Sumac or Cashew Family								
<i>Toxicodendron</i>	<i>radicans</i> ssp. <i>negundo</i>	Poison-ivy	5	-1		S5			G5T	X
Aristolochiaceae		Duchman's-pipe Family								
<i>Aristolochia</i>	<i>clematitis</i>	Birthwort		5	-1	SE1			G?	
Asteraceae		Composite or Aster Family								
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
<i>Prenanthes</i>	<i>altissima</i>	Tall White Rattlesnake-root	5	3		S5			G5?	X
<i>Symphyotrichum</i>	<i>cordifolium</i>	Heart-leaved Aster	5	5		S5			G5	C
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>caesia</i>	Blue-stem Goldenrod	5	3		S5			G5	X
<i>Solidago</i>	<i>flexicaulis</i>	Zig-zag Goldenrod	6	3		S5			G5	X
Balsaminaceae		Touch-me-not Family								
<i>Impatiens</i>	<i>capensis</i>	Spotted Touch-me-not	4	-3		S5			G5	C
Berberidaceae		Barberry Family								
<i>Caulophyllum</i>	<i>thalicteroides</i>	Blue Cohosh	6	5		S5			G	X
Betulaceae		Birch Family								
<i>Carpinus</i>	<i>caroliniana</i> ssp. <i>virginiana</i>	Blue Beech	6	0		S5			G5T	C
<i>Corylus</i>	<i>americana</i>	American Hazel	5	4		S5			G5	C
<i>Ostrya</i>	<i>virginiana</i>	Hop Hornbeam - Ironwood	4	4		S5			G5	C
Brassicaceae		Mustard Family								
<i>Alliaria</i>	<i>petiolata</i>	Garlic Mustard		0	-3	SE5			G5	IC
<i>Nasturtium</i>	<i>officinale</i>	Water-cress		-5	-1	SE?			G?	I
Caprifoliaceae		Honeysuckle Family								
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	I
Celastraceae		Staff-tree Family								
<i>Euonymus</i>	<i>obovata</i>	Running Strawberry-bush	6	5		S5			G5	C
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>alternifolia</i>	Alternate-leaved Dogwood	6	5		S5			G5	X
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Cucurbitaceae		Gourd Family								
<i>Echinocystis</i>	<i>lobata</i>	Prickly Cucumber	3	-2		S5			G5	X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Dipsacaceae		Teasel Family								
<i>Dipsacus</i>	<i>fullonum ssp. sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	IC
Fagaceae		Beech Family								
<i>Fagus</i>	<i>grandifolia</i>	American Beech	6	3		S5			G5	C
<i>Quercus</i>	<i>alba</i>	White Oak	6	3		S5			G5	C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	C
Geraniaceae		Geranium Family								
<i>Geranium</i>	<i>maculatum</i>	Spotted Crane's-bill	6	3		S5			G5	X
Grossulariaceae		Currant Family								
<i>Ribes</i>	<i>americanum</i>	Wild Black Currant	4	-3		S5			G5	C
<i>Ribes</i>	<i>triste</i>	Wild Red Currant	6	-5		S5			G5	X
Hydrophyllaceae		Water-leaf Family								
<i>Hydrophyllum</i>	<i>virginianum</i>	Virginia Water-leaf	6	-2		S5			G5	C
Juglandaceae		Walnut Family								
<i>Carya</i>	<i>cordiformis</i>	Bitternut hickory	6	0		S5			G5	X
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	X
Oleaceae		Olive Family								
<i>Fraxinus</i>	<i>americana</i>	White Ash	4	3		S5			G5	C
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	C
Onagraceae		Evening-primrose Family								
<i>Circaea</i>	<i>lutetiana ssp. canadensis</i>	Enchanter's Nightshade	3	3		S5			G5T5	X
Oxalidaceae		Wood Sorrel Family								
<i>Oxalis</i>	<i>stricta</i>	Upright Yellow Wood-sorrel	0	3		S5			G5	X
Ranunculaceae		Buttercup Family								
<i>Ranunculus</i>	<i>abortivus</i>	Kidney-leaf Buttercup	2	-2		S5			G5	C
<i>Ranunculus</i>	<i>acris</i>	Tall Buttercup			-2	SE5			G5	IC
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Amelanchier</i>	<i>arborea</i>	Downy Juneberry		3		S5			G5	C
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	C
<i>Prunus</i>	<i>virginiana</i>	Choke Cherry	2	1		S5			G5T?	C
Rutaceae		Rue Family								
<i>Zanthoxylum</i>	<i>americanum</i>	American Prickly-ash	3	5		S5			G5	C
Scrophulariaceae		Figwort Family								
<i>Verbascum</i>	<i>thapsus</i>	Common Mullein		5	-2	SE5			G?	IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	I
Tiliaceae		Linden Family								
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3		S5			G5	C
Violaceae		Violet Family								
<i>Viola</i>	<i>sororia</i>	Woolly Blue Violet	4	1		S5			G5	X
MONOCOTYLEDONS		MONOCOTS								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>sp.</i>	Sedge species								
<i>Carex</i>	<i>communis</i>	Fibrous Rooted Sedge	6	5		S5			G5	C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Carex	gracillima	Graceful Sedge	4	3		S5			G5	C
Carex	pensylvanica	Pennsylvania Sedge	5	5		S5			G5	C
Carex	plantaginea	Plantain-leaved Sedge	7	5		S5			G5	C
Carex	rosea	Stellate Sedge	5	5		S5			G5	C
Liliaceae		Lily Family								
Erythronium	americanum ssp. americanum	Yellow Dog's-tooth Violet	5	5		S5			G5T5	X
Maianthemum	racemosum ssp. racemosum	False Solomon's Seal	4	3		S5			G5T	X
Trillium	grandiflorum	White Trillium	5	5		S5			G5	X
Poaceae		Grass Family								
Agrostis	stolonifera	Redtop		-3		S5			G5	C
Bromus	inermis ssp. inermis	Awnless Brome		5	-3	SE5			G4G5T?	IC
Dactylis	glomerata	Orchard Grass		3	-1	SE5			G?	IC
Phalaris	arundinacea	Reed Canary Grass	0	-4		S5			G5	X
Poa	pratensis ssp. pratensis	Kentucky Bluegrass	0	1		S5			G5T	C

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	62	
Native Species	51	82.26%
Exotic Species	11	17.74%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.62%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	53	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	4.35	
CC 0 to 3 – Lowest Sensitivity	13	25.49%
CC 4 to 6 – Moderate Sensitivity	36	70.59%
CC 7 to 8 – High Sensitivity	2	3.92%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	31.09	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.00	
Weediness = -1 – Low Potential Invasiveness	4	36.36%
Weediness = -2 – Moderate Potential Invasiveness	3	27.27%
Weediness = -3 – High Potential Invasiveness	4	36.36%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.97	
Upland	18	29.03%
Facultative Upland	24	38.71%
Facultative	8	12.90%
Facultative Wetland	10	16.13%
Obligate Wetland	3	4.84%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Dryopteridaceae		Wood Fern Family								
Dryopteris	carthusiana	Spinulose Wood Fern	5	-2		S5			G5	X
Onoclea	sensibilis	Sensitive Fern	4	-3		S5			G5	X
Equisetaceae		Horsetail Family								
Equisetum	hyemale var. affine	Scouring-rush	2	-2		S5			G5T5	C
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	saccharinum	Silver Maple	5	-3		S5			G5	C
Acer X	freemanii	Freeman's Maple								
Anacardiaceae		Sumac or Cashew Family								
Toxicodendron	rydbergii	Western Poison-ivy	0	0		S5			G5T	X
Apiaceae		Carrot or Parsley Family								
Angelica	atropurpurea	Dark-purple Alexanders	6	-5		S5			G5	C
Sium	suave	Hemlock Water-parsnip	4	-5		S5			G5	C
Asteraceae		Composite or Aster Family								
Symphyotrichum	cordifolium	Heart-leaved Aster	5	5		S5			G5	C
Symphyotrichum	ericoides var. pansus	Mayflowered Aster	4	4		S1			G5T?	
Solidago	gigantea	Giant Goldenrod	4	-3		S5			G5	X
Balsaminaceae		Touch-me-not Family								
Impatiens	capensis	Spotted Touch-me-not	4	-3		S5			G5	C
Brassicaceae		Mustard Family								
Alliaria	petiolata	Garlic Mustard		0	-3	SE5			G5	IC
Nasturtium	officinale	Water-cress		-5	-1	SE?			G?	I
Caprifoliaceae		Honeysuckle Family								
Sambucus	nigra ssp. canadensis	Common Elderberry	5	-2		S5			G5	X
Celastraceae		Staff-tree Family								
Euonymus	obovata	Running Strawberry-bush	6	5		S5			G5	C
Cornaceae		Dogwood Family								
Cornus	alternifolia	Alternate-leaved Dogwood	6	5		S5			G5	X
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Fagaceae		Beech Family								
Fagus	grandifolia	American Beech	6	3		S5			G5	C
Grossulariaceae		Currant Family								
Ribes	americanum	Wild Black Currant	4	-3		S5			G5	C
Ribes	cynosbati	Prickly Gooseberry	4	5		S5			G5	C
Ranunculaceae		Buttercup Family								
Ranunculus	abortivus	Kidney-leaf Buttercup	2	-2		S5			G5	C
Ranunculus	acris	Tall Buttercup			-2	SE5			G5	IC
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Frangula	alnus	Glossy Buckthorn		-1	-3	SE5			G?	IU
Rosaceae		Rose Family								
Agrimonia	gryposepala	Tall Hairy Agrimony	2	2		S5			G5	C
Geum	aleppicum	Yellow Avens	2	-1		S5			G5	X
Rosa	acicularis ssp. sayi	Prickly Rose	7	3		S5			G5TU	R1
Rosa	multiflora	Multiflora Rose		3	-3	SE4			G?	I
Rubiaceae		Madder Family								
Cephalanthus	occidentalis	Eastern Buttonbush	7	-5		S5			G5	X
Rutaceae		Rue Family								

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Zanthoxylum</i>	<i>americanum</i>	American Prickly-ash	3	5		S5			G5	C
Salicaceae		Willow Family								
<i>Salix</i>	<i>sp.</i>	Willow species								
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	C
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	X
<i>Salix</i>	<i>petiolaris</i>	Slender Willow	3	-4		S5			G4	X
Scrophulariaceae		Figwort Family								
<i>Chelone</i>	<i>glabra</i>	Turtlehead	7	-5		S5			G5	X
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	IC
Urticaceae		Nettle Family								
<i>Urtica</i>	<i>dioica</i> ssp. <i>dioica</i>	European Stinging Nettle		-1	-1	SE2			G5T?	IR
MONOCOTYLEDONS		MONOCOTS								
Araceae		Arum Family								
<i>Symplocarpus</i>	<i>foetidus</i>	Skunk-cabbage	7	-5		S5			G5	C
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>sp.</i>	Sedge species								
<i>Carex</i>	<i>aquaticilis</i>	Aquatic Sedge	7	-5		S5			G5	VU
<i>Carex</i>	<i>crinita</i>	Fringed Sedge	6	-4		S5			G5	C
<i>Carex</i>	<i>intumescens</i>	Bladder Sedge	6	-4		S5			G5	C
<i>Scirpus</i>	<i>atrovirens</i>	Dark-green Bulrush	3	-5		S5			G5?	C
Iridaceae		Iris Family								
<i>Iris</i>	<i>sp.</i>	Iris species								
<i>Iris</i>	<i>versicolor</i>	Multi-coloured Blue-flag	5	-5		S5			G5	X
Juncaceae		Rush Family								
<i>Juncus</i>	<i>sp.</i>	Rush species								
<i>Juncus</i>	<i>effusus</i> var. <i>solutus</i>	Soft Rush	4	-5		S5			G5T?	X
<i>Juncus</i>	<i>tenuis</i>	Path Rush	0	0		S5			G5	X
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Glyceria</i>	<i>striata</i>	Fowl Meadow Grass	3	-5		S5			G5	X
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	47	
Native Species	39	82.98%
Exotic Species	8	17.02%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.47%	
Regionally Significant Species	1	
S1-S3 Species	1	
S4 Species	0	
S5 Species	38	
Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	4.13	
CC 0 to 3 – Lowest Sensitivity	14	35.90%
CC 4 to 6 – Moderate Sensitivity	20	51.28%
CC 7 to 8 – High Sensitivity	5	12.82%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	25.78	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.25	
Weediness = -1 – Low Potential Invasiveness	2	25.00%
Weediness = -2 – Moderate Potential Invasiveness	2	25.00%
Weediness = -3 – High Potential Invasiveness	4	50.00%
Presence of Wetland Species	Total	Percentage
Average Wetness Value	-1.53	
Upland	5	10.64%
Facultative Upland	6	12.77%
Facultative	7	14.89%
Facultative Wetland	16	34.04%
Obligate Wetland	13	27.66%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
Anacardiaceae		Sumac or Cashew Family								
<i>Rhus</i>	<i>hirta</i>	Staghorn Sumac	1	5		S5			G5	C
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Achillea</i>	<i>millefolium</i> var. <i>millefolium</i>	Common Yarrow		3	-1	SE?			G5T?	
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Artemisia</i>	<i>vulgaris</i>	Common Mugwort		5	-1	SE5			G?	IR
<i>Carduus</i>	<i>nutans</i> ssp. <i>nutans</i>	Musk Thistle		5	-1	SE?			G?T?	
<i>Leucanthemum</i>	<i>vulgare</i>	Ox-eye Daisy		5	-1	SE5			G?	
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	IC
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	I
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>juncea</i>	Early Goldenrod	3	5		S5			G5	X
<i>Sonchus</i>	<i>arvensis</i> ssp. <i>arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	IC
Caryophyllaceae		Pink Family								
<i>Stellaria</i>	<i>graminea</i>	Grass-leaved Stitchwort		5	-2	SE5			G?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Fabaceae		Pea Family								
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	I
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Trifolium</i>	<i>repens</i>	White Clover		2	-1	SE5			G?	I
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	I
Oleaceae		Olive Family								
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	C
Polygonaceae		Smartweed Family								
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	IC
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Rubiaceae		Madder Family								
<i>Galium</i>	<i>mollugo</i>	White Bedstraw		5	-2	SE5			G?	I
Salicaceae		Willow Family								
<i>Populus</i>	<i>deltoides ssp. deltoides</i>	Eastern Cottonwood	4	-1		SU			G5T?	X
Scrophulariaceae		Figwort Family								
<i>Verbascum</i>	<i>thapsus</i>	Common Mullein		5	-2	SE5			G?	IC
Tiliaceae		Linden Family								
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3		S5			G5	C
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>sp.</i>	Sedge species								
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C
<i>Setaria</i>	<i>pumila</i>	Yellow Foxtail		0	-1	SE5			G?	I

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	41	
Native Species	15	36.59%
Exotic Species	26	63.41%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.41%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	15	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	1.53	
CC 0 to 3 – Lowest Sensitivity	12	80.00%
CC 4 to 6 – Moderate Sensitivity	3	20.00%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	5.94	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.62	
Weediness = -1 – Low Potential Invasiveness	14	53.85%
Weediness = -2 – Moderate Potential Invasiveness	8	30.77%
Weediness = -3 – High Potential Invasiveness	4	15.38%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	2.27	
Upland	13	31.71%
Facultative Upland	15	36.59%
Facultative	7	17.07%
Facultative Wetland	6	14.63%
Obligate Wetland	0	0.00%

Appendix F. Plant Species List
P02 3666 Scotland CUT1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Anacardiaceae		Sumac or Cashew Family								
Rhus	hirta	Staghorn Sumac	1	5		S5			G5	C
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
Asclepias	syriaca	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
Symphyotrichum	ericoides var. pansus	Mayflowered Aster	4	4		S1			G5T?	
Symphyotrichum	lanceolatum	Tall White Aster	3	-3		S5			G5T?	C
Symphyotrichum	novae-angliae	New England Aster	2	-3		S5			G5	C
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	juncea	Early Goldenrod	3	5		S5			G5	X
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Taraxacum	officinale	Common Dandelion		3	-2	SE5			G5	IC
Caprifoliaceae		Honeysuckle Family								
Viburnum	lentago	Nannyberry	4	-1		S5			G5	C
Cornaceae		Dogwood Family								
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Juglandaceae		Walnut Family								
Juglans	nigra	Black Walnut	5	3		S4			G5	X
Oleaceae		Olive Family								
Fraxinus	pennsylvanica	Red Ash	3	-3		S5			G5	C
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
Crataegus	punctata	Large-fruited Thorn	4	5		S5			G5	C
Salicaceae		Willow Family								
Populus	deltoides ssp. deltoides	Eastern Cottonwood	4	-1		SU			G5T?	X
Vitaceae		Grape Family								
Vitis	riparia	Riverbank Grape	0	-2		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								
Poaceae		Grass Family								
Phalaris	arundinacea	Reed Canary Grass	0	-4		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	22	
Native Species	18	81.82%
Exotic Species	4	18.18%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.22%	
Regionally Significant Species	0	
S1-S3 Species	1	
S4 Species	1	
S5 Species	15	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.39	
CC 0 to 3 – Lowest Sensitivity	12	66.67%
CC 4 to 6 – Moderate Sensitivity	6	33.33%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	10.14	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.00	
Weediness = -1 – Low Potential Invasiveness	1	25.00%
Weediness = -2 – Moderate Potential Invasiveness	2	50.00%
Weediness = -3 – High Potential Invasiveness	1	25.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.19	
Upland	5	22.73%
Facultative Upland	7	31.82%
Facultative	2	9.09%
Facultative Wetland	7	31.82%
Obligate Wetland	0	0.00%

Appendix F. Plant Species List
P02 3666 Scotland CUM1-1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
Asclepias	syriaca	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
Achillea	millefolium var. millefolium	Common Yarrow		3	-1	SE?			G5T?	
Artemisia	vulgaris	Common Mugwort		5	-1	SE5			G?	IR
Symphyotrichum	ericoides var. pansus	Mayflowered Aster	4	4		S1			G5T?	
Symphyotrichum	lanceolatum	Tall White Aster	3	-3		S5			G5T?	C
Symphyotrichum	novae-angliae	New England Aster	2	-3		S5			G5	C
Centaurea	jacea	Brown Knapweed		5	-1	SE5			G?	I
Centaurea	biebersteinii	Spotted Knapweed		5	-3	SE5			G?	I
Lactuca	serriola	Prickly Lettuce		0	-1	SE5			G?	I
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	gigantea	Giant Goldenrod	4	-3		S5			G5	X
Solidago	juncea	Early Goldenrod	3	5		S5			G5	X
Solidago	nemoralis ssp. nemoralis	Gray Goldenrod	2	5		S5			G5T?	X
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Taraxacum	officinale	Common Dandelion		3	-2	SE5			G5	IC
Cornaceae		Dogwood Family								
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Dipsacaceae		Teasel Family								
Dipsacus	fullonum ssp. sylvestris	Wild Teasel		5	-1	SE5			G?T?	IC
Fabaceae		Pea Family								
Lotus	corniculatus	Bird's-foot Trefoil		1	-2	SE5			G?	I
Medicago	lupulina	Black Medick		1	-1	SE5			G?	IC
Melilotus	alba	White Sweet-clover		3	-3	SE5			G?	IC
Polygonaceae		Smartweed Family								
Rumex	crispus	Curly-leaf Dock		-1	-2	SE5			G?	IC
Rosaceae		Rose Family								
Crataegus	sp.	Hawthorn species								
MONOCOTYLEDONS		MONOCOTS								
Cyperaceae		Sedge Family								
Carex	sp.	Sedge species								
Poaceae		Grass Family								
Bromus	inermis ssp. inermis	Awnless Brome		5	-3	SE5			G4G5T?	IC
Dactylis	glomerata	Orchard Grass		3	-1	SE5			G?	IC
Phalaris	arundinacea	Reed Canary Grass	0	-4		S5			G5	X
Phleum	pratense	Timothy		3	-1	SE5			G?	IC
Poa	palustris	Fowl Meadow Grass	5	-4		S5			G5	X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Typhaceae		Cattail Family								
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	X
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	30	
Native Species	14	46.67%
Exotic Species	16	53.33%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.30%	
Regionally Significant Species	0	
S1-S3 Species	1	
S4 Species	0	
S5 Species	13	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.36	
CC 0 to 3 – Lowest Sensitivity	11	78.57%
CC 4 to 6 – Moderate Sensitivity	3	21.43%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	8.82	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.63	
Weediness = -1 – Low Potential Invasiveness	9	56.25%
Weediness = -2 – Moderate Potential Invasiveness	4	25.00%
Weediness = -3 – High Potential Invasiveness	3	18.75%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.41	
Upland	9	30.00%
Facultative Upland	8	26.67%
Facultative	4	13.33%
Facultative Wetland	6	20.00%
Obligate Wetland	2	6.67%

Appendix F. Plant Species List
P02 3691 Manning CUM1-1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Equisetaceae		Horsetail Family								
Equisetum	arvense	Field Horsetail	0	0		S5			G5	C
GYMNOSPERMS		CONIFERS								
Cupressaceae		Cedar Family								
Juniperus	virginiana	Eastern Red Cedar	4	3		S5			G5	X
Thuja	occidentalis	Eastern White Cedar	4	-3		S5			G5	X
Pinaceae		Pine Family								
Picea	abies	Norway Spruce		5	-1	SE3			G?	I
Pinus	strobus	Eastern White Pine	4	3		S5			G5	X
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	negundo	Manitoba Maple	0	-2		S5			G5	C
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Acer X	freemanii	Freeman's Maple								
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
Asclepias	syriaca	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
Achillea	millefolium var. millefolium	Common Yarrow		3	-1	SE?			G5T?	
Ambrosia	artemisiifolia	Common Ragweed	0	3		S5			G5	C
Arctium	minus	Common Burdock		5	-2	SE5			G?T?	IC
Symphyotrichum	ericoides var. pansus	Mayflowered Aster	4	4		S1			G5T?	
Symphyotrichum	lanceolatum	Tall White Aster	3	-3		S5			G5T?	C
Symphyotrichum	puniceum var. puniceum	Purple-stemmed Aster	6	-5		S5			G5T?	X
Cichorium	intybus	Chicory		5	-1	SE5			G?	IC
Cirsium	arvense	Canada Thistle		3	-1	SE5			G?	IC
Cirsium	vulgare	Bull Thistle		4	-1	SE5			G5	I
Erigeron	annus	Eastern Daisy Fleabane	0	1		S5			G5	
Erigeron	philadelphicus ssp. philadelphicus	Philadelphia Fleabane	1	-3		S5			G5T?	C
Inula	helenium	Elecampane		5	-2	SE5			G?	I
Lactuca	serriola	Prickly Lettuce		0	-1	SE5			G?	I
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	gigantea	Giant Goldenrod	4	-3		S5			G5	X
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Taraxacum	officinale	Common Dandelion		3	-2	SE5			G5	IC
Cornaceae		Dogwood Family								
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Dipsacaceae		Teasel Family								
Dipsacus	fullonum ssp. sylvestris	Wild Teasel		5	-1	SE5			G?T?	IC

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Fabaceae		Pea Family								
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	I
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Melilotus</i>	<i>officinalis</i>	Yellow Sweet-clover		3	-1	SE5			G?	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Trifolium</i>	<i>repens</i>	White Clover		2	-1	SE5			G?	I
Fagaceae		Beech Family								
<i>Quercus</i>	<i>alba</i>	White Oak	6	3		S5			G5	C
<i>Quercus</i>	<i>macrocarpa</i>	Bur Oak	5	1		S5			G5	C
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	C
Lamiaceae		Mint Family								
<i>Leonurus</i>	<i>cardiaca ssp. cardiaca</i>	Common Motherwort		5	-2	SE5			G?T?	IC
Lythraceae		Loosestrife Family								
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	IC
Moraceae		Mulberry Family								
<i>Morus</i>	<i>alba</i>	White Mulberry		0	-3	SE5			G?	I
Plantaginaceae		Plantain Family								
<i>Plantago</i>	<i>lanceolata</i>	Ribgrass		0	-1	SE5			G5	IC
<i>Plantago</i>	<i>major</i>	Common Plantain		-1	-1	SE5			G5	IC
Polygonaceae		Smartweed Family								
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	IC
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>alnifolia</i>	Alder-leaved Buckthorn	7	-5		S5			G5	X
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Pyrus</i>	<i>communis</i>	Common Pear		5	-1	SE4			G5	I
Rubiaceae		Madder Family								
<i>Galium</i>	<i>mollugo</i>	White Bedstraw		5	-2	SE5			G?	I
Salicaceae		Willow Family								
<i>Populus</i>	<i>balsamifera ssp. balsamifera</i>	Balsam Poplar	4	-3		S5			G5T?	X
<i>Populus</i>	<i>tremuloides</i>	Trembling Aspen	2	0		S5			G5	X
Scrophulariaceae		Figwort Family								
<i>Linaria</i>	<i>vulgaris</i>	Butter-and-eggs		5	-1	SE5			G?	IC
Vitaceae		Grape Family								
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
<u>MONOCOTYLEDONS</u>		MONOCOTS								
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	X
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Setaria</i>	<i>viridis</i>	Green Foxtail			-1	SE5			G?	I
Typhaceae		Cattail Family								
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	X
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	62	
Native Species	29	46.77%
Exotic Species	33	53.23%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.62%	
Regionally Significant Species	0	
S1-S3 Species	1	
S4 Species	0	
S5 Species	29	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.55	
CC 0 to 3 – Lowest Sensitivity	17	58.62%
CC 4 to 6 – Moderate Sensitivity	11	37.93%
CC 7 to 8 – High Sensitivity	1	3.45%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	13.74	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.64	
Weediness = -1 – Low Potential Invasiveness	18	54.55%
Weediness = -2 – Moderate Potential Invasiveness	9	27.27%
Weediness = -3 – High Potential Invasiveness	6	18.18%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.11	
Upland	12	19.35%
Facultative Upland	21	33.87%
Facultative	12	19.35%
Facultative Wetland	11	17.74%
Obligate Wetland	5	8.06%

Appendix F. Plant Species List

P02 3696 Scotland FOD5-5

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Brassicaceae		Mustard Family								
<i>Nasturtium</i>	<i>officinale</i>	Water-cress		-5	-1	SE?			G?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Hydrophyllaceae		Water-leaf Family								
<i>Hydrophyllum</i>	<i>virginianum</i>	Virginia Water-leaf	6	-2		S5			G5	C
Juglandaceae		Walnut Family								
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	X
Oleaceae		Olive Family								
<i>Fraxinus</i>	<i>pennsylvanica</i>	Red Ash	3	-3		S5			G5	C
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	C
Ulmaceae		Elm Family								
<i>Ulmus</i>	<i>americana</i>	White Elm	3	-2		S5			G5?	X
Violaceae		Violet Family								
<i>Viola</i>	<i>sororia</i>	Woolly Blue Violet	4	1		S5			G5	X
MONOCOTYLEDONS		MONOCOTS								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>sp.</i>	Sedge species								
Liliaceae		Lily Family								
<i>Erythronium</i>	<i>americanum ssp. americanum</i>	Yellow Dog's-tooth Violet	5	5		S5			G5T5	X
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	13	
Native Species	11	84.62%
Exotic Species	2	15.38%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.13%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	12	
Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	3.45	
CC 0 to 3 – Lowest Sensitivity	6	54.55%
CC 4 to 6 – Moderate Sensitivity	5	45.45%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	11.46	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.00	
Weediness = -1 – Low Potential Invasiveness	1	50.00%
Weediness = -2 – Moderate Potential Invasiveness	0	0.00%
Weediness = -3 – High Potential Invasiveness	1	50.00%
Presence of Wetland Species	Total	Percentage
Average Wetness Value	-0.43	
Upland	1	7.69%
Facultative Upland	4	30.77%
Facultative	1	7.69%
Facultative Wetland	7	53.85%
Obligate Wetland	1	7.69%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Equisetaceae		Horsetail Family								
<i>Equisetum</i>	<i>arvense</i>	Field Horsetail	0	0		S5			G5	C
GYMNOSPERMS		CONIFERS								
Pinaceae		Pine Family								
<i>Picea</i>	<i>glauca</i>	White Spruce	6	3		S5			G5	I
<i>Pinus</i>	<i>resinosa</i>	Red Pine	8	3		S5			G5	IR
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
<i>Acer</i>	<i>platanoides</i>	Norway Maple		5	-3	SE5			G?	IU
<i>Acer X</i>	<i>freemanii</i>	Freeman's Maple								
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asteraceae		Composite or Aster Family								
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Arctium</i>	<i>minus</i>	Common Burdock		5	-2	SE5			G?T?	IC
<i>Symphyotrichum</i>	<i>ericoides</i> var. <i>pansus</i>	Mayflowered Aster	4	4		S1			G5T?	
<i>Symphyotrichum</i>	<i>lanceolatum</i>	Tall White Aster	3	-3		S5			G5T?	C
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	C
<i>Symphyotrichum</i>	<i>puniceum</i> var. <i>puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Centaurea</i>	<i>jacea</i>	Brown Knapweed		5	-1	SE5			G?	I
<i>Leucanthemum</i>	<i>vulgare</i>	Ox-eye Daisy		5	-1	SE5			G?	
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	IC
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	I
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	
<i>Lactuca</i>	<i>serriola</i>	Prickly Lettuce		0	-1	SE5			G?	I
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>juncea</i>	Early Goldenrod	3	5		S5			G5	X
<i>Solidago</i>	<i>nemoralis</i> ssp. <i>nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	X
<i>Sonchus</i>	<i>arvensis</i> ssp. <i>arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	IC
Caprifoliaceae		Honeysuckle Family								
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>racemosa</i>	Red Panicled Dogwood/Gray Dogwood	2	-2		S5			G5?	X
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Dipsacaceae		Teasel Family								
<i>Dipsacus</i>	<i>fullonum</i> ssp. <i>sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	IC
Fabaceae		Pea Family								
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	I
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Medicago</i>	<i>sativa</i> ssp. <i>sativa</i>	Alfalfa		5	-1	SE5			G?T?	IC
<i>Melilotus</i>	<i>alba</i>	White Sweet-clover		3	-3	SE5			G?	IC
<i>Robinia</i>	<i>pseudo-acacia</i>	Black Locust		4	-3	SE5			G5	IC
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	I
Guttiferae		St. John's-wort Family								
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	IC

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Oleaceae		Olive Family								
<i>Syringa</i>	<i>vulgaris</i>	Common Lilac		5	-2	SE5			G?	I
Plantaginaceae		Plantain Family								
<i>Plantago</i>	<i>major</i>	Common Plantain		-1	-1	SE5			G5	IC
Polygonaceae		Smartweed Family								
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	IC
Ranunculaceae		Buttercup Family								
<i>Ranunculus</i>	<i>acris</i>	Tall Buttercup			-2	SE5			G5	IC
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Potentilla</i>	<i>simplex</i>	Old-field Cinquefoil	3	4		S5			G5	X
<i>Pyrus</i>	<i>communis</i>	Common Pear		5	-1	SE4			G5	I
Salicaceae		Willow Family								
<i>Salix</i>	<i>nigra</i>	Black Willow	6	-5		S4?			G5	X
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	IC
Verbenaceae		Vervain Family								
<i>Verbena</i>	<i>urticifolia</i>	White Vervain	4	-1		S5			G5	X
Vitaceae		Grape Family								
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								
Poaceae		Grass Family								
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Panicum</i>	<i>capillare</i>	Witch Grass	0	0		S5			G5	X
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	X
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	55	
Native Species	24	43.64%
Exotic Species	31	56.36%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.55%	
Regionally Significant Species	0	
S1-S3 Species	1	
S4 Species	0	
S5 Species	22	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.21	
CC 0 to 3 – Lowest Sensitivity	18	75.00%
CC 4 to 6 – Moderate Sensitivity	5	20.83%
CC 7 to 8 – High Sensitivity	1	4.17%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	10.82	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.77	
Weediness = -1 – Low Potential Invasiveness	15	48.39%
Weediness = -2 – Moderate Potential Invasiveness	8	25.81%
Weediness = -3 – High Potential Invasiveness	8	25.81%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.85	
Upland	15	27.27%
Facultative Upland	17	30.91%
Facultative	11	20.00%
Facultative Wetland	8	14.55%
Obligate Wetland	2	3.64%

Appendix F. Plant Species List
P02 3713 Scotland CUT1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
GYMNOSPERMS		CONIFERS								
Cupressaceae		Cedar Family								
Juniperus	virginiana	Eastern Red Cedar	4	3		S5			G5	X
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	negundo	Manitoba Maple	0	-2		S5			G5	C
Acer	platanoides	Norway Maple		5	-3	SE5			G?	IU
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Acer X	freemanii	Freeman's Maple								
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asteraceae		Composite or Aster Family								
Arctium	minus	Common Burdock		5	-2	SE5			G?T?	IC
Symphyotrichum	ericoides var. pansus	Mayflowered Aster	4	4		S1			G5T?	
Symphyotrichum	lanceolatum	Tall White Aster	3	-3		S5			G5T?	C
Cichorium	intybus	Chicory		5	-1	SE5			G?	IC
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	gigantea	Giant Goldenrod	4	-3		S5			G5	X
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Caprifoliaceae		Honeysuckle Family								
Viburnum	lentago	Nannyberry	4	-1		S5			G5	C
Cornaceae		Dogwood Family								
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Fabaceae		Pea Family								
Medicago	lupulina	Black Medick		1	-1	SE5			G?	IC
Medicago	sativa ssp. sativa	Alfalfa		5	-1	SE5			G?T?	IC
Vicia	cracca	Tufted Vetch		5	-1	SE5			G?	I
Oleaceae		Olive Family								
Fraxinus	pennsylvanica	Red Ash	3	-3		S5			G5	C
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
Crataegus	sp.	Hawthorn species								
Crataegus	monogyna	English Hawthorn		5	-1	SE5			G5	I
Malus	pumila	Common Crabapple		5	-1	SE5			G5	I
Prunus	virginiana	Choke Cherry	2	1		S5			G5T?	C
Solanaceae		Nightshade Family								
Solanum	dulcamara	Bitter Nightshade		0	-2	SE5			G?	IC
Vitaceae		Grape Family								
Parthenocissus	inserta	Inserted Virginia-creeper	3	3		S5			G5	X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>vulpinoidea</i>	Fox Sedge	3	-5		S5			G5	C
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	32	
Native Species	17	53.13%
Exotic Species	15	46.88%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.32%	
Regionally Significant Species	0	
S1-S3 Species	1	
S4 Species	0	
S5 Species	17	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.35	
CC 0 to 3 – Lowest Sensitivity	12	70.59%
CC 4 to 6 – Moderate Sensitivity	5	29.41%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	9.70	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.73	
Weediness = -1 – Low Potential Invasiveness	8	53.33%
Weediness = -2 – Moderate Potential Invasiveness	3	20.00%
Weediness = -3 – High Potential Invasiveness	4	26.67%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.47	
Upland	9	28.13%
Facultative Upland	9	28.13%
Facultative	5	15.63%
Facultative Wetland	8	25.00%
Obligate Wetland	1	3.13%

Appendix F. Plant Species List
P02 3713 Scotland SAS1

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
PTERIDOPHYTES		FERNS & ALLIES								
Equisetaceae		Horsetail Family								
Equisetum	arvense	Field Horsetail	0	0		S5			G5	C
DICOTYLEDONS		DICOTS								
Asclepiadaceae		Milkweed Family								
Asclepias	syriaca	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
Centaurea	jacea	Brown Knapweed		5	-1	SE5			G?	I
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Tussilago	farfara	Coltsfoot		3	-2	SE5			G?	IC
Onagraceae		Evening-primrose Family								
Epilobium	hirsutum	Great Hairy Willow-herb		-4	-2	SE5			G?	I
Polygonaceae		Smartweed Family								
Polygonum	persicaria	Lady's-thumb		-3	-1	SE5			G?	I
Rumex	crispus	Curly-leaf Dock		-1	-2	SE5			G?	IC
Ranunculaceae		Buttercup Family								
Ranunculus	aquatilis var. diffusus	White Water-crowfoot				S5			G5T	
Salicaceae		Willow Family								
Salix	exigua	Sandbar Willow	3	-5		S5			G5	C
Solanaceae		Nightshade Family								
Solanum	dulcamara	Bitter Nightshade		0	-2	SE5			G?	IC
Verbenaceae		Vervain Family								
Verbena	hastata	Blue Vervain	4	-4		S5			G5	C
Verbena	urticifolia	White Vervain	4	-1		S5			G5	X
MONOCOTYLEDONS		MONOCOTS								
Alismataceae		Water-plantain Family								
Alisma	plantago-aquatica	Common Water-plantain	3	-5		S5			G5	C
Cyperaceae		Sedge Family								
Carex	aquatilis	Aquatic Sedge	7	-5		S5			G5	VU
Carex	vulpinoidea	Fox Sedge	3	-5		S5			G5	C
Eleocharis	acicularis	Needle Spike-rush	5	-5		S5			G5	VU
Scirpus	atrovirens	Dark-green Bulrush	3	-5		S5			G5?	C
Scirpus	cyperinus	Wool-grass	4	-5		S5			G5	C
Schoenoplectus	tabernaemontani	American Great Bulrush/softstem bulrush	5	-5		S5			G?	C
Juncaceae		Rush Family								
Juncus	articulatus	Jointed Rush	5	-5		S5			G5	VU
Juncus	effusus var. solutus	Soft Rush	4	-5		S5			G5T?	X
Juncus	tenuis	Path Rush	0	0		S5			G5	X
Lemnaceae		Duckweed Family								
Lemna	minor	Lesser Duckweed	2	-5		S5			G5	X
Poaceae		Grass Family								
Agrostis	stolonifera	Redtop		-3		S5			G5	C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	X
Potamogetonaceae		Pondweed Family								
<i>Potamogeton</i>	<i>sp.</i>	Pondweed species								
Typhaceae		Cattail Family								
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	X
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	27	
Native Species	20	74.07%
Exotic Species	7	25.93%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.27%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	22	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.90	
CC 0 to 3 – Lowest Sensitivity	12	60.00%
CC 4 to 6 – Moderate Sensitivity	7	35.00%
CC 7 to 8 – High Sensitivity	1	5.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	12.97	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.57	
Weediness = -1 – Low Potential Invasiveness	3	42.86%
Weediness = -2 – Moderate Potential Invasiveness	4	57.14%
Weediness = -3 – High Potential Invasiveness	0	0.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	-2.81	
Upland	2	7.41%
Facultative Upland	1	3.70%
Facultative	5	18.52%
Facultative Wetland	6	22.22%
Obligate Wetland	13	48.15%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>saccharum</i>	Sugar Maple	4	3		S5			G5T?	C
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Aquifoliaceae		Holly Family								
<i>Ilex</i>	<i>verticillata</i>	Winterberry	5	-4		S5			G5	X
<i>Nemopanthus</i>	<i>mucronatus</i>	Mountain-holly	8	-5		S5			G5	X
Asteraceae		Composite or Aster Family								
<i>Symphyotrichum</i>	<i>cordifolium</i>	Heart-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>ericoides</i> var. <i>pansus</i>	Mayflowered Aster	4	4		S1			G5T?	
<i>Eurybia</i>	<i>macrophylla</i>	Large-leaved Aster	5	5		S5			G5	C
<i>Symphyotrichum</i>	<i>puniceum</i> var. <i>puniceum</i>	Purple-stemmed Aster	6	-5		S5			G5T?	X
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>caesia</i>	Blue-stem Goldenrod	5	3		S5			G5	X
<i>Solidago</i>	<i>flexicaulis</i>	Zig-zag Goldenrod	6	3		S5			G5	X
Betulaceae		Birch Family								
<i>Carpinus</i>	<i>caroliniana</i> ssp. <i>virginiana</i>	Blue Beech	6	0		S5			G5T	C
Caprifoliaceae		Honeysuckle Family								
<i>Viburnum</i>	<i>acerifolium</i>	Maple-leaved Viburnum	6	5		S5			G5	X
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Dipsacaceae		Teasel Family								
<i>Dipsacus</i>	<i>fullonum</i> ssp. <i>sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	IC
Fagaceae		Beech Family								
<i>Quercus</i>	<i>rubra</i>	Red Oak	6	3		S5			G5	C
Juglandaceae		Walnut Family								
<i>Carya</i>	<i>cordiformis</i>	Bitternut hickory	6	0		S5			G5	X
<i>Carya</i>	<i>ovata</i>	Shagbark Hickory	6	3		S5			G5	X
Lythraceae		Loosestrife Family								
<i>Lythrum</i>	<i>salicaria</i>	Purple Loosestrife		-5	-3	SE5			G5	IC
Polygonaceae		Smartweed Family								
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	IC
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Crataegus</i>	<i>sp.</i>	Hawthorn species								
<i>Prunus</i>	<i>serotina</i>	Black Cherry	3	3		S5			G5	C

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Rubiaceae		Madder Family								
<i>Cephalanthus</i>	<i>occidentalis</i>	Eastern Buttonbush	7	-5		S5			G5	X
Scrophulariaceae		Figwort Family								
<i>Linaria</i>	<i>vulgaris</i>	Butter-and-eggs		5	-1	SE5			G?	IC
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	I
Tiliaceae		Linden Family								
<i>Tilia</i>	<i>americana</i>	American Basswood	4	3		S5			G5	C
Verbenaceae		Vervain Family								
<i>Verbena</i>	<i>hastata</i>	Blue Vervain	4	-4		S5			G5	C
<i>Verbena</i>	<i>urticifolia</i>	White Vervain	4	-1		S5			G5	X
Vitaceae		Grape Family								
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
<u>MONOCOTYLEDONS</u>		MONOCOTS								
Poaceae		Grass Family								
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
Typhaceae		Cattail Family								
<i>Typha</i>	<i>angustifolia</i>	Narrow-leaved Cattail	3	-5		S5			G5	X
<i>Typha</i>	<i>latifolia</i>	Broad-leaved Cattail	3	-5		S5			G5	X

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	35	
Native Species	27	77.14%
Exotic Species	8	22.86%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.35%	
Regionally Significant Species	0	
S1-S3 Species	1	
S4 Species	0	
S5 Species	26	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	4.26	
CC 0 to 3 – Lowest Sensitivity	8	29.63%
CC 4 to 6 – Moderate Sensitivity	17	62.96%
CC 7 to 8 – High Sensitivity	2	7.41%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	22.13	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.13	
Weediness = -1 – Low Potential Invasiveness	2	25.00%
Weediness = -2 – Moderate Potential Invasiveness	3	37.50%
Weediness = -3 – High Potential Invasiveness	3	37.50%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	0.66	
Upland	8	22.86%
Facultative Upland	11	31.43%
Facultative	4	11.43%
Facultative Wetland	6	17.14%
Obligate Wetland	6	17.14%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	saccharum	Sugar Maple	4	3		S5			G5T?	C
Anacardiaceae		Sumac or Cashew Family								
Rhus	hirta	Staghorn Sumac	1	5		S5			G5	C
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asteraceae		Composite or Aster Family								
Centaurea	jacea	Brown Knapweed		5	-1	SE5			G?	I
Cichorium	intybus	Chicory		5	-1	SE5			G?	IC
Cirsium	arvense	Canada Thistle		3	-1	SE5			G?	IC
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Solidago	canadensis	Canada Goldenrod	1	3		S5			G5	X
Solidago	gigantea	Giant Goldenrod	4	-3		S5			G5	X
Sonchus	arvensis ssp. arvensis	Field Sow-thistle			-1	SE5			G?T?	I
Taraxacum	officinale	Common Dandelion		3	-2	SE5			G5	IC
Brassicaceae		Mustard Family								
Alliaria	petiolata	Garlic Mustard		0	-3	SE5			G5	IC
Cornaceae		Dogwood Family								
Cornus	racemosa	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Fabaceae		Pea Family								
Robinia	pseudo-acacia	Black Locust		4	-3	SE5			G5	IC
Juglandaceae		Walnut Family								
Juglans	nigra	Black Walnut	5	3		S4			G5	X
Oleaceae		Olive Family								
Fraxinus	pennsylvanica	Red Ash	3	-3		S5			G5	C
Oxalidaceae		Wood Sorrel Family								
Oxalis	stricta	Upright Yellow Wood-sorrel	0	3		S5			G5	X
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Salicaceae		Willow Family								
Populus	sp.	Poplar species								
Vitaceae		Grape Family								
Vitis	riparia	Riverbank Grape	0	-2		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								
Poaceae		Grass Family								
Bromus	inermis ssp. inermis	Awnless Brome		5	-3	SE5			G4G5T?	IC
Poa	pratensis ssp. pratensis	Kentucky Bluegrass	0	1		S5			G5T	C

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	22	
Native Species	12	54.55%
Exotic Species	10	45.45%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.22%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	1	
S5 Species	11	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	1.92	
CC 0 to 3 – Lowest Sensitivity	9	75.00%
CC 4 to 6 – Moderate Sensitivity	3	25.00%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	6.64	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.00	
Weediness = -1 – Low Potential Invasiveness	4	40.00%
Weediness = -2 – Moderate Potential Invasiveness	2	20.00%
Weediness = -3 – High Potential Invasiveness	4	40.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.95	
Upland	5	22.73%
Facultative Upland	9	40.91%
Facultative	2	9.09%
Facultative Wetland	5	22.73%
Obligate Wetland	0	0.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Cupressaceae		Cedar Family								
<i>Juniperus</i>	<i>virginiana</i>	Eastern Red Cedar	4	3		S5			G5	X
<i>Thuja</i>	<i>occidentalis</i>	Eastern White Cedar	4	-3		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Aceraceae		Maple Family								
<i>Acer</i>	<i>negundo</i>	Manitoba Maple	0	-2		S5			G5	C
<i>Acer X</i>	<i>freemanii</i>	Freeman's Maple								
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asteraceae		Composite or Aster Family								
<i>Achillea</i>	<i>millefolium var. millefolium</i>	Common Yarrow		3	-1	SE?			G5T?	
<i>Ambrosia</i>	<i>artemisiifolia</i>	Common Ragweed	0	3		S5			G5	C
<i>Ambrosia</i>	<i>trifida</i>	Giant Ragweed	0	-1		S5			G5	C
<i>Arctium</i>	<i>minus</i>	Common Burdock		5	-2	SE5			G?T?	IC
<i>Artemisia</i>	<i>vulgaris</i>	Common Mugwort		5	-1	SE5			G?	IR
<i>Bidens</i>	<i>frondosa</i>	Devil's Beggar-ticks	3	-3		S5			G5	X
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	IC
<i>Cirsium</i>	<i>vulgare</i>	Bull Thistle		4	-1	SE5			G5	I
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	
<i>Erigeron</i>	<i>philadelphicus ssp. philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	C
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>flexicaulis</i>	Zig-zag Goldenrod	6	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>juncea</i>	Early Goldenrod	3	5		S5			G5	X
<i>Solidago</i>	<i>nemoralis ssp. nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	X
<i>Sonchus</i>	<i>arvensis ssp. arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	IC
Caprifoliaceae		Honeysuckle Family								
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	I
Fabaceae		Pea Family								
<i>Lotus</i>	<i>corniculatus</i>	Bird's-foot Trefoil		1	-2	SE5			G?	I
Hippocastanaceae		Buckeye Family								
<i>Aesculus</i>	<i>hippocastanum</i>	Horse Chestnut		5	-1	SE2			G?	IR
Oleaceae		Olive Family								
<i>Syringa</i>	<i>vulgaris</i>	Common Lilac		5	-2	SE5			G?	I
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								
Poaceae		Grass Family								

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C
<i>Setaria</i>	<i>viridis</i>	Green Foxtail			-1	SE5			G?	I

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	34	
Native Species	16	47.06%
Exotic Species	18	52.94%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.34%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	16	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	1.81	
CC 0 to 3 – Lowest Sensitivity	12	75.00%
CC 4 to 6 – Moderate Sensitivity	4	25.00%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	7.25	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.61	
Weediness = -1 – Low Potential Invasiveness	10	55.56%
Weediness = -2 – Moderate Potential Invasiveness	5	27.78%
Weediness = -3 – High Potential Invasiveness	3	16.67%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	2.16	
Upland	9	26.47%
Facultative Upland	13	38.24%
Facultative	4	11.76%
Facultative Wetland	6	17.65%
Obligate Wetland	0	0.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Pinaceae		Pine Family								
<i>Pinus</i>	<i>strobus</i>	Eastern White Pine	4	3		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
<i>Asclepias</i>	<i>syriaca</i>	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
<i>Symphyotrichum</i>	<i>novae-angliae</i>	New England Aster	2	-3		S5			G5	C
<i>Centaurea</i>	<i>jacea</i>	Brown Knapweed		5	-1	SE5			G?	I
<i>Leucanthemum</i>	<i>vulgare</i>	Ox-eye Daisy		5	-1	SE5			G?	
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Cirsium</i>	<i>arvense</i>	Canada Thistle		3	-1	SE5			G?	IC
<i>Conyza</i>	<i>canadensis</i>	Horseweed	0	1		S5			G5	C
<i>Erigeron</i>	<i>annus</i>	Eastern Daisy Fleabane	0	1		S5			G5	
<i>Erigeron</i>	<i>philadelphicus</i> ssp. <i>philadelphicus</i>	Philadelphia Fleabane	1	-3		S5			G5T?	C
<i>Solidago</i>	<i>sp.</i>	Goldenrod species								
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>canadensis</i>	Canada Goldenrod	1	3		S5			G5	X
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>nemoralis</i> ssp. <i>nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	X
<i>Sonchus</i>	<i>arvensis</i> ssp. <i>arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
<i>Taraxacum</i>	<i>officinale</i>	Common Dandelion		3	-2	SE5			G5	IC
Brassicaceae		Mustard Family								
<i>Hesperis</i>	<i>matronalis</i>	Dame's Rocket		5	-3	SE5			G4G5	I
Caprifoliaceae		Honeysuckle Family								
<i>Lonicera</i>	<i>tatarica</i>	Tartarian Honeysuckle		3	-3	SE5			G?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>racemosa</i>	Red Panicked Dogwood/Gray Dogwood	2	-2		S5			G5?	X
Dipsacaceae		Teasel Family								
<i>Dipsacus</i>	<i>fullonum</i> ssp. <i>sylvestris</i>	Wild Teasel		5	-1	SE5			G?T?	IC
Fabaceae		Pea Family								
<i>Medicago</i>	<i>lupulina</i>	Black Medick		1	-1	SE5			G?	IC
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
<i>Vicia</i>	<i>cracca</i>	Tufted Vetch		5	-1	SE5			G?	I
Guttiferae		St. John's-wort Family								
<i>Hypericum</i>	<i>perforatum</i>	Common St. John's-wort		5	-3	SE5			G?	IC
Lamiaceae		Mint Family								
<i>Prunella</i>	<i>vulgaris</i> ssp. <i>vulgaris</i>	Common Heal-all		0	-1	SE3			G5T?	
Plantaginaceae		Plantain Family								
<i>Plantago</i>	<i>lanceolata</i>	Ribgrass		0	-1	SE5			G5	IC

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
Polygonaceae		Smartweed Family								
<i>Rumex</i>	<i>crispus</i>	Curly-leaf Dock		-1	-2	SE5			G?	IC
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
<i>Crataegus</i>	<i>monogyna</i>	English Hawthorn		5	-1	SE5			G5	I
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	C
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
Vitaceae		Grape Family								
<i>Vitis</i>	<i>riparia</i>	Riverbank Grape	0	-2		S5			G5	C
MONOCOTYLEDONS		MONOCOTS								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>vulpinoidea</i>	Fox Sedge	3	-5		S5			G5	C
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C
<i>Setaria</i>	<i>pumila</i>	Yellow Foxtail		0	-1	SE5			G?	I

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	41	
Native Species	17	41.46%
Exotic Species	24	58.54%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.41%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	17	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	1.41	
CC 0 to 3 – Lowest Sensitivity	15	88.24%
CC 4 to 6 – Moderate Sensitivity	2	11.76%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	5.82	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.67	
Weediness = -1 – Low Potential Invasiveness	14	58.33%
Weediness = -2 – Moderate Potential Invasiveness	4	16.67%
Weediness = -3 – High Potential Invasiveness	6	25.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.71	
Upland	12	29.27%
Facultative Upland	11	26.83%
Facultative	10	24.39%
Facultative Wetland	7	17.07%
Obligate Wetland	1	2.44%

Appendix F. Plant Species List
P02 6100 White Oak CUP3

W12A Landfill Expansion / City of London

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
GYMNOSPERMS		CONIFERS								
Cupressaceae		Cedar Family								
Thuja	occidentalis	Eastern White Cedar	4	-3		S5			G5	X
Pinaceae		Pine Family								
Pinus	strobus	Eastern White Pine	4	3		S5			G5	X
DICOTYLEDONS		DICOTS								
Aceraceae		Maple Family								
Acer	negundo	Manitoba Maple	0	-2		S5			G5	C
Acer X	freemanii	Freeman's Maple								
Apiaceae		Carrot or Parsley Family								
Daucus	carota	Wild Carrot		5	-2	SE5			G?	IC
Asclepiadaceae		Milkweed Family								
Asclepias	syriaca	Common Milkweed	0	5		S5			G5	C
Asteraceae		Composite or Aster Family								
Cirsium	arvense	Canada Thistle		3	-1	SE5			G?	IC
Solidago	altissima	Tall Goldenrod	1	3		S5				U
Taraxacum	officinale	Common Dandelion		3	-2	SE5			G5	IC
Balsaminaceae		Touch-me-not Family								
Impatiens	capensis	Spotted Touch-me-not	4	-3		S5			G5	C
Brassicaceae		Mustard Family								
Alliaria	petiolata	Garlic Mustard		0	-3	SE5			G5	IC
Caprifoliaceae		Honeysuckle Family								
Lonicera	tatarica	Tartarian Honeysuckle		3	-3	SE5			G?	I
Cornaceae		Dogwood Family								
Cornus	sericea	Red-osier Dogwood	2	-3		S5			G5	C
Dipsacaceae		Teasel Family								
Dipsacus	fullonum ssp. sylvestris	Wild Teasel		5	-1	SE5			G?T?	IC
Fabaceae		Pea Family								
Trifolium	pratense	Red Clover		2	-2	SE5			G?	I
Grossulariaceae		Currant Family								
Ribes	americanum	Wild Black Currant	4	-3		S5			G5	C
Ribes	cynosbati	Prickly Gooseberry	4	5		S5			G5	C
Lamiaceae		Mint Family								
Glechoma	hederacea	Creeping Charlie		5	-2	SE5			G?	I
Oleaceae		Olive Family								
Fraxinus	pennsylvanica	Red Ash	3	-3		S5			G5	C
Primulaceae		Primrose Family								
Lysimachia	nummularia	Moneywort		-4	-3	SE5			G?	I
Rhamnaceae		Buckthorn Family								
Rhamnus	cathartica	Common Buckthorn		3	-3	SE5			G?	IC
Rosaceae		Rose Family								
Fragaria	vesca ssp. americana	Woodland Strawberry	4	4		S5			G5T?	X

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<i>Fragaria</i>	<i>virginiana</i>	Virginia Strawberry	2	1		SU			G5T?	C
<i>Geum</i>	<i>aleppicum</i>	Yellow Avens	2	-1		S5			G5	X
<i>Geum</i>	<i>canadense</i>	White Avens	3	0		S5			G5	X
<i>Prunus</i>	<i>virginiana</i>	Choke Cherry	2	1		S5			G5T?	C
<i>Rosa</i>	<i>multiflora</i>	Multiflora Rose		3	-3	SE4			G?	I
Rubiaceae		Madder Family								
<i>Galium</i>	<i>aparine</i>	Cleavers	4	3		S5			G5	X
Scrophulariaceae		Figwort Family								
<i>Veronica</i>	<i>officinalis</i>	Common Speedwell		5	-2	SE5			G5	I
Solanaceae		Nightshade Family								
<i>Solanum</i>	<i>dulcamara</i>	Bitter Nightshade		0	-2	SE5			G?	IC
Vitaceae		Grape Family								
<i>Parthenocissus</i>	<i>inserta</i>	Inserted Virginia-creeper	3	3		S5			G5	X
MONOCOTYLEDONS		MONOCOTS								
Poaceae		Grass Family								
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	33	
Native Species	18	54.55%
Exotic Species	15	45.45%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.33%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	17	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.56	
CC 0 to 3 – Lowest Sensitivity	11	61.11%
CC 4 to 6 – Moderate Sensitivity	7	38.89%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	10.84	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-2.20	
Weediness = -1 – Low Potential Invasiveness	3	20.00%
Weediness = -2 – Moderate Potential Invasiveness	6	40.00%
Weediness = -3 – High Potential Invasiveness	6	40.00%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	1.58	
Upland	7	21.21%
Facultative Upland	12	36.36%
Facultative	7	21.21%
Facultative Wetland	7	21.21%
Obligate Wetland	0	0.00%

Botanical Name	Botanical Name	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status	OMNR Status	COSEWIC Status	Global Status	Local Status MIDD
<u>GYMNOSPERMS</u>		<u>CONIFERS</u>								
Pinaceae		Pine Family								
<i>Pinus</i>	<i>strobus</i>	Eastern White Pine	4	3		S5			G5	X
<u>DICOTYLEDONS</u>		<u>DICOTS</u>								
Apiaceae		Carrot or Parsley Family								
<i>Daucus</i>	<i>carota</i>	Wild Carrot		5	-2	SE5			G?	IC
Asteraceae		Composite or Aster Family								
<i>Cichorium</i>	<i>intybus</i>	Chicory		5	-1	SE5			G?	IC
<i>Solidago</i>	<i>altissima</i>	Tall Goldenrod	1	3		S5				U
<i>Solidago</i>	<i>gigantea</i>	Giant Goldenrod	4	-3		S5			G5	X
<i>Solidago</i>	<i>nemoralis ssp. nemoralis</i>	Gray Goldenrod	2	5		S5			G5T?	X
<i>Sonchus</i>	<i>arvensis ssp. arvensis</i>	Field Sow-thistle			-1	SE5			G?T?	I
Cornaceae		Dogwood Family								
<i>Cornus</i>	<i>sericea</i>	Red-osier Dogwood	2	-3		S5			G5	C
Fabaceae		Pea Family								
<i>Trifolium</i>	<i>pratense</i>	Red Clover		2	-2	SE5			G?	I
Rhamnaceae		Buckthorn Family								
<i>Rhamnus</i>	<i>cathartica</i>	Common Buckthorn		3	-3	SE5			G?	IC
Salicaceae		Willow Family								
<i>Salix</i>	<i>discolor</i>	Pussy Willow	3	-3		S5			G5	X
<i>Salix</i>	<i>exigua</i>	Sandbar Willow	3	-5		S5			G5	C
<u>MONOCOTYLEDONS</u>		<u>MONOCOTS</u>								
Cyperaceae		Sedge Family								
<i>Carex</i>	<i>sp.</i>	Sedge species								
Juncaceae		Rush Family								
<i>Juncus</i>	<i>effusus var. solutus</i>	Soft Rush	4	-5		S5			G5T?	X
Poaceae		Grass Family								
<i>Agrostis</i>	<i>stolonifera</i>	Redtop		-3		S5			G5	C
<i>Bromus</i>	<i>inermis ssp. inermis</i>	Awnless Brome		5	-3	SE5			G4G5T?	IC
<i>Dactylis</i>	<i>glomerata</i>	Orchard Grass		3	-1	SE5			G?	IC
<i>Elymus</i>	<i>repens</i>	Quack Grass		3	-3	SE5			G?	IC
<i>Phalaris</i>	<i>arundinacea</i>	Reed Canary Grass	0	-4		S5			G5	X
<i>Phleum</i>	<i>pratense</i>	Timothy		3	-1	SE5			G?	IC
<i>Phragmites</i>	<i>australis</i>	Common Reed	0	-4		S5			G5	X
<i>Poa</i>	<i>pratensis ssp. pratensis</i>	Kentucky Bluegrass	0	1		S5			G5T	C

Floristic Summary & Assessment

Species Diversity	Total	Percentage
Total Species	20	
Native Species	11	55.00%
Exotic Species	9	45.00%
Total Taxa in Region (List Region, Source)	10000	
% Regional Taxa Recorded	0.20%	
Regionally Significant Species	0	
S1-S3 Species	0	
S4 Species	0	
S5 Species	12	

Co-efficient of Conservatism and Floral Quality Index	Total	Percentage
Co-efficient of Conservatism (CC) (average)	2.09	
CC 0 to 3 – Lowest Sensitivity	8	72.73%
CC 4 to 6 – Moderate Sensitivity	3	27.27%
CC 7 to 8 – High Sensitivity	0	0.00%
CC 9 to 10 – Highest Sensitivity	0	0.00%
Floral Quality Index (FQI)	6.93	

Presence of Weedy & Invasive Species	Total	Percentage
Mean Weediness	-1.89	
Weediness = -1 – Low Potential Invasiveness	4	44.44%
Weediness = -2 – Moderate Potential Invasiveness	2	22.22%
Weediness = -3 – High Potential Invasiveness	3	33.33%

Presence of Wetland Species	Total	Percentage
Average Wetness Value	0.55	
Upland	4	20.00%
Facultative Upland	7	35.00%
Facultative	1	5.00%
Facultative Wetland	6	30.00%
Obligate Wetland	2	10.00%

Appendix F. Plant Species List

Glossary

Explanation of Terminology

(See the following pages for addition detailed information on terms.)

Botanical and Common Name:	From Newmaster et. al, 1998. Species requiring confirmation noted (cf).
Co-efficient of Conservatism:	This value, ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and fidelity to a specific habitat integrity.
Wetness Index:	This value, ranging from -5 (obligate wetland) to 5 (upland) provides the probability of a species occurring in wetland or upland habitats.
Weediness Index:	This value, ranging from -1 (low) to -3 (high) quantifies the potential invasiveness of non-native plants. In combination with the percentage of non-native plants, it can be used as an indicator of disturbance.
Provincial Status:	Provincial conservation status rank assigned by NHIC; S1 to S5 based on decreasing level of conservation concern; SE = provincial exotic status rank assigned by NHIC, SE1 to SE5 based on increasing abundance, SEH = historic; SU = unrankable (insufficient information to assign a numeric conservation status rank); SH = historic; SX = extirpated; hyb = hybrid (no conservation status assigned) These ranks are not legal designations. S4 and S5 species are generally uncommon to common in the province. Species ranked S1-S3 are considered to be rare in Ontario.
Local Status:	Middlesex County - From Oldham, 2017 (List of the Vascular Plants of Ontario's Carolinian Zone (Ecoregion 7E)) I: introduced; thought to have been present in the Carolinian Zone (CZ) or individual CZ area prior to European settlement; believed to be deliberately or inadvertently introduced to the CZ by humans (followed by a status, below) C: Common U: Uncommon R: Rare H: Historic X: Present; Status Unknown ?: Unconfirmed Report hyb : Hybrid
Annotations:	Provides comments on general distribution and abundance on the subject lands. Definitions of terminology and abbreviations used as follows.
Abundance:	<i>Dominant</i> : A plant with the greatest cover and/or biomass within a plant community and represented throughout the community by large numbers of individuals. Visually more abundant than other species in the same stratum and forming >10% ground cover, and >35% of the vegetation cover in any one stratum. <i>Abundant</i> : Referring to a plant which is represented throughout the polygon or community by large numbers of individuals or clumps. Likely to be encountered anywhere in the polygon. Usually forming >10% ground cover. <i>Occasional</i> : Referring to plants which are present as scattered individuals throughout a community, or represented by one or more large clumps of many individuals. Most species will fall into this category. <i>Rare</i> : Cover or abundance of a plant species that is represented in the area of interest by only one to a few individuals.

Detailed Explanation of Terms

Floral Quality Index and Coefficient of Conservatism Values

Vegetation species and community sensitivity was assessed through the application of coefficient of conservatism values (CC), assigned to each native species in southern Ontario (Oldham, et. al, 1995). The value of CC, ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and fidelity to specific habitat integrity. The occurrence of species with a CC of 9 or 10 can be good indicators of undisturbed conditions such as mature forests, fens or bogs.

General habitat values associated with the CC values are:

- 0-3: species found in a wide variety of communities, including disturbed sites
- 4-6: species associated with a specific community, but tolerate moderate disturbance
- 7-8: species associated with a community in an advanced successional stage, tolerant of minor disturbances
- 9-10: species with a high degree of fidelity to a narrow range of synecological parameters

The floristic quality of an area is reflected in the mean value of CC. For example, an old field or grazed woodlot would tend have a low mean CC; these habitats are dominated by opportunistic species that occur in a wide range of site conditions and are tolerant of disturbance. A bog, prairie or intact forest would have a higher value, reflecting the specific habitat requirements of many of the species and a generally undisturbed condition. The following provides an example of interpretation of CC values:

- mean CC value / % spp CC >8 / Condition of the Landscape
- 5 / 27 / intact
- 3.5 / 19 / slightly degraded
- 1.3 / 2 / severely degraded

The FQI accounts for the species diversity of the area by equating the number of native species with the mean CC value. The FQI is generally used for comparing natural areas. The CC value and FQI of the study area were calculated for the entire study area.

Weediness Index

The sensitivity of natural areas can be assessed through application of the Weediness Index. The Weediness Index quantifies the potential invasiveness of non-native plants, and, in combination with the percentage of non-native plants can be used as an indicator of disturbance. Values (ranging from 1- to -3) have been assigned to most non-native species based on the potential impact each species can have in natural areas:

- -1: little or no impact on natural areas (most non-native plants are in this category)
- -2: occasional impacts on natural areas, generally infrequent or localized
- -3: major potential impacts on natural areas

Wetness Index

All plants in southern Ontario have been assigned a wetland category, based on the designations developed for use by the United States Fish & Wildlife Service. Plants are designated into the following categories:

- *OBL* (Obligate Wetland): occurs almost always in wetlands under natural conditions (estimated >99% probability)
- *FACW* (Facultative Wetland): usually occurs in wetlands, but occasionally found in non-wetlands (estimated 67-99% probability)
- *FAC* (Facultative): equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability)
- *FACU* (Facultative Upland): occasionally occurs in wetlands, but usually occurs in non-wetlands (estimated 1-33% probability)
- *UPL* (Upland): occurs almost never in wetlands under natural conditions (estimated <1% probability)

Further refinement of the Facultative categories are denoted by a “+” or “-” to express exaggerated tendencies for those species. The “+” denotes a greater estimated probability occurring in wetlands than species in the general indicator category, but a lesser probability than species occurring in the next higher category. The “-” denotes a lesser estimated probability of occurring in wetlands than species in the general indicator category, but a greater probability than species occurring in the next lower general category.

Each wetland category has been assigned a numerical value to facilitate the quantification of the wetness index. The wetland categories and their corresponding values are as follows:

- *OBL* : -5
- *FACW+*: -4
- *FACW*: -3
- *FACW-*: -2
- *FAC+*: -1
- *FAC*: 0
- *FAC-*: 1
- *FACU+*: 2
- *FACU*: 3
- *FACU-*: 4
- *UPL*: 5

Provincial Status

Provincial ranks are used by the NHIC to set protection priorities for rare species and natural communities. These rankings are based on the total number of extant Ontario populations and the degree to which they are potentially or actively threatened with destruction. The ranks are:

- **S1: Critically Imperiled**—Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province
- **S2: Imperiled**—Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province
- **S3: Vulnerable**—Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation
- **S4: Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.

- **S5: Secure**—Common, widespread, and abundant in the nation or state/province
- **SH: Possibly Extirpated (Historical)**—Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences
- **SNR Unranked**—Nation or state/province conservation status not yet assessed
- **SX: Presumed Extirpated**—Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered
- **SNA Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
- **SU: Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends
- Rank ranges, e.g. S2S3, indicate that the rank is either S2 or S3, but that current information is insufficient to differentiate.
- **S#S# Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

REFERENCES

Nomenclature based on:

- Newmaster, S.G., A. Lehela, P.W.C Uhlig, S. McMurray and M.J. Oldham. 1998. Ontario plant list. Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, ON, Forest Research Information Paper No. 123. 550 pp. + appendices.

Co-efficient of Conservatism, Wetness & Weediness

- Oldham, M.J., W.D. Bakowsky and D.A. Sutherland. 1995. Floristic quality assessment for southern Ontario. OMNR, Natural Heritage Information Centre, Peterborough. 68 pp.

Provincial (Ontario) Status:

- Natural Heritage Information Centre (NHIC). 2000. Provincial status of plants, wildlife and vegetation communities database. <http://www.mnr.gov.on.ca/MNR/nhic/nhic.html>. OMNR, Peterborough.

Local Status:

- Varga, S., editor. August 2000. Distribution and status of the vascular plants of the Greater Toronto Area. Ontario Ministry of Natural Resources, Aurora District. 103 pp.

Appendix G

Ecological Land Classification Community Descriptions

Appendix G: ELC Descriptions

W12A Landfill Expansion / City of London

Property ID	Patch	ELC Code	ELC Inclusion/ Complex	S-RANK	ELC Description
3298 Scotland Dr	P02	CUP3-2	CUM1-1	SNA	This cultural plantation community was located at the southern end of the property along Scotland Drive. Forest canopy cover was dominant at greater than 60% cover and dominant species included white pine (<i>Pinus strobus</i>) and Norway spruce (<i>Picea abies</i>). Sub-canopy cover included White pine, American elm (<i>Ulmus americana</i>), red-osier dogwood (<i>Cornus sericea</i>) and black cherry (<i>Prunus serotina</i>). Ground cover was dominated by garlic mustard (<i>Alliaria petiolata</i>) and Pennsylvania sedge (<i>Carex pensylvanica</i>). A cultural meadow inclusion was present within the community.
3298 Scotland Dr	P02	MAM2-2	MAS2	S5	This reed canary grass mineral meadow marsh was located in the south end of the property. Ground cover species were dominant at over 60% cover with the most frequent species being reed canary grass (<i>Phalaris arundinacea</i>) and broad-leaved cattail (<i>Typha latifolia</i>), with vervain species (<i>Verbena sp.</i>). Sub canopy species included willow species (<i>Salix sp</i>). A mineral shallow marsh inclusion was present within the community.
3137 Scotland Dr	P02	CUM1-1	CUW1/SW T2-2	SNA	This cultural meadow community was located surrounding a pond and along the roadside in the north east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), bird's-foot trefoil (<i>Lotus corniculata</i>), tall goldenrod (<i>Solidago altissima</i>) and heath aster (<i>Symphyotrichum ericoides</i>). This community was complexed with a willow mineral thicket swamp and a mineral cultural woodland inclusion was also present.
3137 Scotland Dr	P02	CUM1-1	MAM2	SNA	This cultural meadow community was located surrounding a pond and along the roadside in the north east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), tall goldenrod (<i>Solidago altissima</i>), bird's-foot trefoil (<i>Lotus corniculata</i>), and heath aster (<i>Symphyotrichum ericoides</i>). A mineral shallow marsh inclusion was present within this community.
3405 Scotland Dr	P02	CUP3	OAo/CUM 1-1	SNA	This cultural plantation community was located along the southern side of a pond in the northern portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included Scot's pine (<i>Pinus sylvestris</i>), eastern white cedar (<i>Thuja occidentalis</i>) and sugar maple (<i>Acer saccharum</i>). The shrub layer consisted of common buckthorn (<i>Rhamnus cathartica</i>), tartarian honeysuckle (<i>Lonicera tatarica</i>) and red-osier dogwood (<i>Cornus sericea</i>). Ground cover was dominated by smooth brome grass (<i>Bromus inermis</i>), common dandelion (<i>Taraxicum officianale</i>) and wild carrot (<i>Daucus carota</i>). This community was complexed with a cultural meadow and an open aquatic inclusion was also present.
3438 Manning Dr	P03	FOD2-3	-	S3S4	This dry-fresh hickory deciduous forest community was located at the northern end of the propterty. Forest canopy cover was dominant at greater than 60% cover and dominant species included shagbark hickory (<i>Carya ovata</i>). The sub-canopy consisted of shagbark hickory and black walnut (<i>Juglans nigra</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), and choke cherry (<i>Prunus virginiana</i>), while ground cover was dominated by young shagbark hickory, garlic mustard (<i>Alliaria petiolata</i>), and timothy (<i>Phleum pratense</i>).
3465 Scotland Dr	P02	CUM1-1	MAS2/CU T1	SNA	This cultural meadow community was located in the north east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being smooth brome grass (<i>Bromus inermis</i>), canada goldenrod (<i>Solidago canadensis</i>), kentucky bluegrass (<i>Poa pratensis</i>), and spiked sedge (<i>Carex spicata</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), gray dogwood (<i>Cornus racemosa</i>), common apple (<i>Malus pumila</i>) and hawthorn species (<i>Crataegus sp</i>). The tree layer was comprised of sparse white ash (<i>Fraxinus americana</i>), black walnut (<i>Juglans nigra</i>) and eastern cottonwood (<i>Populus deltoides</i>). This community was complexed with a mineral cultural thicket and a mineral shallow marsh inclusion was also present.
3483 Westminster Dr	P02	CUT1	-	SNA	This mineral cultural thicket was located in the southeastern portion of the property. Tall shrub layer species were dominant in this community at over 60% cover with the most frequent species being common buckthorn (<i>Rhamnus cathartica</i>) and hawthorn species (<i>Crataegus sp</i>), while the general shrub layer was dominated by common buckthorn, gray dogwood (<i>Cornus racemosa</i>) and tartarian honeysuckle (<i>Lonicera tatarica</i>). Ground cover consisted of Pennsylvania sedge (<i>Carex pensylvanica</i>), yellow trout-lily (<i>Erythronium americanum</i>) and wild strawberry (<i>Fragaria virginiana</i>).
3483 Westminster Dr	P02	FOD5	-	SNA	This deciduous forest was located in the southern portion of the property near the centre of the natural feature. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), green ash (<i>Fraxinus pennsylvanica</i>), and American beech (<i>Fagus grandifolia</i>). The sub-canopy was dominated by American beech. The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), tartarian honeysuckle (<i>Lonicera tatarica</i>) and gray dogwood (<i>Cornus racemosa</i>). Ground cover consisted of Pennsylvania sedge (<i>Carex pensylvanica</i>) yellow trout-lily (<i>Erythronium americanum</i>), and garlic mustard (<i>Alliaria petiolata</i>).
3483 Westminster Dr	P02	FOD2-4	-	S5	This deciduous forest was located in the southern portion of the property adjacent to Scotland Drive. Forest canopy cover was dominant at greater than 60% cover and dominant species included white oak (<i>Quercus alba</i>), ironwood (<i>Ostrya virginiana</i>), and red oak (<i>Quercus rubra</i>). The sub-canopy was comprised of ironwood, sugar maple (<i>Acer saccharum</i>), and white oak. The shrub layer was dominated by common buckthorn (<i>Rhamnus cathartica</i>) and black cherry (<i>Prunus serotina</i>). Ground cover consisted primarily of yellow trout-lily (<i>Erythronium americanum</i>).
3483 Westminster Dr	P02	FOD2-4	-	S5	This deciduous forest was located in the southern portion of the property at the north end of the natural feature. Forest canopy cover was dominant at greater than 60% cover and dominant species included red oak (<i>Quercus rubra</i>), white oak (<i>Quercus alba</i>), and American beech (<i>Fagus grandifolia</i>). The sub-canopy was dominated by sugar maple (<i>Acer saccharum</i>), ironwood (<i>Ostrya virginiana</i>), and common buckthorn (<i>Rhamnus cathartica</i>). The shrub layer was comprised of common buckthorn, black cherry (<i>Prunus serotina</i>), and gray dogwood (<i>Cornus racemosa</i>). Ground cover was comprised of yellow trout-lily (<i>Erythronium americanum</i>) and common speedwell (<i>Veronica officinalis</i>).

Appendix G: ELC Descriptions

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Property ID	Patch	ELC Code	ELC Inclusion/ Complex	S-RANK	ELC Description
3483 Westminster Dr	P02	SWD	SWT2-5	SNA	This deciduous swamp was located in the southern end of the property and within the centre of the natural feature. The canopy layer was dominated by green ash (<i>Fraxinus pennsylvanica</i>), hybrid white willow (<i>Salix x fragilis</i>) and silver maple (<i>Acer saccharinum</i>), while the sub-canopy consisted of green ash, sugar maple (<i>Acer saccharum</i>) and common buckthorn (<i>Rhamnus cathartica</i>). The shrub layer was dominated by gray dogwood (<i>Cornus racemosa</i>), common red raspberry (<i>Rubus idaeus</i>) and common buckthorn. Ground cover was dominated by reed canary grass (<i>Phalaris arundinacea</i>). A red-osier mineral thicket swamp inclusion was present within the community.
3483 Westminster Dr	P02	MAM2	SWT2	SNA	This mineral meadow marsh community was located in the north portion of the property. Ground cover species were dominant at over 60% cover with the most frequent species being common reed (<i>Phragmites australis</i>), reed canary grass (<i>Phalaris arundinacea</i>), and sedge species (<i>Carex sp</i>). The shrub layer comprised of gray dogwood (<i>Cornus racemosa</i>), common red raspberry (<i>Rubus idaeus</i>), spiraea species (<i>Spiraea sp</i>), and sandbar willow (<i>Salix exigua</i>). The sparse canopy layer consisted of green ash (<i>Fraxinus pennsylvanica</i>), sugar maple (<i>Acer saccharum</i>), black willow (<i>Salix nigra</i>) and common buckthorn (<i>Rhamnus cathartica</i>). A mineral thicket swamp inclusion was present within the community.
3483 Westminster Dr	P02	OAD	MAS2/SW T2-5	SNA	This open water community was located in the centre of the natural feature near the western portion of the property. The mineral shallow marsh inclusion and red-osier mineral thicket swamp situated along the north and eastern sides of the open water community. The shrub layer consisted of red-osier dogwood (<i>Cornus sericea</i>), gray dogwood (<i>Cornus racemosa</i>), and common buckthorn (<i>Rhamnus cathartica</i>), while the ground cover was dominated by broad-leaved cattail (<i>Typha latifolia</i>) and reed canary grass (<i>Phalaris arundinacea</i>).
3502 Manning Dr	P02/P04	CUM1-1	Treerow	SNA	This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), common reed (<i>Phragmites australis</i>), smooth brome grass (<i>Bromus inermis</i>) and reed canary grass (<i>Phalaris arundinacea</i>). A planted treerow consisting of balsam poplar (<i>Populus balsamifera</i>), Norway spruce (<i>Picea abies</i>), white oak (<i>Quercus alba</i>) and sandbar willow (<i>Salix exigua</i>).
3502 Scotland Dr	P02	CUP3	-	SNA	This cultural plantation community was located along the central portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included white pine (<i>Pinus strobus</i>), Norway spruce (<i>Picea abies</i>) and Scot's pine (<i>Pinus sylvestris</i>). The sub-canopy consisted of sugar maple (<i>Acer saccharum</i>) and green ash (<i>Fraxinus pennsylvanica</i>). The shrub layer was dominated by common buckthorn (<i>Rhamnus cathartica</i>), black cherry (<i>Prunus virginiana</i>) and tartarian honeysuckle (<i>Lonicera tatarica</i>), while the ground layer consisted of garlic mustard (<i>Alliaria petiolata</i>) and wooly blue violet (<i>Viola sororia</i>).
3502 Scotland Dr	P02	FOD5-5	SWT2-5/SWD2	S4	This deciduous forest was located in the south west portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), shagbark hickory (<i>Carya ovata</i>), American beech (<i>Fagus grandifolia</i>), and red oak (<i>Quercus rubra</i>), while the sub-canopy consisted of sugar maple, shagbark hickory, and green ash (<i>Fraxinus pennsylvanica</i>). The shrub layer consists of sugar maple, American beech, common buckthorn (<i>Rhamnus cathartica</i>), and black cherry (<i>Prunus virginiana</i>). The ground cover was comprised of young sugar maple, yellow trout-lily (<i>Erythronium americanum</i>) and white trillium (<i>Trillium grandiflorum</i>). Inclusions of a red-osier mineral thicket swamp and an ash mineral deciduous swamp ecosite were present within this community.
3583 Westminster Dr	P02	FOD5-5	MAM2/CUT	S4	This deciduous forest was located throughout the southern and extends towards the northern portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), shagbark hickory (<i>Carya ovata</i>), red oak (<i>Quercus rubra</i>) and American beech (<i>Fagus grandifolia</i>). The sub-canopy consisted of sugar maple, shagbark hickory, red oak and ironwood (<i>Ostrya virginiana</i>). The shrub layer was dominated by sugar maple, American beech, black cherry (<i>Prunus virginiana</i>), and common buckthorn (<i>Rhamnus cathartica</i>). The ground cover was comprised of yellow trout-lily (<i>Erythronium americanum</i>), wooly blue violet (<i>Viola sororia</i>), white trillium (<i>Trillium grandiflorum</i>) and young sugar maple. This community was complexed with a mineral cultural thicket and a mineral meadow marsh inclusion was also present.
3583 Westminster Dr	P02	SWT2	-	SNA	This mineral thicket swamp was located in the eastern portion of the property. The shrub layer was dominant at over 60% coverage with the most frequent species being meadow willow (<i>Salix petiolaris</i>), red-osier dogwood (<i>Cornus sericea</i>), wild black currant (<i>Ribes americanum</i>), and common buckthorn (<i>Rhamnus cathartica</i>). Ground cover was comprised of watercress (<i>Nasturtium officinale</i>), sedge species (<i>Carex species</i>), skunk cabbage (<i>Symplocarpus foetidus</i>) and sensitive fern (<i>Onoclea sensibilis</i>).
3595 Scotland Dr	P02	CUM1-1	-	SNA	This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being smooth brome grass (<i>Bromus inermis</i>), orchard grass (<i>Dactylis glomerata</i>), and Canada thistle (<i>Cirsium arvense</i>). The sparse shrub layer was comprised of red-osier dogwood (<i>Cornus sericea</i>) and common buckthorn (<i>Rhamnus cathartica</i>).
3666 Scotland Dr	P02	CUT1	-	SNA	This mineral cultural thicket was located in the northern portion of the property. Tall shrub layer species were dominant in this community at over 60% cover with the most frequent species being common buckthorn (<i>Rhamnus cathartica</i>) and gray dogwood (<i>Cornus racemosa</i>). The sparse canopy layer consisted of sugar maple (<i>Acer saccharum</i>) and eastern cottonwood (<i>Populus deltoides</i>).
3666 Scotland Dr	P02	CUM1-1	-	SNA	This cultural meadow community was located in the southern portion the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), brown knapweed (<i>Centaurea jacea</i>), bird's-foot trefoil (<i>Lotus corniculatus</i>) and Canada goldenrod (<i>Solidago canadensis</i>).

Appendix G: ELC Descriptions

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Property ID	Patch	ELC Code	ELC Inclusion/ Complex	S-RANK	ELC Description
3666 Scotland Dr	P02	FOD5-5	-	S4	This deciduous forest was located in the northern end of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), bitternut hickory (<i>Carya cordiformis</i>), and red oak (<i>Quercus rubra</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>) and downy arrowwood (<i>Viburnum rafinesquianum</i>). The sparse ground layer consisted of sedge species (<i>Carex sp</i>), may apple (<i>Podophyllum peltatum</i>), moss species, and tall hairy agrimony (<i>Agrimonia gryposepala</i>).
3691 Manning Dr	P02	CUM1-1	OAD	SNA	This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being kentucky blue grass (<i>Poa pratensis</i>), tall goldenrod (<i>Solidago altissima</i>), common dandelion (<i>Taraxicum officinale</i>), and Canada thistle (<i>Cirsium arvense</i>). The shrub layer was comprised primarily of young planted Norway spruce (<i>Picea abies</i>) as well as sparse white oak (<i>Quercus alba</i>), Freeman's maple (<i>Acer x freemanii</i>) and balsam poplar (<i>Populus balsamifera</i>). The sparse canopy layer included white cedar (<i>Thuja occidentalis</i>) and Norway spruce. An open aquatic inclusion was present within this community.
3696 Scotland Dr	P02	FOD5-5	MAM2/SW T2	S4	This deciduous forest was located throughout the eastern and central portions of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), shagbark hickory (<i>Carya ovata</i>), American beech (<i>Fagus grandifolia</i>), and red oak (<i>Quercus rubra</i>). The sub-canopy consisted of sugar maple, shagbark hickory, American elm (<i>Ulmus americana</i>) and green ash (<i>Fraxinus pennsylvanica</i>). The shrub layer was comprised of young sugar maple, American beech, common buckthorn (<i>Rhamnus cathartica</i>) and gray dogwood (<i>Cornus racemosa</i>). Ground cover was dominated by young sugar maple, yellow trout-lily (<i>Erythronium americanum</i>), creeping bentgrass (<i>Agrostis stolonifera</i>) and reed canary grass (<i>Phalaris arundinacea</i>). This community was complexed with a mineral meadow marsh and a mineral thicket swamp inclusion was also present. Surveys were completed from the roadside.
3713 Scotland Dr	P02	CUM1-1	CUT1	SNA	This cultural meadow community was located throughout the property. Ground cover was dominant at greater than 60% cover with the most frequent species being Kentucky blue grass (<i>Poa pratensis</i>), orchard grass (<i>Dactylis glomerata</i>) and smooth brome grass (<i>Bromus inermis</i>). This community was complexed with a mineral cultural thicket.
3713 Scotland Dr	P02	CUT1	CUM1-1	SNA	This mineral cultural thicket was located in the central and northeastern portions of the property. Shrub layer species were dominant in this community at over 60% cover with the most frequent species being common buckthorn (<i>Rhamnus cathartica</i>), gray dogwood (<i>Cornus racemosa</i>) and hawthorn species (<i>Crataegus sp</i>). The sparse canopy layer consisted of freeman's maple (<i>Acer x freemanii</i>), sugar maple (<i>Acer saccharum</i>), choke cherry (<i>Prunus virginiana</i>) and Norway maple (<i>Acer platanoides</i>). A cultural meadow inclusion was present within this community.
3713 Scotland Dr	P02	SAS1	MAM2-2/MAS2	SNA	This submergent shallow aquatic community was located in the northeast portion of the property. Dominant plant species included white water buttercup (<i>Ranunculus aquatalis</i>), small duckweed (<i>Lemna minor</i>), water plantain (<i>Alisma plantago-aquatica</i>), and pondweed species (<i>Potamogeton sp.</i>). The ground cover surrounding this community consisted of needle spikerush (<i>Eleocharis acicularis</i>), reed canary grass (<i>Phalaris arundinacea</i>), and water sedge (<i>Carex aquatilis</i>). This community was complexed with a mineral shallow marsh and a reed canary grass mineral meadow marsh inclusion was also present.
3900 Scotland Dr	P01	FOD5-5	SWT2	S4	This deciduous forest was located in the southern end of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species included sugar maple (<i>Acer saccharum</i>), bitternut hickory (<i>Carya cordiformis</i>), American basswood (<i>Tilia americana</i>), and shagbark hickory (<i>Carya ovata</i>). The sub-canopy was comprised of sugar maple, american basswood, and red oak (<i>Quercus rubra</i>). The shrub layer consisted of common buckthorn (<i>Rhamnus cathartica</i>), gray dogwood (<i>Cornus racemosa</i>), mountain holly (<i>Nemopanthus mucronatus</i>) and riverbank grape (<i>Vitis riparia</i>). Ground cover was dominated by narrow-leaved cattail (<i>Typha angustifolia</i>), broad-leaved cattail (<i>Typha latifolia</i>) and purple loosestrife (<i>Lythrum salicaria</i>). This community was complexed with a mineral thicket swamp.
4166 Scotland Dr	P02	CUW1	-	SNA	This cultural woodland community was located in the eastern portion of the property. Dominant tree species present were black locust (<i>Robinia pseudoacacia</i>), black walnut (<i>Juglans nigra</i>), green ash (<i>Fraxinus pennsylvanica</i>) and sugar maple (<i>Acer saccharum</i>). The sub-canopy was comprised of black locust and black walnut. The dominant shrub species present were common buckthorn (<i>Rhamnus cathartica</i>), staghorn sumac (<i>Rhus typhina</i>) and riverbank grape (<i>Vitis riparia</i>). Ground cover was dominated by smooth brome grass (<i>Bromus inermis</i>) and wild carrot (<i>Daucus carota</i>).
5861 White Oak Rd	P02	CUM1-1	CUW1	SNA	This cultural meadow community was located in the east end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being early goldenrod (<i>Solidago juncea</i>), devil's beggarticks (<i>Bidens frondosa</i>), smooth brome grass (<i>Bromus inermis</i>), and wild carrot (<i>Daucus carota</i>). The shrub layer was comprised of common buckthorn (<i>Rhamnus cathartica</i>), and tartarian honeysuckle (<i>Lonicera tatarica</i>). The sub-canopy consisted of eastern white cedar (<i>Thuja occidentalis</i>), Manitoba maple (<i>Acer negundo</i>), while the sparse canopy was dominated by freeman's maple (<i>Acer freemanii</i>) and horse chestnut (<i>Aesculus hippocastanum</i>). A cultural woodland inclusion was present within this community.
6100 White Oak Rd	P02	CUM1-1	OAD	SNA	This cultural meadow community was located in the north end of the property. Ground cover was dominant at greater than 60% cover with the most frequent species being smooth brome grass (<i>Bromus inermis</i>), goldenrod species (<i>Solidago sp.</i>), and common dandelion (<i>Taraxicum officinale</i>). An open aquatic inclusion was present within the community.

Appendix G: ELC Descriptions

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Property ID	Patch	ELC Code	ELC Inclusion/ Complex	S-RANK	ELC Description
6100 White Oak Rd	P02	CUP3	CUM1-1	SNA	This cultural plantation community was located in the northwestern portion of the property. Forest canopy cover was dominant at greater than 60% cover and dominant species present was white pine (<i>Pinus strobus</i>). The sub-canopy was comprised of white pine, green ash (<i>Fraxinus pennsylvanica</i>), and Manitoba maple (<i>Acer negundo</i>). The shrub layer consisted of common buckthorn (<i>Rhamnus cathartica</i>), red-osier dogwood (<i>Cornus sericea</i>), and choke cherry (<i>Prunus virginiana</i>). Sparse ground cover consisted of garlic mustard (<i>Alliaria petiolata</i>), woodland strawberry (<i>Fragaria vesca</i>), and ground ivy (<i>Glechoma hederacea</i>). A cultural meadow inclusion was present within the community.
6100 White Oak Rd	P02	MAM2-2	SWT2-2	S5	This reed canary grass mineral meadow marsh was located in northwest portion of the property. Ground cover species were dominant at over 60% cover with the most frequent species being reed canary grass (<i>Phalaris arundinacea</i>) and common reed (<i>Phragmites australis</i>). The shrub layer was comprised of pussy willow (<i>Salix discolor</i>), red-osier dogwood (<i>Cornus sericea</i>), and common buckthorn (<i>Rhamnus cathartica</i>). A willow mineral thicket swamp inclusion was present within the community.

Appendix H

Bat Habitat Assessment

Appendix H. Bat Habitat Assessment Results

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Table H1: Bat Habitat Assessment Results – 3438 Manning Drive – FOD 2-3

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
1	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482161	4747962
2	Shagbark Hickory (<i>Carya ovata</i>)	53	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482159	4747972
3	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482157	4747967
4	Shagbark Hickory (<i>Carya ovata</i>)	32	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482152	4747965
5	Shagbark Hickory (<i>Carya ovata</i>)	39	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482154	4747962
6	Shagbark Hickory (<i>Carya ovata</i>)	40	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482137	4747960
7	Shagbark Hickory (<i>Carya ovata</i>)	70	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482140	4747969
8	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482130	4747971
9	Shagbark Hickory (<i>Carya ovata</i>)	50	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482136	4747962
10	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482132	4747966

Appendix H. Bat Habitat Assessment Results

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
11	Shagbark Hickory (<i>Carya ovata</i>)	29	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482132	4747968
12	Shagbark Hickory (<i>Carya ovata</i>)	30	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482125	4747965
13	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482118	4747959
14	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482113	4747950
15	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482119	4747947
16	Shagbark Hickory (<i>Carya ovata</i>)	70	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482137	4747924
17	Shagbark Hickory (<i>Carya ovata</i>)	42	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482138	4747913
18	Shagbark Hickory (<i>Carya ovata</i>)	46	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482133	4747909
19	Shagbark Hickory (<i>Carya ovata</i>)	85	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482136	4747893
20	Shagbark Hickory (<i>Carya ovata</i>)	45	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482141	4747887
21	Shagbark Hickory (<i>Carya ovata</i>)	40	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482149	4747889

Appendix H. Bat Habitat Assessment Results

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
22	Shagbark Hickory (<i>Carya ovata</i>)	50	2	<ul style="list-style-type: none"> • Cavity • Loose bark • Decay Class 1 • Other snag within 10m 	482159	4747885
23	Shagbark Hickory (<i>Carya ovata</i>)	52	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482163	4747886
24	Shagbark Hickory (<i>Carya ovata</i>)	70	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482179	4747924
25	Shagbark Hickory (<i>Carya ovata</i>)	30	2	<ul style="list-style-type: none"> • Cavity • Loose bark • Decay Class 1 • Other snag within 10m 	482178	4747934
26	Shagbark Hickory (<i>Carya ovata</i>)	35	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482174	4747939
27	Shagbark Hickory (<i>Carya ovata</i>)	29	3	<ul style="list-style-type: none"> • Cavity • Loose bark • Decay Class 2 • Other snag within 10m 	482168	4747941

Appendix H. Bat Habitat Assessment Results

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Table H2: Bat Habitat Assessment Results – 3502 Scotland Drive – FOD5-5

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
13	Shagbark Hickory (<i>Carya ovata</i>)	27	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481764	4748282
14	American Elm (<i>Ulmus americana</i>)	32	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	481763	4748282
15	Shagbark Hickory (<i>Carya ovata</i>)	34	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481763	4748284
16	Sugar Maple (<i>Acer saccharum</i>)	25	3	<ul style="list-style-type: none"> • Decay Class 2 • Cavity at top (chimney style 2m long by 30cm wide) 	481753	4748275
17	Sugar Maple (<i>Acer saccharum</i>)	25	3	<ul style="list-style-type: none"> • Loose bark • Cavity • Decay Class 2 	481743	4748279
18	Shagbark Hickory (<i>Carya ovata</i>)	24	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481811	4748260
19	Shagbark Hickory (<i>Carya ovata</i>)	24	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481806	4748269
20	Shagbark Hickory (<i>Carya ovata</i>)	28	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481881	4748296
21	Shagbark Hickory (<i>Carya ovata</i>)	30	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481861	4748228
22	Shagbark Hickory (<i>Carya ovata</i>)	36	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481865	4748240
23	Ash species (<i>Fraxinus sp.</i>)	46	2	<ul style="list-style-type: none"> • Loose bark • Cavities • Knot hole • Decay Class 3 	481742	4748187
26	American Beech (<i>Fagus grandifolia</i>)	40	2	<ul style="list-style-type: none"> • Two Cavities (20cm x 20cm and 30cm x 15cm) 	481766	4748192

Appendix H. Bat Habitat Assessment Results

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Table H3: Bat Habitat Assessment Results – 3298 Scotland Drive – CUP3

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
1	Eastern White Pine (<i>Pinus strobus</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Other snag within 10m 	482448	4748282
2	Eastern White Pine (<i>Pinus strobus</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 	482442	4748282
3	Eastern White Pine (<i>Pinus strobus</i>)	21	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 	482439	4748282

Table H4: Bat Habitat Assessment Results – 3483 Westminster Drive – FOD5-5

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
4	White Ash (<i>Fraxinus americana</i>)	18	4	<ul style="list-style-type: none"> • Loose bark • Cavity • Decay Class 3 	482195	4748257
5	White Ash (<i>Fraxinus americana</i>)	21	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	482184	4748299
6	Silver Maple (<i>Acer saccharinum</i>)	55	1	<ul style="list-style-type: none"> • Cavity • Decay Class 1 • Other snag within 10m 	482170	4748303
7	Hybrid White Willow (<i>Salix x fragilis</i>)	42	1	<ul style="list-style-type: none"> • Cavity • Decay Class 2 • Other snag within 10m 	482188	4748305
8	Hybrid White Willow (<i>Salix x fragilis</i>)	22	3	<ul style="list-style-type: none"> • Cavity (open chimney) • Decay Class 2 • Other snag within 10m 	482190	4748317
9	Hybrid White Willow (<i>Salix x fragilis</i>)	43	3	<ul style="list-style-type: none"> • Cavity (open chimney) • Decay Class 2 • Other snag within 10m 	482215	4748306

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
10	White Ash (<i>Fraxinus americana</i>)	23	1	<ul style="list-style-type: none"> • Cavity • Crack • Loose bark • Decay Class 3 • Other snag within 10m 	482188	4748336
11	White Ash (<i>Fraxinus americana</i>)	20	2	<ul style="list-style-type: none"> • Cavity • Loose bark • Decay Class 3 • Other snag within 10m 	482192	4748332
12	White Ash (<i>Fraxinus americana</i>)	19	1	<ul style="list-style-type: none"> • Crack • Loose bark • Decay Class 3 • Other snag within 10m 	482168	4748334
13	Balsam Poplar (<i>Populus balsamifera</i>)	21	1	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	482160	4748329
14	White Ash (<i>Fraxinus americana</i>)	18	2	<ul style="list-style-type: none"> • Loose bark • Other snag within 10m 	482157	4748320
15	Balsam Poplar (<i>Populus balsamifera</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Other snag within 10m 	482158	4748313
16	Oak species (<i>Quercus sp.</i>)	34	1	<ul style="list-style-type: none"> • Cavity • Loose bark • Decay Class 3 • Other snag within 10m 	482147	4748313
17	White Ash (<i>Fraxinus americana</i>)	21	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	482149	4748315
18	Balsam Poplar (<i>Populus balsamifera</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Other snag within 10m 	482144	4748307
19	Balsam Poplar (<i>Populus balsamifera</i>)	29	1	<ul style="list-style-type: none"> • Cavities • Loose bark • Decay Class 3 • Other snag within 10m 	482148	4748309

Appendix H. Bat Habitat Assessment Results

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
20	Eastern White Pine (<i>Pinus strobus</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Knot hole • Decay Class 3 • Other snag within 10m 	482611	4748305
21	Sugar Maple (<i>Acer saccharum</i>)	36	1	<ul style="list-style-type: none"> • Cavities • Knot holes • Decay Class 3 • Other snag within 10m 	482658	4748285
22	White Oak (<i>Quercus alba</i>)	36	1	<ul style="list-style-type: none"> • Cavity • Knot holes • Decay Class 2 • Live tree • Interior • No leaf clusters 	482154	4748240
23	Hawthorn species (<i>Crataegus sp</i>)	18	3	<ul style="list-style-type: none"> • Cavity • Knot holes • Decay Class 2 	482123	4748265
24	Oak species (<i>Quercus sp</i>)	16	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Dead tree • Interior • No leaf clusters 	482140	4748333
25	Ironwood (<i>Ostrya virginiana</i>)	36	1	<ul style="list-style-type: none"> • Knot holes • Decay Class 1 	482082	4748329
26	Sugar Maple (<i>Acer saccharum</i>)	27	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	482070	4748345
27	Green Ash (<i>Fraxinus pennsylvanica</i>)	17	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Other snag within 10m 	482070	4748340

Appendix H. Bat Habitat Assessment Results

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
28	Oak species (<i>Quercus sp</i>)	16	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 2 • Declining tree • Forest edge • Other snag within 10m • No leaf clusters 	482081	4748345
29	Oak species (<i>Quercus sp</i>)	49	1	<ul style="list-style-type: none"> • Cavity • Decay Class 3 • Dead tree • Forest edge • Other snag within 10m • No leaf clusters 	482105	4748354
30	Ironwood (<i>Ostrya virginiana</i>)	38	3	<ul style="list-style-type: none"> • Cavity • Decay Class 1 • Other snag within 10m 	482138	4748348
31	Trembling Aspen (<i>Populus tremuloides</i>)	19	2	<ul style="list-style-type: none"> • Cavities • Decay Class 3 • Other snag within 10m 	482139	4748356

Table H5: Bat Habitat Assessment Results – 3583 Westminster Drive – FOD5-5

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
1	Shagbark Hickory (<i>Carya ovata</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481656	4748210
2	Sugar Maple (<i>Acer saccharum</i>)	29	2	<ul style="list-style-type: none"> • Cavities • Decay Class 1 	481651	4748186
6	Shagbark Hickory (<i>Carya ovata</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 	481690	4748275

Appendix H. Bat Habitat Assessment Results

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
7	Shagbark Hickory (<i>Carya ovata</i>)	18	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481699	4748269
9	Shagbark Hickory (<i>Carya ovata</i>)	34	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481725	4748329
10	Shagbark Hickory (<i>Carya ovata</i>)	31	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481731	4748335
11	Shagbark Hickory (<i>Carya ovata</i>)	36	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1 • Other snag within 10m 	481735	4748331
12	Green Ash (<i>Fraxinus pennsylvanica</i>)	25	2	<ul style="list-style-type: none"> • Loose bark • Crack • Decay Class 3 	481703	4748406

Table H6: Bat Habitat Assessment Results – 6100 White Oak Road – CUP3

Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
1	Eastern White Pine (<i>Pinus strobus</i>)	17	3	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	480772	4746460
2	Eastern White Pine (<i>Pinus strobus</i>)	20	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	480772	4746430
3	Eastern White Pine (<i>Pinus strobus</i>)	20	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480770	4746420
4	Eastern White Pine (<i>Pinus strobus</i>)	18	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480741	4746444

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Tree ID#	Tree Species ID	dbh (cm)	Height Class	Snag Attributes	Easting	Northing
5	Eastern White Pine (<i>Pinus strobus</i>)	19	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480735	4746445
6	Eastern White Pine (<i>Pinus strobus</i>)	22	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 	480748	4746470
7	Eastern White Pine (<i>Pinus strobus</i>)	23	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480743	4746516
8	Eastern White Pine (<i>Pinus strobus</i>)	25	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480753	4746524
9	Eastern White Pine (<i>Pinus strobus</i>)	21	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 3 • Other snag within 10m 	480734	4746551
10	Eastern White Pine (<i>Pinus strobus</i>)	24	2	<ul style="list-style-type: none"> • Loose bark • Decay Class 1-3 • Other snag within 10m 	480732	4746561
11	Eastern White Pine (<i>Pinus strobus</i>)	24	2	<ul style="list-style-type: none"> • Cavities • Loose bark • Knot hole • Decay Class 3 	480732	4746561

Appendix I

Breeding Bird List

Appendix I. Bird Species List

W12A Landfill Expansion / City of London

Common Name	Scientific Name	G-Rank ¹	S-Rank ²	SARA Status ³	COSEWIC Status ⁴	ESA Status ⁵	CASSARO Status ⁶	Area-sensitive Species ⁵	TRCA L-Rank ⁹	Conservation Priority Rank for Grand River Basin ¹⁰	Priority Species in the Lower Great Lakes/ St. Lawrence Plain (BCR Region 13) ¹¹	Priority Species in the Boreal Hardwood Transition Region (BCR Region 12) ¹²	OBBA 17MH8 4	BS-01	BS-02	BS-03	BS-04	BS-05	BS-06	Incidental
Green Heron	<i>Butorides virescens</i>	G5	S4B	-	-	-	-	-	L4	Level 4 Forest	Maintain Current	Increase	FY	-	-	-	-	-	-	X
Canada Goose	<i>Branta canadensis</i>	G5	S5	-	-	-	-	-	L5	-	Decrease	Decrease	FY	-	-	-	-	-	-	X
Mallard	<i>Anas platyrhynchos</i>	G5	S5	-	-	-	-	-	L5	-	Maintain Current	Maintain Current	FY	-	-	-	-	-	-	H
Turkey Vulture	<i>Cathartes aura</i>	G5	S5B	-	-	-	-	-	L4	Level 3 Forest	-	-	FY	-	-	-	-	-	-	X
Sharp-shinned Hawk	<i>Accipiter striatus</i>	G5	S5	-	-	-	NAR	A	L3	Level 2 Forest	-	-	FY	-	-	-	-	-	-	X
Red-tailed Hawk	<i>Buteo jamaicensis</i>	G5	S5	-	-	-	NAR	A	L5	-	-	-	AE	-	-	-	-	-	-	X
Wild Turkey	<i>Meleagris gallopavo</i>	G5	S5	-	-	-	-	-	L3	-	-	-	FY	-	-	-	-	-	-	S
Killdeer	<i>Charadrius vociferus</i>	G5	S5B,S5N	-	-	-	-	-	L5	-	Increase	Increase	NE	-	-	A	-	-	S	FY
Spotted Sandpiper	<i>Actitis macularia</i>	G5	S5	-	-	-	-	-	L4	Level 3 Open Country	Increase	Maintain Current	T	-	-	-	-	-	-	FY
Mourning Dove	<i>Zenaida macroura</i>	G5	S5	-	-	-	-	-	L5	-	-	-	NY	-	-	-	-	-	S	S
Eastern Wood-Pewee	<i>Contopus virens</i>	G5	S4B	-	SC	SC	SC	-	L4	-	Increase	-	T	-	-	-	-	-	-	S
Alder Flycatcher	<i>Empidonax alnorum</i>	G5	S5B	-	-	-	-	-	L3	Level 3 Forest	-	-	-	-	T	-	-	-	-	S
Willow Flycatcher	<i>Empidonax traillii</i>	G5	S5B	-	-	-	-	-	L4	-	-	-	FY	T	T	-	-	-	-	S
Eastern Kingbird	<i>Tyrannus tyrannus</i>	G5	S4B	-	-	-	-	-	L4	Level 3 Open Country	Increase	-	NE	-	S	-	-	P	H	S
Horned Lark	<i>Eremophila alpestris</i>	G5	S5B	-	-	-	-	-	L3	Level 3 Open Country	-	-	FY	-	-	-	-	-	-	S
Tree Swallow	<i>Tachycineta bicolor</i>	G5	S4B	-	-	-	-	-	L4	-	-	Increase	AE	X	-	X	-	-	X	-
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>	G5	S4B	-	-	-	-	-	L4	Level 2 Open Country	Increase	Increase	H	-	-	-	X	-	X	-
Bank Swallow	<i>Riparia riparia</i>	G5	S4B	-	-	THR	-	-	L3	Level 1 Open Country	Increase	Increase	AE	X	X	-	-	-	-	-
Barn Swallow	<i>Hirundo rustica</i>	G5	S4B	-	THR	THR	THR	-	L4	Level 3 Open Country	Recovery Objective	Recovery Objective	NY	X	-	X	-	X	H	X
American Crow	<i>Corvus brachyrhynchos</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	AE	-	-	S	-	-	S	-
Black-capped Chickadee	<i>Poecile atricapillus</i>	G5	S5	-	-	-	-	-	L5	Level 4 Forest	-	-	CF	-	-	S	-	-	-	S
House Wren	<i>Troglodytes aedon</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	CF	-	-	-	-	S	-	S
American Robin	<i>Turdus migratorius</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	NY	-	S	S	-	-	A	S
Gray Catbird	<i>Dumetella carolinensis</i>	G5	S4B	-	-	-	-	-	L4	Level 4 Forest	-	Increase	NY	-	-	-	-	S	-	-
Cedar Waxwing	<i>Bombycilla cedrorum</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	FY	-	-	-	-	-	-	S
Red-eyed Vireo	<i>Vireo olivaceus</i>	G5	S5B	-	-	-	-	-	L4	-	-	-	NE	-	-	-	-	-	-	S
Yellow Warbler	<i>Dendroica petechia</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	FY	-	T	-	-	-	S	S
Common Yellowthroat	<i>Geothlyphis trichas</i>	G5	S5B	-	-	-	-	-	L4	-	-	Maintain Current	NB	T	-	T	-	T	-	S
Northern Cardinal	<i>Cardinalis cardinalis</i>	G5	S5	-	-	-	-	-	L5	-	-	-	FY	T	T	A	-	T	-	S
Indigo Bunting	<i>Passerina cyanea</i>	G5	S4B	-	-	-	-	-	L4	-	-	-	NY	-	-	-	-	S	-	-
Chipping Sparrow	<i>Spizella passerina</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	NY	-	-	-	-	-	S	S
Clay-coloured Sparrow	<i>Spizella pallida</i>	G5	S4B	-	-	-	-	-	L3	Level 1 Open Country	-	-	-	S	-	-	-	-	-	-
Field Sparrow	<i>Spizella pusilla</i>	G5	S4B	-	-	-	-	-	L4	Level 3 Open Country	Increase	Assess/Maintain	CF	T	T	-	-	-	T	S
Savannah Sparrow	<i>Passerculus sandwichensis</i>	G5	S4B	-	-	-	-	A	L4	Level 1 Open Country	Increase	-	NY	T	A	T	T	A	-	S
Song Sparrow	<i>Melospiza melodia</i>	G5	S5B	-	-	-	-	-	L5	-	-	Increase	NY	T	T	T	S	T	A	A
Bobolink	<i>Dolichonyx oryzivorus</i>	G5	S4B	-	THR	THR	THR	A	L2	Level 2 Open Country	Recovery Objective	Recovery Objective	CF	-	CF	A	P	P	-	CF
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	G5	S4	-	-	-	-	-	L5	-	-	-	FY	-	T	CF	S	A	A	S
Eastern Meadowlark	<i>Sturnella magna</i>	G5	S4B	-	THR	THR	THR	A	L3	Level 2 Open Country	Recovery Objective	-	NE	T	P	T	T	-	S	S
Common Grackle	<i>Quiscalus quiscula</i>	G5	S5B	-	-	-	-	-	L5	-	-	-	FY	-	-	-	-	-	-	X
Brown-headed Cowbird	<i>Molothrus ater</i>	G5	S4B	-	-	-	-	-	L5	-	-	-	FY	S	-	-	-	-	H	-
Orchard Oriole	<i>Icterus spurius</i>	G5	S4B	-	-	-	-	-	-	Level 3 Forest	-	-	-	-	-	-	-	-	-	S
Baltimore Oriole	<i>Icterus galbula</i>	G5	S4B	-	-	-	-	-	L5	-	Maintain Current	-	CF	-	-	-	-	-	S	-
American Goldfinch	<i>Cardeulis tristis</i>	G5	S5B	-	-	-	-	-	L5	Level 3 Open Country	-	-	FY	-	S	-	-	S	S	S

Appendix J

Species at Risk Screening

Appendix J. Species at Risk Habitat Screening

W12A Landfill Expansion / City of London

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Suitable Habitat Identified During Background Review	Species Observed During Field Investigations	Conclusions/ Recommendations
Birds	Bank Swallow <i>Riparia riparia</i>	THR	No Status	THR	■ Bank swallows nest in burrows in natural and human-made settings where there are vertical faces in silt and sand deposits. Many nests are on banks of rivers and lakes, but they are also found in active sand and gravel pits or former ones where the banks remain suitable. The birds breed in colonies ranging from several to a few thousand pairs.	■ The bank swallow is found all across southern Ontario, with sparser populations scattered across northern Ontario. The largest populations are found along the Lake Erie and Lake Ontario shorelines, and the Saugeen River (which flows into Lake Huron).	■ OBBA	■ Moderate Probability Suitable nesting habitat may be present within the study area.	■ Confirmed This species was observed during field investigations. ■ No Suitable habitat was not identified.	■ Suitable nesting habitat for this species was not identified. ■ No further action is required.
Birds	Barn Swallow <i>Hirundo rustica</i>	THR	No Status	THR	■ Barn Swallows often live in close association with humans, building their cup-shaped mud nests almost exclusively on human-made structures such as open barns, under bridges and in culverts. The species is attracted to open structures that include ledges where they can build their nests, which are often re-used from year to year. They prefer unpainted, rough-cut wood, since the mud does not adhere as well to smooth surfaces. ■ This species can typically be associated with the following ELC communities: TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, SAF1 ; containing or adjacent structures that are suitable for nesting.	■ The Barn Swallow may be found throughout southern Ontario and can range as far north as Hudson Bay, wherever suitable locations for nests exist.	■ OBBA, MNRF Aylmer District	■ High Probability Suitable habitat likely present within the study area (structures for nesting and foraging habitat present)	■ Confirmed This species was observed during field investigations. ■ Candidate Barns and similar structures were identified in the study area, although nesting was not confirmed.	■ Should development encroach upon potential nesting habitat, additional surveys may be required. ■ It is recommended that any vegetation clearing be completed outside of the breeding bird season (April 1st - August 31st).
Birds	Bobolink <i>Dolichonyx oryzivorus</i>	THR	No Status	THR	■ Historically, Bobolinks lived in North American tallgrass prairie and other open meadows. With the clearing of native prairies, Bobolinks moved to living in hayfields. Bobolinks often build their small nests on the ground in dense grasses. Both parents usually tend to their young, sometimes with a third Bobolink helping. ■ This species can typically be associated with the following ELC communities: TPO, TPS, CUM1 and MAM2 .	■ The Bobolink breeds across North America. In Ontario, it is widely distributed throughout most of the province south of the boreal forest, although it may be found in the north where suitable habitat exists.	■ NHIC, OBBA, SARO online, MNRF Aylmer District	■ High Probability Suitable habitat likely present within agricultural lands and meadow habitat within the study area.	■ Confirmed This species was observed during field investigations. ■ Confirmed Cultural meadow communities with extensive grass cover provide suitable habitat.	■ This species was observed during breeding bird surveys completed in 2018. ■ Should the proposed development encroach upon suitable habitat, a Notice of Activity (NOA) will need to be prepared for the MNRF prior to commencing development in accordance with Section 23.6 of O. Reg. 242/08
Birds	Eastern Meadowlark <i>Sturnella magna</i>	THR	No Status	THR	■ Eastern Meadowlarks breed 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.This species can typically be associated with the following ELC communities: TPO, TPS, CUM1, CUS , and MAM2 with elevated song perches.	■ In Ontario, the Eastern Meadowlark is primarily found south of the Canadian Shield but it also inhabits the Lake Nipissing, Timiskaming and Lake of the Woods areas.	■ NHIC, OBBA, SARO online, MNRF Aylmer District	■ High Probability Suitable habitat may be present within agricultural lands and meadow habitat within the study area.	■ Confirmed This species was observed during field investigations. ■ Confirmed Cultural meadow communities with extensive grass cover provide suitable habitat.	■ This species was observed during breeding bird surveys completed in 2018. Should the proposed development encroach upon suitable habitat, a Notice of Activity (NOA) will need to be prepared for the MNRF prior to commencing development in accordance with Section 23.6 of O. Reg. 242/08
Birds	Eastern Wood-Pewee <i>Contopus virens</i>	SC	No Status	SC	■ The Eastern Wood-Pewee can be found in every type of wooded community in eastern North America. The size of the forest does not appear to be an important factor in habitat selection as this species has been found in both small fragmented forests and larger forest tracks. 4 ■ This species can typically be associated with the following ELC communities: FOC, FOM, FOD, SWD, SWM and CUW.	■ The Eastern Wood-Pewee Breed throughout central and eastern North America from Saskatchewan to Nova Scotia south along the Atlantic Coast to North Florida and the Gulf Coast. 4	■ OBBA	■ High Probability Suitable habitat may be present within forested ecosites in the study area.	■ Confirmed This species was observed during field investigations. ■ Confirmed Forested communities provide suitable habitat.	■ It is recommended that any vegetation clearing be completed outside of the breeding bird season (April 1st - August 31st). ■ This species was observed during field investigations completed in 2018. Habitat for this species is considered Significant Wildlife Habitat in accordance with the Provincial Policy Statement (2014) and will be addressed further in Section 2.2.5 and Appendix K.

Appendix J. Species at Risk Habitat Screening

W12A Landfill Expansion / City of London

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Suitable Habitat Identified During Background Review	Species Observed During Field Investigations	Conclusions/ Recommendations
Birds	Red-headed Woodpecker <i>Melanerpes erythrocephalus</i>	SC	THR Schedule 1	THR	<ul style="list-style-type: none">■ The Red-headed Woodpecker lives in open woodland and woodland edges, and is often found in parks, golf courses and cemeteries. These areas typically have many dead trees, which the bird uses for nesting and perching. This woodpecker regularly winters in the United States, moving to locations where it can find sufficient acorns and beechnuts to eat. A few of these birds will stay the winter in woodlands in southern Ontario if there are adequate supplies of nuts.■ This species can typically be associated with the following ELC communities: TPS, TPW, CUW, FOD1, FOD2, FOD4-1, FOD6, FOD7, and FOD9 that are open and have an abundance of dead trees.	■ The Red-headed Woodpecker is found across southern Ontario, where it is widespread but rare. Outside Ontario, it lives in Alberta, Saskatchewan, Manitoba and Quebec, and is relatively common in the United States.	■ OBBA	■ Moderate Probability Suitable habitat may be present within wooded ecosites in the study area.	■ No This species was not observed during field investigations. ■ No Suitable habitat was not identified.	■ This species was not observed during field investigations. Suitable habitat for this species was not identified. ■ No further action is required.
Birds	Golden-winged Warbler <i>Vermivora chrysoptera</i>	SC	THR Schedule 1	THR	■ Golden-winged Warblers prefer to nest in areas with young shrubs surrounded by mature forest – locations that have recently been disturbed, such as field edges, hydro or utility right-of-ways, or logged areas.	■ The Golden-winged Warbler is found in southern Saskatchewan, Manitoba, Ontario, and Quebec, as well as the north-eastern United States. In Ontario, these birds breed in central-eastern Ontario, as far south as Lake Ontario and the St. Lawrence River, and as far north as the northern edge of Georgian Bay. Golden-winged Warblers have also been found in the Lake of the Woods area near the Manitoba border, and around Long Point on Lake Erie. Golden-winged Warblers spend the winter in Central America, some Caribbean islands, and the northern part of South America.	■ OBBA	■ Moderate Probability Suitable habitat may be present within wooded ecosites in the study area.	■ No This species was not observed during field investigations. ■ No Suitable habitat was not identified.	■ This species was not observed during field investigations. Suitable habitat for this species was not identified. ■ No further action is required.
Birds	Wood Thrush <i>Hylocichla mustelina</i>	SC	No Status	THR	<ul style="list-style-type: none">■ The Wood Thrush can typically be found in the interior and along the edges of well-developed upland deciduous and mixed forests. Key elements of these forests include trees that are greater than 16 m in height, high variety of deciduous tree species, moderate subcanopy and shrub density, shade, fairly open forest floor, moist soils and decaying leaf litter. Wood Thrush is more likely to occur in larger forests but may also nest in 1 ha fragments and semi-wooded residential areas and parks. Smaller habitat fragments have lower fecundity when compared to larger fragments. ³■ This species can typically be associated with the following ELC communities: FOD and FOM that are greater than 1 ha in size.	<ul style="list-style-type: none">■ The Wood Thrush ranges across central and southern Ontario, southern Quebec, New Brunswick and southern Nova Scotia and the majority of the eastern United States.■ It winters in Central America between southern Mexico and Panama. ³	■ OBBA	■ Moderate Probability Suitable habitat may be present within forested ecosites in the study area.	■ No This species was not observed during field investigations. ■ No Although deciduous forest communities may provide suitable habitat, the species was not detected during field investigations.	■ This species was not observed during breeding bird surveys completed in 2018. Therefore, it is unlikely that this species is present within the study area. ■ No further action is required.
Insects	Monarch <i>Danaus plexippus</i>	SC	No Status	SC	<ul style="list-style-type: none">■ Throughout their life cycle, Monarchs use three different types of habitat. Only the caterpillars feed on milkweed plants and are confined to meadows and open areas where milkweed grows. Adult butterflies can be found in more diverse habitats where they feed on nectar from a variety of wildflowers. Monarchs spend the winter in Oyamel Fir forests found in central Mexico. This species can typically be associated with the following ELC communities: AI, TP and CUM where milkweed plants are present.	■ The Monarch's range extends from Central America to southern Canada. In Canada, Monarchs are most abundant in southern Ontario and Quebec where milkweed plants and breeding habitat are widespread. During late summer and fall, Monarchs from Ontario migrate to central Mexico where they spend the winter months. During migration, groups of Monarchs numbering in the thousands can be seen along the north shores of Lake Ontario and Lake Erie.	■ None	■ N/A	■ Confirmed This species was observed during field investigations. ■ Confirmed Cultural meadow communities with milkweed provide suitable habitat.	■ This species was observed during field investigations completed in 2018. Habitat for this species is considered Significant Wildlife Habitat in accordance with the Provincial Policy Statement (2014) and will be addressed further in Section 2.2.5 and Appendix K.

Appendix J. Species at Risk Habitat Screening

W12A Landfill Expansion / City of London

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Suitable Habitat Identified During Background Review	Species Observed During Field Investigations	Conclusions/ Recommendations
Mammals	Little Brown Myotis (Bat) <i>Myotis lucifugus</i>	END	No Status	END	<ul style="list-style-type: none">■ Bats are nocturnal. During the day they roost in trees and buildings. They often select attics, abandoned buildings and barns for summer colonies where they can raise their young. Bats can squeeze through very tiny spaces (as small as six millimetres across) and this is how they access many roosting areas.■ Little brown bats hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing. This species can typically be associated with any community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.) habitat is available.	■ The little brown bat is widespread in southern Ontario and found as far north as Moose Factory and Favourable Lake. Outside Ontario, this bat is found across Canada (except in Nunavut) and most of the United States.	■ SARO online, MNRF Aylmer Disrict	■ Moderate Probability Forest communities present in the study area may contain cavity trees.	<ul style="list-style-type: none">■ No This species was not observed during field investigations.■ Candidate Forest and swamp communities provide suitable habitat.	<ul style="list-style-type: none">■ Should tree removal be required within Candidate habitat, further consultation with the MNRF is required.■ It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Eastern Small-footed Myotis <i>Myotis leibii</i>	END	-	-	<ul style="list-style-type: none">■ In the spring and summer, eastern small-footed bats will roost in a variety of habitats, including in or under rocks, in rock outcrops, in buildings, under bridges, or in caves, mines, or hollow trees.■ These bats often change their roosting locations every day. At night, they hunt for insects to eat, including beetles, mosquitos, moths, and flies.■ In the winter, these bats hibernate, most often in caves and abandoned mines. They seem to choose colder and drier sites than similar bats and will return to the same spot each year.	■ The eastern small-footed bat has been found from south of Georgian Bay to Lake Erie and east to the Pembroke area. There are also records from the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park. Most documented sightings are of bats in their winter hibernation sites.	■ SARO online, MNRF Aylmer Disrict	■ Moderate Probability Forest communities present in the study area may contain cavity trees.	<ul style="list-style-type: none">■ No This species was not observed during field investigations.■ Candidate Forest and swamp communities provide suitable habitat.	<ul style="list-style-type: none">■ Should tree removal be required within Candidate habitat, further consultation with the MNRF is required.■ It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Northern (Long-eared) Myotis (Bat) <i>Myotis septentrionalis</i>	END	No Status	END	■ Northern long-eared bats are associated with boreal forests, choosing to roost under loose bark and in the cavities of trees. These bats hibernate from October or November to March or April, most often in caves or abandoned mines.This species can typically be associated with the following ELC communities: FOC, FOM, FOD, SWC, SWM and SWD where suitable roosting (i.e. cavity trees and trees with loose bark) habitat is available.	■ The northern long-eared bat is found throughout forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon.This bat is found in all Canadian provinces as well as the Yukon and Northwest Territories.	■ SARO online, MNRF Aylmer Disrict	■ Moderate Probability Forest communities present in the study area may contain cavity trees.	<ul style="list-style-type: none">■ No This species was not observed during field investigations.■ Candidate Forest and swamp communities provide suitable habitat.	<ul style="list-style-type: none">■ Should tree removal be required within Candidate habitat, further consultation with the MNRF is required. It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Tri-colored Bat <i>Perimyotis subflavus</i>	END	END Schedule 1	END	■ In Ontario, the Tri-colored Bat lives in forested habitats, forming day roosts and maternity colonies in older forest within foliage or in high tree cavities, occasionally also in barns or other structures. This species forages over water and along streams in forests. At the close of the summer season, this species congregate at a location to swarm, usually near caves, mines or underground locations where they will winter; it has a strong fidelity to its winter hibernation sites. This bat overwinters in caves, typically individually instead of as a group.	■ This bat is found in Southern Ontario and ranging as far north as Espanola, near Sudbury, having a scattered distribution. Its broad range sweeps from eastern North America down to Central America.	■ SARO online, MNRF Aylmer Disrict	■ Moderate Probability Forest communities present in the study area may contain cavity trees.	<ul style="list-style-type: none">■ No This species was not observed during field investigations.■ Candidate Forest and swamp communities provide suitable habitat.	<ul style="list-style-type: none">■ Should tree removal be required within Candidate habitat, further consultation with the MNRF is required.■ It is recommended that all vegetation clearing be completed outside of the bat roosting season (April 1st - September 30th).
Mammals	Woodland Vole <i>Microtus pinetorum</i>	SC	SC Schedule 1	SC	<ul style="list-style-type: none">■ In Ontario, the Woodland Vole lives in mature deciduous forest in the Carolinian region where there is a deep litter layer that allows it to burrow.■ This species can typically be associated with the following ELC communities: FOD with a deep leaf litter and loose soils.	■ In Ontario, it is known to exist at 30 sites from the Municipality of Chatham-Kent and Lambton County, east to Haldimand County, and north to Halton Regional Municipality and the City of Hamilton. Because it spends most of its time below ground, this species is difficult to spot and may have been missed at other locations in the province.	■ NHIC, SARO online	■ Moderate Probability Forest communities present in the study area may be suitable if deep litter layer and loose soils are present.	<ul style="list-style-type: none">■ No This species was not observed during field investigations.■ No Suitable habitat was not identified.	<ul style="list-style-type: none">■ This species was not observed during field investigations. Suitable habitat for this species was not identified.■ No further action is required.

Appendix J. Species at Risk Habitat Screening

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Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Suitable Habitat Identified During Background Review	Species Observed During Field Investigations	Conclusions/ Recommendations
Mosses	Spoon-leaved Moss <i>Bryoandersonia illecebra</i>	END	END Schedule 1	END	■ Spoon-leaved Moss grows in a range of habitat types but most Canadian populations are located on soil in low-lying areas that are seasonally flooded under trees or shrub thickets. It is often found in close proximity to a species of moss called narrow-leaved wetland plume moss, which is associated with swamps, marshes, and wet meadows. This species can typically be associated with the following ELC communities: SWD , SWT , MAS and MAM that are seasonally flooded.	■ Spoon-leaved Moss is found only in eastern North America, from southern Ontario south to Texas and Florida. In Canada, it is restricted to a few sites in southern Ontario – Elgin, Essex and Welland counties, and the Niagara Region.	■ NHIC, SARO online	■ Moderate Probability Wetland communities present in the study area may provide suitable habitat.	■ No This species was not observed during field investigations. No Although h swamp and marsh communities may provide suitable habitat, the species was not detected during field investigations.	■ This species was not observed during botanical surveys completed in 2018. Therefore, it is unlikely that this species is present within the study area. No further actions are required.
Plants	Bent spike-rush <i>Eleocharis geniculata</i>	END	END Schedule 1	END	■ In Ontario, this species is found on wet, sandy to muddy soil in open flats along the shore of Lake Erie. ■ It occurs occasionally along the edges of wet meadows and seasonal ponds further inland.	■ Bent Spike-rush is primarily a tropical species. In North America it occurs in the Gulf of Mexico region, with geographically separate populations in British Columbia and the Great Lakes basin. ■ In Ontario, it occurs along the shore of Lake Erie, and at one inland site.	-	-	-	-
Plants	Bird's-foot Violet <i>Viola pedata</i>	END	END Schedule 1	END	■ In Ontario, Bird's-foot Violet is found only in black oak savanna, a very rare vegetation type having widely spaced open-grown trees with an understorey of tallgrass prairie herbs. Natural disturbances caused by drought or fire are important for removing trees and shrubs that would otherwise shade out the tiny Bird's-foot Violet. ■ This species can typically be associated with the following ELC communities: TPS1-1 and TPW1-1 .	■ In Canada, Bird's-foot Violet is found only in southern Ontario at a handful of sites. In 2001, the population was estimated to be fewer than 7,000 plants at only five locations.	■ NHIC	■ Low Probability Suitable habitat for this species was not identified through background review.	■ No This species was not observed during field investigations. ■ No Suitable habitat was not identified.	■ This species was not observed during field investigations. Suitable habitat for this species was not identified. ■ No further action is required.
Plants	Broad Beech Fern <i>Phegopteris hexagonoptera</i>	SC	SC Schedule 3	SC	■ The Broad Beech Fern prefers to grow in rich soils in deciduous forests, often in areas dominated by maple and beech trees. It requires moist soil and usually grows in full shade. ■ This species can typically be associated with the following ELC communities: FOD5 and FOD6 with moist soils and closed canopies.	■ The Broad Beech Fern grows in eastern North America from the southern Great Lakes region west to southeast Kansas and northeast Oklahoma, south to northeast Texas and the Gulf Coast and east to the Atlantic coast. In Ontario, the species is found in forest remnants in southern Muskoka, along Lake Erie, and in the eastern Lake Ontario-St. Lawrence River region.	■ NHIC, SARO online	■ Low Probability Suitable habitat for this species was not identified through background review.	■ No This species was not observed during field investigations. ■ No Suitable habitat was not identified.	■ This species was not observed during field investigations. Suitable habitat for this species was not identified. ■ No further action is required.
Reptiles	Eastern Ribbonsnake <i>Thamnophis sauritus</i>	SC	SC Schedule 1	SC	■ The Eastern Ribbonsnake is usually found close to water, especially in marshes, where it hunts for frogs and small fish. A good swimmer, it will dive in shallow water, especially if it is fleeing from a potential predator. At the onset of cold weather, these snakes congregate in underground burrows or rock crevices to hibernate together. This species can typically be associated with the following ELC communities: FOC, FOM, FOD, SWC, SWM, SWD, MAM, MAS, OAO, SAS, SAM and SAF containing or near year round standing or flowing water.	■ The Eastern Ribbon Snake is found from southern Ontario west to Michigan and Wisconsin (isolated pockets), south to Illinois and Ohio, and east to New York State and Nova Scotia, where there is an isolated population. In Ontario, this snake occurs throughout southern and eastern Ontario and is locally common in parts of the Bruce Peninsula, Georgian Bay and eastern Ontario.	■ NHIC, ORAA, SARO online	■ Moderate Probability Suitable habitat may be present in the study area if year round standing water is present.	■ No This species was not observed during field investigations. ■ No Although forest and swamp communities, as well as ponds within the wetland communities may provide suitable habitat, the species was not detected during field investigations.	■ This species was not observed during coverboard surveys and area searches completed in 2018. Therefore, it is unlikely that this species is present within the study area. ■ No further action is required.

Appendix J. Species at Risk Habitat Screening

W12A Landfill Expansion / City of London

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Preferred Habitat ^{1,2}	Known Species Range ^{1,2}	Source Identifying Species Record	Suitable Habitat Identified During Background Review	Species Observed During Field Investigations	Conclusions/ Recommendations
Reptiles	Milksnake <i>Lampropeltis triangulum</i>	No Status	SC Schedule 1	SC	■ The Milksnake can be found in a range of habitats including rocky outcrops, fields and forest edges. In southern Ontario, it is often found in old farm fields and farm buildings where there is an abundance of mice. The Milksnake hibernates underground, in rotting logs or in the foundations of old buildings. ■ This species can be associated with the following ELC communities: BL, TA, AL, RB, TP, CUM, FOC, FOM and FOD.	■ The Milksnake range extends from Quebec and Maine south to Alabama and Georgia, and west to Minnesota and Iowa. In Ontario, it is widespread and locally common in southern Ontario, and can be found as far north as Lake Nipissing and Sault Ste. Marie.	■ ORAA	■ Moderate Probability Suitable habitat may be present in the study area.	■ No This species was not observed during field investigations. ■ No Suitable habitat was not identified.	■ This species was not observed during field investigations. Suitable habitat for this species was not identified. ■ No further action is required.
Reptiles	Snapping turtle <i>Chelydra serpentina</i>	SC	SCScheduled 1	SC	■ Snapping Turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. During the nesting season, from early to mid-summer, females travel overland in search of a suitable nesting site, usually gravelly or sandy areas along streams. Snapping Turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.This species can typically be associated with the following ELC communities: OAO, SA near gravelly or sandy areas.	■ The Snapping Turtle's range extends from Ecuador to Canada. In Canada this turtle can be found from Saskatchewan to Nova Scotia. It is primarily limited to the southern part of Ontario. The Snapping Turtle's range is contracting.	■ ORAA, SARO online	■ Moderate Probability Wetland communities present in the study area may provide suitable habitat if open water is present.	■ No This species was not observed during field investigations. ■ Candidate Although wetlands may provide suitable habitat, the species was not detected during field investigations. However, basking surveys were not conducted.	■ Should development encroach upon candidate habitat, additional surveys may be required.

Appendix K

Significant Wildlife Habitat Screening

Appendix K. Significant Wildlife Habitat Screening

W12A Landfill Expansion / City of London

SWH Ecoregion 7E Criterion Schedule

Table 1.1 Seasonal Concentration Areas of Animals

Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
Waterfowl Stopover and Staging Areas (Terrestrial) <u>Rationale:</u> Habitat important to migrating waterfowl.	American Black Duck Northern Pintail Gadwall Blue-winged Teal Green-winged Teal American Wigeon Northern Shoveler Tundra Swan	CUM1 CUT1 ■ - Plus evidence of annual spring flooding from melt water or run- off within these Ecosites. ■ - Fields with waste grain in the Long Point, Rondeau, Lk. St. Clair, Grand Bend and Pt. Pelee areas may be important to Tundra Swans.	■ Fields with sheet water during Spring (mid- March to May). – Fields flooding during spring melt and run-off provide important invertebrate foraging habitat for migrating waterfowl. – Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available. ■ <u>Information Sources</u> – Anecdotal information from the landowner, adjacent landowners or local naturalist clubs may be good information in determining occurrence. – Reports and other information available from Conservation Authorities (CAs) – Sites documented through waterfowl planning processes (eg. EHJV implementation plan) – Field Naturalist Clubs – Ducks Unlimited Canada – Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	■ Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” ^{ccxi} – Any mixed species aggregations of 100 [€] – or more individuals required. – The area of the flooded field ecosite habitat plus a 100-300m radius buffer dependant on local site conditions and adjacent land use is the significant wildlife habitat ^{cxlviii} . – Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). – SWHMIST ^{cxlix} Index #7 provides development effects and mitigation measures.	■ Low Probability; – Candidate Habitat not present within the study area. – The study area is not within close proximity to Long Point, Rondeau, Lk. St. Clair, Grand Bend or Point Pelee and does not contain historical records of aggregations of 100 or more individuals utilizing sheet water on fields.	■ No; – Confirmed habitat was not observed during field investigations.	■ No further action required.
Waterfowl Stopover and Staging Areas (Aquatic) <u>Rationale:</u> Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.	Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Ruddy Duck	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	■ <u>Information Sources</u> – Environment Canada – Naturalist clubs often are aware of staging/stopover areas. – OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. – Sites documented through waterfowl planning processes (eg. EHJV implementation plan) – Ducks Unlimited projects – Element occurrence specification by Nature Serve: http://www.natureserve.org – Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area	■ Studies carried out and verified presence of: – Aggregations of 100 [€] or more of listed species for 7 days [€] , results in > 700 waterfowl use days. – Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH ^{cxlix} – The combined area of the ELC ecosites and a 100m radius area is the SWH ^{cxlviii} – Wetland area and shorelines associated with sites identified within the SWHTG ^{cxlviii} Appendix K ^{cxlix} are significant wildlife habitat. – Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” ^{ccxi} – Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). – SWH MIST ^{cxlix} Index #7 provides development effects and mitigation measures.	■ No; – Candidate Habitat not present within the study area. – Aquatic habitat within the study area is of insufficient size to support large numbers of waterfowl species.	■ No; – Confirmed habitat was not observed during field investigations.	■ No further action required.

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Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
Shorebird Migratory Stopover Area <u>Rationale:</u> High quality shorebird stopover habitat is extremely rare and typically has a long history of use.	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit Hudsonian Godwit Black-bellied Plover American Golden-Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBO1 BBO2 BBS1 BBS2 BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	<ul style="list-style-type: none">■ Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats.■ Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. Sewage treatment ponds and storm water ponds do not qualify as a SWH,■ <u>Information Sources</u><ul style="list-style-type: none">– Western hemisphere shorebird reserve network.– Canadian Wildlife Service (CWS) Ontario Shorebird Survey.– Bird Studies Canada– Ontario Nature– Local birders and naturalist clubs– NHIC Shorebird Migratory Concentration Area	<ul style="list-style-type: none">■ Studies confirming:<ul style="list-style-type: none">– Presence of 3 or more of listed species and > 1000f shorebird use days during spring or fall migration period. (shorebird use days are the accumulated number of shorebirds counted per day over the course of the fall or spring migration period)– Whimbrel stop briefly (<24hrs) during spring migration, any site with >100f Whimbrel used for 3 years or more is significant.– The area of significant shorebird habitat includes the mapped ELC shoreline ecosites plus a 100m radius area ^{cxlviii}– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST^{cxlix} Index #8 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Suitable shoreline habitat is not present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Raptor Wintering Area <u>Rationale:</u> Sites used by multiple species, a high number of individuals and used annually are most significant	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl <u>Special Concern:</u> Short-eared Owl Bald Eagle	<u>Hawks/Owls</u> Combination of ELC Community Series; need to have present one Community Series from each land class; Forest: FOD, FOM, FOC. Upland: CUM; CUT; CUS; CUW. <u>Bald Eagle:</u> Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or lakes with open water (hunting areas).	<ul style="list-style-type: none">■ The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors.■ Raptor wintering(hawk/owl) sites need to be > 20 ha ^{cxlviii, cxlix} with a combination of forest and upland.^{xvi, xvii, xviii, xix, xx, xxi}■ Least disturbed sites, idle/fallow or lightly grazed field/meadow (>15ha) with adjacent woodlands ^{cxlix}■ Field area of the habitat is to be wind swept with limited snow depth or accumulation.■ Eagle sites have open water and large trees and snags available for roosting.■ <u>Information Sources:</u><ul style="list-style-type: none">– OMNR Ecologist or Biologist– Naturalist club– Natural Heritage Information Center (NHIC) Raptor Winter Concentration Area– Data from Bird Studies Canada, most notably for Short-eared Owls.– Results of Christmas Bird Counts.– Reports and other information available from Conservation Authorities.	<ul style="list-style-type: none">■ Studies confirm the use of these habitats by:<ul style="list-style-type: none">– One or more Short-eared Owls or; One of more Bald Eagles or; At least 10 individuals and two of listed hawk/owl species [Ⓔ].– To be significant a site must be used regularly (3 in 5 years) ^{cxlix} for a minimum of 20 days by the above number of birds [Ⓔ].– The habitat area for an Eagle winter site is the shoreline forest ecosites directly adjacent to the prime hunting area [Ⓔ].– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST^{cxlix} Index #10 and #11 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Candidate Habitat not present within the study area.– Qualifying ecosites are present within the study area but are of insufficient size to support raptor wintering (hawks/owls).– No shorelines adjacent to large rivers or lakes are present to support Bald Eagles.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.

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Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
Bat Hibernacula <u>Rationale:</u> Bat hibernacula are rare habitats in all Ontario landscapes.	Big Brown Bat Tri-colored Bat	Bat Hibernacula may be found in these ecosites: CCR1 CCR2 CCA1 CCA2 (Note: buildings are not considered to be SWH)	<ul style="list-style-type: none">■ Hibernacula may be found in caves, mine shafts, underground foundations and Karsts.■ Active mine sites should not be considered as SWH.■ The locations of bat hibernacula are relatively poorly known.■ <u>Information Sources</u><ul style="list-style-type: none">– OMNR for possible locations and contact for local experts– Natural Heritage Information Center (NHIC) Bat Hibernaculum– Ministry of Northern Development and Mines for location of mine shafts.– Clubs that explore caves (eg. Sierra Club)– University Biology Departments with bat experts.	<ul style="list-style-type: none">■ All sites with confirmed hibernating bats are SWH ^㉔.■ The area includes 200m radius around the entrance of the hibernaculum ^{cxlviii, ccvii, ㉔} for most development types and 1000m for wind farms.■ Studies are to be conducted during the peak swarming period (Aug. – Sept.). Surveys should be conducted following methods outlined in the “Guideline for Wind Power Projects Potential Impacts to Bats and Bat Habitats”^{ccv}.■ SWH MIST^{cxlix} Index #1 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– There are no caves, mine shafts, underground foundations or Karsts within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Bat Maternity Colonies <u>Rationale:</u> Known locations of forested bat maternity colonies is extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	<ul style="list-style-type: none">■ Maternity colonies can be found in tree cavities, vegetation and often in buildings^{xxii, xxv, xxvi, xxvii, xxxi} (buildings are not considered to be SWH). Maternity roosts are not found in caves and mines in Ontario^{xxii}.■ Maternity colonies located in Mature deciduous or mixed forest stands^{ccix, ccx} with >10/ha large diameter (>25cm dbh) wildlife trees^{ccvii}■ Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 ^{ccxiv} or class 1 or 2 ^{ccxii}.■ Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags/ha are preferred^{ccx}■ <u>Information Sources</u><ul style="list-style-type: none">– OMNR for possible locations and contact for local experts– University Biology Departments with bat experts.	<ul style="list-style-type: none">■ Maternity Colonies with confirmed use by;<ul style="list-style-type: none">– >10 Big Brown BatsÍ– >5 Adult Female Silver-haired BatsÍ■ The area of the habitat includes the entire woodland or the forest stand ELC Ecosite containing the maternity coloniesÍ.■ Evaluation methods for maternity colonies should be conducted following methods outlined in the “Bats and Bat Habitats: Guidelines for Wind Power Projects”^{mmccv}.■ SWH MIST^{cxlix} Index #12 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ High Probability;<ul style="list-style-type: none">– Forest communities are present within the study area.	<ul style="list-style-type: none">■ Candidate;<ul style="list-style-type: none">– A full bat habitat assessment was not completed, however candidate habitat was observed during a cavity tree assessment.	<ul style="list-style-type: none">■ Candidate bat cavity trees were observed within the study area.■ Should vegetation removal occur that encroaches into the woodlands, additional surveys may be required. The MNRF <i>Species at Risk Bats within Treed Habitats</i> (2017) is the recommended protocol.■ It is recommended that any vegetation removal be conducted outside of the bat roosting season (April 1st - September 30th).
Turtle Wintering Areas <u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle <u>Special Concern:</u> Northern Map Turtle Snapping Turtle	Snapping and Midland Painted turtles; ELC Community Classes; SW, MA, OA and SA. ELC Community Series; FEO and BOO Northern Map Turtle - Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat.	<ul style="list-style-type: none">■ For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates.■ Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen. cix, cx, cxi, cxviii■ Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH.■ <u>Information Sources</u><ul style="list-style-type: none">– EIS studies carried out by Conservation Authorities.	<ul style="list-style-type: none">■ Presence of 5 over-wintering Midland Painted Turtles is significantÍ.■ One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significantÍ.■ The mapped ELC ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep-water pool where the turtles are over wintering is the SWH.■ Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar.	<ul style="list-style-type: none">■ High Probability;<ul style="list-style-type: none">– Open water and wetland communities are present within the study area.	<ul style="list-style-type: none">■ Candidate;<ul style="list-style-type: none">– Overwintering surveys were not completed, however, turtles were observed within the study area during field investigations.	<ul style="list-style-type: none">■ Should development encroach into candidate habitat, additional surveys may be required.

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Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
			<ul style="list-style-type: none">– Field Naturalist Clubs– OMNRF Ecologist or Biologist– Natural Heritage Information Center (NHIC)	<ul style="list-style-type: none">– May) ^{cvi}. Congregation of turtles is more common where wintering areas are limited and therefore significant ^{cix, cx, cxi, cxii}.■ SWH MIST^{cxlix} Index #28 provides development effects and mitigation measures for turtle wintering habitat.			
Reptile Hibernaculum <u>Rationale:</u> Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	<u>Snakes:</u> Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brownsnake Smooth Green Snake Northern Ring-necked Snake <u>Special Concern:</u> Milksnake Eastern Ribbonsnake	<p>For all snakes, habitat may be found in any ecosite other than very wet ones. Talus, Rock Barren, Crevice and Cave, and Alvar sites may be directly related to these habitats.</p> <p>Observations of congregations of snakes on sunny warm days in the spring or fall is a good indicator.</p>	<ul style="list-style-type: none">■ For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH.■ Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line^{xliv, l, li, lii, cxii}. Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover.■ <u>Information Sources</u><ul style="list-style-type: none">– In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g.old dug wells).– Reports and other information available from Conservation Authorities.– Field Naturalist Clubs– University herpetologists.– Natural Heritage Information Center (NHIC)	<ul style="list-style-type: none">■ Studies confirming:<ul style="list-style-type: none">– Presence of snake hibernacula used by a minimum of five individuals of a snake sp. <u>or</u>; individuals of two or more snake spp.– Congregations of a minimum of five individuals of a snake sp. <u>or</u>; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr/May) and Fall (Sept/Oct)Ā.– Note: If there are Special Concern Species present, then site is SWH– <u>Note:</u> Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population [i.e. strong hibernation site fidelity.]. Other critical life processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m buffer is the SWH[Ⓔ]– SWH MIST^{cxlix} Index #13 provides development effects and mitigation measures for snake hibernacula.	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Suitable habitat features may be present in the study area.– There is potential for burrows, rock crevices, rock piles, stone fences or crumbling foundations to be found in association with the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.– A pile of concrete rubble was observed during field investigations. However, thresholds for numbers of species and/or individual snakes were not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Colonially -Nesting Bird Breeding Habitat (Bank and Cliff) <u>Rationale:</u> Historical use and number of nests in a colony make this habitat significant. An identified colony can be very important to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies).	<p>Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles, cliff faces, bridge abutments, silos, barns (Cliff Swallows).</p> <p>Habitat found in the following ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1</p>	<ul style="list-style-type: none">■ Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed/permitted aggregate area.■ Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles.■ Does not include a licensed/permitted Mineral Aggregate Operation.■ <u>Information Sources</u><ul style="list-style-type: none">– Reports and other information available from Conservation Authorities– Ontario Breeding Bird Atlas ccv.– Bird Studies Canada; NatureCounts http://www.birdscanada.org/birdmon/– Field Naturalist Clubs.	<ul style="list-style-type: none">■ Studies confirming:<ul style="list-style-type: none">– Presence of 1 or more nesting sites with 8^{cxlvix} or more cliff swallow pairs and/or rough-winged swallow pairs during the breeding season.– A colony identified as SWH will include a 50m radius habitat area from the peripheral nests^{ccvii}– Field surveys to observe and count swallow nests are to be completed during the breeding season (May-June). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST^{cxlix} Index #4 provides development effects and mitigation measures	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Although habitat may be present in the study area, it is likely to be man made and/or disturbed or recently disturbed and therefore does not qualify.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.– The study area does not contain suitable ecosites.	<ul style="list-style-type: none">■ No further action required.

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Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
Colonially -Nesting Bird Breeding Habitat (Tree/Shrubs) <u>Rationale:</u> Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night-Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	<ul style="list-style-type: none">■ Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used.■ Most nests in trees are 11 to 15 m from ground, near the top of the tree.■ <u>Information Sources</u><ul style="list-style-type: none">– Ontario Breeding Bird Atlas ^{ccv}, colonial nest records.– Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF).– Natural Heritage Information Center (NHIC) Mixed Wader Nesting Colony– Aerial photographs can help identify large heronries.– Reports and other information available from Conservation Authorities– MNRF District Offices.– Local naturalist clubs.	<ul style="list-style-type: none">■ Studies confirming:<ul style="list-style-type: none">– Presence of 2[Ⓔ] or more active nests of Great Blue Heron or other listed species..– The habitat extends from the edge of the colony and a minimum 300 m radius or extend of the Forest Ecosite containing the colony or any island <15.0ha with a colony is the SWH ^{cc, ccvii}– Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and/or eggshells– SWH MIST^{cxlix} Index #5 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ High Probability;<ul style="list-style-type: none">– Suitable ecosites were identified within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– No colony sites were observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Colonially -Nesting Bird Breeding Habitat (Ground) <u>Rationale:</u> Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer’s Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer’s Blackbird) MAM1 – 6; MAS1 – 3; CUM CUT CUS	<ul style="list-style-type: none">■ Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas.■ Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands.■ <u>Information Sources</u><ul style="list-style-type: none">– Ontario Breeding Bird Atlas ^{ccv}, rare/colonial species records.– Canadian Wildlife Service– Reports and other information available from Conservation Authorities– Natural Heritage Information Center (NHIC) Colonial Waterbird Nesting Area– MNRF District Offices.– Field Naturalist Clubs.	<ul style="list-style-type: none">■ Studies confirming:<ul style="list-style-type: none">– Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, >5 active nests for Common Tern or >2 active nests for Caspian Tern[Ⓔ].– Presence of 5 or more pairs for Brewer’s Blackbird[Ⓔ]– Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant[Ⓔ].– The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC ecosites containing the colony or any island <3.0ha with a colony is the SWH ^{cc, ccvii}– Studies would be done during May/June when actively nesting. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST^{cxlix} Index #6 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ Low Probability;<ul style="list-style-type: none">– Candidate Habitat not present within the study area.– No rocky islands or peninsulas associated with a large lake or river are present within the study area.– Suitable habitat may be present for Brewer’s Blackbird	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.– During breeding bird surveys target species were not observed.	<ul style="list-style-type: none">■ No further action required.
Migratory Butterfly Stopover Areas <u>Rationale:</u> Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral <u>Special Concern</u> Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: <u>Field:</u> CUM CUT CUS <u>Forest:</u> FOC FOD FOM CUP Anecdotaly, a candidate site for butterfly stopover	<ul style="list-style-type: none">■ A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Erie and Ontario ^{cxlix}.■ The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south ^{xxxii, xxxiii, xxxiv, xxxv, xxxvi}.■ The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat ^{cxlviii, cxlix}.	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– The presence of Monarch Use Days (MUD) during fall migration (Aug/Oct)^{xlili}. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500/day^{xxxvii}, significant variation can occur between years and multiple years of sampling should occur ^{xl, xlii}.– Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD– MUD of >5000 or >3000 with the presence of Painted Ladies or Red	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– The study area is more than 5km away from Lake Ontario and Lake Erie.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Candidate habitat was not identified.	<ul style="list-style-type: none">■ No further action required.

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Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Found Within the Study Area	Conclusions/ Recommendations
		will have a history of butterflies being observed.	<ul style="list-style-type: none">■ Stopover areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes xxxvii, xxxviii, xxxix, xl, xli.■ <u>Information Sources</u><ul style="list-style-type: none">– MNRF district Offices– Natural Heritage Information Center (NHIC)– Agriculture Canada in Ottawa may have list of butterfly experts.– Field Naturalist Clubs– Toronto Entomologists Association– Conservation Authorities	<p>Admiral's is to be considered significant. ⑥</p> <ul style="list-style-type: none">– SWH MIST cxlix Index #16 provides development effects and mitigation measures.			
<p>Landbird Migratory Stopover Areas</p> <p><u>Rationale:</u> Sites with a high diversity of species as well as high numbers are most significant.</p>	<p>All migratory songbirds.</p> <p>Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/default.asp?lang=En&n=421B7A9D-1</p> <p>All migrant raptors species:</p> <p>Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors)</p>	<p>All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD</p>	<ul style="list-style-type: none">■ Woodlots need to be >5 ha⑥ in size and within 5 km iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv of Lake Ontario and Erie. If woodlands are rare in an area of shoreline, woodland fragments 2-5ha can be considered for this habitat. ⑥■ If multiple woodlands are located along the shoreline those Woodlands <2km from Lake Erie and Lake Ontario are more significant cxlix■ Sites have a variety of habitats; forest, grassland and wetland complexes cxlix.■ The largest sites are more significant cxlix■ Woodlots and forest fragments are important habitats to migrating birdsccxviii, these features located along the shore and located within 5km of Lake Erie and Lake Ontario are Candidate SWH cxlviii.■ <u>Information Sources</u><ul style="list-style-type: none">– Bird Studies Canada– Ontario Nature– Local birders and naturalist club– Ontario Important Bird Areas (IBA) Program	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Use of the woodlot by >200 birds/day and with >35 spp with at least 10 bird spp. recorded on at least 5 different survey dates⑥. This abundance and diversity of migrant bird species is considered above average and significant.– Studies should be completed during spring (March to May) and fall (Aug to Oct) migration using standardized assessment techniques. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects"ccxi– SWH MIST cxlix Index #9 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– The study area is more than 5km away from Lake Ontario and Lake Erie.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Candidate habitat was not identified.	<ul style="list-style-type: none">■ No further action required.
<p>Deer Winter Congregation Areas</p> <p><u>Rationale:</u> Deer movement during winter in the southern areas of Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions cxlviii.</p>	<p>White-tailed Deer</p>	<p>All Forested Ecosites with these ELC Community Series; FOC FOM FOD SWC SWM SWD</p> <p>Conifer plantations much smaller than 50 ha may also be used.</p>	<ul style="list-style-type: none">■ Woodlots >100 ha in size or if large woodlots are rare in a planning area woodlots>50ha ⑥.■ Deer movement during winter in the southern areas Ecoregion 7E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands cxlviii.■ Large woodlots > 100ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer/ha ccxxiv.■ Woodlots with high densities of deer due to artificial feeding are not significant⑥.■ <u>Information Sources</u><ul style="list-style-type: none">– MNRF District Offices.– LIO/NRVIS	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF cxlviii.– Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF⑥– Studies should be completed during winter (Jan/Feb) when >20cm of snow is on the ground using aerial survey techniquesccxxiv, ground or road surveys, or a pellet count deer density surveyccxxv.– SWH MIST cxlix Index #2 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ Low Probability;<ul style="list-style-type: none">– Forested ecosites present within the study area are likely not large enough to support significant numbers of deer.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Candidate habitat was not identified.	<ul style="list-style-type: none">■ No further action required.

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Table 1.2.1 Rare Vegetation Communities.

Rare Vegetation Community	CANDIDATE SWH ELC Ecosite Code	CANDIDATE SWH Habitat Description	CANDIDATE SWH Detailed Information and Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Cliffs and Talus Slopes <u>Rationale:</u> Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	■ A Cliff is vertical to near vertical bedrock >3m in height. ■ A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris	■ Most cliff and talus slopes occur along the Niagara Escarpment. ■ <u>Information Sources</u> – The Niagara Escarpment Commission has detailed information on location of these habitats. – OMNRF Districts – Natural Heritage Information Center (NHIC) has location information available their website – Field Naturalist Clubs – Conservation Authorities	■ Confirm any ELC Vegetation Type for Cliffs or Talus Slopes lxxviii ■ SWH MIST ^{cxlix} Index #21 provides development effects and mitigation measures.	■ No; – No cliff or talus communities were identified within the study area.	■ No; – Candidate habitat was not identified.	■ No further action required.
Sand Barren <u>Rationale:</u> Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always ≤ 60%.	■ Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered but less than 60%.	■ A sand barren area >0.5ha in size [Ⓔ] . ■ <u>Information Sources</u> – OMNRF Destricts. – Natural Heritage Information Center (NHIC) has location information available on their website – Field Naturalist Clubs – Conservation Authorities	■ Confirm any ELC Vegetation Type for Sand Barrens lxxviii ■ Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics) [Ⓔ] . ■ SWHMIST ^{cxlix} Index #20 provides development effects and mitigation measures.	■ No; – No sand barren communities were identified within the study area.	■ No; – Candidate habitat was not identified.	■ No further action required.
Alvar <u>Rationale:</u> Alvars are extremely rare habitats in Ecoregion 7E.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) <i>Carex crawei</i> 2) <i>Panicum philadelphicum</i> 3) <i>Elocharis compressa</i> 4) <i>Scutellaria parvula</i> 5) <i>Trichostema brachiatum</i> These indicator species are very specific to Alvars within Ecoregion 7E [Ⓔ] .	■ An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plant. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover ^{lxxviii} .	■ An Alvar site > 0.5 ha in size ^{lxxv} . ■ Alvar is particularly rare in Ecoregion 7E where the only known sites are found in the western islands of Lake Erie.cxcix ■ <u>Information Sources</u> – Alvars of Ontario (2000), Federation of Ontario Naturalists ^{lxxvi} . – Ontario Nature – Conserving Great Lakes Alvars ^{ccviii} . – Natural Heritage Information Center (NHIC) has location information available on their website – OMNRF Staff. – Field Naturalist Clubs. – Conservation Authorities.	■ Field studies identify four of the five [Ⓔ] Alvar Indicator Species ^{lxxv} at a Candidate Alvar site is Significant. ■ Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). ■ The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses ^{lxxv} . ■ SWH MIST ^{cxlix} Index #17 provides development effects and mitigation measures.	■ No; – No alvar communities were identified within the study area.	■ No; – Candidate habitat was not identified.	■ No further action required.

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Rare Vegetation Community	CANDIDATE SWH ELC Ecosite Code	CANDIDATE SWH Habitat Description	CANDIDATE SWH Detailed Information and Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Old Growth Forest <u>Rationale:</u> Due to historic logging practices and land clearance for agriculture, old growth forest is rare in Ecoregion 7E.	Forest Community Series: FOD FOC FOM SWD SWC SWM	■ Old-growth forests are characterized by heavy mortality or turnover of over-storey trees resulting in mosaic of gaps that encourage development of multi-layered canopy and an abundance of snags and downed woody debris.	■ Woodland area is >0.5 ha [ⓔ] . ■ <u>Information Sources</u> – OMNRF Forest Resource Inventory mapping – OMNRF Districts. – Field Naturalist Clubs – Conservation Authorities – Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. – Municipal forestry departments	■ Field Studies will determine: – If dominant trees species of the ecosite are >140 years old, then area containing these trees is Significant Wildlife Habitat ^{cxlviii} . – The forested area containing the old growth characteristics will have experienced no recognizable forestry activities (cut steps will not be present) – The area of forest ecosites combined or an eco-element within an ecosite that contain the old growth characteristics is the SWH. – Determine ELC vegetation types for the forest area containing the old growth characteristics ^{xxviii} . – SWH MIST ^{cxlix} Index #23 provides development effects and mitigation measures.	■ Moderate Probability; – Forested ecosites are present within the study area.	■ No; – Candidate habitat was not identified as the age of trees observed does meet the criteria for old-growth forest.	■ No further action required.
Savannah <u>Rationale:</u> Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	■ A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60%. ■ In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario).	■ No minimum size to site [ⓔ] ■ Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. ■ <u>Information Sources</u> – Natural Heritage Information Center (NHIC) has location data available on their website. – OMNRF Districts. – Field Naturalists Clubs. – Conservation Authorities.	■ Field studies confirm one or more of the Savannah indicator species listed in ^{lxxv} Appendix N should be present [ⓔ] . Note: Savannah plant spp. list from Ecoregion 7E should be used ■ Area of the ELC Ecosite is the SWH. ■ Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). ■ SWH MIST ^{cxlix} Index #18 provides development effects and mitigation measures.	■ No; – No savannah communities were identified within the study area.	■ No; – Candidate habitat was not identified.	■ No further action required.
Tallgrass Prairie <u>Rationale:</u> Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	■ A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover. ■ In ecoregion 7E, known Tallgrass Prairie and savannah remnants are scattered between Lake Huron and Lake Erie, near Lake St. Clair, north of and along the Lake Erie shoreline, in Brantford and in the Toronto area (north of Lake Ontario). ^{cc}	■ No minimum size to site [ⓔ] . Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. ■ <u>Information Sources</u> – OMNRF Districts. – Natural Heritage Information Center (NHIC) has location data available on their website. – Field Naturalists Clubs. – Conservation Authorities	■ Field studies confirm one or more of the Prairie indicator species listed in ^{lxxv} Appendix N should be present [ⓔ] . Note: Prairie plant spp. list from Ecoregion 7E should be used ■ Area of the ELC Ecosite is the SWH ■ Site must not be dominated by exotic or introduced species (<50% vegetative cover exotics). ■ SWH MIST ^{cxlix} Index #19 provides development effects and mitigation measures.	■ No; – No tallgrass prairie communities were identified within the study area.	■ No; – Candidate habitat was not identified.	■ No further action required.
Other Rare Vegetation Communities <u>Rationale:</u> Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG ^{cxlviii} . Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	■ Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	■ ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M ^{cxlviii} ■ The OMNRF/NHIC will have up to date listing for rare vegetation communities. ■ <u>Information Sources</u> – OMNRF Districts. – Natural Heritage Information Center (NHIC) has location data available on their website. – Field Naturalists Clubs. – Conservation Authorities	■ Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG ^{cxlviii} . ■ Area of the ELC Vegetation Type polygon is the SWH. ■ SWH MIST ^{cxlix} Index #37 provides development effects and mitigation measures.	■ Moderate Probability; – No rare vegetation communities were identified within the study area during the background review process. However, rare vegetation communities may be identified during field investigations.	■ Confirmed; – One rare vegetation community, an FOD2-3 -Dry – Fresh Hickory Deciduous Forest, was observed within the Study Area during field investigations. The FOD2-3 community has a S-Rank of S3S4 as per the S-Ranks provided by the NHIC.	■ As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless

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Rare Vegetation Community	CANDIDATE SWH ELC Ecosite Code	CANDIDATE SWH Habitat Description	CANDIDATE SWH Detailed Information and Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
							<p>“ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions”.</p> <p>■ It is recommended that the proposed development occur outside of confirmed habitat in order to comply with the PPS (2014).</p>

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Table 1.2.2 Specialized Habitats of Wildlife considered SWH

Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Waterfowl Nesting Area <u>Rationale:</u> Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 Note: includes adjacency to Provincially Significant Wetlands	<ul style="list-style-type: none">■ A waterfowl nesting area extends 120 m ^{cxlix} from a wetland (> 0.5 ha) or a wetland (>0.5 ha) with small wetlands (<0.5ha) within 120m or a cluster of 3 or more small (<0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur ^{cxlix}.■ Upland areas should be at least 120m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests.■ Wood Ducks and Hooded Mergansers utilize large diameter trees (>40cm dbh) in woodlands for cavity nest sites.■ <u>Information Sources</u><ul style="list-style-type: none">– Ducks Unlimited staff may know the locations of particularly productive nesting sites.– OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat.– Reports and other information available from Conservation Authorities	<ul style="list-style-type: none">■ Studies confirmed:<ul style="list-style-type: none">– Presence of 3 or more nesting pairs for listed species excluding Mallards[®] , or;– Presence of 10 or more nesting pairs for listed species including Mallards[®]– Any active nesting site of an American Black Duck is considered significant.– Nesting studies should be completed during the spring breeding season (April - June). Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m ^{cxlviii} from the wetland and will provide enough habitat for waterfowl to successfully nest.– SWH MIST^{cxlix} Index #25 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Wetland communities adjacent to upland habitat were identified within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Although both open and wooded upland communities adjacent to wetlands meet width thresholds, species and abundance thresholds were not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat <u>Rationale:</u> Nest sites are fairly uncommon in Ecoregion 7E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey Special Concern Bald Eagle	ELC Forest Community Series: FOD, FOM, FOC, SWD, SWM and SWC directly adjacent to riparian areas – rivers, lakes, ponds and wetlands	<ul style="list-style-type: none">■ Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water.■ Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree’s canopy.■ Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms).■ <u>Information Sources</u><ul style="list-style-type: none">– Natural Heritage Information Center (NHIC) compiles all known nesting sites for Bald Eagles in Ontario.– MNRF values information (LIO/NRVIS) will list known nesting locations, Note: data from NRVIS is provided as a point and does not represent all the habitat.– Nature Counts, Ontario Nest Records Scheme data.– OMNRF Districts.– Check the Ontario Breeding Bird Atlas ^{ccv} or Rare Breeding Birds in Ontario for species documented– Reports and other information available from Conservation Authorities– Field naturalist Clubs	<ul style="list-style-type: none">■ Studies confirm the use of these nests by:<ul style="list-style-type: none">– One or more active Osprey or Bald Eagle nests in an area^{cxlviii} .– Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH.– For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH ^{ccvii} , maintaining undisturbed shorelines with large trees within this area is important^{cxlviii}.– For a Bald Eagle the active nest and a 400-800 m radius around the nest is the SWH. ^{cvi, ccvii} Area of the habitat from 400-800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat ^{cvi}– To be significant a site must be used annually. When found inactive, the site must be known to be inactive for ≥3 years or suspected of not being used for >5 years before being considered not significant. ^{ccvii}– Observational studies to determine nest site use, perching sites and foraging areas need to be done from mid March to mid August.– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST^{cxlix} Index #26 provides development effects and mitigation measures	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Qualifying vegetation communities adjacent to ponds and wetlands are present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– No nest sites were observed and target species were not identified during breeding bird surveys.	<ul style="list-style-type: none">■ No further action required.

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Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Woodland Raptor Nesting Habitat <u>Rationale:</u> Nests sites for these species are rarely identified; these area sensitive habitats are often used annually by these species.	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl Broad-winged Hawk	May be found in all forested ELC Ecosites. May also be found in SWC, SWM, SWD and CUP3	<ul style="list-style-type: none">■ All natural or conifer plantation woodland/forest stands combined >30ha or with >4 ha of interior habitat ^{bxxviii, lxxxix, xc, xci, xciii, xciv, xcv,xcvi, cxxxiii}. Interior habitat determined with a 200m buffer^{cxlviii}■ Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands.■ In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest.■ <u>Information Sources</u><ul style="list-style-type: none">– OMNRF Districts.– Check the Ontario Breeding Bird Atlas ccv or Rare Breeding Birds in Ontario for species documented.– Check data from Bird Studies Canada.– Reports and other information available from Conservation Authorities	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Presence of 1 or more active nests from species list is considered significant^{cxlviii}.– Red-shouldered Hawk and Northern Goshawk – A 400m radius around the nest or 28 ha habitat area would be applied where optimal habitat is irregularly shaped around the nest) ^{ccvii}.– Barred Owl – A 200m radius around the nest is the SWH ^{ccvii}.– Broad-winged Hawk and Coopers Hawk,– A 100m radius around the nest is the SWH^{ccvii}.– Sharp-Shinned Hawk – A 50m radius around the nest is the SWH^{ccvii}.– Conduct field investigations from mid-March to end of May. The use of call broadcasts can help in locating territorial (courting/nesting) raptors and facilitate the discovery of nests by narrowing down the search area.– SWH MIST^{cxlix} Index #27 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Forest communities identified within the study area are not large enough to meet the size requirement for significance.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Candidate habitat was not identified.	<ul style="list-style-type: none">■ No further action required.
Turtle Nesting Areas <u>Rationale:</u> These habitats are rare and when identified will often be the only breeding site for local populations of turtles.	Midland Painted Turtle <u>Special Concern Species</u> Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m) ^{cxlviii} or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	<ul style="list-style-type: none">■ Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons or other animals.■ For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH.■ Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers are most frequently used.■ <u>Information Sources</u><ul style="list-style-type: none">– Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels).– Check the Ontario Herpetofaunal Atlas records (or other similar atlases) for uncommon turtles; location information may help to find potential nesting habitat for them.– Natural Heritage Information Center (NHIC)– Field Naturalist Clubs	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Presence of 5 or more nesting Midland Painted Turtles[Ⓔ]– One or more Northern Map Turtle or Snapping Turtle nesting is a SWH[Ⓔ].– The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30-100m around the nesting area dependant on slope, riparian vegetation and adjacent land use is the SWH. ^{cxlviii}– Travel routes from wetland to nesting area are to be considered within the SWH as a part of the 30-100m area of habitat. ^{cxlix}– Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting is a recommended method.– SWH MIST ^{cxlix} Index #28 provides development effects and mitigation measures for turtle nesting habitat.	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Suitable ecosites are present within the study area. Exposed mineral soil is present <100m from suitable ecosites.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not identified. Although turtles were observed within the study area, no nesting was observed.	<ul style="list-style-type: none">■ No further action required.
Seeps and Springs <u>Rationale:</u> Seeps/Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps/Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a	<ul style="list-style-type: none">■ Any forested area (with <25% meadow/field/pasture) within the headwaters of a stream or river system ^{cxvii, cxlix}.■ Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species ^{cxix, cxx, cxxi, cxxii, cxiii, cxiv}.■ <u>Information Sources</u><ul style="list-style-type: none">– Topographical Map.	<ul style="list-style-type: none">■ Field Studies confirm:<ul style="list-style-type: none">– Presence of a site with 2 or more[Ⓔ] seeps/springs should be considered SWH.– The area of a ELC forest ecosite or ecoelement within ecosite containing the seeps/springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Forested ecosites are present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.

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Specialized Wildlife Habitat	Wildlife Species	CANDIDATE SWH ELC Ecosite Codes	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
		stream could have seeps/springs.	<ul style="list-style-type: none">– Thermography.– Hydrological surveys conducted by Conservation Authorities and MOE.– Field Naturalists Clubs and landowners.– Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.	<p>condition need to be considered in delineation the habitat ^{cxlviii}.</p> <ul style="list-style-type: none">– SWH MIST ^{cxlix} Index #30 provides development effects and mitigation measures			
<p>Amphibian Breeding Habitat (Woodland).</p> <p><u>Rationale:</u></p> <p>These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations</p>	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	<p>All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD</p> <p>Breeding pools within the woodland or the shortest distance from forest habitat are more significant because they are more likely to be used due to reduced risk to migrating amphibians</p>	<ul style="list-style-type: none">■ Presence of a wetland, pond or woodland pool(including vernal pools) >500m² within or adjacent (within 120m) to a woodland (no minimum size).clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx. Some small wetlands may not be mapped and may be important breeding pools for amphibians.■ Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat cxlviii■ <u>Information Sources</u><ul style="list-style-type: none">– Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records– Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property.– OMNRF Districts and wetland evaluations– Field Naturalist Clubs– Canadian Wildlife Service Amphibian Road Call Survey– Ontario Vernal Pool Association: http://www.ontariovernalpools.org	<ul style="list-style-type: none">■ Studies confirm;<ul style="list-style-type: none">– Presence of breeding population of 1 or more of the listed salamander species or 2 or more of the listed frog species with at least 20 individuals (adults, juveniles, eggs/larval masses) lxxi or 2 or more of the listed frog species wioth Call Level Codes of 3 [Ⓔ].– A combination of observation study and call count survey will be required during the sping (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland/wetlands.– The habitat is the wetland area plus a 230m radius of area. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat.– SWH MIST cxlix Index #14 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Forested and swamp ecosites are present within the study area.	<ul style="list-style-type: none">■ Confirmed;<ul style="list-style-type: none">– Thresholds for species and individuals were met in the Silver Swamp LSW during amphibian breeding surveys.	<ul style="list-style-type: none">■ As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless “ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions”.■ It is recommended that the proposed development occur outside of confirmed habitat in order to comply with the PPS (2014).
<p>Amphibian Breeding Habitat (Wetlands)</p> <p><u>Rationale:</u></p> <p>Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario landscapes.</p>	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	<p>ELC Community Classes SW, MA, FE, BO, OA and SA.</p> <p>Typically these wetland ecosites will be isolated (>120m) from woodland ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) may be adjacent to woodlands.</p>	<ul style="list-style-type: none">■ Wetlands>500m2 (about 25m diameter)) ^{ccvii}, supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats clxxxii .■ Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators.■ Bullfrogs require permanent water bodies with abundant emergent vegetation.■ <u>Information Sources</u><ul style="list-style-type: none">– Ontario Herpetofaunal Summary Atlas (or other similar atlases)– Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count.– OMNRF Districts and wetland evaluations.– Reports and other information available from Conservation Authorities.	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Presence of breeding population of 1 or more of the listed newt/salamander species or 2 or more of the listed frog/toad species with at least 20 individuals (adults or eggs masses) ^{lxxi} or 2 or more of the listed frog/toad species with Call Level Codes of 3 [Ⓔ]. or; Wetland with confirmed breeding Bullfrogs are significant[Ⓔ].– The ELC ecosite wetland area and the shoreline are the SWH.– A combination of observational study and call count surveys ^{ccviii} will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands.– If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule.– SWH MIST cxlix Index #15 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ High Probability;<ul style="list-style-type: none">– Qualifying ecosites are present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations. Thresholds for species and individuals were not met during amphibian breeding surveys.	<ul style="list-style-type: none">■ No further action required.

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Table 1.3 Habitats of Species of Conservation Concern considered SWH

Wildlife	Species	CANDIDATE SWH ELC Ecosite	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Woodland Area-Sensitive Bird Breeding Habitat <u>Rationale:</u> Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager Winter Wren Pileated Woodpecker <u>Special Concern:</u> Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	<ul style="list-style-type: none">■ Habitats where interior forest breeding birds are breeding, typically large mature (>60 yrs old) forest stands or woodlots >30 ha. cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix,■ Interior forest habitat is at least 200 m from forest edge habitat. cxliv■ <u>Information Sources</u><ul style="list-style-type: none">– Local birder clubs.– Canadian Wildlife Service (CWS) for the location of forest bird monitoring .– Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species– Reports and other information available from Conservation Authorities	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Presence of nesting or breeding pairs of 3 or more of the listed wildlife species. ⑤– <u>Note:</u> any site with breeding Cerulean Warblers or Canada Warbler is to be considered SWH.⑤– Conduct field investigations in spring and early summer when birds are singing and defending their territories.– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST cxlix Index #34 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Forested ecosites within the study area are not large enough to provide interior forest habitat.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Marsh Breeding Bird Habitat <u>Rationale:</u> Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan Special Concern: Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	<ul style="list-style-type: none">■ Nesting occurs in wetlands.■ All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present cxxiv.■ For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it may be found in upland shrubs or forest a considerable distance from water.■ <u>Information Sources</u><ul style="list-style-type: none">– OMNRF District and wetland evaluations.– Field Naturalist clubs– Natural Heritage Information Centre (NHIC) Records.– Reports and other information available from Conservation Authorities.– Ontario Breeding Bird Atlas.	<ul style="list-style-type: none">■ Studies confirm:<ul style="list-style-type: none">– Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren or breeding by any combination of 4 or more of the listed species ⑤– Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH ⑤.– Area of the ELC ecosite is the SWH.– Breeding surveys should be done in May/June when these species are actively nesting in wetland habitats.– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”– SWH MIST Index #35 provides development effects and mitigation measures	<ul style="list-style-type: none">■ High Probability;<ul style="list-style-type: none">– Qualifying wetland ecosites are present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Open Country Bird Breeding Habitat <u>Rationale:</u> This wildlife habitat is declining throughout Ontario and North America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow Special Concern Short-eared Owl	CUM1 CUM2	<ul style="list-style-type: none">■ Large grassland areas (includes natural and cultural fields and meadows) >30 ha clx, clxi, clxii, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix .■ Grasslands not Class 1 or 2 agricultural lands, and not being actively used for farming (i.e. no row cropping or intensive hay or livestock pasturing in the last 5 years) ⑤.■ Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older.■ The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species.■ <u>Information Sources</u><ul style="list-style-type: none">– Agricultural land classification maps, Ministry of Agriculture.– Local bird clubs.– Ontario Breeding Bird Atlas– EIS Reports and other information available from Conservation Authorities.	<ul style="list-style-type: none">■ Field Studies confirm:<ul style="list-style-type: none">– Presence of nesting or breeding of 2 or more of the listed species. ⑤– A field with 1 or more breeding Short-eared Owls is to be considered SWH.– The area of SWH is the contiguous ELC ecosite field areas.– Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories.– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST cxlix Index #32 provides development effects and mitigation measures	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Suitable cultural meadow habitat that meets size thresholds is present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Species and number thresholds were not met during breeding bird surveys.	<ul style="list-style-type: none">■ No further action required.

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Wildlife	Species	CANDIDATE SWH ELC Ecosite		CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Shrub/Early Successional Bird Breeding Habitat <u>Rationale:</u> This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records ^{cxci} .	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp. Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher Special Concern: Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2	Patches of shrub ecosites can be complexed into a larger habitat for some bird species	<ul style="list-style-type: none">■ Large field areas succeeding to shrub and thicket habitats >10ha^{clxiv} in size.■ Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (i.e. no row-cropping, haying or live-stock pasturing in the last 5 years) [Ⓔ].■ Shrub thicket habitats (>10 ha) are most likely to support and sustain a diversity of these species ^{clxxiii}.■ Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands.■ Information Sources<ul style="list-style-type: none">– Agricultural land classification maps, Ministry of Agriculture.– Local bird clubs.– Ontario Breeding Bird Atlas– Reports and other information available from Conservation Authorities.	<ul style="list-style-type: none">■ Field Studies confirm:<ul style="list-style-type: none">– Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species. [Ⓔ]– A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as Significant Wildlife Habitat. [Ⓔ]– The area of the SWH is the contiguous ELC ecosite field/thicket area.– Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories– Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects”^{ccxi}– SWH MIST– cxlix Index #33 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Although suitable ecosites are present within the study area they do not meet the size criteria for significance.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.
Terrestrial Crayfish; <u>Rationale:</u> Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare. ^{ccii}	Chimney or Digger Crayfish; (<i>Fallicambarus fodiens</i>) Devil Crawfish or Meadow Crayfish; (<i>Cambarus Diogenes</i>)	MAM1 MAM3 MAM5 MAS1 MAS3 SWT	MAM2 MAM4 MAM6 MAS2 SWD SWM	<ul style="list-style-type: none">■ Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish.■ Constructs burrows in marshes, mudflats, meadows, the ground can't found far from water.■ Both species are a semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed.■ <u>Information Sources</u><ul style="list-style-type: none">– Information sources from “Conservation Status of Freshwater Crayfishes” by Dr. Premek Hamr for the WWF and CNF March 1998	<ul style="list-style-type: none">■ Studies Confirm:<ul style="list-style-type: none">– Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites ^{cci}– Area of ELC ecosite or an Habitat ecoelement area of meadow marsh or swamp within the larger ecosite area is the SWH.– Surveys should be done April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals is very difficult ^{cci}– SWH MIST cxlix Index #36 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Suitable wetland ecosites are present within the study area.	<ul style="list-style-type: none">■ Confirmed;<ul style="list-style-type: none">– Chimneys were observed in suitable habitat during field investigations.	<ul style="list-style-type: none">■ As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless “ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions”.<ul style="list-style-type: none">■ It is recommended that the proposed development occur outside of confirmed habitat in order to comply with the PPS (2014).

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Wildlife	Species	CANDIDATE SWH ELC Ecosite	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat within the Study Area	Confirmed Habitat within the Study Area	Conclusions/ Recommendations
Special Concern and Rare Wildlife Species <u>Rationale:</u> These species are quite rare or have experienced significant population declines in Ontario.	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage Information Centre (NHIC).	All plant and animal element occurrences (EO) within a 1 or 10km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy	<ul style="list-style-type: none">■ When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites lxxviii■ <u>Information Sources</u><ul style="list-style-type: none">– Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species lists with element occurrences data.– NHIC Website “Get Information” : http://nhic.mnr.gov.on.ca– Ontario Breeding Bird Atlas•– Expert advice should be sought as many of the rare spp. have little information available about their requirements.	<ul style="list-style-type: none">■ Studies Confirm:<ul style="list-style-type: none">– Assessment/inventory of the site for the identified special concern or rare species needs to be completed during the time of year when the species is present or easily identifiable.– The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat or foraging habitat.– SWH MIST Index #37 provides development effects and mitigation measures.	<ul style="list-style-type: none">■ High Probability;<ul style="list-style-type: none">– There are records of Special Concern and rare species within or in the vicinity of the study area.	<ul style="list-style-type: none">■ Confirmed;<ul style="list-style-type: none">– Rare species or species of Special Concern were observed within the study area (Monarch within CUM1-1 on properties:<ul style="list-style-type: none">– 3298 Scotland Dr– 3137 Scotland Dr– 3405 Scotland Dr– 3465 Scotland Dr– 3502 Manning Dr– 3595 Scotland Dr– 3666 Scotland Dr– 3691 Manning Dr– 3713 Scotland Dr– 6100 White Oak Rd; Eastern Wood-pewee within FOD5-5 on property 3583 Westminster Dr)	<ul style="list-style-type: none">■ As stated in the PPS 2014, development and site alteration is not permitted within Significant Wildlife Habitat (SWH). Additionally, the PPS (2014) states that development is not permitted within adjacent lands to Significant Wildlife Habitat unless “ecological function of the adjacent lands has been evaluated and it has been demonstrated that there will be no negative impacts on the natural features or their ecological functions”.■ It is recommended that the proposed development occur outside of confirmed habitat in order to comply with the PPS (2014).

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Table 1.4 Animal Movement Corridors

Habitat	SPECIES	CANDIDATE SWH ELC Eco-sites	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Present within the Study Area	Conclusions/ Recommendations
Amphibian Movement Corridors <u>Rationale:</u> Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	<ul style="list-style-type: none">■ Corridors may be found in all ecosites associated with water.■ Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1	<ul style="list-style-type: none">■ Movement corridors between breeding habitat and summer habitat <small>cbxxiv, cbxxv, cbxxvi, cbxxvii, cbxxviii, cbxxix, cbxxx, cbxxxi</small>.■ Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2■ (Amphibian Breeding Habitat –Wetland) of this Schedule ⑤.■ <u>Information Sources</u><ul style="list-style-type: none">– MNRF District Office.– Natural Heritage Information Centre (NHIC).– Reports and other information available from Conservation Authorities.– Field Naturalist Clubs.	<ul style="list-style-type: none">■ Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites.■ Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant cxlix■ Corridors should have at least 15m of vegetation on both sides of waterway cxlix or be up to 200m wide cxlix of woodland habitat and with gaps <20m cxlix .■ Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat cxlix.■ SWH MIST cxlix Index #40 provides development effects and mitigation measures	<ul style="list-style-type: none">■ Moderate Probability;<ul style="list-style-type: none">– Qualifying ecosties are present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations. Amphibian Breeding Habitat – Wetland was not confirmed during amphibian breeding surveys.	<ul style="list-style-type: none">■ No further action required.

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Table 1.5 Significant Wildlife Habitat Exceptions for Ecodistricts within Eco-Region 7E

Habitat	SPECIES	CANDIDATE SWH ELC Eco-sites	CANDIDATE SWH Habitat Criteria and Information Sources	CONFIRMED SWH Defining Criteria	Candidate Habitat Present Within the Study Area	Confirmed Habitat Present within the Study Area	Conclusions/ Recommendations
7E-2	Bat Migratory Stopover Area Rationale: Stopover areas for long distance migrant bats are important during fall migration. Hoary Bat Eastern Red Bat Silver-haired Bat	No specific ELC types.	<ul style="list-style-type: none">■ Long distance migratory bats typically migrate during late summer and early fall from summer breeding habitats throughout Ontario to southern wintering areas. Their annual fall migration may concentrate these species of bats at stopover areas.■ This is the only known bat migratory stopover habitats based on current information.■ <u>Information Sources</u><ul style="list-style-type: none">– OMNRF for possible locations and contact for local experts– University of Waterloo, Biology Department	<ul style="list-style-type: none">■ Long Point (42°35'N, 80°30'E, to 42°33'N, 80°03'E) has been identified as a significant stop-over habitat for fall migrating Silver-haired Bats, due to significant increases in abundance, activity and feeding that was documented during fall migration ccxv.■ The confirmation criteria and habitat areas for this SWH are still being determined.■ SWH MIST cxlix Index #38 provides development effects and mitigation measures	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Candidate habitat not present within the study area.	<ul style="list-style-type: none">■ No;<ul style="list-style-type: none">– Confirmed habitat was not observed during field investigations.	<ul style="list-style-type: none">■ No further action required.