ENVIRONMENTAL IMPACT ASSESSMENT

EAGLE HEIGHTS, BURLINGTON ON

AUGUST 2018

SAVANTA

Environmental Impact Assessment

Eagle Heights Burlington, ON

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August 2018

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1.0 INTRODUCTION

1.1 Background and Context

Penta Properties Inc. (Penta) is proposing to develop 102.2 ha of land located within the City of Burlington, Ontario (**Figure 1**, **Appendix A**).

The Subject Lands are located in the Central Sector of the North Aldershot area (formerly known as the Grindstone Settlement Area), in the City of Burlington. They were formerly comprised of two ownership parcels formerly identified as: the Paletta lands (93.26 ha) and the Taylor lands (9.0 ha). Both parcels are now owned by Penta Properties Inc. and are referred to as the Eagle Heights Lands (Subject Lands). The Subject Lands cover lots 7, 8 and 9, Concession 2 and the unopened road allowance between lots 7 and 8 respectively. The property is generally bounded by the Grindstone Creek valley to the west, Waterdown Road to the east, Mountain Brow Road to the north and Highway 403 to the south. The most northerly part of the Eagle Heights lands extends north of the Mount Hope Hydro Corridor and the most southerly portion (formerly the Taylor property) is bounded on the east and west by creek tributaries and is crossed by an 86 m wide Ontario Hydro corridor, which runs east to west across the property.

1.2 Brief History of Development Application

In 1991, applications were made by the Grindstone Settlement Area Owners Group to amend Provincial and City planning documents to permit residential development in the Central Sector of North Aldershot. The public agencies conducted a review that became known as the North Aldershot Interagency Review (NAIR). The 1994 final report by NAIR was adopted by the City of Burlington and the Region of Halton to form the basis for future planning in North Aldershot.

In 1994, an Environmental Impact Assessment (EIA) was completed in response to Draft Plans of Subdivision for the Subject Lands (Ecological Services for Planning Ltd.; ESP 1994). In 1996, as part of the settlement of referrals to the Ontario Municipal Board (OMB), Amendment 197 of the Official Plan (OPA 197) was adopted by the City of Burlington and zoning bylaws and Draft Plans of Subdivision were subsequently approved (referred to herein as the approved 1996 plan).

The plan for development was revised in 2002 and was subject to another EIA (Stantec Consulting Limited 2004). The 2003 development plan was modified in 2006 and updated in 2010. The 2002 plan was designed to meet the OPA 197 and NAIR recommendations, as well as to integrate innovative forms of development in natural settings (Metropolitan Consulting Inc., MCI; updated 2010), while providing for an overall increase in density.

In 2013, Savanta Inc. (Savanta) was retained to produce a revised EIA report in response to updated Draft Plans of Subdivision for the Eagle Heights and Taylor lands (MCI updated 2010). The 2013 Draft Plan excluded the lands located north of the Mount Hope Hydro Corridor and those lands were not assessed as part of the 2013 EIA. The 2010 draft plan was similar to the approved 1996 plan, in terms of its general configuration of proposed development into pods, defined by the development limits set in the 1996 settlement agreement with development being largely restricted to the tableland areas associated with the Subject Lands.

Since the submission of the 2013 EIA, Penta has been engaged in discussions, site visits and meetings with the City of Burlington (City), the Niagara Escarpment Commission (NEC), the Region of Halton (Region) and Conservation Halton (CH) regarding the range of potential impacts associated with development of the Subject Lands. The City, Region, NEC, CH and the Ministry of Natural Resources and Forestry (MNRF) conducted site visits of the Subject Lands in both 2013 and 2015 to assess features present, conduct butternut health assessment surveys (MNRF) and carry out wetland, woodland dripline and top of bank feature stakings.

In addition, comments with respect to the 2013 EIA were received from the Region, CH, the City and the NEC in 2013. Savanta's responses to these comments are provided in a comprehensive table that includes responses from other members of Penta's technical team and are provided as an appendix to the FSR completed by MCI (2018a). Savanta conducted updated field surveys in 2014, 2015 and 2016, in part to address agency comments and in part to ensure the availability of current field data and an adequate characterization of existing conditions. This EIA focuses on data collected between 2013 to 2017; older data contributed to baseline condition characterization and an understanding of ecological significance.

1.2 Summary of Proposed Development

Based on this updated field data and updated information and analyses being completed by other consultants on Penta's technical team (e.g., Terra-Dynamics, Matrix Solutions and Soil-Mat), the Draft Plans were updated by MCI in 2018.

The updated Draft Plan and the associated Planning Justification Report (MCI 2018c) restricts development on the Penta property to the tableland, in accordance with limits established in the NAIR reporting and in OPA 197. The development areas, valley boundaries, buffer zones and environmental open space are the same as those approved in 1996, except in the southeast corner of Sub-Area 7 where the valley boundary has been refined based upon a topographic survey of the treed dripline, top of bank and wetland limits which were staked in 2013 and 2015 by Savanta, MCI, the Region and CH. Differences exist within the development areas (pod boundaries), in part to reflect changes in technology and urban design over the 15-year period between plan iterations.

The updated Draft Plan proposes a residential community consisting of a range of housing types in locations that were proposed by planning and engineering members of the Penta consulting team, to fit with and respect the physical characteristics of the Subject Lands. According to the earlier Planning Justification Report (Envision and Scott Burns Planning Consultants 2007), the following aspects of the NAIR Planning Principles and Evaluation Criteria have been given particular emphasis in the updated, 2018 Plan:

- Having regard for the topographical character of the landscape within the pods and ensuring that the development areas do not cut off any wildlife corridors and linkages;
- Retaining any significant trees and significant vegetation, recognizing that most of the development areas have been farmed in the past and continue to be farmed in some cases;
- Minimizing encroachment into environmentally sensitive lands;
- Respecting the scale and unique character of the existing community;

- Having regard for the rural character of the existing roads;
- Recognizing various area users such as hikers and residents;
- Encouraging land stewardship; and
- Preserving utility corridors (e.g., hydro and pipeline).

The key differences in the 2018 Plan from previous versions are the introduction of new forms of housing and higher housing densities. This includes the addition of multi-unit buildings and different types of cluster homes. The planning and engineering members of the Penta consulting team have designed these housing forms to respect the natural character of the area and to reduce the 'footprint' of the development. Larger lot single-family homes are proposed adjacent to the existing roads and in locations where the homes can be more appropriately situated into the areas of more complex topography. Townhouse homes have been proposed to preserve the landscape setting and to create a unique residential community that takes advantage of the extensive ecological resources of the area (Envision and Scott Burns Planning Consultants 2007).

Generally, the plan proposes to preserve important existing landscape features within the development areas, including remnant specimen trees and local landform elements that add to the area's character (e.g., drainage channels). The 2018 plan incorporates more current stormwater management techniques to minimize the impact of the proposed development on the Grindstone Creek and associated valleyland ecosystems. A more fulsome description of the proposed updated development is presented in section 5.0. For a more detailed comparison of the approved and proposed plans, the reader is referred to associated planning and engineering materials developed by the applicant.

1.3 EIA Requirements

This report presents the results of inventories and analyses of existing natural heritage conditions and provides an assessment of the significance and sensitivity of these resources in the context of the proposed development. Site observations and inventory findings were analyzed to assess potential constraints to development.

This report is based on a suite of inventories and analyses carried out between 2013 and 2017. It provides an assessment of potential direct and indirect impacts on various terrestrial and aquatic features and associated natural functions, based upon appropriate site observations during the appropriate seasons. Key findings from historical surveys were reviewed and considered for analysis of significance or potential impacts where appropriate.

The assessment of impacts associated with the proposed development of the Subject Lands has been informed by the findings of updated studies completed by Penta's technical team, which are listed below:

- Eagle Heights Property Hydrological Study and Stormwater Management Report, MCI, 2016;
- Eagle Heights Property Functional Servicing Report, MCI, 2018a;
- Eagle Heights Planning Justification Report, MCI, 2018c;
- Evaluation of Water Balances in Wetlands in Eagle Heights, MCI, 2018b;

- Eagle Heights and Taylor Property Geomorphic Assessment, Matrix Solutions Inc., 2018; and
- Eagle Heights and Taylor Property Slope Stability Assessment, Soil-Mat Engineers & Consultants, 2017.

1.4 Natural Heritage Planning Considerations

An assessment of the quality and extent of natural heritage features found on, and adjacent to, the Subject Lands and the potential impacts to these features from the proposed development applications was undertaken to address the requirements of the following regulatory agencies, local and regional municipalities, and/or legislation:

- City of Burlington Official Plan (1994);
- Region of Halton Official Plan (1995);
- Conservation Halton;
- Niagara Escarpment Planning and Development Act (2017, c.20, Sched.8, s.101);
- Provincial Policy Statement (PPS) (1997);
- Endangered Species Act (ESA) (S.O. 2007, c.6); and
- Fisheries Act (R.S.C., 1985, c. F-14).

1.4.1 City of Burlington Official Plan

We have been advised by Penta's legal team that the City of Burlington 1994 Official Plan and OPA 197 is the operative document for review of this application. OPA 197 establishes goals, policies and objectives to guide the future development of the central sector of North Aldershot.

Generally, OPA 197 identifies that……"developers shall be required to demonstrate:

- Opportunities to preserve and enhance natural habitats at creek mouths, headwaters, and creek valleys connecting the waterfront with the City's urban and rural planning areas shall be identified through special studies and through development proposals;
- Public access to public lands containing significant natural features or habitat shall respect the sensitivity of the natural areas to human disturbance;
- Landscaping design, including the use of native species, that preserve and enhances the natural environment shall be encouraged;
- Practices that reduce the potential to pollute air, soil and water and that have beneficial effects on aquatic and terrestrial ecosystems shall be encouraged;
- Development and redevelopment will result in minimum damage to significant trees, wooded areas and hedgerows as identified by and Environmental Evaluation; and
- Development will be designed to preserve the open space setting of the Niagara Escarpment face, as well as all creek and stream valleys in the area…."

More specifically Section 3.1.3.4 of OPA 197 requires that an "Environmental Evaluation" report be prepared to the satisfaction of the City for development applications affecting lands that are:

- "Within an area identified by the Ministry of Natural Resources as a Regionally Significant Wetland;
- Within an area identified by the Ministry of Natural Resources as a Regionally or Provincially Significant Area of Natural and Scientific Interest;
- Within 120 m of a Regionally or Provincially Significant Wetland, and Regionally or Provincially Significant Area of Natural and Scientific Interest as identified by the Ministry of Natural Resources; and
- Within 60 m of an Environmentally Sensitive Area. "

Map 10 of OPA 197 identifies the watercourse channels, existing wooded features and valley of Grindstone Creek as "Environmental Protection". A list of criteria used to determine this designation is provided in Section 3.1.4.1. of OPA 197. Detailed planning information is provided in the Eagle Heights Planning Justification Report (2018) prepared by Metropolitan.

1.4.2 Region of Halton Official Plan

We have been advised by Penta's legal team that the Regional Official Plan (ROP) adopted on March 30, 1994 and approved by the Minister of Municipal Affairs and Housing (MMHA) on November 27, 1995 is the operative document for review of this application.

According to "Map 1 – The Regional Structure" of the 1994 ROP the Subject Lands are designated as:

- Environmentally Sensitive Area;
- Parkway Belt West Plan Area;
- Greenlands B;
- North Aldershot Policy Area; and
- Area Eligible for Urban Services.

Please refer to the "Eagle Heights Planning Justification Report" (2018) prepared by Metropolitan for further explanation with respect to the ROP policies applicable to the Subject Lands.

1.4.3 Conservation Halton

CH conducts reviews of planning processes associated with the future development of properties within its jurisdictional boundaries. In addition, CH provides planning and technical advice to planning authorities to assist them in fulfilling their responsibilities regarding natural hazards, natural heritage and other relevant policy areas pursuant to the Planning Act.

CH administers the *Regulation of Development, Interference with Wetlands, Alterations to Shorelines and* Watercourses permit process, under Ontario Regulation 162/06. Permission is required from CH for any work, including residential development, in or adjacent to watercourses, rivers or stream valleys, or other natural hazards such as wetlands where the development could interfere with the hydrology of the area.

CH's Online Interactive Regulation Limit Mapping depicts numerous features that run parallel to the Grindstone Creek Valley throughout the entirety of the Subject Lands as being within the

Approximate Regulation Limit (ARL). These features include headwater drainage features and wooded linkages. Refinement or adjustments to the ARL can be made as a part of the permit application process if it is demonstrated that the hazard limit differs from that shown on the interactive mapping.

1.4.4 Niagara Escarpment Planning and Development Act

The Niagara Escarpment Planning and Development Act was first drafted in 1990 and was last amended in 2017 and is enforced by the NEC. The objectives of the Niagara Escarpment Plan (NEP) are to:

a) "protect unique ecological and historic areas;
b) maintain and enhance the quality and character of natural streams and water supplies;
c) provide adequate opportunities for outdoor recreation;
d) maintain and enhance the open landscape character of the Niagara Escarpment in so far as possible, by such means as compatible farming or forestry and by preserving the natural scenery;
e) ensure that all new development is compatible with the purpose of the act;
f) provide adequate public access to the Niagara Escarpment; and,
g) support municipalities within the Niagara Escarpment Planning Area".

As shown on Map 3 (Regional Municipality of Halton) within the NEP, the northern portion of the Subject Lands contains a small area of lands designated as Escarpment Protection Area (**Figure 2**, **Appendix B**). The NEP discusses Escarpment Protection Areas in section 1.4 as being important areas "because of their visual prominence and their environmental significance, including increased resilience to climate change through the provision of essential ecosystem services". Lands exhibiting the following are designated as Escarpment Protection Areas:

- "Escarpment slopes and Escarpment Related Landforms where existing land uses have significantly altered the natural environment (e.g. agricultural lands or residential development);
- Areas in close proximity to Escarpment slopes that are visually part of the landscape unit; and,
- Areas of Natural and Scientific Interest (Life Science), or environmentally sensitive or environmentally significant areas identified by municipalities or conservation authorities".

Map 3 of the NEP plan identifies the Subject Lands to be within the "North Aldershot Policy Area".

1.4.5 Provincial Policy Statement and Associated Guidelines

The 1997 Provincial Policy Statement (PPS) is the guiding planning document for this application. The PPS (1997), issued under the Planning Act, provides direction on matters of provincial interest related to land use planning and development.

Seven types of natural features are defined in 1997 PPS:

- Significant Wetlands;

- Significant Portions of the Habitat of Endangered and Threatened Species;
- Fish Habitat;
- Significant Woodlands;
- Significant Valleylands;
- Significant Wildlife Habitat (SWH); and
- Significant Areas of Natural and Scientific Interest (ANSI).

The 1997 PPS states that development and site alteration are not permitted in significant wetlands (south and east of the Canadian Shield) and significant portions of the habitat of endangered and threatened species. The 1997 PPS also states that development and site alteration may be permitted in the remaining identified natural features "if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified". The 1997 PPS further states that "development and site alteration may be permitted on adjacent lands… if it has been demonstrated that there will be no negative impacts on the natural features or on the ecological functions for which the area is identified". In 1997, section 3 of the Planning Act required that, in exercising any authority that affects planning matters, planning authorities "shall have regard to" policy statements issued under the Act.

Investigations regarding natural heritage features on the Subject Lands, has considered current technical information and guidance. The presence of these features on the Subject Lands is assessed in section 3.4.

1.4.6 Ontario Endangered Species Act (ESA)

The provincial ESA 2007 was developed to:

- Identify species at risk (SAR), based upon best available science;
- Protect SAR and their habitats and to promote the recovery of SAR; and
- Promote stewardship activities that would support those protection and recovery efforts.

The ESA protects all threatened, endangered and extirpated species listed on the Species at Risk in Ontario (SARO) list. These species are legally protected from harm or harassment and their associated habitats are legally protected from damage or destruction, as defined under the ESA 2007 (OMNR 2007).

1.4.7 Federal Fisheries Act

Fisheries and Oceans Canada (DFO) administers the federal *Fisheries Act* which defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes" (Sec. 31.5). Under the *Fisheries Act* fish do not need to directly use aquatic habitat in order for it to be considered 'fish habitat'. The Act prohibits serious harm to fish, which is defined as the death of fish or any permanent alteration to, or destruction of, fish habitat.

2.0 DATA COLLECTION APPROACH AND METHODS

2.1 Background References

The detailed technical work completed for these and nearby lands in past reports has been reviewed. These reports include the following (also, see references):

- Planning Justification Report (Envision & Scott Burns Planning Consultants 2007);
- Functional Servicing and Stormwater Management Report (Metropolitan Consulting Inc., 2010 updated in 2013);
- Environmental Impact Assessment, Paletta and Taylor Lands, City of Burlington (Stantec Consulting Ltd. 2004);
- Environmental Impact Assessment, Eagle Heights Lands, Grindstone Settlement Area, City of Burlington (Ecological Services for Planning; ESP, now Stantec Consulting Ltd. 1994);
- Stable Top of Bank Assessment Eagle Heights and Taylor Properties, Waterdown Road, Burlington, Ontario (Peto MacCallum Ltd. 2006);
- Geotechnical Investigation, Eagle Heights and Taylor Property, Waterdown Road, Burlington, Ontario (Peto MacCallum Ltd. 2003);
- Hamilton-Wentworth Natural Areas Inventory Volume I and II (A.E Heagy 1993);
- Ecological Survey of the Niagara Escarpment Volume I and II (J.L Riley, J.V. Jalava and S. Varga 1996);
- Grindstone Creek Subwatershed Study (Stantec Consulting, formerly, Cosburn Patterson Wardman Ltd. 1994);
- The North Aldershot Inter-Agency Review (Hemson Consulting Ltd. and Hough Stanbury Woodland Ltd. 1994);
- Burlington Official Plan (City of Burlington 1994); and
- Halton Region Official Plan (Region of Halton 1995).

Additionally, Savanta has relied, in part, upon supporting background information and previous site surveys to provide additional insight into the overall character of these Subject Lands. Examples of these resources include:

- MNRF: Online Resources;
  - Land Information Ontario (LIO) Natural Features Mapping
  - Natural Heritage Information Centre (NHIC) Database
  - SAR website
- MNRF, Aurora District communications and files;
- Conservation Halton communications and files.

Table 1 (**Appendix B**) summarizes all species at risk (SAR) and species of conservation concern that were identified during background review of the above noted documents**.**

2.1.1 LIO Natural Features Summary

Based on the MNRF LIO geographic database the following features were identified within the Subject Lands:

- Two unnamed watercourses running in a north to south direction;
- Grindstone Creek which abuts the western limit of the Subject Lands; and
- A portion of the Grindstone Creek Valley ANSI along the western boundary of the Subject Lands.

The following natural heritage features were identified adjacent to or within the general vicinity of the Subject Lands:

- Sassafras-Waterdown Woods ANSI and Sassafras Wood ESA are located on the east side of Waterdown Road;
- Waterdown Escarpment Woods ESA is found north of the Subject Lands, approximately 1.7 km away;
- Falcon Creek Wetland Complex is identified north of the Subject Lands, approximately 1.9 km away;
- Grindstone Creek ANSI is located northwest of the Subject Lands, approximately 0.3 km away;
- Clappison Escarpment Woods ANSI and ESA are found west of the Subject Lands, approximately 0.8 km away;
- Bridgeview Valley ESA is identified approximately 2.0 km southwest of the Subject Lands; and
- Hendrie Valley ANSI and Hendrie Valley-Lambs Hollow Wetland are located 1.6 km south of the Subject Lands.

LIO Natural Heritage features as identified within the Subject Lands are illustrated on **Figure 2**, (**Appendix A**).

2.1.2 Natural Heritage Information Centre Database (NHIC)

The NHIC database, maintained by the MNRF, was searched for records of provincially significant plants, vegetation communities and all forms of wildlife on, and in the vicinity of the Subject Lands. The database provides occurrence data by 1 km^2 area blocks, which overlap with areas outside of the Subject Lands. Four blocks contain information pertaining to the Subject Lands: 17NH9096, 17NH9196, 17NH9097 and 17NH9197. Within these blocks, the search revealed 17 records, three of which had an element occurrence rank of 'Historical' (> 50 years old). These historic species are not addressed as current occurrences in this reporting.

Of the species reported in the atlas squares, six are Endangered in Ontario: Yellow-breasted Chat (*Icteria irens)*, American Columbo (*Frasera caroliniensis)*, American Chestnut (*Castanea dentata)*, Eastern Flowering Dogwood (*Cornus florida)*, Butternut (*Juglans cinerea)* and Red Mulberry (*Morus rubra)*; three are Threatened in Ontario: Bobolink (*Dolichonyx oryzivorus)*, Cerulean Warbler (*Setophaga cerulean)* and Eastern Meadowlark (*Sturnella magna)*. One

Special Concern species in Canada (not at risk in Ontario) was identified: Eastern Milksnake (*Lampropeltis triangulum)*. Additionally, three other species of conservation concern were identified: Forked Panicgrass (*Dichanthelium dochotomum)* and Meadow Evening Primrose (*Oenothera pilosella)* are ranked S2 (very rare in Ontario), while Perfoliate Bellwort (*Uvularia perfoliata)* is ranked S1S2 (very rare to extremely rare in Ontario). This information assisted in defining the search effort and target species for studies on and immediately adjacent to the Subject Lands.

2.1.3 Ontario Breeding Bird Atlas

The Ontario Breeding Bird Atlas (OBBA) (Cadman et al. 2007) contains detailed information on the population and distribution status of Ontario birds (2005). The data is presented on 10 km x 10 km squares. The data square that overlaps with the Subject Lands is used to determine the potential bird species list for that area. It should be noted that the Subject Lands are a small component of the overall bird atlas square, and therefore it is unlikely that all bird species are found within the Subject Lands. Habitat type, availability and size are all contributing factors in bird species presence and use.

A total of 109 bird species were recorded in the atlas square (17NH99) that overlap with the Subject Lands. Of the species reported in the atlas square, three are Threatened in Ontario: Barn Swallow (*Hirundo rustica*), Chimney Swift (*Chaetura pelagica)*, and Least Bittern (*Ixobrychus exilis)*; and five are Special Concern in Ontario: Eastern Wood-Pewee (*Contopus virens*), Wood Thrush (*Hylocichla mustelina)*, Red-headed Woodpecker (*Melanerpes erythrocephalus)*, Golden-winged Warbler (*Vermivora chrysoptera)* and Peregrine Falcon (*Falco peregrinus)*. This information assisted in defining the search effort and target species for studies on, and immediately adjacent to, the Subject Lands.

2.1.4 Ontario Nature Reptile and Amphibian Atlas

Ontario Nature Reptile and Amphibian Atlas contains detailed information on the population and distribution status of Ontario herpetofauna (Ontario Nature 2015). The data are presented on 10 km x 10 km squares. The data square that overlaps with the Subject Lands is used to determine the potential herpetofauna species list for that area. It should be noted that the Subject Lands are a small component of the overall herpetofauna atlas square, and therefore it is unlikely that all herpetofauna species are found within the Subject Lands. Habitat type, availability and size are all contributing factors in herpetofauna species presence and use.

A total of 26 species were recorded in one atlas square (17NH99) that overlaps with the Subject Lands. Of the 26 herpetofauna species reported in the atlas square, five are turtle species, seven are snake species, five are salamander species and nine are frog and toad species. The atlas square search results show:

- One Endangered species in Ontario: Jefferson Salamander (*Ambystoma jeffersonianum);*
- One Threatened in Ontario species: Blanding's Turtle (*Emydoidea blandingii)*;
- Two Special Concern in Ontario species: Snapping Turtle (*Chelydra serpentina)* and Northern Map Turtle (*Graptemys geographica)*; and

- One S3 (rare to uncommon in Ontario) species: Western Chorus Frog (Great Lakes/St. Lawrence – Canadian Shield Population) (*Pseudacris triseriata)*.

2.1.5 Ontario Insect Atlas

The Ontario Insect Atlas contains detailed information on the population and distribution status of Ontario insects. The data is presented on 10 km x 10 km squares. The data square that overlaps with the Subject Lands is used to determine the potential insect species list for that area. Habitat type, availability and size are all contributing factors in insect species presence and use.

A total of 65 species were recorded in the atlas square (17NH99) that overlaps with the Subject Lands. Of the 65 species, two are considered SAR: Monarch (*Danaus plexippus),* listed as a Special Concern species in Ontario and Endangered in Canada, and Mottled Duskywing (*Erynnis martialis)*, listed as Endangered in Canada.

2.1.6 Fisheries and Oceans Canada

A comprehensive review was conducted of the DFO's Open Maps Data Viewer mapping that illustrates the distribution and population status of SAR fish and mussels of Ontario.

No aquatic SAR were identified within, or in the direct vicinity of the Subject Lands.

2.2 Agency Discussions

2.2.1 Conservation Halton

Since the submission of the 2013 EIA, Penta has been engaged in discussions, site visits and meetings with Conservation Halton (CH) to discuss the range of impacts associated with development of the Subject Lands. CH in conjunction with both the City, Region, Niagara Escarpment Commission (NEC), and MNRF conducted site visits of the Subject Lands in both 2013, 2014 and 2015, respectively, to assess features present, and carry out wetland, woodland dripline and top of bank feature staking, along with representatives of the proponents' consultants. A summary of these visits is provided in **Table 2** (**Appendix B**).

In addition, comments with respect to the 2013 EIA were received from the Region, CH, the City and the NEC in 2013. Responses to these comments are provided in a comprehensive table located in an appendix in the FSR (MCI 2018). Savanta conducted updated field surveys in 2014, 2015 and 2016 partly to address agency comments and to bring all data and field surveys up to current standards for surveys that were more than 5 years old. Individual discussions were held with the leadership and staff of CH, in order to ensure a common understanding of CH interests and technical comments.

2.2.2 Ministry of Natural Resources and Forestry (MNRF)

The MNRF Aurora District participated in agency site walks of the Subject Lands in 2013. In addition, a separate site walk was carried out with the MNRF on August 9, 2013 to review SAR associated with the Subject Lands specific to Butternut, Jefferson Salamander and Eastern

Flowering Dogwood. MNRF did not note any concerns during the site walk or in subsequent discussions/correspondence.

Potential impacts to SAR associated with the Subject Lands will be addressed directly with the MNRF through the SAR Information Gathering Form (IGF) process. Due to the sensitive nature of this information, all correspondence and related materials will remain with the MNRF.

3.0 ENVIRONMENTAL SETTINGS AND CHARACTERISTICS

3.1 Physical Baseline Conditions

Peto MacCallum Ltd. conducted a geotechnical investigation (2003) and a Stable Top of Bank Assessment (2006) for both the Eagle Heights and Taylor lands. These investigations examined subsurface soil, bedrock, and groundwater conditions; municipal service installation; roadway construction; house foundations; stormwater management facilities; and assessed stability of the creek valley and ravine slopes. The Grindstone Creek Subwatershed Study (CH 1998) and Eagle Heights and Taylor Properties Functional Servicing and Stormwater Management Report (MCI 2018) provide substantial information on the hydrology of the Subject Lands. The pertinent findings from these studies are summarized in the following sections.

3.1.1 Hydrology

The property occurs within the Lake Ontario watershed and more specifically within the Grindstone Creek subwatershed. The main valley of the Grindstone Creek abuts the Eagle Heights lands to the west and northwest and three Grindstone Creek tributaries traverse Eagle Heights and part of the Taylor lands from north to south. These tributaries have been designated Tributaries 4, 5, and 6 in the Grindstone Creek Subwatershed Study (CH 1998). A narrow strip of tableland along the west side of the site, varying from 0 m to 70 m wide, drains directly into the main Grindstone Creek while the rest of the tableland drains into the on-site tributaries. Tributary 4 drains most of the Taylor lands. Tributary 5 splits into two distinct watercourses north of Flatt Road, and these collectively drain the north end and most of the central portion of the Eagle Heights lands. The Eagle Heights lands west of Flatt Road extension drain into Tributary 6 (MCI updated 2010). **Figure 3** (**Appendix A**) depicts the watercourses present on the Subject Lands.

3.1.2 Soils and Physiography and Slope Stability

The Subject Lands are part of a till plain sloping down from the Niagara Escarpment to the Lake Ontario basin. Clayey silt is the predominant soil type on the Subject Lands and is underlain by shale bedrock. Soil types encountered include sandy silt, fine to coarse sand, silty clay and crushed limestone (fill). The geotechnical investigation (Peto MacCallum Ltd. 2003) provides additional information.

Peto MacCallum has investigated the slope stability aspects of the Subject Lands. Summary comments provided below, address their findings on the Penta lands.

The north half of the Taylor property is bordered on the west by a 10 m to 12 m deep ravine containing Tributary 4. The ravine is vegetated by mature trees and brush. A densely vegetated, minor ravine also exists along the eastern limit of the property. No evidence of instability or seepage was observed in the ravines (Peto MacCallum Ltd. 2006).

On the Eagle Heights lands, no evidence of recent erosion in Grindstone Creek was identified and little evidence of seepage on the slope face was noted (Peto MacCallum Ltd. 2006). The slopes of Tributary 6 are vegetated with mature forest and show no evidence of instability or seepage. An 8 m to 10 m deep ravine is found between Tributary 5 and Flatt Road Extension.

The slopes of this ravine are: vegetated with mature forest/dense brush; and possess a few relatively inactive erosion scars on the toe of the slope; show weathered shale bedrock in the stream channel. Small areas of possible seepage were observed 3 m above the ravine basin (near Flatt Road). Finally, the slopes of Tributary 5 are vegetated by mature forest, shale bedrock was observed in the creek channel, no evidence was found of instability in the ravine sidewalls and relatively inactive erosion scars were observed where creek meanders impinged on the toe of the slope (Peto MacCallum Ltd. 2006).

A more comprehensive and updated review has recently been completed by Soil-Mat (2017).

3.1.3 Hydrogeology

A comprehensive review and study is currently underway by Terra-Dynamics and is anticipated to be ready in late summer/fall of 2018.

3.1.4 Water Balance

A surface water feature based water balance assessment for three forb dominated wetlands within three tributaries (i.e., Tributary 4, Tributary 5E and Tributary 5S) and a tableland Cattail marsh/ Pond (former Taylor Pond) was completed for the Subject Lands. Metropolitan Consulting (2018) developed and programmed a continuous hydrological model (i.e., Guelph All-Weather Sequential Events Runoff) for the feature-based water balance. These four wetlands were confirmed by Terra-Dynamics to be surface water fed features. See section 6.1.1 for summary of results and proposed mitigation measures and Metropolitan Consulting (2018) for full details on the field studies conducted, data analyzes and water balance modelling.

A groundwater feature based water balance is underway by Terra-Dynamics and will be provided in an EIA technical addendum. There are two forb dominated wetlands within Tributary 5W and two forb dominated wetlands within Tributary 6 that are primarily supported by groundwater. Groundwater supported wetlands were instrumented in 2018 with pre-development and post-development water balance modeling to follow.

3.2 Biological Baseline

3.2.1 Landscape Ecology

In a more general context, the Subject Lands occur within the Carolinian, or Deciduous Forest Zone (also referred to as the mixed wood plains), an area characterized by a relatively warmer climate, which supports plant species typical of more southern areas. This zone is referred to by the Province as Ecoregion 7E. Broadleaved trees, including American Beech, Sugar Maple, Basswood, Red Maple, White Oak and Bur Oak, dominate natural upland forest cover in this region (Rowe 1972). Also found in this region are Canada's main distribution of Black Walnut, Sycamore, Swamp White oak and Shagbark Hickory.

Figure 2 (**Appendix A**) depicts the broad landscape around the Subject Lands. The dominant features in terms of the potential movement of organisms, matter and energy across the landscape are the series of natural areas associated with the slopes of the escarpment (e.g.,

Clappison Woods, Grindstone Creek and its natural areas, Sassafras Woods), and the many tributaries draining to Lake Ontario. This system of natural areas and functions are generally well-linked to the north with the broad escarpment and its concentration of ecosystem features and functions (excepting existing settlement areas) and is generally interrupted by the concentration of infrastructure to the south along the 400-series highway, regional and local roads and the main rail line corridor. The Grindstone Creek Valley abuts the western edge of the Subject Lands and provides a broad north-south connection to the Niagara Escarpment to the north and south, with its outlet to Lake Ontario. The Grindstone Creek Watershed study identifies that the Grindstone main valley, below the escarpment "*constitutes a significant migration route that is used by a number of fish and bird species*" between Hamilton Bay and the Escarpment Greenbelt (CH 1998).

The larger and more extensive regional corridors facilitate connectivity and wildlife movement through the river valley and escarpment natural systems. Another existing corridor that likely functions at a regional scale are the open portions of the Parkway Belt West, south and west of the Study Area and adjacent to Highway 403. These open areas, used for hydroelectric transmission, include natural open space that facilitates a level of connectivity. Other semi-natural features on the landscape that contribute to the effectiveness of regional corridors include the Mount Hope Hydro corridor in the northern half of the Subject Lands, an 86 m wide Ontario Hydro Corridor associated with the most southerly portion of the Subject Lands (formerly the Taylor property), and the Gate of Heaven Cemetery located to the east of the Grindstone Creek Valley.

The linkages and connectivity discussed above are generally strong but are affected by the current and proposed transportation infrastructure.

The local landscape is dominated by agricultural fields, open space/natural areas, commercial farming operations/greenhouses and an established road network. The Subject Lands provide an opportunity for wildlife movement/linkage in an east west direction within the hydro corridors, located in both the northern and southern portions of the Subject Lands. The existing Grindstone Creek Valley bordering the western limit of the Subject Lands as well as the matrix of watercourse channels provide for movement of wildlife in a north-south direction. Beyond the Subject Lands these connections are limited due to the internal road structure (Waterdown Road, Flatt Road and Flatt Road Extension), residential development located north of the Subject Lands and north of Main Street in Waterdown and Highway 403 to the south of the Subject Lands.

It is also anticipated that culverts associated with existing roadways will facilitate the localized movement of small to medium-sized wildlife (frogs, toads, snakes, turtles, raccoons, skunks, rabbits, squirrels, opossums, voles, etc.). The proposed development of the Subject Lands will include the replacement of culverts along Flatt Road. The design of these culverts along Tributaries 4, 5 east and 5 west, as well as the construction of a new culvert proposed for Road C along Tributary 5 west will provide enhanced wildlife crossings for small to medium wildlife. The detailed design of these culverts is being developed by Matrix Solutions, with input from Savanta. The design principles for enhanced wildlife crossings within the Subject Lands, will encompass aquatic biology, stream morphology and hydraulics and terrestrial connectivity. Finalized road widths and profiles will affect the opportunities for enhanced wildlife passage at each crossing location. Some additional information follows, regarding how these crossings will function.

Target wildlife species for wildlife crossings through the culverts (wet crossings where associated with watercourses) and underpasses (dry crossings) are amphibians (Spring Peeper, American Toad, Gray Tree Frog, Green Frog, Western Chorus Frog), potentially reptiles (i.e., snake and turtle species), and small to medium sized mammals (voles, shrews, mice, Gray Squirrel, Striped Skunk, Common Raccoon, Eastern Cottontail, Red Fox, Virginia Opossum and Coyote). Ungulates (i.e., White-tailed Deer) will cross over the road, and measures (i.e., signage, vegetation planting at ROWs) to avoid collisions with road traffic are further discussed at the end of this letter.

Studies of small-medium mammals, amphibians and reptiles have determined that movement of these species through culverts is most highly correlated with presence of vegetative cover at culvert entrance as well as abundance of these species on either side of the culvert (Foresman 2004; Clevenger and Waltho 2004). Small to medium-sized mammals, amphibian and reptiles were observed to use a wide variety of culvert diameter and/or width for passage (Brehm 1989; Krikoswki 1989; Yanes et al. 1995; Clevenger et al 2001; Foresman 2004; Woltz et al. 2008). Krikoswki (1989) observed amphibians using 0.3 m tunnels that were up to 42 m in length. Clevenger et al. (2001) found that 1.0 m to 1.5 m diameter culvert facilitates passage for medium mammals, while 0.5 m to 1.0 m diameter culverts were suitable for movement of small mammals. Woltz et al. (2008) found that amphibians and reptiles avoid using culverts less than 0.5 m in diameter. Substrate embankment material within the culvert/tunnel is important; amphibians and small mammals will avoid rip-rap (difficult terrain); smaller substrate should be placed on top of rip-rap (where rip-rap is needed) to support amphibian and small mammal movement.

3.3 Terrestrial Surveys

Field investigations have been completed over the course of the project life to gather ecological data to assist in understanding the potential constraints to development. Extensive field visits were conducted for the original Environmental Appraisal and 1994 EIS documents including breeding bird surveys, winter wildlife observations, amphibian call count surveys, spring stream assessments, summer and fall botanical inventories, and community classifications. More recently, field programs were completed in 2007, 2009, 2011, and annually from 2012 to 2016. Field visits were carried out to update the existing ecological database; they included additional targeted surveys including reptile surveys, Bobolink and Eastern Meadowlark surveys, Lepidopteron and Odonate surveys, woodland density surveys and Butternut Health Assessments. Detailed information regarding field investigations carried out from 2014 to 2017 is provided in **Table 2** (**Appendix B**).

3.3.1 Vegetation and Botanical Inventories

Vegetation communities were first identified on aerial imagery and then verified in the field. Vegetation community types were confirmed, sampled and revised, if necessary, using the sampling protocol of the ELC for Southern Ontario (Lee at al. 1998). ELC was completed to the finest level of resolution (Vegetation Type) where feasible. Species names generally follow nomenclature from the Flora Ontario – Integrated Botanical Information System (FOIBIS; Newmaster and Ragupathy 2012).

The provincial status of all plant species is based on NHIC (2016) and vegetation communities is

based on NHIC (2016). Identification of potentially sensitive native plant species is based on their assigned coefficient of conservatism (CC) value, as determined by Oldham et al. (1995). This CC value, ranging from 0 (low) to 10 (high), is based on a species tolerance of disturbance and fidelity to a specific natural habitat. Species with a CC value of 9 or 10 generally exhibit a high degree of fidelity to a narrow range of habitat parameters.

SURVEY RESULTS

Ecological Land Classification

The Subject Lands include tableland agricultural fields and forested and non-forested valleys. Cultural communities of meadows, thickets, and coniferous plantations are generally located within the major valley systems. Sugar Maple, White Ash (*Fraxinus americana)*, Red Oak, Shagbark Hickory and Black Walnut are the dominant forest trees. The main woody species in the cultural communities are Black Walnut, Manitoba Maple (*Acer negundo)*, Scots Pine (*Pinus sylvestris)*, Gray Dogwood (*Cornus racemosa)* and Staghorn Sumac (*Rhus typhina)*.

ELC mapping of the Subject Lands is shown on **Figure 4** (**Appendix A**). A detailed list and description of ELC units is provided in **Table 3** (**Appendix B**). No provincially rare vegetation communities were present on the Subject Lands (NHIC 2016).

Vascular Plants

Botanical inventories completed on the Subject Lands identified a total of 293 species of vascular plants. Of that number, 184 (or 63%) are native and 109 (or 37%) are exotic. A full species list is included in **Table 4** (**Appendix B**).

The majority of the native species (90%) are ranked S5 (secure in Ontario). Sixteen species (9%) are ranked S4 (apparently secure in Ontario; NHIC 2016), while two species are ranked S2? (presumed imperiled).

The S4, or provincially uncommon. plant species are:

- Blue Cohosh (*Caulophyllum giganteum*), an S4S5 species – this is a common species in southern Ontario, related to and often confused with the more southern and rarer *C. thalictroides*; on the Subject Lands it is found in most deciduous forest units on valley slopes;
- Running Strawberry Bush (*Euonymus obovatus*) – common in deciduous woods in valley locations, e.g., FOD5-3 and FOD5-8/FOD2;
- American Beech (*Fagus grandifolia*) – common in all deciduous upland forests;
- American Witch-hazel (*Hamamelis virginiana*), an S4S5 species - common in deciduous woods in valley locations, e.g., FOD5-3 and FOD5-8/FOD2;
- Black Walnut (*Juglans nigra*), an S4? species – mostly in CUW1 unit where it is dominant;
- Canada Horse-balm (*Collinsonia canadensis*) – rare in unit FOD4-2;
- Sassafras (*Sassafras albidum*) – edges of deciduous woods at the northern section of the Subject Lands;
- Canada Moonseed (*Menispermum canadense*) – locally abundant in unit FOD2;

- White Ash (*Fraxinus americana*), an S4? species – in most upland deciduous forest units; recently upgraded in its rank due to emerald ash borer infestation;
- Northern Evening-primrose (*Oenothera parviflora*), an S4? species – occasional in cultural meadows;
- Virginia Knotweed (*Persicaria virginiana*) – common and abundant in most deciduous forest units on the tableland;
- Summer Grape (*Vitis aestivalis*) – edges of units FOD4-2 and roadside at the northern end of Flatt Road Extension;
- Drooping Sedge (*Carex prasina*) – local in moist areas near creek in unit FOD5-8/FOD2;
- Michigan Lily (*Lilium michiganense*) – local and uncommon in deciduous forest units;
- White Cut Grass (*Leersia virginica*) – abundant at several locations on the narrow creek floodplain in unit FOD5-8/FOD2; and
- Herbaceous Carrion Flower (*Smilax herbacea*) – scattered in many types of deciduous forest units.

Five regionally rare plants were observed, as per the Halton Region rarity rankings (Varga 2005):

- Tower-mustard (*Turritis glabra*) – local at edges of fields in the northern half of the Subject Lands;
- Virginia Knotweed (*Persicaria virginiana*) – common and abundant in most deciduous forest units on the tableland;
- Summer Grape (*Vitis aestivalis*) – edge of unit FOD4-2 and roadside at the northern end of Flatt Road Extension;
- Skunk Cabbage (*Symplocarpus foetidus*) – local on valley bottoms in unit FOD5-8/FOD2; and
- Drooping Sedge (*Carex prasina*) – local in moist areas near creek in unit FOD5-8/FOD2.

One species (Drooping Sedge, *Carex prasina*) recorded from the Subject Lands had a co-efficient of conservation value of 9 or 10. Species with a co-efficient of conservation typically have narrow habitat ranges and require more specific habitat requirements. Drooping Sedge was associated with the forested ravines associated with watercourses within the Subject Lands.

Two provincially rare (S2?) and endangered species are summarized below:

Butternut (*Juglans cinerea*) is Endangered in Ontario and Canada. Based on searches conducted by Savanta ecologists, in August and September of; 2009, 2012 and 2013, 30 Butternut trees were identified on the Subject Lands. Butternut is further discussed in section 3.2.1.2 of this report.

Eastern Flowering Dogwood (*Cornus florida*) is Endangered in Ontario and Canada. The spread of dogwood anthracnose disease has caused significant declines in Ontario populations (and elsewhere in the species range). Several specimens were located on valley slopes in unit FOD5-8/FOD5/2 during combined Savanta and agency (CH, Region of Halton) site visits in 2013.

MNRF Evaluated Wetlands/Provincially Significant Wetlands

There are no MNRF evaluated wetlands on the Subject Lands or adjacent lands.

Unevaluated / Other Wetlands

Six small and isolated wetlands are limited to narrow floodplains of Tributary 4 north of Flatt Road, Tributary 5W and Tributary 6 on the bottom of local valleys, while the seventh is associated with Taylor Pond. They are composed of widespread species representing common cover types such as cattail marsh and meadow marsh (**Figure 4**, **Appendix A**).

3.3.1.2 Butternut Health Assessment

Butternut is an Endangered tree species that is being affected by a canker disease (*Ophiognomonia claviginenti-julandacearum)*. As such, butternut heath assessments were completed on the lands after individuals and groups of butternuts were observed during previous field investigations.

2013 Results

A total of 29 trees were assessed by Savanta's butternut health assessor on July 11, July 17 and August 9, 2013. The assessed trees were numbered on site using white paint.

Butternuts were assessed using the Butternut Assessment Guidelines (MNRF 2011); trees were assessed by a certified Butternut Health Assessor. As per the guidelines, butternuts are classified under three categories. Butternuts that are assessed as Category 1 (also referred to as "non-retainable") are affected by butternut canker to such an advanced degree that retaining the tree would not support the protection or recovery of the butternut trees in the area in which the tree is located/ Category 2 trees (also referred to as "retainable") are not affected by butternut canker to the degree of Category 1 trees (i.e., butternut canker is not too advanced) and retaining the tree could support the protection and recovery of butternut trees. Category 3 trees (also referred to as "archivable") are trees that may be useful in determining resistance to butternut canker. These trees are not eligible under Section 23.7 of Ontario Regulation 252/08. Hybridized trees are also not protected under the Endangered Species Act.

A total of 19 Category 1 trees, eight Category 2 trees and two Category 3 trees were classified during site visits.

Category 1 trees do not meet the retention criteria in the Butternut Assessment Guidelines based on crown vigour and the degree of cankers on the root flare and/or stem. These trees are allowed to be removed after the 30-day period that follows submission of the Butternut Health Assessment (BHA) report to the MNRF. It should be noted that the Ontario Recovery Team encourages that all Butternut trees be conserved, whether they meet the retention criteria or not. Removal of cankered trees is not an objective of the Recovery Strategy for Butternut. Category 2 trees satisfy the retention criteria in the Butternut Assessment Guidelines. Activities that may affect up to 10 Category 2 trees may be eligible under section 23.7 of Ontario Regulation 242/08 in accordance with the conditions set out in the Regulation. Category 3 trees are not eligible to be killed, harmed or removed under section 23.7 Ontario Regulation 242/08.

2016 Results

A butternut health assessment update survey was completed for the Eagle Heights property on August 24, 2016. This survey was part of a series of Butternut surveys that have been conducted since 2009. The purpose of this survey was to document any changes to previously assessed Butternut trees and document any new observations. As of 2016, the MNRF now requires a buffer of up to 50 m to be applied to all retainable trees, though the exact width of the buffer is treated on a tree-by-tree basis.

Assessment results from the 2013 Butternut survey were used as baseline data for this survey. Trees previously identified as Category 2 or Category 3 were re-assessed using protocol outlined in the Butternut Assessment Guidelines (MNRF 2011); trees were assessed by a certified Butternut Health Assessor. Previously identified non-retainable (Category 1) trees were not re-assessed with the exception of one tree.

Any Butternut trees not previously documented were also assessed. The search area extended 50 m out from the construction footprint of the current development plans.

The detailed results of this survey (findings and location of observations) are maintained on file due to confidentiality with respect to SAR and area summarized as follows:

- Ten new Butternut trees were recorded, and four trees had the Category designation changed. One of these changes was the result of the tree deteriorating in health due to Butternut canker;
- Two Butternut trees changed Categories because of their proximity to badly cankered trees (a result triggered by newly documented Category 1 trees). Trees within 40 m of a badly cankered tree are considered to have a higher exposure to the canker and are thus evaluated differently;
- Only one Category 1 tree was re-assessed as an error in data entry was detected. This tree should have originally been identified as Category 3, and the re-assessment confirmed it should continue to be identified as a Category 3 tree; and
- Of the 10 new Butternuts observed, nine were assessed as Category 1, and one was assessed as Category 3.

In summary, a total of 26 Category 1 trees, five Category 2 trees and six Category 3 trees were documented within the Subject Lands.

3.3.2 Wildlife Species

3.3.2.1 Amphibian Call Count and Egg Mass Surveys

Three-rounds of evening amphibian call-count surveys (AMC) were completed in April, May and June of 2014, and March, May and June in 2016. Three-rounds of daytime amphibian egg mass surveys (EMS) were completed in March, May and June 2016. Survey stations were identified using a preliminary review of aerial photography and/or during earlier surveys. Stations were verified in the field to confirm the presence of suitable breeding habitat.

Amphibian Call Count Surveys (AMC)

These surveys followed standard protocols outlined in the Great Lakes Marsh Monitoring Program (BSC 2003). Surveys were conducted on warm nights with little wind. Surveys commenced one half hour before dusk and end before midnight. Visits were 15 days apart and as per protocols. The first occurred with a minimum nighttime air temperature of 5°C, the second visit with a minimum of 10°C and the third visit with a minimum of 17°C. If noise from plane, road traffic and/or trains was present, monitoring was delayed and began during a quiet period.

Each station was surveyed for three minutes and a three-level call category system was used to identify the level and type of frog activity.

The standard call levels are:

1) Individual calls do not overlap and calling individuals can be discreetly counted;
2) Calls of individuals sometimes overlap but number of individuals can still be estimated; and
3) Overlap among calls seems continuous (full chorus) and a count estimate is impossible.

Anurans were recorded as within the station if they were within 100 m. All other species were recorded as incidental records heard outside the station. Road crossing observations were documented, during call-count surveys, at targeted areas (i.e., potential animal movement corridors for non-woodland breeding amphibians; MNRF 2015).

Amphibian Egg Mass Surveys (EMS)

These surveys were conducted for salamanders, frogs and toads during daylight hours in early April, May, and June. EMS surveys were conducted in 2016 at all AMC stations that still provided suitable breeding habitat and were observational/qualitative in nature, focusing on visual searches for tadpoles and egg masses. Area searches were conducted at all stations; these included walking the perimeter of the vernal pool/wetland while scanning for egg masses and tadpoles. Any submerged sticks or shrubs standing in the water, to which eggs might be attached, were carefully checked with minimal intrusion into the vernal pool/wetland. For each station, the survey was deemed to be completed when a complete check of locations where egg masses or tadpoles had occurred or within a 30-minute allotment, whichever was less.

The number of individuals of each amphibian species was recorded and the life stage was noted (e.g., egg mass, tadpole or adult). Characteristics of the breeding habitat were also noted, including: pool shape, water depth, water temperature, canopy cover, in-feature vegetation, presence of suitable egg attachment sites, and observations of predatory fish.

Both the NHIC Centre (2016) database and the SARO list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each amphibian species recorded on the Subject Lands.

2014 Results

One station was surveyed on the Subject Lands at Taylor Pond (station E). Three amphibian species were recorded during the cumulative AMC assessments. Detailed results of the AMC surveys are provided in **Table 5** (**Appendix B**). All of the amphibian species are provincially ranked S5 (common and secure) or S4 (apparently common and secure).

2016 Results

Three amphibian stations were surveyed during round 1 AMC in March 2016. During the April EMS round 1 survey, one of these stations (station C) was dry and a new, small vernal pool was discovered in the Grindstone Creek valley (station H) which was surveyed in April but was found to be dry during the May survey. In addition, the small wetland communities near the headwaters and adjacent to Tributary 4 were examined however there was insufficient water to support amphibian breeding. Amphibian stations are illustrated on **Figure 5** (**Appendix A**).

Five amphibian species were cumulatively recorded within the Subject Lands during the AMC and EMS assessments. Detailed results of the AMC surveys and EMS surveys are provided in **Table 6** and **Table 7** (**Appendix B**), respectively. All of the amphibian species are provincially ranked S5 (common and secure) or S4 (apparently common and secure).

3.3.2.2 Salamanders

On June 12, 2013 a site visit was conducted in, and adjacent to the Subject Lands. An early spring site visit (March and April 2013) recorded vernal pooling in five areas within the Subject Lands that were identified through aerial photo interpretation and analysis of ELC communities as potential salamander breeding pools. Areas examined included a range of habitat types including woodlands, watercourse riparian areas, wetlands, valleylands and tableland areas. No suitable salamander breeding pools were identified on the Subject Lands during these investigations.

3.3.2.3 Reptiles

The site visits completed in 2014 and 2016 included surveys for snake emergence from potential hibernacula, road mortality, turtle overwintering habitat, and turtle nesting habitat. The weather was appropriate for completion of these reptile surveys and was as follows: air temperature above 8°C, full / partial sun, and wind 1 to 5 km/hr. Specific survey methods are described below.

Survey stations and transects are summarized on **Figures 6** and **7** (**Appendix A**). Detailed survey results are provided in **Tables 8**, **9**, **10** and **11** (**Appendix B**). One turtle basking station, nine turtle nesting transects, eight snake transects, and three road transects were established on the Subject Lands and adjacent roadways.

Turtle Emergence Survey Methods

Potentially suitable aquatic habitat for turtles was identified using aerial photography and/or site reconnaissance results (ponds, open wetlands, and riparian/lacustrine areas). Binoculars were used to scan, from a distance, for ten minutes, the edges and surface of each water body for

basking turtles (COSEWIC 2008; MNRF 2015; Caverhill et al. 2011). Data recorded includes: water and air temperatures (basking prevalent when air is warmer than water), vegetation composition around the water body, and presence of basking features (logs, floating vegetation mats, floating/emergent debris such as tires).

Turtle Nesting Survey Methods

These surveys occurred during peak turtle nesting period, which spans from late spring to early summer (late May to June). Candidate turtle nesting areas may include shores/beaches of wetlands, lakes or rivers; gravel trails and driveways; and farm field margins with suitable substrate and aspect in relatively close proximity to core habitat (i.e., areas where turtles are observed basking). Potentially suitable nesting areas were searched for evidence, such as test nest dig sites, claw marks, turtle trails or predated nests. Where potential habitat was noted, soil auger samples (where permissible) or soil type mapping were reviewed for the presence of potentially suitable substrate. Data recorded included: nesting area size, % slope of the nesting area, % canopy cover over the nesting area, direction of orientation (i.e., east facing), location (UTM coordinates), soil substrate, and distance from roadways.

Species-specific habitat preferences (i.e., COSEWIC 2008) and the survey methods of the MNRF (2015) and Toronto Zoo (Caverhill et al. 2011; Kula 2011) were considered in the formulation of this survey protocol.

Snake Emergence Survey Methods

Preliminary aerial photography review was performed to identify suitable snake habitat, which may include cultural meadow, disturbed meadow, wetland edges, cultural woodland, cultural savannah, rural residence and farm buildings. Surveys focused on searching natural cover, like rocks, logs and debris (carpeting, tarps). All objects were replaced as they were found to reduce disturbance. Old barns, foundations and houses, where access was granted, were also searched.

Transects were walked along the Subject Lands as well as along roads for basking snakes or snake mortalities. Data recorded during snake surveys includes species observed and locations (UTM coordinates), air temperature, water temperature, start and end time, and weather conditions.

This survey methodology focuses on snake hibernacula features, to determine if these features occur on the Subject Lands. Survey methods are based on MNRF and Toronto Zoo (Caverhill et al. 2011) snake survey protocols and are also informed by specifies-specific habitat preferences.

Wildlife Road-crossing Surveys

Three wildlife road-crossing surveys were conducted on clear, sunny days to search for signs of wildlife/road interactions, including dead specimens, live specimens, and other evidence (tracks, scat, feathers). Evidence was recorded along with the UTM coordinates. Photos were taken of dead specimens. Data recorded included: air temperature, start and end time, and weather conditions. This survey protocol was adapted from the Ontario Road Ecology Group (OREG 2010).

2014 Results

Turtle nesting and basking survey stations/transects surveyed are illustrated on **Figure 6** (**Appendix A**). All reptile species recorded on the Subject Lands are listed in **Table 8** (**Appendix B**).

One turtle basking station was surveyed on the Subject Lands at the Taylor Pond where two Snapping Turtles (*Chelydra serptentina*) were observed. One was observed basking within the pond while the other was along the shoreline. One turtle nesting transect was completed along the southern boundary of the agricultural fields north of the Taylor Pond. Suitable nesting substrate is available (sandy loam), although no nesting evidence was recorded.

2016 Results

The reptile and wildlife road-crossing survey stations and transects are illustrated on **Figures 6** and **7** (**Appendix A**). All wildlife species recorded on the Subject Lands are listed in **Table 24** (**Appendix B**).

One S5 (common and secure) reptile species, Eastern Gartersnake (*Thamnophis sirtalis*) was observed within the Subject Lands at the following locations and survey dates:

- One Eastern Gartersnake was observed along T7 (Sept. 16); and,
- One Eastern Gartersnake was observed along T8 (Sept. 16).

No turtle nesting evidence was recorded at station TB1. Soil auger tests completed at turtle nesting stations T1 and T5 detected poor nesting suitability due to low quality nesting substrate (clay to clay-loam soil types). Soil mapping indicates suitable substrate (high sand content soils) at T2 to T9. Soil auger tests were conducted at all nesting stations. No turtle basking evidence was observed during 2016 survey effort. Detailed results of the turtle, snake transect, and road morality surveys are provided in **Tables 9**, **10** and **11** (**Appendix B**), respectively**.**

3.3.2.4 Breeding Birds

Two rounds of breeding birds were completed during the spring and summer of 2014. The general survey protocol was based on a combination of the 'The Atlas of the Breeding Birds of Ontario, 2001-2005' (Cadman et al. 2007), 'The Ontario Forest Bird Monitoring Program (1987-1997): Goals, methods and species trends observed' (Cadman et al. 1998) and the 'Marsh Monitoring Program' (BSC 2003).

Three rounds of breeding bird and grassland SAR bird surveys were completed during the spring and summer of 2015. The purpose of the breeding bird surveys conducted on the Subject Lands was to determine the presence, abundance and behaviours of existing avian species. All incidental bird species observations on adjacent lands were also recorded. Surveys were conducted following protocol set forth by the Ontario Breeding Bird Atlas (Cadman et al. 2007), the Ontario Forest Bird Monitoring Program (Cadman et al. 1998) and the Marsh Monitoring Program (Bird Studies Canada 2014 and 2006).

Surveys were conducted between dawn and five hours after dawn with suitable wind conditions, no thick fog or precipitation (Cadman et al. 2007). Point count stations were located in various habitat types within the Subject Lands and combined with area searches to help determine the presence, variety and abundance of bird species. Each point count station was surveyed for 10 minutes for birds within 100 m and outside 100 m. All species recorded on a point-count were mapped to provide specific spatial information and were observed for signs of breeding behaviour. Surveys were conducted at least 10 days apart.

During breeding bird surveys, vegetation was assessed for potential presence of SAR habitat. If suitable habitat was encountered or individuals were observed standard protocols were utilized (in consultation with MNRF).

Open grassland habitat, including pasture, hay fields and fallow areas, was surveyed according to the MNR (2012) Guidelines for Bobolink and Eastern Meadowlark. Point count stations (discussed above) were located within open grassland habitat. Where this habitat was greater than 250m wide or long, two point count stations were completed (point count stations are set up every 250m in large habitats). Transects or area searches were also conducted in addition to the 10 minute point count stations.

Both the NHIC (2016) database and the SARO list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each bird species.

2011/2012 Results

Breeding bird surveys were completed on June 28, 2011 and June 12, 2012 to supplement the 1994 (Stantec) and 2007 (Savanta) area searches that were conducted in the post-breeding season. A total of nine-point count locations were placed in all represented habitats (**Figure 8**, **Appendix A**).

Specific surveys were conducted for Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark (Sturnella magna), two open country grassland SAR, given the more recent listing of these species under the Endangered Species Act, 2007. While threatened, these species tend to be generally widespread and commonly encountered in suitable habitat in southern Ontario.

Savanta conducted targeted surveys for Eastern Meadowlark and Bobolink within the Subject Lands on June 28, 2011, and June 13, 2012. Surveys were conducted in early/mid-morning and late afternoon/early evening period, as long as displaying activity was apparent. The survey protocol was discussed with MNRF prior to any surveys being undertaken. Surveys focused on hay fields, fallow fields and meadows within the Subject Lands. The fallow and hay fields were cultivated late in 2012, in preparation for conversion to row crops (corn, beans). Those crop types do not provide suitable habitat for these bird species and it is expected that habitat for these species is no longer present within the Subject Lands. Habitat suitability for these species can change over time as farming practices change (e.g., crop rotation, fallow periods).

Suitable weather conditions were essential with the key element being little or no wind. Surveys conducted during light overcast conditions, or even very light rain seemed to have the greatest level of activity. Multiple visits to a site were not conducted unless there was ambiguity regarding

the population size or breeding status, in most cases an accurate estimate of the total number of birds present and breeding evidence could be obtained on a single visit.

The number of males present was used to estimate population size; this species has an “open” mating system and is semi-colonial. As such the estimation of breeding pairs in a traditional sense is not feasible. Upon locating a field with Bobolink or Eastern Meadowlark through use of a roadside scope, typically one transect (or two if the field was wider than 200 m) would be walked through the length of the field. Upon seeing the first Bobolink, the surveyor would walk directly to the area the bird(s) were in, count the number of males visible then make a loud “spishing” noise - a birding technique that can make birds inquisitive and causes them to come out in the open. Almost invariably the spishing brought males out, that were not otherwise visible or displaying. The spishing was also successful at getting females to appear as well. Once an accurate estimate of the total number of individuals was made, the observer would walk rapidly out of this area and proceed further into the field until all previously counted birds were well away, and only “new” birds remained. Duplication was avoided by carefully watching the area covered previously, while conducting the next spishing session. Usually the distance between stops varied from 100 m to 150 m. The spishing and estimating would be repeated at these intervals until the entire field had been surveyed.

During surveys three pieces of species information were ascertained: the total number of males present; whether or not females were present (indicating that the males are not just unmated birds occupying marginal habitat); and proof of breeding. An area was confirmed as breeding habitat if one or more of the following observations was made: females were flushed from nests at close range and became agitated; adults were seen feeding young or with food; adults were seen carrying fecal sacs from the nest; or when barely fledged young with short tails were recorded. No attempt was made to find any actual nests for fear a scent trail might subsequently lead a predator to the nest.

Detailed survey results are found on **Table 12** (**Appendix B**).

2014 Results

A total of 5 new point count stations were surveyed within the Subject Lands. Point count stations were located within upland and riparian forests, thickets and cultural meadows (**Figure 8**, **Appendix A**). Detailed survey results are found on **Table 13** (**Appendix B**).

A total of 42 bird species were observed within the Subject Lands. Of this total, six species are confirmed, 16 probable and 18 possible breeders on the Subject Lands. The remaining bird species (two) are considered non-breeders, flyovers or migrants. The observed breeding bird species are discussed in the Sections below.

A total of 37 (93%) of the confirmed, probable or possible breeders are provincially ranked S5 (common and secure) and S4 (apparently common and secure) or SNA (introduced species such as Rock Pigeon and European Starling). The remaining three bird species are considered S1 – S3 (critically imperiled to vulnerable) and are discussed in the sections below.

SAR and Provincially Significant Species (S1 – S3)

- Eastern Wood-Pewee: territorial males were found at PCs 1 and 3 (two males) and incidentally near PC 5.
- Barn Swallow: two active nests were found on the Woodview/Fellowship Building under the overhangs into the north side of the building.
- Wood Thrush: one singing male was found about 100 m north of Flatt Rd., west of the Flatt Rd. extension, in riparian forest.
- Bobolink: In 2012, this species was breeding in hayfields present at PC 1, 2. There had been 6 territorial males in these two fields. In 2014, these fields had been ploughed and were no longer suitable for this species.
- Eastern Meadowlark: In 2012, this species was breeding in hayfields present at PC 1, 2. There had been one pair in these two fields. In 2014, these fields had been ploughed and were no longer suitable for this species.

Area-sensitive Species

The following species observed on the Subject Lands are regarded as area sensitive. Their minimum area requirements are given as well.

- Hairy Woodpecker (10 ha)
- White-breasted Nuthatch (10 ha)
- Mourning Warbler (30 ha)
- Scarlet Tanager (20 ha)

2015 Results

A total of seven-point count stations were surveyed within the Subject Lands. Point count stations were located within cultural meadow, upland forest and thickets **Figure 8** (**Appendix A**).

A total of 52 bird species were observed within the Subject Lands. Of this total, four species are confirmed, 22 are probable and 22 are possible breeders on the Subject Lands. The remaining four bird species are considered non-breeders, flyovers or migrants. The observed breeding bird species are discussed in the sections below. All species observed on the Subject Lands are listed in **Table 14** (**Appendix B**)**.**

A total of 48 (100%) of the confirmed, probable or possible breeders are provincially ranked S5 (common and secure), S4 (apparently common and secure) or SNA (species not native to Ontario). No bird species are considered provincially rare (S1 - S3; NHIC 2016).

The following SAR were observed on the Subject Lands:

- Barn Swallow (Threatened in Ontario and Canada);
- Chimney Swift (Threatened in Ontario and Canada);
- Wood Thrush (Special Concern in Ontario and Threatened in Canada); and
- Eastern Wood-Pewee (Special Concern in Ontario and Canada).

Barn Swallow was observed flying over the Subject Lands. No suitable breeding structures were observed, and no further evidence of breeding was observed. The agricultural lands and mosaic of forested habitats provide foraging habitat for Barn Swallows.

Singing male Wood Thrushes in suitable breeding habitat were observed at point counts 2, 3 and 4. Probable breeding evidence was recorded on the Subject Lands within the entire FOD5-3 polygon along the forested slope adjacent to Grindstone Creek as multiple males were heard simultaneously singing at point counts 2, 3, and 4.

Eastern Wood-Pewee was observed at point counts 1, 2, 3 and 4 in suitable breeding habitat. Probable evidence of breeding was determined on the Subject Lands within the entire FOD5-3 polygon along the forested slope adjacent to Grindstone Creek.

Chimney Swift was observed in flight over point count 5. No suitable breeding structures were observed (anthropogenic or natural) however it is possible that a large snag or other natural cavity was present in the mature hardwoods. It is also possible that these birds were foraging from a breeding site in the nearby community of Waterdown. The entire Subject Lands were considered suitable foraging habitat for Chimney Swift.

No suitable habitat for Grassland SAR birds, such as Bobolink and Eastern Meadowlark, was observed on the Subject Lands.

3.3.2.5 Insect Survey

Insect surveys do not currently have a set protocol in Ontario. Species detection is dependent on repeated visits during the appropriate flight times for a given species in suitable habitat. Dragonflies and butterflies are conspicuous, easily observed and have plentiful resources to aid in identification of Ontario species and as a result, focus is on these groups during surveying.

Surveys were conducted between mid-morning and noon or late afternoon to sunset with mostly sunny skies, suitable low wind conditions, no thick fog or precipitation. Temperatures were between 22°C and 30°C such that insect activity was optimal. Area searches were placed within all habitats present within the Subject Lands to help determine the presence, variety and abundance of insect species. In order to provide comprehensive coverage of all insect species flight periods, three survey periods were chosen:

- Early May to mid-June;
- Mid-June to mid-July; and
- Late July to late August.

During insect surveys, vegetation and landscape features (rivers, streams, other waterbodies) were assessed for potential presence of SAR habitat. If suitable habitat or food plants (butterflies only) were encountered or individuals were observed, standard protocols were utilized (in consultation with MNRF).

Both the NHIC (2016) database and the SARO list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each insect species.

2016 Results

A total of 19 dragonfly and 29 butterfly species were observed within the Subject Lands. The observed species are discussed in the sections below. All species observed on the Subject Lands are listed in **Table 15** (**Appendix B**). Area search transect locations are identified on **Figure 9** (**Appendix A**).

A total of 46 (96%) of the species are provincially ranked S5 (common and secure), S4 (apparently common and secure) or SNA (species not native to Ontario). Three insect species are considered provincially or nationally rare (S1-S3; NHIC, 2013) and are discussed in the sections below.

The following SAR and S1-S3 species were observed on the Subject Lands.

- Oblique Spiketail (*Cordulegaster obliqua*) (S1) Two males were observed on June 9 along the edges of agricultural fields bordered with meadow. This location is different from where an individual was documented incidentally 2014, indicating that this species is most likely using multiple seeps/drainages within woodlands on the Subject Lands for breeding. Members of the genus *Cordulegaster* are typically found breeding in seepages/cold water streams within forest where the larvae use deep silty substrate for development.
- Common Sootywing (*Pholisora catullus*) (S3). An individual was observed June 9 along an agricultural field edge bordered by meadow. The host plant for this species is Lamb's Quarters (*Chenopodium album*).
- Monarch (*Danaus plexippus*)(Special Concern in Ontario)(Endangered in Canada; COSEWIC)(Special Concern in Canada; SARA). One individual was noted on June 9 feeding in a patch of *Phlox spp.* within forested portions of the Subject Lands. Given the date, it is probable that this was a migrant returning north. It is possible that Monarch may be using the Subject Lands for breeding as Common Milkweed (*Asclepias syriaca*) is found along field edges throughout much of the site.

3.3.2.6 Bat Habitat and Acoustic Surveys

Recent listing of four bat species on the SAR list as Endangered has prompted a need to assess potential for habitat to exist on the Subject Lands. In addition, surveyed lands were assessed for candidate bat maternity colony roost habitat as per guidance within the Province's Significant Wildlife Habitat criteria for Ecoregion 7E (MNRF 2015). Subsequent monitoring for bat activity took place to confirm presence/absence of associated bat species.

Bat Habitat Assessment

On May 16, 2016 cavity tree density surveys were completed for the Subject Lands.

Cavity tree density surveys were completed in association with qualitative assessments of bat habitat as snags are considered to be indicators of high quality potential maternity roost habitat. Bat maternity roost habitat is considered by the MNRF to be a type of significant wildlife habitat (as per the Provincial Policy Statement). Further, four bat species are listed as Endangered on the SAR in Ontario list, Eastern Small-footed Myotis (*Myotis leibii*), Little Brown Myotis (*Myotis*

lucifugus), Tri-coloured Bat (*Perimyotis subflavus*) and Northern Myotis (*Myotis septentrionalis*). These species are known to establish maternity roosts in trees, both within woodlands and hedgerows.

Surveys were completed according to MNRF survey guidelines as outlined in, "Bats and Bat Habitats: Guidelines for Wind Power Projects" (MNR 2011).

Areas to be surveyed were determined through the use of aerial interpretation, Ecological Land Classification (ELC) mapping of the Subject Lands, and ground-truthing. Where present, targeted ELC communities were deciduous forests (FOD), mixed wood forests (FOM), coniferous forests (FOC), deciduous swamp (SWD), mixed wood swamps (SWM), and coniferous swamps (SWC). For the purposes of this survey, hedgerows (HR), cultural woodlands (CUW), and residential or disturbed areas were also targeted. Surveys were conducted during the leaf-off period on days when visibility was good.

Using the above criteria, several areas were identified to be searched on the Subject Lands. ELC communities greater than 1 ha were surveyed using a plot-based approach, which consisted of randomly selecting 10 plots within the community. Each plot had a radius of 12.6 m (0.05 ha) and a GPS waypoint was recorded for each plot center. Within each plot, all trees greater than or equal to 25 cm diameter-at-breast height (DBH) were visually inspected using binoculars to document any cavities that may or may not be present along the trunk or large branches. Each tree containing suitable cavities, or peeling bark (preferred by the Tri-coloured Bat), had the following information recorded: UTM, species, DBH, approximate height, decay class, canopy cover, total number of cavities and height information for the top three cavities. Each tree was also photographed.

For all communities and hedgerows less than 1 ha, the entire community was surveyed using a transect approach, where transects were 5 m to 20 m apart (depending on visibility).

These results were then used to assess the quality of the area to provide bat maternity roost habitat, with areas with ≥10 cavity trees/ha determined to provide the greatest potential bat maternity roost habitat in accordance with MNRF guidelines.

Bat Acoustic Surveys

Surveys to detect bat species were carried out in June 2016 and were completed using ultrasonic detectors and recorders over three site visits. The methods and results of these surveys are provided herein.

The intent of acoustic surveys is to determine presence/absence of four endangered SAR bat species. The proposed acoustic field program was developed using a combination of professional experience and guidance from the MNRF adapted from the MNRF Guelph District's Bat and Bat Habitat Surveys of Treed Habitats (May 2016).

Bat species can be identified using sonographic characteristics from calls used by bats to echolocate. These ultrasonic calls can be detected, recorded, and analyzed by biologists trained in bat sonogram interpretation to reasonably predict the species of bats present.

Active mobile acoustic surveys consisted of walking transects and 10-minute point count stations using Wildlife Acoustics' Echo Meter Touch (EMT) devices, to record bat activity. Transects and point count stations were selected where roosting cavities suspected of providing suitable bat habitat were observed during the snag tree surveys in June**.** Presence of bat species was to be established and further rounds were not required, if at any round the presence of SAR bat species was confirmed.

Surveys were conducted on June 21, June 24 and June 29, starting at dusk and ending at midnight when temperatures were >10°C with low winds and no precipitation. The EMT recorder was elevated approximately 2 m above the ground to reduce background noise. All ultrasonic recordings were filtered to eliminate recordings with high levels of noise or with no bat calls, and then further analyzed using SONOBat's auto-classification. Any calls with a positive species identification were manually vetted by a wildlife ecologist with training in bat species identification by sonogram.

Both the NHIC (2016) database and the SARO list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each bat species.

2016 Results

Bat Habitat Assessment

The results of the surveys are presented in **Table 16** (**Appendix B**) by area number, corresponding with the locations on **Figure 10** (**Appendix A**).

Based on the results presented in **Table 16** (**Appendix B**), potentially suitable roost habitat may be present within Polygons 1, 3, 4, 5, 8 and 9, however these polygons are not considered candidates for Bat Maternity Colony SWH, due to the low density of suitable trees per hectare.

Although the Subject Lands do not contain high densities of suitable roosting trees for bats, targeted surveys for presence of bat species should be considered given that suitable cavity trees were identified within Polygons 1, 3, 4, 5, 8 and 9. These targeted surveys can identify whether or not SAR bats are present on the Subject Lands, and if they are using the lower quality habitat within communities identified above.

Bat Acoustic Surveys

Bat acoustic survey dates and conditions are presented in **Table 17** (**Appendix B)**.

Two bat species have been confirmed to be present on the Subject Lands: Big Brown Bat *(Eptesicus fuscus)* and Eastern Red Bat *(Lasiurus borealis)*. During three evenings of active acoustic surveys, a total of five low frequency calls and 12 high frequency calls were recorded; with a cumulative total of seven passes by all species. Of these calls, one was identified as an Eastern Red Bat and four were identified as Big Brown Bat. No recordings of SAR bat species were identified. All bat call recordings occurred along transects T1 and T2 (**Figure 10**, **Appendix A**).

3.3.3 Aquatic Ecology

3.3.3.1 Fish Habitat Assessment

The MNR has identified the portion of Grindstone Creek proper downstream of the Niagara Escarpment that forms the western and northwest boundary of the Eagle Heights lands as a migratory run for salmonids. Three tributaries also flow through the Subject Lands (two through Eagle Heights and one west of the Taylor lands), however, no fish have been observed in these smaller watercourses. Watercourses on the Subject Lands are depicted in **Figure 3** (**Appendix A**).

The Grindstone Creek Subwatershed Study (CH 1998) and the Eagle Heights and Taylor Properties Functional Servicing and Stormwater Management Report (MCI 2007, updated 2010) provide extensive background information on Grindstone Creek and associated tributaries located on the Subject Lands. Stantec Consulting also conducted aquatic habitat surveys in 1992 for a Natural Environment Inventory Report (ESP 1992). The Hamilton Harbour Fisheries Management Plan (Bowlby et al. 2009) discusses the Grindstone Creek Watershed as one of the contributors to the fisheries resources of Hamilton Harbour. The tributaries crossing the Eagle Heights lands and the Taylor lands have all been identified as small riverine warmwater systems by the Fisheries Management Plan. That Plan recognizes that tributaries rising along the escarpment are high gradient and very susceptible to erosion. The pertinent results of these reports, along with field observations are presented below.

Tributary 4

Tributary 4 arises as a cultivated depression in agricultural lands in the southern half of the Eagle Heights Lands, immediately west of Waterdown Road. The tributary continues southerly and flows across part of the Taylor Property, eventually joining Grindstone Creek south of Highway 403. The tributary flows ephemerally and is dependent to a large extent on storm drainage directed from Waterdown Road. The ditch line along Waterdown Road terminates near the upper end of Tributary 4, and road runoff enters the field area. Depending on the year, the Tributary 4 area may be cultivated such that no flow in the channel is present. When precipitation generates runoff conveyed through the roadside ditch, flow may tend to erode a rill channel through the surficial soils given the high gradient of the topography. Given cultivation of the area, no riparian vegetation exists to maintain bank soils and considerable downcutting and headcutting of the channel is evident, resulting in an entrenched channel that cannot utilize any floodplain to disperse flow energy. The channel bottom consists of silt and eroded clays deposited by runoff from the adjacent fields, and numerous erosional rills were observed entering the main flow path along its length.

Nearing Flatt Road, the gradient of the channel decreases, and delta-like deposits of eroded sediment are present resulting in a loss of channel definition. A small, cattail pocket exists immediately upstream of Flatt Road.

Sporadic discontinuous pools of water were noted in the channel during a site visit on September 3, 2009, however these were remnants of recent runoff events. The channel was dry and is expected to flow ephemerally, during spring melt and following heavy thunderstorms. The erosion

caused by flowing water is severe and has resulted in an unstable channel. Ecologically, the upper portion of Tributary 4 is highly degraded and serves only to convey flows that are generated from runoff from Waterdown Road, which should typically be handled by the City through roadside ditching. Larger quantities of sediment due to this road runoff are typically eroded and transported to more ecologically viable reaches of Tributary 4 downstream of Flatt Road. No fish were observed during fieldwork, and fish are not expected to inhabit the watercourse upstream of Flatt Road given the ephemeral flow patterns, lack of suitable habitat and the high energy/high gradient environment. No fish have been observed during previous studies (CH 1998).

Tributary 5

Tributary 5 comprises two branches through the Eagle Heights lands, with the east branch constituting the main tributary ravine between Waterdown Road and Grindstone Creek Valley. The main channel for tributary 5, downstream of Flatt Road, is considered warmwater baitfish habitat while the upstream branches are considered intermittent. The upstream classification is based on water temperature, intermittent flow and no evidence of groundwater upwelling. No fish were observed during previous watershed studies (CH 1998). The tributary was classified as a minor valley during previous studies (Peto MacCallum 2006).

The east branch upstream of Flatt Road is contained within a deep ravine valley. Minor flow was noted during the September 3, 2009 site visit. The ravine contains a well-defined stream channel that exhibits a medium to high gradient. Channel substrates consist of hardpan clay, deposited silts, and small fractured Queenston Shale fragments. The tributary likely expresses intermittent flow conditions during summers with normal precipitation levels.

The west branch arises as a poorly defined drainage path in its upper reaches on the Eagle Heights lands. The flow path would be more appropriately described as a drainage draw through agricultural lands for much of its upper length. As it meanders westerly towards Flatt Road extension, it enters a wooded area where channel definition becomes apparent due to the lack of cohesive bank vegetation. The wooded area provides substantial shading that precludes the establishment of bank grasses, and the bank areas are therefore more susceptible to erosion and shaping by high-energy, intermittent flows.

At Flatt Road, both tributaries are confined within deep ravine valleys.

Tributary 6

This tributary is classified as a minor valley by previous studies (Peto MacCallum 2006). Tributary 6 exhibits characteristics very similar to Tributary 5, in that the flow path is contained within a well-defined wooded valley. In areas of open tree canopy, substantial vegetation lines the valley bottom such that the area resembles a linear wetland more so than a stream channel. Nearing Flatt Road, the tree canopy becomes denser and substantial shade precludes the establishment of bank grasses. As a result, channel definition improves, and a series of pools and riffles is evident.

At Flatt Road, the channel swings abruptly and flows along the toe of the road slope. A concrete block retaining wall is located at the toe of slope and a substantial portion of this wall has collapsed into the stream channel. Finally, channel flow encounters a drop into the culvert beneath Flatt

Road and continues through several online ponds associated with a landscape company to the south of Flatt Road.

The tributary north of Flatt Road is considered intermittent. No fish were observed during the September 3, 2009 site visit. Given the presence of the barrier at Flatt Road and intermittent flow conditions, fish are not expected to inhabit any portions of the reach upstream of Flatt Road.

Unnamed Watercourse on Taylor Lands

The smaller parcel of land south of Flatt Road contains a poorly defined drainage draw that extends southerly to a small pond located at the south property boundary. The draw exhibits no defined channel and serves only to convey ephemeral drainage towards the pond. The pond is highly stagnant, with thick growths of duckweed and algae. Various patches of terrestrial grasses and shrubs located throughout the pond suggest that water levels fluctuate in response to annual precipitation and runoff levels. Given the stagnation of the pond, fish are unlikely to thrive due to fluctuating water levels and expected diurnal variations in dissolved oxygen. No fish were observed at this location during September 3, 2009 field investigations.

3.3.3.2 Headwater Drainage Feature Assessment

Three rounds of headwater drainage feature assessments were completed in the spring and summer of 2014 to identify ephemeral, intermittent and permanently flowing surface water drainage features on the Subject Lands. Potential headwater drainage features on the Subject Lands were assessed for categorization and subsequent management recommendations using the Credit Valley Conservation/Toronto Region and Conservation Authority (CVC/TRCA) Guidelines for the “Evaluation, Classification and Management of Headwater Drainage Features” (2014). Management recommendations were identified for each headwater drainage feature using the CVC/TRCA 2014 Guidelines.

During the first site visit, the entire Subject Lands were walked to identify potential headwater drainage features. Each headwater drainage feature observed was separated into specific reaches, per the guidance on reach delineation in CVC/TRCA (2014) and the HDFA was completed for each reach based on the protocols identified in the Ontario Stream Assessment Protocol (OSAP) (Stanfield 2013), Section 4: Module 10 (Assessing Headwater Drainage Features). Savanta used a modified field data collection form, based on the OSAP data form, to standardize data collection and ensure all necessary data is recorded in an efficient manner during the site investigations. A photographic record of each headwater drainage feature was collected during each survey event. The intent of the third round was primarily to review those drainage features that had standing or flowing water during the second round in order to determine if they would be classified as permanently flowing or intermittent (i.e., typically not flowing during summer or other dry periods).

Following completion of the three survey rounds, the collected data was used to classify each headwater drainage feature, based on the CVC/TRCA Guideline hierarchy.

2014 Results

There are three main watercourses on the Subject Lands, including Tributaries 4, 5 and 6, all of which are Tributaries of Grindstone Creek (**Figure 3**, **Appendix A**). With the exception of Tributary 4, these watercourses were not assessed as headwater drainage features. However, each watercourse has headwater drainage features draining into it on the Subject Lands. A total of eight headwater drainage features, several of which were delineated with multiple reaches, are present on the Subject Lands (**Figure 3**, **Appendix A**). These are discussed in the following sections, organized by the main watercourse each feature is associated with.

Tributary 4

- Tributary 4 (T4) – For the purposes of this analysis, a portion of Tributary 4 exhibiting permanent watercourse characteristics on the Subject Lands was assessed using the CVC/TRCA 2014 Guidelines to understand the importance of the feature, and to aid in assigning a management recommendation. This tributary originates in several headwater drainage features on the Subject Lands (as discussed further below) and generally becomes a defined watercourse downstream from feature T4A2. The tributary flows off the Subject Lands through a culvert beneath Flatt Road. The T4 reach was flowing during the first and second site visits and was holding water during the final headwater drainage feature assessment. Although the feature has suitable fish habitat present (riffle, run and undercut bank morphology), no fish were observed during any of the assessment rounds. The culvert at Flatt Road is perched and may provide a barrier to upstream fish movement onto the Subject Lands. The wetted width of the watercourse ranged from 0.22 m to 0.26 m wide during each assessment, with an average bankfull width of 0.29 m. On either side of the banks, the riparian zone was dominated by wetland tolerant plant species for the first 1.5 m, with a mixture of meadow and cropland species on the adjacent uplands.
- Feature T4A1 – This ephemeral headwater drainage feature runs southeast from T4A5 and through a cropped agricultural landscape before draining into feature T4A2. The feature, which was identified as a natural channel, since it had defined bed and banks, was flowing during the spring freshet but dry by late spring. No fish were observed within the flowing channel during the first round. The wetted width of the feature was 0.15 m wide with an average bankfull width of 0.295 m.
- Feature T4A2 – This ephemeral headwater drainage feature comprises the upper reach of Tributary T4 and receives inflow from other headwater drainage features (T4A1, T4A3 and T4A4). Riparian vegetation adjacent to the feature consisted entirely of cropped agricultural lands. The feature was flowing during the spring freshet, with wetted and bankfull width measurements of 0.12 m and 0.40 m, respectively, but dry by the second-round assessment. No fish habitat was present within the feature, and no fish were observed during flowing conditions.
- Feature T4A3 – This ephemeral headwater drainage feature originates on the agricultural portion of the Subject Lands and runs into T4A2. The feature was flowing during the spring freshet, but dry during the second-round assessment. Instream erosion was identified within the feature as a result of the steep topographic gradient. The feature flows through a barren agricultural field and has limited riparian vegetation on either bank. No fish habitat or fish were present during any site visit.

- Feature T4A4 – This ephemeral headwater drainage feature originates on the agricultural portion of the Subject Lands and runs into T4A2. It was identified as a natural channel on the basis of having defined bed and banks, but this is likely due to erosion of the underlying agricultural soils as a result of the steep gradient of the feature and absence of functional riparian buffer zone. Minimal sediment deposition and feature roughness was documented within the feature. Wetted width and bankfull width measurements taken during the first-round site visit were 0.11 m and 0.30 m, respectively. No suitable fish habitat was recorded within the feature.
- Feature T4A5 – This ephemeral headwater drainage feature is the upstream reach of feature T4A1. It originates as drainage from a manicured lawn offsite and flows onto the Subject Lands, through an open agricultural field and a narrow hedgerow, where it flows through a perched culvert before the T4A1 reach break. This feature was identified as a swale due to the lack of defined bed and banks. During first round site visit, standing water was documented within the swale and it was dry upon the second-round assessment. No fish were observed, nor expected, within the reach. Limited riparian vegetation was identified on either bank of the feature, as the area is actively farmed lands.

Tributary 5

- Feature T5A1 – This intermittent headwater drainage feature is located on a tributary of Tributary 5. Only the portion of the feature within the open agricultural field between two wooded areas was assessed, since no development will occur within the wooded areas upstream and downstream from the assessed reach. The T5A1 reach was identified as a swale feature between two topographic highs within the agricultural field. Flowing water was documented during the first two assessment rounds, flowing into the forested Tributary 5 valley towards Flatt Road. The wetted width ranged from 0.42 m to 0.27 m during flowing conditions, with bankfull width measured at 0.64 m. No fish were observed during any site visit, although riffle and run habitats were available. The Flatt Road culvert may represent a barrier to upstream movement and the feature lacks definition within the wooded area downstream from T5A1, which may further prevent upstream fish movement. A portion of Tributary 5 runs through a buried tunnel on the property south of Flatt Road, which may further restrict upstream fish movement.
- Feature T5A2 – This ephemeral swale originates in a topographic low point at the edge of a woodlot and runs southwest into T5A1. Agricultural crops are present within the riparian zone along both banks. Flows were observed during the first-round assessment, with a wetted width of 0.44 m and a bankfull width of 0.47 m. No fish habitat was identified within the feature; no fish were observed during any site visit.
- Feature T5A3 – This swale feature runs between two forested features flowing north towards the Tributary 5 valley. This intermittent feature was flowing during first round and was documented holding water during the second round. The riparian vegetation on either side of the bank was predominantly agricultural, although within the first 1.5 m, both banks were found to have meadow vegetation. No fish habitat was observed within the feature, and no fish were observed during any site visit. The width of the feature was measured to be 5 m within this topographic low.

Tributary 6

- Feature T6A1 – The feature comprises the lower reach of one headwater drainage feature flowing into Tributary 6. The T6A1 reach was identified as a swale that was flowing during the first and second round assessment into a woodlot to the west of Flatt Road Extension, but it was dry during round 3. The wetted width was approximately 0.48 m, and bankfull width was measured at 0.80 m. Riparian vegetation was dominated by meadow species, although agricultural and forested vegetation communities were identified 10-30 m away from the feature. The swale collected water draining from both the agricultural field and the adjacent Flatt Road Extension.
- Feature T6A2 – This reach of the feature, also identified as a swale, runs along the southern border of a residential property between reaches T6A3 and T6A1. The feature was flowing during the first round and contained standing water during the second-round site visit in late spring, which is consistent with a highly intermittent system. However, several areas of the reach were found to contain flowing water in the third assessment, although flow was dissipating at the downstream end of the reach and not continuing downstream in the feature. The source of the flowing water could not be identified during the assessment and the upstream and downstream reaches (T6A3 and T6A1, respectively) were dry. The source of the flow could have possibly been the result of activities of the homeowner prior to the assessment (e.g. lawn watering). Regardless, the flow was not contributing to downstream flows in the drainage feature, so it is not considered to be a permanently flowing reach. Wetted and bankfull width were measured during the second-round assessments to be 0.17 m and 0.43 m, respectively. No fish habitat was identified within the reach, and no fish were observed within the feature. Some erosion mechanisms (rills) were observed within and adjacent to the feature. Minimal sediment deposition and feature roughness was recorded.
- Feature T6A3 – This intermittent, poorly defined feature runs south through an agricultural field originating near the Flatt Road Extension and flows into the T6A2 reach through a farm lane culvert. The reach contained standing water during the first and second round assessments and was dry in summer. Limited riparian vegetation was present a cropped riparian zone. No fish habitat or fish were present within the reach.

Part 2 of the 2014 HDFA Guidelines provides an approach to classifying headwater drainage features by providing a step by step characterization of specific functions that may be associated with the features assessed, including hydrology, riparian function and provision of fish or terrestrial habitat. **Table 18** (**Appendix B**) summarizes the key components of this analysis for each of the headwater drainage feature reaches, based on the three rounds of HDFA completed in 2014.

Part 3 of the 2014 HDFA Guidelines provides guidance on linking the characteristics and functions of features to specific management recommendations that may be applied to those features. To assist, the 2014 HDFA guidelines include Figure 2: “Flow Chart Providing Direction on Management Options”. The flow chart depicts various decision points associated with hydrology, fish habitat, riparian vegetation and terrestrial habitat, and ultimately leads the user to an appropriate management recommendation for each feature or reach. Management recommendations can include the following:

- Protection;
- Conservation;
- Mitigation;
- Maintain Recharge;
- Maintain/Replicate Terrestrial Linkage; or,
- No Management Required.

The flow chart was used to determine the management recommendation for the headwater drainage features on the Subject Lands, as identified in the final column of **Table 18**, (**Appendix B**). Management recommendations for the identified features on the Subject Lands were either Protection, Mitigation or No Management Required. The classification for each reach is as follows, along with the recommended management approaches, as noted in CVC/TRCA (2014) for each type of classification:

Protection (T4):

- Protect and/or enhance the existing feature and its riparian zone corridor, and groundwater discharge or wetland in-situ;
- Maintain hydroperiod;
- Incorporate shallow groundwater and base flow protection techniques such as infiltration treatment;
- Use natural channel design techniques or wetland design to restore and enhance existing habitat features, if necessary; realignment generally not permitted; and
- Design and locate the Stormwater management system (i.e. extended detention outfalls) to avoid impacts (i.e., sediment, temperature) to the feature.

Mitigation (T4A1, T4A2, T4A3, T4A4, T5A1, T6A1, T6A2):

- Replicate or enhance functions through enhanced lot level conveyance measures, such as well-vegetated swales (herbaceous, shrub and tree material) to mimic online wet vegetation pockets, or replicate through constructed wetland features connected to downstream;
- Replicate on-site flow and outlet flows at the top end of the system to maintain functions with vegetated swales, bioswales, etc. If catchment drainage has been previously removed due to diversion of Stormwater flows, restore lost functions through enhanced lot level controls (i.e. restore original catchment using clean roof drainage); and/or
- Replicate Functions by lot level conveyance measures (i.e., vegetated swales) connected to the natural heritage system, as feasible and/or Low Impact Development (LID) stormwater options.

No Management Required (T4A5, T5A2, T5A3, T6A3):

- The feature that was identified has been field verified to confirm that no feature and/or functions associated with headwater drainage features are present on the ground and/or there is no connection downstream. These features are generally characterized by lack of flow, evidence of cultivation, furrowing, presence of a seasonal crop, and lack of natural vegetation. No management recommendations required.

As discussed in section 3.3.3.1, an unnamed tributary was assessed in previous years on the Taylor Lands. Headwater drainage feature assessment was not completed on the feature in 2014 since it was located partially outside of the Subject Lands. Descriptions from previous investigations suggest that the feature was an ephemeral, poorly defined feature. Since no formal assessment was completed, a precautionary management recommendation of mitigation has been assigned to all headwater drainage features associated with the Taylor Lands. This is the most conservative management recommendation for a poorly defined feature available.

3.3.3.3 Fluvial Geomorphological Assessment

Matrix Solutions (formerly Parish Geomorphic) completed a geomorphic assessment of all permanent watercourses on the Subject Lands, which include Tributaries 4, 5 east, 5 west and 6. Their results and discussion are reported under a separate cover, *Eagle Heights and Taylor Property Geomorphic Assessment* (2018). This assessment is currently being updated in cooperation with Penta's technical team to address storm water management/erosion concerns and to accommodate crossings for small to medium wildlife.

The combined drainage of the tributaries is approximately 170 ha (Matrix Solutions 2018). The 2016 and 2009 Rapid Geomorphic Assessments completed on the tributaries suggested that the downstream reaches are in transition, while the upstream reaches are stable. As discussed in previous sections, five road crossings are proposed to occur, with four of the road crossings being associated with Flatt Road expansion and one associated with proposed Street C, over Tributary 5. All road crossings will have open bottom culverts to accommodate critical discharge rates, except for Tributary 6 since the downstream watercourse is altered (piped).

Matrix Solutions proposes that Tributary 4, upstream of Flatt Road, be realigned due to its incised nature to "maintain hydrologic function, establish a riparian corridor and improve geomorphic function".

No critical erosion issues were noted within the report.

3.3.3.4 Benthic Invertebrate Sampling

Entomogen Inc. (Entomogen) collected benthic invertebrate samples at five sampling locations (**Figure 11**, **Appendix A**) in Tributaries 4, 5 and 6 on May 27, 2014. Sampling was completed in both branches of Tributary 5 upstream of Flatt Road (labeled Trib 5A and Trib 5B sampling locations), and downstream on the Taylor Lands (Trib 5C sampling location). Benthic sampling at all stations was completed using the traveling kick and sweep method, as outlined in the Ontario Benthos Biomonitoring Network (OBBN) Protocol. Samples were sieved in the field using a 400 µm sieve, preserved in 95% ethanol and returned to the lab for sorting and identification to family level by a taxonomist. Entomogen completed statistical analyses to calculate the following community indices to analyze the benthic invertebrate community and water quality at each monitoring station:

- Hilsenhoff family-level biotic index (HBI);
- Simpson's family-level diversity index (1-D);
- Inverse Simpson's family level index (1/D);

- Shannon-Wiener Diversity Index';
- Pielou's evenness;
- % Chironomidae; and
- % EPT.

2014 Results

Table 19 (**Appendix B**) summarizes the benthic invertebrate community results at each sampling location, while the complete Entomogen report is provided in **Appendix C**.

A total of 28 different taxa found in the three tributaries across the five sampling locations. Of those, five families were sampled at Trib 4, fifteen families at Trib 5A, thirteen families at Trib 5B, eleven families at Trib 5C and eleven families at Trib 6. The most common benthic families included Amphipoda at Trib 4 and Trib 5A, Nemouridae at Trib 5B and 5C, and Siphlonuridae at Trib 6.

As shown in **Table 20** (**Appendix B**) HBI results from all Tributary 5 sampling locations indicate very good to excellent water quality with pollution unlikely to occur at the site, whereas Tributary 4 HBI results indicated fair water quality with fairly substantial pollution or disturbance likely. Tributary 6 HBI results indicated fairly poor quality with very substantial pollution or disturbance likely.

The Simpson's Family Level Diversity Index is a measure of diversity which, takes into account the number and relative abundance of species present in each sample size. Based on this information, Tributary 6 has the highest diversity, with Tributary 4 and 5 showing moderate diversity, depending on the specific site of the sample. This was further shown by the Shannon-Wiener Diversity Index, which indicates that Tributary 6 and Tributary 5A are within the normal range of diversity (1.5 – 3.5), however the values for Tributary 4, 5B and 5C all fall slightly below the usual range of diversity. Pielou's Evenness measures the biodiversity of the community; all sites showed moderate distribution of individuals.

Percentage Chironomidae is the percentage of individuals of the Chironomidae family; Chironomidae often are an indicator of water quality as their abundance typically increases with decreased water quality. All samples had low percentage of Chironomidae, with Tributary 4 having no Chironomidae in any samples.

Percentage EPT evaluates the percentage of individuals that are from the orders of Ephemeroptera, Plecoptera and Trichoptera (EPT). These orders are very sensitive to pollutants, so their abundance typically decreases with decreased water quality. Tributary 4 had no EPT species found, which would agree with the other indices that showed generally poor water quality. All other samples had very high percentage of EPT values, indicating that the streams are likely of good quality.

Overall, Entomogen has determined that Tributary 5 and 6 have fair to good water quality, while Tributary 4 appears to have only fair water quality with little diversity.

3.4 Analysis of Ecological and Natural Heritage Significance (PPS 1997)

Seven types of natural features are defined in the 1997 PPS:

- Significant Wetlands;
- Significant Portions of the Habitat of Endangered and Threatened Species;
- Fish Habitat;
- Significant Woodlands;
- Significant Valleylands;
- Significant Wildlife Habitat (SWH); and
- Significant Areas of Natural and Scientific Interest (ANSI).

Development and site alteration are not permitted in significant wetlands (south and east of the Canadian Shield) and significant portions of the habitat of endangered and threatened species. Development and site alteration may be permitted in the remaining identified natural features "if it has been demonstrated that there will be no negative impacts on the natural features or the ecological functions for which the area is identified".

Development and site alteration may be permitted on adjacent land if it has been demonstrated that there will be no negative impacts on the natural features or on the ecological functions for which the area s identified.

3.4.1 Significant Wetlands

Within Ontario, Significant Wetlands are identified by the MNRF or by their designates. Other evaluated or unevaluated wetlands may be identified for conservation by the municipality or the conservation authority. There are no provincially significant wetlands (PSWs) identified within the Subject Lands.

Other/Unevaluated Wetlands (Non-PSW)

An unevaluated wetland (MAS2-1) is associated with the pond located within the former Taylor property. This wetland was staked with CH on August 28th, 2014 and is identified as a regulated wetland under Ontario Regulation 162/06, thereby affording it protection pursuant to CH's Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06 and Land Use Planning Policy Document (August 11, 2011).

Other wetlands identified within the Subject Lands as illustrated on **Figure 3** (**Appendix A**) include:

- MAS2-1 – one unit identified within the riparian corridor of Tributary 4. This wetland is primarily surface water fed;
- MAM2-10 - one unit identified within the riparian corridor of Tributary 4. This wetland is located immediately south of the MAS2-1 and is primarily surface water fed;
- MAS2-1 – one tableland wetland associated with the Taylor Pond that discharges to Tributary 4. This wetland is primarily surface water fed;

- MAS2-1/MAM2-10 – identified within the riparian corridor of Tributary 5 W. This wetland is primarily supported by groundwater; and
- MAM2-10 – two units which are associated with the riparian corridor of Tributary 6. Both of these wetlands are primarily supported by groundwater.

For each unevaluated wetland that is surface water fed, the change in catchment size and surface water runoff post-development was compared with the pre-development conditions to inform where a feature-based water balance was required. The change post-development in catchment size and/or runoff volumes of all of the surface water fed wetlands indicated the need for a feature-based water balance. Metropolitan Consulting (2018) provides details on this matter.

3.4.2 Habitat of Endangered and Threatened Species

SAR and their habitats are considered provincially sensitive information. The survey methods, results and potential impacts to SAR species and their habitats will be submitted to the MNRF Aurora District through the IGF process. Due to the sensitive nature of this information, all correspondence and precise location-related information will remain with the MNRF. Two endangered species and three threatened species were recorded within the Subject Lands and are discussed below.

Butternut

Butternut is listed as Endangered in Ontario and Canada. A total of 26 Category 1 trees, five Category 2 trees and six Category 3 trees were documented within the Subject Lands. The MNRF Recovery Strategy (2013) does not identify the critical habitat of Butternut, due to the diversity of suitable habitats, with the expectation that an appropriate level of habitat protection will be applied for the recovery of the species. Impacts to this species will be addressed under specific assessment by the MNRF through the SAR Information Gathering Form (IGF) process.

Eastern Flowering Dogwood

Eastern Flowering Dogwood is listed as Endangered in Ontario and Canada. Two Eastern Flowering Dogwood trees were observed within the valley associated with the east branch of Tributary 5 in 2013. Both trees are located well outside of the development footprint and are within protected valleylands. Impacts to this species will be addressed under specific assessment by the MNRF through the SAR IGF process.

Barn Swallow

Barn Swallows (Threatened in Ontario and Canada) were observed foraging over the Subject Lands in 2015. In addition, Barn Swallow was observed historically within the Subject Lands in 2007, 2010 and 2011. No nesting structures or suitable breeding habitat was recorded on the Subject Lands. Barn Swallow nesting activity was observed during 2014 breeding bird surveys at the Woodview Children's center located outside of the Subject Lands. Suitable foraging habitat is present (i.e., agricultural lands and a mosaic of forested habitats) within the Subject Lands and will be addressed under specific assessment by the MNRF through the SAR IGF process.

Chimney Swift

Chimney Swift (Threatened in Ontario and Canada) was observed foraging over the Subject Lands in both 2011 and 2012. Chimney Swift breeds and roosts in chimney's as well as other manmade structures including air vents, old open wells, outhouses, abandoned cisterns and lighthouses (OMNR 2009). A nocturnal survey to detect Chimney Swift leaving their nest sites was carried out during the breeding bird season on July 10, 2012. No Chimney swift were observed during the nocturnal survey. No nesting sites were observed, and no breeding evidence was recorded on the Subject Lands. This species is not believed to be nesting on the Subject lands.

Bobolink and Eastern Meadowlark

Bobolink and Eastern Meadowlark (both species are Threatened in Ontario and Canada) were confirmed to be breeding within the Subject Lands in 2011 and 2012. Habitat for these species no longer exists given a shift from hayfields to row crop production. The areas where these two species were observed in 2011 and 2012 no longer represent suitable habitat and there is no other suitable habitat for Bobolink or Eastern Meadowlark on the Subject Lands.

3.4.3 Fish Habitat

Fish habitat, as defined in the federal *Fisheries Act,* c. F-14, means "spawning grounds and nursery, rearing, food supply, and migration areas on which fish depend directly or indirectly in order to carry out their life processes". Fish, as defined in S.2 of the Fisheries Act, c. F-14, includes "parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals" (DFO 2013).

Grindstone Creek provides high quality coldwater fish habitat. Tributaries 4, 5 and 6 to Grindstone Creek were assessed within the Subject Lands and Tributaries 4 and 6 were determined to provide indirect fish habitat, while Tributary 5 provides direct fish habitat.

3.4.4 Significant Woodlands

Significant woodlands are identified by the planning authority using criteria established by the MNRF. Under the NHRM (2010), woodlands are defined as:

> *...treed areas that provide environmental and economic benefits to both the private landowner and the general public, such as erosion prevention, hydrological and nutrient cycling, provision of clean air and the long-term storage of carbon, provision of wildlife habitat, outdoor recreational opportunities, and the sustainable harvest of a wide range of woodland products. Woodlands include treed areas, woodlots or forested areas and vary in their level of significance at the local, regional and provincial levels.*

The Subject Lands occur within Halton Region which is characterized by 22% to 23% forest cover (21.9% - Riley and Mohr 1994 and 22.9% Gartner Lee 2002).

Table 7.2 of the NHRM summarizes evaluation criteria and thresholds for each criterion for significant woodland designation. The criteria are:

- Size – where woodland cover is about 15% to 30% of land cover woodlands 20 ha in size or larger should be considered significant.

- Ecological Functions

  a) Woodland Interior – 2 ha or more of interior woodland habitat where woodland cover is about 15% to 30%;

  b) Proximity to other woodlands or habitats – a portion of the woodland is located within 30 m of a significant natural feature or fish habitat and are assumed to receive ecological benefit from the woodland and the woodland meets the minimum area thresholds of 5 ha to 20 ha;

  c) Linkages - woodlands that are within a defined natural heritage system or provide a connecting link between two significant features, each of which is within a specified distance of 120 m may be deemed significant;

  d) Water Protection – woodlands that are within 50 m of a sensitive groundwater discharge, sensitive recharge, sensitive headwater area, watercourse or fish habitat and meet the minimum area thresholds of 0.5 ha to 10 ha; and

  e) Woodland diversity – woodlands with a naturally occurring composition of native forest species that have declined significantly south and east of the Canadian Shield and meet minimum area thresholds of 1 ha to 20 ha and woodlands with a high native diversity through a combination of composition and terrain (i.e., woodland extending from hilltop to valley bottom or to opposite slopes and meet minimum thresholds of 2 ha to 20 ha.

- Uncommon Characteristics – woodlands that are uncommon (i.e., S1, S2 or S3 ranked woodlands) in terms of species composition, cover type, age or structure and older woodlands (i.e., older than 100 years old).

- Economic and Social Functional Values – woodlands that have high economic or social values through particular site characteristics or deliberate management.

The woodlands on the Subject Lands have been examined and mapped in terms of ELC community types. These woods include some larger blocks, which are contiguous and connected to the Grindstone Creek Valley and the Niagara Escarpment; they are wholly or partially within 50 m of a major creek and its tributaries. Patch sizes were measured, and each patch was considered in terms of the presence of other indicators of potential significance.

Significant woodlands are shown on **Figure 12** (**Appendix A**).

3.4.5 Significant Valleylands

Significant valleylands are defined and designated by the planning authority. General guidelines for determining significance of these features are presented in the NHRM (MNR 2010) for Policy 2.1 of the PPS. Recommended criteria for designating significant valleylands include prominence as a distinctive landform, degree of naturalness, and importance of its ecological functions, restoration potential, and historical and cultural values

A review of the suggested criteria for determination of significance presented in the Natural Heritage Reference Manual (NHRM) (MNR 2010) confirms that the Grindstone Creek Valley which borders the western boundary of the Subject Lands is a significant valleyland as shown on **Figure 12** (**Appendix A**).

3.4.6 Areas of Natural and Scientific Interest

The Grindstone Creek Valley Life Science ANSI forms the west and northwest boundary of the Eagle Heights lands.

The Grindstone Creek Valley Life Science ANSI provides the best representation of south-trending re-entrant valley, shale valley, and shale valley bottomland features in the Niagara Peninsula Section. These include high representation of moist and drier broadleaf and mixed valley slope forests, broadleaf bottomland forests and wetlands. The sheltered, southerly exposures of the valley results in a relatively warm dry microclimate, that supports many Carolinian and prairie/savannah species common to more southerly areas including oak-hickory forests (Varga 1995).

Drier ridges and upper-valley slopes support forests dominated by Red and White Oak forests along with some Sugar Maple and Shagbark Hickory. Moister lower-valley slopes are dominated by Sugar Maple with groves of American Beech. A few seeps on the valley slopes support meadow marshes of Spotted Jewelweed. The bottomlands support Sugar Maple on the higher terraces and White Ash, Manitoba Maple, Crack Willow and White Elm on the lower terraces. Bottomland meadow marshes of Spotted Jewelweed, Spotted Joe-pye-weed and Reed Canary Grass are common. The Grindstone Creek Valley is the major riverine corridor in the regional landscape. The MNR has identified this creek as a coldwater stream north of the Niagara Escarpment and as a migratory run for salmonids south of the escarpment. The creek valley and associated forests also provide an important movement corridor and winter habitat for white-tailed deer, songbirds, and other wildlife (Heagy 1993).

3.4.7 Significant Wildlife

Significant wildlife habitat (SWH) is one of the more complex natural heritage features to identify and evaluate. There are several provincial documents that discuss identifying and evaluating SWH including the NHRM (MNR 2010), the Significant Wildlife Habitat Technical Guide (MNR 2000), and the SWH Eco-Region Criterion Schedule (MNRF 2015). The Subject Lands are located in Eco-Region 7E and were therefore assessed using the 7E Criterion Schedule (MNRF 2015).

There are four general types of SWH:

- Seasonal concentration areas;
- Rare or specialized habitats;
- Habitat for species of conservation concern; and
- Animal movement corridors.

Seasonal Concentration Areas

Seasonal concentration areas are those sites where large numbers of a species gather together at one time of the year, or where several species congregate. Seasonal concentration areas include: deer yards; wintering sites for snakes, bats, raptors and turtles; waterfowl staging and molting areas, bird nesting colonies, shorebird staging areas, and migratory stopover areas for passerines or butterflies. Only the best examples of these concentration areas are usually designated as significant wildlife habitat. Areas that support Special Concern species or provincially vulnerable to imperiled species (S1-S3), or if a large proportion of the population may be lost if the habitat is destroyed, are examples of seasonal concentration areas which should be designated as significant.

Rare or Specialized Habitats

Rare and specialized habitat are two separate components. Rare habitats are those with vegetation communities that are considered rare in the province. SRANKS are rarity rankings applied to species at the ‘state’, or in Canada at the provincial level, and are part of a system developed under the auspices of the Nature Conservancy (Arlington, VA). Generally, community types with SRANKS of S1 to S3 (extremely rare to rare-uncommon in Ontario), as defined by the NHIC (2016), could qualify. It is to be assumed that these habitats are at risk and that they are also likely to support additional wildlife species that are considered significant. Specialized habitats are microhabitats that are critical to some wildlife species. The NHRM (MNR 2010) defines specialized habitats as those that provide for species with highly specific habitat requirements; areas with exceptionally high species diversity or community diversity; and areas that provide habitat that greatly enhances species’ survival.

Habitat for Species of Conservation Concern

Species of conservation concern include those that are provincially rare (S1 to S3), provincially historic records (SH) and Special Concern species. Several specialized wildlife habitats are also included in this SWH category, i.e., terrestrial crayfish habitat and significant breeding bird habitats for marsh, open country and early successional bird species.

Habitats of species of conservation concern do not include habitats of endangered or threatened species as identified by the ESA (2007). Endangered and threatened species are discussed in section 3.4.2.

Animal Movement Corridors

Animal movement corridors are areas that are traditionally used by wildlife to move from one habitat to another. This is usually in response to different seasonal habitat requirements, including

areas used by amphibians between breeding and summer/over-wintering habitats, called amphibian movement corridors.

Table 21 (**Appendix B**), discusses all types of SWH relevant to the Subject Lands based primarily on the Savanta 2014, 2015 and 2016 data.

As detailed in **Table 21** (**Appendix B**), a variety of SWH types are confirmed to be present on the Subject Lands that are illustrated on **Figure 12** (**Appendix A**):

- Turtle wintering habitat within the Taylor Pond/wetland identified as Reed Canary Grass Mineral Meadow Marsh (MAS2-1);
- Woodland amphibian breeding habitat is present within the Taylor pond/wetland at AMC 8 (**Figure 5**, **Appendix A**); and
- Habitat of Special Concern and provincially rare (S1-S3) species, including Eastern Wood-Pewee, Wood Thrush, Snapping Turtle, Butternut and Monarch was observed.

3.4.8 Summary of Ecological Components Subject to Impact Assessment

The PPS (1997) defines the limits of important features to consider in terms of impact assessment. For context and to limit the potential for impacts more generally, the following aspects were considered for impact avoidance, mitigation and/or potential offsets.

- Significant Portions of Habitat of Endangered and Threatened Species:
  - Butternut;
  - Eastern Flowering Dogwood;
  - Barn Swallow;
  - Chimney Swift; and
  - Bobolink and Eastern Meadowlark.
- Unevaluated Wetlands (non- PSW);
- Significant Woodlands;
- Significant Valleylands
- Significant Wildlife Habitat (relevant SWH criteria are met for habitat size, vegetation and indicator species; MNRF 2015):
  - Turtle wintering habitat;
  - Woodland amphibian breeding habitat; and
  - Species of Conservation Concern (Eastern Wood-Pewee, Wood Thrush, Snapping Turtle, Monarch).

The impact assessment also addresses potential impacts to the Niagara Escarpment Protection Area.

4.0 NIAGARA ESCARPMENT PLAN

The northern most portion (north of the hydro corridor) of the Subject Lands (**Figure 12**, **Appendix A**) is located within the Niagara Escarpment Protection Area and Map 3 of the Plan identifies the area to be within the "North Aldershot Policy Area". The lands north of the hydro corridor within the NEP are not part of the current application but are within the study area for the Subject Lands. The draft plan identifies the NEP lands as a "Draft Approved Area" with ten residential lots. The Eagle Heights Planning Justification Report (2018) provides more detailed information with respect to the planning application history specific to the NEP.

Section 2.6 of the NEP outlines objectives to ensure that hydrologic features and functions including the quality, quantity and character of groundwater and surface water, at a local watershed level, are protected and where possible enhanced. The following are key hydrologic features within the meaning of the NEP:

- Permanent and intermittent streams;
- Lakes (and their littoral zones);
- Seepage areas and springs; and
- Wetlands.

Section 2.7 of the Niagara Escarpment Plan (2017) outlines requirements with respect to development affecting natural heritage features and functions and defines the following as key natural heritage features within the meaning of the plan:

- Wetlands;
- Habitat of endangered and threatened species;
- Fish habitat;
- Life Science Areas of Natural and Scientific Interest;
- Earth Science Areas of Natural and Scientific Interest;
- Significant valleylands;
- Significant woodlands;
- Significant wildlife habitat; and
- Habitat of special concern species in Escarpment Natural and Escarpment Protection areas.

The portion of the Subject Lands located within the Escarpment Protection Area and within 120 m were reviewed and considered for the presence of key hydrologic and key natural heritage features as defined within the NEP. These features are summarized as follows:

- ELC communities CUW1/CUT1-1, CUW1 and CUW1/FOD4-2 are identified as significant woodlands;
- The Grindstone Creek Valley which abuts the western boundary of the Subject Lands is identified as a significant valleyland;
- Fish habitat is identified within the Grindstone Creek which abuts the western boundary of the Subject Lands; and
- Grindstone Creek is identified as a key hydrologic feature.

5.0 PROPOSED DEVELOPMENT

The proposed development as depicted on the Draft Plan of Subdivision prepared MCI (2018c) proposes a total of 193 single detached residential units, 21 single family condominium units and 566 cluster block units, open space areas, a compensation block, parks, valleylands, buffers, a storm water management pond (SWM) and infiltration trenches. The Draft Plan of subdivision is shown on **Figure 13** (**Appendix A**). The proposed development will also include the extension and realignment of Horning Road within the northern portion of the Subject Lands within Niagara Escarpment protection area. Details with respect to the proposed alignment and extension of Horning Road are provided on Figure 2.3 of the Functional Servicing Report (FSR) (MCI 2018a).

The NHS includes retained features and associated buffers (denoted in brackets) as follows:

- Taylor Pond non-PSW wetlands (15 m buffer measured from staked wetland limits);
- Provincially significant woodlands (7.5 m buffer measured from staked dripline);
- Provincially significant valleylands (15 m buffer measured from staked top of bank);
- Grindstone Creek ANSI (15 m buffer measured from staked top of bank or staked dripline whichever is greater);
- Minor valleys associated with tributaries 5 and 6 (7.5 m buffer measured from staked top of bank, meander belt or staked dripline);
- Retained woodlands that are not associated with staked valley features (7.5 m measured from staked dripline); and
- Tributary 4 (7.5 m measured from meander belt or staked top of bank whichever is greater).

Fish habitat and significant habitat for endangered and threatened species are protected from development, except in accordance with provincial and federal requirements. This may for example, include developments that have satisfied requirements under the ESA (2007), such as an Overall Benefit Permit test or MNRF registration for certain SAR and development activities. Development will not occur within the significant valleyland identified along the Grindstone Creek watercourse corridor; this feature will be protected by a 15 m planted buffer. Minor encroachments will occur within the tableland portion of the Grindstone Creek ANSI and within the Niagara Escarpment Protection Area. Impacts to these features are discussed in more detail in sections 6.1.5 and 6.1.8 respectively.

Development may occur in significant woodlands and SWH provided that it has been demonstrated that there will be no negative impacts on the natural features and their ecological functions. The retained vegetation within the NHS protects most of the significant woodlands on-site and contains the following SWH types that are not expected to be impacted by development once the NHS is implemented (i.e., buffers are planted and pre-development water balance conditions are maintained for the wetland): SWH, and habitat of several rare flora/fauna species (Eastern Wood-Pewee, Wood Thrush, Butternut), portions of significant woodland, and several SWH types will be impacted by development. This is discussed in more detail in section 6.

The proposed development will retain the non-PSW wetland associated with the former Taylor pond and the other five non-evaluated wetlands identified within the Subject Lands in-situ in the

post-development condition. SWH for Snapping Turtle and woodland breeding amphibians will also be retained within the former Taylor pond.

The Draft Plan respects the significant valley areas associated with Grindstone Creek that will be protected with a 15 m vegetated buffer. The watercourse channels of Tributaries 5 and 6 and their associated valleys will be maintained and protected with a 7.5 m vegetated buffer. Tributary 4 north of Flatt Road is proposed to be re-aligned to maintain hydrologic function, establish a riparian corridor and improve geomorphic function (Matrix Solutions 2018).

The proposed development will displace primarily cultural vegetative communities and agricultural uses. Approximately 4.03 ha of natural forest communities (e.g., non-cultural woodlands) will be displaced on the Subject Lands. Approximately 2.65 ha of cultural vegetation communities (e.g., cultural thickets, cultural woodlands, cultural plantations) will be displaced and about 0.3 ha of hedgerow will be removed.

As identified on the Draft Plan, one stormwater management pond is proposed in the southeast portion of the Subject Lands between the east and west branch of Tributary 5 in Block EE. The FSR and the Draft Continuous Hydrological Modelling and Stormwater Management Report (MCI 2018) outline the storm water management facilities proposed within the Subject Lands.

The FSR and SWM report prepared by MCI (2018a) outline the criteria and stormwater management implementation plan, preliminary grading and sanitary servicing for the Subject Lands. Stormwater management (SWM) measures proposed to be implemented within the final site development are summarized in the points below and provided in Table 12 of the SWM study (MCI 2018):

- The three existing tributaries of the Grindstone Creek (4, 5 and 6) will host 7 independent sub-areas of development as shown on Figure 3.2 of the FSR (MCI 2018a);
- Each of the 7 sub-areas associated with the Subject Lands will be serviced by a unique SWM facility or by a number of SWM facilities;
- One SWM pond is proposed within the Subject Lands and will be situated east of Flatt Road extension between tributary branches 5 east and 5 west and will outlet downstream in Tributary 5 west;
- Six “superpipe” storage systems are proposed on streets;
- Nine private onsite storage facilities are proposed to manage storm runoff quantity and quality control;
- Where feasible infiltration trenches are proposed as SWM storage facilities and if the underlying geological conditions permit, these trenches will also operate as infiltration chambers (pending final results of Hydrogeological studies presently being completed by Terra-Dynamics);
- Onsite private SWM storage facilities proposed for the cluster housing blocks (Blocks D, E, H, K, JJ, OO, SS, P, CC, DD) will be subject to further approval at the site plan application stage;

- Each superpipe and private on-site storage facility will be equipped with a stormceptor before releasing the runoff from the Subject Lands to the receiving watercourses;
- Superpipe and private onsite storage facilities will be equipped with an Oil-Grit Separator (OGS);
- Storm drainage will be conveyed to the three tributaries branches of Grindstone Creek with eventual drainage Grindstone Creek downstream of the Subject Lands and downstream of Highway 403; and
- In all cases storm water will be treated via a treatment train approach with an oil grit separator unit.

The FSR provides detailed information regarding the wastewater system proposed for the Subject Lands. Internal streets will generally be serviced with 200 mm diameter sewers with 150 mm sewers proposed for the first sections of each separate sub-system to facilitate self-cleaning velocities. Seven lots fronting Waterdown Road will have sanitary sewer connections to the sanitary sewer that will be constructed as part of the Waterdown Road widening project. The sewer line will cross the open area of Sub-Area 6 within an easement and at the south end of Sub-Area 6 a gravity sewer will be installed to connect to Flatt Road using trenchless technology to preserve the valley and associated natural features. The 300 mm sanitary outlet sewer is proposed to follow Street X south from Flatt Road and then cross Tributary 4 to an existing church property on the east bank. The Tributary 4 crossing is proposed at the location of an old farm crossing and will be carried out using a trenchless method of construction. In order to service lands external to the Subject Lands from a wastewater perspective crossing of both Tributaries 4 and 5 are proposed using trenchless construction methods. A third crossing of Tributary 6 on the Aldershot Landscape property which is located to the south of Flatt Road is proposed however the FSR does not specify if this will be accomplished using a trenchless or open cut construction method. In addition, the preliminary sewer alignment will also cross the unevaluated wetland at the south end of the Subject Lands and is proposed to be carried out using trenchless construction methods.

The preliminary grading proposed for the Subject Lands has been designed to address the 1996 settlement principles that grading for lots and roads be designed where feasible to conform with the existing landform and that grades meet existing ground at the valley buffer zone limits. In addition, OPA 197 states that “site design and development shall integrate with the existing topography to maximize the preservation of significant existing trees, steep slopes (>15%) and existing drainage patterns”.

Figures 4-1 to 4-7 of the FSR demonstrate how these grading principles can be achieved within the Subject Lands and summarized below:

- Freehold lot grading will be accommodated using split drainage and back to front drainage as appropriate. Walkout and lookout house models are proposed in areas where the grades are suitable to minimize regrading;
- The use of retaining walls has been minimized within the Subject Lands;
- 3:1 slopes and terracing are proposed in areas to meet existing grades at the buffers to accommodate grade differences at internal lot boundaries;

- Where feasible large trees on lots will be preserved;
- Cluster housing has been selected to conform with the natural landform and will be oriented to best fit existing grades;
- Grass swales are proposed to drain runoff from cluster blocks; and
- Grading for cluster blocks will be designed to accommodate lot level and conveyance controls and specimen trees and others designated for preservation including a remnant hedgerow in Sub-Area 6.

The Geotechnical Report (Peto MacCallum 2003) investigated the suitability of the native soils associated with the Subject Lands for the implementation of artificial infiltration systems and preliminary studies confirmed that sandy soils are present in Sub-Area 7 and Sub-Area 1; clay till and shale soils associated with the remaining Sub-Areas are less suitable for infiltration measures. A more comprehensive study is currently underway by Terra-Dynamics and is anticipated to be completed in late summer/early fall of 2018.

Lot level and conveyance measures currently being considered of the Subject Lands include:

- Reduced grading to allow ponding and natural infiltration gardens;
- Sump pumping foundation drains to rear yard ponding areas;
- Directing roof leaders to rear yard ponding areas, soakaway pits, or to cisterns or rain barrels;
- Rainwater and roof top gardens;
- Infiltration trenches;
- Porous pavement;
- Grass swales;
- Previous pipe and catchbasin systems;
- Stream and valley corridor buffer strips; and
- Vegetated filter strips.

5.1 Buffers

Buffers are typically defined as areas adjacent to a natural feature that are intended to provide some separation and protection from proposed adjacent land uses. They are intended to reduce impacts that might negatively impact the natural feature or its associated functions. In residential developments, a primary impact requiring mitigation planning is the effect of increased numbers of people (and their pets if allowed to roam un-controlled). Buffers are one of a number of mitigation measures that were considered in this impact assessment, to reduce potential impacts and protect natural features/functions associated within the Subject Lands.

The outer boundaries of the natural heritage system (NHS) have been established through a staking of the woodland dripline, wetland and top of bank features associated with the Subject Lands. As discussed in section 5, the proposed development plan incorporates variable vegetated buffer protection zones ranging in 7.5 m to 15 m in size.

This section provides a technical summary of the rationale and considerations for the determination of the recommended vegetation buffer zones.

Key features of the natural core areas within the Subject Lands include:

- Significant woodland;
- Significant valleyland (Grindstone Creek Valley);
- Significant wildlife habitat (i.e., Eastern Wood-Pewee and Wood Thrush) associated with the aforementioned significant woodland;
- Watercourse/Fish Habitat associated with the Grindstone Creek and associated tributaries (4, 5 and 6);
- Unevaluated wetland communities associated with the riparian areas of tributaries 4 and 6 and the Taylor Pond;
- Significant wildlife habitat (i.e., amphibian breeding habitat) associated with the Taylor pond wetland community (MAS2-1);
- Grindstone Creek Provincially Significant ANSI; and
- Niagara Escarpment Protection Area.

The key functions of the Natural Core Areas on the Subject Lands are:

- Provision of breeding and foraging habitat for wildlife, including birds, mammals, and amphibians, including special concern and endangered species;
- Provision of movement corridors for wildlife, with connections to the Grindstone Creek valley and Greenbelt to the west, and the Niagara Escarpment to the north and associated connections to the regional landscape;
- Prevention of soil erosion associated with the woodland vegetation on the valley slopes;
- Flood reduction associated with the woodland and wetland vegetation communities;
- Nutrient cycling and hydrological cycling associated with woodland and wetland vegetation communities;
- Improvements in air quality relating to the presence of woodland and wetland vegetation; and
- Provision of surface water flows downstream to Grindstone Creek.

Understanding those features and functions, allows for the consideration of an appropriate protective buffer, to be implemented in association with other mitigation measures. The recommended buffers/vegetation protection zones have carefully considered the physical characteristics of the natural edge (e.g., soils types, moisture regime, woodland edge structure and composition and rooting habits of adjacent trees) and how much buffer space will be required to protect that edge. Typically, woodlands and wetlands benefit from larger buffers, while cultural communities require less buffering to ensure the conservation of the natural edge.

Complementary mitigation measures have included access management (i.e., fencing, signage and plantings) to address impacts related to human use within the NHS (trampling, human use, dumping etc.).

The following highlights key buffer components/considerations:

- A 15 m vegetation protection zone is identified from the limits of the staked top of bank along the Grindstone Creek significant valleylands, and ANSI area located along the western edge of the Subject Lands. The steep valley slopes associated with this area will deter human interaction/use and no trails are proposed along the edge which will further limit human use of this area. Native thorny shrubs (e.g., raspberry species) and fencing can be employed to further discourage woodland access. The 15 m vegetated buffer will provide protection for the rooting zones of trees given the clay soils associated with the Subject Lands. The vegetated buffer will provide some additional woodland area along the edge of the valley within the tablelands which will enhance wildlife habitat for Eastern Wood-Pewee and Wood Thrush within the Subject Lands. Wildlife using the Grindstone Creek valley are expected to continue to use these areas to complete their life cycles;

- A 15 m vegetation buffer from the staked limit of the former Taylor pond wetland. No direct encroachment is proposed within this wetland feature. Assuming mitigation measures with respect to soil erosion, stormwater management, and water balance are addressed (discussed separately in the section 6 below) no indirect impacts to this feature are predicted. Native thorny shrubs (e.g., raspberry species) can be employed to further discourage access to the wetland. Wildlife using the wetland are expected to continue to use this feature to complete their life cycles;

- A 7.5 m vegetated buffer measured from staked top of bank or dripline (whichever is greater) for significant woodlands associated with the minor valleys of watercourse channels 5 and 6. As with Grindstone Creek the valley slopes associated with these areas will serve as a deterrent to most human interaction and use of these areas. Native thorny shrubs (e.g., raspberry species) and fencing can be employed to further manage woodland access. The proposed vegetated buffer will provide protection for the rooting systems of retained trees within these features given the clay soils associated with the Subject Lands. Wildlife using these woodland areas are expected to continue to use these features to complete their life cycles;

- A 7.5 m buffer measured from staked dripline for other retained significant woodlands (outside of watercourse/minor valleys associated with watercourse channels 5 and 6). Significant woodlands outside of the watercourse corridors/valleys are primarily located within the former Taylor lands south of Flatt Road. These woodlands do not provide critical support functions for wildlife within the NHS which would necessitate the maintenance of larger buffers for protection. The proposed vegetated buffer will provide protection for the rooting systems of retained trees within these features and wildlife using these woodland areas are expected to continue to use these features to complete their life cycles. Native thorny shrubs (e.g., raspberry species) and fencing can be employed to discourage human access/encroachment;

- With drainage patterns generally expected to be maintained post development, buffers will not be required to provide runoff filtration from the Subject Lands for the NHS features;

- Mitigation measures with respect to soil erosion, stormwater management, and water balance are addressed separately in section 6 below; and

- Given the recommendation to fence rear yards along the NHS, encroachments into the natural core areas will be limited.

In addition, design elements can be incorporated into the landscape of adjacent lands that can function to complement, enhance or supplement buffer zones. Common mitigation strategies that can be applied to adjacent land uses include (CVC 2012)(OMAFRA 2004):

- Earth berms;
- Bioengineering measures, such as brush mattresses and coir logs, used for revegetation and slope stabilization;
- Infiltration galleries (if soils are feasible);
- SWM features and facilities;
- Directional lighting;
- Signage; and
- Controlled access points.

One or a combination of these techniques can be applied to support mitigation efforts for the NHS. Infiltration galleries (if implemented) and SWM facilities proposed within the Subject Lands will assist in the management of fertilizers, pesticides and herbicides directly on site before they reach adjacent natural features.

Lighting impacts can be mitigated through the use of low-radiance, directional lighting to reduce the impacts of artificial lighting and alleviate the function requirements of buffers. Using light mitigation measures can reduce the width required for a buffer to function effectively.

Impacts associated with ad-hoc recreational activities, dumping/debris, encroachment, harvesting of native species, contamination and pet control can be mitigated over the long term through active mitigation strategies, such as signage that aims to inform and educate the public. Buffers will provide short term protection from these impacts but without additional mitigation and management these impacts will permeate into natural areas over time regardless of buffer width. Controlled access points, like sustainable trail networks can also assist in mitigating impacts related to ad-hoc trails, recreational activities and trampling. Designated access points direct pedestrians to trail networks and recreational areas designed to avoid sensitive natural features.

Considering a multitude of mitigation strategies ensures that the most effective technique can be selected to address impacts related to changing land use. **Table 22** (section 6 below) provides a summary of potential mitigation measures by impact type and development activity. It is recommended that mitigation strategies be implemented as a condition of draft approval.

6.0 IMPACT ASSESSMENT, AVOIDANCE AND MITIGATION MEASURES

This EIA presents and discusses the natural heritage features and associated functions that occur on and/or adjacent to the Subject Lands.

The EIS assesses the potential effects on these natural heritage features and functions that could occur over the short-term and long-term following implementation of the Draft Plan of Proposed Subdivision and identifies planning, design and construction practices that will maintain and, where possible, improve or restore the health, diversity and size of the key natural heritage feature and its connectivity with other key natural heritage features.

The Impact Assessment is detailed in **Table 22** (below) – this table provides a comprehensive review of the natural heritage features and associated functions and their significance and sensitivity. Impactors (potential sources of impact) are identified along with potential effects without any form of mitigation. Impact avoidance, mitigation and/or restoration measures are identified along with predicted net effects. Monitoring measures are identified to measure the effectiveness of mitigation.

The Impact Assessment is based upon the proposed Draft Plan of Subdivision (May, 2018) and supporting engineering details (FSR, SWM Study, Geomorphic Assessment Report). Other supporting engineering reports including the hydrogeological reports and geotechnical analysis were not available at the time of writing of this EIA. Accordingly, a number of assumptions have been made to allow the impact assessment to be completed. Once additional development planning and engineering information is available, it may be necessary to review and revise the impact assessment. Conclusions and recommendations may also be adjusted.

For purposes of this evaluation, the details of the impact assessment are provided within **Table 22**. Some key points are discussed in the following sections.

6.1 Summary of Predicted Direct/Indirect Affects

This assessment considers both potential direct and indirect effects and is based on the proposed residential land uses for the area, the proposed stormwater management and servicing strategies outlined in the FSR and SWM report and the findings geomorphic assessments carried Matrix Solutions.

6.1.1 Provincially Significant Wetlands (PSWs) and Other Retained Wetlands

There are no PSW's associated with the Subject Lands.

For unevaluated wetlands located within the clay till plain where wetlands are fed by surface water drainage, the change in catchment size and surface water runoff volumes post-development was compared with the pre-development conditions to inform where a surface water feature based water balance was required. The riparian wetlands within Tributary 4 (MAS2-1 and a MAM2-10), the tableland wetland (MAS2-1/pond) within the Tributary 4 catchment area and the riparian wetland (MAM2-2) within Tributary 5E will experience changes in catchment size and/or surface runoff volumes, requiring a surface water wetland water balance (Metropolitan Consulting 2018b).

A surface water-based wetland water balance was completed by Metropolitan Consulting (2018b) with ecological input from Savanta. The table below summarizes the pre to post development changes in catchment size for these wetlands. A monthly hydrograph and table of surface water volumes for each wetland pre and post development (with and without mitigation) are provided in Metropolitan Consulting (2018b).

Pre to Post Development Changes in Catchment Size for Wetlands

Wetland	Catchment Area (ha)		
	Pre-development	Post-development	% Change
Tributary 4 MAS2-1/MAM2-10	10.19	10.86	6.5% increase
Taylor Pond (MAS2-1/pond) within Tributary 4 catchment area	4.97	6.01	21% increase
Tributary 5E – MAM2-2	1.45	0.74	2.5% decrease

Sandy surficial soils with a high groundwater table are present in Tributary 5W and Tributary 6. Groundwater is thought to be the dominant water source for the three wetlands (MAS2-1/MAM2-10, MAM2-10a, MAM2-10b) within these tributaries (Terra-Dynamics 2018). A groundwater wetland water balance assessment is underway by Terra-Dynamics, to be submitted as an EIS technical addendum.

Tributary 4 – North of Flatt Road

Pre-development, Tributary 4 north of Flatt Road, contains a Cattail mineral shallow marsh forb which drains into a mineral meadow marsh. None of these wetlands support amphibian breeding habitat. Post-development, without mitigation surface water volumes, depending on riparian floodplain topography, may transform the meadow marsh to a shallow marsh and the Cattail marsh to a wetland with permanently standing water. Post-development, surface water will be collected in cisterns of the cluster development housing condominium block (subcatchment 409) from April 15th to October 31st (Metropolitan Consulting 2018b). The Cattail mineral shallow marsh post-development spring surface water volumes are 80% to 100% of existing conditions, summer volumes are 65% to 70% over existing with fall volumes 60% to 130% over existing conditions (Metropolitan Consulting 2018b). Bioretention cells within the road side ditches of subcatchment 406 is planned to attenuate flows to the meadow marsh south of the Cattail marsh (Metropolitan Consulting 2018b). At this time the effect of the bioretention cells on monthly surface water volume inputs into the meadow marsh has not been modeled. The water balance model, without accounting for the bioretention cells, indicates that surface water runoff volumes post-development into the meadow marsh are 150% to 200% higher in the spring and fall and 200% higher in the summer over existing conditions (Metropolitan Consulting 2018b). Bathymetry of the

wetlands within the Tributary is not available and it is not known whether the increase in surface water runoff volume to the meadow marsh will increase the size and depth of this feature or whether the increased water volumes will be carried downstream.

Former Taylor Pond

An unevaluated (non-PSW) wetland (Cattail mineral shallow marsh) is associated with the pond located within the formerly identified Taylor property and is identified as a regulated wetland under CH policies (Ontario Regulation 162/06). This wetland is also identified as providing significant wildlife habitat for Snapping Turtle and woodland breeding amphibians. A poorly defined drainage draw located south of Flatt Road extends southerly to this wetland. The draw exhibits no defined channel and serves only to convey ephemeral drainage towards the wetland and pond. The pond was observed to be stagnant, with dense patches of duckweed and algae. Various patches of terrestrial grasses and shrubs located throughout the pond suggest that water levels fluctuate in response to annual precipitation and runoff levels.

Post-development, existing condition surface water runoff volumes to the wetland can be maintained with a split pipe from the super pipe system (MCI 2018b). Excess runoff will be discharged through a constructed and naturalized drainage swale, which outlets to Tributary 4. The proposed drainage swale is entirely outside of the MAS2-1. At detailed design, the infrastructure requirements to meet pre-development surface runoff volumes to the wetland will be determined. The proposed mitigation measures will maintain the existing hydrology to support significant wildlife habitat for Snapping Turtles and woodland breeding amphibians, post-development.

Potential exists for both direct and indirect impacts to this wetland. Direct impacts may result from construction encroachments (equipment and material) into the wetland. Indirect effects may occur as a result of impacts from erosion, sedimentation, accidental spills, potential hydrologic changes and/or human impacts in the post development setting.

A 15 m buffer has been applied from the boundary of the wetland, as shown in **Figure 13** (**Appendix A**) to protect this natural heritage feature. Buffers are one method for impact mitigation; other mitigation measures focused on managing human use/interference (e.g., fencing, trail signage, effective trail design) need to be addressed within a more active and ongoing approach to impact management.

Private lots will terminate at the edge of the 15 m buffer, with no portion of the privately-owned lot extending into the buffer. In order to manage storm water management flows and meet water balance requirements to the former Taylor pond, wetland a drainage swale is proposed within the wetland buffer which will be connected to downstream of the Taylor pond outlet. Further details with respect to the location of the drainage swale are provided in Figure 7 of the FSR (Metropolitan, 2018b). Limit of work devices (e.g., silt fence or other form of temporary fencing) will be installed at the limit of the 15 m setback prior to commencement of vegetation removal and grading on adjacent lots and prior to the commencement of construction for the proposed drainage swale in order to prevent accidental encroachment into the setback area during construction.

A vegetation restoration plan for the 15 m setback area will be developed during the detailed design stage and will incorporate native species as appropriate.

Tributary 5E – MAM2-2

A Reed Canary-grass mineral meadow marsh is present at the start of Tributary 5E where adjacent to Block OO. This wetland does not support amphibian breeding. Post-development without mitigation: spring (March and April) surface runoff volumes match pre-development conditions; June to October surface runoff volumes are 200% to 300% higher than pre-development conditions; and, November and December surface water volumes are 100-125% of pre-development conditions. Depending on the topography of the riparian area, this wetland may either transition from a mineral meadow marsh to a mineral shallow marsh or remain as is with the increase in surface water runoff volumes discharged into Tributary 5E. Should the wetland transition to a mineral shallow marsh due to increased surface water volumes in summer this wetland may provide suitable habitat to support amphibian breeding, which it does not provide under pre-development conditions.

Water Quality Impacts on Unevaluated Wetlands

Bioretention cells that discharge to super pipes are proposed for stormwater management, with the exception of cluster blocks, which will have private SWM storage facilities with an Oil Grit Separator (OGS) system (MCI 2018a). The LIDs and the private stormwater facilities will receive water from both pervious and impervious surfaces, and 80% total suspended solid (TSS) removal will be achieved. Road salt is not removed by LIDs, SWM settling ponds or OGSs, and will be discharged to riparian wetlands and their watercourses. The existing dominant wetland vegetation present (Cattail and Reed Canary-grass is highly tolerant to salt. Amphibian breeding habitat is sensitive to salt concentrations (e.g. masculinization of populations); under existing conditions there is no breeding amphibian habitat present in the wetlands.

Indirect Impacts on Unevaluated Wetlands

Potential indirect impacts associated with stormwater runoff should be addressed through the preparation and implementation of an Erosion and Sedimentation Control (ESC). The ESC Plan should be developed based on the guidance provided in the *Erosion and Sediment Control Guideline for Urban Construction* (GGHCA 2006). Limit of work measures (e.g., temporary fencing, silt fencing) should be installed at the edge of the buffer to prevent the contractor from encroaching into the wetland.

To minimize the potential for negative impacts on the wetland due to accidental spills during construction, it is recommended that the contractor prepare a spill prevention and response plan to outline the material handling and storage protocols, mitigation measures (e.g., spill kits on-site), monitoring measures and spill response plans (i.e., emergency contact procedures, including MOECC Spills Action Centre, and response measures including containment and clean-up).

During construction, impacts on the wetland may occur as a result of:

- Change in surface water drainage to wetland, due to grading ahead of installation of LIDs and superpipes;
- Reduction in groundwater contributions to wetland due to potential pumping required to facilitate construction;
- Changes in the surface water outlet from the wetland associated with piping of the downstream channel; and
- Effects on water quality associated with runoff from urban areas to be addressed through an Erosion and Sediment Control (E&SC) Plan.

These impacts are expected to be temporary.

Wetland Buffers

Wetlands MAS2-1/MAS2-10, two units of MAM2-10 are associated with the riparian corridors of watercourses 5 and 6 and will not be directly impacted by the proposed development. They will be further protected with 7.5 m vegetated buffers.

MAM2-1 and one unit of MAM2-10 are associated with the riparian corridor of Tributary 4 just south of Flatt Road in a retained park block (Block TT). The watercourse channel will be protected from development and buffer widths will be dependent on the results of the geomorphic assessment which are ongoing. In addition, Matrix solutions is currently assessing the appropriate culvert sizing for the crossing of Tributary 4 at Flatt Road. Culvert sizing will have to be assessed and factored into future storm water management considerations in order to ensure there are no impacts to the existing hydrological regime associated with this wetland.

MAM2-2 which is located in the northeast portion of the Subject Lands will also be protected from direct impacts of development within Valley Land Block II which will be protected with a 7.5 m vegetated buffer.

6.1.2 Provincially Significant Woodlands and Other Retained Woodlands

The Subject Lands contain 63.9 ha of significant woodlands and the Draft Plan of Subdivision indicates that 6.68 ha of significant woodland will be removed to facilitate the proposed development.

Significant woodlands will therefore be directly impacted by vegetation removal during the construction process. Longer-term indirect effects on residual significant woodlands within the Subject Lands may occur due to the creation of new woodland edges following vegetation removal and potential slope stability issues.

Direct removal of significant woodlands can potentially result in negative impacts including overall reduction in significant woodland within the planning area and loss/reduction in the ecological, biophysical and economic functions provided by woodlands (e.g., significant or general wildlife habitat, SAR habitat, hydrological functions, erosion prevention, carbon sequestration, aesthetics).

Based on the current Draft Plan of Subdivision, the proposed encroachment into the significant woodlands can meet the test of no negative impacts, subject to a condition to develop and implement appropriate mitigation measures and/or compensation (e.g., plantings, buffer installation, off-site measures, etc.). Block I on the Draft Plan of Subdivision is 0.82 ha in size and has been identified as an area for potential restoration which can be used to mitigate some impacts associated with the removal of significant woodlands through restoration plantings. In addition, enhanced buffer plantings will provide 6.07 ha of additional woodland area within the Subject Lands. Other measures that can be considered include offsite restoration areas within the Grindstone Creek watershed.

6.1.3 Significant Wildlife Habitat

Confirmed Significant Wildlife Habitat present on the Subject Lands includes:

- Turtle wintering habitat within the former Taylor Pond/wetland identified as Reed Canary Grass Mineral Meadow Marsh (MAS2-1);
- Woodland amphibian breeding habitat is present within the Taylor pond/wetland at AMC 8 (**Figure 5**, **Appendix A**); and
- Habitat of Special Concern and provincially rare (S1-S3) species, including Eastern Wood-Pewee, Wood Thrush, Snapping Turtle, Butternut and Monarch was observed.

The potential impacts of the proposed development on each of these Significant Wildlife Habitat types, as well as any mitigation measures to prevent or minimize negative impacts, are discussed below.

Three areas of Eastern Wood-Pewee habitat are identified within retained woodlands within the Subject Lands: Two within the Grindstone Creek valley and one associated with an FOD2 woodland located on the former Taylor lands (**Figure 12**, **Appendix A**). Retained woodlands along the Grindstone Valley will be protected with a 15 m buffer (measured from staked dripline or staked top of bank, whichever is greater) and the woodland within the former Taylor Lands will be protected with a 7.5 m enhanced buffer (measured from staked dripline).

Wood Thrush habitat is identified within the retained woodland areas associated with the valley of Watercourse 6 (**Figure 12**, **Appendix A**). This woodland/valley feature will be protected with a 7.5 m buffer measured from staked top of bank or woodland dripline whichever is greater.

No impacts to the habitat for both Eastern Wood-Pewee and Wood Thrush are predicted. Vegetative plantings proposed within the enhanced buffer areas are anticipated to provide additional habitat and protection for these species.

One individual Monarch was observed to be feeding within a patch of *Phlox spp*. within a forested portion of the Subject Lands and was thought to be a migrant returning north. It is possible that Monarch may be using the Subject Lands for breeding as Common Milkweed is found along field edges throughout much of the site. However, based on the low numbers of this species observed, and the highly-disturbed nature of the Subject Lands (due to ongoing active farming activities within the open areas) this is not considered to represent significant habitat for this species. Therefore, this is not considered SWH for Monarch. Milkweed can be planted within the vegetated

buffers proposed along retained woodlands to enhance Monarch breeding habitat within the Subject Lands.

The MAS2-1/POND which is located at the southern boundary of the Subject Lands within the former Taylor lands contains wintering habitat for Snapping Turtle and woodland amphibian breeding habitat for Spring Peeper, Gray Tree frog and Green frog. This wetland/pond will be retained along with adjacent vegetation and protected with a 15 m enhanced buffer. Existing conditions surface water volumes will be maintained post-development through a split pipe system (See section 6.1.1). In addition, vegetation within the enhanced buffer planting area can be designed to enhance habitat needs for amphibian species to provide suitable overwintering/foraging opportunities and if feasible an area to accommodate a nesting beach for snapping turtles. It is recommended that enhancement measures be developed in cooperation, and with input from the CH.

6.1.4 Provincially Significant Valleylands

A valley associated with the Grindstone Creek watercourse corridor abuts the western boundary of the Subject Lands. The form and function of the Grindstone Creek valley will not be directly affected by the development. The proposed Draft Plan respects these valley areas.

The development footprint is outside the staked top of bank associated with the major valley of the Grindstone creek, which is further separated from the development by a 15 m vegetated buffer (**Figure 13**, **Appendix A**). None of the stormwater management ponds will outlet directly into the main Grindstone Creek valley. As well, a 7.5 m buffer is proposed between the staked top of bank of the minor valleys of tributaries 5 and 6 and all development areas (**Figure 13**, **Appendix A**).

6.1.5 Significant Areas of Natural and Scientific Interest

The Grindstone Creek Valley Life Science ANSI contains significant forest, valley lands, and fish habitat along with providing a natural corridor and winter habitat for a variety of wildlife. The best representation of the natural features associated with the ANSI are confined to the valley of Grindstone Creek. The Grindstone Creek Valley and associated ANSI will be protected from development and is identified as Valley Lands within Block A of the draft plan. In addition, the proposed draft plan provides for a 15 m vegetated buffer between the staked top of bank for the Grindstone Creek valley and the residential development and none of the stormwater management ponds will outlet directly into the main Grindstone Creek valley.

No direct impacts are anticipated to the valley from the proposed development. The valley walls of Grindstone Creek are steep and heavily vegetated; these characteristics will serve as a natural barrier to access by residents from the development. Appropriate access restrictions should be implemented where it is deemed beneficial to limit pedestrian and pet effects (e.g., through the use of native barrier plantings within the buffer area, fencing, signage and education materials).

The proposed draft plan will result in the removal of 0.66 ha of cultural woodland located on the tablelands adjacent to the valley but within the ANSI boundary. Impacts of this removal would be similar to those described to be associated with significant woodlands (section 6.1.2). As with significant woodlands this proposed encroachment into ANSI could meet the test of no negative

impacts, subject to developing and implementing appropriate mitigation measures and/or compensation (e.g., plantings, buffer installation, off-site measures, etc.). Block I on the Draft Plan of Subdivision is 0.82 ha in size and has been identified as an area for potential restoration which can be used to mitigate some impacts associated with the removal of this feature though proposed restoration plantings. Other measures that can be considered include offsite restoration areas within the Grindstone Creek watershed.

6.1.6 Habitat of Endangered and Threatened Species

Butternut

A total of 26 Category 1 trees, five Category 2 trees and six Category 3 trees were documented within the Subject Lands. The MNRF Butternut Recovery Strategy (2013) does not identify the critical habitat of this species, due to the diversity of suitable habitats, with the expectation that an appropriate level of habitat protection will be applied for the recovery of the species. Impacts to this species will be addressed under specific assessment by the MNRF through the SAR IGF process.

Eastern Flowering Dogwood

Eastern Flowering Dogwood is listed as Endangered in Ontario and Canada. Two Eastern Dogwood trees were observed within the valley associated with the east branch of Tributary 5 in 2013. Both trees are located outside of the development footprint (59 m and 128 m, respectively) and are within protected valleylands. No impacts to this species are anticipated as a result of the proposed development and impacts will be addressed under specific assessment by the MNRF through the SAR IGF process.

Barn Swallow and Chimney Swift

Barn Swallows and Chimney Swift were observed foraging over the Subject Lands. The removal of foraging habitat resulting from the conversion of the lands from open space agricultural lands to residential uses will be addressed under a specific assessment by MNRF, through the SAR IGF process.

Confirmed Barn Swallow nesting habitat was documented offsite at the Woodview Children's center. No impact to Barn Swallow nesting habitat is predicted as the Woodview Children's center is not proposed to be removed and is far from site alteration on the Subject Lands.

Bobolink and Eastern Meadowlark

Bobolink and Eastern Meadowlark were confirmed to be breeding within the Subject Lands in 2011 and 2012. Habitat for these species no longer exists due to agricultural row crop production. Therefore, there are no impacts predicted to these species as a result of the proposed development. The areas where these two species were observed in 2011 and 2012 no longer represent suitable habitat and there is no other suitable habitat for Bobolink or Eastern Meadowlark on the Subject Lands.

6.1.7 Fish/Aquatic Habitat

Potential effects on fish habitat that could occur from the proposed development include:

- Impaired fish habitat and/or negative impacts on aquatic biota (i.e., fish and benthic invertebrates), including deteriorated health or mortality, due to erosion and sedimentation from construction areas;
- Mortality or health impacts due to accidental spills of toxic materials during construction;
- Disturbance of fish due to in-water work associated with road crossings, sewer installation, SWM infrastructure and Tributary 4 channel realignment;
- Alterations and/or loss of direct and indirect fish habitat, and changes in fish passage potential due to Flatt Road widening and associated culvert extensions and installation of a new road crossing on Street C;
- Temporary and/or permanent alteration of fish habitat due to installation of the buried sewer line beneath Tributary 4;
- Alterations in watercourse water balance (e.g., timing and volume of flows) and associated negative impacts on fish habitat functions; and
- Long-term impairment of watercourse water quality (including chemical contaminants, solids and temperature) due to runoff from developed areas.

As noted in **Table 22**, avoidance and mitigation measures have been developed to prevent or minimize negative effects on fish and fish habitat. Key avoidance and mitigation measures to be implemented include:

- Preparation and implementation of an ESC plan to minimize the potential for negative impacts due to erosion from the construction site;
- Preparation and implementation of a spill prevention and response plan to prevent or minimize the potential for spills of potentially toxic materials during construction;
- Adherence to in-water work timing windows (i.e., no in-water work between March 15 and July 15) to prevent negative impacts on fish during critical reproductive periods;
- Implementation of setbacks (i.e., 15 m from Grindstone Creek top of bank/dripline and Taylor Pond and 7.5 m from the top of bank, dripline, floodplain and/or meander belt from Tributaries 4, 5 and 6) to prevent direct impacts on fish habitat and minimize potential indirect impacts;
- Use of appropriately sized open-bottom water crossing structures to minimize impacts on fish habitat and biophysical processes (e.g., flow conveyance and sediment transport) and enhance fish passage at existing crossings on Flatt Road;
- Use of directional drilling with appropriate contingency measures in place to install the sewer beneath Tributary 4 to prevent direct negative effects on fish habitat that could occur due to other installation methodologies (e.g., open-cut);

- Realignment of the upper headwater drainage feature reaches of Tributary 4 to maintain important hydrological functions to downstream fish habitat (i.e., through maintenance of an open channel conveyance system) with long-term enhancements due to improved stability and riparian function through vegetation planting; and
- Use of a variety of SWM and LID measures to ensure maintenance of critical water balance and water quality in tributaries providing direct or indirect fish habitat.

The primary potential long-term net effects on fish habitat will be the long-term presence of longer culverts on Flatt Road and the new Street C culvert and changes in stormwater discharge locations due to SWM infrastructure. The details associated with culverts and SWM discharge outlets (e.g., headwalls and discharge channels) will be confirmed during detailed design. It is recommended that impacts be discussed with CH and DFO to confirm permitting and additional mitigation and or compensation requirements under relevant legislation.

Maintenance of a suitable water balance through implementation of mitigation measures will be a key consideration to prevent impacts on fish habitat and associated functions necessary to maintain the local fish community.

Enhancements to fish habitat are expected due to potential improvements in fish passage potential at the Tributary 4 and 5 culverts on Flatt Road, improvements in the biophysical function of the upper reaches of Tributary 4 that will be realigned, and enhanced riparian function associated with vegetation restoration plantings within setback areas.

A variety of construction and post-construction monitoring programs are recommended to ensure that construction mitigation and post-construction enhancements have been installed and are functioning as designed and that no unanticipated impacts are occurring.

Provided the avoidance and mitigation recommended in this section and **Table 22** is implemented and that the detailed designs associated with infrastructure within or in close proximity to watercourses are discussed with CH and DFO, and any required permits or approvals are obtained (with any additional mitigation and/or compensation identified during the application processes being implemented), the effects on fish habitat are predicted to be avoided, mitigated or compensated for in accordance with all regulatory requirements.

6.1.8 Niagara Escarpment

As described in section 1.2.5 the Subject Lands are within the “North Aldershot Policy Area”, which permits the creation of new lots in accordance with the land use policies set out in the City of Burlington Official Plan.

The Draft Plan of subdivision will result in the removal of 3.76 ha of significant woodland (CUW1, CUT1-1 and FOD4-2 vegetation communities) within the designated Escarpment Protection Area. This area also contains a few existing residential dwellings on the west side of Horning Road adjacent to the Grindstone Creek Valley. Portions of the vegetation communities have already been affected by the introduction of the dwellings and associated human disturbance patterns. The FOD4-2 and CUW 1 vegetation communities throughout Southern Ontario, including the units on the Subject Lands, are being negatively affected by Emerald Ash Borer. This exotic pest is

causing high mortality of ash trees, favouring the spread of invasive species (e.g., European Buckthorn) in the understory.

Impacts of this removal would be similar to those described to be associated with significant woodlands (section 7.1.2). As with significant woodlands this proposed encroachment into an NEP key natural heritage feature could meet the test of no negative impacts, subject to developing and implementing appropriate mitigation measures and/or compensation (e.g., plantings, buffer installation, off-site measures, etc.). Block I on the Draft Plan of Subdivision is 0.82 ha in size and has been identified as an area for potential restoration which can be used to mitigate some impacts associated with the removal of this feature through proposed restoration plantings. Other measures that can be considered include offsite restoration areas within the Grindstone Creek watershed. Offsite habitat compensations could include the creation of early successional habitat. Exact habitat compensation opportunities will be discussed during the detailed design phase and in consultation with the appropriate agencies (NEC, CH and the Region).

Other key natural features and hydrologic features that were evaluated within the NEP area are associated with Grindstone Creek which abuts the western boundary of the Subject Lands and include: Fish habitat, Significant Valleyland and the Grindstone Creek key hydrologic feature. Each of these features is described in more detail in the paragraphs that follow.

Fish Habitat

No direct impacts to fish habitat are predicted as no storm water outlets are proposed to outlet into the Grindstone Creek valley (within and outside of the NEC area). Indirect effects are those potential effects on the biophysical environment outside of fish habitat, but that could potentially result in adverse effects on fish habitat. This could potentially include erosion from the work area with associated sedimentation in watercourses, water management practices during construction and accidental spills. Indirect effects and recommended mitigation measures to address impacts to fish habitat within Grindstone Creek are generally the same as those described in section 6.1.7.

Significant Valleylands

The form and function of the Grindstone Creek valley are not expected to sustain any direct effects associated with the development. The proposed Draft Plan respects these valley areas. The development footprint is outside the staked top of bank associated with the major valley of the Grindstone creek, which is further separated by Horning Road. None of the stormwater management ponds will outlet directly into the main Grindstone Creek valley (within or outside of the NEC area).

Grindstone Creek Hydrologic Feature

According to Section 6.3(a) of the NEP a proposal for development within 120 meters of hydrologic feature that has the potential to result in a negative impact on the feature and/or it's functions, a hydrologic evaluation will be required that demonstrates that the development will protect the key hydrologic features and functions including:

- Quality and quantity of groundwater and surface water;

- Natural streams or drainage patterns; and
- The overall water budget for the watershed, including existing and planned municipal drinking water systems.

In addition, Section 6.3(b) of the NEP identifies that planning, design and construction practices that will minimize erosion, sedimentation and the introduction of nutrients or pollutants and protect and where possible, enhance or restore the health, diversity and size of the key hydrologic feature. The SWM plan and FSR (MCI 2018) outlines the proposed stormwater management requirements, based on several objectives, including flood control, erosion prevention and quality control and how these objectives will be achieved within the Subject Lands through the design and implementation of the SWM plan. Indirect effects and recommended mitigation measures to address impacts (erosion control, sedimentation) are generally similar to those outlined for fish habitat described in section 7.1.3.2.

A preliminary water balance was available from MCI however it will be updated/revised pending the results of hydrogeological data currently being collected by Terra-Dynamics. Impacts to the Grindstone Creek hydrologic function will have to be reassessed pending the finalized stormwater management system and overall surface and groundwater balance.

6.1.9 Other Predicted Indirect Impacts

The proposed development in the principally open and agricultural areas of the Subject Lands will limit the potential for direct and/or cumulative effects. Potential indirect impacts and resultant effects may include:

- Noise, vibration and lighting and potential effects on wildlife behaviour and/or reproductive success (i.e., during construction and post development);
- Localized micro-drainage changes that could cause localized ponding and inundation of rooting systems;
- Introduction of non-native plant species in the disturbed margins of the developed footprint, displacing some native flora;
- Stress/dieback of retained vegetation along developed edges (root/stem/crown impacts, sediment); and
- Impacts on wildlife and plant populations associated with anticipated increased human and pet impacts on retained natural areas (i.e., due to off-leash pet cats and dogs).

Recommended Measures to Avoid and Mitigate Potential Effects

The extent to which construction will affect the edge conditions can be limited by the implementation of the following measures:

- Locate and flag development limits prior to construction;
- Pre-construction erection of erosion and sedimentation control fencing along confirmed protection edges and specific trees (at outer limit of the dripline) for proposed retention along the woodland edge closest to the development;
- Appropriate pre-construction briefing of site workers to advise regarding the sensitivity of the development edge conditions (i.e., SAR habitat, locally uncommon flora, etc.); and

- Matching of tree retention areas at existing grade (i.e., feathered grades from development edges).

Light Effects on Wildlife

Light impacts on nature has been the subject of extensive scientific study. Ecological light pollution may interrupt natural behaviors, expose individuals to higher predation levels, and/or disrupt navigational abilities. Most recently, evidence has pointed to the effects of light on pollinators, a group of species already under substantial pressure from the application of neonicotinoid pesticides on some crops and landscape stock (Knop et al 2017).

Primary sources for “new light” will be from road lighting. In particular, the use of larger light standards can be problematic by allowing light penetration into forested blocks, which could inhibit or affect wildlife use. The placement of rear lots or public parks close to natural areas can also introduce unwanted lighting.

To minimize light being directed into the adjacent ecological features, outdoor common area lighting should be located and directed away from the retained wooded areas. Public pathways should be discouraged in proximity to retained natural areas. Finally, to minimize impacts on birds, direct upward light should be eliminated, spill light should be minimized, and all lighting sources should illuminate only non-reflective surfaces (e.g., as per City of Toronto Green Development Standard, 2007).

Pet Impacts on Wildlife

Cat predation is the largest human-related source of bird mortality in Canada. There is a lack of data regarding cat mortality rates in Canada. However, Blancher (2013) presents rough estimates of pet cats in Canada at 8.5 million with another 1.4 million to 4.2 million feral cats. That research paper indicates that 2% to 7% of birds in southern Canada are killed each year by cats.

This is a challenging issue to manage and control, in part because of the magnitude of the problem and in part because of the human bond with pets and the belief by some owners that cats should be allowed to wander freely outdoors without controls.

Although predation and excrement associated impacts can be partially mitigated through effective animal control by-laws and enforcement, these impacts should be anticipated and either tolerated or regulated through on-going management and public education. Van Patter (2015) suggests a number of measures to manage feral populations, some of which would also be broadly applicable to housecats, e.g.:

- Outreach focused on preventing owned cat reproduction and abandonment;
- Programs to rehome feral cats; and
- Implement feral trap-neuter-return (TNR) in tandem with owned cat management (i.e., licensing, low cost spay/neuter).

Other activities and measures are suggested; in extreme circumstances, municipalities may deem it necessary to ban the ownership of predatory pets.

7.0 PREDICTED NET EFFECTS AND MONITORING

The work completed to date provides a baseline condition assessment from which to make predictions of the effects of development on the natural heritage features and associated functions within the Subject Lands.

With the impacts predicted and the implementation of the mitigation and restoration measures noted in section 6 and the detailed restoration plan that will be developed for the Subject Lands, the following are the predicted net effects from the proposed development within the Subject Lands. These and related mitigation and monitoring measures are listed on **Table 22**.

- Wetland features and functions will be better protected with restored buffers (e.g., reduced overland runoff into wetland features) and groundwater and surface water balance can be achieved;

- Grindstone Creek significant valleyland features and associated functions will be protected with the installation of a 15 m vegetated buffer;

- The restoration and creation of habitat will extend across the Subject Lands (i.e., better buffered woodland and wetland features) resulting in increased species diversity and a more robust NHS;

- No net negative effects will occur on Significant Wildlife Habitat;

- No net negative effects on fish habitat in Grindstone Creek and associated tributaries are predicted provided the avoidance and mitigation recommended in section 6.1.7 and **Table 22** is implemented and that the detailed designs associated with infrastructure within or in close proximity to watercourses are discussed with CH and DFO;

- Enhancements to fish habitat are expected due to potential improvements in fish passage potential at the Tributary 4 and 5 culverts on Flatt Road, improvements in the biophysical function of the upper reaches of Tributary 4 that will be realigned, and enhanced riparian function associated with vegetation restoration plantings within setback areas; and

- No net effects to SAR are predicted to occur and will be addressed through the SAR IGF.

Table 22: Predicted Effects, Mitigation, Enhancement and Net Effects

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
PPS NATURAL HERITAGE FEATURES						
1. Significant Wetlands	Not Present/ Not Applicable	N/A	N/A	N/A	N/A	N/A
2. Significant Coastal Wetlands	Not Present/ Not Applicable	N/A	N/A	N/A	N/A	N/A
3. Significant Woodlands	The following ecological land classification (ELC) vegetation communities were assessed to determine their significance on the landscape: CUP3-3, CUW1, CUW1-4, CUW1-5, FOD2, FOD3-1, FOD4-2, FOD4-4, FOD5-3, and FOD5-8. Woodlands on and adjacent to the Subject Lands have been identified as significant based on various criteria including size, interior habitat and the presence of watercourses and wetlands. A total of 63.9 ha of significant woodlands are identified on the Subject Lands. Some woodlands on and adjacent to the Subject Lands provide Significant Wildlife Habitat and habitat for endangered species.	Potential impacts to Significant Woodlands on the Subject Lands would include the following: • Vegetation clearing within significant woodlands to facilitate construction of the proposed development; • Development and site alteration adjacent to slopes within residual woodlands; • Increased pedestrian use of the woodlands; • Increase in lighting from residential development; and, • Construction activity adjacent to dripline.	The below noted effects to Significant Woodlands are predicted to occur should the site be developed: • Direct removal of 6.68 ha of significant woodland and associated loss of woodland function (e.g., wildlife habitat). • Potential effects on residual woodland due to clearing and site alteration. • Potential changes in form and function of residual woodland on and adjacent to the Subject Lands due to edge effects associated with removal of existing woodland area (e.g., sunscald, windthrow, increased light penetration). • Potential alterations in the significant of woodlands on the adjacent lands due to decrease in woodland size associated with removal of parts of the woodlands on the Subject Lands. • Potential alterations in water balance within the residual woodlands. • Wildlife disturbance due to increase in human access into the woodland - invasive species transport is likely. • Wildlife disturbance due to increase in light penetrating the woodland.	• The site plan generally respects the woodlands with a 15 m vegetated buffer zone along the Grindstone Valley and a minimum 7.5 buffer zone in other areas (measured from staked dripline or top of bank whichever is greater). There is a total of 6.68 ha (10% loss) of woodland removals in CUW1-5, CUW1, FOD4-2 and FOD5-3 vegetation communities. • Pre-stressing trees along the proposed new edge over a pre-construction period; • Trees removed from significant woodlands will be felled away from the retained woodland; • Tree protection measures (e.g., hoarding, temporary fencing at the dripline) may be used to avoid effects on residual woodland trees during construction; • Off-site compensation may be necessary to address predicted loss of significant woodland area on the Subject Lands. Conceptual restoration themes could include increasing size or enhancing linkage functions of adjacent woodlands; • Stormwater management should consider water balance needs of residual woodlands to ensure they are maintained; • Native plantings (shrubs and trees) will be planted within vegetated buffer zones. Native	• Permanent loss of 6.68 ha of Significant Woodlands on the Subject Lands; • Permanent increase in woodland area and/or function in off site woodlands if off-site compensation is undertaken;	• Monitor success of compensation restoration plantings and vegetated buffer zones to ensure no further impacts to existing Significant Woodlands.

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
			• Potential construction-related impacts from on-site grading and other machinery include: - Soil compaction and potential for micro-drainage changes that could cause localized ponding and inundation of rooting systems; - Introduction of non-native plant species I the disturbed margins of the developed footprint, displacing some native flora; and, - Stress/dieback (root impact, contaminants, increased sediment).	thorny shrubs (i.e. raspberry species) will be installed at strategic locations to discourage woodland access by humans; • New lighting along the streetscape will be directed away from natural vegetation communities to limit impacts to wildlife activity; • Tree protection fencing and erosion and sediment control measures will be installed adjacent to all natural heritage features to protect the integrity of the natural feature and aide in eliminating excess disturbance through vegetation removals, ground disturbance and dislodgement of sediment; • Where trees are proposed for removal, appropriate arboricultural best management practices should be utilized, and care should be taken to prevent damage to the trunks and root systems of nearby trees. Minimizing use of heavy equipment and will prevent inadvertent damage to retained woodlot features;		
4. Significant Valleylands	• Significant Valleyland is identified within the Grindstone Creek Valley.	• The form and function of Grindstone Creek Valley are not expected to sustain any direct effects associated with the proposed development. The development footprint is outside of the stable top of bank of the major valley of Grindstone Creek. • Potential impacts to the Significant Valleylands on the Subject Lands are all associated with construction activity adjacent to the staked top of bank features. • Large topographic relief is apparent between the tablelands (where development is proposed)	• No direct effects should occur to the valleyland features as they are outside of the development footprint and a 15 m vegetated buffers will be proposed along the valleylands to protect adjacent natural heritage features. • Potential alterations in water balance within the valley resulting in erosion.	• Stormwater management should consider water balance needs of residual woodlands to ensure they are maintained; • Erosion and sediment control measures should be placed along the valleylands to protect the features from increased erosion and soil mobility into the valleys and their associated tributary features. •	• No negative effects are anticipated.	• Construction monitoring to ensure the effectiveness and maintenance of the erosion and sediment control measures.

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
		and the creek itself. Therefore, it is assumed that the large topographic relief will discourage pedestrians from accessing the valley.				
5. Significant Wildlife Habitat	• The following SWH types are confirmed on the Subject Lands: - Turtle Wintering Area; - Woodland Amphibian Breeding Habitat; - Special Concern and Rare Wildlife Species: o Eastern Wood-Pewee Habitat; o Wood Thrush Habitat; and, o Snapping Turtle Habitat. • Turtle Wintering Area, Woodland Amphibian Breeding and Snapping Turtle SWH types were confirmed within Taylor Pond on the Taylor Lands. • Eastern Wood-Pewee and Wood Thrush habitats were confirmed within the Grindstone Creek Valley. • Wood Thrush habitat is confirmed within the minor valley associated with Tributary 6.	• No direct impacts are predicted to SHW as the development footprint will not encroach into areas identified as SWH within the Subject Lands. The proposed development will be set back a minimum of 38 m from the Taylor pond/wetland. The woodlands that contain habitat for Eastern Wood Pewee and Wood Thrush will be retained and will be protected with vegetated buffers. • Potential indirect impacts associated with the Taylor Pond (Turtle Wintering SWH, Woodland Amphibian SWH and Snapping Turtle) and Wood Thrush and Eastern Wood Pewee include: • Short-term Impacts (i.e., related to construction activities): - Increased soil disturbance (e.g., soil compaction or erosion); and, - Loud disturbances. • Long-term Impacts (i.e., related to residential development): - Increased pedestrian usage; - Introduction of pets; - Increased traffic; - Increased lighting; - Drainage, water balance, impacts to Taylor Pond's hydroperiods; and, - Water quality concerns within Taylor Pond.	There are no perceived direct effects associated with development near Taylor Pond that will affect the SWH types present. Indirect effects include: Indirect effects from short-term impacts include: (1) Increased soil disturbance: - Soil compaction reduces the pore space within the soils, limiting what plant species are able to root in the substrate; and, - Colonization of invasive species on disturbed soils. (2) Loud disturbances: - Disturbance of wildlife patterns and behaviours (i.e., interfere with breeding calls from amphibians and birds); and, - Temporarily vacate habitats near construction. Indirect effects from long-term impacts include: (1) Increased pedestrian usage: - Increased invasive species transport; and, - Degradation of surrounding vegetation. (2) Introduction of pets: - Predation of wildlife (e.g., turtle and bird nests). (3) Increased traffic:	• Tree protection fencing and erosion and sediment control measures will be installed along the northern side of Taylor Pond to protect the integrity of the natural feature and aide in eliminating excess disturbance through vegetation removals, ground disturbance and dislodgement of sediment. • Noise associated with construction is only temporary and will have short term impacts on wildlife behaviour. • Appropriate SWM and LID measures will be placed throughout the site to ensure water discharged into Taylor Pond will meet set water quality standards. • Native plantings (shrubs and trees) will be planted within vegetated buffer zones. Native thorny shrubs (e.g., raspberry species – *Rubus sp.)* will be installed at strategic locations to discourage woodland access by humans and their pets. • Signage adjacent to Grindstone Creek Valley and Taylor Pond will be installed outlining the importance of maintaining these natural heritage features undisturbed. It will encourage residents to keep all pets (including cats) on leashes when they are outside. • New lighting along the streetscape will be directed away from natural	• No negative effects are anticipated.	• Construction monitoring to ensure the effectiveness and maintenance of the erosion and sediment control measures.

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
			- Injury or mortality of wildlife crossing roadways; and, - Increased road runoff into Taylor Pond (decrease water quality). (4) Increased lighting: - Disrupt wildlife behaviours (i.e., encourage turtle hatchlings to move closer to the lights, disturb migration of food sources); and, - Shade tolerant vegetation unable to prosper in areas of intense light. (5) Drainage, water balance impacts to Taylor Pond's hydroperiods: - Pond may dry up before larvae transform or be unsuitable to provide overwintering habitat for amphibians and turtle species. (6) Water quality concerns within Taylor Pond: - Release of contaminants (i.e., sediments, high nutrient concentrations, gasoline, oil, road salt, etc.) which may harm or kill wildlife who live or use Taylor Pond to carry out certain life stages; and, - Increased algae growth within ponds, resulting in creation of an anoxic environment.	vegetation communities to limit impacts to wildlife activity.		
6. Fish Habitat	• Three tributaries of Grindstone Creek are present on the Eagle Heights Property north of Flatt Road: Tributary 4, Tributary 5 and Tributary 6. Tributaries 4 and 6 provide indirect fish habitat north of Flatt Road, while Tributary 5	• Earthworks (e.g., grading, filling) and vegetation removal on the Subject Lands in proximity to watercourses. • Use of heavy equipment during construction and associated potential for accidental spills of	• Erosion and sedimentation from the disturbed work area during construction could result in increased turbidity and suspended solids in watercourses. This could cause negative effects on fish habitat (e.g., infilling of interstitial	• Erosion and sedimentation control measures will be used throughout construction to avoid/minimize the potential for negative effects on fish habitat. • A spill prevention and response plan will be prepared and	• Potential for effects due to erosion and sedimentation and/or accidental spills will be minimized. • Temporary, localized effects on fish and fish habitat due to in-water work requirements. No	• A construction monitoring program will be developed and implemented to ensure that the ESC measures are installed correctly and maintained in good working order throughout construction

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	provides potential Type 4 Warmwater Baitfish Habitat, although fish are not known to have been observed in the reach north of Flatt Road. Tributaries 4 and 5 also run through portions of the Taylor Property south of Flatt Road. These reaches are considered to be Type 4 Warmwater Baitfish Habitat. • Grindstone Creek (Type 1 Coldwater Fish Habitat) flows through portions of the western end of the Subject Lands. Grindstone Creek supports a diverse resident fish community and spawning habitat for migratory salmonids from Lake Ontario. • A number of headwater drainage features are also present on the Subject Lands. These features drain into Tributaries 4, 5 or 6. None of these features provide direct fish habitat, but some provide contributing functions (e.g. hydrological contributions and water quality maintenance) for downstream fish communities.	potentially toxic materials (e.g., fuel, oil, hydraulic fluid). • Sanitary sewer crossing of Tributary 4 east of the Taylor Property. • Widening and raising the elevation of Flatt Road and installation of new culverts at the existing Tributary 4, 5 and 6 crossings. • Construction of a new road crossing (Street C) on the west branch of Tributary 5. • The realignment or removal of the following headwater drainage features recommended for Mitigation or No Management Required through the Headwater Drainage Feature Assessment (see Figure X, Appendix A): • Upper portions of Tributary 4 (headwater drainage features T4A1 through T4A5); • Upper portions of Tributary 6 branch (headwater drainage features T6A2 and T6A3); and, • Headwater drainage features T5A2 and T5A3 associated with the western and eastern branches of Tributary 5, respectively. • Changes in surface water runoff and groundwater infiltration due to increased imperviousness, with potential alterations in surface water quantity and quality in watercourses. • Construction and operation of stormwater management infrastructure (SWM Pond, superpipes and underground storage facilities), including outlets to watercourses. • Direct surface water runoff from portions of the development	spaces in gravelly riffles) and mortality, health effects or altered behaviour of aquatic biota (i.e., fish and benthic invertebrates) and aquatic vegetation. • Accidental spills during construction could impair water quality and have negative effects on aquatic biota and aquatic and riparian vegetation. • In-water construction associated with Flatt Road culvert replacements, Street C culvert installation, Tributary 4 realignment, headwater drainage feature removals and SWM infrastructure installation (as may be necessary for outlet structures) could result in disruption to fish within or downstream from the work area due to equipment presence, changes in flow and impacts on water quality. • Potential direct effects associated with Tributary 4 are as follows: • Extending the Flatt Road culvert could result in direct loss or alteration of fish habitat in the Tributary. However, installation of a new culvert may provide for upstream fish passage past Flatt Road (the existing culvert is perched and is a barrier to fish movement); • Realignment of the upper reaches of Tributary 4 (T4A1 through T4A4) upstream of Flatt Road may result in temporary effects on contributing habitat functions, but long-term improvements in productivity are anticipated due to realignment, restoration and downstream culvert improvements; • Removal of headwater drainage T4A5. The HDFA management	implemented to identify measures to avoid negative effects due to accidental spills during construction. • In-water work should be completed outside the warm water timing window specified by MNRF (March 15 to July 15), although some work in ephemeral or intermittent features may be possible during the window if the features are dry (subject to regulatory approvals and appropriate contingency plans). • A minimum setback of 15 m from the Grindstone Creek top of bank/dripline will be provided to protect coldwater fish communities. • A minimum setback of 7.5 m will be provided from the top of bank, dripline, floodplain and/or meander belt to minimize potential negative effects on fish habitat in Tributaries 4, 5 and 6. A 15 m setback will be provided from Taylor Pond. Setback areas will be vegetated to provide enhanced ecological functions. • It is anticipated that replacement culverts at Tributaries 4, 5 and 6 along Flatt Road will be open-bottom structures to improve habitat conditions and fish passage potential compared to existing corrugated steel plate culverts, although this will need to be confirmed during detailed design. Where possible, culvert extensions should occur upstream from Flatt Road instead of downstream, given higher sensitivity habitat downstream. • Realignment of the upper reaches of Tributary 4 assessed as requiring Mitigation under HDFA will ensure that hydrological	disruption during critical fish reproductive periods. • Net effects due to adjacent development minimized with proposed vegetated setbacks. • Alterations to fish habitat may occur due to Flatt Road culvert extensions and installation of the Street C crossing. Use of open-bottom structures may result in improvements to fish passage and biophysical functions compared to existing conditions along Flatt Road. Impacts and mitigation to be assessed during detailed design and permitting. • Realignment of upper reaches of Tributary 4 is anticipated to result in improved habitat conditions compared to existing degraded conditions associated with the eroded channel through the agricultural field. • No net effects on Tributary 4 are anticipated due to storm sewer installation following implementation of mitigation. • Water quality will be maintained or enhanced through treatment in LIDs and SWM infrastructure compared to runoff from existing agricultural fields. • No net effects on fish habitat are anticipated due to changes in surface water and groundwater conveyance and infiltration provided water balance is maintained through use of SWM and LID strategies.	• Monitoring of adherence to and effectiveness of the spill prevention and response measures is recommended throughout the construction period • Monitoring during in-water work to confirm mitigation is effective in preventing/minimizing negative effects • Post-construction monitoring of the realigned Tributary 4 channel should be conducted by a fluvial geomorphologist to ensure the channel is functioning as designed as designed and no unforeseen negative impacts are occurring • Monitoring of vegetation growth within areas of the riparian setback (where revegetation is required) is recommended to confirm form and functional objectives are satisfied

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
		abutting surface water drainage features (e.g., rear yards) and potential impacts on water quality.	recommendation for this reach was No Management Required, and therefore, it can be removed from the landscape with no predicted long-term negative effects; and • Potential construction effects to the watercourse and riparian vegetation associated with installation of the sanitary storm sewer crossing of Tributary 4 east of the Taylor Property. • Potential direct effects associated with Tributary 5 include the following: • Extending the Flatt Road culvert could result in direct loss of fish habitat in the tributary and effects on upstream fish passage at the road crossing; • Construction of the Street C road culvert could impact fish habitat in Tributary 5; and • Removal of headwater drainage features T5A2 and T5A3 from the landscape. Both features were assessed as No Management Required, therefore, they can be removed from the landscape with no predicted long-term negative effects • Potential direct effects associated with Tributary 6 include the following: • Widening of Flatt Road could potentially require filling within the Tributary 6 valley, which may have negative effects on fish habitat; • Extension of the Flatt Road culvert in an upstream direction will result in loss of some indirect fish habitat. No negative effects on long-term direct fish habitat are anticipated; and	functions are maintained. The realigned Tributary 4 channel should be stabilized prior to commissioning. Vegetation plantings adjacent to the channel and in the riparian area should be installed to provide enhanced riparian function compared to existing agricultural fields. • The sanitary sewer crossing of Tributary 4 will be installed by directional drilling beneath the watercourse. The crossing has been located at a former farm crossing to limit potential effects on undisturbed riparian and valley vegetation. Erosion and sedimentation and water management measures will be undertaken during installation of the sewer. • The removals of headwater drainage features that require mitigation (T4A1, T4A2, T4A3, T4A4, T6A2) requires the replication of their functions. Replication of their functions will occur through the implementation of LID and SWM measures. • The Street C road crossing will consist of an open bottom culvert. This reach is not anticipated to provide direct fish habitat. The open bottom culvert will maintain natural biophysical processes within the channel that will benefit downstream fish habitat. • Flatt Road widening in the vicinity of Tributary 6 is anticipated to preferentially occur on the south side of the road to prevent any requirement for filling or alteration of the Tributary 6 valley on the upstream side of the road. • Post-construction surface water will be conveyed through SWM ponds and underground storage		

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
			• Removals of headwater drainage features T6A2 and T6A3. Feature T6A3 was assessed as No Management Required, therefore it can be removed from the landscape with no predicted long-term negative effects. Feature T6A2 was assessed as requiring Mitigation, therefore it able to be removed but its hydrological functions must be replicated. • Alterations in water delivery (i.e., timing, volume of discharge) to the watercourses via surface and/or groundwater pathways due to changes in stormwater runoff and infiltration could potentially result in negative impacts on fish habitat. • Positive effects to surface water quality in the Tributaries could occur as the stormwater management infrastructure will reduce the total suspended solids prior to release into the creek, compared to existing surface water runoff from agricultural fields and highly disturbed areas. Effects on water temperature could occur due to SWM infrastructure. • Potential impacts on water quality due to runoff from residential rear yards and other areas abutting surface water drainage features.	chambers to provide enhanced quality control. SWM infrastructure will provide quantity and erosion control to minimize potential for negative impacts on receiving watercourses. • Underground storage chambers and superpipes will be used to manage the majority of stormwater on the Subject Lands, with only one surface pond being required. Potential for LIDs will also be examined during detailed design. Buried infrastructure will assist in mitigating water temperature increases in receiving watercourses. Opportunities to mitigation thermal effects of the SWM Pond will be examined during detailed design. • Water balance in tributaries should be maintained through a combination of traditional SWM infrastructure and LIDs where feasible to prevent negative impacts on fish habitat. This will have to be confirmed following completion of detailed water balance assessments. • SWM discharge infrastructure (e.g., outlet headwalls and discharge channels) should be designed to minimize negative impacts on instream and riparian habitat in watercourses. • Vegetation setbacks will assist in mitigating potential impaired quality of surface runoff from portions of lots draining via overland flow directly to watercourses.		
7. Habitat of Endangered and Threatened Species	• The following threatened and endangered species were observed within the Subject Lands: - Butternut;	• N/A	• N/A	• N/A	• N/A	• N/A

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	- Eastern Flowering Dogwood; - Barn Swallow; - Chimney Swift; and - Bobolink and Eastern Meadowlark. • Potential impacts to species at risk will be addressed directly with the MNRF through the Endangered Species Act *Information Gathering Form*.					
8. Significant Areas of Natural and Scientific Interest	• The Subject Lands are adjacent to the Grindstone Creek Valley ANSI. Limited site development or alteration will occur adjacent to the natural heritage features. Some site alteration will occur on actively farmed lands that are already disturbed. • Grindstone Creek Valley Life Science ANSI contains significant woodlands, valleylands and fish habitat. Associated impacts with these features are discussed at length in this table in sections 3, 4 and 6. • Grindstone Creek Valley provides a natural corridor for terrestrial, aquatic and semi-aquatic species. No development will occur within the valley system beyond the established top of bank. • Other ANSIs identified on **Figure 2** (**Appendix A**) are far removed from the Subject Lands, therefore, no impacts are anticipated.	• The proposed draft plan will result in the removal of 0.66 ha of cultural woodland located on the tablelands adjacent to the valley but within the ANSI boundary. Potential impacts include: • Development and site alteration adjacent to slopes within residual woodlands; • Increased pedestrian use of the woodlands; • Increase in lighting from residential development; and, • Construction activity adjacent to dripline.	• Direct removal of 0.66 ha of significant woodland and associated loss of woodland function (e.g., wildlife habitat). • The steep and heavily vegetated valley walls will serve as a barrier to residents trying to access the feature. • Indirect impacts are similar to those associated with Significant Woodlands and Significant Valleyland.	• The portions of the ANSI within the Grindstone Creek Valley will be protected with a 15 m vegetated buffer. • Off-site compensation may be necessary to address predicted loss of significant woodland within the tableland area of the ANSI. Conceptual restoration themes could include increasing size or enhancing linkage functions of adjacent woodlands.	• Permanent loss of 0.66 ha of Significant Woodlands in the ANSI. • Permanent increase in woodland area and/or function in offsite woodlands if off-site compensation is undertaken;	• Monitor success of compensation restoration plantings and vegetated buffer zones to ensure no further impacts to existing Significant Woodlands.
• <u>OTHER PROVINCIAL PLANS</u>						
1. Greenbelt Plan	• Grindstone Creek Valleylands are designated as Protected Countryside with the Greenbelt Planning Area. A portion of the Subject Lands that are adjacent to the Grindstone Creek Valleylands are also designated as Protected Countryside (see **Figure 2**,	• Potential impacts to the Greenbelt on the Subject Lands would include the following: • Vegetation clearing within a significant woodland identified as a key natural heritage feature to	• Direct removal of 0.16 ha of significant woodland in a key natural heritage feature of the Greenbelt and associated loss of woodland function (e.g., wildlife habitat). • The steep and heavily vegetated valley walls will serve as a barrier	• The majority of the Greenbelt is located within the Grindstone Creek Valley which will be protected with a 15 m vegetated buffer. • Off-site compensation may be necessary to address predicted loss of significant woodland within	• Permanent loss of 0.66 ha of Significant Woodlands in the Greenbelt. • Permanent increase in woodland area and/or function in offsite woodlands if off-site compensation is undertaken;	• Monitor success of compensation restoration plantings and vegetated buffer zones to ensure no further impacts to existing Significant Woodlands.

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	Appendix A). • The Draft Plan of subdivision will result in the removal 2.98 ha of active agricultural lands and will result in minor encroachment (0.16 ha) to the edges of a small Manitoba Maple cultural woodland (CUW1-5) which identified as significant woodland and a key natural heritage feature. The Grindstone Creek Valley will be protected with a 15 meter vegetated buffer and the retained portion of the woodland will be protected with a 7.5 m buffer measured from staked dripline.	facilitate construction of the proposed development; • Development and site alteration adjacent to slopes within residual woodlands; • Increased pedestrian use of the woodlands; • Increase in lighting from residential development; and, • Construction activity adjacent to dripline.	to residents trying to access the feature. • Indirect impacts are similar to those associated with Significant Woodlands and Significant Valleyland.	the tableland area of the Greenbelt. Conceptual restoration themes could include increasing size or enhancing linkage functions of adjacent woodlands.		
2. Oak Ridges Moraine	• The Subject Lands are located outside of the Oak Ridges Moraine	• N/A	• N/A	• N/A	• N/A	• N/A
3. Niagara Escarpment	• The northern most portion of the Subject Lands are designated as Escarpment Protection Area (see Figure 2, Appendix A).	• Proposed removal of 3.76 ha of Significant Woodland which is identified as a key natural heritage feature within the designated Escarpment Protection Area. • Indirect impacts to: • Significant Valleyland of Grindstone Creek; • Fish habitat in Grindstone Creek; and • Hydrologic function of Grindstone Creek. • Additional impacts associated with retained features would include the following: • Increased pedestrian use of the woodlands; • Increase in lighting from residential development; and, • Construction activity adjacent to dripline of Significant Woodland and Significant Valleyland Features.	• Direct removal of 3.76 ha of significant woodland in a key natural heritage feature within the Escarpment Protection Area and associated loss of woodland function (e.g., wildlife habitat). • No potential impacts to Grindstone Creek Significant Valley are anticipated. The development footprint is outside the staked top of bank associated with the major valley of the Grindstone creek, which is further separated by Horning Road. • None of the stormwater management ponds will outlet directly into the main Grindstone Creek valley. • No direct effects to fish habitat and the hydrologic function of Grindstone Creek are predicted with appropriate SWM design, surface and ground water balance and appropriate sediment control measures as described in the “Fish Habitat” section of this table.	• A total of 3.76 ha of Significant Woodland (CUW1, CUT1-1 and FOD4-2 vegetation communities) are proposed for removal from lands designated as Escarpment Protection Area. Portions of the vegetation communities have already been degraded from the introduction of the dwellings and associated human disturbance patterns. The FOD4-2 and CUW 1 vegetation communities throughout Southern Ontario, including the units on the Subject Lands, are being negatively affected by Emerald Ash Borer. Therefore, habitat available on site in these specific communities is predicted to degrade in future ecological value. • Off-site compensation may be necessary to address predicted loss of significant woodland within the tableland area of the Greenbelt. Conceptual restoration themes could include increasing	• No net effects on fish habitat or the hydrologic function of Grindstone Creek are anticipated due to changes in surface water and groundwater conveyance and infiltration provided water balance is maintained through use of SWM and LID strategies. • Permanent loss of 3.76 ha of Significant Woodlands in the Escarpment Protection Area. • Permanent increase in woodland area and/or function in off-site woodlands if off-site compensation is undertaken;	• Monitor success of compensation restoration plantings and vegetated buffer zones to ensure no further impacts to existing Significant Woodlands. • Construction monitoring to ensure the effectiveness and maintenance of the erosion and sediment control measures.

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
			• Additional impacts associated with retained features would include the following: • Increased pedestrian use of the woodlands; • Wildlife disturbance due to increase in human access into the woodland - invasive species transport is likely; • Wildlife disturbance due to increase in light penetrating the woodland; and • Construction activity adjacent to dripline of Significant Woodland. Potential construction-related impacts from on-site grading and other machinery include: - Soil compaction and potential for micro-drainage changes that could cause localized ponding and inundation of rooting systems; - Introduction of non-native plant species I the disturbed margins of the developed footprint, displacing some native flora; and, - Stress/dieback (root impact, contaminants, increased sediment).	size or enhancing linkage functions of adjacent woodlands.		
• OTHER FEATURES AND FUNCTIONS						
1. Other Wetlands	• A total of seven wetland vegetation communities are present on the Subject Lands: • Two small mineral meadow marsh (MAM2-10; Forb mineral meadow marsh) vegetation communities are associated with Tributary 6; • One mineral meadow marsh (MAM2-10/MAS2-1; Forb mineral meadow marsh/cattail mineral shallow marsh) wetland is	• While site alteration and development will occur near or adjacent to these wetland communities, no wetland removals will occur to accommodate the current draft plan. • Impacts associated with development near the wetland communities include: • Increase in pedestrian use.	• While there are no direct effects associated with the development, there are some indirect effects that should be accounted for, including: • Potential indirect effects due to erosion and sedimentation from the construction site could potentially result in impaired water quality within the wetland and	• The wetlands associated with Tributary 4 and the western branch of Tributary 5 will be well protected as they are deep within natural defined valleylands and/or significant woodland features and isolated from site alteration. • The wetland pocket near the eastern branch of Tributary 5 will have development adjacent to cultural meadow (CUM1-1) and cultural woodland (CUW1-	• No net effects on the wetland are anticipated to occur during construction provided the mitigation measures (ESC, spill prevent and response measures) are implemented. • No net effects on the wetlands due to adjacent development are anticipated provided that stormwater management and/or	• Monitoring during construction is recommended to confirm that erosion and sedimentation control measures and spill prevention and response measures are installed and functioning as designed. Remedial measures should be implemented as soon as possible if deficiencies or unanticipated negative effects are identified during monitoring

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	associated with the western branch of Tributary 5; • One mineral meadow marsh (MAM2-2; Reed-canary grass mineral meadow marsh) community is located near the eastern Tributary 5 branch; • Two mineral meadow marsh (MAS2-1/MAM2-10; Cattail mineral shallow marsh/forb mineral meadow marsh) wetlands are located within the floodplain of the southern extent of Tributary 4; and, • One cattail mineral shallow marsh (MAS2-1) is associated with Taylor Pond.	• Increased lighting from residential development. • Potential indirect effects due to construction of the proposed development adjacent to the wetland and increased impervious cover related to the installation of buildings, roads and parking areas adjacent to wetlands which may provide surface water to the wetlands. • Alteration to surface water inputs to the wetland due to alterations to the surface/ground water drainage patterns supporting the wetlands.	smothering of vegetation due to deposited sediment. • Accidental spills of potentially contaminating materials (e.g., fuel, oil) from construction equipment could potentially result in negative effects to vegetation and wildlife within and downstream from the wetland. • Alterations in surface and/or groundwater delivery to the wetlands due to changes in stormwater infiltration and runoff in the catchment area could potentially result in changes to the form and function of the wetland (i.e., reduction in habitat for species dependent on current moisture regime). Water balance investigations have been completed by MCI for Tributary 4 and its catchment (Taylor Pond) and Tributary 5 E (Metropolitan, 2018b). Results are discussed in Section 6.1.1 of the EIS. • Development impacts on groundwater fed wetlands within Tributary 5 W and Tributary 6 will be included in a future EIA appendix upon the completion of groundwater baseline monitoring and post-development modeling. • Wildlife disturbance due to increase in human access near the wetlands. • Disturbance near wetlands allowing for exotic and invasive species to colonize nearby lands. • Wildlife disturbance due to increased artificial light penetrating the wetlands.	4/CUW1) communities. Development of a cul-de-sac will occur 20 m away from the wetland, and 23 to 32 m away from residential backyards to the south and east, respectively. • The two meadow marsh communities associated with the floodplain of Tributary 4 will be retained and protected with 7.5 m vegetated buffer. • The cattail mineral shallow marsh is that is associated with Taylor Pond on the Taylor Lands will be protected by a 15 m vegetated buffer as this vegetation community hosts many amphibian, reptile and bird species including Snapping Turtle (listed as Special Concern in Ontario) and has great ecological value to its associated natural heritage system. • All vegetated buffers will consist of native shrub and tree species. Native thorny shrubs will be installed throughout the vegetated buffers to deter access to wetland communities. • Erosion and sedimentation control measures will be used throughout construction to avoid/minimize the potential for off-site sedimentation within the wetlands. • A spill prevention and response plan will be prepared to identify measures to avoid negative effects due to accidental spills during construction on the Subject Lands. • Stormwater management, potentially including Low Impact Development (LID) measures will be used to maintain water balance to the wetland (if necessary,	LID measures are effective in maintaining water balance.	• Monitoring of vegetation survival and growth within areas of the15 m buffer associated with the Taylor Pond that were planted to confirm targets for survival, vegetation species and form are met. • Post-construction monitoring of vegetation communities within the wetland is recommended to confirm that water balance is being maintained.

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
				based on results of water balance assessment). • Where possible, new lighting will be directed away from wetland communities. • Erosion and sediment control measures should be implemented to ensure no fine sediment is removed from or transported into any wetlands during the construction period.		
2. Regionally and Locally Important Species	• The following species are identified as being locally important (Varga 2005): • Tower-mustard (*Tumitis glabra)* – R3; • Virginia Knotweed (*Polygonum virginianum)* – R4; • Summer Grape (*Vitis aestivalis)* – R3; • Skunk-cabbage (*Symplocarpus foetidus)* – R2; and, • Drooping Sedge (*Carex prasina)* – R3. • Drooping Sedge and Skunk Cabbage were within protected Significant Valleylands and Significant Woodlands that will have protected vegetated buffers and are well removed from site alteration and development. Therefore, there is no impact anticipated with these plants. • Virginia Knotweed was observed abundantly throughout the site in deciduous forests. • Tower Mustard was only documented once during botanical inventories along the edge of forests adjacent to the northern agricultural field.	• The following impacts are perceived to affect Virginia Knotweed, Tower-mustard and Summer Grape: • Increased pedestrian use within habitat; • Increase in lighting from residential development; and, • Construction activity within vicinity of the species.	• The below noted effects are predicted to occur should site development and/or alteration occur: • Mortality due to increased stress or injury of the stems during construction. • Increased vectors for transference of the disease due to increased access to the general public; • Soil compaction and potential for micro-drainage changes that could cause localized ponding and inundation of rooting systems. Grading may also cause damage to rooting systems; • Loss of reproductive habitat; and, • Introduction of non-native and invasive plant species that may outcompete species.	• 6.07 ha of vegetated buffer zones are proposed along the edges of Significant Woodlands throughout the site, which will protect the ecological integrity of the woodlot and the overall health of the system. • Erosion and sediment control measures will be in place to protect Significant Woodland and Valleyland features on the site. • There are no anticipated negative impacts to the species populations.	• There are no anticipated negative impacts to the species populations.	• N/A

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	POTENTIAL IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	• Summer Grape was observed along the edge of FOD4-2 unit and along the northern edge of Flatt Road Extension.					
3. Environmentally Significant Areas	• Similarly, to the Grindstone Creek Valley ANSI, there is also a Grindstone Creek ESA with similar boundaries. Potential impacts and effects are discussed above in section 8 of this table. • Other ESAs identified on Figure 2 (Appendix A) are far removed from the Subject Lands, therefore, no impacts are anticipated.	• N/A	• N/A	• N/A	• N/A	• N/A
4. Other – Presence of Species under the ESA	• Not Present/ Not Applicable	• N/A	• N/A	• N/A	• N/A	• N/A
5. Other - Presence of Species Under the *Migratory Birds Convention Act*	• The federal *Migratory Birds Convention Act* (MBCA) prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests.	• During construction, in particular tree removal, migratory birds, and eggs and nests of these birds, could inadvertently be harmed.	• Inadvertent harm to migratory birds or their eggs or nests.	• Any tree or vegetation removal should occur outside of the migratory bird-nesting window of April 1 – July 31 (approximate). In rare circumstances where this window cannot be avoided, a nest search is recommended, and a buffer will be marked off surrounding any active nests that must be maintained until activity in the nest has ceased.	• With the implementation of the mitigation measures, no net effect is anticipated.	• None

8.0 CONCLUSIONS AND RECOMMENDATIONS

This EIA addresses the natural heritage features and associated functions on, and adjacent to, the Subject Lands. The proposed residential development and its potential direct and indirect impacts are identified along with recommendations regarding mitigation and enhancement measures and predicted residual effects.

The Subject Lands were investigated on various occasions by a team of ecologists between 2011 and 2017. Findings have been presented which characterize the Subject Lands in terms of ecological significance and which allow for an assessment of potential impacts in response to a detailed review of the proposed Draft Plan of Subdivision developed by Penta Properties Inc.

The majority of proposed residential development occurs in areas that are relatively open and/or have been subject to ongoing disturbance (i.e., agricultural lands). Development largely avoids areas determined to provide the greatest degree of ecological functions (i.e., Grindstone Valley, minor creek valleys, significant wildlife habitat).

The proposed Draft Plan of Subdivision does result in encroachment into natural features on the Subject Lands. Those encroachments are predicted to affect:

- Significant Woodlands; and
- NEC key natural heritage features.

There will be no direct encroachment into the former Taylor Pond unevaluated wetland and other unevaluated wetlands on the Subject Lands. A surface water balance for wetlands within Tributary 4 and its catchment (Taylor Pond) as well as Tributary 5 E was completed (Metropolitan Consulting 2018b). With the exception of the wetland associated with Taylor Pond proposed mitigation measures for spring surface runoff volumes under existing conditions are maintained post-development, and summer surface water volumes are increased (Tributary 4 MAM2-10; Tributary 5E MAM2-2) or decreased (Tributary 4 MAS2-1). Detailed topographic mapping of the wetland and floodplain and modelling would inform whether wetlands can be expected to grow in size and potential transition to a different vegetation community (i.e., from meadow marsh to mineral shallow marsh) where summer surface water volumes are increased post-development. This modeling may demonstrate that additional surface water volumes will not be attenuated within the wetlands but are discharged into the watercourse. A split pipe system is planned for the Taylor Pond wetland to maintain existing monthly surface water volumes post-development. Development impacts on groundwater fed wetlands within Tributary 5 W and Tributary 6 will be included in a future EIA appendix upon the completion of groundwater baseline monitoring and post-development modeling.

Implementation of the proposed development, as depicted on the Draft Plan of Subdivision will result in the removal of 6.68 ha of significant woodland; 3.76 ha within the NEC area. All other significant woodlands within the Subject Lands will be retained and protected with a vegetated buffer.

A number of detailed studies are being completed by other members of the applicant's consulting team related to final hydrology/stormwater management, updated geomorphological

assessments and hydrogeological assessments. The impact assessment presented in this report will benefit from a review of those studies to validate impact predictions and to supplement avoidance and mitigation measures to prevent or minimize negative impacts on the identified significant natural heritage features on or within 120 m of the Subject Lands.

The conclusions and recommendations in this EIA are based upon the conceptual level of development planning presented in this report and in the lack of detailed information regarding hydrogeological assessment and final stormwater management. As development discussions proceed and as plans are developed in more detail, predicted effects and detailed mitigation measures can be further considered as well as potential mitigation/compensation measures within and outside of the Subject Lands (i.e., offsite restoration opportunities).

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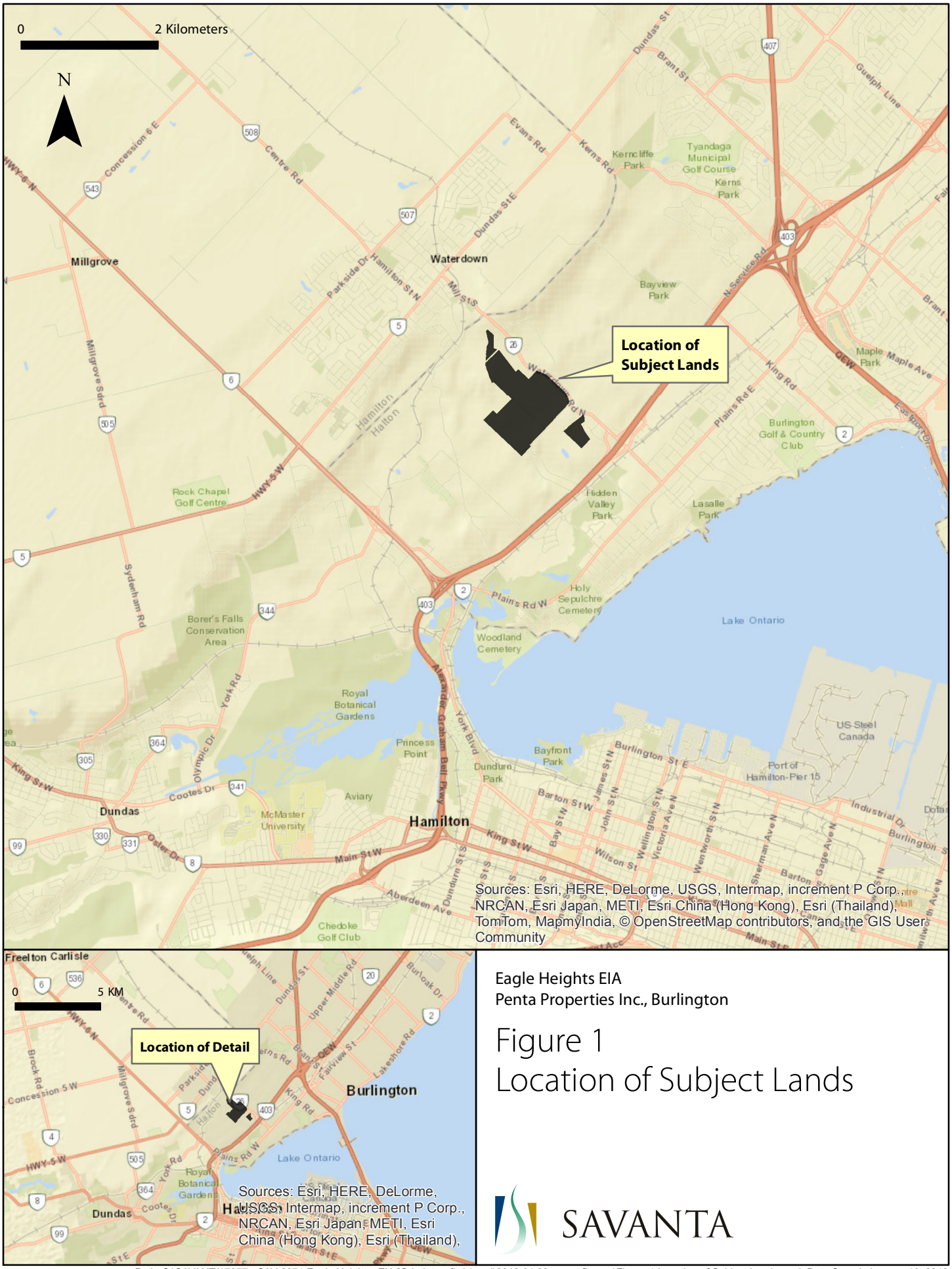
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APPENDICES

Appendix A – Figures

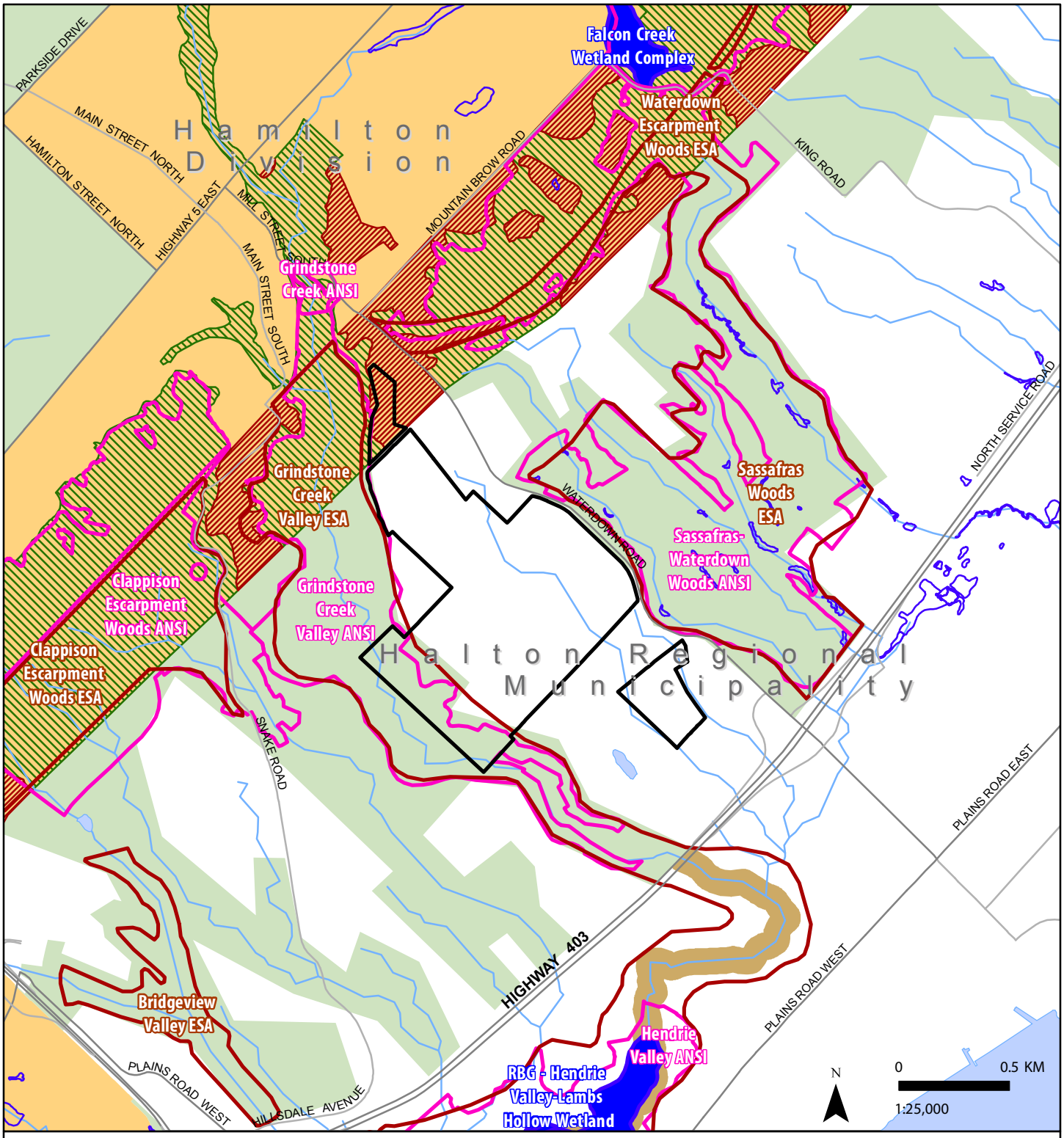


Eagle Heights EIA
Penta Properties Inc., Burlington

Figure 1
Location of Subject Lands

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Eagle Heights EIA
Penta Properties Inc., Burlington

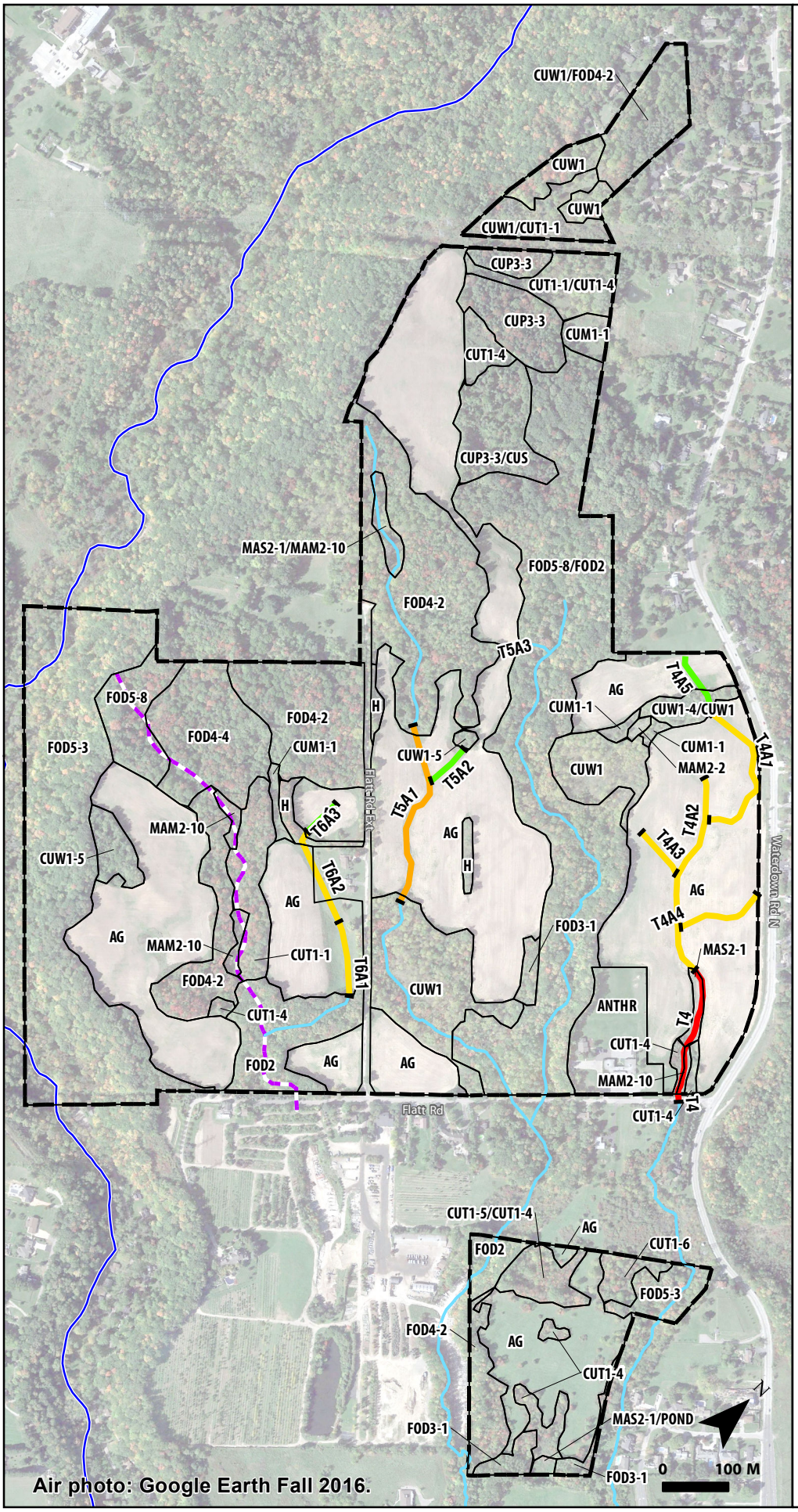
Figure 2
Landscape Context

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- Subject Lands
- ANSI (MNRF LIO)
- ESA (MNRF LIO)
- Waterbody (MNRF LIO)
- Watercourse (MNRF LIO)
- Wetland Evaluated-Provincial (MNRF LIO)
- Wetland not evaluated per OWES (MNRF LIO)
- NEP-Escarpment Natural
- NEP-Escarpment Protection
- Niagara Escarpment Plan
- Protected Countryside
- Urban River Valley

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Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
Ecological Land Classification
Watercourse

Management

Protection
Mitigation
Conservation
No Management

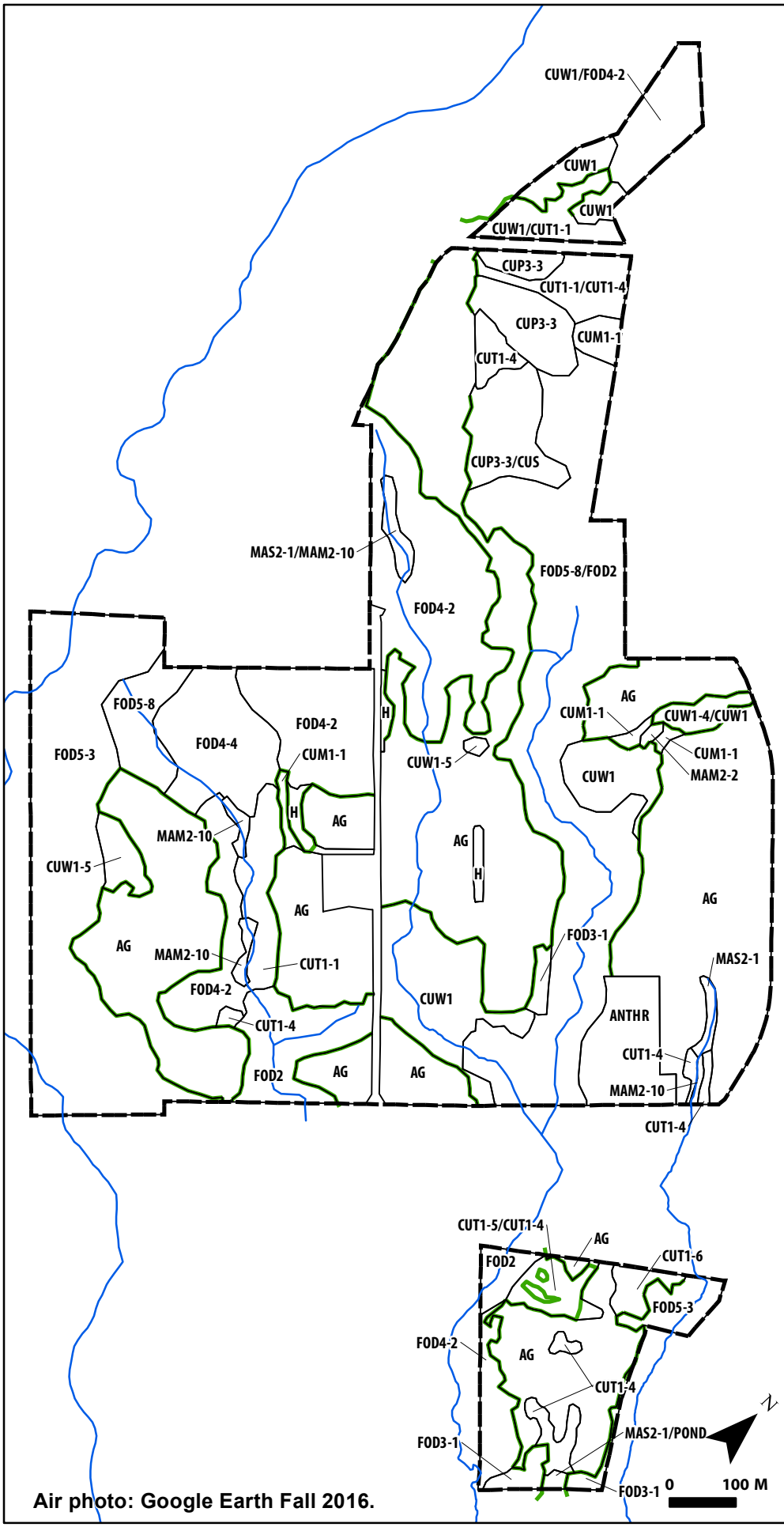
Habitat Classification

Type 1 Coldwater Fish Habitat
Type 4 Warmwater Baitfish Habitat
Type 4 Intermittent
Type 5 Altered Intermittent

Figure 3
Headwater Drainage Features

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Eagle Heights EIA
Penta Properties Inc., Burlington

ELC LEGEND

CULTURAL (CU)

CUP3-3	Scots Pine Coniferous Plantation
CUS	Cultural Savanna
CUW1*	Black Walnut-White Ash Cultural Woodland
CUW1-4*	Black Locust Cultural Woodland
CUW1-5*	Manitoba Maple Cultural Woodland
CUT1-1	Sumac Cultural Thicket
CUT1-4	Grey Dogwood Cultural Thicket
CUT1-5*	White Ash Cultural Thicket
CUT1-6*	Black Walnut Cultural Thicket
CUM1-1	Old Field Cultural Meadow

FOREST (FO)

FOD2	Dry-Fresh Oak-Maple-Hickory Deciduous Forest
FOD3-1	Dry-Fresh Poplar Deciduous Forest
FOD4-2	Dry-Fresh White Ash Deciduous Forest
FOD4-4*	Dry-Fresh Manitoba Maple Deciduous Forest
FOD5-3	Dry-Fresh Sugar Maple-Oak Deciduous Forest
FOD5-8	Dry-Fresh Sugar Maple-White Ash Deciduous Forest

MARSH (MA)

MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

**Not listed in Southern Ontario ELC Guide*

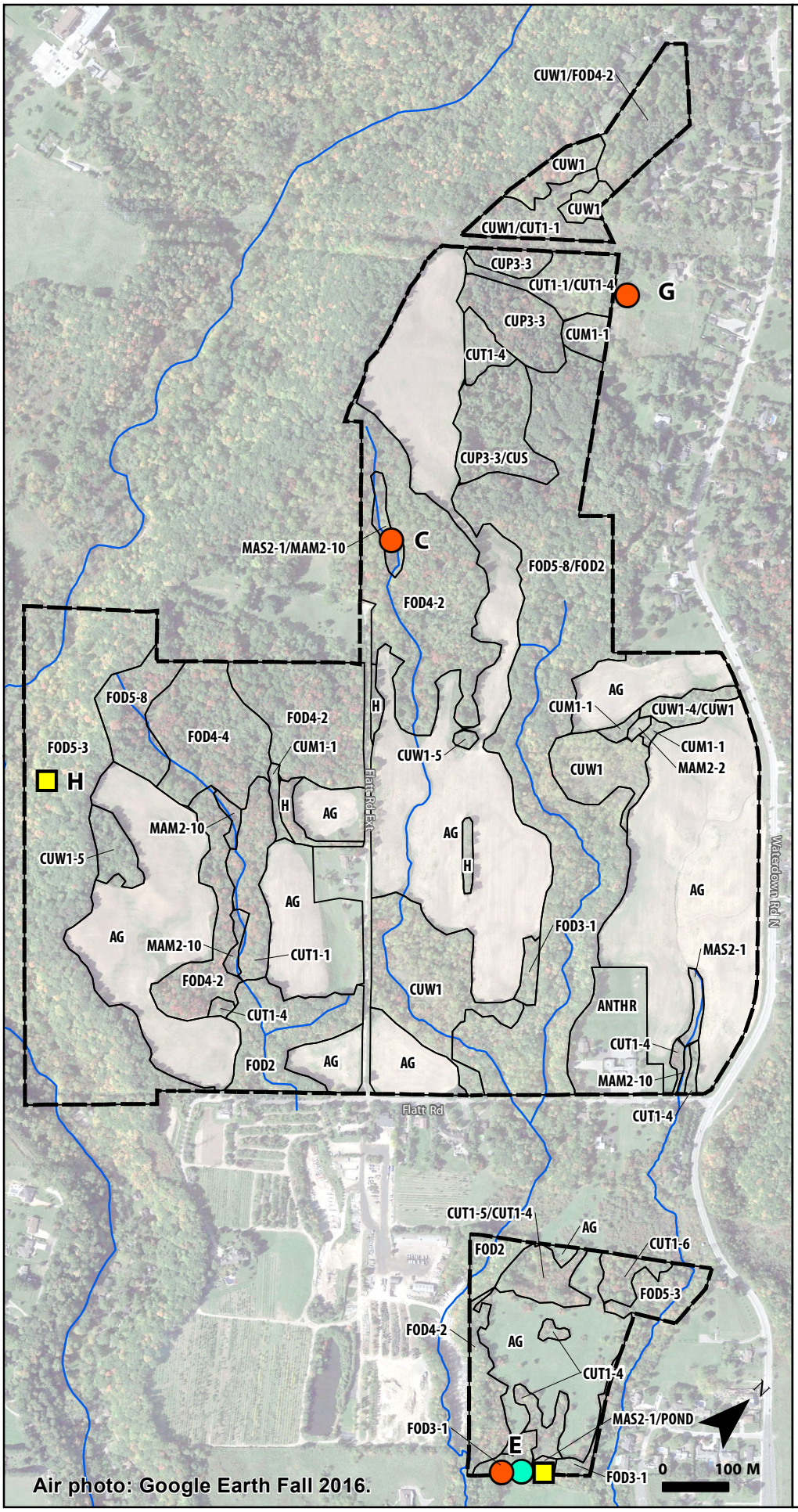
AG	Agricultural
ANTHR	Anthropogenic Use
H	Hedgerow

Subject Lands
Ecological Land Classification
Dripline (Staked 2015)
Watercourse

Figure 4
Ecological Land Classification

SAVANTA

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Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands

Watercourse

Amphibian Surveys

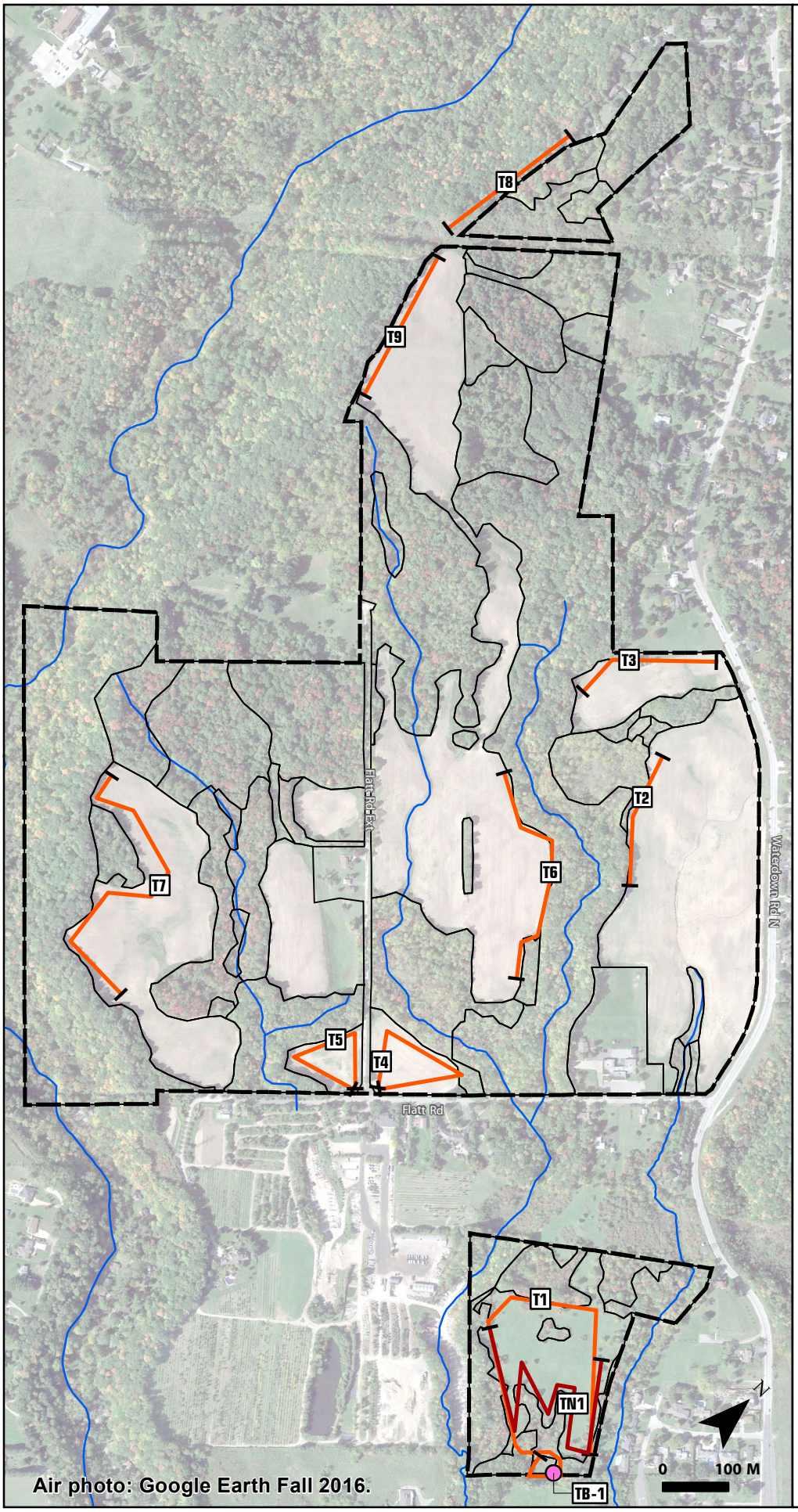
2014, Amphibian Call Count

2016, Amphibian Call Count

2016, Egg Mass Survey

Figure 5
Amphibian Survey Locations (2014, 2016)

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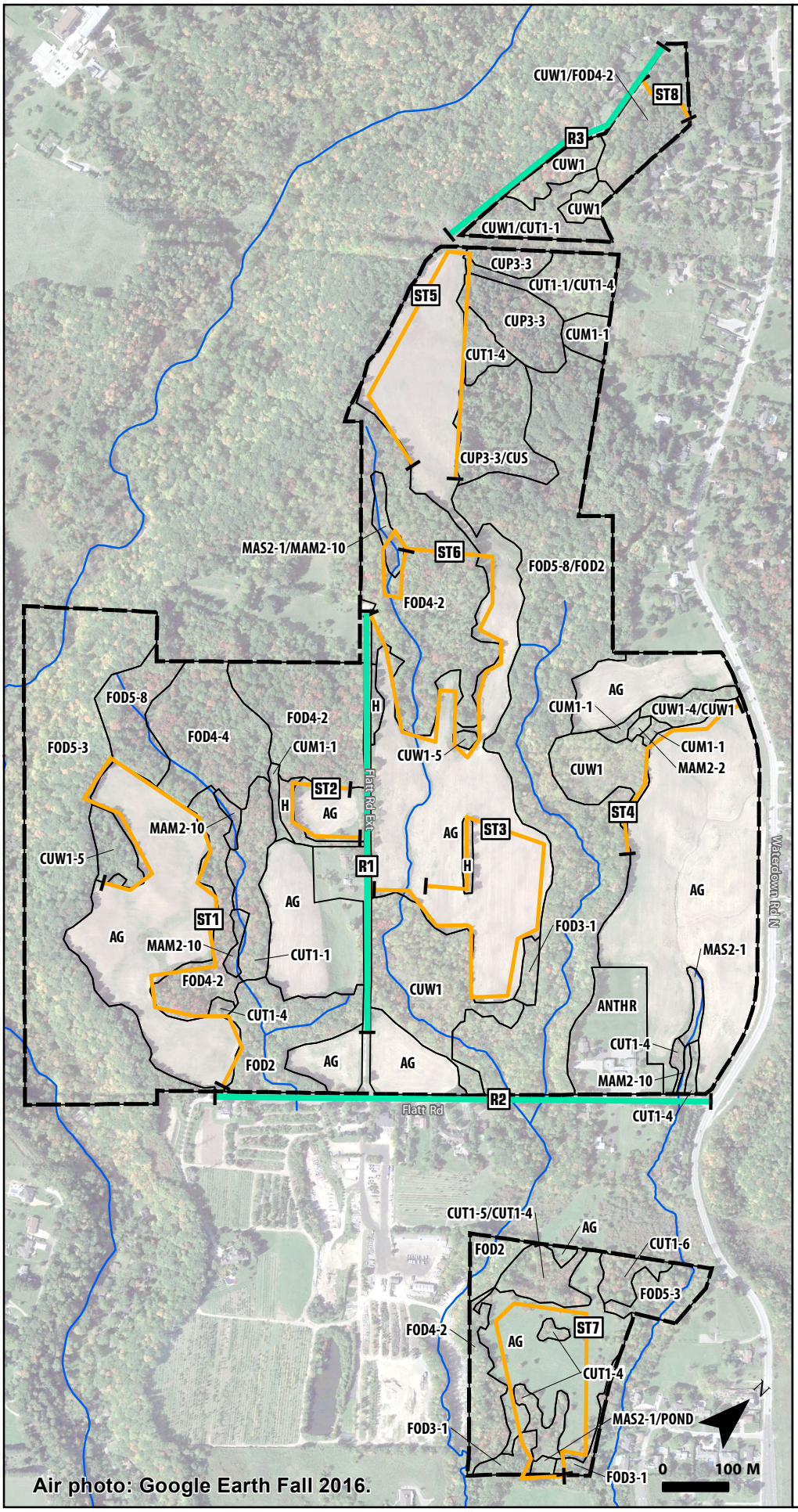
Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
T1 Turtle Nesting Transects (2014)
TN1 Turtle Nesting Transects (2016)
Watercourse
Turtle Basking Survey (2014/2016)

Figure 6
Turtle Survey Locations (2014/2016)

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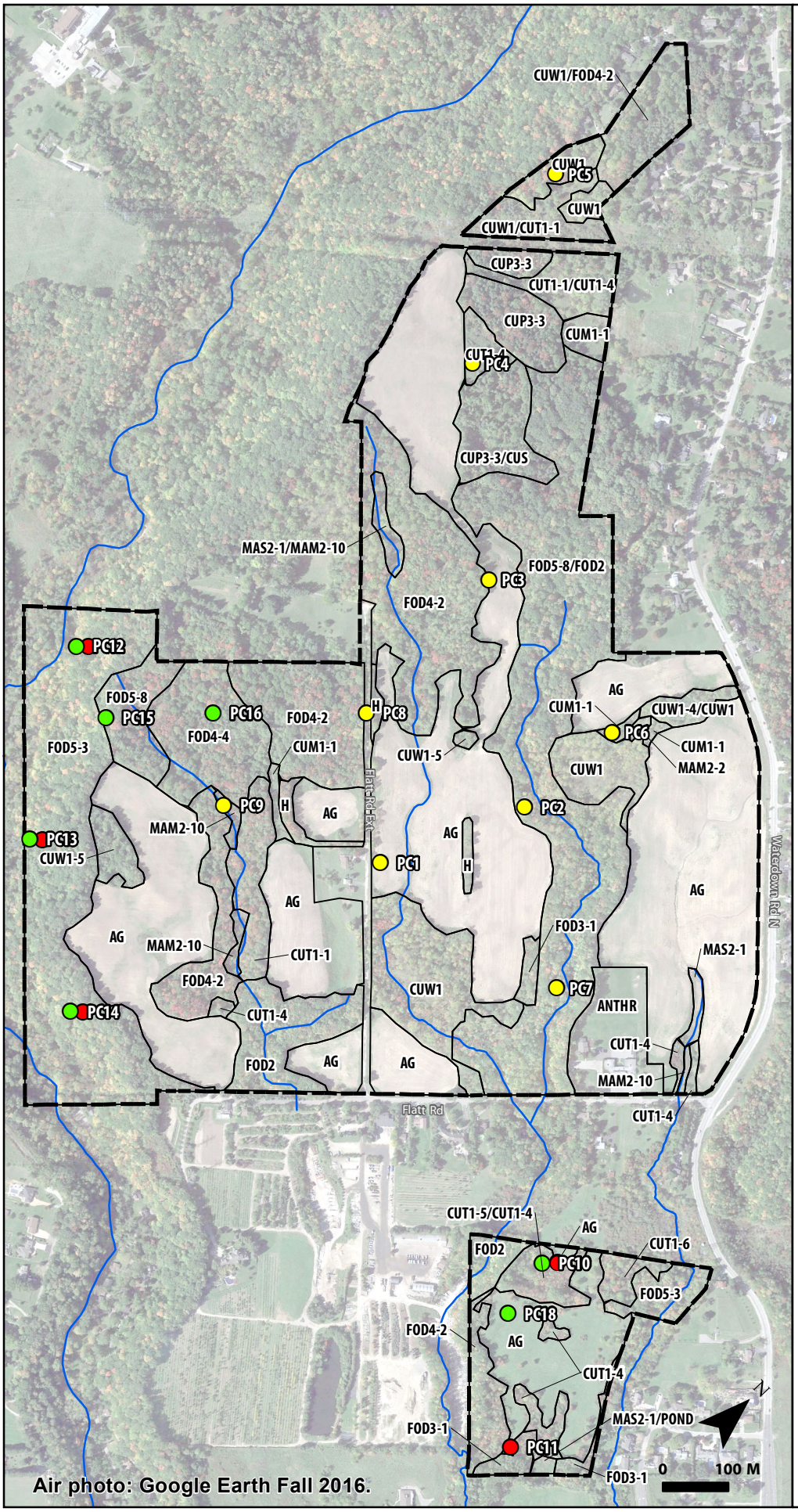
Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
Roadside Snake Transect
On-Site Snake Transect
Watercourse

Figure 7
Snake Survey Locations (2016)

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Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
Ecological Land Classification
Watercourse

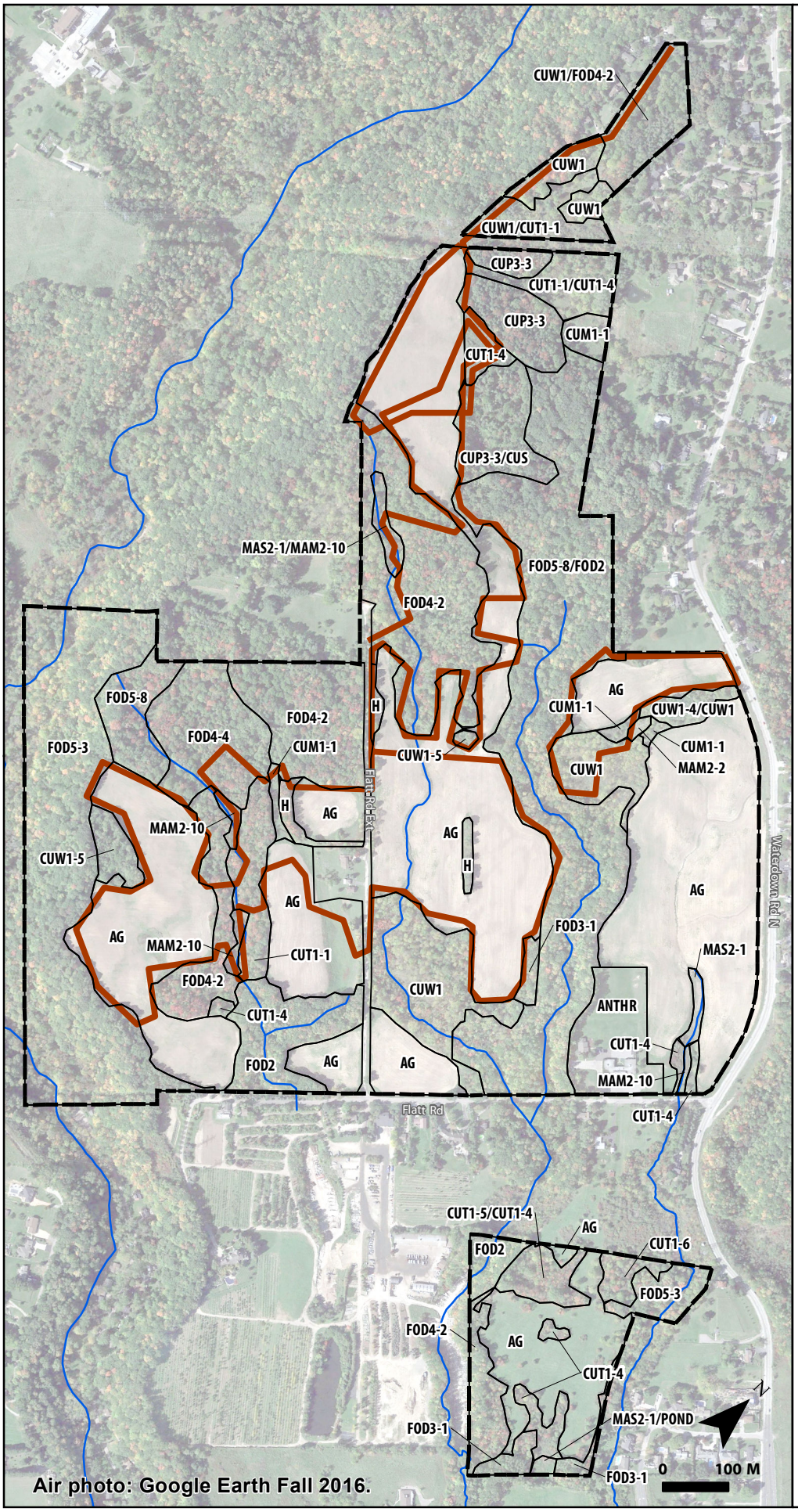
Breeding Bird Surveys

2012
2014
2015

Figure 8
Breeding Bird Surveys (2012, 2014, 2015)

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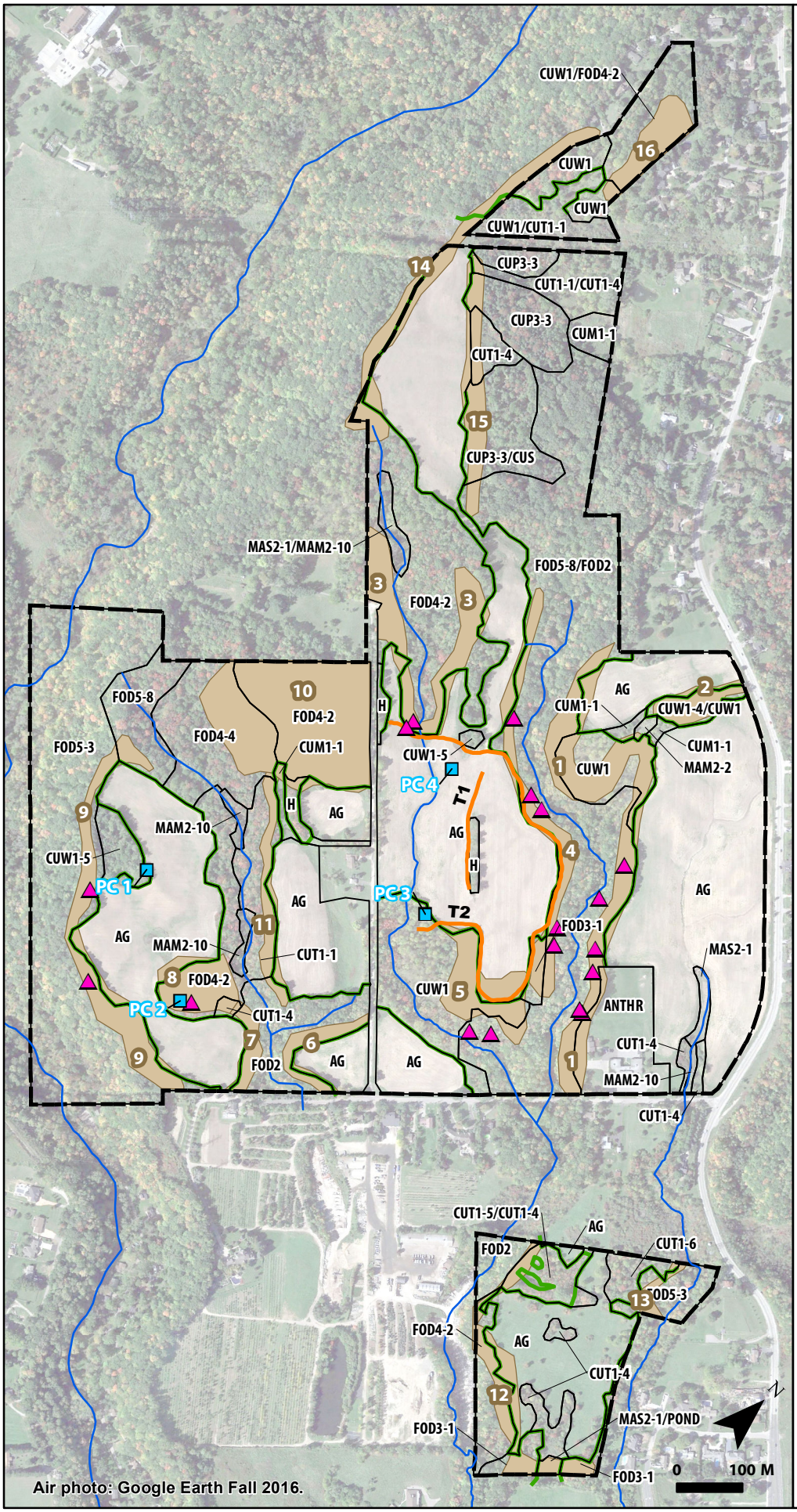
Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
Ecological Land Classification
Watercourse
Insect Area Search Transect

Figure 9
Insect Area Searches (2016)

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Eagle Heights EIA
Penta Properties Inc., Burlington

ELC LEGEND

CULTURAL (CU)

CUP3-3	Scots Pine Coniferous Plantation
CUS	Cultural Savanna
CUW1*	Black Walnut-White Ash Cultural Woodland
CUW1-4*	Black Locust Cultural Woodland
CUW1-5*	Manitoba Maple Cultural Woodland
CUT1-1	Sumac Cultural Thicket
CUT1-4	Grey Dogwood Cultural Thicket
CUT1-5*	White Ash Cultural Thicket
CUT1-6*	Black Walnut Cultural Thicket
CUM1-1	Old Field Cultural Meadow

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FOD2	Dry-Fresh Oak-Maple-Hickory Deciduous Forest
FOD3-1	Dry-Fresh Poplar Deciduous Forest
FOD4-2	Dry-Fresh White Ash Deciduous Forest
FOD4-4*	Dry-Fresh Manitoba Maple Deciduous Forest
FOD5-3	Dry-Fresh Sugar Maple-Oak Deciduous Forest
FOD5-8	Dry-Fresh Sugar Maple-White Ash Deciduous Forest

MARSH (MA)

MAM2-2	Reed-canary Grass Mineral Meadow Marsh
MAM2-10	Forb Mineral Meadow Marsh
MAS2-1	Cattail Mineral Shallow Marsh

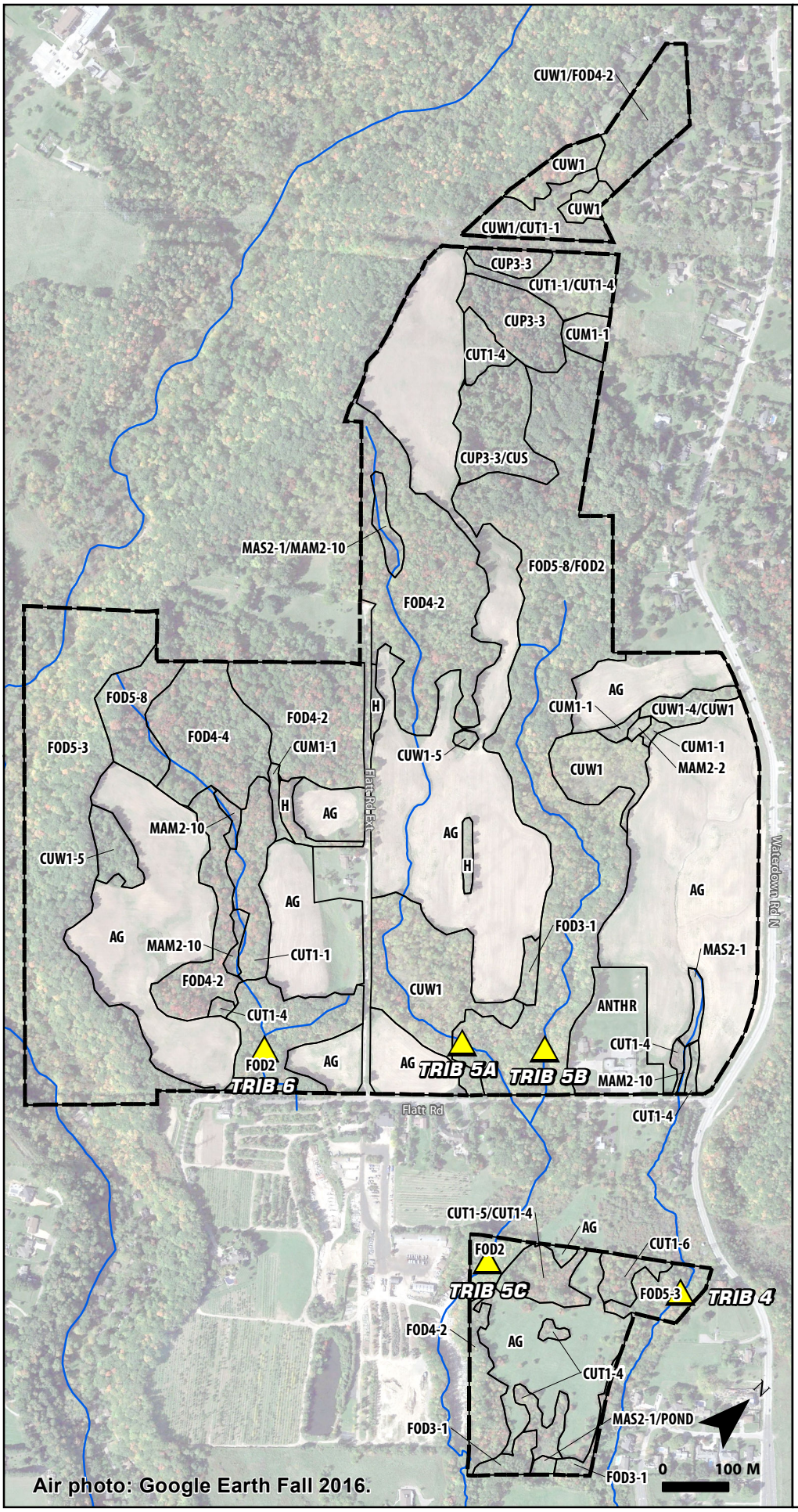
**Not listed in Southern Ontario ELC Guide*

AG	Agricultural
ANTHR	Anthropogenic Use
H	Hedgerow

Subject Lands
Ecological Land Classification
Dripline (Staked 2015)
Watercourse
Point Count Station
Snag Location
Transect Location
16 Snag Density Polygon

Figure 10
Bat Habitat Assessment and Acoustic Survey

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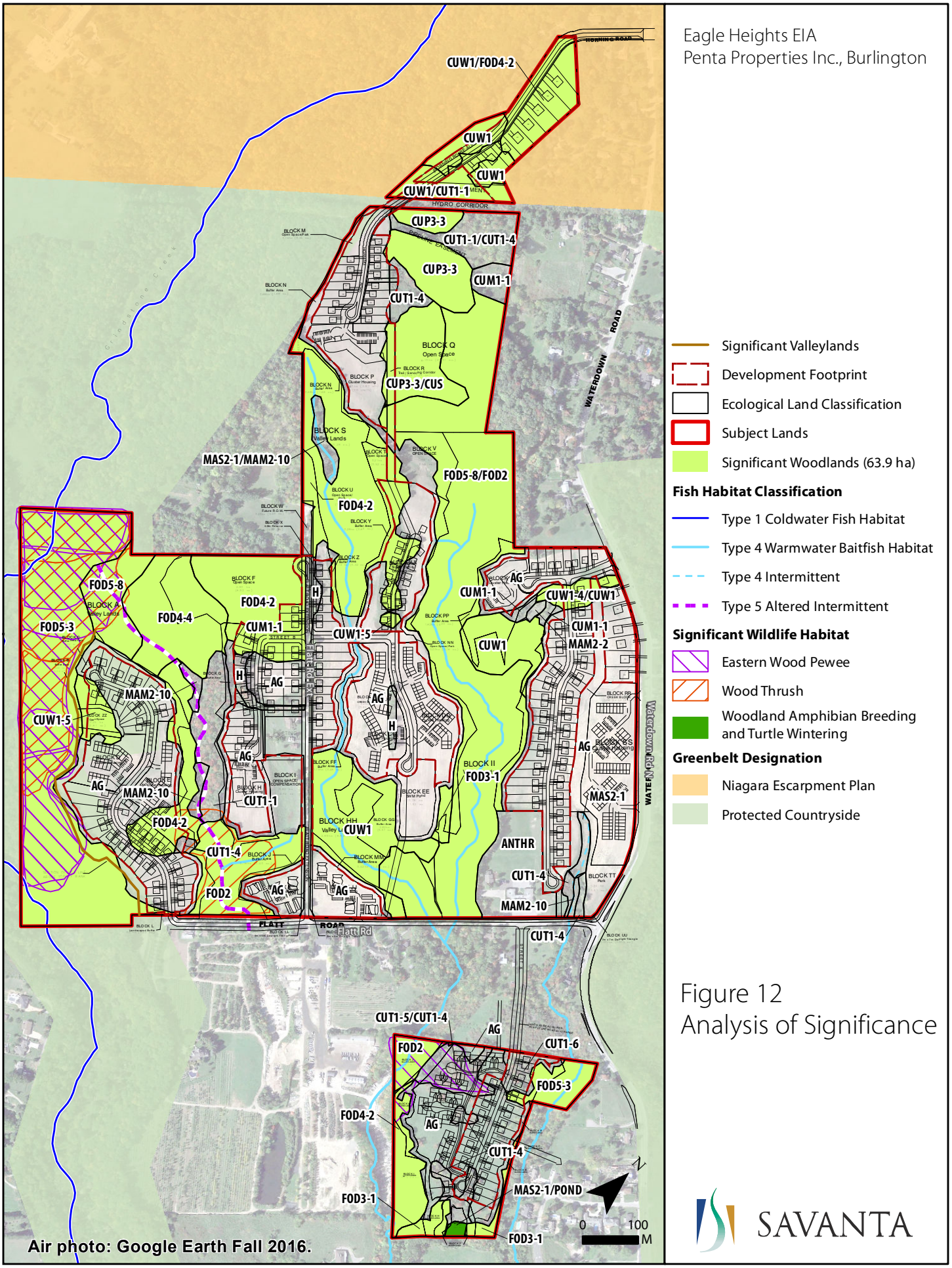
Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
Watercourse
Benthic Sampling Location

Figure 11
Benthic Sampling Locations

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Eagle Heights EIA
Penta Properties Inc., Burlington

- Significant Valleylands
- Development Footprint
- Ecological Land Classification
- Subject Lands
- Significant Woodlands (63.9 ha)

Fish Habitat Classification

- Type 1 Coldwater Fish Habitat
- Type 4 Warmwater Baitfish Habitat
- Type 4 Intermittent
- Type 5 Altered Intermittent

Significant Wildlife Habitat

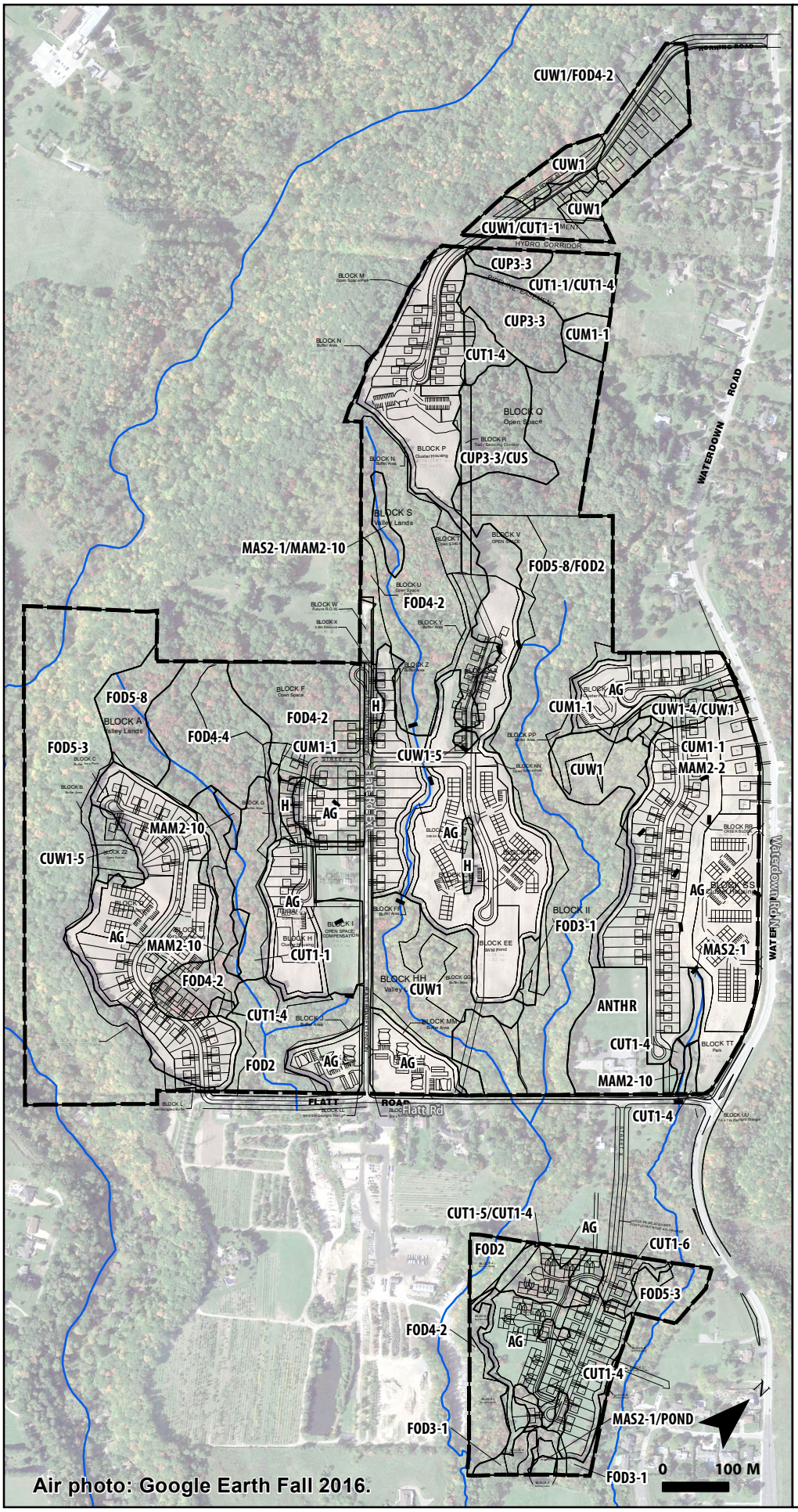
- Eastern Wood Pewee
- Wood Thrush
- Woodland Amphibian Breeding and Turtle Wintering

Greenbelt Designation

- Niagara Escarpment Plan
- Protected Countryside

Figure 12
Analysis of Significance

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Eagle Heights EIA
Penta Properties Inc., Burlington

Subject Lands
Ecological Land Classification
Watercourse

Figure 13
Draft Plan

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Appendix B – Tables

Table 1: Background Natural Heritage Data

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
A. NATURAL HERITAGE INFORMATION CENTRE (NHIC)							
Yellow-breasted Chat	*Icteria irens*	S2B	G5	END	END	17-JUN-2006	N
American Columbo	*Frasera caroliniensis*	S2	G5	END	END	02-JUN-2003	N
Meadow Evening Primrose	*Oenothera pilosella*	S2	G5			26-JUN-1977	N
Perfoliate Bellwort	*Uvularia perfoliata*	S1S2	G5			11-MAY-2001	N
American Chestnut	*Castanea dentata*	S1S2	G4	END	END	07-JUN-2011	N
Eastern Flowering Dogwood	*Cornus florida*	S2?	G5	END	END	00-JUN-2011	N
Eastern Milksnake	*Lampropeltis triangulum*	S4	G5	NAR	SC	XX-APR-1987	N
Butternut	*Juglans cinerea*	S2?	G4	END	END	15-JUN-1996	N
Bobolink	*Dolichonyx oryzivorus*	S4B	G5	THR	THR	03-JUN-2005	N
Forked Panicgrass	*Dichanthelium dichotomum*	S2	G5T5			XX-XXX-1989	N
Cerulean Warbler	*Setophaga cerulean*	S3B	G4	THR	END	03-JUN-2015	N
Eastern Green-violet	*Hybanthus concolor*	S2	G5			29-SEP-1969	N
Red Mulberry	*Morus rubra*	S2	G5	END	END	12-NOV-2000	N
Eastern Meadowlark	*Sturnella magna*	S4B	G5	THR	THR	04-JUN-2001	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
B. ONTARIO BREEDING BIRD ATLAS (OBBA)							
Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC		N
Wood Thrush	*Hylocichla mustelina*	S4B	G5	SC	THR		N
Chimney Swift	*Chaetura pelagica*	G5	S4B, S4N	THR	THR		N
Red-headed Woodpecker	*Melanerpes erythrocephalus*	G5	S4B	SC	THR		N
Barn Swallow	*Hirundo rustica*	G5	S4B	THR	THR		N
Golden-winged Warbler	*Vermivora chrysoptera*	S4B	G4	SC	THR		N
Least Bittern	*Ixobrychus exilis*	S4B	G5	THR	THR		N
Peregrine Falcon	*Falco peregrinus*	S3B	G4	SC	SC		N
C. ONTARIO NATURE HERPETOLOGY ATLAS							
Snapping Turtle	*Chelydra serpentina*	S3	G5	SC	SC	12-SEP-2017	N
Northern Map Turtle	*Graptemys geographica*	S3	G5	SC	SC	21-JUL-2017	N
Western Chorus Frog (Great Lakes/St. Lawrence – Canadian Shield Population)	*Pseudacris triseriata*	S3	G5	NAR	THR	27-MAY-2007	N
Blanding's Turtle	*Emydoidea blandingii*	S3	G4	THR	THR	17-APR-2017	N
Jefferson Salamander	*Ambystoma jeffersonianum*	S2	G4	END	END	XX-XXX-2007	N

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSEWIC	Last Observed	Extirpated
D. ONTARIO BUTTERFLY ATLAS							
Monarch	*Danaus plexippus*	S2N, S4B	G5	SC	END	22-NOV-2017	N
Mottled Duskywing	*Erynnis martialis*	S2	G3	NR	END	08-JUN-2012	N

Table 2: Savanta Field Studies and Natural Inventories (2015, 2016, 2017)

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
2013		
January 14	Tree Density Survey	G. Buckton
March 28	Salamander Emergence Survey	G. Buckton
April 16	Site Visit with Conservation Halton and Halton Region	G. Buckton H. Davis
June 12	Salamander Risk Assessment Survey	G. Buckton S. Catton
July 11	Butternut Health Assessment	G. Buckton H. Whitehouse
July 17	Agency Site Visit with MCI, MNRF, Region of Halton, Conservation Halton, the Niagara Escarpment Commission and the City of Burlington	S. Catton S. Geddes H. Whitehouse A. Zimic C. Zoladeski
August 9	Site Visit with MNRF Regarding Eastern Flowering Dogwood and Jefferson Salamander Butternut Site Visit with MNRF	S. Catton H. Whitehouse A. Zimic
August 20	Top of Bank Staking with MCI, Ecoplans, City of Burlington and Conservation Halton	S. Catton H. Davis G. Buckton
2014		
March 13, 14	Winter Wildlife Survey	H. Davis A. Zimic
April 29	Amphibian Call Count Survey Round 1	C. Zoladeski
May 1	Headwater Drainage Feature Assessment Round 1	M. Adamson O. Park

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
May 16	Turtle Basking Survey	H. Davis A. Zimic
May 27	Headwater Drainage Feature Assessment Round 2	M. Adamson S. Geddes O. Park
June 13	Amphibian Call Count Survey Round 2	C. Zoladeski
June 13	Breeding Bird Survey Round 1	P. Burke
June 13	Turtle Nesting Survey	H. Davis R. Lee
June 27	Breeding Bird Survey Round 2	P. Burke O. Park
June 30	Benthic Invertebrate Survey	C. Kerling
August 7	Site Visit to Review Sewer Easement	S. Geddes
August 11	Headwater Drainage Feature Assessment Round 3	M. Adamson O. Park
August 26	Pre-wetland Staking Exercise at Taylor Pond	C. Zoladeski
August 28	Staking of Taylor Wetland with Conservation Halton	A. Zimic C. Zoladeski
2015		
June 2	Breeding Bird Survey Round 1	P. Burke O. Park
June 19	Breeding Bird Survey Round 2	T. Lucas
July 5	Breeding Bird Survey Round 3	L. Foerster
July 31	Pre-dripline Staking Exercise	R. Lee J. Hilditch O. Park C. Zoladeski

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
August 4	Woodland Dripline Staking	R. Lee C. Zoladeski
August 13	Top of Bank Staking with MCI, Conservation Halton and City of Burlington	T. Hilditch A. Mochrie O. Park
September 25	Top of Bank Staking with MCI and Conservation Halton	A. Mochrie
October 2	Vegetation Site Assessment	J. Leslie
October 7	Top of Bank Staking with Conservation Halton and MCI	A. Mochrie
October 9	Top of Bank Staking with Conservation Halton, City of Burlington, MMM and MCI	A. Mochrie
November 4	Dripline Staking on Taylor Lands with Conservation Halton	A. Mochrie
November 6	Staked Dripline on Taylor Lands	C. Zoladeski
2016		
March 17	Amphibian Call Count Survey Round 1	C. Collinson C. Zoladeski
April 29	Amphibian Egg Mass Survey Round 1 Reptile Survey Round 1	P. Burke H. Davis
May 9	Reptile Survey Round 2	J. Leslie
May 10	Reptile Survey Round 3	P. Burke
May 16	Bat Snag Density Surveys	E. Lee O. Park
May 20	Amphibian Call Count Survey Round 2	C. Zoladeski
May 24	Amphibian Egg Mass Survey Round 2	C. Collinson E. Lee
June 2	Turtle Nesting Survey	R. Lee M. Green
June 9	Insect Survey Round 1	P. Burke

FIELD DATE	NATURE OF INVESTIGATION	SURVEYOR
		M. Green
June 15	Spring Botanical Inventory	C. Zoladeski
June 21	Amphibian Egg Mass Survey Round 3 Amphibian Call Count Survey Round 3 Acoustic Bat Monitoring Round 1	C. Collinson J. Hilditch O. Park
June 24	Insect Survey Round 2	P. Burke
June 24	Acoustic Bat Monitoring Round 2	C. Collinson J. Hilditch O. Park
June 29	Acoustic Bat Monitoring Round 3	J. Hilditch O. Park
July 19	Summer Botanical Inventory	C. Zoladeski
August 22	Insect Survey Round 3	P. Burke
August 24	Butternut Health Assessment	J. Leslie
September 1	Watercourse Assessment	N. Boucher A. Zimic
September 15	Fall Reptile Survey Round 2	C. Collinson M. Green
September 16	Fall Reptile Survey Round 2	H. Davis O. Park
October 19	Fall Botanical Survey	C. Zoladeski
2017		
August 8	Site Assessment	C. Zoladeski

Table 3: Ecological Landscape Classification (ELC) Community Descriptions

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK/ G-RANK (NHIC, 2013)
FOREST		
Deciduous Forest		
FOD2 Dry-Fresh Oak-Maple-Hickory Deciduous Forest	• This forest type is dominant on the steep slopes of the northern portion of the main ravine between Flatt Road Extension and Waterdown Road and is the main community in a smaller ravine woodlot in the corner of Flatt Road Extension and Flatt Road. • Sugar Maple (*Acer saccharum*), Red Oak (*Quercus rubra*) and Shagbark Hickory (*Carya ovata*) are the main tree species, followed by White Pine (*Pinus strobus*). • Chokecherry (*Prunus virginiana*) is the main understory shrub. • The herbaceous layer is dominated by Herb Robert (*Geranium robertianum*) and Enchanter's Nightshade (*Circaea lutetiana*).	S5
FOD3-1 Dry-Fresh Poplar Deciduous Forest	• Young stands of Trembling (*Populus tremuloides*) and Large-tooth Aspen (*P. grandidentata*), with occasional larger trees of Red Oak and Sugar Maple. • Dense shrub cover of Gray Dogwood (*Cornus foemina*).	S5
FOD4-2 Dry-Fresh White Ash Deciduous Forest	• Young communities of densely growing White Ash (*Fraxinus americana*), with occasional Black Walnut (*Juglans nigra*) and Manitoba Maple (*Acer negundo*). • Abundant tall shrub layer of ash saplings and true shrubs, such as Gray Dogwood, Common Buckthorn (*Rhamnus cathartica*) and Red Raspberry (*Rubus idaeus*). • The herb cover is dominated by Garlic Mustard (*Alliaria petiolata*).	S5
FOD4-4* Dry-Fresh Manitoba Maple Deciduous Forest	• Regenerating forest of young Manitoba Maple trees and occasional Black Walnut and White Ash. • Shrubs include Red Raspberry and Riverbank Grape (*Vitis riparia*). • Herbaceous cover of Garlic Mustard.	N/A
FOD5-3 Dry-Fresh Sugar Maple-Oak Deciduous Forest	• A small area of deciduous forest located in the northeast corner of the Taylor property. • The tree canopy is dominated by Sugar Maple and Red Oak. • The community is significantly degraded and Common Buckthorn dominates the shrub layer. • A larger and better-quality area covers the valley slopes along the western boundary of the Subject Lands.	S5
FOD5-8 Dry-Fresh Sugar Maple-White Ash Deciduous Forest	• This community type usually occurs in a complex with the dominant FOD2 type in major ravines. • Sugar Maple is the dominant tree, followed by White Ash. • Secondary species are Red Oak, Shagbark Hickory and Black Cherry (*Prunus serotina*). • The shrub and herb layers are similar to those of unit FOD2 with the former dominated by Choke Cherry (*Prunus virginiana*).	S5

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK/ G-RANK (NHIC, 2013)
CULTURAL		
Cultural Meadow		
CUM1-1 Dry-Moist Old Field Meadow	• A diverse group of open communities, consisting of a mosaic of many species in various dominance combinations. • The main species are Tall Goldenrod (*Solidago altissima*), Redtop (*Agrostis gigantea*), Kentucky Bluegrass (*Poa pratensis*), Awnless Brome (*Bromus inermis*), New England Aster (*Symphyotrichum novae-angliae*), White Sweetclover (*Melilotus albus*) and Wild Carrot (*Daucus carota*). • This community is often associated with Gray dogwood thicket (CUT1-4).	N/A
Cultural Thicket		
CUT1-1 Sumac Cultural Thicket	• This tall thicket is dominated by Staghorn Sumac (*Rhus typhina*). • The herbaceous layer is composed of Canada Bluegrass (*Poa compressa*), Bouncing-bet (*Saponaria officinalis*), Tufted Vetch (*Vicia cracca*), Dame's Rocket (*Hesperis matronalis*) and White Sweetclover.	N/A
CUT1-4 Gray Dogwood Cultural Thicket	• Tall and dense thickets of Gray Dogwood, usually overgrown by Wild Grape. • Ground cover is low due to dense canopy of the shrub layer.	N/A
CUT1-5* White Ash Cultural Thicket	• Tall thicket of densely growing white ash regeneration with scattered overtopping Red Oak trees. • True shrubs include Gray Dogwood and hawthorn (*Crataegus* sp.).	N/A
CUT1-6* Black Walnut Cultural Thicket	• Open thicket of regenerating young trees and saplings of Black Walnut. • Herbaceous layer is composed of Old Field Meadow (CUM1-1) species.	N/A
Cultural Savanna		
CUS Cultural Savanna	• Occurring in complex with unit CUP3-3, this association consists of sparsely growing Scots Pine (*Pinus sylvestris*) together with regenerating hardwoods, such as White Ash, Trembling Aspen and Black Walnut.	N/A
Cultural Plantation		
CUP3-3 Scots Pine Coniferous Plantation	• Old and poorly managed plantations of Scots Pine. • Shrub and herbaceous layers are poorly developed.	N/A

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK/ G-RANK (NHIC, 2013)
Cultural Woodland		
CUW1* Black Walnut Cultural Woodland	• These are successional but maturing woods of variable canopy density of Black Walnut. • Black Raspberry and Gray Dogwood are the main shrubs. • The groundcover is composed of common Old Field Meadow species.	N/A
CUW1-4* Black Locust Cultural Woodland	• A small area just off Waterdown Road, dominated by Black Locust (*Robinia pseudoacacia*) and some presence of Red Maple (*Acer rubrum*) and Sugar Maple. • The main shrubs are Black and Red Raspberries. • The herb layer is composed of mainly non-native species, such as Awnless Brome, Orchard Grass (*Dactylis glomerata*) and Common Nipplewort (*Lapsana communis*).	N/A
CUW1-5* Manitoba Maple Cultural Woodland	• A disturbed woodland of Manitoba Maple, with occasional presence of White Elm (*Ulmus americana*), Sugar Maple, Black Walnut, Red Oak and White Ash. • In the shrub layer grow Gray Dogwood, Tartarian Honeysuckle (*Lonicera tatarica*), Red Raspberry and Multiflora Rose (*Rosa multiflora*).	N/A
MARSH		
Meadow Marsh		
MAM2-2 Reed-canary Grass Mineral Meadow Marsh	• This unit is almost entirely composed of densely growing Reed-canary Grass (*Phalaris arundinacea*), to the exclusion of other species.	S5
MAM2-10 Forb Mineral Meadow Marsh	• These communities are dominated by tall forbs, with occasional presence of Reed-canary Grass. • The main species are Spotted Joe-pye-weed (*Eutrochium maculatum*), Tall Panicled Aster (*Symphyotrichum lanceolatum*), Elecampane Flower (*Inula helenium*), Common Boneset (*Eupatorium perfoliatum*) and Blue Vervain (*Verbena hastata*).	S4S5
Shallow Marsh		
MAS2-2 Cattail Mineral Shallow Marsh	• These units are dominated by Glaucous Cattail (*Typha glauca*), with secondary presence of Tall Panicled Aster, Reed-canary Grass and Jewelweed (*Impatiens capensis*).	S5

*Denotes a type not listed in the Southern Ontario ELC Guide

Latin Name	Latin Synonym	Common Name	Coefficient of Conservatism	Wetness Index	Weediness Index	Provincial Status S-Rank	OMNR Status	COSEWIC Status	Global Status G-Rank	Local Status Source	Local Status (Halton) Crins et al. 2006	Local Status (Halton) Varga 2005	Authority
Dennstaedtiaceae		**Bracken Fern Family**											
Pteridium aquilinum		Bracken Fern	2	3		S5			G5		X	X	(L.) Kuhn
Dryopteridaceae		**Wood Fern Family**											
Athyrium filix-femina		Lady Fern	4	0		S5			G5		X	X	(L.) Roth ex Mert.
Dryopteris carthusiana	*Dryopteris spinulosa*	Spinulose Wood Fern	5	-2		S5			G5		X	X	(Vill.) H.P. Fuchs
Dryopteris cristata		Crested Wood Fern	7	-5		S5			G5		X	X	(L.) A. Gray
Dryopteris intermedia		Evergreen Wood Fern	5	0		S5			G5		X	X	(Muhlenb. ex Willd.) A. Gray
Dryopteris marginalis		Marginal Wood Fern	5	3		S5			G5		X	X	(L.) A. Gray
Matteuccia struthiopteris var. *pensylvanica*		Ostrich Fern	5	-3		S5			G5T5		X	X	(L.) Tod.
Onoclea sensibilis		Sensitive Fern	4	-3		S5			G5		X	X	L.
Equisetaceae		**Horsetail Family**											
Equisetum arvense		Field Horsetail	0	0		S5			G5		X	X	L.
Equisetum hyemale ssp. affine		Scouring-rush	2	-2		S5			G5T5		X	X	L.
Thelypteridaceae		**Marsh Fern Family**											
Thelypteris palustris	*Dryopteris thelypteris*	Marsh Fern	5	-4		S5			G5		X	X	Schott
Cupressaceae		**Cedar Family**											
Thuja occidentalis		Eastern White Cedar	4	-3		S5			G5		X	X	L.
Pinaceae		**Pine Family**											
Abies balsamea		Balsam Fir	5	-3		S5			G5		X	U	(L.) Miller
Picea abies		Norway Spruce		5	-1	SNA			G5		X	XSR	(L.) Karsten
Picea glauca		White Spruce	6	3		S5			G5		U	U	(Moench) Voss
Pinus strobus		Eastern White Pine	4	3		S5			G5		X	X	L.
Pinus sylvestris		Scots Pine		5	-3	SNA			GNA		X	X	L.
Tsuga canadensis		Eastern Hemlock	7	3		S5			G5		X	X	(L.) Carrière
Aceraceae		**Maple Family**											
Acer negundo		Manitoba Maple	0	-2		S5			G5		X	X	L.
Acer rubrum		Red Maple	4	0		S5			G5		X	X	L.
Acer saccharinum		Silver Maple	5	-3		S5			G5		X	X	L.
Acer saccharum ssp. saccharum		Sugar Maple	4	3		S5			G5T5		X	X	Marshall
Acer x freemanii		Freeman's Maple				SNA			GNA		X	X	E. Murr.
Amaranthaceae		**Amaranth Family**											
Amaranthus retroflexus		Red-root Amaranth		2	-1	SNA			G5		X	X	L.
Anacardiaceae		**Sumac or Cashew Family**											
Rhus typhina		Staghorn Sumac	1	5		S5			G5		X	X	L.
Toxicodendron radicans ssp. negundo	*Rhus radicans ssp. negun*	Climbing Poison Ivy	5	-1		S5			G5T5		X	X	L.
Toxicodendron rydbergii	*Rhus rydbergii, Toxicoden*	Rydberg's Poison Ivy	0	0		S5			G5T		X	X	Small ex Rydb.
Apiaceae		**Carrot or Parsley Family**											
Cicuta bulbifera		Bulb-bearing Water-hemlock	5	-5		S5			G5		X	U	L.
Cicuta maculata		Spotted Water-hemlock	6	-5		S5			G5		X	X	L.
Daucus carota		Wild Carrot		5	-2	SNA			GNR		X	X	L.
Taenidia integerrima		Yellow Pimpernel	9	5		S4			G5		U	U	(L.) Drude
Torilis japonica		Erect Hedge-parsley		5	-3	SNA			GNR		X	X	(Houtt.) DC.
Apocynaceae		**Dogbane Family**											
Apocynum androsaemifolium ssp. androsaemifolium		Spreading Dogbane	3	5		S5			G5T5		X	X	L.
Vinca minor		Periwinkle		5	-2	SNA			GNR		X	X	L.
Araliaceae		**Ginseng Family**											
Aralia nudicaulis		Wild Sarsaparilla	4	3		S5			G5		X	X	L.
Asclepiadaceae		**Milkweed Family**											
Asclepias syriaca		Common Milkweed	0	5		S5			G5		X	X	L.
Cynanchum rossicum	*Vincetoxicum rossicum*	European Swallow-wort				SNA			GNR		X	X	(Kleopov) Borhidi
Asteraceae		**Composite or Aster Family**											
Achillea millefolium		Yarrow		3	-1	S5			G5		X	X	L.
Ambrosia artemisiifolia		Annual Ragweed	0	3		S5			G5		X	X	L.
Anthemis arvensis		Corn Chamomille		5	-1	SNA			GNR		X	X	L.
Arctium minus		Common Burdock		5	-2	SNA			GNR		X	X	(Hill) Bernh.
Bidens frondosa		Devil's Beggaticks	3	-3		S5			G5		X	X	L.
Centaurea stoebe	*Centaurea maculosa*	Spotted Knapweed		5	-3	SNA			GNR		X	X	Lam.
Cichorium intybus		Chicory		5	-1	SNA			GNR		X	X	L.
Cirsium arvense		Canada Thistle		3	-1	SNA			GNR		X	X	(L.) Scop.
Cirsium muticum		Swamp Thistle	8	-5		S5			G5				Michx.
Cirsium vulgare		Bull Thistle		4	-1	SNA			GNR		X	X	(Savi) Ten.
Conyza canadensis	*Erigeron canadensis*	Horseweed	0	1		S5			G5		X	X	(L.) Cronquist
Erigeron philadelphicus ssp. philadelphicus		Philadelphia Fleabane	1	-3		S5			G5T5		X	X	L.
Erigeron strigosus		Daisy Fleabane	0	1		S5			G5		X	X	Muhlenb. ex Willd.
Eupatorium perfoliatum		Common Boneset	2	-4		S5			G5		X	X	L.
Eurybia macrophylla	*Aster macrophyllus*	Large-leaved Aster	5	5		S5			G5		X	X	L.
Eutrochium maculatum var. maculatum	*Eupatorium maculatum va*	Spotted Joe Pye Weed	3	-5		S5			G5T5		X	X	L.
Galinsoga quadriradiata		Fringed Galinsoga		5	-1	SNA			GNR		X	X	Rúiz, Lopez & Pavón
Helianthus divaricatus		Woodland Sunflower	7	5		S5			G5		U	U	L.
Inula helenium		Elecampane Flower		5	-2	SNA			GNR		X	X	L.
Lactuca serriola		Prickly Lettuce		0	-1	SNA			GNR		X	X	L.
Lapsana communis		Common Nipplewort		5	-2	SNA			GNR		X	X	L.
Leucanthemum vulgare	*Chrysanthemum leucanth*	Oxeye Daisy		5	-1	SNA			GNR		X	X	L.
Picris hieracioides		Hawkweed Oxtongue		5	-1	SNA			G5		X	X	L.
Pilosella caespitosa	*Hieracium caespitosum*	Field Hawkweed		5	-2	SNA			GNR		X	X	Dumort.
Rudbeckia hirta		Black-eyed Susan	0	3		S5			G5		X	X	L.
Solidago altissima		Tall Goldenrod	1	3		S5			G5		X	X	L.
Solidago caesia		Blue-stemmed Goldenrod	5	3		S5			G5		X	X	L.
Solidago canadensis		Canada Goldenrod	1	3		S5			G5		X	X	L.
Solidago flexicaulis		Zig-zag Goldenrod	6	3		S5			G5		X	X	L.
Solidago gigantea		Smooth Goldenrod	4	-3		S5			G5		U	U	Aiton
Solidago juncea		Early Goldenrod	3	5		S5			G5		U	U	Aiton
Solidago nemoralis ssp. nemoralis		Gray Goldenrod	2	5		S5			G5T5		X	X	Aiton
Sonchus arvensis ssp. *arvensis*		Field Sow-thistle				SNA			GNRTNR		X	X	L.
Symphyotrichum cordifolium	*Aster cordifolius*	Heart-leaved Aster	5	5		S5			G5		X	X	L.
Symphyotrichum ericoides var. *ericoides*	*Aster ericoides* ssp. *ericoi*	White Heath Aster				S5			G5T5		X	X	L.
Symphyotrichum laeve	*Aster laevis*	Smooth Aster	7	5		S5			G5T?		U	U	L.
Symphyotrichum lanceolatum var. lanceolatum	*Aster lanceolatus ssp. lan*	White Panicled Aster	3	-3		S5			G5T5		X	X	Willd.
Symphyotrichum lateriflorum	*Aster lateriflorus*	Starved Aster	3	-2		S5			G5		X	X	(L.) Britton
Symphyotrichum novae-angliae	*Aster novae-angliae*	New England Aster	2	-3		S5			G5		X	X	L.
Symphyotrichum puniceum var. puniceum	*Aster puniceus var. punic*	Swamp Aster				S5			G5T5		X	X	L.

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Taraxacum officinale		Common Dandelion		3	-2	SNA			G5		X	X	G. Weber
Tragopogon dubius		Yellow Goat's-beard		5	-1	SNA			GNR		X	X	Scop.
Tussilago farfara		Colt's Foot		3	-2	SNR			GNR		X	X	L.
Balsaminaceae		**Touch-me-not Family**											
Impatiens capensis		Spotted Jewelweed	4	-3		S5			G5		X	X	Meerb.
Berberidaceae		**Barberry Family**											
Berberis thunbergii		Japanese Barberry		4	-3	SNA			GNR		X	X	DC.
Berberis vulgaris		European Barberry		3	-2	SNA			GNR		X	X	L.
Caulophyllum giganteum		Giant Blue Cohosh				S4S5			G4G5		?	X	(Farw.) Leconte & Blackwell
Podophyllum peltatum		May Apple	5	3		S5			G5		X	X	L.
Betulaceae		**Birch Family**											
Betula alleghaniensis		Yellow Birch	6	0		S5			G5		X	X	Britton
Betula papyrifera		White Birch		2		S5			G5		X	X	Marshall
Carpinus caroliniana		Blue-beech	6	0		S5			G5		X	X	Walter
Corylus cornuta		Beaked Hazelnut	5	5		S5			G5		X	X	Marshall
Ostrya virginiana		Eastern Hop-hornbeam	4	4		S5			G5		X	X	(Miller) K. Koch
Boraginaceae		**Borage Family**											
Echium vulgare		Blueweed		5	-2	SNA			GNR		X	X	L.
Hackelia virginiana		Virginia Stickweed	5	1		S5			G5?		U	U	(L.) I.M. Johnston
Brassicaceae		**Mustard Family**											
Alliaria petiolata	*Alliaria officinalis*	Garlic Mustard		0	-3	SNA			GNR		X	X	(M. Bieb.) Cavara & Grande
Barbarea vulgaris		Yellow Rocket		0	-1	SNA			GNR		X	X	R. Br.
Berteroa incana		Hoary false-alyssum		5	-3	SNA			GNR		X	X	(L.) DC.
Capsella bursa-pastoris		Common Shepherd's Purse		1	-1	SNA			GNR		X	X	(L.) Medik.
Cardamine diphylla	*Dentaria diphylla*	Two-leaf Toothwort	7	5		S5			G5		X	X	(Michx.) Alph. Wood
Cardamine pensylvanica		Pennsylvania Bitter-cress	6	-4		S5			G5		U	U	Muhlenb. ex Willd.
Erucastrum gallicum		Common Dogmustard		5	-1	SNA			G5		X	X	(Willd.) O. Schulz
Erysimum cheiranthoides		Worm-seed Mustard		3	-1	SNA			G5		X	X	L.
Hesperis matronalis		Dame's Rocket		5	-3	SNA			G4G5		X	X	L.
Lepidium campestre		Field Pepper-grass		5	-1	SNA			GNR		X	X	(L.) R. Br.
Nasturtium microphyllum		Small-leaved Water-cress		-5	-3	SNA			GNR		X	X	(Boenn.) Reichb.
Thlaspi arvense		Field Penny-cress		5	-1	SNA			GNR		X	X	L.
Turritis glabra	*Arabis glabra*	Tower-mustard	4	5		S5			G5		U	R3	(L.) Bernh.
Campanulaceae		**Bellflower Family**											
Campanula rapunculoides		Creeping Bellflower		5	-2	SNA			GNR		X	X	L.
Lobelia siphilitica		Great Blue Lobelia	6	-4		S5			G5		X	X	L.
Caprifoliaceae		**Honeysuckle Family**											
Diervilla lonicera		Northern Bush-honeysuckle	5	5		S5			G5		X	X	Miller
Lonicera canadensis		American Fly-honeysuckle	6	3		S5			G5		X	X	Bartram
Lonicera dioica		Mountain Honeysuckle	5	3		S5			G5		X	X	L.
Lonicera maackii		Amur Honeysuckle		5	-2	SNA			GNR		X	X	(Rupr.) Maxim.
Lonicera tatarica		Tartarian Honeysuckle		3	-3	SNA			GNR		X	X	L.
Sambucus canadensis		Common Elderberry	5	-2		S5			G5T5		X	X	L.
Symphoricarpos albus		Common Snowberry	7	4		S5			G5		X	X	(L.) S.F. Blake
Viburnum acerifolium		Maple-leaf Viburnum	6	5		S5			G5		X	X	L.
Viburnum lantana		Wayfaring-tree		5	-1	SNA			GNR		X	X	L.
Viburnum opulus		Cranberry Viburnum		0	-1	S5			G5			X	L.
Viburnum rafinesquianum		Downy Arrowwood	7	5		S5			G5		X	U	Schult.
Caryophyllaceae		**Pink Family**											
Arenaria serpyllifolia		Thyme-leaf Sandwort		0	-2	SNA			GNR		X	X	L.
Cerastium fontanum	*Cerastium vulgatum*	Common Mouse-ear Chickweed		3	-1	SNA			GNR		X	X	Baumg.
Dianthus armeria		Deptford-pink		5	-1	SNA			GNR		X	X	L.
Saponaria officinalis		Bouncing-bet		3	-3	SNA			GNR		X	X	L.
Silene noctiflora		Night-flowering Catchfly		5	-1	SNA			GNR		X	X	L.
Silene vulgaris	*Silene cucubalus*	Maiden's Tears		5	-1	SNA			GNR		X	X	(Moench) Garcke
Stellaria graminea		Little Starwort		5	-2	SNA			GNR		X	X	L.
Celastraceae		**Staff-tree Family**											
Euonymus obovatus		Running Strawberry Bush	6	5		S4			G5		X	X	Nutt.
Convolvulaceae		**Morning-glory Family**											
Convolvulus arvensis		Field Bindweed		5	-1	SNA			GNR		X	X	L.
Cornaceae		**Dogwood Family**											
Cornus alternifolia		Alternate-leaf Dogwood	6	5		S5			G5		X	X	L. f.
Cornus florida		Eastern Flowering Dogwood	7	4		S2?	END	END	G5		U	U	L.
Cornus foemina	*Cornus racemosa*	Grey Dogwood	2	-2		S5			GNR		X	X	Miller
Cornus rugosa		Roundleaf Dogwood	6	5		S5			G5		X	X	Lam.
Cornus sericea	*Cornus stolonifera*	Red-osier Dogwood	2	-3		S5			G5		X	X	Michx.
Cucurbitaceae		**Gourd Family**											
Echinocystis lobata		Wild Mock-cucumber	3	-2		S5			G5		X	X	(Michx.) Torr. & A. Gray
Dipsacaceae		**Teasel Family**											
Dipsacus fullonum	*Dipsacus sylvestris*	Fuller's Teasel		5	-1	SNA			GNR		X	X	L.
Fabaceae		**Pea Family**											
Amphicarpaea bracteata		American Hog-Peanut	4	0		S5			G5		X	X	(L.) Fern.
Hylodesmum glutinosum	*Desmodium glutinosum*	Large Tick-trefoil	6	5		S4			G5		X	X	(Muhlenb. ex Willd.) Alph. Wood
Lathyrus palustris		Vetchling Peavine	6	-3		S5			G5				L.
Lathyrus tuberosus		Earth-nut peavine		5	-1	SNA			GNR		X	X	L.
Lotus corniculatus		Bird's-foot Trefoil		1	-2	SNA			GNR		X	X	L.
Medicago lupulina		Black Medic		1	-1	SNA			GNR		X	X	L.
Melilotus albus		White Sweetclover		3	-3	SNA			G5		X	X	Medik.
Melilotus officinalis		Yellow Sweetclover		3	-1	SNA			GNR		X	X	(L.) Pall.
Robinia pseudoacacia		Black Locust		4	-3	SNA			G5		X	X	L.
Trifolium hybridum		Alsike Clover		1	-1	SNA			GNR		X	X	L.
Trifolium pratense		Red Clover		2	-2	SNA			GNR		X	X	L.
Trifolium repens		White Clover		2	-1	SNA			GNR		X	X	L.
Vicia cracca		Tufted Vetch		5	-1	SNA			GNR		X	X	L.
Vicia tetrasperma		Lentil Vetch		5	-1	SNA			GNR		X	X	(L.) Schreb.
Fagaceae		**Beech Family**											
Fagus grandifolia		American Beech	6	3		S4			G5		X	X	Ehrh.
Quercus alba		White Oak	6	3		S5			G5		X	X	L.
Quercus macrocarpa		Bur Oak	5	1		S5			G5		X	X	Michx.
Quercus rubra		Northern Red Oak	6	3		S5			G5		X	X	L.

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Geraniaceae		**Geranium Family**											
Geranium maculatum		Wild Crane's-bill	6	3		S5			G5		X	U	L.
Geranium robertianum		Herb-robert		5	-2	SNA			G5		X	X	L.
Grossulariaceae		**Currant Family**											
Ribes americanum		Wild Black Currant	4	-3		S5			G5		X	X	Miller
Ribes cynosbati		Prickly Gooseberry	4	5		S5			G5		X	X	L.
Ribes rubrum		Northern Red Currant		5	-2	SNA			G4G5		X	X	L.
Hamamelidaceae		**Witch-hazel Family**											
Hamamelis virginiana		American Witch-hazel	6	3		S4S5			G5		X	X	L.
Juglandaceae		**Walnut Family**											
Carya ovata		Shagbark Hickory	6	3		S5			G5		X	U	(Miller) K. Koch
Juglans cinerea		Butternut	6	2		S2?	END	END	G4		X	X	L.
Juglans nigra		Black Walnut	5	3		S4?			G5		X	X	L.
Lamiaceae		**Mint Family**											
Collinsonia canadensis		Canada Horse-balm	8	0		S4			G5		U	U	L.
Glechoma hederacea		Ground Ivy		5	-2	SNA			GNR		X	X	L.
Lamium amplexicaule		Common Deadnettle		5	-1	SNA			GNR		X	X	L.
Leonurus cardiaca		Common Motherwort		5	-2	SNA			GNR		X	X	L.
Lycopus americanus		American Bugleweed	4	-5		S5			G5		X	X	Muhlenb. ex Bartram
Mentha arvensis		Corn Mint	3	-3		S5			G5		X	X	L.
Monarda fistulosa var. fistulosa	*Monarda fistulosa*	Wild Bergamot Beebalm	6	3		SU			G5T5?		X	X	L.
Nepeta cataria		Catnip		1	-2	SNA			GNR		X	X	L.
Prunella vulgaris ssp. *lanceolata*		Self-heal	5	5		S5			G5T5		X	X	L.
Teucrium canadense ssp. *canadense*		Wood Germander	6	-2		S5?			G5T5		R5	R5	L.
Lauraceae		**Laurel Family**											
Sassafras albidum		Sassafras	6	3		S4			G5		U	U	(Nutt.) Nees
Lythraceae		**Loosestrife Family**											
Lythrum salicaria		Purple Loosestrife		-5	-3	SNA			G5		X	X	L.
Malvaceae		**Mallow Family**											
Malva neglecta		Dwarf Cheeseweed		5	-1	SNA			GNR		X	X	Wallr.
Menispermaceae		**Moonseed Family**											
Menispermum canadense		Canada Moonseed	7	0		S4			G5		X	X	L.
Moraceae		**Mulberry Family**											
Morus alba		White Mulberry		0	-3	SNA			GNR		X	X	L.
Oleaceae		**Olive Family**											
Fraxinus americana		White Ash	4	3		S4?			G5		X	X	L.
Fraxinus nigra		Black Ash	7	-4		S5?			G5		X	X	Marshall
Fraxinus pennsylvanica		Red Ash	3	-3		S5			G5		X	X	Marshall
Ligustrum vulgare		European Privet		1	-2	SNA			GNR		X	X	L.
Syringa vulgaris		Common Lilac		5	-2	SNA			GNR		X	X	L.
Onagraceae		**Evening-primrose Family**											
Circaea lutetiana	*Circaea canadensis ssp. c*	Enchanter's Nightshade	3	3		S5			G5		X	X	L.
Epilobium ciliatum ssp. *ciliatum*		Hairy Willow-herb	3	3		S5			G5T5		X	X	Raf.
Epilobium hirsutum		Great-hairy Willow-herb		-4	-2	SNA			GNR		X	X	L.
Oenothera parviflora		Northern Evening-primrose	1	3		S4?			G4?		X	X	L.
Oxalidaceae		**Wood Sorrel Family**											
Oxalis stricta		Upright Yellow Wood-sorrel	0	3		S5			G5		X	X	L.
Plantaginaceae		**Plantain Family**											
Plantago lanceolata		English Plantain		0	-1	SNA			G5		X	X	L.
Plantago major		Common Plantain		-1	-1	SNA			G5		X	X	L.
Polygalaceae		**Milkwort Family**											
Polygala senega		Seneca Snakeroot	7	3		S4			G4G5		X	X	L.
Polygonaceae		**Smartweed Family**											
Persicaria maculosa	*Polygonum persicaria*	Lady's-thumb		-3	-1	SNA			G3G5		X	X	L.
Persicaria virginiana	*Polygonum virginianum*	Virginia Knotweed	6	0		S4			G5		U	R4	L.
Polygonum aviculare ssp. aviculare		Prostrate Knotweed		1	-1	SNA			GNR		X	X	L.
Rumex crispus		Curly Dock		-1	-2	SNA			GNR		X	X	L.
Rumex obtusifolius		Bitter Dock		-3	-1	SNA			GNR		X	X	L.
Primulaceae		**Primrose Family**											
Lysimachia ciliata		Fringed Loosestrife	4	-3		S5			G5		X	X	L.
Ranunculaceae		**Buttercup Family**											
Actaea pachypoda		White Baneberry	6	5		S5			G5		X	X	Elliott
Actaea rubra		Red Baneberry	5	5		S5			G5		X	X	(Aiton) Willd.
Caltha palustris		Marsh-marigold	5	-5		S5			G5		X	U	L.
Clematis virginiana		Virginia Virgin's-bower	3	0		S5			G5		X	X	L.
Ranunculus abortivus		Kidney-leaf Buttercup	2	-2		S5			G5		X	X	L.
Ranunculus acris		Tall Buttercup			-2	SNA			G5		X	X	L.
Ranunculus recurvatus		Hooked Buttercup	4	-3		S5			G5		X	X	Poir.
Ranunculus sceleratus var. sceleratus		Cursed Buttercup	2	-5		SU			G5T5		X		L.
Thalictrum dioicum		Early Meadow-rue	5	2		S5			G5		X	X	L.
Thalictrum pubescens		Tall Meadow-rue	5	-2		S5			G5		X	X	Pursh
Rhamnaceae		**Buckthorn Family**											
Rhamnus cathartica		Common Buckthorn		3	-3	SNA			GNR		X	X	L.
Rosaceae		**Rose Family**											
Agrimonia gryposepala		Tall Hairy Groovebur	2	2		S5			G5		X	X	Wallr.
Crataegus species		Hawthorn species											
Fragaria virginiana		Virginia Strawberry	2	1		S5			G5		X	X	Miller
Geum aleppicum		Yellow Avens	2	-1		S5			G5		X	X	Jacq.
Geum canadense		White Avens	3	0		S5			G5		X	X	Jacq.
Geum fragarioides	*Waldsteinia fragarioides*	Barren Strawberry	5	5		S5			G5		X	U	(Michx.) Tratt.
Malus pumila		Common Apple		5	-1	SNA			G5		X	X	Miller
Potentilla recta		Sulphur Cinquefoil		5	-2	SNA			GNR		X	X	L.
Prunus avium		Sweet Cherry		5	-2	SNA			GNR		X	X	(L.) L.
Prunus serotina		Black Cherry	3	3		S5			G5		X	X	Ehrh.
Prunus virginiana		Choke Cherry	2	1		S5			G5		X	X	L.

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Pyrus communis		Common Pear		5	-1	SNA			G5		X	X	L.
Rosa blanda		Smooth Rose	3	3		S5			G5		X	X	Aiton
Rosa multiflora		Multiflora Rose		3	-3	SNA			GNR		X	X	Thunb. ex Murray
Rubus allegheniensis		Alleghany Blackberry	2	2		S5			G5		X	X	Porter
Rubus idaeus ssp. *strigosus*	*Rubus idaeus* ssp. *melan*	Red Raspberry	0	-2		S5			G5T5		X	X	L.
Rubus occidentalis		Black Raspberry	2	5		S5			G5		X	X	L.
Rubus odoratus		Purple Flowering Raspberry	3	5		S5			G5		X	X	L.
Sorbus aucuparia		European Mountain-ash		5	-2	SNA			G5		X	X	L.
Spiraea alba		Narrow-leaved Meadow-sweet	3	-4		S5			G5		X	X	Du Roi
Rubiaceae		**Madder Family**											
Galium aparine		Catchweed Bedstraw	4	3		S5			G5		X	U	L.
Galium palustre		Marsh Bedstraw	5	-5		S5			G5		X	X	L.
Galium triflorum		Sweet-scent Bedstraw	4	2		S5			G5		X	X	Michx.
Salicaceae		**Willow Family**											
Populus alba		White Poplar		5	-3	SNA			G5		X	X	L.
Populus balsamifera		Balsam Poplar	4	-3		S5			G5		X	X	L.
Populus deltoides ssp. *deltoides*		Eastern Cottonwood	4	-1		S5			G5T5		X	U	Bartram ex Marshall
Populus grandidentata		Large-tooth Aspen	5	3		S5			G5		X	X	Michx.
Populus tremuloides		Trembling Aspen		0		S5			G5		X	X	Michx.
Salix alba		White Willow			-2	SNA			G5		X	X	L.
Salix amygdaloides		Peach-leaved Willow	6	-3		S5			G5		X	U	Anderss.
Salix bebbiana		Bebb's Willow	4	-4		S5			G5		X	X	Sarg.
Salix discolor		Pussy Willow	3	-3		S5			G5		X	X	Muhlenb.
Salix eriocephala		Heart-leaved Willow	4	-3		S5			G5		X	X	Michx.
Salix pentandra		Laurel Willow		5	-1	SNA			GNR		X	X	L.
Salix petiolaris		Meadow Willow	3	-4		S5			G5		X	X	Sm.
Salix x rubens		Reddish Willow		-4	-3	SNA			GNA		X	X	Schrank
Santalaceae		**Sandalwood Family**											
Comandra umbellata		Bastard Toad-flax	6	3		S5			G5		U	U	(L.) Nutt.
Scrophulariaceae		**Figwort Family**											
Verbascum thapsus		Common Mullein		5	-2	SNA			GNR		X	X	L.
Veronica officinalis		Common Speedwell		5	-2	SNA			G5		X	X	L.
Veronica peregrina ssp. *peregrina*		Purslane Speedwell	0	-4		S5			G5T5		?	X	L.
Solanaceae		**Nightshade Family**											
Solanum dulcamara		Climbing Nightshade		0	-2	SNA			GNR		X	X	L.
Tiliaceae		**Linden Family**											
Tilia americana		American Basswood	4	3		S5			G5		X	X	L.
Ulmaceae		**Elm Family**											
Ulmus americana		White Elm	3	-2		S5			G5		X	X	L.
Ulmus rubra		Slippery Elm	6	0		S5			G5		X	X	Muhlenb.
Urticaceae		**Nettle Family**											
Boehmeria cylindrica		False Nettle	4	-5		S5			G5		X	X	(L.) Sw.
Laportea canadensis		Wood Nettle	6	-3		S5			G5		X	X	(L.) Wedd.
Pilea pumila		Dwarf Clearweed	5	-3		S5			G5		X	X	(L.) A. Gray
Urtica dioica ssp. *dioica*		European Stinging Nettle		-1	-1	SNA			G5T5?		X		L.
Verbenaceae		**Vervain Family**											
Verbena hastata		Blue Vervain	4	-4		S5			G5		X	X	L.
Verbena urticifolia		White Vervain	4	-1		S5			G5		X	X	L.
Violaceae		**Violet Family**											
Viola sororia	*Viola sororia var. affinis*	Woolly Blue Violet				S5			G5		X	X	Willd.
Vitaceae		**Grape Family**											
Parthenocissus inserta	*Parthenocissus vitacea*	Inserted Virginia-creeper	3	3		S5			G5		X	X	(A. Kern.) Fritsch
Vitis aestivalis		Summer Grape	7	3		S4			G5		U	R3	Michx.
Vitis riparia		Riverbank Grape	0	-2		S5			G5		X	X	Michx.
Araceae		**Arum Family**											
Arisaema triphyllum		Jack-in-the-pulpit	5	-2		S5			G5		X	X	(L.) Schott
Symplocarpus foetidus		Skunk-cabbage	7	-5		S5			G5		U	R2	(L.) Salisb. ex Nutt.
Cyperaceae		**Sedge Family**											
Carex albursina		White Bear Sedge	7	5		S5			G5		X	X	E. Sheld.
Carex arctata		Drooping Wood Sedge	5	5		S5			G5		X	X	Boott
Carex blanda		Woodland Sedge	3	0		S5			G5		X	X	Dewey
Carex cephalophora		Oval-headed Sedge	5	3		S5			G5		X	X	Muhlenb. ex Willd.
Carex cristatella		Crested Sedge	3	-4		S5			G5		X	X	Britton
Carex granularis		Meadow Sedge	3	-4		S5			G5		X	X	Muhlenb. ex Willd.
Carex hystericina		Porcupine Sedge	5	-5		S5			G5		X	X	Muhlenb. ex Willd.
Carex interior		Inland Sedge	6	-5		S5			G5		X	X	L.H. Bailey
Carex leptonervia		Finely-nerved Sedge	5	0		S5			G5		X	X	(Fern.) Fern.
Carex molesta		Troublesome Sedge	5	2		S4S5			G4		U	U	Mack.
Carex pedunculata		Long-stalked Sedge	5	5		S5			G5		X	X	Muhlenb. ex Willd.
Carex pensylvanica		Pennsylvania Sedge	5	5		S5			G5		X	X	Lam.
Carex plantaginea		Plantain-leaved Sedge	7	5		S5			G5		X	X	Lam.
Carex platyphylla		Broad-leaved Sedge	7	5		S4S5			G5		X	X	J. Carey
Carex prasina		Drooping Sedge	10	-5		S4			G4		U	R3	Wahlenb.
Carex radiata		Eastern Star Sedge	4	5		S5			G5		X	X	(Wahlenb.) Small
Carex rariflora		Loose-flowered Alpine Sedge				S5			G5				(Wahlenb.) Sm.
Carex retrorsa		Retrorse Sedge	5	-5		S5			G5		X	X	Schwein.
Carex spicata		Spiked Sedge		5	-1	SNA			GNR		X	X	Hudson
Carex stipata		Awl-fruited Sedge	3	-5		S5			G5		X	X	Muhlenb. ex Willd.
Carex tenera		Straw Sedge	4	-1		S5			G5		X	X	Dewey
Carex vulpinoidea		Fox Sedge	3	-5		S5			G5		X	X	Michx.
Cyperus esculentus		Yellow Nut-grass	1	-3		S5			G5		X	X	L.
Eleocharis erythropoda		Red-footed Spike-rush	4	-5		S5			G5		X	X	Steud.
Schoenoplectus tabernaemontani	*Scirpus validus*	American Great Bulrush	5	-5		S5			G5		X	X	L.
Scirpus cyperinus		Wool-grass	4	-5		S5			G5		X	X	(L.) Kunth
Juncaceae		**Rush Family**											
Juncus dudleyi		Dudley's Rush	1	0		S5			G5		X	X	Wiegelb
Juncus effusus var. effusus	*Juncus effusus* var. *solutu*	Soft Rush	4	-5		SNA			GNR		X	X	L.
Juncus tenuis		Path Rush	0	0		S5			G5		X	X	Willd.
Liliaceae		**Lily Family**											
Asparagus officinalis		Garden Asparagus		3	-1	SNA			G5?		X	X	L.

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Erythronium americanum		Yellow Trout-lily	5	5		S5			G5		X	X	Ker Gawl.
Lilium michiganense		Michigan Lily	7	-1		S4			G5		X	X	Farw.
Maianthemum canadense		Wild Lily-of-the-valley	5	0		S5			G5		X	X	Desf.
Maianthemum racemosum	*Smilacina racemosa*	False Solomon's Seal	4	3		S5			G5T		X	X	(L.) Link
Polygonatum pubescens		Downy Solomon's Seal	5	5		S5			G5		X	X	(Willd.) Pursh
Trillium grandiflorum		White Trillium	5	5		S5			G5		X	X	(Michx.) Salisb.
Uvularia grandiflora		Large-flowered Bellwort	6	5		S5			G5		X	X	Sm.
Orchidaceae		**Orchid Family**											
Epipactis helleborine		Common Helleborine		5	-2	SNA			GNR		X	X	(L.) Crantz
Poaceae		**Grass Family**											
Agrostis gigantea		Redtop		0	-2	SNA			G4G5		X	X	Roth
Agrostis stolonifera		Redtop		-3		S5			G5		X	X	L.
Bromus inermis		Awnless Brome		5	-3	SNA			G5TNR		X	X	Leyss.
Bromus latiglumis		Broad-glumed Brome	7	-2		S4			G5		R5	R2	(Shear) Hitchc.
Bromus tectorum		Downy Chess		5	-2	SNA			GNR		X	X	L.
Dactylis glomerata		Orchard Grass		3	-1	SNA			GNR		X	X	L.
Digitaria ischaemum		Small Crabgrass		3	-1	SNA			GNR		X	X	(Schreb. ex Schwein.) Schreb. ex Muhlenb.
Echinochloa crus-galli		Common Barnyard Grass		-3	-1	SNA			GNR		X	X	(L.) P. Beauv.
Elymus hystrix	*Hystrix patula*	Bottle-brush Grass	5	5		S5			G5		X	X	L.
Elymus repens		Quack Grass		3	-3	SNA			GNR		X	X	(L.) Gould
Elymus virginicus		Virginia Wild Rye	5	-2		S5			G5		X	X	L.
Eragrostis cilianensis		Stink Grass		3	-1	SNA			GNR		X	X	(All.) Lutati ex Hubb.
Glyceria striata		Fowl Meadow Grass	3	-5		S5			G5		X	X	(Lam.) A. Hitchc.
Hordeum jubatum ssp. jubatum		Foxtail Barley		-1	-1	S5?			G5T5		X	X	L.
Leersia oryzoides		Rice Cut Grass	3	-5		S5			G5		X	X	(L.) Sw.
Leersia virginica		White Cut Grass	6	-3		S4			G5		X	U	Willd.
Muhlenbergia mexicana var. mexicana		Mexican Satin Grass	1	-3		S5			G5T5		X	X	(L.) Trin
Panicum capillare		Witch Grass	0	0		S5			G5		X	X	L.
Phalaris arundinacea var. arundinacea	*Phalaris arundinacea*	Reed Canary Grass	0	-4		S5			GNR		X	X	L.
Phleum pratense		Timothy		3	-1	SNA			GNR		X	X	L.
Poa alsodes		Grove Meadow Grass	7	-2		S4			G4G5		U	R5	A. Gray
Poa compressa		Canada Blue Grass	0	2		SNA			GNR		X	X	L.
Poa nemoralis		Woodland Blue Grass		0	-1	SNA			G5		X	X	L.
Poa palustris		Fowl Meadow Grass	5	-4		S5			G5		X	X	L.
Poa pratensis ssp. pratensis		Kentucky Bluegrass	0	1		SNA			G5T5		X	X	L.
Puccinellia distans		Spreading Goose Grass		-5	-1	SNA			G5		X	X	(Jacq.) Parl.
Schedonorus arundinaceus	*Festuca arundinacea, Lol*	Tall Fescue		2	-1	SNA			GNR		X	X	Schreb.
Schedonorus pratensis	*Festuca pratensis, Lolium*	Meadow Fescue		4	-1	SNA			G5		X	X	Hudson
Schizachne purpurascens		False Melic Grass	6	2		S5			G5		X	X	(Torr.) Swallen
Smilacaceae		**Catbrier Family**											
Smilax herbacea		Herbaceous Carrion Flower	5	0		S4?			G5		X	X	L.
Typhaceae		**Cattail Family**											
Typha angustifolia		Narrow-leaved Cattail	3	-5		SNA			G5		X	X	L.
Typha x glauca		Glaucous Cattail	3	-5		SNA			GNA		X	X	Godron

STATISTICS

Species Richness

Total Number of Species:	330	
Native Species:	214	65%
Exotic Species:	116	35%
S1-S3 Species:	2	1%
S4 Species:	23	11%
S5 Species:	187	88%

Floristic Quality Indices

Mean Co-efficient of Conservatism (CC)	4.2	
CC 0 - 3 = lowest sensitivity	68	33%
CC 4 - 6 = moderate sensitivity	115	56%
CC 7 - 8 = high sensitivity	21	10%
CC 9 - 10 = highest sensitivity	2	1%
Floristic Quality Index (FQI)	61	

Weedy and Invasive Species

Mean Weediness Index:	-1.7	
-1 = low potential invasiveness	56	50%
-2 = moderate potential invasiveness	36	32%
-3 = high potential invasivenss	20	18%

Wetland Species

Mean Wetness Index	1.2	
upland	93	29%
facultative upland	80	25%
facultative	56	18%
facultative wetland	64	20%
obligate wetland	26	8%

Table 5: Amphibian Call Count Survey Station Results (2014)

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
1	E					3								Y	-
2	E				3	1 (5)					1 (2)			Y	-
3	E				3						1 (4)			Y	-

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	*Anaxyrus americanus*
FOTO	Fowler's Toad	*Anaxyrus fowleri*
GRTR	Gray Treefrog	*Hyla versicolor*
CHFR	Western Chorus Frog	*Pseudacris triseriata*
WOFR	Wood Frog	*Lithobates sylvaticus*
NLRF	Northern Leopard Frog	*Lithobates pipiens*
PIFR	Pickerel Frog	*Lithobates palustris*
GRFR	Green Frog	*Lithobates clamitans*
BULL	American Bullfrog	*Lithobates catesbeianus*
MIFR	Mink Frog	*Lithobates septentrionalis*
SPPE	Spring Peeper	*Pseudacris crucifer*

CALL CODES	
X	No amphibians heard
1	Calls can be counted without error
2	Calls overlap but can be reliably estimated
3	Calls overlap too much to estimate number

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling

Table 6: Amphibian Call Count Survey Station Results (2016)

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
1	C	X												Y	5
2	C													N	Dry
1	E					3		1 (1)						Y	50
2	E				3	3					1 (2)			Y	Deep
3	E										1 (2)			Y	30
1	G	X												Y	No access
2	G				1 (2)	1 (2)								Y	No access

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	*Anaxyrus americanus*
FOTO	Fowler's Toad	*Anaxyrus fowleri*
GRTR	Gray Treefrog	*Hyla versicolor*
CHFR	Western Chorus Frog	*Pseudacris triseriata*
WOFR	Wood Frog	*Lithobates sylvaticus*
NLRF	Northern Leopard Frog	*Lithobates pipiens*
PIFR	Pickerel Frog	*Lithobates palustris*
GRFR	Green Frog	*Lithobates clamitans*
BULL	American Bullfrog	*Lithobates catesbeianus*
MIFR	Mink Frog	*Lithobates septentrionalis*
SPPE	Spring Peeper	*Pseudacris crucifer*

CALL CODES	
X	No amphibians heard
1	Calls can be counted without error
2	Calls overlap but can be reliably estimated
3	Calls overlap too much to estimate number

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling

Table 6: Amphibian Call Count Survey Station Results (2016)

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
3	G	X												Y	No access

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	*Anaxyrus americanus*
FOTO	Fowler's Toad	*Anaxyrus fowleri*
GRTR	Gray Treefrog	*Hyla versicolor*
CHFR	Western Chorus Frog	*Pseudacris triseriata*
WOFR	Wood Frog	*Lithobates sylvaticus*
NLRF	Northern Leopard Frog	*Lithobates pipiens*
PIFR	Pickerel Frog	*Lithobates palustris*
GRFR	Green Frog	*Lithobates clamitans*
BULL	American Bullfrog	*Lithobates catesbeianus*
MIFR	Mink Frog	*Lithobates septentrionalis*
SPPE	Spring Peeper	*Pseudacris crucifer*

CALL CODES	
X	No amphibians heard
1	Calls can be counted without error
2	Calls overlap but can be reliably estimated
3	Calls overlap too much to estimate number

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling

Table 7: Amphibian Egg Mass Survey Results

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
1	H	X												Y	10
2	H													N	Dry
1	E								1					Y	60
2	E								1		7			Y	40
3	E										3			Y	40

Note: The quantity reported in each cell is the cumulative count of all life stages (egg mass, tadpole, adult) of the individuals observed of that species during each egg mass survey round

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	*Anaxyrus americanus*
FOTO	Fowler's Toad	*Anaxyrus fowleri*
GRTR	Gray Treefrog	*Hyla versicolor*
CHFR	Western Chorus Frog	*Pseudacris triseriata*
WOFR	Wood Frog	*Lithobates sylvaticus*
NLRF	Northern Leopard Frog	*Lithobates pipiens*
PIFR	Pickerel Frog	*Lithobates palustris*
GRFR	Green Frog	*Lithobates clamitans*
BULL	American Bullfrog	*Lithobates catesbeianus*
MIFR	Mink Frog	*Lithobates septentrionalis*
SPPE	Spring Peeper	*Pseudacris crucifer*

Table 8: Turtle Survey Results (2014)

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
13-JUN-14	1	TB1			2						

Turtle Survey Results – Nesting

- No turtle nesting evidence was observed during transect; soils were a sandy loam composition
- TN1 to TN11 had clay dominated soils that were not suitable for nesting;
- TN12 was gravel dominated though no evidence of nesting was present. The station was designated unsuitable due to the activity along the driveway resulting in high mortality.
- No nesting evidence (i.e., test digs, claw marks, predated nests) were observed on site.

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOTU	No Turtles	No turtles despite survey effort
MPTU	Midland Painted Turtle	*Chrysemys picta marginata*
SNTU	Snapping Turtle	*Chelydra serpentina*
MATU	Northern Map Turtle	*Graptemys geographica*
BLTU	Blanding's Turtle	*Emydoidea blandingii*
SSTU	Spiny Soft-shelled Turtle	*Apalone spinifera*
WOTU	Wood Turtle	*Glyptemys insculpta*
STIN	Stinkpot Turtle	*Stemotherus odoratus*
SPTU	Spotted Turtle	*Clemmys guttata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 9: Turtle Survey Results (2016) – Basking

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
29-AP-16	1	TB1	X								
02-JU-16	2	TB1	X								
16-SE-16	3	TB1	DRY								

Turtle Survey Results – Nesting

- A visual turtle nesting habitat / evidence survey was completed (Transects 1 to 9 and around perimeter of turtle basking station E);
- Soil auger tests were conducted at T1 to T9;
- Soil mapping indicates suitable substrate (high sand content soils) at T2 to T9; and
- No nesting evidence (i.e., test digs, claw marks, predated nests) was observed.

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOTU	No Turtles	No turtles despite survey effort
MPTU	Midland Painted Turtle	*Chrysemys picta marginata*
SNTU	Snapping Turtle	*Chelydra serpentina*
MATU	Northern Map Turtle	*Graptemys geographica*
BLTU	Blanding's Turtle	*Emydoidea blandingii*
SSTU	Spiny Soft-shelled Turtle	*Apalone spinifera*
WOTU	Wood Turtle	*Glyptemys insculpta*
STIN	Stinkpot Turtle	*Stemotherus odoratus*
SPTU	Spotted Turtle	*Clemmys guttata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JU
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 10: Snake Coverboard and Transect Survey Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NO.	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
29-AP-16	1	T1	X														
29-AP-16	1	T2		1													
29-AP-16	1	T3	X														
29-AP-16	1	T4	X														
29-AP-16	1	T5	X														
29-AP-16	1	T6	X														
29-AP-16	1	T7	X														
16-MA-16	2	T1	X														
16-MA-16	2	T2	X														
16-MA-16	2	T3	X														
16-MA-16	2	T4	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platifhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JU
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 10: Snake Coverboard and Transect Survey Results

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NO.	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
16-MA-16	2	T5	X														
15-SE-16	3	T1	X														
15-SE-16	3	T2	X														
15-SE-16	3	T3	X														
15-SE-16	3	T4	X														
15-SE-16	3	T5	X														
15-SE-16	3	T6	X														
16-SE-16	3	T7		1													
16-SE-16	3	T8 (new)		1													

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
RBSN	Northern Red-bellied Snake	*Storeria occipitomaculata occipitomaculata*
RASN	Gray Ratsnake	*Pantherophis spiloides*
RISN	Eastern Ribbonsnake	*Thamnophis sauritus*
BLRA	Blue Racer	*Coluber constrictor foxii*
BUGA	Butler's Gartersnake	*Thamnophis butleri*
FOSN	Eastern Foxsnake	*Pantherophis gloyd*
HOSN	Eastern Hog-nosed Snake	*Heterodon platifhinos*
MASS	Massassauga	*Sistrusus catenatus catenatus*
RNSN	Ring-necked Snake	*Diadophis punctatus*
SGSN	Smooth Greensnake	*Opheodrys vernalis*
QUSN	Queensnake	*Regina septemvittata*

DATE	
MONTH	CODE
January	JA
February	FE
March	MR
April	AP
May	MA
June	JU
July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 11: Wildlife Road Crossing Survey Results (2016)

SURVEY DATE (DD-MM-YY)	SURVEYROUND (X OF Y)	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
16-MA-16	1 of 3	1	None	-	-	-	-
16-MA-16	1 of 3	2	None	-	-	-	-
16-MA-16	1 of 3	3	None	-	-	-	-
02-JU-16	2 of 3	1	Eastern Chipmunk	591675	4796633	1	D
02-JU-16	2 of 3	2	None	-	-	-	-
02-JU-16	2 of 3	3	None	-	-	-	-
16-SE-16	3 of 3	1	Grey Squirrel	591672	4796629	3	D
16-SE-16	3 of 3	2	Blue Jay	59316	4796253	1	D
16-SE-16	3 of 3	3	None	-	-	-	-

LEGEND:

STATUS		MONTH	
D	Dead	JA	January
L	Live	FE	February
		MR	March
		AL	April
		MA	May
		JN	June
		JL	July
		AU	August
		SE	September
		OC	October
		NO	November
		DE	December

Table 12: Specialized BBS Results - SAR

Survey Date	Species Code*	Habitat Polygon Label	Number of Individuals	Sex	Adult or Juvenille	Breeding Evidence / Behaviour	Other Comments
13-Jun-12	BOBO	BOBO-1	9	6 males, 3 females	Adult	FS; carrying food obs'd for one female; other ones agitated and visiting probable nesting site	
13-Jun-12	BOBO	BOBO-2	2	males	adult	displaying	
13-Jun-12	BOBO	BOBO-3	1	male	adult	flyover	not suitable nesting habitat
13-Jun-12	BOBO	BOBO-4	1	male	adult	flyover	not suitable nesting habitat
13-Jun-12	EAME	EAME-1	3	male, female, unknown	adults, juvenile	FY	juvenile capable of flight
13-Jun-12	BARS	BARS-1	1	unknown	adult	x	no suitable nesting structure on property; foraging
12-Jun-12	BANS	BANS-1	1	unknown	adult	x	no suitable nesting structure on property; foraging
12-Jun-12	EAKI	EAKI-1	1	unknown	adult	SH	
13-Jun-12	EAKI	EAKI-1	1	unknown	adult	SH	
13-Jun-12	FISP	FISP-1	1	male	adult	SM	
13-Jun-12	FISP	FISP-2	2	male, female	adult	pair, agitated	
13-Jun-12	FISP	FISP-3	1	unknown	adult	agitated	
13-Jun-12	FISP	FISP-4	1	male	adult	SM	
13-Jun-12	FISP	FISP-5	2	male, female	adult	pair, agitated	
13-Jun-12	FISP	FISP-6	1	male	adult	SM	
13-Jun-12	EWPE	EWPE-1	1	male	adult	SM	
13-Jun-12	SCTA	SCTA-1	1	male	adult	SM	
13-Jun-12	SCTA	SCTA-2	1	male	adult	SM	
13-Jun-12	SAVS	SAVS-1	1	male	adult	SM	
13-Jun-12	SAVS	SAVS-2	1	male	adult	SM	
13-Jun-12	EATO	EATO-1	2	male, female	adult	pair, agitated	
13-Jun-12	ARSP	ARSP-1	1	male	adult		Odonate - Arrowhead Spiketail

[1] **Survey Type**: BBS (Breeding Bird Survey), SSM (Specialized Survey - Marsh Birds), SSN (Specialized Survey - Nocturnal Birds), SSR (Specialized Survey - Raptors), SSW (Specialized Survey - Waterfowl), SAR (Specialized Survey - Species at Risk)

*** Species Code**: consistent with the American Ornithologists' Union. 2012. Species 4-Letter-Codes. Accessed May 25, 2012. Available online: www.birdsontario.org/atlas/codes.jsp?lang=en&pg=species/

SAVANTA INC.
Table 13: Breeding Bird Survey Results (2014)

Common Name	Species Code	Scientific Name	Provincial Status (S Rank)	National Status (G Rank)	COSSARO (MNR)	COSEWIC (Federal)	Area Sensitive	Highest Breeding Evidence*
Anseriformes								
Anatidae								
Greater White-fronted Goose	GWFG	*Anser albifrons*						
Snow Goose	SNGO	*Chen caerulescens*	S5B	S5				
Ross's Goose	ROGO	*Chen rossi*						
Brant	BRAN	*Branta bernicla*						
Cackling Goose	CACG	*Branta hutchinsii*						
Canada Goose	CANG	*Branta canadensis*	S5	G5				X
Mute Swan	MUSW	*Cygnus olor*	SNA	G5				
Trumpeter Swan	TRUS	*Cygnus buccinator*	S4	G4				
Tundra Swan	TUSW	*Cygnus columbianus*	S4	G5				
Wood Duck	WODU	*Aix sponsa*	S5	G5				
Gadwall	GADW	*Anas strepera*	S4	G5				
American Wigeon	AMWI	*Anas americana*	S4	G5				
American Black Duck	ABDU	*Anas rubripes*	S4	G5				
Mallard	MALL	*Anas platyrhynchos*	S5	G5				
Blue-winged Teal	BWTE	*Anas discors*	S4	G5				
Northern Shoveler	NSHO	*Anas clypeata*	S4	G5				
Northern Pintail	NOPI	*Anas acuta*	S5	G5				
Green-winged Teal	GWTE	*Anas crecca*	S4	G5				
Canvasback	CANV	*Aythya valisineria*						
Redhead	REDH	*Aythya americana*	S2B, S4N	G5				
Ring-necked Duck	RNDU	*Aythya collaris*	S5	G5				
Greater Scaup	GRSC	*Aythya marila*	S4	G5				
Lesser Scaup	LESC	*Aythya affinis*	S4	G5				
Surf Scoter	SUSC	*Melanitta perspicillata*						
White-winged Scoter	WWSC	*Melanitta fusca*						
Black Scoter	BLSC	*Melanitta americana*						
Long-tailed Duck	LTDU	*Clangula hyemalis*						
Bufflehead	BUFF	*Bucephala albeola*	S4	G5				
Common Goldeneye	COGO	*Bucephala clangula*	S5	G5				
Barrow's Goldeneye	BAGO	*Bucephala islandica*						
Hooded Merganser	HOME	*Lophodytes cucullatus*	S5B,S5N	G5				
Common Merganser	COME	*Mergus merganser*	S5B,S5N	G5				
Red-breasted Merganser	RBME	*Mergus serrator*	S4B,S5N	G5				
Ruddy Duck	RUDU	*Oxyura jamaicensis*	S4B,S4N	G5			10	
Galliformes								
Phasianinae								
Gray Partridge	GRPA	*Perdix perdix*	SNA	G5				
Ring-necked Pheasant	RNPH	*Phasianus colchicus*	SNA	G5				
Ruffed Grouse	RUGR	*Bonasa umbellus*	S4	G5			20	
Spruce Grouse	SPGR	*Falcipennis canadensis*						
Wild Turkey	WITU	*Meleagris gallopavo*	S5	G5				
Northern Bobwhite	NOBO	*Colinus virginianus*	S1	G5	END	END		
Gaviiformes								
Gaviidae								
Common Loon	COLO	*Gavia immer*	S5B,S5N	G5			70	
Podicipediformes								
Podicipedidae								
Pied-billed Grebe	PBGR	*Podilymbus podiceps*	S4B,S4N	G5				
Suliformes								
Phalacrocoracidae								
Double-crested Cormorant	DCCO	*Phalacrocorax auritus*	S5B	G5				
Pelecaniformes								
Ardeidae								
American Bittern	AMBI	*Botaurus lentiginosus*	S4B	G4			10	
Least Bittern	LEBI	*Ixobrychus exilis*	S4B	G5	THR	THR		
Great Blue Heron	GBHE	*Ardea herodias*	S4	G5				
Great Egret	GREG	*Ardea alba*	S2B	G5				

Green Heron	GRHE	*Butorides virescens*	S4B	G5				
Black-crowned Night-Heron	BCNH	*Nycticorax nycticorax*	S3B,S3N	G5				
Pelecanidae								
American White Pelican		*Pelecanus erythrorhynchos*	S2B	G4	THR	NAR		
Accipitriformes								
Cathartidae								
Turkey Vulture	TUVU	*Cathartes aura*	S5B	G5				
Pandionidae								
Osprey	OSPR	*Pandion haliaetus*	S5B	G5				
Accipitridae								
Bald Eagle	BAEA	*Haliaeetus leucocephalus*	S4B,S2N	G4	SC	NAR		
Northern Harrier	NOHA	*Circus cyaneus*	S4B	G5			55	
Sharp-shinned Hawk	SSHA	*Accipiter striatus*	S5	G5			20-30	
Cooper's Hawk	COHA	*Accipiter cooperii*	S4	G5			4-50+	
Northern Goshawk	NOGO	*Accipiter gentilis*	S4	G5			100	
Red-shouldered Hawk	RSHA	*Buteo lineatus*	S4B	G5			50-70	
Broad-winged Hawk	BWHA	*Buteo platypterus*	S5B	G5			100	
Red-tailed Hawk	RTHA	*Buteo jamaicensis*	S5	G5				
Rough-legged Hawk	RLHA	*Buteo lagopus*	S1B, S4N	G5				
Golden Eagle	GOEA	*Aquila chrysaetos*	S2B	G5	END	NAR		
Gruiformes								
Rallidae								
Yellow Rail	YEAR	*Coturnicops noveboracensis*	S4B	G4	SC	SC		
King Rail	KIRA	*Rallus elegans*	S2B	G4G5	END	END	100	
Virginia Rail	VIRA	*Rallus limicola*	S5B	G5				
Sora	SORA	*Porzana carolina*	S4B	G5				
Common Gallinule	COGA	*Gallinula galeata*	S4B	G5				
American Coot	AMCO	*Fulica americana*	S4B	G5			50	
Gruidae								
Sandhill Crane	SACR	*Grus canadensis*	S5B	G5				
Charadriiformes								
Charadriidae								
Black-bellied Plover	BBPL	*Pluvialis squatarola*	S4N	G5				
American Golden-Plover	AMGP	*Pluvialis dominica*						
Semipalmated Plover	SEPL	*Charadrius semipalmatus*						
Piping Plover	PIPL	*Charadrius melodus*	S1B	G3	END	END		
Killdeer	KILL	*Charadrius vociferus*	S5B, S5N	G5				SH
Scolopacidae								
Spotted Sandpiper	SPSA	*Actitis macularius*	S5	G5				
Solitary Sandpiper	SOSA	*Tringa solitaria*	S4B	G5				
Greater Yellowlegs	GRYE	*Tringa melanoleuca*	S4B,S4N	G5				
Lesser Yellowlegs	LEYE	*Tringa flavipes*	S4B,S4N	G5				
Upland Sandpiper	UPSA	*Bartramia longicauda*	S4B	G5			25	
Whimbrel	WHIM	*Numenius phaeopus*						
Hudsonian Godwit	HUGO	*Limosa haemastica*						
Marbled Godwit	MAGO	*Limosa fedoa*						
Ruddy Turnstone	RUTU	*Arenaria interpres*						
Red Knot	REKN	*Calidris canutus (rufa)*	S1N	G4T2	END	END		
Sanderling	SAND	*Calidris alba*	S5N	G5				
Semipalmated Sandpiper	SESA	*Calidris pusilla*						
Least Sandpiper	LESA	*Calidris minutilla*						
White-rumped Sandpiper	WRSA	*Calidris fuscicollis*						
Baird's Sandpiper	BASA	*Calidris bairdii*						
Pectoral Sandpiper	PESA	*Calidris melanotos*						
Purple Sandpiper	PUSA	Calidris maritima						
Dunlin	DUNL	*Calidris alpina*	S4B, S5N	G5				
Stilt Sandpiper	STSA	*Calidris himantopus*						
Short-billed Dowitcher	SBDO	*Limnodromus griseus*						
Wilson's Snipe	WISN	*Gallinago delicata*	S5B	G5				
American Woodcock	AMWO	*Scolopax minor*	S4B	G5				
Wilson's Phalarope	WIPH	*Phalaropus tricolor*	S3B	G5				

Red-necked Phalarope	RNPH	*Phalaropus lobatus*						
Laridae								
Bonaparte's Gull	BOGU	*Chroicocephalus philadelphia*	S4B,S4N	G5				
Little Gull	LIGU	*Hydrocoloeus minutus*						
Ring-billed Gull	RBGU	*Larus delawarensis*	S5B,S4N	G5				X
Herring Gull	HEGU	*Larus argentatus*	S5B,S5N	G5				
Iceland Gull	ICGU	*Larus glaucoides*						
Lesser Black-backed Gull	LBGU	*Larus fuscus*						
Glaucous Gull	GLGU	*Larus hyperboreus*	S4N	G5				
Great Black-backed Gull	GBBG	*Larus marinus*	S2B	G5				
Caspian Tern	CATE	*Hydroprogne caspia*	S3B	G5				
Black Tern	BLTE	*Chlidonias niger*	S3B	G4	SC	NAR	20	
Common Tern	COTE	*Sterna hirundo*	S4B	G5				
Forster's Tern	FOTE	*Sterna forsteri*	S2B	G5			300	
Columbiformes								
Columbidae								
Rock Pigeon	ROPI	*Columba livia*	SNA	G5				
Mourning Dove	MODO	*Zenaida macroura*	S5	G5				
Cuculiformes								
Cuculidae								
Yellow-billed Cuckoo	YBCU	*Coccyzus americanus*	S4B	G5				
Black-billed Cuckoo	BBCU	*Coccyzus erythropthalmus*	S5B	G5				
Strigiformes								
Strigidae								
Barn Owl	BARO	*Tyto alba*	S1	G5	END	END		
Eastern Screech-Owl	EASO	*Megascops asio*	S4	G5				
Great Horned Owl	GHOW	*Bubo virginianus*	S4	G5				
Snowy Owl	SNOW	*Bubo scandiacus*	SNA	G5				
Barred Owl	BDOW	*Strix varia*	S5	G5			100	
Long-eared Owl	LEOW	*Asio otus*	S4	G5				
Short-eared Owl	SEOW	*Asio flammeus*	S2N, S4B	G5	SC	SC	75	
Boreal Owl	BOOW	*Aegolius funereus*	S4	G5				
Northern Saw-whet Owl	NSOW	*Aegolius acadicus*	S4	G5				
Caprimulgiformes								
Caprimulgidae								
Common Nighthawk	CONI	*Chordeiles minor*	S4B	G5	SC	THR		
Eastern Whip-poor-will	EWWI	*Antrostomus vociferus*	S4B	G5	THR	THR	100	
Apodiformes								
Apodidae								
Chimney Swift	CHSW	*Chaetura pelagica*	S4B, S4N	G5	THR	THR		
Trochilidae								
Ruby-throated Hummingbird	RTHU	*Archilochus colubris*	S5B	G5				
Coraciiformes								
Alcedinidae								
Belted Kingfisher	BEKI	*Megaceryle alcyon*	S4B	G5				
Piciformes								
Picidae								
Red-headed Woodpecker	RHWO	*Melanerpes erythrocephalus*	S4B	G5	SC	THR		
Red-bellied Woodpecker	RBWO	*Melanerpes carolinus*	S4	G5				SH
Yellow-bellied Sapsucker	YBSA	*Sphyrapicus varius*	S5B	G5			30-50	
Downy Woodpecker	DOWO	*Picoides pubescens*	S5	G5				SH
Hairy Woodpecker	HAWO	*Picoides villosus*	S5	G5			10	SH
Black-backed Woodpecker	BBWO	*Picoides arcticus*	S4	G5				
Northern Flicker	NOFL	*Colaptes auratus*	S4B	G5				SH
Pileated Woodpecker	PIWO	*Dryocopus pileatus*	S5	G5			30-50*	
Falconiformes								
Falconidae								
American Kestrel	AMKE	*Falco sparverius*	S4	G5				
Merlin	MERL	*Falco columbarius*	S5B	G5				

Peregrine Falcon	PEFA	*Falco peregrinus*	S3B	G4	SC	SC		
Passeriformes								
Tyrannidae								
Olive-sided Flycatcher	OSFL	*Contopus cooperi*	S4B	G5	SC	THR		
Eastern Wood-Pewee	EAWP	*Contopus virens*	S4B	G5	SC	SC		T
Yellow-bellied Flycatcher	YBFL	*Empidonax flaviventris*	S5B	G5				
Acadian Flycatcher	ACFL	*Empidonax virescens*	S2S3B	G5	END	END	30-36	
Alder Flycatcher	ALFL	*Empidonax alnorum*	S5B	G5				
Willow Flycatcher	WIFL	*Empidonax traillii*	S5B	G5				
Least Flycatcher	LEFL	*Empidonax minimus*	S4B	G5				
Eastern Phoebe	EAPH	*Sayornis phoebe*	S5B	G5				
Great Crested Flycatcher	GCFL	*Myiarchus crinitus*	S4B	G5				SH
Eastern Kingbird	EAKI	*Tyrannus tyrannus*	S4B	G5				P
Laniidae								
Loggerhead Shrike	LOSH	*Lanius ludovicianus*	S2B	G5	END	END	25	
Northern Shrike	NSHR	*Lanius excubitor*	SNA	G5				
Vireonidae								
White-eyed Vireo	WEVI	*Vireo griseus*	S2B	G5				
Yellow-throated Vireo	YTVI	*Vireo flavifrons*	S4B	G5			30	
Blue-headed Vireo	BHVI	*Vireo solitarius*	S5B	G5			100	
Warbling Vireo	WAVI	*Vireo gilvus*	S5B	G5				SM
Philadelphia Vireo	PHVI	*Vireo philadelphicus*	S5B	G5				
Red-eyed Vireo	REVI	*Vireo olivaceus*	S5B	G5				T
Corvidae								
Gray Jay	GRAJ	*Perisoreus canadensis*	S5	G5				
Blue Jay	BLJA	*Cyanocitta cristata*	S5	G5				P
American Crow	AMCR	*Corvus brachyrhynchos*	S5B	G5				SH
Common Raven	CORA	*Corvus corax*	S5	G5				
Alaudidae								
Horned Lark	HOLA	*Eremophila alpestris*	S4B	G5				SH
Hirundinidae								
Purple Martin	PUMA	*Progne subis*	S4B	G5				
Tree Swallow	TRES	*Tachycineta bicolor*	S4B	G5				
Northern Rough-winged Swallow	NRWS	*Stelgidopteryx serripennis*	S4B	G5				
Bank Swallow	BANS	*Riparia riparia*	S4B	G5	THR	THR		
Cliff Swallow	CLSW	*Petrochelidon pyrrhonota*	S4B	G5				
Barn Swallow	BARS	*Hirundo rustica*	S4B	G5	THR	THR		AE
Paridae								
Black-capped Chickadee	BCCH	*Poecile atricapillus*	S5	G5				A
Boreal Chickadee	BOCH	*Poecile hudsonicus*	S5	G5				
Tufted Titmouse	TUTI	*Baeolophus bicolor*	S4	G5				
Sittidae								
Red-breasted Nuthatch	RBNU	*Sitta canadensis*	S5	G5			0	
White-breasted Nuthatch	WBNU	*Sitta carolinensis*	S5	G5			10	A
Certhiidae								
Brown Creeper	BRCR	*Certhia americana*	S5B	G5			30	
Troglodytidae								
Carolina Wren	CAWR	*Thryothorus ludovicianus*	S4	G5				
House Wren	HOWR	*Troglodytes aedon*	S5B	G5				T
Winter Wren	WIWR	*Troglodytes hiemalis*	S5B	G5			30	
Sedge Wren	SEWR	*Cistothorus platensis*	S4B	G5				
Marsh Wren	MAWR	*Cistothorus palustris*	S4B	G5				
Polioptilidae								
Blue-gray Gnatcatcher	BGGN	*Polioptila caerulea*	S4B	G5			30	
Regulidae								
Golden-crowned Kinglet	GCKI	*Regulus satrapa*	S5B	G5			0	
Ruby-crowned Kinglet	RCKI	*Regulus calendula*	S4B	G5				

Turdidae								
Eastern Bluebird	EABL	*Sialia sialis*	S5B	G5				
Veery	VEER	*Catharus fuscescens*	S4B	G5			10-20	
Gray-cheeked Thrush	GCTH	*Catharus minimus*	S4B	G5				
Swainson's Thrush	SWTH	*Catharus ustulatus*	S4B	G5				
Hermit Thrush	HETH	*Catharus guttatus*	S5B	G5			20-30	
Wood Thrush	WOTH	*Hylocichla mustelina*	S4B	G5	SC	THR		SM
American Robin	AMRO	*Turdus migratorius*	S5B	G5				FS
Mimidae								
Gray Catbird	GRCA	*Dumetella carolinensis*	S4B	G5				A
Northern Mockingbird	NOMO	*Mimus polyglottos*	S4	G5				
Brown Thrasher	BRTH	*Toxostoma rufum*	S4B	G5				
Sturnidae								
European Starling	EUST	*Sturnus vulgaris*	SNA	G5				P
Motacillidae								
American Pipit	AMPI	*Anthus rubescens*	S4	G5				
Bombycillidae								
Bohemian Waxwing	BOWA	*Bombycilla garrulus*						
Cedar Waxwing	CEDW	*Bombycilla cedrorum*	S5B	G5				SH
Calcariidae								
Lapland Longspur	LALO	*Calcarius lapponicus*	S3B	G5				
Snow Bunting	SNBU	*Plectrophenax nivalis*	SNA	G5				
Parulidae								
Ovenbird	OVEN	*Seiurus aurocapilla*	S4B	G5			20	
Louisiana Waterthrush	LOWA	*Parkesia motacilla*	S3B	G5	SC	SC	100	
Northern Waterthrush	NOWA	*Parkesia noveboracensis*	S5B	G5			20	
Golden-winged Warbler	GWWA	*Vermivora chrysoptera*	S4B	G4	SC	THR		
Blue-winged Warbler	BWWA	*Vermivora cyanoptera*	S4B	G5				
Black-and-white Warbler	BAWW	*Mniotilta varia*	S5B	G5			100	
Prothonotary Warbler	PRWA	*Protonotaria citrea*	S1B	G5				
Tennessee Warbler	TEWA	*Oreothlypis peregrina*	S5B	G5				
Orange-crowned Warbler	OCWA	*Oreothlypis celata*	S4B	G5				
Nashville Warbler	NAWA	*Oreothlypis ruficapilla*	S5B	G5				
Connecticut Warbler	CONW	*Oporornis agilis*						
Mourning Warbler	MOWA	*Geothlypis philadelphia*	S4B	G5			30	SM
Common Yellowthroat	COYE	*Geothlypis trichas*	S5B	G5				SM
Hooded Warbler	HOWA	*Setophaga citrina*	S4B	G5			15-30	
American Redstart	AMRE	*Setophaga ruticilla*	S5B	G5			20-30	
Kirtland's Warbler	KIWA	*Setophaga kirtlandii*	S1B	G1	END	END		
Cape May Warbler	CMWA	*Setophaga tigrina*	S5B	G5				
Cerulean Warbler	CERW	*Setophaga cerulea*	S3B	G4	THR	END	100	
Northern Parula	NOPA	*Setophaga americana*	S4B	G5			100	
Magnolia Warbler	MAWA	*Setophaga magnolia*	S5B	G5			30	
Bay-breasted Warbler	BBWA	*Setophaga castanea*	S5B	G5				
Blackburnian Warbler	BLWA	*Setophaga fusca*	S5B	G5			30-50	
Yellow Warbler	YWAR	*Setophaga petechia*	S5B	G5				T
Chestnut-sided Warbler	CSWA	*Setophaga pensylvanica*	S5B	G5				
Blackpoll Warbler	BLWA	*Setophaga striata*	S4B	G5				
Black-throated Blue Warbler	BTBW	*Setophaga caerulescens*	S5B	G5			30-50	
Palm Warbler	PAWA	*Setophaga palmarum (palmarum)*	S5B	G5				
Pine Warbler	PIWA	*Setophaga pinus*	S5B	G5			15-30	
Yellow-rumped Warbler	YRWA	*Setophaga coronata*	S5B	G5				
Prairie Warbler	PRAW	*Setophaga discolor*	S3B	G5				
Black-throated Green Warbler	BTGW	*Setophaga virens*	S5B	G5			30	
Canada Warbler	CAWA	*Cardellina canadensis*	S4B	G5	SC	THR	30	
Wilson's Warbler	WIWA	*Cardellina pusilla*	S4B	G5				
Yellow-breasted Chat	YBCH	*Icteria virens*	S2B	G5	END	END		
Emberizidae								
Eastern Towhee	EATO	*Pipilo erythrophthalmus*	S4B	G5				A
American Tree Sparrow	ATSP	*Spizella arborea*	S4B	G5				
Chipping Sparrow	CHSP	*Spizella passerina*	S5B	G5				SM

Clay-colored Sparrow	CCSP	*Spizella pallida*	S4B	G5				
Field Sparrow	FISP	*Spizella pusilla*	S4B	G5				T
Vesper Sparrow	VESP	*Pooecetes gramineus*	S4B	G5				
Savannah Sparrow	SAVS	*Passerculus sandwichensis*	S4B	G5				SM
Grasshopper Sparrow	GRSP	*Ammodramus savannarum*	S4B	G5				
Henslow's Sparrow	HESP	*Ammodramus henslowii*	SHB	G4	END	END	50	
Fox Sparrow	FOSP	*Passerella iliaca*	S4B	G5				
Song Sparrow	SOSP	*Melospiza melodia*	S5B	G5				FS
Lincoln's Sparrow	LISP	*Melospiza lincolnii*	S5B	G5				
Swamp Sparrow	SWSP	*Melospiza georgiana*	S5B	G5				
White-throated Sparrow	WTSP	*Zonotrichia albicollis*	S5B	G5			20	
White-crowned Sparrow	WCSP	*Zonotrichia leucophrys*	S4B	G5				
Dark-eyed Junco	DEJU	*Junco hyemalis*	S5B	G5				
Cardinalidae								
Scarlet Tanager	SCTA	*Piranga olivacea*	S4B	G5			20	T
Northern Cardinal	NOCA	*Cardinalis cardinalis*	S5	G5				A
Rose-breasted Grosbeak	RBGR	*Pheucticus ludovicianus*	S4B	G5				A
Indigo Bunting	INBU	*Passerina cyanea*	S4B	G5				T
Icteridae								
Bobolink	BOBO	*Dolichonyx oryzivorus*	S4B	G5	THR	THR	10	
Red-winged Blackbird	RWBL	*Agelaius phoeniceus*	S4	G5				DD
Eastern Meadowlark	EAME	*Sturnella magna*	S4B	G5	THR	THR		
Western Meadowlark	WEME	*Sturnella neglecta*	S3B	G5				
Yellow-headed Blackbird	YHBL	*Xanthocephalus xanthocephalus*	S2B	G5				
Rusty Blackbird	RUBL	*Euphagus carolinus*	S4B	G5				
Brewer's Blackbird	BRBL	*Euphagus cyanocephalus*	S4B	G5				
Common Grackle	COGR	*Quiscalus quiscula*	S5B	G5				FY
Brown-headed Cowbird	BHCO	*Molothrus ater*	S4B	G5				P
Orchard Oriole	OROR	*Icterus spurius*	S4B	G5				SM
Baltimore Oriole	BAOR	*Icterus galbula*	S4B	G5				AE
Fringillidae								
Pine Grosbeak	PIGR	*Pinicola enucleator*	S4B	G5				
Purple Finch	PUFI	*Carpodacus purpureus*	S4B	G5				
House Finch	HOFI	*Carpodacus mexicanus*	SNA	G5				SH
Red Crossbill	RECR	*Loxia curvirostra*	S4B	G5				
White-winged Crossbill	WWCR	*Loxia leucoptera*	S5B	G5				
Common Redpoll	CORE	*Acanthis flammea*	S4B	G5				
Pine Siskin	PISI	*Spinus pinus*	S4B	G5				
American Goldfinch	AMGO	*Spinus tristis*	S5B	G5				SH
Evening Grosbeak	EVGR	*Coccothraustes vespertinus*	S4B	G5				
Passeridae								
House Sparrow	HOSP	*Passer domesticus*	SNA	G5				

Highest Breeding Evidence*: Codes assigned for breeding evidence are consistent with the Ontario Breeding Bird Atlas (OBBA). 2012. Breeding Evidence Codes. Accessed May 25, 2012. Available online: http://www.birdsontario.org. Several different types of breeding evidence are often recorded for any given species over the course of surveys and incidental observations - this table reports only the highest level of breeding evidence

Common Name	Species Code	Scientific Name	Provincial Status (S Rank)	National Status (G Rank)	COSSARO (MNR)	COSEWIC (Federal)	SWH Indicator Species	Highest Breeding Evidence*
Anseriformes								
Anatidae								
Greater White-fronted Goose	GWFG	*Anser albifrons*	SNA	G5				
Snow Goose	SNGO	*Chen caerulescens*	S5B	G5			X	
Ross's Goose	ROGO	*Chen rossi*	S1B	G4				
Brant	BRAN	*Branta bernicla*	S4N	G5			X	
Cackling Goose	CACG	*Branta hutchinsii*	S4N	G5			X	
Canada Goose	CANG	*Branta canadensis*	S5	G5			X	OB-X
Mute Swan	MUSW	*Cygnus olor*	SNA	G5				
Trumpeter Swan	TRUS	*Cygnus buccinator*	S4	G4			X	
Tundra Swan	TUSW	*Cygnus columbianus*	S4	G5			X	
Wood Duck	WODU	*Aix sponsa*	S5	G5			X	PR-P
Gadwall	GADW	*Anas strepera*	S4	G5			X	
American Wigeon	AMWI	*Anas americana*	S4	G5			X	
American Black Duck	ABDU	*Anas rubripes*	S4	G5			X	
Mallard	MALL	*Anas platyrhynchos*	S5	G5			X	
Blue-winged Teal	BWTE	*Anas discors*	S4	G5			X	
Northern Shoveler	NSHO	*Anas clypeata*	S4	G5			X	
Northern Pintail	NOPI	*Anas acuta*	S5	G5			X	
Green-winged Teal	GWTE	*Anas crecca*	S4	G5			X	
Canvasback	CANV	*Aythya valisineria*	S1B, S4N	G5			X	
Redhead	REDH	*Aythya americana*	S2B, S4N	G5			X	
Ring-necked Duck	RNDU	*Aythya collaris*	S5	G5			X	
Greater Scaup	GRSC	*Aythya marila*	S4	G5			X	
Lesser Scaup	LESC	*Aythya affinis*	S4	G5			X	
Surf Scoter	SUSC	*Melanitta perspicillata*	S4B,S4N	G5			X	
White-winged Scoter	WWSC	*Melanitta fusca*	S4B,S4N	G5			X	
Black Scoter	BLSC	*Melanitta americana*					X	
Long-tailed Duck	LTDU	*Clangula hyemalis*					X	
Bufflehead	BUFF	*Bucephala albeola*	S4	G5			X	
Common Goldeneye	COGO	*Bucephala clangula*	S5	G5			X	
Barrow's Goldeneye	BAGO	*Bucephala islandica*						
Hooded Merganser	HOME	*Lophodytes cucullatus*	S5B,S5N	G5			X	
Common Merganser	COME	*Mergus merganser*	S5B,S5N	G5			X	
Red-breasted Merganser	RBME	*Mergus serrator*	S4B,S5N	G5			X	
Ruddy Duck	RUDU	*Oxyura jamaicensis*	S4B,S4N	G5			X	
Galliformes								
Phasianinae								
Gray Partridge	GRPA	*Perdix perdix*	SNA	G5				
Ring-necked Pheasant	RNPH	*Phasianus colchicus*	SNA	G5				
Ruffed Grouse	RUGR	*Bonasa umbellus*	S4	G5			X	
Spruce Grouse	SPGR	*Falcipennis canadensis*					X	
Wild Turkey	WITU	*Meleagris gallopavo*	S5	G5			X	
Northern Bobwhite	NOBO	*Colinus virginianus*	S1	G5	END	END		
Gaviiformes								
Gaviidae								
Common Loon	COLO	*Gavia immer*	S5B,S5N	G5			X	
Podicipediformes								
Podicipedidae								
Pied-billed Grebe	PBGR	*Podilymbus podiceps*	S4B,S4N	G5			X	
Suliformes								
Phalacrocoracidae								
Double-crested Cormorant	DCCO	*Phalacrocorax auritus*	S5B	G5				
Pelecaniformes								
Ardeidae								
American Bittern	AMBI	*Botaurus lentiginosus*	S4B	G4			X	
Least Bittern	LEBI	*Ixobrychus exilis*	S4B	G5	THR	THR		
Great Blue Heron	GBHE	*Ardea herodias*	S4	G5			X	
Great Egret	GREG	*Ardea alba*	S2B	G5			X	
Green Heron	GRHE	*Butorides virescens*	S4B	G5			X	
Black-crowned Night-Heron	BCNH	*Nycticorax nycticorax*	S3B,S3N	G5			X	
Pelecanidae								
American White Pelican		*Pelecanus erythrorhynchos*	S2B	G4	THR	NAR		
Accipitriformes								
Cathartidae								
Turkey Vulture	TUVU	*Cathartes aura*	S5B	G5				
Pandionidae								
Osprey	OSPR	*Pandion haliaetus*	S5B	G5			X	OB-X

Accipitridae								
Bald Eagle	BAEA	*Haliaeetus leucocephalus*	S4B,S2N	G4	SC	NAR	X	
Northern Harrier	NOHA	*Circus cyaneus*	S4B	G5			X	
Sharp-shinned Hawk	SSHA	*Accipiter striatus*	S5	G5			X	
Cooper's Hawk	COHA	*Accipiter cooperii*	S4	G5			X	
Northern Goshawk	NOGO	*Accipiter gentilis*	S4	G5			X	
Red-shouldered Hawk	RSHA	*Buteo lineatus*	S4B	G5	NAR	NAR	X	
Broad-winged Hawk	BWHA	*Buteo platypterus*	S5B	G5			X	
Red-tailed Hawk	RTHA	*Buteo jamaicensis*	S5	G5			X	PO-S
Rough-legged Hawk	RLHA	*Buteo lagopus*	S1B, S4N	G5			X	
Golden Eagle	GOEA	*Aquila chrysaetos*	S2B	G5	END	NAR		
Gruiformes								
Rallidae								
Yellow Rail	YEAR	*Coturnicops noveboracensis*	S4B	G4	SC	SC	X	
King Rail	KIRA	*Rallus elegans*	S2B	G4G5	END	END		
Virginia Rail	VIRA	*Rallus limicola*	S5B	G5			X	
Sora	SORA	*Porzana carolina*	S4B	G5			X	
Common Gallinule	COGA	*Gallinula galeata*	S4B	G5			X	
American Coot	AMCO	*Fulica americana*	S4B	G5			X	
Gruidae								
Sandhill Crane	SACR	*Grus canadensis*	S5B	G5			X	
Charadriiformes								
Charadriidae								
Black-bellied Plover	BBPL	*Pluvialis squatarola*	S4N	G5			X	
American Golden-Plover	AMGP	*Pluvialis dominica*					X	
Semipalmated Plover	SEPL	*Charadrius semipalmatus*					X	
Piping Plover	PIPL	*Charadrius melodus*	S1B	G3	END	END		
Killdeer	KILL	*Charadrius vociferus*	S5B, S5N	G5				OB-X
Scolopacidae								
Spotted Sandpiper	SPSA	*Actitis macularius*	S5	G5			X	
Solitary Sandpiper	SOSA	*Tringa solitaria*	S4B	G5			X	
Greater Yellowlegs	GRYE	*Tringa melanoleuca*	S4B,S4N	G5			X	
Lesser Yellowlegs	LEYE	*Tringa flavipes*	S4B,S4N	G5			X	
Upland Sandpiper	UPSA	*Bartramia longicauda*	S4B	G5			X	
Whimbrel	WHIM	*Numenius phaeopus*					X	
Hudsonian Godwit	HUGO	*Limosa haemastica*					X	
Marbled Godwit	MAGO	*Limosa fedoa*					X	
Ruddy Turnstone	RUTU	*Arenaria interpres*					X	
Red Knot	REKN	*Calidris canutus (rufa)*	S1N	G4T2	END	END		
Sanderling	SAND	*Calidris alba*	S5N	G5			X	
Semipalmated Sandpiper	SESA	*Calidris pusilla*					X	
Least Sandpiper	LESA	*Calidris minutilla*					X	
White-rumped Sandpiper	WRSA	*Calidris fuscicollis*					X	
Baird's Sandpiper	BASA	*Calidris bairdii*					X	
Pectoral Sandpiper	PESA	*Calidris melanotos*					X	
Purple Sandpiper	PUSA	Calidris maritima					X	
Dunlin	DUNL	*Calidris alpina*	S4B, S5N	G5			X	
Stilt Sandpiper	STSA	*Calidris himantopus*					X	
Short-billed Dowitcher	SBDO	*Limnodromus griseus*					X	
Wilson's Snipe	WISN	*Gallinago delicata*	S5B	G5				
American Woodcock	AMWO	*Scolopax minor*	S4B	G5				
Wilson's Phalarope	WIPH	*Phalaropus tricolor*	S3B	G5				
Red-necked Phalarope	RNPH	*Phalaropus lobatus*					X	
Laridae								
Bonaparte's Gull	BOGU	*Chroicocephalus philadelphia*	S4B,S4N	G5				
Little Gull	LIGU	*Hydrocoloeus minutus*					X	
Ring-billed Gull	RBGU	*Larus delawarensis*	S5B,S4N	G5			X	OB-X
Herring Gull	HEGU	*Larus argentatus*	S5B,S5N	G5			X	
Iceland Gull	ICGU	*Larus glaucoides*						
Lesser Black-backed Gull	LBGU	*Larus fuscus*						
Glaucous Gull	GLGU	*Larus hyperboreus*	S4N	G5				
Great Black-backed Gull	GBBG	*Larus marinus*	S2B	G5			X	
Caspian Tern	CATE	*Hydroprogne caspia*	S3B	G5			X	
Black Tern	BLTE	*Chlidonias niger*	S3B	G4	SC	NAR	X	
Common Tern	COTE	*Sterna hirundo*	S4B	G5			X	
Forster's Tern	FOTE	*Sterna forsteri*	S2B	G5				
Columbiformes								
Columbidae								
Rock Pigeon	ROPI	*Columba livia*	SNA	G5				
Mourning Dove	MODO	*Zenaida macroura*	S5	G5				PO-S
Cuculiformes								
Cuculidae								
Yellow-billed Cuckoo	YBCU	*Coccyzus americanus*	S4B	G5				PO-S
Black-billed Cuckoo	BBCU	*Coccyzus erythropthalmus*	S5B	G5			X	
Strigiformes								

Strigidae								
Barn Owl	BARO	*Tyto alba*	S1	G5	END	END		
Eastern Screech-Owl	EASO	*Megascops asio*	S4	G5				PO-H
Great Horned Owl	GHOW	*Bubo virginianus*	S4	G5				
Snowy Owl	SNOW	*Bubo scandiacus*	SNA	G5			X	
Barred Owl	BDOW	*Strix varia*	S5	G5			X	
Long-eared Owl	LEOW	*Asio otus*	S4	G5				
Short-eared Owl	SEOW	*Asio flammeus*	S2N, S4B	G5	SC	SC	X	
Boreal Owl	BOOW	*Aegolius funereus*	S4	G5				
Northern Saw-whet Owl	NSOW	*Aegolius acadicus*	S4	G5				
Caprimulgiformes								
Caprimulgidae								
Common Nighthawk	CONI	*Chordeiles minor*	S4B	G5	SC	THR		
Eastern Whip-poor-will	EWWI	*Antrostomus vociferus*	S4B	G5	THR	THR		
Apodiformes								
Apodidae								
Chimney Swift	CHSW	*Chaetura pelagica*	S4B, S4N	G5	THR	THR		PO-H
Trochilidae								
Ruby-throated Hummingbird	RTHU	*Archilochus colubris*	S5B	G5				
Coraciiformes								
Alcedinidae								
Belted Kingfisher	BEKI	*Megaceryle alcyon*	S4B	G5				PO-H
Piciformes								
Picidae								
Red-headed Woodpecker	RHWO	*Melanerpes erythrocephalus*	S4B	G5	SC	THR		
Red-bellied Woodpecker	RBWO	*Melanerpes carolinus*	S4	G5				PR-T
Yellow-bellied Sapsucker	YBSA	*Sphyrapicus varius*	S5B	G5			X	
Downy Woodpecker	DOWO	*Picoides pubescens*	S5	G5				PO-H
Hairy Woodpecker	HAWO	*Picoides villosus*	S5	G5				PO-S
Black-backed Woodpecker	BBWO	*Picoides arcticus*	S4	G5				
Northern Flicker	NOFL	*Colaptes auratus*	S4B	G5				
Pileated Woodpecker	PIWO	*Dryocopus pileatus*	S5	G5			X	PO-H
Falconiformes								
Falconidae								
American Kestrel	AMKE	*Falco sparverius*	S4	G5			X	
Merlin	MERL	*Falco columbarius*	S5B	G5				
Peregrine Falcon	PEFA	*Falco peregrinus*	S3B	G4	SC	SC		
Passeriformes								
Tyrannidae								
Olive-sided Flycatcher	OSFL	*Contopus cooperi*	S4B	G5	SC	THR		
Eastern Wood-Pewee	EAWP	*Contopus virens*	S4B	G5	SC	SC		PR-T
Yellow-bellied Flycatcher	YBFL	*Empidonax flaviventris*	S5B	G5				
Acadian Flycatcher	ACFL	*Empidonax virescens*	S2S3B	G5	END	END		
Alder Flycatcher	ALFL	*Empidonax alnorum*	S5B	G5				
Willow Flycatcher	WIFL	*Empidonax traillii*	S5B	G5			X	
Least Flycatcher	LEFL	*Empidonax minimus*	S4B	G5				
Eastern Phoebe	EAPH	*Sayornis phoebe*	S5B	G5				PO-S
Great Crested Flycatcher	GCFL	*Myiarchus crinitus*	S4B	G5				PR-P
Eastern Kingbird	EAKI	*Tyrannus tyrannus*	S4B	G5				
Laniidae								
Loggerhead Shrike	LOSH	*Lanius ludovicianus*	S2B	G5	END	END		
Northern Shrike	NSHR	*Lanius excubitor*	SNA	G5				
Vireonidae								
White-eyed Vireo	WEVI	*Vireo griseus*	S2B	G5				
Yellow-throated Vireo	YTVI	*Vireo flavifrons*	S4B	G5				
Blue-headed Vireo	BHVI	*Vireo solitarius*	S5B	G5			X	
Warbling Vireo	WAVI	*Vireo gilvus*	S5B	G5				PO-S
Philadelphia Vireo	PHVI	*Vireo philadelphicus*	S5B	G5				
Red-eyed Vireo	REVI	*Vireo olivaceus*	S5B	G5				PR-T
Corvidae								
Gray Jay	GRAJ	*Perisoreus canadensis*	S5	G5				
Blue Jay	BLJA	*Cyanocitta cristata*	S5	G5				PR-T
American Crow	AMCR	*Corvus brachyrhynchos*	S5B	G5				PR-T
Common Raven	CORA	*Corvus corax*	S5	G5				
Alaudidae								
Horned Lark	HOLA	*Eremophila alpestris*	S4B	G5				
Hirundinidae								
Purple Martin	PUMA	*Progne subis*	S4B	G5				
Tree Swallow	TRES	*Tachycineta bicolor*	S4B	G5				
Northern Rough-winged Swallow	NRWS	*Stelgidopteryx serripennis*	S4B	G5			X	
Bank Swallow	BANS	*Riparia riparia*	S4B	G5	THR	THR	X	
Cliff Swallow	CLSW	*Petrochelidon pyrrhonota*	S4B	G5			X	
Barn Swallow	BARS	*Hirundo rustica*	S4B	G5	THR	THR		PO-H

Paridae								
Black-capped Chickadee	BCCH	*Poecile atricapillus*	S5	G5				PR-T
Boreal Chickadee	BOCH	*Poecile hudsonicus*	S5	G5				
Tufted Titmouse	TUTI	*Baeolophus bicolor*	S4	G5				
Sittidae								
Red-breasted Nuthatch	RBNU	*Sitta canadensis*	S5	G5			X	
White-breasted Nuthatch	WBNU	*Sitta carolinensis*	S5	G5				PR-A
Certhiidae								
Brown Creeper	BRCR	*Certhia americana*	S5B	G5				
Troglodytidae								
Carolina Wren	CAWR	*Thryothorus ludovicianus*	S4	G5				
House Wren	HOWR	*Troglodytes aedon*	S5B	G5				PR-P
Winter Wren	WIWR	*Troglodytes hiemalis*	S5B	G5			X	
Sedge Wren	SEWR	*Cistothorus platensis*	S4B	G5			X	
Marsh Wren	MAWR	*Cistothorus palustris*	S4B	G5			X	
Polioptilidae								
Blue-gray Gnatcatcher	BGGN	*Polioptila caerulea*	S4B	G5				PO-H
Regulidae								
Golden-crowned Kinglet	GCKI	*Regulus satrapa*	S5B	G5				
Ruby-crowned Kinglet	RCKI	*Regulus calendula*	S4B	G5				
Turdidae								
Eastern Bluebird	EABL	*Sialia sialis*	S5B	G5				
Veery	VEER	*Catharus fuscescens*	S4B	G5			X	
Gray-cheeked Thrush	GCTH	*Catharus minimus*	S4B	G5				
Swainson's Thrush	SWTH	*Catharus ustulatus*	S4B	G5				
Hermit Thrush	HETH	*Catharus guttatus*	S5B	G5				
Wood Thrush	WOTH	*Hylocichla mustelina*	S4B	G5	SC	THR		PR-T
American Robin	AMRO	*Turdus migratorius*	S5B	G5				CO-FY
Mimidae								
Gray Catbird	GRCA	*Dumetella carolinensis*	S4B	G5				PR-A
Northern Mockingbird	NOMO	*Mimus polyglottos*	S4	G5				
Brown Thrasher	BRTH	*Toxostoma rufum*	S4B	G5			X	
Sturnidae								
European Starling	EUST	*Sturnus vulgaris*	SNA	G5				PO-H
Motacillidae								
American Pipit	AMPI	*Anthus rubescens*	S4	G5				
Bombycillidae								
Bohemian Waxwing	BOWA	*Bombycilla garrulus*						
Cedar Waxwing	CEDW	*Bombycilla cedrorum*	S5B	G5				PO-H
Calcariidae								
Lapland Longspur	LALO	*Calcarius lapponicus*	S3B	G5				
Snow Bunting	SNBU	*Plectrophenax nivalis*	SNA	G5				
Parulidae								
Ovenbird	OVEN	*Seiurus aurocapilla*	S4B	G5			X	
Louisiana Waterthrush	LOWA	*Parkesia motacilla*	S3B	G5	SC	SC		
Northern Waterthrush	NOWA	*Parkesia noveboracensis*	S5B	G5				
Golden-winged Warbler	GWWA	*Vermivora chrysoptera*	S4B	G4	SC	THR	X	
Blue-winged Warbler	BWWA	*Vermivora cyanoptera*	S4B	G5				PO-S
Black-and-white Warbler	BAWW	*Mniotilta varia*	S5B	G5				
Prothonotary Warbler	PRWA	*Protonotaria citrea*	S1B	G5				
Tennessee Warbler	TEWA	*Oreothlypis peregrina*	S5B	G5				
Orange-crowned Warbler	OCWA	*Oreothlypis celata*	S4B	G5				
Nashville Warbler	NAWA	*Oreothlypis ruficapilla*	S5B	G5				
Connecticut Warbler	CONW	*Oporornis agilis*						
Mourning Warbler	MOWA	*Geothlypis philadelphia*	S4B	G5				
Common Yellowthroat	COYE	*Geothlypis trichas*	S5B	G5				PO-S
Hooded Warbler	HOWA	*Setophaga citrina*	S4B	G5				
American Redstart	AMRE	*Setophaga ruticilla*	S5B	G5				PO-S
Kirtland's Warbler	KIWA	*Setophaga kirtlandii*	S1B	G1	END	END		
Cape May Warbler	CMWA	*Setophaga tigrina*	S5B	G5				
Cerulean Warbler	CERW	*Setophaga cerulea*	S3B	G4	THR	END	X	
Northern Parula	NOPA	*Setophaga americana*	S4B	G5			X	
Magnolia Warbler	MAWA	*Setophaga magnolia*	S5B	G5				
Bay-breasted Warbler	BBWA	*Setophaga castanea*	S5B	G5				
Blackburnian Warbler	BLWA	*Setophaga fusca*	S5B	G5			X	
Yellow Warbler	YWAR	*Setophaga petechia*	S5B	G5				PR-T
Chestnut-sided Warbler	CSWA	*Setophaga pensylvanica*	S5B	G5				PO-S
Blackpoll Warbler	BLWA	*Setophaga striata*	S4B	G5				
Black-throated Blue Warbler	BTBW	*Setophaga caerulescens*	S5B	G5			X	
Palm Warbler	PAWA	*Setophaga palmarum (palmarum)*	S5B	G5				
Pine Warbler	PIWA	*Setophaga pinus*	S5B	G5				
Yellow-rumped Warbler	YRWA	*Setophaga coronata*	S5B	G5				
Prairie Warbler	PRAW	*Setophaga discolor*	S3B	G5				

Black-throated Green Warbler	BTGW	*Setophaga virens*	S5B	G5			X	
Canada Warbler	CAWA	*Cardellina canadensis*	S4B	G5	SC	THR		
Wilson's Warbler	WIWA	*Cardellina pusilla*	S4B	G5				
Yellow-breasted Chat	YBCH	*Icteria virens*	S2B	G5	END	END	X	
Emberizidae								
Eastern Towhee	EATO	*Pipilo erythrophthalmus*	S4B	G5			X	PR-T
American Tree Sparrow	ATSP	*Spizella arborea*	S4B	G5				
Chipping Sparrow	CHSP	*Spizella passerina*	S5B	G5				PO-S
Clay-colored Sparrow	CCSP	*Spizella pallida*	S4B	G5			X	
Field Sparrow	FISP	*Spizella pusilla*	S4B	G5			X	PR-T
Vesper Sparrow	VESP	*Pooecetes gramineus*	S4B	G5			X	
Savannah Sparrow	SAVS	*Passerculus sandwichensis*	S4B	G5			X	
Grasshopper Sparrow	GRSP	*Ammodramus savannarum*	S4B	G5	SC		X	
Henslow's Sparrow	HESP	*Ammodramus henslowii*	SHB	G4	END	END		
Fox Sparrow	FOSP	*Passerella iliaca*	S4B	G5				
Song Sparrow	SOSP	*Melospiza melodia*	S5B	G5				CO-FS
Lincoln's Sparrow	LISP	*Melospiza lincolnii*	S5B	G5				
Swamp Sparrow	SWSP	*Melospiza georgiana*	S5B	G5				
White-throated Sparrow	WTSP	*Zonotrichia albicollis*	S5B	G5				
White-crowned Sparrow	WCSP	*Zonotrichia leucophrys*	S4B	G5				
Dark-eyed Junco	DEJU	*Junco hyemalis*	S5B	G5				
Cardinalidae								
Scarlet Tanager	SCTA	*Piranga olivacea*	S4B	G5			X	PR-T
Northern Cardinal	NOCA	*Cardinalis cardinalis*	S5	G5				CO-FY
Rose-breasted Grosbeak	RBGR	*Pheucticus ludovicianus*	S4B	G5				PR-T
Indigo Bunting	INBU	*Passerina cyanea*	S4B	G5				PR-A
Icteridae								
Bobolink	BOBO	*Dolichonyx oryzivorus*	S4B	G5	THR	THR		
Red-winged Blackbird	RWBL	*Agelaius phoeniceus*	S4	G5				CO-FY
Eastern Meadowlark	EAME	*Sturnella magna*	S4B	G5	THR	THR		
Western Meadowlark	WEME	*Sturnella neglecta*	S3B	G5				
Yellow-headed Blackbird	YHBL	*Xanthocephalus xanthocephalus*	S2B	G5				
Rusty Blackbird	RUBL	*Euphagus carolinus*	S4B	G5				
Brewer's Blackbird	BRBL	*Euphagus cyanocephalus*	S4B	G5			X	
Common Grackle	COGR	*Quiscalus quiscula*	S5B	G5				PO-H
Brown-headed Cowbird	BHCO	*Molothrus ater*	S4B	G5				PR-P
Orchard Oriole	OROR	*Icterus spurius*	S4B	G5				PR-A
Baltimore Oriole	BAOR	*Icterus galbula*	S4B	G5				PR-T
Fringillidae								
Pine Grosbeak	PIGR	*Pinicola enucleator*	S4B	G5				
Purple Finch	PUFI	*Carpodacus purpureus*	S4B	G5				
House Finch	HOFI	*Carpodacus mexicanus*	SNA	G5				PO-H
Red Crossbill	RECR	*Loxia curvirostra*	S4B	G5				
White-winged Crossbill	WWCR	*Loxia leucoptera*	S5B	G5				
Common Redpoll	CORE	*Acanthis flammea*	S4B	G5				
Pine Siskin	PISI	*Spinus pinus*	S4B	G5				
American Goldfinch	AMGO	*Spinus tristis*	S5B	G5				PR-P
Evening Grosbeak	EVGR	*Coccothraustes vespertinus*	S4B	G5				
Passeridae								
House Sparrow	HOSP	*Passer domesticus*	SNA	G5				

Species Common Name and Scientific Name: consistent with the American Ornithologists' Union. 2012. Check-list of North American Birds. Accessed May 25, 2012. Available online: www.aou.org/checklist/north/full.php/

Species Code: consistent with the American Ornithologists' Union. 2012. Species 4-Letter-Codes. Accessed May 25, 2012. Available online: www.birdsontario.org/atlas/codes.jsp?lang=en&pg=species/

Highest Breeding Evidence: Codes assigned for breeding evidence are consistent with the Ontario Breeding Bird Atlas (OBBA). 2012. Breeding Evidence Codes. Accessed January 25, 2014. Available online: http://www.birdsontario.org/dataentry/codes.jsp?page=breeding/. Several different types of breeding evidence are often recorded for any given species over the course of surveys - this table reports only the highest level of breeding evidence

S ranks: Provincial ranks are from the Natural Heritage Information Centre; S1 (critically imperiled), S2 (imperlied), S3 (vulnerable), S4 (apparently secure), S5 (secure); ranks were updated using NHIC species list October 2013

G ranks: National ranks are from the Natural Heritage Information Centre; G1 (extremely rare), G2 (very rare), G3 (rare to uncommon), G4 (common), G5 (very common); ranks were updated using NHIC species list October 2013

COSSARO (MNRF): Ontario Species at Risk as listed by the Committee on the Status of Species at Risk in Ontario (from NHIC Table October 2013); END - Endangered, THR - Threatened, SC - Special Concern, NAR - Not at Risk; Candidate Species at Risk to be assessed by COSSARO are listed online: www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STDPROD_068707.html/.

COSEWIC: Assessed Species at Risk at the national level as listed by the Committee on the Status of Endangered Wildlife in Canada (from NHIC Table October 2013); END - Endangered, THR - Threatened, SC - Special Concern, NAR - Not at Risk; Candidate Species at Risk to be assessed by COSEWIC are listed online: www.cosewic.gc.ca/eng/sct3/index_e.cfm/.

SWH Indicator Species: SWH refers to Significant Wildlife Habitat as defined by the MNR (2012) draft Significant Wildlife Habitat Criteria Tables for Ecoregions 7E and 6E (as appropriate for the Subject Lands). SWH indicator species are identified in this table and any potential SWH is discussed in the text of this report.

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Local Status (Halton)	Local Status (Hamilton)	Local Status)	Regional Status (Waterloo)	Niagara Peninsula CA	Local Status (CVC)
ODONATA											
River Jewelwing	*Calopteryx aequabilis*	S5	G5			HU	m				
Ebony Jewelwing	*Calopteryx maculata*	S5	G5				m				
Spotted Spreadwing	*Lestes congener*	S5	G5			HU	m				
Slender Spreadwing	*Lestes rectangularis*	S5	G5								
Taiga Bluet	*Coenagrion resolutum*	S5	G5			HR	m				
Tule Bluet	*Enallagma carunculatum*	S5	G5			HR	m				
Familiar Bluet	*Enallagma civile*	S5	G5								
Marsh Bluet	*Enallagma ebrium*	S5	G5								
Eastern Forktail	*Ischnura verticalis*	S5	G5								
Common Green Darner	*Anax junius*	S5	G5								
Arrowhead Spiketail	*Cordulegaster obliqua*	S1	G4			HU	H				
Common Baskettail	*Epitheca cynosura*	S5	G5			HU					
Eastern Pondhawk	*Erythemis simplicicollis*	S5	G5								
Widow Skimmer	*Libellula luctuosa*	S5	G5								
Twelve-Spotted Skimmer	*Libellula pulchella*	S5	G5								
Painted Skimmer	*Libellula semifasciata*	S2	G5			HR	m				
Wandering Glider	*Pantala flavescens*	S4	G5			HU	m				
Common Whitetail	*Plathemis lydia*	S5	G5								
Ruby Meadowhawk	*Sympetrum rubicundulum*	S5	G5								
Black Saddlebags	*Tramea lacerata*	S4	G5								
BUTTERFLIES											
Silver Spotted Skipper	*Epargyreus clarus*	S4	G5								
Northern Cloudywing	*Thorybes pylades*	S5	G5				H				
Juvenal's Duskywing	*Erynnis juvenalis*	S5	G5								
Wild Indigo Duskywing	*Erynnis baptisiae*	S4	G5			HR	m				
Common Sooty Wing	*Pholisora catullus*	S3	G5			HR	m				
Least Skipper	*Ancyloxypha numitor*	S5	G5								
European Skipper	*Thymelicus lineola*	SNA	G5								
Peck's Skipper	*Polites peckius*	S5	G5								
Tawny-edged Skipper	*Polites themistocles*	S5	G5								
Crossline Skipper	*Polites origenes*	S4	G5								
Northern Broken-Dash	*Wallengrenia egermet*	S5	G5								
Hobomok Skipper	*Poanes hobomok*	S5	G5								
Dun Skipper	*Euphyes vestris*	S5	G5		THR						
Black Swallowtail	*Papilio polyxenes*	S5	G5								
Eastern Tiger Swallowtail	*Papilio glaucus*	S5	G5								
Cabbage White	*Pieris rapae*	SNA	G5								
Clouded Sulphur	*Colias philodice*	S5	G5								
Banded Hairstreak	*Satyrium calanus*	S4	G5								
Silvery Blue	*Glaucopsyche lygdamus*	S5	G5				m				
Pearl Crescent	*Phyciodes tharos*	S4	G5								
Northern Crescent	*Phycoides pascoensis*	S5	G5								
Question Mark	*Polygonia interrogationis*	S5	G5								
Eastern Comma	*Polygonia comma*	S5	G5								
Red Admiral	*Vanessa atalanta*	S5	G5								
Red-spotted Purple	*Limenitis arthemis astyanax*	S5	G5T5								
Northern Pearly Eye	*Enodia anthedon*	S5	G5								
Little Wood-Satyr	*Megisto cymela*	S5	G5								
Common Ringlet	*Coenonympha tullia*	S5	G5								
Monarch	*Danaus plexippus*	S4B, S2N	G4	SC	SC						

SUMMARY

Total Odonata: **20**
Total Butterflies: **29**

SIGNIFICANT SPECIES

Global: **0**
National: **3**
Provincial: **1**
Regional: **0**
Local:

Explanation of Status and Acronymns

COSSARO: Committee on the Status of Species at Risk in Ontario
COSEWIC: Committee on the Status of Endangered Wildlife in Canada
S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)
S2: Imperiled—Imperiled in the province, very few populations (often 20 or fewer),

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Local Status (Halton)	Local Status (Hamilton)	Local Status)	Regional Status (Waterloo)	Niagara Peninsula CA	Local Status (CVC)

S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)
S4: Apparently Secure—Uncommon but not rare
S5: Secure—Common, widespread, and abundant in the province
SX: Presumed extirpated
SH: Possibly Extirpated (Historical)
SNR: Unranked
SU: Unrankable—Currently unrankable due to lack of information
SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
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
S#B- Breeding status rank
S#N- Non Breeding status rank
?: Indicates uncertainty in the assigned rank
G1: Extremely rare globally; usually fewer than 5 occurrences in the overall range
G1G2: Extremely rare to very rare globally
G2: Very rare globally; usually between 5-10 occurrences in the overall range
G2G3: Very rare to uncommon globally
G3: Rare to uncommon globally; usually between 20-100 occurrences
G3G4: Rare to common globally
G4: Common globally; usually more than 100 occurrences in the overall range
G4G5: Common to very common globally
G5: Very common globally; demonstrably secure
GU: Status uncertain, often because of low search effort or cryptic nature of the species; more data needed.
T: Denotes that the rank applies to a subspecies or variety
Q: Denotes that the taxonomic status of the species, subspecies, or variety is questionable.
END: Endangered
THR: Threatened
SC: Special Concern
NAR: Not At Risk
IND: Indeterminant, insufficient information to assign status
DD: Data Deficient
6: Rare in Site Region 6
7: Rare in Site Region 7
Area: Minimum patch size for area-sensitive species (ha)
H- highly significant in Hamilton Region (i.e. rare)
m- moderately significant in Hamilton Region (i.e. uncommon)
L1- extremely rare locally (Toronto Region)
L2- very rare locally (Toronto Region)
L3- rare to uncommon locally (Toronto Region)
HR- rare in Halton Region, highly significant
HU- uncommon in Halton Region, moderately significant

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COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Local Status (Halton)	Local Status (Hamilton)	Local Status)	Regional Status (Waterloo)	Niagara Peninsula CA	Local Status (CVC)

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Table 16: Cavity Density Survey Results from the Subject Lands

AREA IDENTIFICATION	COMMUNITY TYPE	AREA SIZE (ha)	# OF CAVITY TREES OBSERVED	#OF CAVITY TREES/HECTARE
Polygon 1	FOD5-8/FOD2	11.9	6	0.5
Polygon 2	CUW1-4/CUW1	0.5	0	0
Polygon 3	FOD4-2	5.7	2	0.35
Polygon 4	FOD5-8/FOD2	11.9	5	0.42
Polygon 5	FOD5-3	4.0	2	0.5
Polygon 6	FOD2	2.0	0	0
Polygon 7	FOD2	2.0	0	0
Polygon 8	FOD4-2	1.9	1	0.53
Polygon 9	CUW1-5	0.7	2	2.86
Polygon 10	FOD5-3	10.1	0	0
Polygon 11	CUT1-1	1.3	0	0
Polygon 12	FOD4-2	1.2	0	0
Polygon 13	AG	3.8	0	0
Polygon 14	AG	14.3	0	0
Polygon 15	CUP3-3	1.4	0	0
Polygon 16	FOD4-2	2.0	0	0

Table 17: Bat Acoustic Survey Dates and Conditions

SURVEYORS (SURNAME, INITIAL)	SURVEY ROUND	DATE (2016)	TIME		EQUIPMENT USED	AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS	MOON PHASE
			START	END							
Collinson, C Park, O Hilditch, J	1	JU 21	22:25	23:40	Echometer Touch	20.0	56	0	2	N/A	Full Moon (99%)
Collinson, C Park, O Hilditch, J	2	JU 24	21:27	22:59	Echometer Touch	20	49	0	2	N/A	Waning Gibbous (82%)
Park, O Hilditch, J	3	JU 29	21:02	22:30	Echometer Touch	24	34	60	3	N/A	Waning Crescent (29%)

Table 18: Headwater Drainage Feature Classifications and Management Recommendations

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation
	Function	Modifiers				
T4	**FT: 1** **FC (Round 1): 5** **FC (Round 2): 4** **FC (Round 3): 2** **Important** – flowing in spring and standing water in late summer	Agricultural	**Important** – Wetland riparian area	**Contributing** – Fish not expected to be present upstream from Flatt Road, which appears to provide a barrier to upstream movement due to perching of the culvert.	**Important** – Wetland provides amphibian breeding habitat	**Protection**
T4A1	**FT: 1** **FC (Round 1): 5** **FC (Round 2): 1** **Contributing** - flowing during freshet, but dry during other periods	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**Mitigation**
T4A2	**FT: 1** **FC (Round 1): 4** **FC (Round 2): 1** **Contributing** - flowing during freshet, but dry during other periods	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**Mitigation**
T4A3	**FT: 1** **FC (Round 1): 4** **FC (Round 2): 1** **Contributing** - flowing during freshet, but dry during other periods	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**Mitigation**
T4A4	**FT: 1** **FC (Round 1): 4** **FC (Round 2): 1** **Contributing** - flowing during freshet, but dry during other periods	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**Mitigation**
T4A5	**FT: 7** **FC (Round 1): 2** **FC (Round 2): 1**	Agricultural	**Limited** – Primarily cropped riparian area, hedgerow present as well	**Contributing** – Fish not present due to barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**No Management Required**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation
	Function	Modifiers				
	Limited - Standing water during spring, dry by second round.					
T5A1	**FT: 1** **FC (Round 1): 5** **FC (Round 2): 4** **FC (Round 3): 1** **Valued** - flowing during spring, but dry during summer	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not expected to be present due to barriers to movement and lack of suitable habitat downstream from reach	**Limited** – no terrestrial habitat function provided	**Mitigation**
T5A2	**FT: 7** **FC (Round 1): 4** **FC (Round 2): 2** **FC (Round 3): 1** **Limited** - flowing during freshet, standing in late spring and dry during summer	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not expected to be present due to barriers to movement and lack of suitable habitat within and downstream from reach	**Limited** – no terrestrial habitat function provided	**No Management Required**
T5A3	**FT: 7** **FC (Round 1): 4** **FC (Round 2): 2** **FC (Round 3): 1** **Limited -** flowing during freshet, but standing in late spring and dry during summer	Agricultural	**Valued** – Meadow riparian area	**Contributing** – Fish not expected to be present due to barriers to movement and lack of suitable habitat in reach	**Limited** – no terrestrial habitat function provided	**No Management Required**
T6A1	**FT: 7** **FC (Round 1): 5** **FC (Round 2): 4** **FC (Round 3): 1** **Valued** - flowing during spring, but dry during summer	Agricultural	**Valued** – Meadow riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**Mitigation**
T6A2	**FT: 7** **FC (Round 1): 5** **FC (Round 2): 2** **FC (Round 3): 4**	Agricultural, Residential backyard	**Valued** – Meadow riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**Mitigation**

Drainage Feature Segment	Step 1. Hydrology		Step 2. Riparian	Step 3. Fish Habitat	Step 4. Terrestrial Habitat	Management Recommendation
	Function	Modifiers				
	Valued – flowing during freshet, standing in late spring, but flowing again during summer, but infiltrating near downstream end of reach					
T6A3	**FT: 4** **FC (Round 1): 2** **FC (Round 2): 2** **FC (Round 3): 1** **Limited –** standing water in spring, dry in summer	Agricultural	**Limited** – Cropped riparian area	**Contributing** – Fish not present due to downstream barrier to movement at Flatt Road	**Limited** – no terrestrial habitat function provided	**No Management Required**

Table 19: Summary of Benthic Invertebrate Community Sampling Results

Order	Family	2014 Results				
		TRIB 4	TRIB 5A	TRIB 5B	TRIB 5C	TRIB 6
Hirudinea	*Glossiphoniidae*	6	1	0	0	0
Oligochaeta	*Naididae*	0	0	2	2	5
Isopoda		45	76	1	61	0
Basommatophora	*Lymnaeidae*	0	1	0	0	2
Coleoptera	*Dytiscidae*	0	2	3	0	2
	Haliplidae	1	0	0	0	0
Diptera	*Chironomidae*	0	7	7	9	3
	Psychodidae	0	0	0	0	1
	Simuliidae	0	0	5	0	17
	Stratiomyidae	0	4	1	0	0
	Tabanidae	0	0	13	1	0
	Tanyderidae	1	0	0	0	0
	Tipulidae	0	0	0	1	2
Ephemeroptera	*Baetidae*	0	0	21	16	0
	Isonychiidae	0	0	0	2	0
	Siphlionuridae	0	0	0	0	66
Megaloptera	*Sialidae*	0	0	14	0	0
Odonata	*Coenagrionidae*	0	0	0	2	0
	Libellulidae	0	2	0	0	0
Plecoptera	*Nemouridae*	0	50	204	133	33
Trichoptera	*Brachycentridae*	0	1	0	0	0
	Hydropsychidae	0	1	0	0	0
	Limnephilidae	0	3	0	0	0
	Rhyacophilidae	0	1	0	0	0
	Uenoidae	0	2	2	0	0
Veneroida	*Pisidiidae*	4	6	12	13	17
Turbellaria		0	0	0	0	1
	Total	**69**	**162**	**303**	**249**	**932**

Table 20: Benthic Invertebrate Community Indices

Index	2014 Results				
	TRIB 4	TRIB 5A	TRIB 5B	TRIB 5C	TRIB 6
Hilsenhoff Family-Level Biotic Index	5.275	3.809	3.327	3.502	5.839
Shannon-Wiener Diversity Index	0.459	1.531	1.329	1.411	1.623
Simpson's Family-Level Index (1-D)	0.541	0.672	0.534	0.648	0.731
Simpson's Family-Level Index (1/D)	2.718	3.048	2.144	2.838	3.724
Pielou's Eveness	0.605	0.566	0.518	0.588	0.677
% Chironomidae	0.000	4.321	2.310	3.614	2.013
% EPT	0.000	35.802	74.917	60.643	66.443

Table 21: Significant Wildlife Habitat Assessment Ecoregion 7E

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands
SEASONAL CONCENTRATION AREAS					
Waterfowl Stopover and Staging Areas (terrestrial)	Yes – CUM and CUT vegetation communities present; however, they are small in size relative to this habitat type use	No – No evidence of sheet water during spring	No	N/A	N/A
Waterfowl Stopover and Staging Areas (aquatic)	Yes – MAS2-1 vegetation community present	No – Taylor Pond does not meet the size criteria and does not have large areas of relief to attract or support significant numbers of waterfowl	No	N/A	N/A
Shorebird Migratory Stopover Areas	Yes – MAM vegetation community present on Subject Lands	No – Taylor Pond does not meet the size criteria to attract or support significant numbers of waterfowl	No	N/A	N/A
Raptor Wintering Areas	Yes – FOD and CUM, CUT, CUW and CUS present on the Subject Lands	No – Though the woodlots on the Subject Lands meet the size criteria, the adjacent fields/meadow communities are small and disturbed (actively managed row crops) and do not exhibit wind-swept characteristics	No	N/A	N/A
Bat Hibernacula	No – Cave ecosites are absent from the Subject Lands	N/A	N/A	N/A	N/A
Bat Maternity Colonies	Yes – FOD vegetation community present on Subject Lands	Yes – mature, woodlots on site contain suitable trees and densities	Yes	Three nights of survey effort were completed on the Subject Lands. Big Brown Bat (*Eptesicus fuscus)* was recorded during surveys. Additional acoustic surveys are recommended.	Candidate – additional fieldwork required
Turtle Wintering Areas	Yes – MAM and MAS vegetation communities present on Subject Lands.	Yes – Taylor Pond has potential to maintain water depths deep enough not to freeze	Yes	Two Snapping Turtles (*Chelydra serpentina)* were observed during 2014 surveys at Taylor Pond (TB1); no turtles were observed during 2016 surveys. Abundance criteria met.	Yes – SWH type confirmed on site at Taylor Pond.
Reptile Hibernacula	Yes	Yes – due to the proximity to the Niagara Escarpment features may be present on the Subject Lands	Yes	One Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was observed on April 29, 2016 along ST2 (see **Figure 7, Appendix A)**, and one Eastern Gartersnake was observed at ST7 and ST8 (**Figure 7, Appendix A)** on September 16, 2016 during targeted survey efforts. Abundance criteria was not met.	No

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands
Colonial Bird Nesting Sites (bank/cliff; tree/shrub; or ground)	No – Eroding steep banks, slopes, cliff faces; SWM and SWD wetlands; and rocky peninsula habitat types are all absent from the Subject Lands	N/A	N/A	N/A	N/A
Migratory Butterfly Stopover Areas	Yes – CUM, CUT, CUS, FOD and CUP vegetation communities present on Subject Lands	No – Though the most southern limit of the site is 1.9 km from Lake Ontario and contains woodland habitat >10ha, it does not provide the other necessary requirement of undisturbed, large open fields with abundant nectar-preferred vegetation. The fields are actively managed row crops and are considered highly disturbed. The site is also located inland, and not on a spit nor along the waterfront, providing the shortest travel distance across the lake	No	N/A	N/A
Landbird Migratory Stopover Areas	Yes – FOD vegetation community present on Subject Lands	Yes – woodlots meet minimum size criteria (5 ha) and are found within 5 km of Lake Ontario	Yes	Abundance criteria not met. All results were captured during breeding bird surveys, which occurred during June and July months. No large abundances of migratory birds were observed during the various site visits and field investigations that occurred during the spring or fall timing windows.	Candidate – due to proximity to Lake Ontario.
Deer Winter Congregation Areas	N/A – MNRF to determine	N/A	N/A	N/A	No
RARE VEGETATION COMMUNITIES					
Rare Vegetation Types (cliffs, talus slopes, sand barrens, alvars, old-growth forests, savannahs, and tallgrass prairies)	No – ELC surveys were completed for the entire site throughout spring, summer and fall	N/A	N/A	N/A	N/A
Other Rare Vegetation Types	No – ELC surveys were completed for the entire site throughout spring, summer and fall	N/A	N/A	N/A	N/A
SPECIALIZED WILDLIFE HABITAT					

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands
Waterfowl Nesting Area	Yes – MAM and MAS vegetation communities present on Subject Lands	No – size criteria not met; communities unable to support number of individuals required	No	N/A	N/A
Bald Eagle and Osprey Habitats	Yes – FOD communities adjacent to wetlands and Grindstone Creek.	Yes – species are known to use these types of habitat present on the site in Southern Ontario	Yes	No species observed on site during targeted survey efforts.	No
Woodland Raptor Nesting Habitat	Yes – FOD vegetation communities are present on the Subject Lands	No – Though the woodland communities on the Subject Lands are contiguous in parts with the surrounding Grindstone Creek forested community, the woodlands on site are not wide enough to provide a minimum of 4 ha of interior forested habitat from a 200 m forested buffer	No	N/A	N/A
Turtle Nesting Areas	Yes – MAS communities present on the Subject Lands	Yes – Taylor Pond may support suitable turtle nesting opportunities as it is removed from roadways and soil mapping suggests sandy loam substrate present throughout the Subject Lands	Yes	Targeted nesting surveys were completed in 2014 and 2016. No turtle nesting evidence was present during these site assessments. See **Figure 6 (Appendix A)** for transect locations.	No
Seeps and Springs	Yes – Forested ecosites within headwater drainage areas present on Subject Lands	Yes – due to proximity to the Niagara Escarpment, seeps and springs may be present on the Subject Lands	Yes – data will be collected incidentally during ecological surveys and thoroughly investigated through hydrogeological surveys	Pending additional studies from Terra Dynamics	Pending additional studies
Woodland Amphibian Breeding Habitats (within or < 120m from woodland)	Yes – FOD vegetation community present on Subject Lands.	Yes – presence of wetland and pond communities adjacent to FOD communities.	Yes	Abundance thresholds met at Taylor Pond (amphibian station E) during 2014 and 2016 surveys. **See Figure 5 (Appendix A)** for amphibian station locations.	Yes – SWH type confirmed on site at Taylor Pond, amphibian station E.
Wetland Amphibian Breeding Habitats (wetland >120m from woodland)	Yes – MAM and MAS communities present on the Subject Lands	Yes – size criteria met	Yes	Abundance thresholds not met during 2014 or 2016 surveys.	No
Woodland Area-Sensitive Bird Breeding Habitat	Yes – FOD vegetation communities are present on the Subject Lands	No – Though the woodland communities on the Subject Lands are contiguous in parts with the surrounding Grindstone Creek forested community, the woodlands on site are not wide enough	No	N/A	N/A

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands
		to provide a minimum of 4 ha of interior forested habitat from a 200 m forested buffer.			
SPECIES OF CONSERVATION CONCERN					
Marsh Bird Breeding Habitat	Yes – MAM and MAS vegetation communities are present on the Subject Lands	Yes – all wetlands that contain shallow water and emergent aquatic vegetation should be considered	Yes	No species were observed despite targeted survey effort.	No
Open Country Bird Breeding Habitat	Yes – CUM vegetation community present on Subject Lands	No – The largest CUM vegetation community on the Subject Lands is 0.4 ha in size. The Subject Lands does not support large grassland areas greater than 30 ha, therefore, the size criteria for cultural meadow is not met	No	N/A	N/A
Shrub/Early Successional Bird Breeding Habitat	Yes – CUW, CUS and CUT vegetation communities present on Subject Lands	No – The largest fields succeeding to shrub and thicket habitats present on the Subject Lands is 3.1 ha in size. Therefore, the size criteria for greater than 10 ha for CUW, CUS and CUT was not met.	No	N/A	N/A
Terrestrial Crayfish	Yes – MAM and MAS vegetation communities present on Subject Lands	Yes	Yes	No species or chimneys identified on the Subject Lands.	No
SPECIAL CONCERN AND RARE WILDLIFE SPECIES					
Eastern Wood-Pewee (*Contopus virens*)	N/A	Yes – FOD communities present on Subject Lands	Yes	Yes – two individuals were observed at point count (PC) 12, and one individual was observed at PC10 during 2014 surveys. One individual was observed at PC12, one at PC13, one at PC14 and one at PC15 during 2015 surveys (see **Figure 8, Appendix A** for station locations).	Yes
Wood Thrush (*Hylocichla mustelina*)	N/A	Yes – FOD communities present on Subject Lands	Yes	Yes – one individual was heard at PC15 and two individuals were heard at PC12 on June 2, 2015. One individual was also heard at PC13 on June 19, 2015. The species was not documented during 2014 targeted surveys (see **Figure 8, Appendix A** for station locations).	Yes
Monarch (*Danaus plexippus*)	N/A	No – Open areas within the Subject Lands are highly disturbed (managed as row crop agriculture) with limited availability of nectar-preferred vegetation. The Subject Lands are unable to support significant quantities of Monarch.	No	One individual was observed within the forested portions of the Subject Lands during targeted insect surveys in 2016.	No

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands
Snapping Turtle (*Chelydra serpentina*)	N/A	Yes – Associated with watercourses and wetlands on Subject Lands	Yes	Two individuals were observed during 2014 turtle basking surveys in Taylor Pond (TB-1) (see **Figure 6, Appendix A** for station locations).	Yes
ANIMAL MOVEMENT CORRIDORS					
Amphibian Movement Corridors	N/A	No suitable wetland breeding habitat on site.	No	N/A	N/A

Appendix C – Eagle Heights Benthic Invertebrate Report, 2014. Entomogen Inc.

Eagle Heights Benthic Invertebrate Report 2014

Project # 6374

July 23rd , 2014

Prepared by: Candice Kerling, Ecologist
Prepared for: George Buckton, Project Manager

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Five sites, as chosen by Savanta Inc., were visited on May 27th, 2014 to take traveling kick and sweep benthic samples according to OBBN protocol. Samples were identified to family, and these values examined to determine the water quality and establish baseline conditions for comparison in the future.

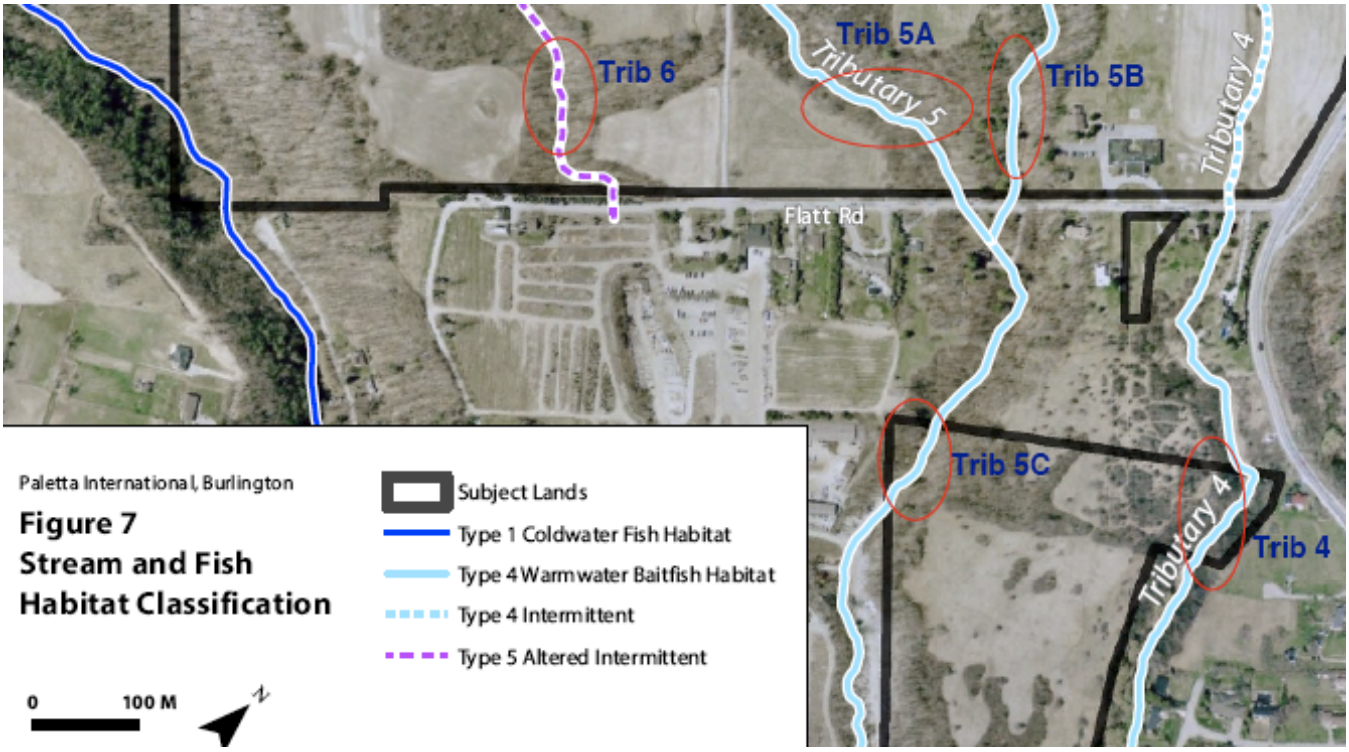


Figure 1. Five sampling locations on the Eagle Heights Property: Trib 4, Trib 5A, Trib 5B, Trib 5C and Trib 6.

A total of 28 different taxa were observed across the three sites. This data was examined using 6 specific tests: Hilsenhoff's Family Level Biotic Index (FBI), Simpson's Family Level Index, Shannon-Wiener Diversity Index, Pielou's Evenness, % Chironomidae, and % EPT. Results for each stream can be seen in Table 1.

Table 1. Indices used to test the water quality for the 5 tributaries on the Eagle Heights property.

Index	TRIB 4	TRIB 5A	TRIB 5B	TRIB 5C	TRIB 6
Hilsenhoff family-level biotic index	5.275	3.809	3.327	3.502	5.839
Simpson's Index (D)	0.459	0.328	0.466	0.352	0.269
Simpson's Index of Diversity (1-D)	0.541	0.672	0.534	0.648	0.731
Simpson's Reciprocal Index (1/D)	2.178	3.048	2.144	2.838	3.724
Shannon-Wiener Diversity Index	1.083	1.531	1.329	1.411	1.623
Pielou's Evenness	0.605	0.566	0.518	0.588	0.677
% Chironomidae	0.000	4.321	2.310	3.614	2.013
% EPT	0.000	35.802	74.917	60.643	66.443

The *Hilsenhoff FBI* uses a single value to summarize the various tolerances of benthic arthropod communities and indicate pollution. Tolerance values range from 0 to 10 and the value will increase as water quality decreases (0.00 indicates excellent water quality with organic pollution unlikely, to a value of 10.00 for very poor water quality and severe organic pollution likely). FBI may be applicable for assessment of toxic pollutants, but at this point has only been evaluated for organic pollutants.

Tributary 5 gave values of 3.809 (5A), 3.327 (5B) and 3.502 (5C), which ranks it as very good to excellent water quality with pollution unlikely occurring at this site. Tributary 4 had a FBI of 5.275 ranking the site as only fair water quality, with fairly substantial pollution or disturbance likely. Tributary 6 had a FBI value of 5.839, ranking it as fairly poor quality with very substantial pollution or disturbance likely.

Simpson's Family Level Diversity Index is a measure of diversity, which takes into account the number of species present, as well as the relative abundance of each species. It can be viewed as either (1-*D*) or (1/*D*) (both values given in Table 1). This index examines the species richness of a population, giving a value between 0-1; as *D* increases the diversity of the population decreases. Based on the values, we can infer that Tributary 6 had the highest diversity, with Tributary 4 and 5 showing moderate diversity depending on the specific site of the sample.

The values calculated for the Shannon-Wiener Diversity Index, another diversity index, agree with this assessment. The samples from Tributary 6 and Trib 5A fall within the normal range of diversity (1.5-3.5), however, the values for the Shannon-Wiener Index indicate that Trib 4, Trib 5B and Trib 5C all fall slightly below the usual range of diversity.

Pielou's Evenness is a measure of biodiversity that quantifies how equal the community is numerically. The value, between 0-1, expresses how evenly individuals are distributed among the different families. A value of 1 indicates no/low variation and individuals are distributed equally, and a value of 0 indicates very high variation and an unequal distribution of individuals. All sites have a moderate distribution of individuals.

% Chironomidae is the percentage of individuals in the sample that are from the Family Chironomidae. The % Chironomidae will often increase with decreasing water quality, they can also be found in variable quantities in high quality streams. All samples had a low percentage of Chironomidae, with Tributary 4 having no Chironomidae at all in the samples, which conflicts with the results from the Hilsenoff FBI and the diversity indices.

% EPT is a value that looks at the percentage of individuals that are from the Orders of Ephemeroptera, Plecoptera and Trichoptera. These Orders are very sensitive to pollutants, and therefore will decrease as water quality decreases. Tributary 4 had zero EPTs found, which would agree with the other indices that it is of poor water quality. All other samples had very high % EPT values, indicating that the streams are likely of good quality.

Overall, these results suggest that Tributary 5 and 6 have fair to good water quality. Conversely, Tributary 4 appears to have only fair water quality with little diversity.

Table 2. Eagle Heights – Raw data from benthic samples, May 27th, 2014.

Class	Order	Family	TRIB 4	TRIB 5A	TRIB 5B	TRIB 5C	TRIB 6	TOTAL
ANNELIDA	HIRUDINEA	GLOSSIPHONIIDAE	6	1				7
ANNELIDA	OLIGOCHAETA	NAIDIDAE			2	2	5	9
CRUSTACEA	AMPHIPODA		45	78	1	61		185
CRUSTACEA	ISOPODA		12	3	18	9		42
GASTROPODA	BASOMMATOPHORA	LYMNAEIDAE		1			2	3
INSECTA	COLEOPTERA	DYTISCIDAE		2	3		2	7
INSECTA	COLEOPTERA	HALIPLIDAE	1					1
INSECTA	DIPTERA	CHIRONOMIDAE		7	7	9	3	26
INSECTA	DIPTERA	PSYCHODIDAE					1	1
INSECTA	DIPTERA	SIMULIIDAE			5		17	22
INSECTA	DIPTERA	STRATIOMYIDAE		4	1			5
INSECTA	DIPTERA	TABANIDAE			13	1		14
INSECTA	DIPTERA	TANYDERIDAE	1					1
INSECTA	DIPTERA	TIPULIDAE				1	2	3
INSECTA	EPHEMEROPTERA	BAETIDAE			21	16		37
INSECTA	EPHEMEROPTERA	ISONYCHIIDAE				2		2
INSECTA	EPHEMEROPTERA	SIPHLONURIDAE					66	66
INSECTA	MEGALOPTERA	SIALIDAE			14			14
INSECTA	ODONATA	CORDULEGASTRIDAE				2		2
INSECTA	ODONATA	LIBELLULIDAE		2				2
INSECTA	PLECOPTERA	NEMOURIDAE		50	204	133	33	420
INSECTA	TRICHOPTERA	BRACHYCENTRIDAE		1				1
INSECTA	TRICHOPTERA	HYDROPSYCHIDAE		1				1
INSECTA	TRICHOPTERA	LIMNEPHILIDAE		3				3
INSECTA	TRICHOPTERA	RHYACOPHILIDAE		1				1
INSECTA	TRICHOPTERA	UENOIDAE		2	2			4
PELECYPODA	VENEROIDA	PISIDIIDAE	4	6	12	13	17	52
TURBELLARIA							1	1
Total			69	162	303	249	149	932