



# **ENVIRONMENTAL IMPACT STUDY**

**GRAND NIAGARA  
NIAGARA FALLS, ON**

FEBRUARY 2017



# **Ecological Impact Study**

## **Grand Niagara, Niagara Falls ON**

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## Table of Contents

<b>1.0</b>	<b>INTRODUCTION.....</b>	<b>3</b>
1.1	Study Purpose.....	3
1.2	Natural Heritage Planning Considerations .....	3
1.2.1	Municipal Official Plans .....	4
1.2.2	Niagara Peninsula Conservation Authority .....	5
1.2.3	Provincial Legislation and Associated Guideline Documents.....	6
<b>2.0</b>	<b>DATA COLLECTION APPROACH &amp; METHODS.....</b>	<b>8</b>
2.1	Background References .....	8
2.1.1	LIO Natural Features Summary .....	8
2.1.2	NHIC Database.....	8
2.2	Agency Discussion.....	9
2.2.1	Ministry of Natural Resources and Forestry (MNRF).....	9
2.2.2	Niagara Peninsula Conservation Authority (NPCA).....	9
2.3	Field Investigations .....	9
<b>3.0</b>	<b>Environmental Setting and characteristics .....</b>	<b>11</b>
3.1	Physical Baseline Conditions .....	11
3.2	Biological Baseline Conditions.....	11
3.2.1	Vegetation Communities .....	11
3.2.2	Wildlife Species .....	14
3.2.3	Aquatic Resources.....	21
3.3	Analysis of Ecological & Natural Heritage Significance (PPS) .....	25
3.3.1	Significant Wetlands .....	25
3.3.2	Habitat of Endangered and Threatened Species.....	26
3.3.3	Fish Habitat.....	26
3.3.4	Significant Woodlands .....	27
3.3.5	Significant Valleyland .....	28
3.3.6	Significant Wildlife Habitat.....	28
<b>4.0</b>	<b>PROPOSED DEVELOPMENT .....</b>	<b>31</b>
<b>5.0</b>	<b>IMPACT ASSESSMENT, AVOIDANCE AND MITIGATION MEASURES.....</b>	<b>33</b>
<b>6.0</b>	<b>PREDICTED NET EFFECTS AND MONITORING.....</b>	<b>43</b>
<b>7.0</b>	<b>CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>45</b>
	<b>APPENDICES .....</b>	<b>51</b>

**APPENDIX A - FIGURES**

- Figure 1 Location of Subject Lands
- Figure 2 Natural Heritage Features – Desktop Analysis
- Figure 3 Vegetation Communities
- Figure 4 Wildlife Monitoring Station Locations
- Figure 5 Headwater Drainage Features
- Figure 6 Existing Fish Habitat
- Figure 7 Woodland Assessment
- Figure 8 Significant Wildlife Habitat
- Figure 9 Analysis of Natural Heritage Significance
- Figure 10 Preliminary Natural Heritage Map

**APPENDIX B – 2016 FIGURES**

- Figure 1 2016 Calling Amphibian Stations
- Figure 2 Bird Point Count Stations
- Figure 3 Reptile Survey Stations and Transects
- Figure 4 Insect Area Searches
- Figure 5 Bat Habitat Assessment and Acoustic Survey Results

**APPENDIX C – DETAILED TECHNICAL SURVEY METHODS****APPENDIX D - TABLES**

- Table 1 Natural Heritage Information Centre (NHIC) Data
- Table 2 Ecological Field Survey Personnel, Survey Dates and Conditions
- Table 3 ELC Types on the Subject Lands
- Table 4 Plant Species List
- Table 5 Targeted Vegetation Survey Results Summary
- Table 6 Amphibian Call Count Survey Results
- Table 7 Amphibian Egg Mass Survey Results
- Table 8 Wildlife Species List
- Table 9 Snake Survey Results (2015)
- Table 10 Snake Survey Results (2016)
- Table 11 Turtle Basking Survey Results
- Table 12 Turtle Nesting Survey Results
- Table 13 Wildlife Road Crossing Survey Results
- Table 14 Snag Tree Density Survey Results
- Table 15 Bat Acoustic Survey Results
- Table 16 Significant Wildlife Habitat Assessment
- Table 17 Predicted Effects, Mitigation, Enhancement and Net Effects

**APPENDIX E - DRAFT SECONDARY PLAN SCHEDULE (November 2016)****APPENDIX F – ECOLOGICAL RESTORATION PLAN**



## 1.0 INTRODUCTION

### 1.1 Study Purpose

The Grand Niagara Incorporated (Grand Niagara) holdings (Subject Lands) are located in the urban area of the City of Niagara Falls (City), south of the Welland River, north of Biggar Road, west of the QEW and east of Morris Road (**Figure 1, Appendix A**). The Subject Lands have been investigated since the late 1990s, in response to proposed development. The earliest environmental work responded to the proposed golf course and to associated facilities. Construction was initiated on the golf course areas of the Grand Niagara Resort in 2002, after considerable multi-season and multi-disciplinary investigations. Supplementary natural heritage studies were completed from 2012 to 2014 as development options were explored and a draft EIS (Savanta Inc., July 24, 2014) was prepared.

In response to proposed development of residential and hospital land uses, Savanta was retained by Grand Niagara in 2015, to complete an ecological studies update report. Detailed natural heritage studies were conducted in 2015 to update ecological data, to interpret the significance of natural features and functions associated with the Subject Lands, and to present preliminary information regarding natural heritage constraints and opportunities and predicted impacts, mitigation and enhancement measures, in relation to proposed development. In response to preliminary comments obtained from the Niagara Peninsula Conservation Authority (NPCA) in 2015 additional targeted field surveys were carried out in 2016 specific to birds, amphibians, reptiles, bats and species at risk (SAR).

The Subject Lands are currently undergoing Secondary Plan approval with the City of Niagara Falls. As part of the Secondary Plan process a preliminary development limit was established in cooperation with MMM Group Ltd and various approval agencies including the City of Niagara Falls (City), the Region of Niagara (Region) and the NPCA.

This EIS provides a preliminary impact assessment based on development limits and preliminary Storm Water Management design concepts completed by WSP/MMM Group Ltd. (November 2016). A more detailed impact assessment is forthcoming, pending the approval of the Secondary Plan, finalization of the development plan and acceptance of the restoration concepts, presented as part of this, EIS by the Region, the City and the NPCA.

Figures and data tables from the Savanta 2015 and 2016 ecological studies are provided in Appendices A and B and C, respectively.

### 1.2 Natural Heritage Planning Considerations

In addition to an assessment of natural heritage features and functions of the Subject Lands, there are legislation and environmental policies that also affect development on these lands. Planning Act related discussions are addressed directly by MMM Group Limited (MMM). This report addresses Natural Heritage policies and associated guidelines; areas affected by these regulatory aspects are illustrated on **Figure 2 (Appendix A)**.

In terms of municipal policies, the City of Niagara Falls proposed that OPA 69 be applied to the Subject Lands as an outcome of OPA 96 Ontario Municipal Board settlement discussions with

the proponent in 2014. That settlement proposal is applied in this report, recognizing that OPA 96 and its associated environmental policies (i.e., policies 12.1, 12.2) do not fully apply, and that the current PPS (i.e., 2014) should be applied along with other relevant and current agency legislation and policies (e.g., Conservation Authorities Act, Ontario Regulation 155/06 and Endangered Species Act, 2007).

This EIS serves to address requirements as outlined in Section 6.3 of the Draft Grand Niagara Secondary Plan (MMM Ltd. November 2016). As per dialogue amongst the agencies during this planning process progress, this report will also serve as the baseline from which the EIS can be updated as the concept and SWM plan details are finalized (i.e., as required in order to comply with the Regional Official Plan). Portions of the Region's Core Natural Heritage System occur on the Subject Lands (Section 7 and Schedule C; Region, 2015); development adjacent to these natural features triggers the need for an EIS.

The Subject Lands are located outside the Greenbelt Plan Area. The site is subject to the Provincial Policy Statement (2014), Ontario *Endangered Species Act* (2007) and NPCA regulations.

### **1.2.1 Municipal Official Plans**

Given that the City of Niagara Falls OPA 96 does not apply to these lands, the Region of Niagara Official Plan (consolidated version August 2015) was relied upon for additional guidance and direction pertaining to natural heritage features and associated functions.

As noted previously, the Subject Lands contain elements of the Region's Core Natural Heritage System (the Regional NHS). Policy 7.B.1.1. (RPP 2015) summarizes the components of the Regional Core NHS as follows:

- Environmental Protection Areas (EPA) or Environmental Conservation Areas (ECA);
- Potential Natural Heritage Corridors connecting the Core Natural Areas;
- Greenbelt Natural Heritage and Water Resource Systems; and,
- Fish Habitat.

The Region's EPA designation includes:

- Provincially significant wetlands;
- Provincially significant life science Areas of Natural and Scientific Interest (ANSIs);
- Significant habitat of endangered and threatened species (not mapped by the Region, where identified this habitat will be subject to EPA policies);
- Greenbelt Natural Heritage System (wetlands, significant valleylands, significant woodlands, SWH, habitat of species of concern, publicly owned conservation lands savannahs, tallgrass prairies, alvars); and,

Environmental Conservation Areas (ECA) include:

- Significant woodlands, significant wildlife habitat, significant habitat of species of concern;
- Regionally significant life science ANSIs;

- Other evaluated wetlands;
- Significant valleylands;
- Savannahs, tallgrass prairie and alvars; and,
- Publicly owned conservation lands.

Potential Natural Heritage Corridors include:

- Areas that maintain and, where possible, enhance the ecological functions of the corridor in linking the core natural areas.

Regional NHS policies (Chapter 7.B; Region, 2015) that apply to Regional NHS elements on the Subject Lands are summarized below:

- Only minor adjustments to EPA boundaries will be permitted without amendment to the Regional Official Plan (Plan);
- Development and site alteration may be permitted without amendment to the Plan in ECAs and on adjacent land to EPA and ECAs outside the Greenbelt NHS if it has been demonstrated over the long term, that there will be no significant negative impact on the Regional NHS or adjacent lands and the proposed development or site alteration is not prohibited by other policies;
- Where it is demonstrated that all, or a portion of, an ECA does not meet the criteria for designation under this Plan, the restrictions on development and site alteration do not apply;
- Where development or site alteration is proposed in or near a potential natural heritage corridor (shown conceptually on Schedule C), development should be located, designed and constructed to maintain and where possible, enhance the ecological functions of the corridor in linking core natural areas or an alternative corridor should be developed;
- Development or site alteration within fish habitat may occur if it will result in no net loss of the productive capacity of fish habitat as determined by the Department of Fisheries and Oceans or its designate; and
- Where development or site alteration is approved in or adjacent to the Regional NHS, new lots shall not extend into the area to be retained in a natural state as part of the NHS or the buffer zone identified through an EIS.

### **1.2.2 Niagara Peninsula Conservation Authority**

The NPCA conducts reviews of planning processes associated with the future development of properties within its jurisdiction. In addition, the NPCA provides planning and technical advice to planning authorities to assist them with fulfilling their responsibilities regarding natural hazards, natural heritage and other relevant policy areas pursuant to the Planning Act. The NPCA administers the Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Permit process, under Ontario Regulation 155/06.

### **1.2.3 Provincial Legislation and Associated Guideline Documents**

#### **Provincial Policy Statement (2014)**

The PPS (MMAH 2014) provides direction on matters of provincial interest related to land use planning and development. It "...supports a comprehensive, integrated and long-term approach to planning..." The PPS is to be read in its entirety and land use planners and decision-makers need to consider all relevant policies and how they work together.

This EIS addresses those policies that are specific to Natural Heritage (section 2.1) with some reference to other policies with relevance to Natural Heritage and impact assessment considerations and areas of overlap (e.g., those related to Efficient and Resilient Development and Land Use Patterns, section 1.1; Sewage, Water and Stormwater, section 1.6.6; Water, section 2.2; Natural Hazards, section 3.1).

Eight types of significant natural heritage features are defined in the PPS, as follows:

- Significant wetlands;
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat;
- Fish habitat;
- Habitat of endangered and threatened species; and,
- Significant areas of natural and scientific interest (ANSIs).

Development and site alteration shall not be permitted in significant wetlands, or in significant coastal wetlands. Development and site alteration shall not be permitted in: significant woodlands, significant valleylands, significant wildlife habitat or significant ANSIs, unless it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Development and site alteration shall not be permitted in the habitat of endangered and threatened species or in fish habitat, except in accordance with provincial and federal requirements. Development and site alteration may be permitted on lands adjacent to fish habitat provided it has been demonstrated that there will be no negative impacts on the natural feature or their ecological functions.

#### **Ontario's Endangered Species Act (2007)**

The provincial Endangered Species Act (ESA) 2007 was developed to:

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

The ESA protects all threatened, endangered and extirpated species identified 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.

## 2.0 DATA COLLECTION APPROACH AND METHODS

### 2.1 Background References

Substantial work has already been completed on the Subject Lands. Studies completed by ESG International Ltd. (ESG, now Stantec Consulting) included:

- Environmental Impact Assessment (EIA), 2001;
- Tree Preservation Plan, March 7, 2001;
- EIA Addendum Report, June 22, 2001; and,

Environmental Implementation Report (EIR), March 12, 2003. The previous studies made specific reference to data collected from:

- OMNR wetlands and fisheries information;
- Natural Heritage Information Centre (NHIC) rare species and communities;
- NPCA natural areas, species of concern and hazard land mapping;
- Regional Official Plans, ESA studies, natural areas reports, greenway inventory and tree-cutting bylaw;
- City Official Plan, Urban Wooded and Treed Inventory and Assessment study; and,
- Various provincial wildlife atlases (i.e., butterflies, amphibians, reptiles, breeding birds, mammals).

This EIS, which incorporates the results of detailed ecological surveys conducted in 2015 and 2016, partially relies upon additional supporting background information, agencies and resources that are listed below:

- Federal and Provincial Species at Risk (SAR) websites;
- Ontario Ministry of Natural Resources and Forestry (MNR), Aurora District;
- Natural Heritage Information Centre (NHIC) rare species and communities;
- NPCA Natural Areas Inventory (2010);
- NPCA South Niagara Falls Watershed Report (2008); and,
- Natural Heritage Information Centre (NHIC, 2016).

#### 2.1.1 LIO Natural Features Summary

Based on a search of the MNR Land Information Ontario (LIO) geographic database, there are no ANSIs present on or within 120 m of the Subject Lands. LIO natural heritage features are shown on **Figure 2 (Appendix A)**.

#### 2.1.2 NHIC Database

The MNR maintains the NHIC database. A search of this database in 2016 identified 64 Species at Risk and 72 provincially rare species (SH, S1-S3) in the vicinity of the Subject Lands as summarized in **Table 1 (Appendix D)**. A habitat assessment was conducted for these species, which helped to inform the Savanta field program and targeted wildlife surveys were

completed where suitable habitat conditions were found. The results of these surveys are provided in section 3 of this EIS.

## **2.2 Agency Discussion**

### **2.2.1 Ministry of Natural Resources and Forestry (MNR)**

The MNR Guelph District Information Request Form pertaining to Species at Risk (SAR) and natural heritage features on, and adjacent to, the Subject Lands was submitted on October 21, 2015 and a response letter was received on November 23, 2015. The response letter identified the following Species at Risk on or in the immediate vicinity of the Subject Lands: Blanding's Turtle, Snapping Turtle, Grass Pickerel, Drooping Trillium, Milksnake and Chimney Swift.

An MNR Information Gathering Form (IGF) will be submitted to address potential impacts to SAR and their habitats. Due to the sensitive nature of this information, all correspondence and outcomes will remain with the MNR and its jurisdiction.

### **2.2.2 Niagara Peninsula Conservation Authority (NPCA)**

The NPCA provided comments to the Terms of Reference for the EIS at a pre-consultation meeting for the Grand Niagara Secondary Plan on August 6, 2015. Based on these comments a technical meeting with the NPCA took place on October 7, 2015, to review and provide clarification with respect to their comments on natural heritage. In addition, some targeted field investigation actions were identified for completion in the spring of 2016. The results of these 2016 surveys are discussed in section 3 of this EIS.

Consultation has been ongoing with the NPCA to develop a restoration plan for the Subject Lands and a preliminary restoration concept plan was presented to NPCA staff at a technical working group meeting on April 8, 2016. The Ecological Restoration Plan presented in Appendix F of this EIS, was refined based upon preliminary feedback and comments received from the NPCA and City staff.

## **2.3 Field Investigations**

The substantial background information already available through historic fieldwork conducted on the Subject Lands was supplemented with targeted fieldwork to verify the current ecological condition of the Subject Lands. That fieldwork was undertaken by Savanta in 2012, 2013 and in 2014. Detailed ecological studies were then conducted in 2015 in response to the proposed development of residential and hospital land uses. In addition, targeted field studies to address comments received from the NPCA were conducted in the spring and summer of 2016.

Field studies were conducted by ESG for the original Environmental Impact Assessment in 2001 and for the Environmental Implementation Report in 2003. Field investigations completed in 2000, 2002 and 2003 included: fish habitat assessment and fisheries inventory, three-season botanical inventories, Ecological Land Classification of vegetation communities, woodland assessments, breeding bird surveys, breeding amphibian surveys, incidental wildlife (including discernable movement paths) and soils. Additional work completed by Savanta in 2006/2007 included: late season botanical survey (October 15, 2006), tree assessment (November 28,

2006), and verification of vegetation communities (ELC) and species composition (July 31, 2007).

Surveys conducted by Savanta ecologists through the course of this work are provided in **Appendix D**.

The 2015 survey data figures are presented in **Appendix A** and 2016 survey figures are presented in **Appendix B**. **Appendix C** summarizes the more detailed methods employed during the more recent Savanta field surveys. All data tables are presented in **Appendix D**.



### 3.0 ENVIRONMENTAL SETTING AND CHARACTERISTICS

#### 3.1 Physical Baseline Conditions

The Subject Lands are situated in the Haldimand Clay physiographic region (Chapman and Putnam 1984). Soils are characterized as being poorly drained and the water table is usually located close to the surface until late spring. Surface cracking is common during dry periods. The surface horizon ranges from 15 cm to 20 cm deep and has a texture of clay loam to clay; subsoils are heavy clays.

Further supplementary information regarding soils, hydrology, and slopes were provided in previous reports listed in section 2.1.

#### 3.2 Biological Baseline Conditions

The Subject Lands occur in the Carolinian or Deciduous Forest Zone, an area that is characterized by a warmer climate supporting plant species more typical of southern areas. In this broad zone, dominant associations on upland clay and silt areas were maple-beech-elm-basswood and butternut-chestnut-white ash-black cherry. The lowland vegetation communities are dominated by single species such as white cedar, willow, tamarack, alder, red or silver maple or black ash (Rowe 1972). A variety of locally rare species are also known to occur in the vicinity of the Subject Lands, including Black Gum (*Nyssa sylvatica*) and Pignut Hickory (*Carya glabra*).

##### 3.2.1 Vegetation Communities

**Table 3 (Appendix B)** provides brief descriptions of the ELC types recognized on the Subject Lands. Current vegetation community types and locations are depicted on **Figure 3 (Appendix A)**. The Subject Lands contain a variety of tableland, wetland and riparian natural areas along with anthropogenically created features (i.e., hedgerows, golf course rough areas and ponds) that have been colonized by flora and fauna. Riparian vegetation is discontinuous along the Lyons Creek and Grassy Brook watercourses on-site. A vegetated buffer remains along the extent of the Welland River at the north end of the site; it is closely associated with valley slopes and wetland vegetation. The relatively larger natural area patches are most closely associated with the Lower Grassy Brook Provincially Significant Wetland complex (PSW) (**Figure 2, Appendix A**). Areas outside of the naturally vegetated areas have been disturbed by farming, golf operations and by a railway spur line.

Botanical inventories and Ecological Land Classification assessments were conducted on July 21, August 7 and August 13, 2015 (no access was available during the survey period for 2015 spring ephemeral flora); surveys were conducted in previous years (**Table 4, Appendix D**). Targeted surveys were also conducted for several provincially rare or 'at risk' plants identified by the NPCA during a pre-consultation meeting on August 6, 2015 and during a technical team meeting on October 7, 2015.

## Ecological Land Classification

**Table 3 (Appendix D)** provides brief descriptions of the ELC types recognized on the Subject Lands. Some communities are characterized at higher levels of classification than the ELC Type due to high diversity of species, absence of clear dominants, and/or prevalence of human influences (golf course use, historical land uses). The following vegetation communities are considered provincially and/or globally rare (NHIC 2013):

- Pin Oak Mineral Deciduous Swamp SWD1-3: G2, S2S3 – located south of the rail line within an area zoned ECA and is within the buffer of the Lyon’s Creek watercourse;
- Two other pin oak swamp communities (SWD1-5\* and SWD1-6\*) are not listed in the southern Ontario ELC manual. The dominance of Pin Oak in these communities suggests they may reasonably be considered in a manner that is similar to SWD1-3. SWD1-5\* is located north of the rail line and is partially contained within the buffer of the Lyon’s Creek watercourse. SWD1-6\* is part of a provincially significant wetland (PSW) unit south of the rail line; and
- Buttonbush Mineral Thicket Swamp SWT2-4: G4, S3 – is a small inclusion that is part of the central mineral maple swamp (SWD3-5) north of the rail line and south of Grassy Brook Road. This particular Buttonbush community is located within the buffer of an adjacent PSW. This community is also the only regionally rare (NPCA 2010) type on the Subject Lands.

### 3.2.1.1 Vascular Plants

Botanical inventories completed on the Subject Lands identified a total of 226 species of vascular plants. Of that number, 165 (or 73%) are native and 61 (or 27%) are exotic. A full species list is included in **Table 4 (Appendix D)**.

The majority of the native species (91%) are ranked S5 (secure in Ontario). Thirteen species (8%) are ranked S4 (apparently secure in Ontario; NHIC, 2013), while one species (Black Gum) is ranked S3 (Vulnerable; this species is described further below). Seven regionally rare and 10 regionally uncommon plants were observed (Oldham, 2010); none of these species are considered rare in Ontario. Two plant species with high coefficients of conservation (values of 9 or 10) were recorded on-site: Black Gum and Pin Oak (*Quercus palustris*). Black Gum, which is discussed further below, will be retained within a PSW. Pin Oak, which is widespread on the Subject Lands, will persist in many retained vegetation communities and proposed restoration areas.

No Species at Risk (SAR) plant species were recorded on the Subject Lands. Targeted searches confirmed the presence of one provincially rare (S3; NHIC 2016) plant species: Black Gum. This species was located in the PSW on the north side of Grassy Brook Road, where at least four mature trees (DBH 30 cm to 40 cm) and associated shrub-sized stems from root suckers grow in the vicinity of vernal pools.

Five locally rare plant species (Oldham 2010) occur on the Subject Lands:

- Fennel-leaved Pondweed (*Stuckenia pectinata*);

- Greater Duckweed (*Spirodela polyrhiza*);
- Water-meal (*Wolffia columbiana*);
- Hispid Hedge-nettle (*Stachys hispida*); and
- Cardinal Flower (*Lobelia cardinalis*).

### 3.2.1.2 Targeted 2016 Vegetation Surveys

Targeted surveys were carried out on August 2 and September 14, 2016 when the plants would be more evident (i.e., flowering, fruiting, or in full vegetative growth) to detect six plant species of significance (at the provincial and regional scales) that were identified by the NPCA and at an August 6, 2015 pre-consultation meeting and an October 7, 2015 technical meeting:

- Eastern Flowering Dogwood (*Cornus florida*): Endangered in Ontario and Canada;
- White Wood Aster (*Aster divaricatus*): Threatened in Ontario and Canada;
- Swamp Rose-mallow (*Hibiscus palustris*): Special Concern in Ontario and Canada;
- Butternut (*Juglans cinerea*): Endangered in Ontario and Canada;
- Large Yellow Pond-lily (*Nuphar lutea ssp. advena*): provincially rare (S3); and
- Green Arrow-arum (*Peltandra virginica*): provincially imperiled (S2).

Although these species were not found during prior ecological surveys conducted by Savanta (or by previous consultants ESG and Gartner Lee), there remained some uncertainty regarding absence or presence since suitable habitat exists for some species and, in some cases, records may occur near the Subject Lands.

None of the six-species listed above were located on the Subject Lands. These species have not been found within the Subject Lands despite numerous years of biological inventories. It is unlikely that these species are present with the Subject Lands.

**Table 5 (Appendix D)** provides a summary of the species' habitat requirements, potential habitats present on the Subject Lands, and commentary regarding the potential reason for the species' absence.

### 3.2.1.3 Historical Vegetation Observations

ESG (2001) recorded three locally rare species north of Grassy Brook Road: Fragrant White Water Lily (*Nymphaea odorata ssp. odorata*), Black Gum and Sallow Sedge (*Carex lurida*).

One species provincially rare (S3; NHIC 2016) species was recorded by ESG (2003): Pignut Hickory (*Carya glabra*). This species was observed in a woodland south of the railway and is uncommon in Niagara Region (Oldham 2010). It was not relocated during 2012 to 2016 vegetation surveys.

The following species identified in the ESG (2003) report are rare in Niagara Region (Oldham 2010). Despite targeted surveys, these species were not relocated during more recent surveys conducted by Savanta.

- Purple Cress (*Cardamine douglassii*);
- Rough Hedge-nettle (*Stachys hispida*);

- Dark-purple Alexanders (*Angelica atropurpurea*);
- Rough Fleabane (*Erigeron strigosus* var. *septentrionalis*);
- Wild Red Currant (*Ribes triste*);
- Rose-twisted Stalk (*Streptopus roseus*);
- Pin Cherry (*Prunus pensylvanica*); and
- Beaked Hazel (*Corylus cornuta*).

### 3.2.2 Wildlife Species

Site visits were performed during 2012 to 2015 (Savanta) to assess wildlife use of the Subject Lands, with additional targeted surveys carried out in 2016. Surveys included targeted searches for breeding birds, Species at Risk grassland birds, calling amphibians, snakes, turtles, bats, insects and incidental observations of mammals. Surveys included assessments of potential wildlife corridor functions. Methods are summarized in **Appendix C** and results are discussed in the following. Results from previous studies are provided for context.

#### 3.2.2.1 Breeding Bird and Species at Risk Bird Surveys

A total of 30, point count stations were surveyed within the Subject Lands. Point count stations were located within cultural meadow, upland forest, forested swamp, golf course, wetland, disturbed land and agricultural lands (**Figure 2, Appendix B**).

A total of 61 bird species were observed within the Subject Lands. Of this total, 7 species are confirmed, 35 are probable and 11 are possible breeders on the Subject Lands. The remaining 8 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 8 (Appendix D)**.

A total of 53 (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). One bird species is considered provincially rare (S1 - S3; NHIC 2016) and is discussed below.

Great Egret (S2B; NHIC 2016) was observed visiting and foraging along the edges of golf course water bunkers on the Subject Lands. These birds are presumed adults from nesting colonies in the Niagara River and no breeding evidence was recorded on the Subject Lands.

The following Species at Risk were observed on the Subject Lands:

- Bobolink (*Dolichonyx oryzivorus*) - Threatened in Ontario and Canada;
- Barn Swallow (*Hirundo rustica*) - Threatened in Ontario and Canada;
- Eastern Wood-Pewee (*Contopus virens*) - Special Concern in Ontario and Canada; and
- Wood Thrush (*Hylocichla mustelina*) - Special Concern in Ontario and Threatened in Canada.

Surveying for grassland bird Species at Risk included 11 point count stations placed in cultural meadows and disturbed/fallow areas. These polygons did not provide suitable breeding habitat for Bobolink or Eastern Meadowlark due to small size, high disturbance and linear shape (i.e.,

lack of core/interior habitat). Several of the surveyed polygons were larger but did not provide suitable breeding habitat due to high disturbance, areas of bare soil or standing water, and inappropriate vegetation composition/structure (i.e., high forb content, low grass content, disturbed annual row crops). No breeding, post-breeding staging/flocking observations were recorded during surveys.

Two male Bobolinks were observed in flight at point count station 1 (**Figure 2, Appendix B**), however no suitable breeding habitat was present at this location or anywhere else on the Subject Lands. These males were considered wanderers from off-site breeding habitat in the nearby landscape. No breeding evidence was recorded for this species on the Subject Lands.

Barn Swallows were observed foraging over the Subject Lands on several occasions. No nesting sites were observed for Barn Swallow on the Subject Lands; however, suitable foraging habitat is present (i.e., woodland edges and water bodies) for this species.

Probable breeding evidence was recorded for both Eastern Wood-Pewee (*Contopus virens*) and Wood Thrush (*Hylocichla mustelina*). Each species was observed in seven locations on the Subject Lands.

Four locally uncommon or rare bird species that were recorded on the Subject Lands are considered rare in Niagara region (NPCA 2010):

- American Woodcock (*Scolopax minor*);
- Virginia Rail (*Rallus limicola*);
- Eastern Screech-Owl (*Otus asio*); and
- Orchard Oriole (*Icterus spurius*).

A variety of species recorded on the Subject Lands are indicators of significant wildlife habitat (MNRF 2015), which is discussed further in section 3.3.6.

All bird species recorded in the 2001 EIS (48 species in total) and 2003 EIA (15 species in total) are provincially ranked S5 (common and secure in Ontario) or S4 (apparently secure in Ontario) (NHIC 2016).

### 3.2.2.2 Crepuscular and Nocturnal Bird Surveys (2016)

Targeted bird surveys were completed for nocturnal, marsh and crepuscular species on May 10 and May 18, 2016 to determine the presence, abundance and behaviours of existing avian species (**Table 2, Appendix D**).

Two nocturnal point count stations were sampled along with two, marsh bird, monitoring stations; and four crepuscular monitoring stations within the Subject Lands. In addition, thirty breeding bird point count stations were also surveyed (**Figure 2, Appendix B**).

A total of 31 bird species were observed within the Subject Lands during the surveys (**Table 8, Appendix B**). Four species were recorded that were targeted by the nocturnal, marsh and crepuscular bird surveys: Virginia Rail, Great Horned Owl, Eastern Screech-Owl and American Woodcock. Of these, two species are confirmed, and two are probable breeders on the Subject

Lands. The remaining 27 bird species are considered breeders, flyovers or migrants that occupy non-targeted habitats of these surveys.

All four of the observed, targeted breeding bird species are provincially ranked S5 (common and secure) or S4 (apparently common and secure) (NHIC 2016). Each species is described further below:

- Virginia Rail is a locally rare summer resident (NPCA 2010). One pair was observed in suitable breeding habitat, a small cattail marsh with open water at breeding bird point count 7 (**Figure 2, Appendix B**). This pond also hosted a pair of Virginia Rail in 2015 and 2014.
- American Woodcock is a locally uncommon summer resident (NPCA 2010). Males were observed displaying simultaneously at three locations within the Subject Lands at point counts 29, 16 and 6 (**Figure 2, Appendix B**).
- Great Horned Owl is not ranked by NPCA (2010). This species is considered an uncommon resident by Black and Roy (2010). A nest containing two young, which later fledged, was found in the PSW north of Grassybrook Road at breeding bird point count 10 (**Figure 2, Appendix B**). The nest had fallen to the ground by late May.
- Eastern Screech-Owl is not ranked by NPCA (2010). This species is considered an uncommon resident in Black and Roy (2010). Two adults, giving agitated responses to playback were located in the PSW north of Grassy Brook Road at breeding bird point count 10 and the woodlot northeast of the rail line and Crowland Avenue at breeding bird point count 3 (**Figure 2, Appendix B**).

### 3.2.2.3 Amphibians

Three rounds of evening amphibian call-count surveys (AMC) were completed in April, May and June of 2015. In addition, three rounds of daytime amphibian egg mass surveys (EMS) were completed in April, May and June 2016. Survey dates and conditions are provided in **Table 6 (Appendix D)**. Survey stations were identified through assessment of aerial photography, vegetation communities and ground observations. Stations were verified in the field to confirm the presence of suitable breeding habitat.

#### 2015 Amphibian Call Count Surveys (AMC)

A total of 41 amphibian call count stations were surveyed within the Subject Lands. Stations were located within swamps, marshes, naturalized ponds and golf course ponds (**Figure 1, Appendix B**). Of these stations, 8 were dry at the time of the second round (May) amphibian call count survey. Full amphibian call count data is provided in **Table 6 (Appendix D)**.

A total of 6 amphibian species were heard calling within the Subject Lands during the three rounds of call count surveys (**Table 6, Appendix D**). All of these species are provincially ranked S5 (common and secure) or S4 (apparently common and secure) (NHIC 2016). No Species at Risk or provincially rare amphibians were recorded on the Subject Lands. All of these amphibian species are considered widespread in the Niagara region (NPCA 2010).



### Incidental Observations

During turtle basking surveys conducted in 2015 and 2016, Bullfrog was heard calling at turtle basking stations 4, 10, 14 and 16 (**Figure 4, Appendix A**).

During 2015 AMC surveys, several incidental wildlife observations of note were recorded, including a bat species observed at amphibian station CC (echo-meter did not pick up a recording for this individual) and American Woodcock heard calling at amphibian stations DD, L, P, and W (**Figure 4, Appendix A**). All wildlife species observed on the Subject Lands are summarized in **Table 8 (Appendix B)**.

Fourteen amphibian egg mass stations were surveyed and are illustrated on **Figure 1 (Appendix B)**. Survey dates, personnel and details are provided in **Table 2 (Appendix D)**.

A cumulative total of five amphibian species were recorded within the Subject Lands during the EMS assessments. One additional species (Bullfrog) was observed incidentally during a turtle basking survey at EMS station 13 on September 19, 2016. Detailed results of the EMS surveys are provided in **Table 7 (Appendix D)**. All amphibian species recorded on the Subject Lands are listed in **Table 8 (Appendix D)**. All of the amphibian species are provincially ranked S5 (common and secure) or S4 (apparently common and secure) (NHIC 2016).

#### **3.2.2.4 Reptiles**

Reptile surveys were completed on the Subject Lands during 2015 to 2016 and included: turtle basking surveys, turtle nesting surveys, and snake surveys. Reptile survey dates and conditions are provided in **Table 2 (Appendix D)**. These surveys help to identify the presence and abundance of often-elusive reptile species, contributing to an understanding of habitat diversity and quality. Species at Risk and/or significant wildlife habitat may be identified through these methods.

The 2015 reptile survey stations and transects are illustrated on **Figure 4 (Appendix A)** and the 2016 reptile survey stations and transects on **Figure 3 (Appendix B)**. In 2015, 17 turtle basking stations, three turtle nesting transects, and four road transects were established on the Subject Lands and adjacent roadways. In 2016, three turtle basking stations and 14 turtle nesting transects were surveyed on the Subject Lands. All reptile species recorded on the Subject Lands are listed (**Table 8, Appendix B**). Detailed results of the 2015 and 2016 turtle basking and nesting surveys are provided in **Tables 11 and 12** respectively (**Appendix D**)

In 2015, one turtle species was recorded within the Subject Lands (Midland Painted Turtle, *Chrysemys picta*), which is provincially ranked S5 (common and secure in Ontario; NHIC 2016) and considered widespread in Niagara region (NPCA 2010). One or more Midland Painted Turtles were recorded at a variety of ponds on the Subject Lands (detailed results are provided in **Tables 11 and 12 (Appendix D)**). An additional species was recorded during 2016: Snapping Turtle (*Chelydra serpentina*). That species is Special Concern in Ontario and Canada.

Savanta's only record of Snapping Turtle on the Subject Lands was a young-of-the-year individual found dead, on September 19, 2016, on the golf cart path east of Crowland Avenue (northeast of turtle nesting transect 5). No adult Snapping Turtles have been recorded on the Subject Lands. A dead young-of-the-year Midland Painted Turtle was incidentally recorded

during an amphibian survey on May 6, 2016, northeast of turtle nesting transect 2. No turtle nesting evidence (i.e., test digs, claw marks, egg shells) was recorded. Soil auger tests were not permitted on the active golf course but were conducted on the agricultural fields. Soil mapping indicates suitable substrate (low clay content soils) along transects 3, 5, 11, 12 and 14 (**Figure 4, Appendix A**). Sand present in golf course bunkers was too shallow to support nesting.

An autumn turtle basking survey was conducted in September 2016 to check for potentially suitable overwintering habitat. Only turtle basking station 18 had water present and potentially suitable turtle over-wintering conditions (muck bottom). The other ponds (turtle basking stations 14 and 16) were found to be dry in September 2016 and did not provide suitable overwintering conditions.

### Snake Surveys

Three transects were surveyed in 2015 (**Figure 4, Appendix A**) and 13 transects were surveyed in 2016 (**Figure 3, Appendix B**). Three snake species were recorded on the Subject Lands: Eastern Gartersnake (*Thamnophis sirtalis sirtalis*), Northern Watersnake (*Nerodia sipedon*), and Brownsnake (*Storeria dekayi*), all of which are common and secure in Ontario (S5; NHIC 2016). Detailed results of the snake surveys are provided in **Tables 9 and 10 (Appendix D)**.

No suitable snake hibernacula or congregations of snakes were observed.

### Historical Surveys

Low numbers of two common snake species were observed during 2012 and 2014 surveys (Eastern Gartersnake and one Dekay's Brownsnake), and one turtle species (Midland Painted Turtle). No reptiles are mentioned in the previous studies (ESG 2001 and 2003). All reptile species observed are common and secure in Ontario (NHIC 2016).

#### **3.2.2.5 Insects**

Insect surveys were conducted within the Subject Lands in the spring and summer of 2016 to identify the presence and abundance of two targeted insect Orders: Butterflies (Order: Lepidoptera; super-family: Papilionoidea) and Dragonflies (Order: Odonata). Survey locations are illustrated on **Figure 4 (Appendix B)**.

Insect surveys were also conducted following breeding bird surveys that occurred in 2015. Butterflies and dragonflies are excellent indicators of habitat diversity and quality (Hall et al. 2014, Catling and Brownell 2000). Dragonflies are particularly noted as indicators of water quality (Needham et al. 2014) and several Species at Risk in both groups are identified in Ontario. Survey dates and conditions are provided in **Table 2 (Appendix D)**.

During the targeted 2016 insect surveys, a total of 27 dragonfly and 23 butterfly species were observed within the Subject Lands. In 2015, insect surveys conducted after breeding bird surveys recorded eight butterfly and 13 dragonfly species on the Subject Lands. Most species are provincially ranked S5 (common and secure), S4 (apparently common and secure) or SNA



(species not native to Ontario), except for those listed below. All species observed on the Subject Lands are listed in **Table 8 (Appendix D)**.

The following provincially rare insect species (S1-S3; NHIC 2016) were observed on the Subject Lands:

- Monarch (*Danaus plexippus*) (Special Concern in Ontario and Endangered in Canada);
- Slender Bluet (*Enallagma traviatum*) (S1);
- Unicorn Clubtail (*Arigomphus villosipes*) (S2S3);
- Swamp Darner (*Epiasechna heros*) (S2S3);
- Double-Striped Bluet (*Enallagma basidens*) (S3); and
- Terrestrial Crayfish (*Fallicambarus sp.*) (S3).

The following species observed on the Subject Lands are considered rare in Niagara Region (NPCA 2010):

- Emerald Spreadwing (*Lestes dryas*);
- Slender Spreadwing (*Lestes rectangularis*);
- Prince Baskettail (*Epithea cynosura*);
- Spot-winged Glider (*Pantala hymenaea*);
- Cherry-faced Meadowhawk (*Sympetrum internum*);
- Tawny-edged Skipper (*Polites themistocles*); and
- Acadian Hairstreak (*Satyrium acadicum*).

The Species at Risk butterfly (Monarch) and one local species of interest (Tawny-edged Skipper) rely on open habitat meadow areas for feeding and reproduction. Three of the provincially rare species (Unicorn Clubtail, Double-striped Bluet and Slender Bluet) and all of the locally rare species, except Cherry-faced Meadowhawk and Emerald Spreadwing, were found at golf course ponds. The remaining provincially rare insect, Swamp Darner, and two locally rare species (Emerald Spreading and Cherry-faced Meadowhawk) were found in the treed swamp PSW north of Grassy Brook Road. Single Terrestrial Crayfish chimneys were observed at several locations near golf course ponds; only one location had two chimneys within the same vegetation unit.

### 3.2.2.6 Mammals

#### Bat Habitat Assessment

Recent listing of four bat species on the Species at Risk in Ontario (SARO) list as Endangered has prompted the need to assess potential for habitat to exist on the Subject Lands. The four endangered bat species are: 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.

Surveyed areas were assessed for candidate bat maternity colony roost habitat as per guidance within the MNR (2015) Significant Wildlife Habitat criteria for ecoregion 7E.

Nineteen areas were identified to be searched on the Subject Lands and are illustrated on **Figure 5 (Appendix B)**. The results of the cavity tree surveys are presented in **Table 14 (Appendix D)** below. Survey personnel, times and details are provided in **Table 2 (Appendix D)**.

Based on the results above, none of the treed areas proposed for removal meet bat maternity colony SWH criteria. Transects conducted along the edges of treed areas to be retained also did not meet bat maternity colony SWH criteria. It is possible suitable bat maternity SWH exists in the interior of retained treed features, however, these features are not proposed for removal. SWH is discussed further in Section 3.3.2.6.

#### Bat Species Acoustic Monitoring Surveys

Survey personnel, times and details are provided in **Table 2 (Appendix B)**. Nine point count stations and 9 transects were selected for acoustic monitoring on the Subject Lands (**Figure 5, Appendix B**). Recordings from acoustic surveys confirmed four bat species were present on the Subject Lands: Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Eastern Red Bat (*Lasiurus borealis*) and Hoary Bat (*Lasiurus cinereus*). A cumulative total of 134 bat passes were recorded over the three evening surveys. Of these calls 121 were low frequency calls, and 13 high frequency calls were recorded. The high frequency calls did not show characteristics of Myotis or Perimyotis species. No Species at Risk bats were detected on the Subject Lands. Bat survey results are provided in **Table 15 (Appendix D)**.

#### **3.2.2.7 Other Wildlife**

Incidental wildlife observations (mammals, insects, amphibians, etc.) were recorded during surveys conducted by Savanta in both 2015 and 2016. Direct observations, calls, tracks, scats and runways were used to record wildlife present within the Subject Lands. These observations were used to document wildlife and wildlife habitat and to characterize the nature, extent and significance of animal usage within the Subject Lands.

All wildlife species recorded during Savanta's 2015 and 2016 fieldwork are listed in **Table 8 (Appendix D)**. Seven mammal, one bird, one reptile, and four amphibian species were recorded incidentally during surveys conducted on the Subject Lands. All incidental species observed are provincially ranked S5 (common and secure), S4 (apparently common and secure) or SNA (species not native to Ontario).

Seven mammal species were observed on the Subject Lands through incidental observations recorded in 2012 and 2014. Previous studies (ESG 2001 and 2003) recorded three mammal species that were not observed during recent surveys (Savanta 2012 to 2014): Northern Short-tailed Shrew (*Blarina brevicauda*), Eastern Cottontail (*Sylvilagus floridanus*), and Meadow Vole (*Microtus pennsylvanicus*). These species are expected to persist on the Subject Lands after development.

### 3.2.3 Aquatic Resources

#### 3.2.3.1 Headwater Drainage Feature Assessment

The 2014 HDFA Guidelines address the approach towards classification of the headwater drainage features by providing step-by-step characterization of specific functions that may be associated with the features. These functions include: hydrology, riparian vegetation within 0 m to 30 m of the feature, fish and fish habitat and the presence of terrestrial habitat.

The HDFA guidelines provide subsequent guidance on linking the characteristics and functions of features to specific management recommendations that may be applied to those features. The Guidelines include a figure entitled “Flow Chart Providing Direction on Management Options” to guide the user through the functional assessment of features. The flow chart depicts various decision points associated with hydrology, fish habitat, riparian vegetation and terrestrial vegetation, and ultimately leads to an appropriate management recommendation for the feature on the landscape in the context of changing land use. The flow chart was used to determine the management recommendations for the features on the Subject Lands.

Thirty-four headwater drainage features were identified and assessed by Savanta in the field in 2015 (**Figure 5, Appendix A**). The assessments and analyses resulted in a management recommendation of “No Management Required” for all HDFs assessed indicating “these features are generally characterized by minimal flow, no fish or fish habitat and no amphibian habitat” (CVC/TRCA, 2014). It should be noted that these features occur in cultivated agricultural fields and exhibit no riparian vegetation. It is possible that they have been cultivated completely through in other years, however in 2015, it was apparent that a no-till approach to sowing soybeans was utilized so the drainage scars were evident on the landscape. In clay-based soils, drainage is often “encouraged” on the landscape through the use of V-ditch plows, designed to create a shallow trench that speeds up the process of field drainage during the spring period thus allowing for earlier seeding times. V-ditches are often created in the fall in preparation for the spring runoff period of the following year.

#### 3.2.3.2 Aquatic Habitat Assessment

##### Grassy Brook

The Grassy Brook headwaters originate 5.5 km to the west of the Subject Lands, near the Welland Canal, west of Darby Road. The creek winds in a northeasterly direction from its origins, entering the Subject Lands after crossing under Morris Road (**Figure 6, Appendix A**). From this point, it extends through the Subject Lands and continues in an easterly direction, eventually flowing into the Welland River east of the Queen Elizabeth Way (QEW), and downstream Power Canal (the reach of the Welland River downstream from the Power Canal is locally known as Chippawa Creek). The Welland River (Chippawa Creek) then continues east, joining the Niagara River upstream of Niagara Falls. Grassy Brook is a warmwater system.

A watercourse and fish habitat assessment was conducted by Savanta on August 15, 2012 and then reassessed during 2015 surveys to identify any changes since 2012. The assessment included an examination of Grassy Brook at the Morris Road crossing, and included walking the entire length of the channel on the Subject Lands from the west property boundary and

downstream of Crowland Avenue/Grand Niagara Drive. The creek was examined for evidence of flows, bank conditions and dimensions, substrate and vegetation.

At Morris Road, Grassy Brook appears as a grass-lined watercourse with a bottom width of approximately 3 m. The entire channel is lined with terrestrial grasses. Bankfull width of the channel is approximately 10 m, and the banks are lined primarily with Reed Canary Grass. No flow was present in the channel in 2012, however, standing water was present at the culvert. A thick growth of duckweed was observed on the standing pool, suggesting the water had been present for some time and was exhibiting stagnation. In April 2015, much more water was present in the creek, and evidence of overbank conditions was noted in the field edges upstream of Crowland Avenue.

At the Crowland Avenue/Grand Niagara Drive crossing, the creek retains its grass-lined drain appearance. The creek flows under Crowland Avenue via a 4-m wide box culvert, and the downstream channel is lined with heavy growth of cattail and terrestrial grasses. No water was present in August 2012 at the culvert or through much of the length of the channel examined. In April 2015, more water was present. It is apparent that Grassy Brook experiences seasonal fluctuations in flow, with high flows and overbank conditions occurring in early spring and subsidence to intermittent conditions in summer and early fall.

As the channel enters the wooded area east of Crowland Avenue, terrestrial vegetation lining the channel bed thins out due to overhead shading. Deposited woody debris within the floodplain provides evidence of seasonal high flows and overbank conditions. The channel bottom width is approximately 2 m to 3 m, while the bankfull width is approximately 10 m and varies with local micro-topography.

Further into the wooded area, a section of the channel exhibited exposed mud substrates and bare bank areas. This short channel section contained no vegetation due to a combination of complete shading and sustained pooling of water. A shallow pool, approximately 5 cm deep during the August 2015 investigation, was noted in this area. No fish were observed in this pool, however green frogs were present.

Beyond the exposed bed area, the overhead canopy thins out somewhat to allow more sunlight in, and the channel resumes its appearance as a grass-lined watercourse. At the downstream end of the wooded area, riparian vegetation is restricted to a narrow band of poplar trees and old-field vegetation. Buffer widths are minimal at this location, approximating 3 m to 5 m in width at their widest point. The channel is more incised and straight at this location, resembling an agricultural drain.

Downstream of the wooded riparian area, much of the channel is open, and resembles the reed canary grass-lined configuration noted in the reaches upstream of Crowland Avenue/Grand Niagara Drive. The north side of the channel exhibits a minimal vegetated buffer of approximately 2 m between the channel and the adjacent soybean field.

Fisheries data for Grassy Brook was obtained from the NPCA in 2012. Species captured at various stations along Grassy Brook are representative of a warmwater community and, depending on station location (i.e., proximity to the Welland River), include a variety of cyprinids (minnows), as well as top predators, such as Largemouth Bass (*Micropterus salmoides*) and Northern Pike (*Esox Lucius*). Northern Pike spawning habitat and Grass Pickerel (*Esox*

*americanus vermiculatus*), designated as Special Concern in Ontario and Canada, have been recorded from the Grassy Brook system. While Grass Pickerel is not currently listed under the *Endangered Species Act*, its dual federal/provincial listing as “Special Concern” has led to the identification of Grassy Brook as Type 1, critical fish habitat by MNRF. Examples of Type 1 habitat include “critical spawning and rearing areas, migration routes, over-wintering areas, productive feeding areas and habitats occupied by sensitive species (OMNR 2000; cited in NPCA 2011).

Fisheries and Oceans Canada (DFO) has produced mapping entitled *Distribution of Fish Species at Risk*, commonly referred to as SARA mapping, for the majority of Conservation Authority jurisdictions in Ontario, including the Niagara Peninsula Conservation Authority. The SARA mapping for the area identifies both Grassy Brook and the Lyon’s Creek Tributary as habitat for Grass Pickerel.

The data provided by NPCA (October 29, 2012) indicate that Grass Pickerel have been found at fisheries sampling stations in Grassy Brook upstream of the Subject Lands. *The Niagara River Watershed Fish Community Assessment (1997-2011)*, prepared by MNRF, summarizes fish community data for a variety of watercourses in the Niagara River watershed, including Grassy Brook. That report provides records for Grass Pickerel upstream of the Subject Lands, as well as Northern Pike, which have very similar spawning habitat requirements.

*Esocidae*, such as Grass Pickerel and Northern Pike, inhabit warm, slow-moving streams, ponds and bays of lakes with an abundance of aquatic vegetation. They will spawn in the spring when water temperatures are in the range of 8°C to 12°C, and lay their eggs in vegetated areas where the eggs adhere to instream vegetation and organic debris. No parental care is provided to the eggs or young.

Given that Grassy Brook is an intermittent or discontinuously flowing watercourse, Grass Pickerel likely move into the watercourse from the Welland River in the spring and move upstream through the reaches on the Grand Niagara lands during high flow periods when sufficient water is present to allow for migration of this species. Based on the records of this species upstream from the Subject Lands and the habitat conditions on the Subject Lands, spawning likely occurs upstream. Following spawning, they then likely recede downstream towards the Welland River as flow conditions taper off and become discontinuous as the summer season progresses.

There are some areas of the channel on the Subject Lands that support ample in-stream vegetation, however other portions of the channel are surrounded by dense riparian or streamside vegetation that provides heavy shade that precludes in-stream vegetation growth. This results in a discontinuous reach of grass-lined and bare channel sections. Areas of well-connected grassy floodplain would provide suitable conditions for spawning when overbank flows occur during the spring. Downstream of Crowland Avenue, channel areas with open grassy banks tend to be incised and somewhat disconnected from the floodplain, while channel sections with shallower banks and which are frequently connected to floodplain overbank flows are in the forested stand that does not support good understory or instream vegetation for spawning habitat.

Channel sections upstream of Crowland Avenue and Morris Road are much more open and are characterized by a considerable length of grass-lined channel, due to the lack of shade



providing riparian tree growth in these agricultural areas. In general, those upstream areas contain ample in-stream vegetation for spawning habitat. The overbank and floodplain zones are well connected to the main channel, however, vegetation tends to be reduced or impacted by cultivation practices in the open agricultural lands.

Based on these observations, potential spawning habitat for Grass Pickerel and Northern Pike within Grassy Brook is generally limited downstream from Crowland Avenue, while upstream reaches do appear to provide suitable spawning areas. Therefore, the reaches of Grassy Brook downstream from Crowland Avenue would be considered to provide primarily upstream and downstream migration habitat for Grass Pickerel and Northern Pike, while upstream reaches would provide spawning and early season nursery habitat prior to flows becoming intermittent.

### Lyon's Creek Tributary

A tributary of Lyon's Creek arises approximately 2 km southwest of the Subject Lands on the west side of McKenney Road. The tributary enters the Subject Lands at the western boundary, downstream of Morris Road, and continues across the Subject Lands generally parallel to, and south of, Grassy Brook (**Figure 6, Appendix A**). It continues in an easterly direction to its confluence with Lyon's Creek, east of the QEW immediately south of Lyon's Creek Road. This tributary is an intermittent warmwater watercourse.

During the April 30, 2015 site visit, the tributary exhibited discontinuous pockets of standing water, with evidence of previous flooding and overbank flow conditions. The feature is primarily a shallow watercourse flowing through alternating pockets of mineral meadow marsh, occasional deciduous swamp pockets and agricultural fields. The majority of the channel's riparian vegetation is limited to narrow meadow marsh communities beyond which the land is ploughed for agricultural purposes.

Historical fish data are available for Lyon's Creek near its confluence with the Welland River (Niblett Environmental Associates, 1995). Fisheries data are also available for Hunter Drain, which empties into the Welland River at the junction of the river and Lyon's Creek. Fisheries data, for Lyon's Creek collected in 1974, 1976 and 1981, was also summarized by Niblett Environmental Associates (1995).

A total of 21 fish species have been reported from the length of Lyon's Creek, including areas outside of the Subject Lands. In addition to the usual complement of minnow and sucker species, Black and Brown Bullhead, Tadpole Madtom, Grass Pickerel, Northern Pike, Central Mudminnow, Rock Bass, Pumpkinseed, Black Crappie, and Yellow Perch have been documented. Spawning of northern pike has been documented in both Lyon's Creek and Hunter Drain (ESG, 2001).

Grass Pickerel was recorded from the Lyon's Creek system. No MNRF fisheries data are available for the tributary associated with the Subject Lands, nor was it sampled for any of the years listed in the *Niagara River Watershed Fish Community Assessment* report.

Based on surveys conducted by ESG (2001) only two species of fish were recorded from the tributary to Lyon's Creek on the Subject Lands: Pumpkinseed and Golden Shiner. A detailed habitat assessment carried out by ESG at the time, described the reach of the Lyon's Creek Tributary downstream of Crowland Avenue as providing little aquatic diversity. The channel is

described as poorly defined and approximately two meters in width with a well vegetated floodplain consisting of soft silts, sands and clay. Little evidence of permanent flow was observed by ESG in 2001, however at the downstream edge of the woodlot, rushes and cattails are established suggesting lengthier periods of moisture.

According to studies conducted by ESG (2001), a few locations throughout this watercourse on the Subject Lands could provide spawning habitat for both Grass Pickerel and Northern Pike if fish access from downstream is feasible. Observations of habitat conditions by Savanta, particularly in the reaches upstream of Crowland Avenue suggest that instream vegetation dominated by Reed Canary Grass, and seasonal flooding conditions provide potentially suitable spawning habitat for Esocids, including Grass Pickerel. MNRF has designated the reach of the tributary of Lyon's Creek on the Subject Lands as Type 1 critical fish habitat, likely based on potential for provision of migration habitat for Northern Pike and Grass Pickerel, with critical spawning present in some locations, predominantly upstream from Crowland Avenue.

### **3.3 Analysis of Ecological & Natural Heritage Significance (PPS)**

Eight types of significant natural heritage features are defined in the PPS, as follows:

- Significant wetlands;
- Significant coastal wetlands;
- Significant woodlands;
- Significant valleylands;
- Significant wildlife habitat;
- Fish habitat;
- Habitat of endangered and threatened species; and,
- Significant areas of natural and scientific interest (ANSIs).

Development and site alteration shall not be permitted in significant wetlands, or in significant coastal wetlands. Development and site alteration shall not be permitted in: significant woodlands, significant valleylands, significant wildlife habitat or significant ANSIs, unless it is demonstrated that there will be no negative impacts on the natural features or their ecological functions.

Development and site alteration shall not be permitted in the habitat of endangered and threatened species or in fish habitat, except in accordance with provincial and federal requirements. Development and site alteration may be permitted on lands adjacent to fish habitat provided it has been demonstrated that there will be no negative impacts on the natural feature or their ecological functions.

A number of these elements appear to occur within and/or immediately adjacent to the Subject Lands. These are discussed in detail in the following sections.

#### **3.3.1 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. MNRF's database was consulted and natural heritage features (i.e.,

PSW, woodlands) are depicted, along with NPCA-identified natural features on **Figure 2 (Appendix A)**. Portions of the Lower Grassy Brook PSW complex and the Welland River East PSW complex are located on the Subject Lands.

### **3.3.2 Habitat of Endangered and Threatened Species**

Species at Risk (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 MNR/Aurora District through the Information Gathering Form (IGF) process. Due to the sensitive nature of this information, all correspondence and outcomes will remain with the MNR/Aurora District and its jurisdiction. No endangered species were recorded on the Subject Lands. Two threatened species were recorded within the Subject Lands and are discussed below.

#### Bobolink

Two male Bobolinks were observed in flight at one point count station however no suitable breeding habitat was present at this location or anywhere else on the Subject Lands. These males were considered wanderers from off-site breeding habitat in the nearby landscape. No breeding evidence was recorded for this species on the Subject Lands.

#### Barn Swallow

Barn Swallows were observed in low numbers foraging over the Subject Lands on several occasions. No nesting sites were observed for Barn Swallow on the Subject Lands; however suitable foraging habitat is present (i.e., woodland edges and water bodies). Barn Swallow nesting activity was observed incidentally at a private, non-participating residence outside of the Subject Lands (west of Crowland Avenue). Barn Swallow foraging habitat will be addressed under specific assessment by the MNR/Aurora District through the SAR *Information Gathering Form* process.

### **3.3.3 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).

The SARA mapping for the Niagara Region identifies both Grassy Brook and Lyon's Creek tributary, on the Subject Lands, as habitat for Grass Pickerel (Special Concern in Ontario and Canada). Grassy Brook is an intermittent watercourse that provides warmwater fish habitat. This watercourse is designated by the MNR/Aurora District as Type 1 critical fish habitat due to potential spawning habitat for Grass Pickerel and Northern Pike. Spawning habitat on the Subject Lands downstream from Crowland Avenue is generally limited, however, suitable spawning habitat is present upstream from Crowland Avenue. Grass Pickerel has been recorded upstream of the Subject Lands and they likely pass through the reach that crosses the Subject Lands as they migrate to upstream spawning areas from overwintering habitat in the Welland River.



The unnamed tributary of Lyon's Creek that crosses the Subject Lands is an intermittent watercourse that provides warmwater fish habitat. The Lyon's Creek Tributary is mapped as providing suitable spawning habitat for Grass Pickerel and Northern Pike and, according to studies conducted by ESG (2001), a number of locations throughout this reach on the Subject Lands (predominantly upstream from Crowland Avenue) could provide spawning habitat for both these species of fish, provided access from downstream is feasible. Due to these characteristics the watercourse is considered Type 1 or critical fish habitat.

None of the headwater drainage features noted on the Subject Lands (**Figure 5, Appendix A**) provide fish habitat.

### 3.3.4 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 Region (2015) defines woodland as a treed area that provides environmental and economic benefits to both the private landowner and general public, such as ecosystem goods and services. It does not include a cultivated fruit or nut orchard or a plantation used for the purpose of producing Christmas trees.

In accordance with this definition, natural treed communities (FOC, FOD, FOM, SWC, SWD, SWM) and cultural forest/plantation communities (CUW, CUP) are considered woodlands (i.e., meet the Forestry Act woodland density requirements). Woodland patches are considered part of the same continuous woodland if they are within 20 m of each other.

To be identified as significant, a woodland on the Subject Lands must meet one or more of the following criteria (Region, 2015):

- a) Contain threatened or endangered species or species of concern (Special Concern in Ontario or Canada or provincially ranked S1-S3);
- b) Within the Urban Area, be 2 hectares or greater in size;
- c) Contain interior woodland habitat at least 100m in from the woodland boundaries;
- d) Contain older growth forest and be 2 hectares or greater in area;
- e) Overlap or contain one or more of the other significant natural heritage features listed in Region (2015) policies 7.B.1.3 or 7.B.1.4 (i.e., EPA, ECA or fish habitat); and,
- f) Abut or be crossed by a watercourse or water body and be 2 or more hectares in area.

The majority of the treed ELC polygons on the Subject Lands meet the Region's (2015) definition of woodland. Woodland patches that meet one or more of the significant woodland criteria, listed above, are shown on **Figure 7 (Appendix A)**.

### **3.3.5 Significant Valleyland**

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 valley lands include prominence as a distinctive landform, degree of naturalness, and importance of its ecological functions, restoration potential, and historical and cultural values

The Welland River was identified as a significant valleyland. The contiguous riparian vegetation that fronts the Welland River, on the Subject Lands, was identified as significant valleyland on as shown on **Figure 9 (Appendix A)**.

### **3.3.6 Significant Wildlife Habitat**

Significant wildlife habitat 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 (OMNRF 2015). The Subject Lands are located in Eco-region 7E and were therefore assessed using the 7E Criterion Schedule (OMNRF, 2015).

There are four general types of significant wildlife habitat (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 Natural Heritage Information Centre (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 3.3.2.

#### 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 16 (Appendix D)**, discusses all types of SWH relevant to the Subject Lands based primarily on the Savanta 2015 and 2016 data.

As detailed in **Table 16 (Appendix D)**, a variety of SWH types are present on the Subject Lands that are illustrated on **Figure 8 (Appendix A)**:

- Rare vegetation communities are present, including: Pin Oak deciduous swamp (SWD1-3) and a small inclusion of Buttonbush thicket swamp (SWT2-4);
- Wetland amphibian breeding habitat is present east of Crowland Avenue at four golf course ponds and one natural pond (primarily due to low numbers of Bullfrog);
- Woodland amphibian breeding habitat is present east of Crowland Avenue in the PSW north of Grassy Brook Road;
- Habitat of Special Concern and provincially rare (S1-S3) species, including Wood Thrush, Eastern Wood-Pewee, Grass Pickerel, Black Gum, Slender Bluet, Double-striped Bluet, Unicorn Clubtail, and Swamp Darner. Monarch was also observed; however, large concentrations are normally required for designation of provincially significant wildlife habitat for this species. Terrestrial Crayfish chimneys were observed, which can belong to an S3 species however the latter is addressed under a separate SWH category; and
- Terrestrial Crayfish SWH is present within one cultural meadow located adjacent to turtle basking station 15.

Animal movement corridors are required to connect wetland amphibian breeding SWH to suitable non-breeding (summer and winter) habitats. Wetland amphibian breeding SWH is present in four golf course ponds and one natural pond south of Grassy Brook Road due to the presence of low number of Bullfrog; this species stays close to the breeding pond for all life processes and, as such, individual movement corridors have not been identified. From a broader perspective, north of Grassy Brook Road, the Welland River and adjacent PSW vegetation serve as the primary animal movement corridor. South of Grassy Brook Road, the large PSW units and railway PSW units may serve as a movement corridor. The Grassy Brook and Lyon's Creek watercourse corridors also provide some linkage functions; however, riparian vegetation is discontinuous.

#### 4.0 PROPOSED DEVELOPMENT

The composite of Natural Heritage policy related definitions is depicted on **Figure 9 (Appendix A)**. These areas represent a variety of natural features and associated functions which reflect a level of significance.

The proposed development limit and preliminary configuration of major roads, as illustrated in the Secondary Plan, are depicted on **Appendix E**. The Secondary Plan illustrates the preliminary natural heritage system (NHS), limit of development (i.e., NHS limit) and proposed major roads. The preliminary NHS shown in the Secondary Plan was refined in some areas through the preparation of this EIS, and the proposed Ecological Restoration Plan (**Appendix F**).

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

- Provincially significant wetlands (30 m buffer);
- Welland River (30 m buffer; generally, wider due to frontage by a PSW and associated buffer) - note: the overall watercourse buffer for the Welland River, which is Type 1 fish habitat, is typically the greater of the 30 m fish habitat setback, the regulatory floodplain, or the limit of the meander belt - the latter requires additional input from engineering/hydrology;
- Lyon's Creek and Grassy Brook watercourses (15 m buffer; due to overlap with other retained features / buffers the average setback from each side of the watercourse is 50 m for Grassy Brook and 40 m from Lyon's Creek);
- Certain retained other, non-PSW wetlands (15 m buffer); and
- Retained woodlands (10 m buffer).

Development is not permitted nor proposed within provincially significant wetlands (PSW) on the Subject Lands. Critical fish habitat and significant habitat for endangered and threatened species are also protected from development, except in accordance with provincial and federal requirements. This may for example, include developments that has satisfied requirements under the Endangered Species Act, 2007, such as an overall benefit Permit test or MNRF registration for certain Species at Risk and development activities. Development will not occur within the significant valleyland identified along the Welland River; this feature is already protected as fish habitat and PSW.

Development may occur in significant woodlands and significant wildlife habitat (SWH) provided 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 wetlands): woodland amphibian breeding SWH, rare vegetation community SWH, habitat of several rare flora/fauna species (Eastern Wood-Pewee, Grass Pickerel, Black Gum and Swamp Darner). Portions of significant woodland and several SWH types will be impacted by development. This is discussed further below.

The proposed development east of Crowland Avenue will result in the removal of 4.3 ha of other, non-PSW wetland (including swamp, marsh and shallow aquatic vegetation types) and 7.1 ha of upland forest. All of the golf course ponds and two natural ponds are proposed for removal, some of which contain SWH for provincially rare odonates (Slender Bluet, Double-striped Bluet and Unicorn Clubtail) and wetland amphibians (namely low numbers of Bullfrog). Two other SWH types will be impacted by the proposed development: Terrestrial Crayfish (the single SWH area is located on the golf course and proposed for removal); and habitat of the Special Concern species Wood Thrush (due to proposed removal of the woodland south of the rail line and northeast of Biggar Road/Crowland Avenue where this species resided in 2015).

These impacts will be mitigated through habitat enhancement and restoration west of Crowland Avenue and planting of NHS buffers east of Crowland Avenue. These mitigation efforts are described in the Ecological Restoration Plan contained in **Appendix F**. The Restoration Plan includes the creation of 9.0 ha of wetland west of Crowland Avenue, which will include: deciduous treed swamp; floodplain fish spawning wetlands; riparian marsh; open wetland restoration area containing meadow marsh, shallow marsh and shallow aquatic vegetation communities; and shrub thicket swamp. Woodland restoration will also be conducted as part of the Restoration Plan; producing 8.6 ha of restored forest.

The Restoration Plan (**Appendix F**) provides a detailed description of the area of existing forest and unevaluated wetland vegetation types that will be removed due to development, along with the area of each proposed wetland and woodland restoration area.

The preliminary Stormwater Management Report prepared by WSP/MMM Group (2016) outlines criteria and stormwater management implementation plan for the Subject Lands. Stormwater management (SWM) measures proposed to be implemented within the final site development include but are not limited to the following:

- Implementation of Low Impact Development (LID) practises including a variety of sustainable SWM techniques including lot level and end of pipe controls;
- Wet Ponds; and
- Water Quality Treatment Devices – including oil-grit separators.

A detailed Functional Servicing Report (FSR) will be completed once Secondary Plan has been approved and a detailed development plan is developed.

## 5.0 IMPACT ASSESSMENT, AVOIDANCE AND MITIGATION MEASURES

This section of the EIS assesses the impacts, predicted effects, mitigation and enhancement measures associated with the proposed Secondary Plan and available engineering and servicing information.

The Subject Lands contain a variety of tableland, wetland and riparian natural areas along with anthropogenically created features (i.e., hedgerows, golf course rough areas and golf course ponds). The predominant natural features on and adjacent to the Subject Lands are associated with the Lower Grassy Brook PSW, the Welland River East PSW, and natural features associated with the Welland River and tributaries of Grassy Brook and Lyon's Creek that traverse the Subject Lands (Type 1 fish habitat).

The range of potential impacts from proposed development can generally be divided into these two categories: direct impacts are normally associated with the physical removal or alteration of natural features that could occur based upon a land use application, and indirect impacts may be changes or impacts (these could be minor or major) to less visible functions or avenues that could cause negative impacts to natural heritage features over time.

Impact discussions are summarized in **Table 17 (Appendix D)** along with recommendations for proposed mitigation. Ecological enhancement and restoration opportunities are outlined in the Ecological Restoration Plan (**Appendix F**) that once implemented will result in a net gain in habitat function for a variety of species within the Grassy Brook and Lyon's Creek watersheds.

### 5.1 Summary of Predicted Direct/Indirect Affects

This assessment considers both potential direct and indirect effects and is based on the proposed Secondary Plan land uses for the area and the conceptual stormwater management strategies.

#### 5.1.1 *Habitat of Endangered and Threatened Species*

Barn Swallow was observed to be foraging within the Subject Lands and nesting offsite west of Crowland Avenue. Barn Swallow foraging habitat will be addressed under specific assessment by MNRF, through the SAR Information Gathering Form (IGF) process.

#### 5.1.2 *Provincially Significant Wetlands (PSW's) and Other Retained Wetlands*

The Lower Grassy Brook PSW and Welland River East PSW are both located, in part within the Subject Lands and will be protected with a 30 m buffer. Certain retained non-PSW wetlands will be protected with a 15 m buffer (namely two Pin Oak swamp types: SWD1-3 and SWD1-5). At this stage details with respect to SWM have not been provided. Pre-development water balance conditions need to be maintained for all retained PSW wetland and non-PSW units.

#### 5.1.3 *Fish/Aquatic Habitat*

The Welland River will be protected by a minimum 30 m fish habitat set back, however, the buffer is generally wider due to frontage by the river slope, PSW and associated buffer. The overall watercourse buffer for the Welland River, which is Type 1 fish habitat, will generally be



greater than the 30 m fish habitat setback, the regulatory floodplain, or the limit of the meander belt.

The Lyon's Creek and Grassy Brook watercourses, will be protected by a minimum 15 m riparian buffer. Due to overlap with other retained features/buffers the average setback from each side of the watercourse is 50 m for Grassy Brook and 40 m from Lyon's Creek. The predicted effects associated with the proposed development are listed below.

#### Direct Effects

- Potential in-water construction requirements for infrastructure (e.g., roads, buried infrastructure, stormwater management outfalls);

#### Indirect Effects

- Erosion and sedimentation from the construction area;
- Effects due to stormwater management during construction; and
- Accidental spills (e.g., fuel or oil from machinery) with transport of spilled material to watercourses.

Each of these potential effects is discussed below.

#### **5.1.3.1 Direct Effects During Construction**

Direct effects are those construction activities or structures that directly affect the aquatic environment (i.e., they occur within areas considered to be fish habitat). The watercourse buffers are the primary mitigation measure to prevent direct effects on fish and fish habitat, since no construction work, with the exception of linear infrastructure crossings (as discussed below), will be implemented within the buffer areas.

At this stage in the development, detailed information regarding potential infrastructure requirements within either of the watercourses on the Subject Lands is not available. However, based on the proposed Secondary Plan, there will be at least one permanent road crossing of both Grassy Brook and the Lyon's Creek Tributary. It is likely that stormwater management infrastructure (e.g., wet pond discharge outfalls and channels) may be required within fish habitat as well. Buried infrastructure (e.g., water and sewer lines) may also have to be constructed across watercourses. The potential effects of these activities and recommended mitigation measures are discussed in the following sections.

#### Road Water Crossings

Installation of road water crossing structures along Grassy Brook or the Lyon's Creek Tributary could potentially result in a number of temporary and permanent effects on fish and fish habitat. Temporary effects could include:

- Disturbance to fish and fish habitat during installation of water crossing structures; and
- Temporary loss of habitat during the installation process.



The primary mitigation measure to prevent adverse effects on fish due to in-water construction is adherence to in-water timing restriction windows specified by the MNRF. These state that, for warmwater watercourses in southern Ontario, in-water work should not be conducted between March 15 and July 15 to protect the reproductive periods of warm water fish species. Adherence to this mitigation will ensure that any disturbance that does occur does not affect critical fish reproductive processes (e.g., spawning, incubation and emergence). Temporary disturbance outside of reproductive periods will likely cause fish to leave the zone of impact and may temporarily alter local foraging and habitat use. However, this should only occur over a relatively short time frame when work is occurring in water. Given the intermittent nature of the watercourses, it may be possible to install the water crossing structures during periods when the watercourse is dry, which would completely prevent direct effects on fish.

If installation of the water crossing structures is required when water is present in the watercourses, work site isolation measures would likely be required to dewater the work area, minimize in-water work requirements and facilitate proper installation of the structures. This could consist of dam and pump operations or various other types of bypass systems. These types of work site isolation systems would result in temporary loss of habitat within the dewatered work area, but assuming adherence to in-water work timing restrictions, this loss of habitat would not affect reproductive processes. This may cause temporary restrictions in movements and some minor density dependent effects due to fish avoidance of work areas and increases in density in residual habitats, but no significant long-term effects are anticipated. A fish rescue program should be implemented prior to completion of work site isolation to ensure that fish are safely removed to suitable habitats in the vicinity of the work site. Should dewatering be necessary prior to fish removal, screening should be present around the pump inlet to prevent mortality due to impingement and/or entrainment.

Permanent effects on fish and fish habitat due to water crossing structures could include:

- Effects on fish movements (e.g., creation of full or partial barriers to upstream movement); and
- Loss or alteration of fish habitat within the footprint of the structure.

Improperly designed or installed water crossing structures could potentially result in adverse effects on fish movements in Grassy Brook or the Lyon's Creek Tributary. Effects on movements of Grass Pickerel or Northern Pike in the spring could potentially result in significant effects on reproductive processes for those species. In order to prevent effects on fish movements, the water crossing structures should be properly designed to prevent creation of barriers to upstream movement. This could include specification of culverts that span the bankfull width of the channel to avoid effects on water levels and flow velocities within the crossing.

Depending on the type of crossing, there could be adverse effects on fish habitat, if any part of the crossing structure alters or destroys habitat below the average high water mark (e.g., fill associated with embankments). To minimize adverse effects on habitat, water crossing structures should be open span culverts or closed culverts with substrates placed on the culvert invert and should span the bankfull width or even the meander belt of the watercourse. Should water crossing structures result, in loss or alteration of fish habitat, offsetting measures (e.g., habitat creation or enhancement elsewhere) may be required.

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### Stormwater Management Infrastructure

Typically, the only component of stormwater management infrastructure that would be installed within fish habitat would be the outfall headwall and channel to convey flows to the receiving watercourse. Potential adverse effects on fish and fish habitat could include temporary disturbance and loss of habitat due to in-water work and permanent changes in habitat due to the presence of the structure.

In order to minimize the potential for adverse effects, infrastructure should be installed outside the warmwater timing restriction period (March 15 to July 15). Should work in water be required outside this time period, there could be some potential disturbance of local fish communities and temporary habitat loss, but effects would be anticipated to be minor and localized, with fish avoiding the work area and congregating in residual habitats.

Outfall infrastructure should be located to avoid critical fish habitats (e.g., potential floodplain spawning areas for Grass Pickerel and Northern Pike) and outfall channels, if required, should be properly designed based on fluvial geomorphological principals to prevent erosion and downstream sedimentation.

### Buried Infrastructure

Buried infrastructure (e.g., water or sewer lines) may be required to cross the watercourses as part of the proposed development. Should this be required, several proposed crossing methodologies could be employed, including high pressure directional drilling or open cut channels.

High pressure directional drilling would prevent any direct effects on fish habitat within the watercourses, assuming the bell holes were located outside the average annual high water mark. In order to minimize effects, vegetation clearing should be minimized for bell hole areas and mitigation measures, including appropriate sediment and erosion controls, should be used to prevent drilling fluids and drill spoils from being transported to the watercourse. The design of the crossing should ensure that the crossing location will not be subject to channel bed erosion that could expose the infrastructure and that the crossing depth is sufficient to prevent channel bed collapse during installation. Contingency plans should be in place prior to commencement of installation to deal with such a situation, which could result in adverse effects on water quality, fish and fish habitat.

Should open-cut construction be required for buried infrastructure installation, it should occur outside reproductive periods (March 15 to July 15) and work site isolation measures, with appropriate erosion and sedimentation controls, should be implemented to minimize potential for adverse effects. Channel bed and bank restoration should be completed following construction to restore substrates and riparian vegetation.

#### **5.1.3.2 Indirect Effects During Construction**

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. Each of these are discussed in the following sections.

### Erosion and Sedimentation

Erosion and sedimentation from the disturbed work area associated with the proposed development could potentially result in adverse effects to water quality (e.g., increased turbidity) or sedimentation and associated effects on fish (e.g., injury or mortality due to suspended sediments or altered habitat use) or fish habitat (e.g., loss of interstitial spaces in rocky areas, smothering of aquatic vegetation and/or incubating eggs).

It is recommended that the contractor prepare and implement an Erosion and Sedimentation Control (ESC) Plan to minimize the potential for erosion and sedimentation from the construction site. The ESC Plan should be developed based on the guidance provided in the *Erosion and Sediment Control Guideline for Urban Construction* (GGHCA 2006). Basic elements of the plan should include consideration of:

- Construction phasing to minimize the amount of time soils are barren and therefore, more susceptible to erosion;
- Requirements and timing for rehabilitation of disturbed areas;
- Stormwater management strategies during construction;
- Grading and removal of headwater drainage features during periods when the features are dry, to minimize potential for adverse effects on downstream water quality;
- Erosion prevention measures (e.g., hydroseeding, sodding, erosion control matting, tarping of stockpiles);
- Sedimentation control measures (e.g., silt fences); and
- Inspection and performance monitoring requirements and adaptive management considerations.

Implementation of an effective ESC Plan, incorporating both erosion and sediment controls, coupled with regular inspection and performance monitoring and implementation of any remedial actions necessary to ensure effective performance, is anticipated to be largely effective in preventing the movement of eroded soil particles off-site towards fish habitat in Grassy Brook, the Tributary of Lyon's Creek and the Welland River.

However, it is anticipated that some erosion and off-site sedimentation will occur at some point during the construction process. The watercourse buffers will assist in mitigating potential effects on fish and fish habitat. The vegetated buffer will promote retention and infiltration of surface water and filtration (through settling) of suspended sediment eroded from the construction area.

Overall, no negative effects to fish and fish habitat are predicted to occur as a result of erosion and sedimentation during construction, provided an effective ESC Plan, including monitoring and adaptive management, is implemented.

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### Stormwater Management During Construction

Increases in stormwater runoff from the disturbed areas of the construction site or pumping of groundwater from excavations, potentially resulting in higher flows to the watercourses could cause increases in bed and bank erosion with associated potential effects on fish and fish habitat, aside from the obvious potential increase in erosion from the work area.

It is recommended that the contractor consider management of stormwater throughout the construction period as part of the overall ESC Plan, since stormwater flows through disturbed areas are one of the primary causes of erosion and sedimentation from construction sites. Increased volumes of runoff during construction could also potentially result in increases in erosion due to overland flow within the watercourse buffer areas, particularly if stormwater runoff from the construction area is concentrated. To mitigate these potential effects, stormwater management techniques should be implemented prior to construction in order to control surface water runoff. Implementation of an effective stormwater control plan during construction is anticipated to prevent adverse effects on fish and fish habitat.

Pumping of groundwater from excavations may be required, depending upon the depth of the excavation and groundwater level at the time. If pumping is necessary, consideration should be given to the discharge location, and potential impacts on surface water quality and quantity. Mitigation (e.g., sedimentation filter bags) should be provided to ensure that discharge quality criteria are met (e.g., highly turbid water is not discharged to the environment). Pumped water should be discharged at the edge of the setbacks adjacent to watercourses with mitigation (e.g., rip rap pad) to ensure that discharge water does not erode the soils at the immediate discharge location. Implementation of effective mitigation is anticipated to prevent adverse effect on fish and fish habitat.

### Accidental Spills

Accidental spills of potentially hazardous materials (e.g., fuel and oil from heavy equipment), if transported to Grassy Brook or the Tributary of Lyon's Creek, could cause stress or injury to fish and other aquatic biota (e.g., benthic invertebrates).

In order to mitigate the potential for adverse effects on fish and fish habitat due to potential 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). Implementation of an effective spill prevention and response plan is anticipated to be largely effective in preventing adverse effects on fish and fish habitat in Grassy Brook, the Tributary of Lyon's Creek and the Welland River.

### Potential Post-Construction Effects

No direct effects on the aquatic environment are anticipated to occur during the post-construction period, since there would be no requirement for any activity within fish habitat (i.e., below the average annual high water mark of any watercourses providing fish habitat).

However, several potential indirect effects on the aquatic environment may occur during the post-construction period including:

- Changes in flow and water quality due to stormwater management; and
- Effects on water quality associated with runoff from urban areas.

These potential effects and recommended mitigation measures are discussed in the following sections.

### Stormwater Management

The main potential long-term effect on the aquatic environment due to the presence of the proposed development would be potential changes in flows and water quality within Grassy Brook and the Lyon's Creek Tributary due to stormwater management practices. Given that the catchment area of the Welland River that will be affected by the proposed development is very small, and flows in the river are large compared to the other smaller watercourses, no adverse effects of stormwater management are anticipated to occur in the Welland River.

However, the smaller watercourses could be negatively affected in a number of ways, potentially including:

- Increased peak flows resulting in higher rates of bed and bank erosion (with associated effects on fish and fish habitat) and high flow velocities with potential effects on fish movements;
- Higher rates of surface water runoff to watercourses resulting in more rapid increases and decreases in flow and water level (i.e., increased "flashiness") causing adverse effects on fish use of floodplains (e.g., Grass Pickerel or Northern Pike spawning success) and prolonged use of the tributaries for other life cycle purposes; and
- Altered flows and aquatic habitat availability should stormwater discharges be located at different locations in the catchment than current discharge vectors (i.e., stormwater infrastructure diverts flows to ponds located near the downstream end of catchment areas, effectively bypassing the watercourses over much of their length upstream from the pond discharge).

The Stormwater Management Plan (WSP and MMM Group, 2016) outlines the conceptual stormwater management requirements, based on several objectives, including flood control, erosion prevention and quality control. The Plan suggests that wet ponds be constructed within the catchments of Grassy Brook and the Lyon's Creek Tributary to detain 25-mm of rainfall over a 24-hour period in order to provide erosion protection. It also suggests that wet ponds be designed to provide enhanced (Level 1) quality control (80% removal of total suspended solids). Based on the hydraulic modeling completed for the post-construction scenario, no quantity controls were recommended, since the proposed development has little overall effect on 1-100 year flow rates and water levels. The Stormwater Management Plan does recommend that Low Impact Development measures be considered to mimic natural hydrological patterns in the area.

It is recommended that a detailed water balance study be completed during future design stages for the proposed stormwater management system. The goal of the stormwater management system should be to maintain or enhance flows and water levels in Grassy Brook and the Tributary of Lyon's Creek to meet ecological objectives, while ensuring that all other stormwater management criteria are satisfied. Specifically, the plan should ensure that that flow levels and durations in the watercourses are not substantially altered and that existing spring flood levels are maintained or enhanced to promote spawning of species such as Northern Pike and Grass Pickerel within the floodplain. Maintaining the hydroperiod of overbank flows will ensure that these species continue to have access to suitable spawning habitat within the floodplain and that incubating eggs and newly hatched fry are not stranded within the floodplain due to rapidly receding water levels. Additional stormwater management mitigation, over and above that identified within the Stormwater Management Plan (WSP and MMM Group, 2016) may be required to meet these ecological objectives.

Quality control within the wet ponds will assist in ensuring that runoff from the urban area is mitigated with respect to suspended solids prior to discharge, in order to minimize negative effects on receiving waterbodies and associated fish communities and habitat.

Given that Grassy Brook and the Tributary of Lyon's Creek are warmwater watercourses and that flows in these features are intermittent, and typically, not occurring during the hottest portions of the year, thermal mitigation associated with stormwater management is not anticipated to be required.

#### Effects on Water Quality

Some surface water on the Subject Lands will infiltrate through residential lawns and into the shallow groundwater flowing towards Grassy Brook and the Tributary of Lyon's Creek, or will flow directly as overland runoff from residential rear yards into the adjacent watercourses. This runoff or infiltration water could potentially be impaired due to residential use of potential contaminants (e.g., lawn fertilizers) or other residential land use activities (including accidental spills in rear yards). However, the minimum 15 m setback from watercourses, will assist in mitigating potential effects on surface water quality and corresponding effects on fish habitat. It is recommended that riparian planting plans be developed as part of the overall Natural Heritage System design for the development in order to enhance those riparian areas that may currently be lacking in natural vegetation, and hence, riparian function, due to existing agricultural or golf course activities.

#### **5.1.4 Other Predicted Indirect Impacts**

The proposed development in the principally open and already disturbed or golf course areas of the Subject Lands (i.e., golf course greens and ponds, meadows, isolated wetland pockets) 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., terrestrial crayfish habitat, locally uncommon flora, etc.); and
- Matching of tree retention areas at existing grade (i.e., feathered grades from development edges).

### Light and Noise Effects on Wildlife

Light can be a concern where it is directed towards a variety of natural features and functions.

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).

### **5.1.5 Potential for Enhancements and Ecological Benefits**

As discussed in section 4, development within the Subject Lands is proposed primarily within the golf course and disturbed tableland areas. Minor encroachments will occur to woodlands, non-PSW wetlands and open water golf course ponds.

In the case of the Secondary Plan Area there are many opportunities for the enhancement and restoration of natural areas and associated functions within and adjacent to the Subject Lands that will provide an overall net gain in ecological function within the Welland River, Grassy Brook and Lyon’s Creek watersheds.

An Ecological Restoration Plan (**Appendix F**) has been developed for the Subject Lands in consultation with both the NPCA and the City. The Natural Heritage System (NHS) proposed east of Crowland Avenue and ecological restoration works west of Crowland Avenue have been designed to mitigate the impacts of the proposed development and to provide substantial enhancement measures for existing and future natural features and associated functions.

The NHS east of Crowland Avenue includes the following buffers: provincially significant wetlands (30 m), Welland River (30 m and wider in some areas due to frontage by a PSW and associated buffer), Lyon's Creek and Grassy Brook watercourses (15 m; due to overlap with other retained features / buffers average set back from each side of the watercourse is 50 m for Grassy Brook and 40 m for Lyon's Creek), certain retained unevaluated wetlands (15 m), and retained woodlands (10 m). The restoration plan provides greater than 1:1 replacement area for the proposed removal of non-PSW wetlands and woodlands given the proposed development of the Subject Lands.

The NHS and restoration activities will protect and add ecological features and functions (including a diversity of restored vegetation communities and specialized wildlife habitats), improve landscape connectivity and forest / wetland patch size, create interior forest habitat > 100 m from forest edge (in two locations west of Crowland Avenue and in one location east of Crowland Avenue), and improve habitats for species of conservation concern (i.e., Grass Pickerel, Barn Swallow, Eastern Wood-Pewee, Wood Thrush, Green Heron, bats, turtles, open wetland and woodland amphibians, and provincially rare insects).

Measures are also provided to facilitate wildlife movement within the NHS, i.e., enhanced wildlife crossings to guide small and medium-sized animals through culverts beneath roadways; and a wildlife linkage to connect the NHS portions that are separated by Grassy Brook Road.

Cumulatively, the Ecological Restoration Plan provides mitigation for predicted development impacts and strategically amasses upland and wetland vegetation around existing high quality Environmental Protection Areas west of Crowland Avenue. The Plan increases and improves wetland extent and ecological functions, with the establishment of innovative fish spawning habitat within the Grassy Brook and Lyons watercourses west of Crowland Avenue and the result of the proposed Plan is the establishment of an enhanced, robust and interconnected Natural Heritage System.



## 6.0 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 5 and **Appendix F**, the following are the predicted net effects from the proposed development within the Subject Lands.

Predicted Net Effects:

The following are predicted net effect outcomes based upon analyses in this report (**Appendix F**):

- The PSW wetlands will be conserved, with the successful matching of pre and post development water balances;
- Wetland features and functions will be better protected with restored buffers (e.g., reduced overland runoff into wetland features);
- A net increase in woodland cover will be achieved, including an increase in slough forest cover;
- Minor increases in area sensitive, woodland interior habitat;
- Habitat increases for Wood Thrush and Eastern Wood-Pewee west of Subject Lands;
- Potential improvements to valleyland feature and associated functions with the installation of a 30 m buffer;
- Better connected, more resilient and diverse wildlife habitat;
- The restoration and creation of habitat will extend across the Subject Lands (i.e., through expanded riparian areas and better buffered woodland features) through disturbed agricultural habitat to the west;
- No net negative effect on Significant Wildlife Habitat;
- Overall positive effects are expected through the creation of a more contiguous and diverse NHS;
- No net negative effects on fish habitat in Lyon's Creek, Grassy Brook and the Welland River;
- Enhancements to fish habitat will result from improved riparian systems through and upstream of the Subject Lands;
- Increased Grass Pickerel habitat will be established in the riparian systems of Grassy Brook and Lyon's Creek, through habitat improvements and through the installation of specialized, innovative spawning structures;
- No net effects to SAR are predicted to occur given the proposed mitigation measures;
- Overall increase in non-PSW wetland areas and the degree of ecological functions; and
- Increase species diversity in a more robust NHS.

### Monitoring

A monitoring program should be discussed and developed amongst the City and other agencies to ensure that:

- Protective, mitigation strategies and actions are effectively implemented;
- Ecological Restoration measures are effectively implemented; and
- Restored features and associated functions are developing along projected trajectories.

## 7.0 CONCLUSIONS AND RECOMMENDATIONS

This EIS report addresses the natural heritage features and associated functions currently found on, and adjacent to, the Subject Lands, and assesses the potential impacts of the proposed development. Given that specific development plans for the Subject Lands will not be advanced until after the approval of the Secondary Plan, impacts have been assessed on the proposed development limits (**Appendix E**). Once development is further refined and a SWM report has been completed for the Subject Lands, an updated impact assessment can be completed.

The Subject Lands contain PSWs, Habitat of Endangered and Threatened Species, Significant Valleylands, Fish Habitat, areas of Significant Woodland, Significant Wildlife Habitat and the presence of Special Concern species as well as provincially and locally rare flora and fauna.

Generally, direct impacts associated with the proposed development will be limited, given that the proposed development limits provide for the protection of PSW's, woodlands and fish habitat. Development is proposed primarily within existing golf course areas and disturbed cultural areas with minor intrusion and/or removal of localized woodlands, unevaluated wetlands and open water habitat (golf course ponds). Indirect effects are discussed in relation to the potential for:

- Construction related impacts on natural features and edge conditions;
- Changes in wetland conditions associated with catchment alterations;
- Potential impacts on aquatic conditions and fish habitat; and
- Potential impacts on listed species and those considered rare at more regional and local scales.

The proposed Ecological Restoration Plan for the Subject Lands (**Appendix F**) outlines opportunities for the enhancement and restoration of natural areas and associated functions within the Grand Niagara Secondary Plan Area. The potential for development within natural areas and for the enhancement and restoration of natural areas continues to be the focus of dialogue with the City and NPCA to ensure development achieves an overall environmental benefit over time, on a subwatershed scale.

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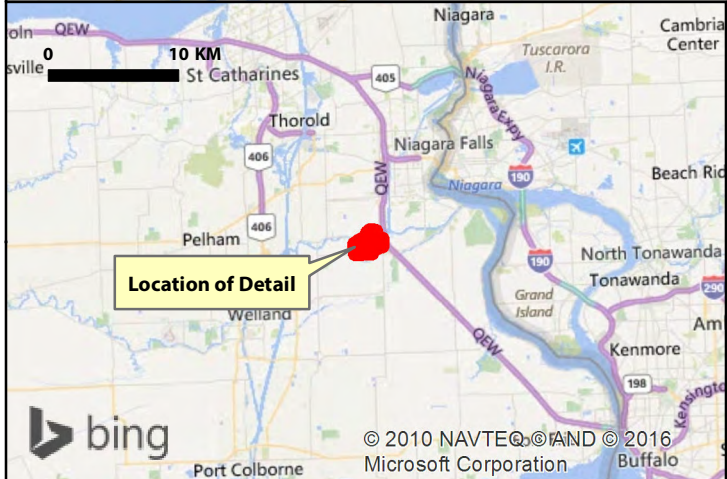
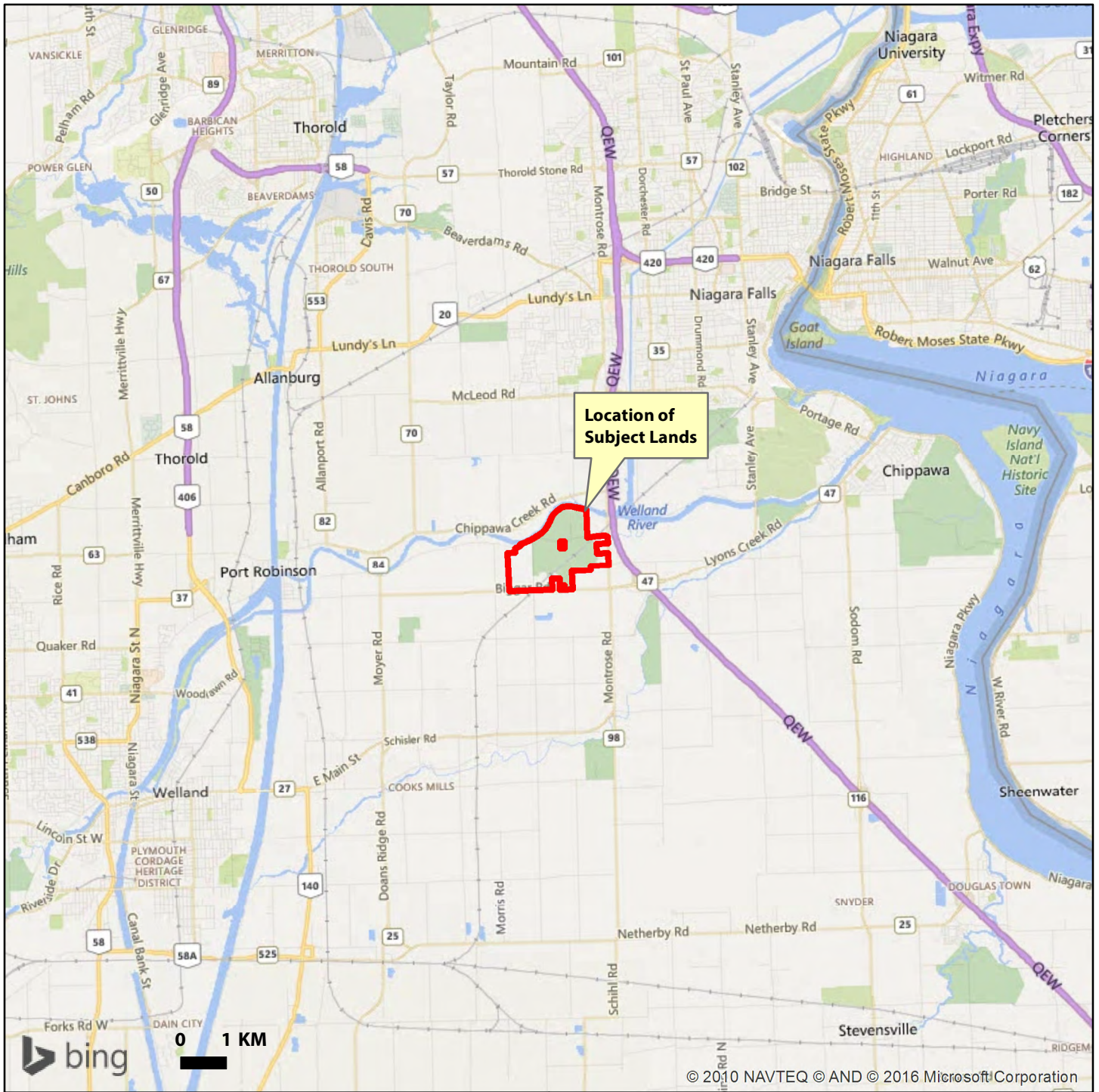
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**APPENDICES**

**Appendix A – 2015 Figures**



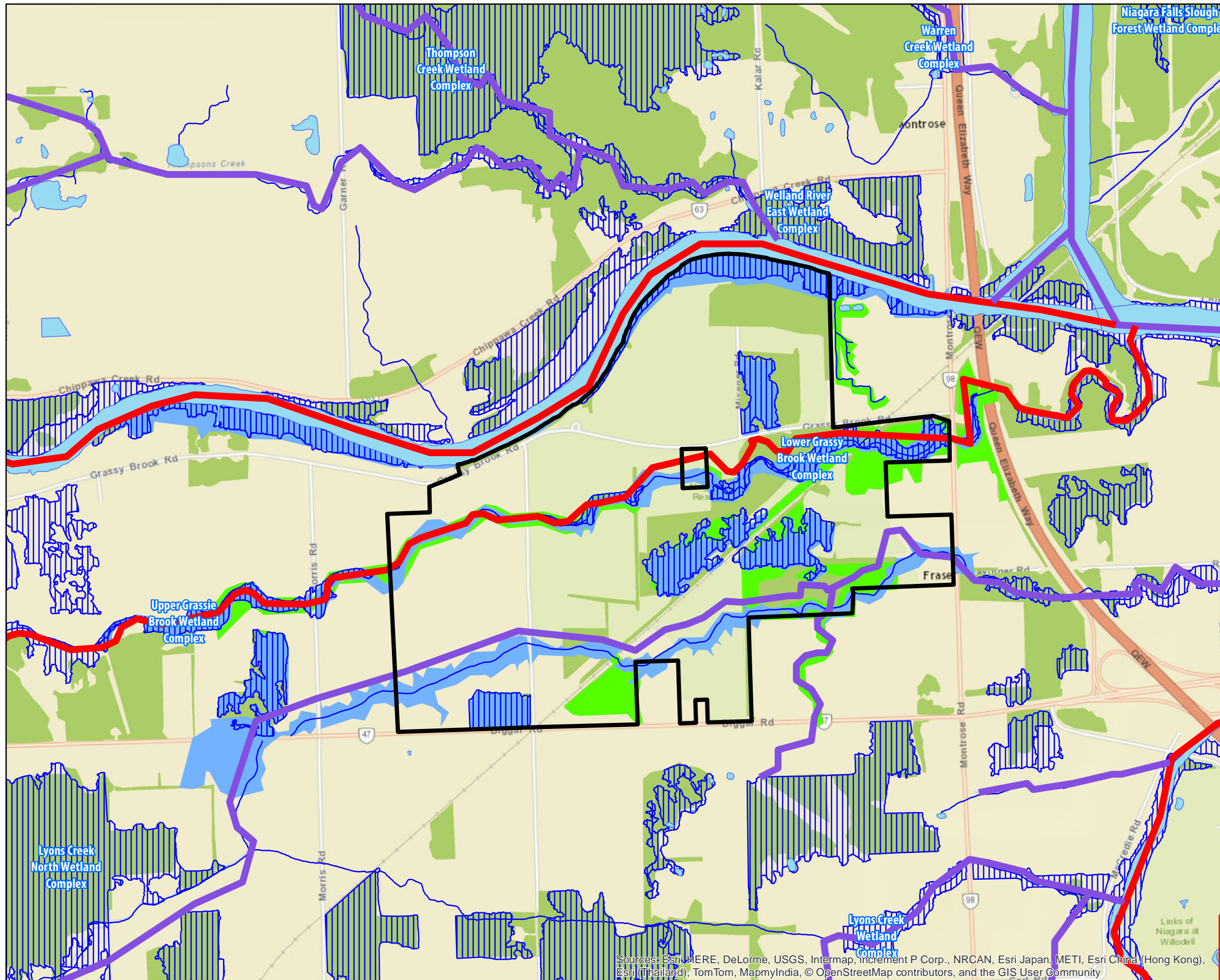
**Grand Niagara**

Figure 1 Location of Subject Lands

 Grand Niagara Holdings







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1:15,000

**Grand Niagara Holdings**

**Fish Habitat (MNRF LIO)**

- TYPE 1
- TYPE 2

**Natural Features (MNRF LIO)**

- ANSI
- Evaluated-Provincially significant wetland
- Watercourse
- Woodland

**Niagara Regional Policy Plan 2015 Sch C**

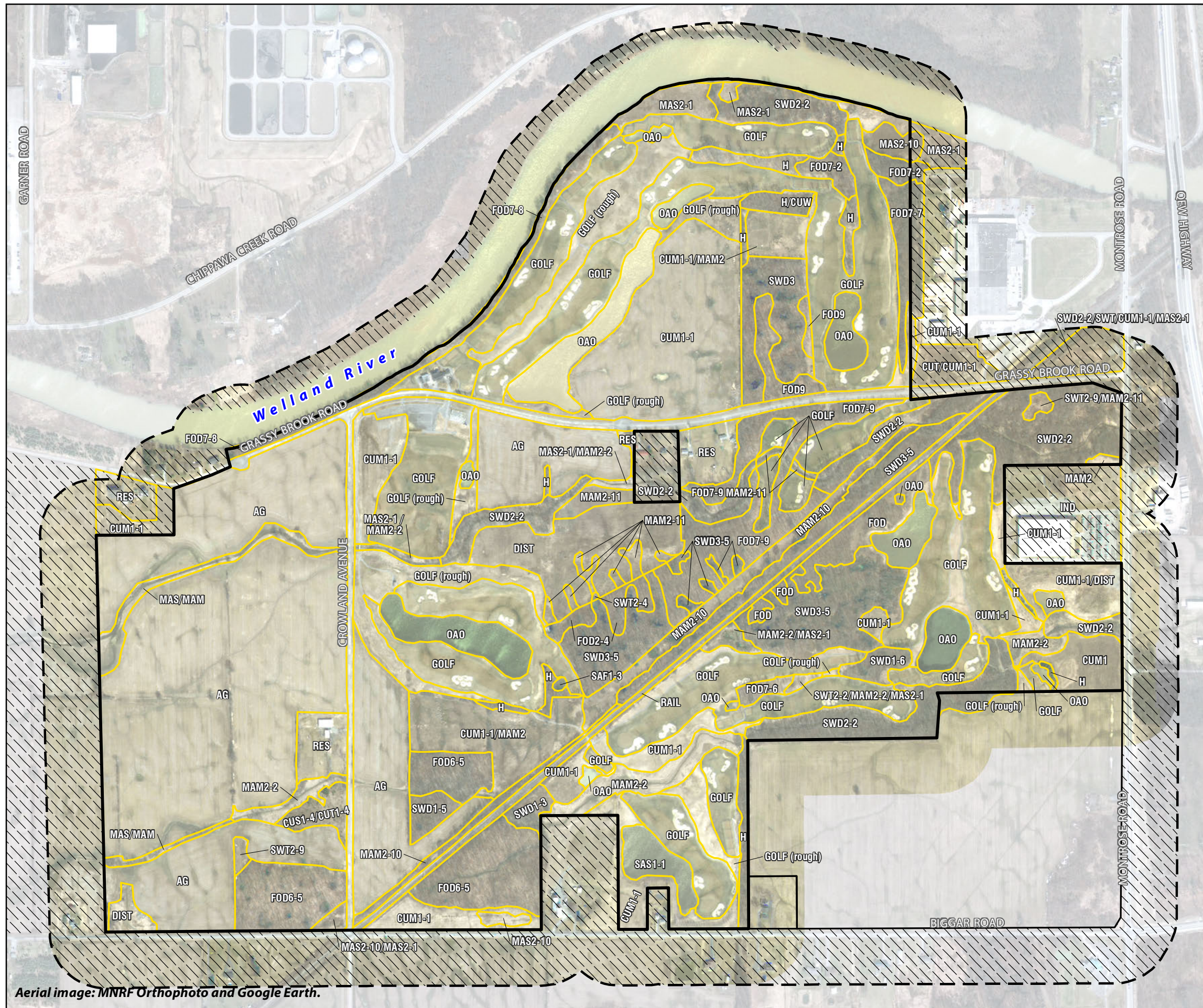
- ECA Amendment 96 Schedule A
- EPA Amendment 96 Schedule A

Grand Niagara  
Figure 2  
Natural Heritage Features -  
Desktop Analysis



Sources: Esri, HERE, DeLorme, USGS, Intermap, Increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community





- Grand Niagara Holdings
- Non-participating land
- 120m adjacent lands
- Ecological Land Classification

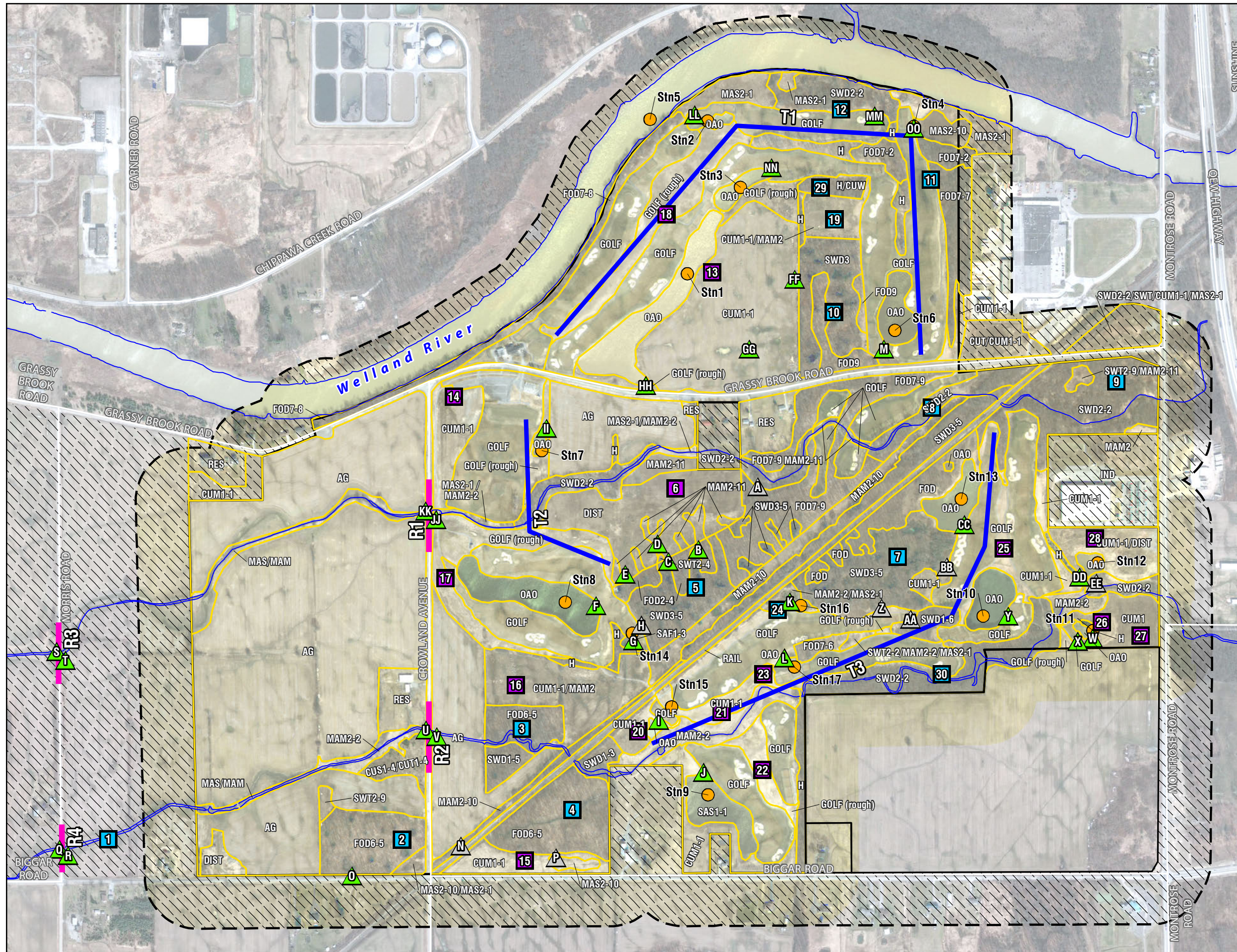
**ELC Legend**

- |               |         |  |              |                      |  |
|---------------|---------|--|--------------|----------------------|--|
| <b>FOREST</b> | FOD     | Deciduous Forest                                       | <b>MARSH</b> | MAM                  | Meadow Marsh                                     |
|               | FOD2-4  | Dry-Fresh Oak-Hardwood Deciduous Forest                |              | MAM2                 | Mineral Meadow Marsh                             |
|               | FOD6-5  | Fresh-Moist Sugar Maple-Hardwood Deciduous Forest      |              | MAM2-2               | Reed-canary Grass Mineral Meadow Marsh           |
|               | FOD7-2  | Fresh-Moist Ash Lowland Deciduous Forest               |              | MAM2-10              | Forb Mineral Meadow Marsh                        |
|               | FOD7-6* | Fresh-Moist Red Maple Lowland Deciduous Forest         |              | MAM2-11*             | Mixed Mineral Meadow Marsh                       |
|               | FOD7-7* | Fresh-Moist Ash-Elm Lowland Deciduous Forest           |              | MAS                  | Shallow Marsh                                    |
|               | FOD7-8* | Fresh-Moist Walnut-Ash-Willow Lowland Deciduous Forest |              | MAS2-1               | Cattail Mineral Shallow Marsh                    |
|               | FOD7-9* | Fresh-Moist Pin Oak-Green Ash Lowland Deciduous Forest |              | MAS2-10*             | Common Reed Mineral Shallow Marsh                |
|               | FOD9    | Fresh-Moist Oak-Maple-Hickory Deciduous Forest         |              | <b>OPEN WATER</b>    |  |
|               |         |  |              | OA0                  | Open Aquatic                                     |
|               |         |  |              | <b>SHALLOW WATER</b> |  |
|               |         |  |              | SAS1-1               | Pondweed Submerged Shallow Aquatic               |
|               |         |  |              | SAF1-3               | Duckweed Floating-leaved Shallow Aquatic         |
|               |         |  |              | <b>CULTURAL</b>      |  |
|               |         |  |              | CUW                  | Cultural Woodland                                |
|               |         |  |              | CUS1-4*              | White Pine Cultural Savanna                      |
|               |         |  |              | CUT                  | Cultural Thicket                                 |
|               |         |  |              | CUT1-4               | Grey Dogwood Cultural Thicket                    |
|               |         |  |              | CUM1-1               | Fresh-Moist Old Field Meadow                     |
|               |         |  |              |                      | <i>*not listed in Southern Ontario ELC Guide</i> |
|               |         |  |              | RES                  | Residence  |
|               |         |  |              | H                    | Hedgerow   |
| <b>SWAMP</b>  | SWD1-3  | Pin Oak Mineral Deciduous Swamp                        |              |                      |  |
|               | SWD1-5* | Green Ash-Pin Oak Mineral Deciduous Swamp              |              |                      |  |
|               | SWD1-6* | Pin Oak-Ash-Maple Mineral Deciduous Swamp              |              |                      |  |
|               | SWD2-2  | Green Ash Mineral Deciduous Swamp                      |              |                      |  |
|               | SWD3    | Maple Mineral Deciduous Swamp                          |              |                      |  |
|               | SWD3-5* | Maple Mineral Deciduous Swamp                          |              |                      |  |
|               | SWT     | Thicket Swamp  |              |                      |  |
|               | SWT2-2  | Willow Mineral Thicket Swamp                           |              |                      |  |
|               | SWT2-4  | Buttonbush Mineral Thicket Swamp                       |              |                      |  |
|               | SWT2-9  | Grey Dogwood Mineral Thicket Swamp                     |              |                      |  |

Grand Niagara  
Figure 3  
Vegetation Communities

Aerial image: MNR Orthophoto and Google Earth.





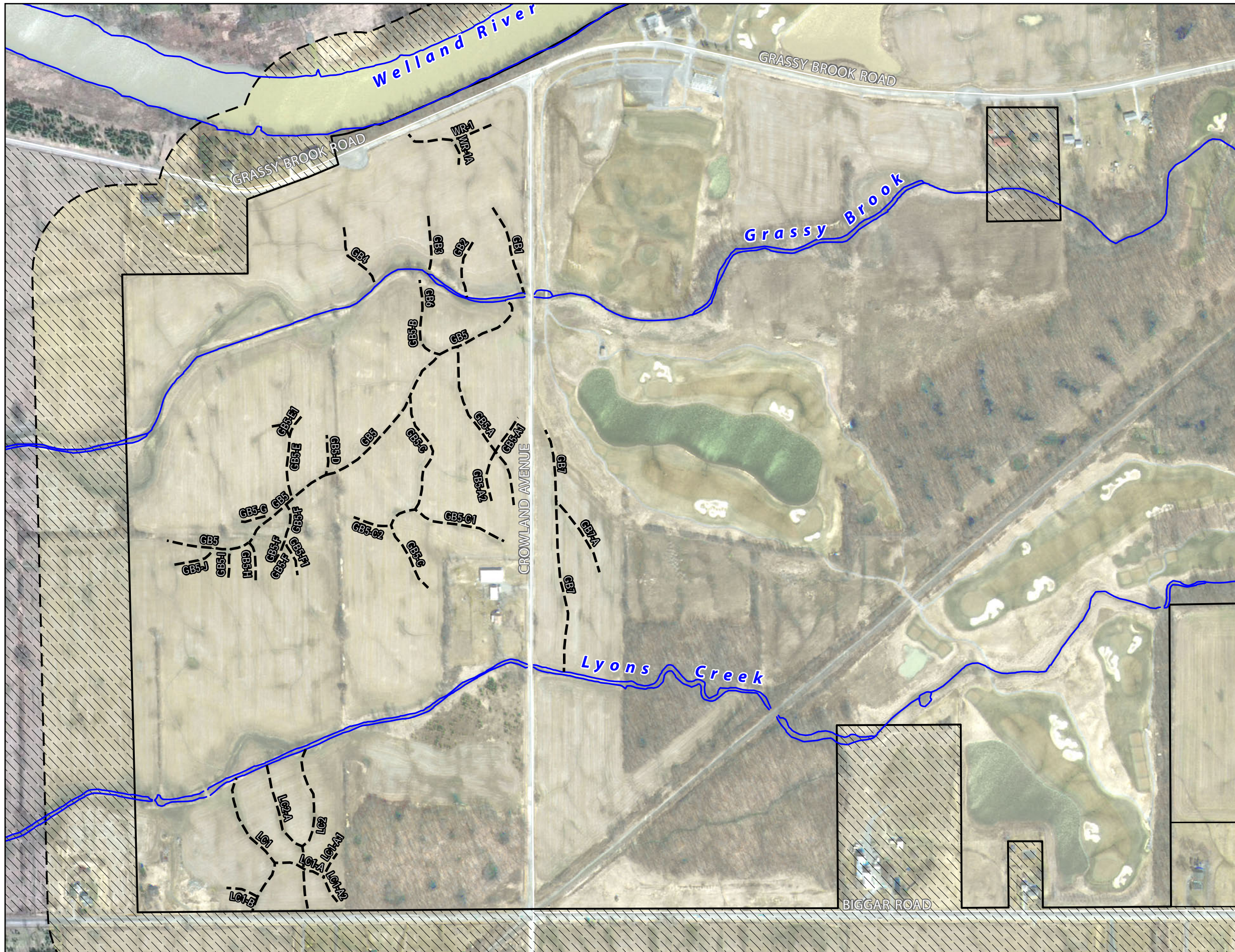
- 0 200 Meters
- N
- Grand Niagara Holdings
- Non-participating lands
- 120m Adjacent Lands
- Ecological Land Classification
- Amphibian call station location
- No amphibian breeding habitat present as of May 2015
- Breeding bird survey point count station (2015)
- Grassland Species at Risk bird point count station (2015)
- Turtle basking station
- Wildlife road crossing transect
- Reptile survey transect

Aerial image: MNR Orthophoto and Google Earth.

Grand Niagara  
 Figure 4  
 Wildlife Monitoring  
 Station Locations







0 200 Meters

N

- Grand Niagara Holdings
- Non-participating lands
- 120m Adjacent Lands

**Headwater Drainage**

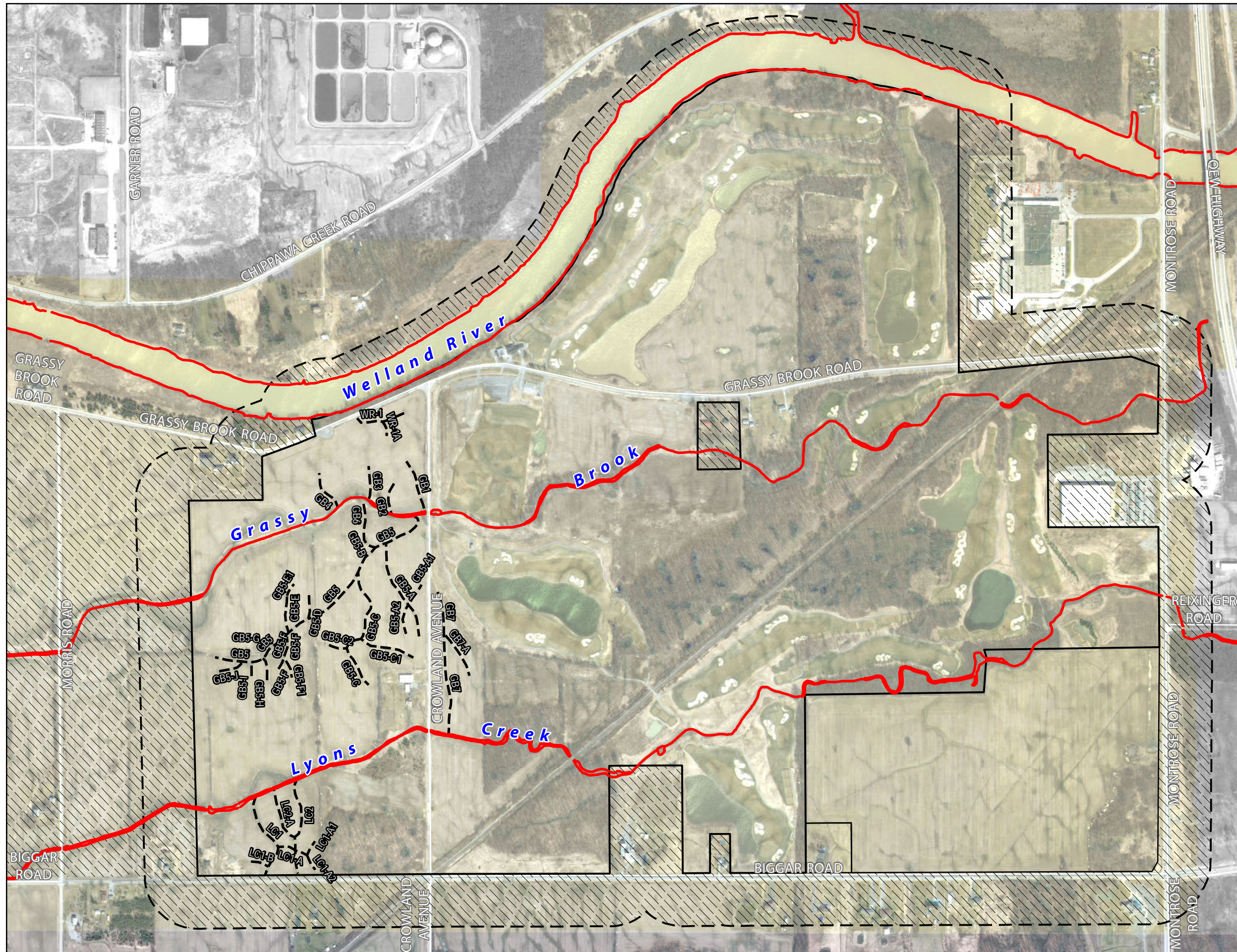
- No management required
- Headwater Drainage Feature Assessment Guidelines Management Recommendations (TRCA/CVC)*
- Watercourse (MNRF LIO)

Orthophoto: Google Earth. Image date spring 2010.

Grand Niagara  
 Figure 5  
 Headwater Drainage  
 Features







0 200 Meters

N

- Grand Niagara Holdings
- Non-participating lands
- 120m Adjacent Lands

Headwater Drainage

- No management required

*Headwater Drainage Feature Assessment Guidelines Management Recommendations (TRCA/CVC)*

Fish Habitat

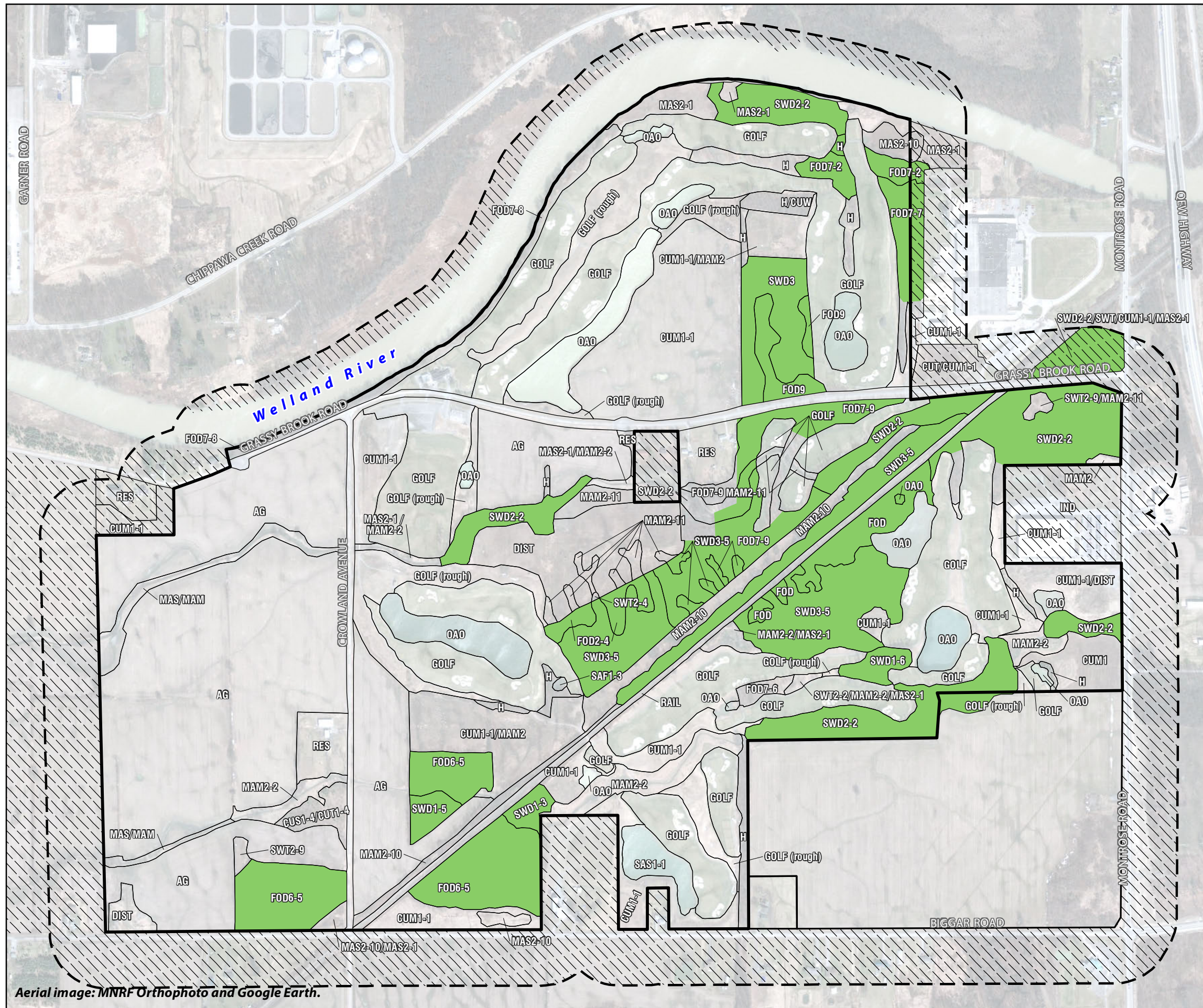
- Type 1 - Critical Fish Habitat

Orthophoto: Google Earth. Image date spring 2010.

Grand Niagara  
 Figure 6  
 Existing Fish Habitat







- Grand Niagara Holdings
- Non-participating land
- 120m adjacent lands
- Ecological Land Classification
- Significant woodlands

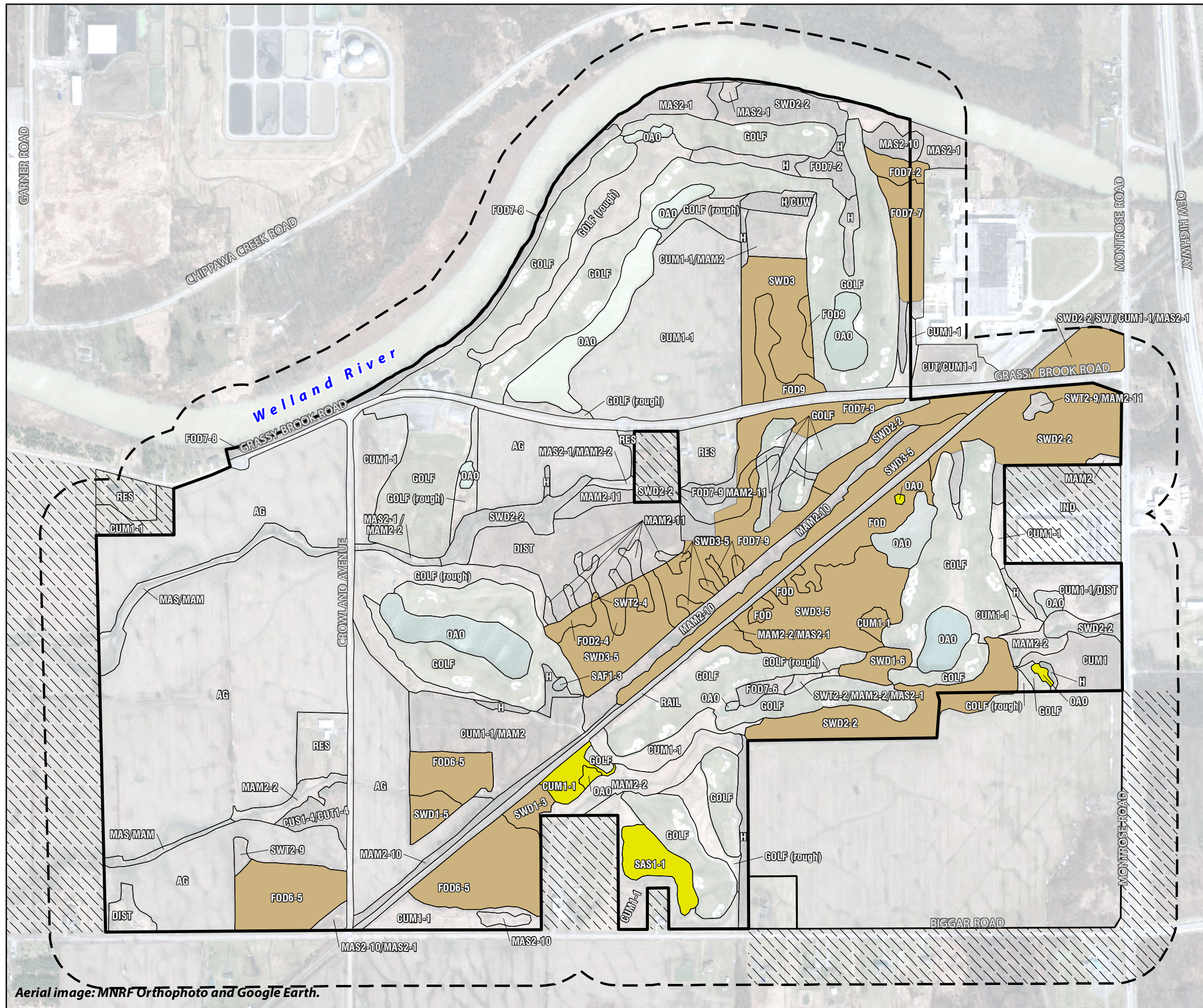
**ELC Legend**

- |               |         |  |                      |          |  |
|---------------|---------|--|----------------------|----------|--|
| <b>FOREST</b> | FOD     | Deciduous Forest                                       | <b>MARSH</b>         | MAM      | Meadow Marsh                                     |
|               | FOD2-4  | Dry-Fresh Oak-Hardwood Deciduous Forest                |                      | MAM2     | Mineral Meadow Marsh                             |
|               | FOD6-5  | Fresh-Moist Sugar Maple-Hardwood Deciduous Forest      |                      | MAM2-2   | Reed-canary Grass Mineral Meadow Marsh           |
|               | FOD7-2  | Fresh-Moist Ash Lowland Deciduous Forest               |                      | MAM2-10  | Forb Mineral Meadow Marsh                        |
|               | FOD7-6* | Fresh-Moist Red Maple Lowland Deciduous Forest         |                      | MAM2-11* | Mixed Mineral Meadow Marsh                       |
|               | FOD7-7* | Fresh-Moist Ash-Elm Lowland Deciduous Forest           |                      | MAS      | Shallow Marsh                                    |
|               | FOD7-8* | Fresh-Moist Walnut-Ash-Willow Lowland Deciduous Forest |                      | MAS2-1   | Cattail Mineral Shallow Marsh                    |
|               | FOD7-9* | Fresh-Moist Pin Oak-Green Ash Lowland Deciduous Forest |                      | MAS2-10* | Common Reed Mineral Shallow Marsh                |
|               | FOD9    | Fresh-Moist Oak-Maple-Hickory Deciduous Forest         | <b>OPEN WATER</b>    |          |  |
|               |         |  |                      | OA0      | Open Aquatic                                     |
|               |         |  | <b>SHALLOW WATER</b> |          |  |
|               |         |  |                      | SAS1-1   | Pondweed Submerged Shallow Aquatic               |
|               |         |  |                      | SAF1-3   | Duckweed Floating-leaved Shallow Aquatic         |
|               |         |  | <b>CULTURAL</b>      |          |  |
|               |         |  |                      | CUW      | Cultural Woodland                                |
|               |         |  |                      | CUS1-4*  | White Pine Cultural Savanna                      |
|               |         |  |                      | CUT      | Cultural Thicket                                 |
|               |         |  |                      | CUT1-4   | Grey Dogwood Cultural Thicket                    |
|               |         |  |                      | CUM1-1   | Fresh-Moist Old Field Meadow                     |
|               |         |  |                      |          | <i>*not listed in Southern Ontario ELC Guide</i> |
|               |         |  |                      | RES      | Residence  |
|               |         |  |                      | H        | Hedgerow   |
| <b>SWAMP</b>  |         |  |                      |          |  |
|               | SWD1-3  | Pin Oak Mineral Deciduous Swamp                        |                      |          |  |
|               | SWD1-5* | Green Ash-Pin Oak Mineral Deciduous Swamp              |                      |          |  |
|               | SWD1-6* | Pin Oak-Ash-Maple Mineral Deciduous Swamp              |                      |          |  |
|               | SWD2-2  | Green Ash Mineral Deciduous Swamp                      |                      |          |  |
|               | SWD3    | Maple Mineral Deciduous Swamp                          |                      |          |  |
|               | SWD3-5* | Maple Mineral Deciduous Swamp                          |                      |          |  |
|               | SWT     | Thicket Swamp  |                      |          |  |
|               | SWT2-2  | Willow Mineral Thicket Swamp                           |                      |          |  |
|               | SWT2-4  | Buttonbush Mineral Thicket Swamp                       |                      |          |  |
|               | SWT2-9  | Grey Dogwood Mineral Thicket Swamp                     |                      |          |  |

Grand Niagara  
Figure 7  
Woodland Assessment

Aerial image: MNR Orthophoto and Google Earth.





- Grand Niagara Holdings
- Non-participating Land
- 120m Adjacent Lands
- Ecological Land Classification
- Significant Wildlife Habitat
- Significant wildlife habitat in created anthropogenic features

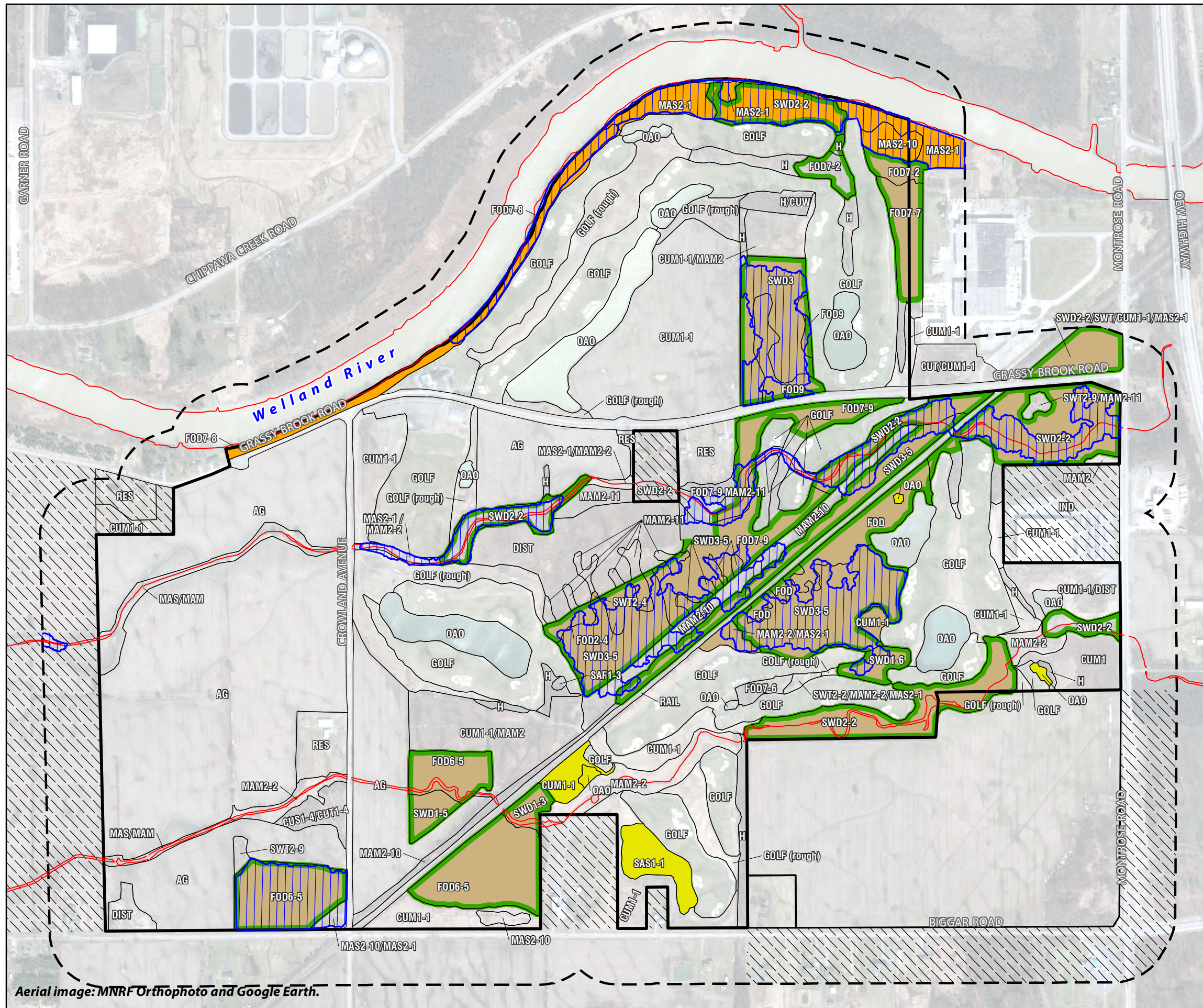
**ELC Legend**

- |               |              |  |              |                      |  |
|---------------|--------------|--|--------------|----------------------|--|
| <b>FOREST</b> | FOD          | Deciduous Forest                                       | <b>MARSH</b> | MAM                  | Meadow Marsh                                     |
|               | FOD2-4       | Dry-Fresh Oak-Hardwood Deciduous Forest                |              | MAM2                 | Mineral Meadow Marsh                             |
|               | FOD6-5       | Fresh-Moist Sugar Maple-Hardwood Deciduous Forest      |              | MAM2-2               | Reed-canary Grass Mineral Meadow Marsh           |
|               | FOD7-2       | Fresh-Moist Ash Lowland Deciduous Forest               |              | MAM2-10              | Forb Mineral Meadow Marsh                        |
|               | FOD7-2*      | Fresh-Moist Red Maple Lowland Deciduous Forest         |              | MAM2-11*             | Mixed Mineral Meadow Marsh                       |
|               | FOD7-3*      | Fresh-Moist Ash-Elm Lowland Deciduous Forest           |              | MAS                  | Shallow Marsh                                    |
|               | FOD7-4*      | Fresh-Moist Pin Oak-Green Ash Lowland Deciduous Forest |              | MAS2-1               | Cattail Mineral Shallow Marsh                    |
|               | FOD7-5*      | Fresh-Moist Walnut-Ash-Willow Lowland Deciduous Forest |              | MAS2-10*             | Common Reed Mineral Shallow Marsh                |
|               | FOD7-6*      | Fresh-Moist Pin Oak-Green Ash Lowland Deciduous Forest |              | <b>OPEN WATER</b>    |  |
|               | FOD9         | Fresh-Moist Oak-Maple-Hickory Deciduous Forest         |              | OA0                  | Open Aquatic                                     |
|               | <b>SWAMP</b> |  |              | <b>SHALLOW WATER</b> |  |
|               | SWD1-3       | Pin Oak Mineral Deciduous Swamp                        |              | SAS1-1               | Pondweed Submerged Shallow Aquatic               |
|               | SWD1-5*      | Green Ash-Pin Oak Mineral Deciduous Swamp              |              | SAF1-3               | Duckweed Floating-leaved Shallow Aquatic         |
|               | SWD1-6*      | Pin Oak-Ash-Maple Mineral Deciduous Swamp              |              | <b>CULTURAL</b>      |  |
|               | SWD2-2       | Green Ash Mineral Deciduous Swamp                      |              | CUW                  | Cultural Woodland                                |
|               | SWD3         | Maple Mineral Deciduous Swamp                          |              | CUS1-4*              | White Pine Cultural Savanna                      |
|               | SWD3-5*      | Maple Mineral Deciduous Swamp                          |              | CUT                  | Cultural Thicket                                 |
|               | SWT          | Thicket Swamp  |              | CUT1-4               | Grey Dogwood Cultural Thicket                    |
|               | SWT2-2       | Willow Mineral Thicket Swamp                           |              | CUM1-1               | Fresh-Moist Old Field Meadow                     |
|               | SWT2-4       | Buttonbush Mineral Thicket Swamp                       |              |                      | <i>*not listed in Southern Ontario ELC Guide</i> |
|               | SWT2-9       | Grey Dogwood Mineral Thicket Swamp                     |              | RES                  | Residence  |
|               |              |  |              | H                    | Hedgerow   |

Grand Niagara  
Figure 8  
Significant Wildlife Habitat

Aerial image: MNR Orthophoto and Google Earth.





- Grand Niagara Holdings
- Non-participating Land
- 120m Adjacent Lands
- Ecological Land Classification
- Critical Fish Habitat Type 1
- Provincially Significant Wetland
- Significant Woodlands
- Significant Valleyland
- Significant wildlife habitat
- Significant wildlife habitat in created anthropogenic features

**ELC Legend**

<b>FOREST</b>	FOD	Deciduous Forest	<b>MARSH</b>	MAM	Meadow Marsh
	FOD2-4	Dry-Fresh Oak-Hardwood Deciduous Forest		MAM2	Mineral Meadow Marsh
	FOD6-5	Fresh-Moist Sugar Maple-Hardwood Deciduous Forest		MAM2-2	Reed-canary Grass Mineral Meadow Marsh
	FOD7-2	Fresh-Moist Ash Lowland Deciduous Forest		MAM2-10	Forb Mineral Meadow Marsh
	FOD7-6*	Fresh-Moist Red Maple Lowland Deciduous Forest		MAM2-11*	Mixed Mineral Meadow Marsh
	FOD7-7*	Fresh-Moist Ash-Elm Lowland Deciduous Forest		MAS	Shallow Marsh
	FOD7-8*	Fresh-Moist Walnut-Ash-Willow Lowland Deciduous Forest		MAS2-1	Cattail Mineral Shallow Marsh
	FOD7-9*	Fresh-Moist Pin Oak-Green Ash Lowland Deciduous Forest		MAS2-10*	Common Reed Mineral Shallow Marsh
	FOD9	Fresh-Moist Oak-Maple-Hickory Deciduous Forest	<b>OPEN WATER</b>		
<b>SWAMP</b>	SWD1-3	Pin Oak Mineral Deciduous Swamp	OAO	Open Aquatic	
	SWD1-5*	Green Ash-Pin Oak Mineral Deciduous Swamp	<b>SHALLOW WATER</b>		
	SWD1-6*	Pin Oak-Ash-Maple Mineral Deciduous Swamp	SAS1-1	Pondweed Submerged Shallow Aquatic	
	SWD2-2	Green Ash Mineral Deciduous Swamp	SAF1-3	Duckweed Floating-leaved Shallow Aquatic	
	SWD3	Maple Mineral Deciduous Swamp	<b>CULTURAL</b>		
	SWD3-5*	Maple Mineral Deciduous Swamp	CUW	Cultural Woodland	
	SWT	Thicket Swamp	CUS1-4*	White Pine Cultural Savanna Cultural Thicket	
	SWT2-2	Willow Mineral Thicket Swamp	CUT	Cultural Thicket	
	SWT2-4	Buttonbush Mineral Thicket Swamp	CUT1-4	Grey Dogwood Cultural Thicket	
	SWT2-9	Grey Dogwood Mineral Thicket Swamp	CUM1-1	Fresh-Moist Old Field Meadow	

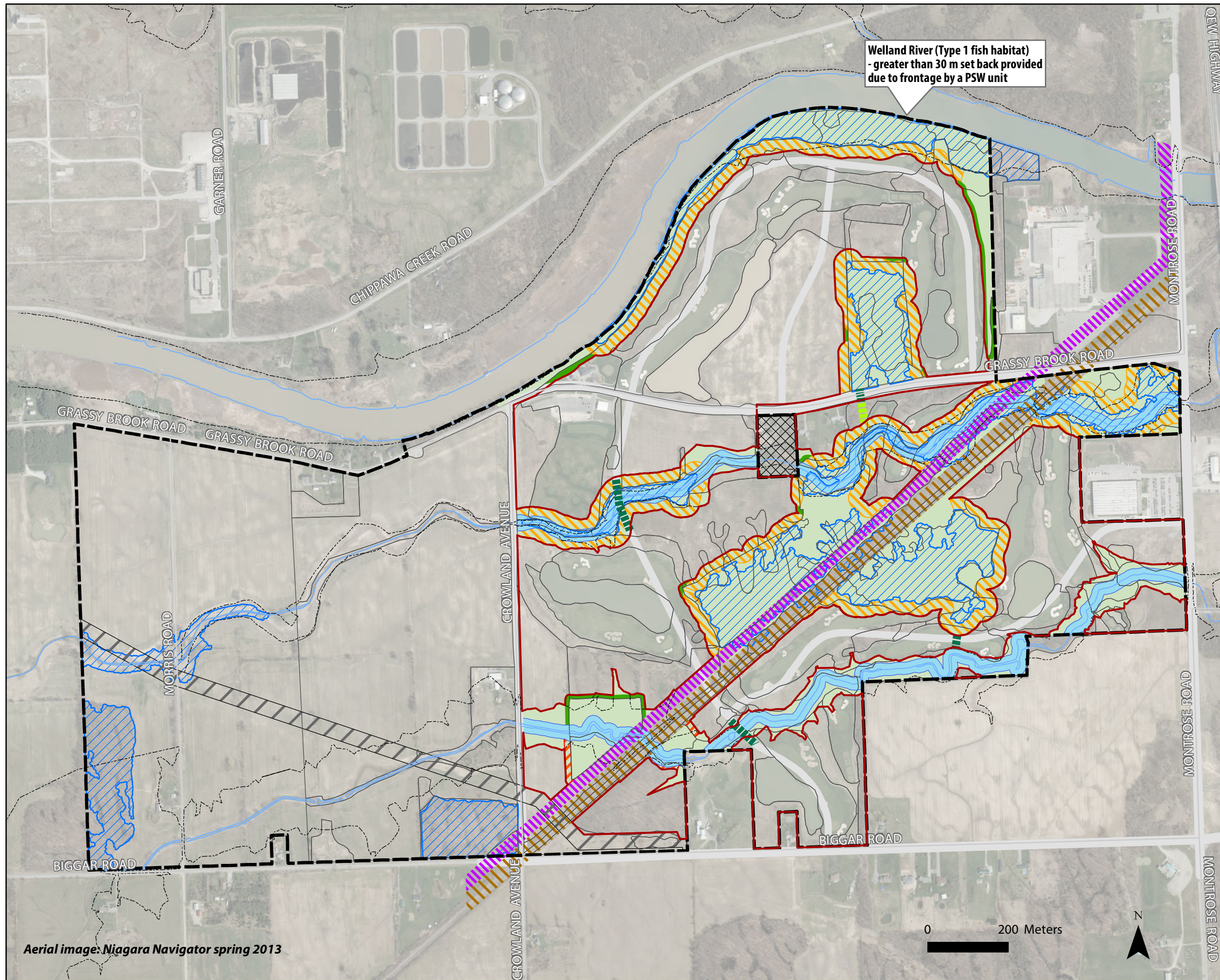
*\*not listed in Southern Ontario ELC Guide*

RES Residence  
H Hedgerow

Grand Niagara  
Figure 9  
Analysis of Natural Heritage Significance

Aerial image: MNR Orthophoto and Google Earth.





Welland River (Type 1 fish habitat)  
 - greater than 30 m set back provided  
 due to frontage by a PSW unit

- Study Area
  - Non-participating Land
  - Ecological Land Classification
  - Pipeline Easement
  - Rail Line
  - Utility Corridor
  - 100 Year Floodline
- Preliminary Natural Heritage System**
- Preliminary NHS Limit (includes greater of wetland, watercourse and woodland buffers and 100 year floodline)
  - Preliminary Natural Heritage System
  - Watercourse 15m Buffer
  - Provincially Significant Wetland
  - 15m Unevaluated Wetland Buffer
  - 30m Provincially Significant Wetland Buffer
  - 10m Woodland Buffer
  - Conceptual Wildlife Linkage
  - Conceptual Enhanced Wildlife Crossing

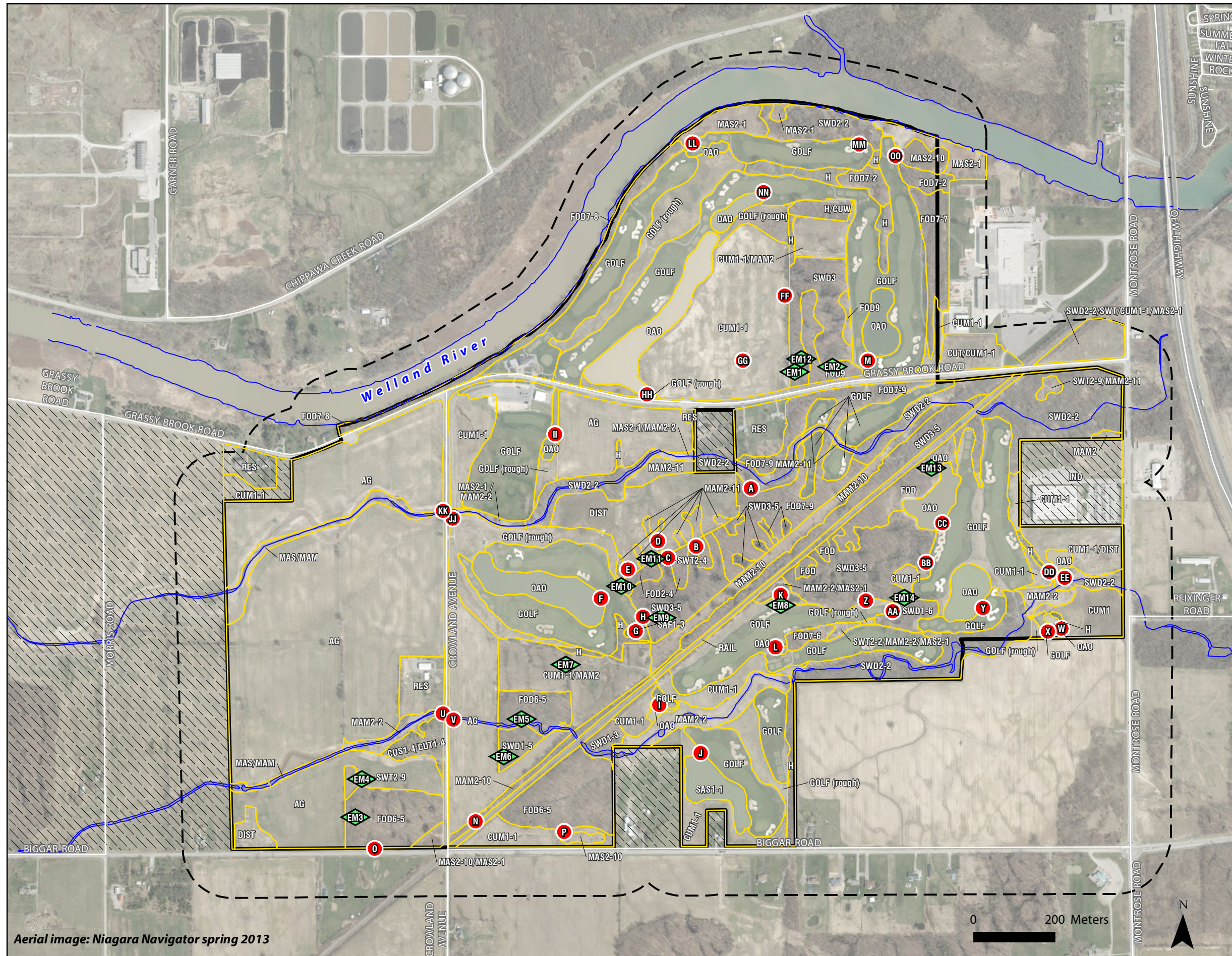
Grand Niagara  
 Figure 10  
 Preliminary Natural  
 Heritage System

Aerial image: Niagara Navigator spring 2013



**Appendix B – 2016 Figures**





- Grand Niagara Holdings
- Non-participating Land
- Subject land 120m buffer
- Ecological Land Classification
- Amphibian Egg Mass Survey Station
- Amphibian Call Count Station (2015)

Grand Niagara

Figure 1  
2016 Calling Amphibian  
Stations

Aerial image: Niagara Navigator spring 2013

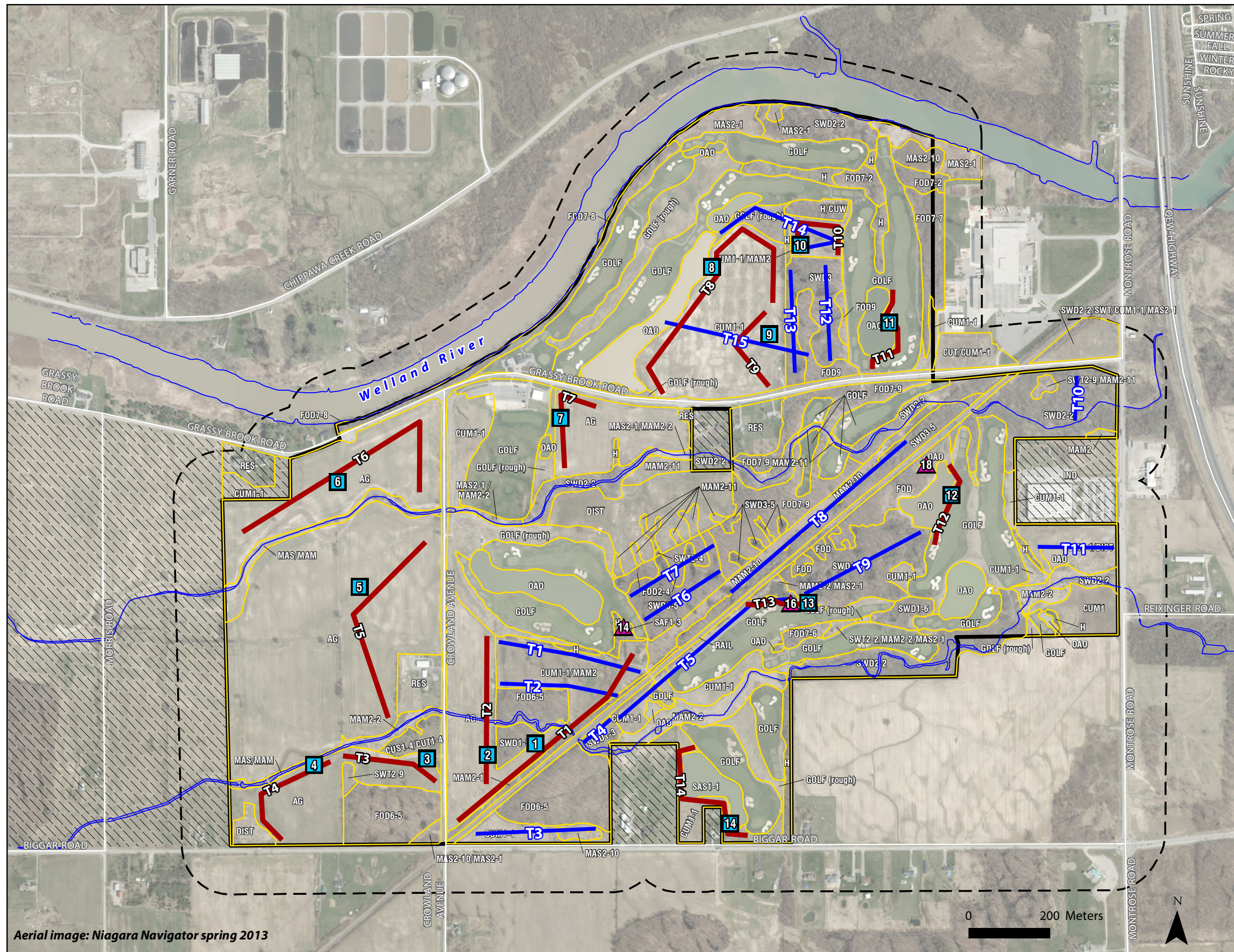
0 200 Meters











- Grand Niagara Holdings
- Non-participating Land
- Subject land 120m buffer
- Ecological Land Classification
- Turtle Basking Station
- Turtle Nesting Soil Sample Station
- Snake Transect
- Turtle Nesting Transect

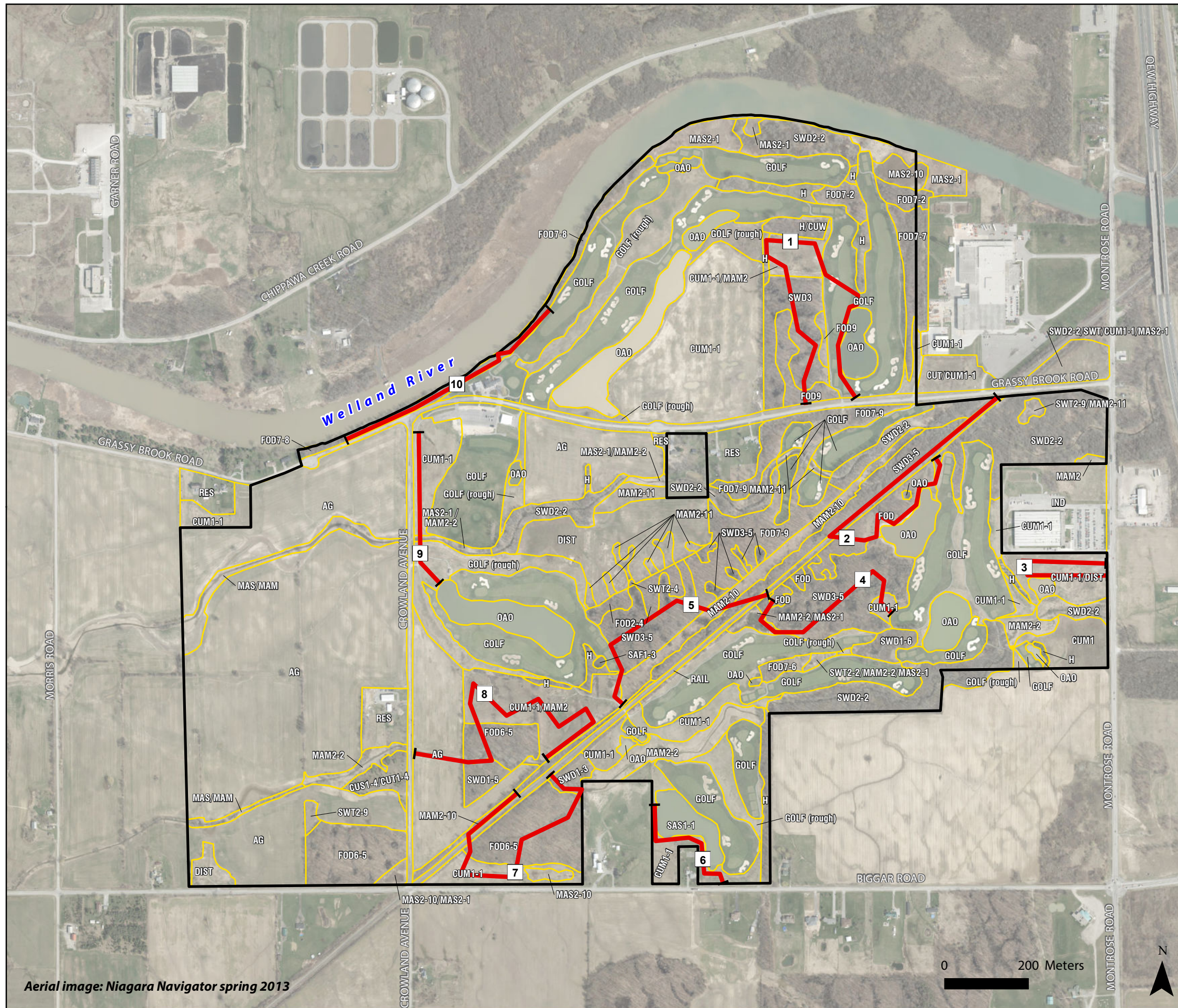
Grand Niagara




Figure 3  
2016 Reptile Survey  
Stations and Transects



Aerial image: Niagara Navigator spring 2013





-  Grand Niagara Holdings
-  Ecological Land Classification
-  Insect Area Search Location

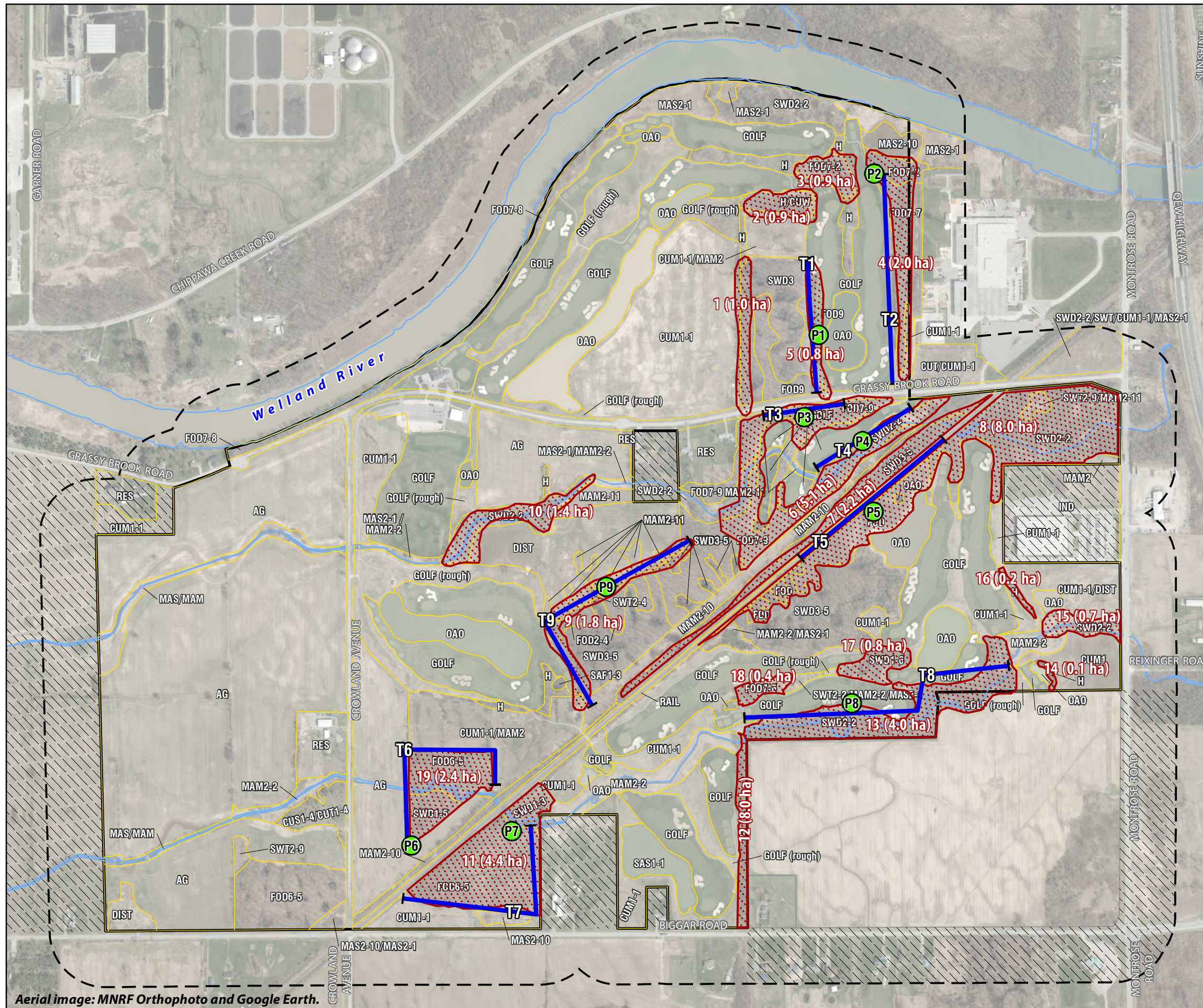
Grand Niagara

Figure 4  
2016 Insect Area Searches










Aerial image: Niagara Navigator spring 2013





**ELC Legend**

<b>FOREST</b>		<b>MARSH</b>	
FOD	Deciduous Forest	MAM	Meadow Marsh
FOD2-4	Dry-Fresh Oak-Hardwood Deciduous Forest	MAM2	Mineral Meadow Marsh
FOD6-5	Fresh-Moist Sugar Maple-Hardwood Deciduous Forest	MAM2-2	Reed-canary Grass Mineral Meadow Marsh
FOD7-2	Fresh-Moist Ash Lowland Deciduous Forest	MAM2-10	Forb Mineral Meadow Marsh
FOD7-6*	Fresh-Moist Red Maple Lowland Deciduous Forest	MAM2-11*	Mixed Mineral Meadow Marsh
FOD7-7*	Fresh-Moist Ash-Elm Lowland Deciduous Forest	MAS	Shallow Marsh
FOD7-8*	Fresh-Moist Walnut-Ash-Willow Lowland Deciduous Forest	MAS2-1	Cattail Mineral Shallow Marsh
FOD7-9*	Fresh-Moist Pin Oak-Green Ash Lowland Deciduous Forest	MAS2-10*	Common Reed Mineral Shallow Marsh
FOD9	Fresh-Moist Oak-Maple-Hickory Deciduous Forest	<b>OPEN WATER</b>	
		OA0	Open Aquatic
<b>SWAMP</b>		<b>SHALLOW WATER</b>	
SWD1-3	Pin Oak Mineral Deciduous Swamp	SAS1-1	Pondweed Submerged Shallow Aquatic
SWD1-5*	Green Ash-Pin Oak Mineral Deciduous Swamp	SAF1-3	Duckweed Floating-leaved Shallow Aquatic
SWD1-6*	Pin Oak-Ash-Maple Mineral Deciduous Swamp	<b>CULTURAL</b>	
SWD2-2	Green Ash Mineral Deciduous Swamp	CUW	Cultural Woodland
SWD3	Maple Mineral Deciduous Swamp	CUS1-4*	White Pine Cultural Savanna
SWD3-5*	Maple Mineral Deciduous Swamp	CUT	Cultural Thicket
SWT	Thicket Swamp	CUT1-4	Grey Dogwood Cultural Thicket
SWT2-2	Willow Mineral Thicket Swamp	CUM1-1	Fresh-Moist Old Field Meadow
SWT2-4	Buttonbush Mineral Thicket Swamp		<i>*not listed in Southern Ontario ELC Guide</i>
SWT2-9	Grey Dogwood Mineral Thicket Swamp	RES	Residence
		H	Hedgerow

-  Grand Niagara Holdings
-  Non-participating land
-  120m adjacent lands
-  Ecological Land Classification
-  Watercourse
-  Acoustic Survey Station
-  Acoustic Survey Transect
-  Habitat Assessment Locations

Grand Niagara  
Figure 5  
2016 Bat Habitat Assessment and Acoustic Survey Results

Aerial image: MNR Orthophoto and Google Earth.



## **Appendix C – Detailed Technical Survey Methods**

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## APPENDIX C: DETAILED TECHNICAL SURVEY METHODOLOGIES

### 1. Vegetation

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 et 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). Regional rarity of vegetation communities was based on the Niagara Natural Areas Inventory (NPCA 2010). Regional rarity of plants was based on Oldham (2010).

The provincial status of all plant species and vegetation communities is based on NHIC (2016) and NHIC (2013), respectively. 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.

### 2. Breeding Bird and Species at Risk Bird Surveys

Two rounds of breeding bird 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). Survey dates and conditions are provided in Table 2 (**Appendix B**). Access was not available to conduct a 2015 first round breeding bird survey.

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 survey 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 the potential presence of Species at Risk habitat. If suitable habitat was encountered or individuals were observed standard protocols were utilized (in consultation with MNR).

If present, 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 250 m wide or long, two-point count stations were completed (point count stations are set up every 250 m in large habitats). Transects or area searches were also conducted in addition to the 10-minute point count stations.



Both the Natural Heritage Information Centre (NHIC 2016) database and the Species at Risk in Ontario (SARO) list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each bird species.

### 3. Crepuscular and Nocturnal Bird Surveys

Station locations were determined using aerial photography habitat interpretation or Ecological Land Classification habitat assessment.

Survey methods are adapted from the second Ontario Breeding Bird Atlas (Cadman et al. 2007) and Takats et al. (2001). Following the Ontario Nocturnal Owl Survey, the surveys for various owl species including, but not limited to, Eastern Screech Owl (*Megascops asio*), Barred Owl (*Strix varia*), and Northern Saw-whet Owl (*Aegolius acadicus*) are to be completed on an evening between March 1 and April 30, ideally during the first quarter to full lunar phase (Takats et al. 2001) in southern Ontario.

Due to the southern latitude of the Subject Lands within Ontario, many of the species targeted by Ontario Nocturnal Owl Survey are not typically present in Niagara Region. The high human population density combined with low forest cover is suitable typically for only Eastern Screech Owl and Great Horned Owl (*Bubo virginianus*) (Cadman et al. 2007). Both species remain quite vocal and responsive to playback through the month of May when breeding is well underway.

Stations were situated in suitable habitat, separated by a distance of at least 1.6 km. The owl survey commenced no sooner than 30 minutes after sunset on calm, clear evenings. Each station was surveyed using the following process: the survey began with a two-minute silent period to listen for calls. Callback tapes of Eastern Screech Owl, Northern Saw-whet Owl and Barred Owl were then played. Data recorded included: species, start and end time, weather conditions and distance of calling individuals from each station.

Marsh bird monitoring surveys occur during dusk (four hours before sunset and completed before onset of darkness) or dawn (30 minutes before sunrise until 10 am) with warm, calm and dry conditions. Survey methods were adapted from the Marsh Monitoring Program marsh bird survey protocol (Jones 2016). Stations were placed at the edge of open wetlands at least 250 m apart. A 15-minute survey was conducted at each station. The survey began with a five-minute silent listening (passive) period, followed by a five-minute call broadcast period to elicit calls of Virginia Rail (*Rallus limicola*), Sora (*Porzana carolina*), Least Bittern (*Ixobrychus exilis*), Common Moorhen (*Gallinula galeata*), American Coot (*Fulica americana*) and Pied-billed Grebe (*Podilymbus podiceps*), and ended with another five-minute silent listening period.

Surveys for crepuscular birds, namely American Woodcock (*Scolopax minor*) and Wilson's Snipe (*Gallinago delicata*), occur approximately 20 minutes after sunset. Survey methods were adapted from the American Woodcock Singing Ground Survey (BSC 2013). Stations were placed throughout the Subject Lands in a roughly regular spaced pattern approximately 600 m apart. Conditions should be similar to nocturnal and marsh bird monitoring bird surveys, as described in the paragraphs above. The survey requires listening for calling/displaying birds for two minutes, and recording relative positions and numbers of birds.

Both the Natural Heritage Information Centre (NHIC 2016) database and the Species at Risk in Ontario (SARO) list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each bird species.

#### **4. Amphibian Call Count (AMC) Surveys**

Surveys followed standard protocols outlined in the Great Lakes Marsh Monitoring Program (BSC 2003). The stations were identified using a preliminary review of aerial photography and verified in the field to confirm the presence of suitable breeding habitat.

Surveys were conducted on warm nights with light to gentle breezes. The surveys commenced one half hour before dusk and ended shortly after midnight. Each round of surveys was conducted at least 15 days apart and as per protocols, the first visit 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 paused until there was a quiet period.

Each station was surveyed for three minutes and a three-level call category system was utilized to identify the activity of the frogs. The 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; 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 amphibian movement corridors for non-woodland breeding amphibians; MNRF 2015).

During all evening amphibian surveys, Wildlife Acoustics' Echo Meter Touch Ultrasonic Modules were used to record and analyze bat echolocations. Each bat recording is assigned a GPS location for accuracy. The echo-meter serves as a reconnaissance exercise in an attempt to: identify bats in the general area (e.g., foraging over ponds or open meadows/wetlands); and identify potential bat roost habitat (maternity roost, as well as day roost for Species at Risk bats). Roosts can include trees/snags with signs of decay and cavities, as well old buildings/structures. Bats are discussed in Section 3.2.2.6.

Both the Natural Heritage Information Centre (NHIC 2016) database and the Species at Risk in Ontario (SARO) list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each amphibian species.

#### **5. Amphibian Egg Mass Surveys (EMS)**

Surveys were conducted for salamanders, frogs and toads during daylight hours in April, May, and June. EMS surveys were conducted at all AMC stations 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 Natural Heritage Information Centre (NHIC 2016) database and the Species at Risk in Ontario (SARO) list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each amphibian species recorded on the Subject Lands.

## 6. Turtle Survey Methods

**Table 2**, below, summarizes the turtle survey methodology used to screen for two significant wildlife habitat categories that pertain to turtles: turtle overwintering habitat and turtle nesting habitat (MNRF 2015).

This survey methodology focuses on Snapping Turtle and Midland Painted Turtle; two species that generally occur in the vicinity of the Subject Lands. This survey methodology is also suitable for observing Blanding’s Turtle in the spring (MNRF 2015). The OMNR (2012, 2015) and Toronto Zoo (Caverhill et al. 2011) turtle survey methods were considered in the formation of this survey protocol. Where turtles are recorded, the presence of animal movement corridors will also be considered.

**Table 2: Summary of Turtle Survey Methodology**

VARIABLE	SIGNIFICANT WILDLIFE HABITAT CATEGORY (MNRF 2015)	
	Turtle Overwintering Habitat	Turtle Nesting Habitat
<b>Habitat Characteristics Summary</b>	<ul style="list-style-type: none"> <li>• Soft organic substrate or soil that exceeds frost line</li> <li>• Aquatic: typically permanent wetland or pond areas with sufficient unfrozen water to allow movement</li> <li>• Terrestrial: brush piles and leaf cover</li> <li>• High Dissolved Oxygen (DO) indicates a high-quality overwintering site but is not indicative of use (turtles will use both high and low DO areas, but survive better in high DO)</li> </ul>	<ul style="list-style-type: none"> <li>• Turtles nest in areas of moist but well drained sandy loam with suitable sun exposure (i.e., a south or southeast facing slope)</li> <li>• Turtle nests on gravel shoulders/embankments of provincial or municipal roads are not SWH (MNRF 2015)</li> </ul>

VARIABLE	SIGNIFICANT WILDLIFE HABITAT CATEGORY (MNR 2015)	
	Turtle Overwintering Habitat	Turtle Nesting Habitat
Identifying / Confirming Habitat Presence	<ul style="list-style-type: none"> <li>• Mid-April through May is the optimal period for basking turtle observations</li> <li>• Basking Snapping Turtles are most often observed in May</li> <li>• Midland Painted Turtles bask throughout active seasons</li> <li>• Basking Blanding's Turtles are most often observed in May</li> <li>• Turtle species can also be observed in early fall, especially September, while travelling to reach overwintering sites, often crossing roads</li> </ul>	<ul style="list-style-type: none"> <li>• Identify and examine candidate nesting areas within 0.5 km overland and 8km via connecting waterways of each turtle occurrence</li> <li>• Turtle nests in natural areas are most often found in sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes, and rivers</li> <li>• Turtle nests can be found outside natural areas, i.e. farm fields, lawns, walking trails with suitable substrate and sun exposure</li> </ul>

Potentially suitable aquatic habitat for turtles was identified using aerial photography (ponds, open wetlands, and riparian/lacustrine areas). A detailed turtle basking and nesting survey was conducted in June 2015 (the basking survey included all water bodies on the Subject Lands). The 2016 turtle survey work built upon this prior work by focusing on targeted areas. In 2016, three ponds that may provide suitable over-wintering habitat were surveyed for basking turtles. A turtle nesting survey was also conducted in 2016 across the Subject Lands.

Spring turtle basking surveys were conducted on May 25 and 27, 2016 and a fall turtle basking survey was conducted on September 19, 2016. Binoculars were used to scan, from a distance, for ten minutes, the edge and surface of each waterbody for basking turtles. Data recorded include: water and air temperatures (basking is generally more prevalent when air is warmer than water), water depth (measured arm reach from shoreline), vegetation composition around the water body, % slope leading to water edge, % of pond containing basking features (logs, floating vegetation mats, floating/emergent debris like tires), and % canopy cover overhanging the pond.

For any turtle occurrences noted during the 2015 and 2016 turtle basking surveys, aerial interpretation was performed on lands within 0.5 km overland and 8 km along connecting stream features to screen for potential nesting areas. A turtle nesting survey was conducted on May 27, 2016. Candidate turtle nesting areas include: shores/beaches of wetlands, lakes or rivers; trails and driveways; and farm field margins (etc.), so long as suitable substrate and sun exposure are present. These areas were ground-truthed and, where potential habitat was noted, a soil auger sample was completed to confirm soil substrate and depth. Data recorded include: 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 depth.

## 7. Snake Survey Methods

Preliminary aerial photography review was performed to identify suitable snake habitat (cultural meadow, disturbed meadow, wetland edges, cultural woodland, cultural savannah, rural residence and farm buildings). Surveys focused on searching natural cover, like 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. Snakes were also searched for during all turtle basking and turtle nesting surveys.

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.

Survey methods are based on MNR Species at Risk protocols (2012) and Toronto Zoo snake survey protocols (Caverhill et al. 2011). Survey dates and conditions for both 2015 and 2016 snake surveys are provided in Table 2 (Appendix B).

## 8. Insect Survey Methods

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 and 30 degrees Celsius 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
- Late July to late August

During insect surveys, vegetation and landscape features (rivers, streams, other waterbodies) were assessed for potential presence of Species at Risk 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 Natural Heritage Information Centre (NHIC, 2016) database and the Species at Risk in Ontario (SARO) list (Ontario Regulation 230/08) were reviewed to determine the current provincial status for each insect species.

## 9. Bat Habitat Survey Methods

Survey methods were completed per OMNR (2011) survey guidelines as outlined in *Bats and*

*Bat Habitats: Guidelines for Wind Power Projects.* Areas to be surveyed were determined using aerial interpretation, Ecological Land Classification (ELC) mapping of the Subject lands, and ground-truthing. Cavity searches were conducted within treed areas proposed for removal and transects were conducted along retained treed areas. Targeted ELC communities included deciduous forests (FOD), mixedwood forests (FOM), coniferous forests (FOC), deciduous swamp (SWD), mixedwood 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.

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, cracks, or peeling bark that may or may not be present along the trunk or large branches. Each tree containing suitable cavities, cracks, or peeling bark 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 in size, the entire community was surveyed using a transect approach, where transects were 5 to 20 m apart (depending on visibility).

The results of these surveys were then used to assess the quality of the area to provide bat maternity roost habitat. Areas with  $\geq 10$  cavity trees/ha provide the greatest potential for bat maternity roost habitat, as per OMNR (2011) guidelines.

## **10. Bat Species Acoustic Monitoring Surveys**

As described in Section 3.2.2.6.1, the treed areas on the Subject Lands do not meet minimum criteria for bat maternity colony SWH due to low densities of suitable cavity trees per hectare. Targeted bat acoustic surveys were conducted on the Subject Lands to search for Species at Risk bats. The acoustic field program was developed using a combination of professional experience and guidance adapted from the MNRF Guelph District (2016) *Bat and Bat Habitat Surveys of Treed Habitats*.

Bat species can be identified using sonographic characteristics of echolocation calls used by bats to detect their surroundings. 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 acoustic surveys consisted of using EchoMeter Touch recorders (by Wildlife Acoustic) to record bat activity. Active survey locations were selected based on aerial interpretation, Ecological Land Classification (ELC) vegetation community types, and ground-truthing for suitable bat micro-habitat such as clusters of large diameter (>25 cm dbh) trees with peeling bark and cavities, along the edges of woodlands, hedgerows, as well as where woodlots are proposed to be removed.



Bat echolocation calls were actively recorded using EchoMeter Touch devices paired with an SM3BAT (by Wildlife Acoustics) set to record during the selected point count and transect locations. The locations were selected in areas that had the highest habitat potential for bats. However, due to the large size of the Subject Lands, transects and point counts were placed strategically throughout the lands, with a focus on areas considered for removal and potential corridors (Figure 5, Appendix A2). In addition, the ultrasonic microphone from the SM3BAT recorder and the EchoMeter Touch device was elevated at least 2 m above the ground to reduce background noise and echoes. During processing of the recordings, all ultrasonic recordings were filtered to eliminate those with high levels of noise or with no bat calls, and then further analyzed using the auto-classification tool in SonoBat software. Any calls with a positive identification were manually vetted by a wildlife ecologist with training in bat species identification by sonogram

### **11. Headwater Drainage Feature Assessment Surveys**

Potential drainage features on the Subject Lands were assessed for categorization and subsequent identification of management recommendations using the Credit Valley Conservation (CVC)/Toronto Region and Conservation Authority (TRCA) Guidelines for the “Evaluation, Classification, and Management of Headwater Drainage Features” (2014). Savanta has adopted the 2014 guidelines and developed a standardized approach to the headwater drainage feature assessments (HDFA).

Savanta conducted two site visits to examine headwater drainage features; in the spring on April 30, 2015 and in the summer on July 8, 2015. During the April 30 survey, all features were generally dry except for some shallow standing water at the extreme downstream ends of a few features associated with Lyon’s Creek and occasional shallow standing water in low areas. In all cases, no flowing water was observed. During both visits, standard field sheets were completed and a photographic record was taken. A third visit was not required as all features were dry during the second-round visit.

### **12. Aquatic Habitat Assessment**

Savanta conducted aquatic habitat assessments for two watercourses on the Subject Lands: Grassy Brook and a tributary of Lyons Creek. These assessments were conducted in conjunction with HDFA surveys on April 30 and July 8, 2015 and build upon assessments of Grassy Brook conducted by Savanta in 2012. Both watercourses are discussed in detail below.



**Appendix D – Tables**

Table 1: Natural Heritage Information Centre (NHIC) Data

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSWEIC	Last Observed	Extirpated
Northern Bobwhite	<i>Colinus virginianus</i>	S1	G4G5	END	END	1900	Y
Hairy Green Sedge	<i>Carex hirsutella</i>	S3	G5			1981	
Smith's Bulrush	<i>Schoenoplectiella smithii</i>	S2S3	G5?			1896-08	Y
Round-leaved Yellow Violet	<i>Viola rotundifolia</i>	SH	G5			1892-06	Y
White-haired Panicgrass	<i>Dichanthelium ovale</i> ssp. <i>praecocius</i>	S3	G5T5?			1902-06-17	
Shiny Wedge Grass	<i>Sphenopholis nitida</i>	S1	G5			1985-09-25	Y
Northern Hawthorn	<i>Crataegus pruinosa</i> var. <i>dissona</i>	S3	G4G5			1982-06-11	
Stiff Gentian	<i>Gentianella quinquefolia</i>	S1S2	G5T4T5			1894-09-03	Y
Scarlet Beebalm	<i>Monarda didyma</i>	S3	G5			1904	
Sharp-fruited Rush	<i>Juncus acuminatus</i>	S3	G5			1901-07-08	
Stiff Yellow Flax	<i>Linum medium</i> var. <i>medium</i>	S3?	G5T3T4			1877-07-27	
Woodland Flax	<i>Linum virginianum</i>	S2	G4G5			1897-07-16	

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSWEIC	Last Observed	Extirpated
Timber Rattlesnake	<i>Crotalus horridus</i>	SX	G4	EXP	EXP	1941-08-22	Y
Unicorn Clubtail	<i>Arigomphus villosipes</i>	S2S3	G5			1934-06-20	
Copenhagen Hawthorn	<i>Crataegus intricate</i>	SH	G5			1912-10-07	
Fairywand	<i>Chamaelirium luteum</i>	SX	G5			1891-06-12	Y
Biennial Gaura	<i>Oenothera gaura</i>	S3	G5			1995-09-13	
Panicked Hawkweed	<i>Hieracium paniculatum</i>	S2	G5			1937-08-16	
Shumard Oak	<i>Quercus shumardii</i>	S3	G5	SC	SC	1980	
Northern Bayberry	<i>Morella pensylvanica</i>	S1	G5			1968-07-01	
Azure Bluet	<i>Enallagma aspersum</i>	S3	G5			1997-06-27	
Yellow-breasted Chat	<i>Icteria virens</i>	S2B	G5	END	END	1983-07-07	
Eastern Flowering Dogwood	<i>Cornus florida</i>	S2?	G5	END	END	1980	
Round-leaved Greenbrier	<i>Smilax rotundifolia</i>	S2	G5	THR	THR	1999-09-22	
American Water-willow	<i>Justicia americana</i>	S2	G5	THR	THR	2007-10-04	
Greater Redhorse	<i>Moxostoma valenciennesi</i>	S3	G4			1992-08-26	
Swamp Rose-mallow	<i>Hibiscus moscheutos</i>	S3	G5	SC	SC	2004	

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSWEIC	Last Observed	Extirpated
Green Arrow Arum	<i>Peltandra virginica</i>	S3	G5			2004	
Large Yellow Pond-lily	<i>Nuphar advena</i>	S3	G5T5			2004	
Slim-flowered Muhly	<i>Muhlenbergia tenuiflora</i>	S2	G5T5			1948-08-20	
Great Plains Ladies'-tresses	<i>Spiranthes magnicamporum</i>	S3?	G4			2004	
Deer-tongue Panicgrass	<i>Dichanthelium clandestinum</i>	S2	G5?			1995-09-13	
Snapping Turtle	<i>Chelydra serpentina</i>	S3	G5	SC	SC	2015-07-16	
Northern Map Turtle	<i>Graptemys geographica</i>	S3	G5	SC	SC	2015-04-25	
Jefferson/Blue-spotted Salamander Complex	<i>Ambystoma hybrid</i>	S2	GNA			2012-05-06	
Blanding's Turtle	<i>Emydoidea blandingi</i>	S3	G4	THR	THR	2011-05-10	
Barn Swallow	<i>Hirundo rustica</i>	S4B	G5	THR	THR		
Bobolink	<i>Dolichonyx oryzivorus</i>	S4B	G5	THR	THR		
Chimney Swift	<i>Chaetura pelagica</i>	S4B, S4N	G5	THR	THR		
Eastern Meadowlark	<i>Sturnella magna</i>	S4B	G5	THR	THR		
Eastern Wood-Pewee	<i>Contopus virens</i>	S4B	G5	SC	SC		

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSWEIC	Last Observed	Extirpated
Grasshopper Sparrow	<i>Ammodramus savannarum</i>	S4B	G5	SC	SC		
Wood Thrush	<i>Hylocichla mustelina</i>	S4B	G4	SC	THR		
Grass Pickerel	<i>Esox americanus vermiculatus</i>	S3	G5T5	SC	SC		
Allegheny Mountain Dusky Salamander	<i>Desmognathus ochrophaeus</i>	S1	G5	END	END		
Fowler's Toad	<i>Anaxyrus fowleri</i>	S2	G5	END	END		
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	S2	G5	END	END		
Northern Dusky Salamander	<i>Desmognathus fuscus</i>	S1	G5	END	END		
Acadian Flycatcher	<i>Empidonax virescens</i>	S2S3B	G5	END	END		
Bald Eagle	<i>Haliaeetus leucocephalus</i>	S4B, S2N	G4	SC			
Barn Owl	<i>Tyto alba</i>	S1	G5	END	END		
Black Tern	<i>Chlidonias niger</i>	S3B	G4	SC			
Cerulean Warbler	<i>Setophaga cerulean</i>	S3B	G4	THR	END		
Least Bittern	<i>Ixobrychus exilis</i>	S4B	G5	THR	THR		
Louisiana Waterthrush	<i>Parkesia motacilla</i>	S3B	G5	SC	THR		
Peregrine Falcon	<i>Falco peregrinus</i>	S3B	G4	SC	SC		

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSWEIC	Last Observed	Extirpated
Piping Plover	<i>Charadrius melodus</i>	S1B	G3	END	END		
Prothonotary Warbler	<i>Protonotaria citrea</i>	S1B	G5	END	END		
Eastern Pondmussel	<i>Ligumia nasuta</i>	S1	G4	END	END		
Kidneyshell	<i>Ptychobranhus fasciolaris</i>	S1	G4G5	END	END		
Lake Chubsucker	<i>Erimyzon sucetta</i>	S2	G5	THR	END		
Redside Dace	<i>Clinostomus elongatus</i>	S2	G3G4	END	END		
Round Pigtoe	<i>Pleurobema sintoxia</i>	S1	G4G5	END	END		
Snuffbox	<i>Epioblasma triquetra</i>	S1	G3	END	END		
Rusty-patched Bumble Bee	<i>Bombus affinis</i>	S1	G1G2	END	END		
Woodland Vole	<i>Microtus pinetorum</i>	S3?	G5	SC	SC		
American Chestnut	<i>Castanea dentate</i>	S1S1	G4	END	END		
American Columbo	<i>Frasera caroliniensis</i>	S2	G5	END	END		
Broad Beech Fern	<i>Phegopteris hexagonoptera</i>	S3	G5	SC	SC		
Cherry Birch	<i>Betula lenta</i>	S1	G5	END	END		
Common Hoptree	<i>Ptelea trifoliata var. trifoliata</i>	S3	G5	THR	THR		

Common Name	Scientific Name	S-Rank	G-Rank	COSSARO	COSWEIC	Last Observed	Extirpated
Cucumber Tree	<i>Magnolia acuminata</i>	S2	G5	END	END		
Deerberry	<i>Vaccinium stamineum</i>	S1	G5	THR	THR		
Dwarf Hackberry	<i>Celtis tenuifolia</i>	S2	G5	THR	THR		
Green Dragon	<i>Arisaema dracontium</i>	S3	G5	SC	SC		
Red Mulberry	<i>Morus rubra</i>	S2	G5	END	END		
Spoon-leaved Moss	<i>Bryoandersonia illecebra</i>	S2	G5	END	END		
Spotted Wintergreen	<i>Chimaphila maculate</i>	S2	G5	END	END		
Virginia Mallow	<i>Sida hermaphrodita</i>	S1	G3	END	END		
White Wood Aster	<i>Eurybia divaricate</i>	S2S3	G5	THR	THR		
Common Five-lined Skink	<i>Eumeces fasciatus</i>	S2	G5	END	END		
Eastern Ribbonsnake	<i>Thamnophis sauritus</i>	S4	G5	SC	SC		
Gray Ratsnake	<i>Pantherophis spiloides</i>	S1	G5T5	END	END		
Massasauga	<i>Sistrurus catenatus</i>	S1	GNR	END	END		
Spiny Softshell	<i>Apalone spinifera spinifera</i>	S2	G5	THR	END		



**Table 2: Ecological Field Survey Personnel, Survey Dates and Conditions**

SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Davis, H. Park, O.	Calling Amphibians	29-AP-15	20:58	23:25	13	61	10	0	None
Davis, H. Park, O.	Calling Amphibians	30-AP-15	20:54	00:35	11	63	15	1	None
Geddes, S. Collinson, C.	Headwater Drainage Feature Assessment	30-AP-15	09:00	16:00	16	44	0	3	None
Davis, H.	Calling Amphibians	14-MA-15	21:20	23:02	13	44	70	2	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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

SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Park, O.									
Davis, H. Park, O.	Calling Amphibians	15-MA-15	21:08	23:25	19	59	100	3	Light Drizzle
Davis, H. Zoladeski, C.	Calling Amphibians	21-MA-15	21:10	23:04	12	56	95	2	None
Lee, R. Park, O. Hilditch, J. Mitchell, C	Wildlife Road Crossing Survey	23-JU-15	15:00	15:38	28	45	10	1	None
Hilditch, T. Lee, R.	Turtle Basking and Turtle Nesting	23-JU-15	09:00	15:00	20	82	80	4	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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MA	May
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OC	October
NO	November
DE	December

SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Park, O. Hilditch, J. Mitchell, C.									
Davis, H. Park, O.	Calling Amphibians	24-JU-15	21:39	00:06	20	62	10	2	None
Lucas, T.	Breeding Bird	24-JU-15	05:30	10:45	15	N/A	0	0	None
Davis, H. Park, O.	Calling Amphibians	25-JU-15	21:30	00:00	17	94	20	1	None
Lucas, T.	Breeding Bird	25-JU-15	05:30	10:45	20	N/A	70	0	None
Lucas, T.	Breeding Bird	26-JU-15	06:00	07:30	16	N/A	100	1	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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JL	July
AU	August
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OC	October
NO	November
DE	December

SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Geddes, S. Collinson, C.	Headwater Drainage Feature Assessment	8-JL-15	09:00	16:00	20	51	0	3	None
Burke, P.	Breeding Bird	8-JL-15	05:15	12:00	15	N/A	60	2	None
Burke, P.	Breeding Bird	9-JL-15	05:15	10:30	20	N/A	90	0	None
Zoladeski, C.	ELC and Vascular Plant Inventory	21-JL-15	N/A	N/A	21	59	30	2	None
Zoladeski, C. Lee, R.	ELC and Vascular Plant Inventory	7-AU-15	N/A	N/A	20	66	100	2	None
Zoladeski, C. Collinson, C.	ELC and Vascular Plant Inventory	13-AU-15	N/A	N/A	21	63	80	3	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Davis, H. Kucharik, M.	Amphibian Egg Mass	6-MA-16	10:07	14:23	15	50	10	0	None
Burke, P.	Marsh Bird and Crepuscular Bird	10-MA-16	18:50	22:00	10	N/A	70	1	None
Burke, P.	Snake Transect	11-MA-16	09:53	14:23	13-15	27	80	1	None
Leslie, J. Male, S.	Bat Cavity Tree Density	17-MA-16	N/A	N/A	14	47	100	1	Drizzle
Leslie, J. Male, S.	Bat Cavity Tree Density	18-MA-16	10:00	14:00	18	N/A	10	1	None
Burke, P. Male, S.	Nocturnal Bird	18-MA-16	20:30	21:20	20	N/A	25	2	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Burke, P. Lee, R.	Amphibian Egg Mass Snake Transect Turtle Basking	25-MA-16	09:50	14:20	23	53	60	1	None
Lee, R. Lee, E.	Amphibian Egg Mass	27-MA-16	11:30	13:45	31	53	50	1	None
Lee, R. Green, M.	Turtle Basking and Turtle Nesting	27-MA-16	09:27	10:14	25	76	80	2	None
Burke, P.	Odonata and Butterflies	10-JU-16	09:30	N/A	16	N/A	5	0	None
Park, O. Green, M.	Bat Acoustic Monitoring	14-JU-16	21:08	01:31	22	23	0	1	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Park, O. Boucher, N. Williamson, L. Hilditch, J.	Bat Acoustic Monitoring	22-JU-16	21:11	00:15	24	29	0	2	None
Park, O. Collinson, C. Williamson, L. Hilditch, J.	Bat Acoustic Monitoring	27-JU-16	21:10	23:35	28	40	30	3	None
Lee, R. Lee, E.	Amphibian Egg Mass	28-JU-16	15:22	15:39	25	54	80	0	None
Burke, P.	Odonata and Butterflies	28-JU-16	08:00	12:00	20-22	N/A	40-80	1	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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SURVEYORS (SURNAME, INITIAL)	SURVEY TYPE	DATE	TIME		AIR TEMP (°C)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS
			START	END					
Zoladeski, C.	Significant Plant Species	2-AU-16	N/A	N/A	25	55	80	2	Drizzle
Burke, P.	Odonata and Butterflies	5-AU-16	08:00	N/A	27	N/A	40	2-3	None
Zoladeski, C.	Significant Plant Species	15-SE-16	N/A	N/A	17	64	100	3	None
Boucher, N. Davis, H.	Turtle Basking	19-SE-16	10:40	11:15	22	78	5	1	None

**LEGEND:**

BEAUFORT WIND SPEED SCALE	
0	Calm (<1 km/hr)
1	Light Air (1-5 km/hr)
2	Light Breeze (6-11 km/hr)
3	Gentle Breeze (12-19 km/hr)
4	Moderate Breeze (20-28 km/hr)

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NO	November
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**Table 3: Ecological Land Classification (ELC) Types on the Subject Lands**

ELC TYPE	DESCRIPTION	G-RANK (NHIC, 2013)	S-RANK (NHIC, 2013)
<b>1. CENTRAL BLOCK (Savanta Inc., 2012)</b>			
<b>FOREST</b>			
FOD Upland Deciduous Forest	<ul style="list-style-type: none"> <li>Pockets of this upland forest were located in the wooded area south of the railway. A diversity of species is present in this community with no defined dominant species.</li> </ul>	NR	NR
FOD2-4 Dry-Fresh Oak- Hardwood Deciduous Forest	<ul style="list-style-type: none"> <li>Occurs along the edge of the EPA woodland along the south side of the Phase 1 Lands. Red oak and sugar maple dominate, followed by black cherry, shagbark hickory and white oak</li> </ul>	G?	S5
<b>MARSH</b>			
MAM2-2 Reed-canary Grass Mineral Meadow Marsh	<ul style="list-style-type: none"> <li>Beyond the strip of cattail marsh (MAS2-1), described next, that borders Grassy Brook near Crowland Avenue, the vegetation changes to a reed-canary grass meadow marsh with a few sedges and forbs</li> <li>Roughly half of the MAM2-2 zone remains intact, while the outer half (5-10 m wide) has been mown. A 15m setback was maintained from the creek bed</li> <li>Several scattered young trees of willow and green ash and a few clusters of buttonbush grow along the banks of Grassy Brook.</li> <li>The floodplain is topographically quite well defined</li> </ul>	NR	NR

ELC TYPE	DESCRIPTION	G-RANK (NHIC, 2013)	S-RANK (NHIC, 2013)
MAM2-10 Forb Mineral Meadow Marsh	<ul style="list-style-type: none"> <li>This community is located in the Right of Way that divides the two wooded wetlands north and south of the railway</li> </ul>	G?	S4S5
MAM2-11* Mixed Graminoid-Forb Mineral Meadow Marsh	<ul style="list-style-type: none"> <li>Occurs along the edge of the EPA woodland along the south side of the Phase 1 Lands</li> <li>Red oak and sugar maple dominate, followed by black cherry, shagbark hickory and white oak</li> </ul>	NR	NR
MAS2-1 Cattail Mineral Shallow Marsh	<ul style="list-style-type: none"> <li>At Crowland Avenue, west of the Phase 1 lands, a narrow strip of dense cattail shallow marsh that is 7 - 8 metres wide covers the bed of Grassy Brook</li> <li>Beyond this strip, the vegetation changes to a reed-canary grass meadow marsh (MAM2-2), described previously</li> <li>The floodplain is topographically quite well defined in this area</li> </ul>	G5	S5
<b>SWAMP</b>			
SWD2-2 Green Ash Mineral Deciduous Swamp	<ul style="list-style-type: none"> <li>Occurs within the narrow confines of Grassy Brook where the floodplain widens. Shrub- and herb-rich, with abundances of buttonbush, reed-canary grass, tall white aster, Virginia wild rye, and water-pepper</li> </ul>	G?	S5

ELC TYPE	DESCRIPTION	G-RANK (NHIC, 2013)	S-RANK (NHIC, 2013)
SWD3-5* Maple Mineral Deciduous Swamp	<ul style="list-style-type: none"> <li>• This is the main wetland community within the EPA adjacent to the Phase 1 lands and in the wooded area south of the railway</li> <li>• For the EPA adjacent to the Phase 1 lands, the maple swamp is primarily located deeper (south from the forest edge) into the woods, with lobes extending almost to the edge of the woodlot, or present as isolated “islands” within the FOD2-4 matrix</li> <li>• Maple swamp occupies the majority of the wooded area south of the railway</li> <li>• Only small areas near the tracks are sufficiently elevated to develop an upland forest (i.e. non-wetland) cover</li> <li>• Within the maple swamps, red and silver maples are usual dominants, with associates being pin oak and shagbark hickory. Shrub layer is well developed with frequent buttonbush</li> <li>• The herb layer is rich with sedges, grasses and forbs</li> </ul>	NR	NR
SWT2-2 Willow Mineral Thicket Swamp  Buttonbush Thicket Swamp	<ul style="list-style-type: none"> <li>• A small patch of the willow thicket swamp is located near the southwest edge of the wooded swamp south of the railway</li> </ul>	G5	S5
		G4	S3

ELC TYPE	DESCRIPTION	G-RANK (NHIC, 2013)	S-RANK (NHIC, 2013)
<b>MEADOW</b>			
CUM1-1 Dry-Moist Old Field Meadow	<ul style="list-style-type: none"> <li>Located near the extent of the northeast corner of the Phase 1 lands, this small cultural meadow borders the meadow marsh (MAM2-11) located in the floodplain of Grassy Brook.</li> </ul>	NR	NR
<b>2. NORTH BLOCK (Savanta Inc., 2014)</b>			
<b>FOREST</b>			
FOD9 Fresh-Moist Oak- Maple-Hickory Deciduous Forest	<ul style="list-style-type: none"> <li>A variably composed forest without clear dominant tree species. In the main canopy grow beech, red oak, shagbark hickory, sugar maple, red maple, ironwood and white elm</li> <li>Shrubs include: choke cherry, Virginia creeper, red raspberry and tree saplings</li> <li>In the ground cover grow: may-apple, wood fern, Jack-in-the-pulpit, enchanter's nightshade, wild crane's-bill, and wild lily-of-the valley</li> </ul>	NR	NR
<b>SWAMP</b>			
SWD3 Maple Mineral Deciduous Swamp	<ul style="list-style-type: none"> <li>This is a complex community of treed areas and closely-surrounded several vernal pools, where aquatic and marsh species may be found.</li> <li>Several canopy tree species are present, none decidedly dominating the community, for example swamp maple, red maple, swamp white oak, shagbark hickory and green ash.</li> </ul>	NR	NR



ELC TYPE	DESCRIPTION	G-RANK (NHIC, 2013)	S-RANK (NHIC, 2013)
	<ul style="list-style-type: none"> <li>The shrub layer is composed of poison ivy, blue beech, Virginia creeper and saplings of canopy trees.</li> <li>The herb layer is well developed but patchy, with sensitive fern, fowl meadow grass, Jack-in-the-pulpit and several species of sedges.</li> </ul>		
<b>CULTURAL</b>			
CUW/H Deciduous Cultural Woodland / Hedgerow	<ul style="list-style-type: none"> <li>This is a moist area, essentially a wide hedgerow, composed of an open canopy of green ash, black cherry and swamp white oak</li> <li>The tall shrub layer is very well developed and dominated by grey dogwood, hawthorn and buckthorn</li> </ul>	NR	NR
H Hedgerow	<ul style="list-style-type: none"> <li>A north-south hedgerow connects the larger woodlot (FOD9/SWD3) and a smaller cultural woodland fragment / broader hedgerow (CUW/H)</li> <li>The north-south hedgerow can be divided into a treed southern half and a mostly shrub-dominated northern half</li> <li>The main mature trees in the southern half are swamp white oak, pin oak, red oak, shagbark hickory and black cherry</li> <li>Species in the northern half of the hedgerow include hawthorn, silky dogwood, common buckthorn and young black cherry trees</li> </ul>	NR	NR

ELC TYPE	DESCRIPTION	G-RANK (NHIC, 2013)	S-RANK (NHIC, 2013)
<b>3. SOUTH BLOCK (Savanta Inc., 2014)</b>			
<b>FOREST</b>			
FOD6-5 Fresh-Moist Sugar Maple-Hardwood Deciduous Forest	<ul style="list-style-type: none"> <li>A lowland forest composed of sugar maple and several co-dominants, including red oak, shagbark hickory, beech, basswood and swamp white oak</li> <li>Understorey shrub and herb layers are well developed, with tree saplings, choke cherry, multiflora rose, enchanter's nightshade, white avens, jewelweed, wild crane's-bill, may-apple, and Pennsylvania sedge</li> </ul>	G5	S5
<b>SWAMP</b>			
SWD1-5* Green Ash-Pin Oak Mineral Deciduous Swamp	<ul style="list-style-type: none"> <li>This unit occupies a corner portion of the southern woodlot in the vicinity of a small vernal pool.</li> <li>Main species in the tree canopy are green ash and pin oak, with shagbark hickory as associate. Poison ivy and swamp rose are the dominant shrubs, while the herb layer is composed of moneywort, jewelweed, fowl meadow grass, and various sedges.</li> </ul>	NR	NR

\*Not listed in Southern Ontario ELC

NR – Not ranked by the NHIC (2012) database

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
<b>PTERIDOPHYTES</b>		<b>FERNS and ALLIES</b>							
<b>Dennstaedtiaceae</b>		<b>Bracken Fern Family</b>							
<i>Pteridium aquilinum</i>		Bracken Fern	2	3		S5			G5
<b>Dryopteridaceae</b>		<b>Wood Fern Family</b>							
<i>Athyrium filix-femina</i>		Lady Fern	4	0		S5			G5
<i>Dryopteris carthusiana</i>	<i>Dryopteris spinulosa</i>	Spinulose Wood Fern	5	-2		S5			G5
<i>Onoclea sensibilis</i>		Sensitive Fern	4	-3		S5			G5
<i>Polystichum acrostichoides</i>		Christmas Fern	5	5		S5			G5
<b>Equisetaceae</b>		<b>Horsetail Family</b>							
<i>Equisetum arvense</i>		Field Horsetail	0	0		S5			G5
<b>Thelypteridaceae</b>		<b>Marsh Fern Family</b>							
<i>Thelypteris palustris</i>	<i>Dryopteris thelypteris</i>	Marsh Fern	5	-4		S5			G5
<b>GYMNOSPERMS</b>		<b>CONIFERS</b>							
<b>Cupressaceae</b>		<b>Cedar Family</b>							
<i>Thuja occidentalis</i>		Eastern White Cedar	4	-3		S5			G5
<b>Pinaceae</b>		<b>Pine Family</b>							
<i>Pinus nigra</i>		Austrian Pine		-5	-1	SNA			GNA
<i>Pinus strobus</i>		Eastern White Pine	4	3		S5			G5
<i>Pinus sylvestris</i>		Scotch Pine		5	-3	SNA			GNA
<b>DICOTYLEDONS</b>		<b>DICOTS</b>							
<b>Aceraceae</b>		<b>Maple Family</b>							
<i>Acer negundo</i>		Manitoba Maple	0	-2		S5			G5
<i>Acer rubrum</i>		Red Maple	4	0		S5			G5
<i>Acer saccharum ssp. saccharum</i>		Sugar Maple	4	3		S5			G5T5
<i>Acer x freemanii</i>		Freeman's Maple				SNA			GNA
<b>Anacardiaceae</b>		<b>Sumac or Cashew Family</b>							
<i>Rhus typhina</i>		Staghorn Sumac	1	5		S5			G5
<i>Toxicodendron rydbergii</i>	<i>Rhus rydbergii, Toxicodendron</i>	Rydberg's Poison Ivy	0	0		S5			G5T
<b>Apiaceae</b>		<b>Carrot or Parsley Family</b>							
<i>Cicuta maculata</i>		Spotted Water-hemlock	6	-5		S5			G5
<i>Daucus carota</i>		Wild Carrot		5	-2	SNA			GNR

SAVANTA INC.  
Table 4: Plant Species List

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<i>Sium suave</i>		Hemlock Water-parsnip	4	-5		S5			G5
<b>Apocynaceae</b>									
<b>Dogbane Family</b>									
<i>Apocynum androsaemifolium ssp. androsaemifolium</i>		Spreading Dogbane	3	5		S5			G5T5
<b>Araliaceae</b>									
<b>Ginseng Family</b>									
<i>Aralia nudicaulis</i>		Wild Sarsaparilla	4	3		S5			G5
<b>Asclepiadaceae</b>									
<b>Milkweed Family</b>									
<i>Asclepias incarnata</i>		Swamp Milkweed	6	-5		S5			G5
<i>Asclepias syriaca</i>		Common Milkweed	0	5		S5			G5
<b>Asteraceae</b>									
<b>Composite or Aster Family</b>									
<i>Achillea millefolium</i>		Yarrow		3	-1	S5			G5
<i>Ambrosia artemisiifolia</i>		Annual Ragweed	0	3		S5			G5
<i>Arctium minus</i>		Common Burdock		5	-2	SNA			GNR
<i>Bidens cernua</i>		Nodding Beggarticks	2	-5		S5			G5
<i>Bidens frondosa</i>		Devil's Beggarticks	3	-3		S5			G5
<i>Bidens tripartita</i>		Three-parted Beggarticks	4	-3		S5			G5
<i>Carduus nutans ssp. nutans</i>		Nodding Thistle		5	-1	SNA			GNR
<i>Centaurea stoebe</i>	<i>Centaurea maculosa</i>	Spotted Knapweed		5	-3	SNA			GNR
<i>Cichorium intybus</i>		Chicory		5	-1	SNA			GNR
<i>Cirsium arvense</i>		Canada Thistle		3	-1	SNA			GNR
<i>Cirsium vulgare</i>		Bull Thistle		4	-1	SNA			GNR
<i>Erigeron annuus</i>		Annual Fleabane				S5			G5
<i>Erigeron strigosus</i>		Daisy Fleabane	0	1		S5			G5
<i>Eupatorium perfoliatum</i>		Common Boneset	2	-4		S5			G5
<i>Eurybia macrophylla</i>	<i>Aster macrophyllus</i>	Large-leaved Aster	5	5		S5			G5
<i>Euthamia graminifolia</i>	<i>Solidago graminifolia</i>	Grass-leaved Goldenrod	2	-2		S5			G5
<i>Eutrochium maculatum var. maculatum</i>	<i>Eupatorium maculatum</i> var.	Spotted Joe Pye Weed	3	-5		S5			G5T5
<i>Lactuca serriola</i>		Prickly Lettuce		0	-1	SNA			GNR
<i>Leucanthemum vulgare</i>	<i>Chrysanthemum leucanthemum</i>	Oxeye Daisy		5	-1	SNA			GNR
<i>Pilosella caespitosa</i>	<i>Hieracium caespitosum</i>	Field Hawkweed		5	-2	SNA			GNR
<i>Rudbeckia hirta</i>		Black-eyed Susan	0	3		S5			G5
<i>Solidago altissima</i>		Tall Goldenrod	1	3		S5			G5
<i>Solidago caesia</i>		Blue-stemmed Goldenrod	5	3		S5			G5
<i>Solidago canadensis</i>		Canada Goldenrod	1	3		S5			G5
<i>Solidago flexicaulis</i>		Zig-zag Goldenrod	6	3		S5			G5
<i>Solidago juncea</i>		Early Goldenrod	3	5		S5			G5

SAVANTA INC.  
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<i>Solidago rugosa</i>		Rough-leaf Goldenrod	4	-1		S5			G5
<i>Sonchus arvensis</i> ssp. <i>arvensis</i>		Field Sow-thistle				SNA			GNRTNR
<i>Sonchus asper</i>		Prickly Sow-thistle		0	-1	SNA			GNR
<i>Symphyotrichum cordifolium</i>	<i>Aster cordifolius</i>	Heart-leaved Aster	5	5		S5			G5
<i>Symphyotrichum ericoides</i> var. <i>ericoides</i>	<i>Aster ericoides</i> ssp. <i>ericoides</i>	White Heath Aster				S5			G5T5
<i>Symphyotrichum lanceolatum</i> var. <i>lanceolatum</i>	<i>Aster lanceolatus</i> ssp. <i>lanceolatus</i>	White Panicked Aster	3	-3		S5			G5T5
<i>Symphyotrichum lateriflorum</i>	<i>Aster lateriflorus</i>	Starved Aster	3	-2		S5			G5
<i>Symphyotrichum novae-angliae</i>	<i>Aster novae-angliae</i>	New England Aster	2	-3		S5			G5
<i>Symphyotrichum pilosum</i> var. <i>pilosum</i>	<i>Aster pilosus</i> var. <i>pilosus</i>	Old Field Aster	4	2		S5			G5T5
<i>Symphyotrichum puniceum</i> var. <i>puniceum</i>	<i>Aster puniceus</i> var. <i>puniceus</i>	Swamp Aster				S5			G5T5
<i>Tragopogon dubius</i>		Yellow Goat's-beard		5	-1	SNA			GNR
<b>Balsaminaceae</b>		<b>Touch-me-not Family</b>							
<i>Impatiens capensis</i>		Spotted Jewelweed	4	-3		S5			G5
<b>Berberidaceae</b>		<b>Barberry Family</b>							
<i>Podophyllum peltatum</i>		May Apple	5	3		S5			G5
<b>Betulaceae</b>		<b>Birch Family</b>							
<i>Betula alleghaniensis</i>		Yellow Birch	6	0		S5			G5
<i>Betula papyrifera</i>		White Birch		2		S5			G5
<i>Carpinus caroliniana</i>		Blue-beech	6	0		S5			G5
<i>Ostrya virginiana</i>		Eastern Hop-hornbeam	4	4		S5			G5
<b>Boraginaceae</b>		<b>Borage Family</b>							
<i>Echium vulgare</i>		Blueweed		5	-2	SNA			GNR
<b>Brassicaceae</b>		<b>Mustard Family</b>							
<i>Alliaria petiolata</i>	<i>Alliaria officinalis</i>	Garlic Mustard		0	-3	SNA			GNR
<i>Hesperis matronalis</i>		Dame's Rocket		5	-3	SNA			G4G5
<i>Lepidium campestre</i>		Field Pepper-grass		5	-1	SNA			GNR
<b>Campanulaceae</b>		<b>Bellflower Family</b>							
<i>Lobelia cardinalis</i>		Cardinal Flower	7	-5		S5			G5
<b>Caprifoliaceae</b>		<b>Honeysuckle Family</b>							
<i>Lonicera tatarica</i>		Tartarian Honeysuckle		3	-3	SNA			GNR
<i>Sambucus canadensis</i>		Common Elderberry	5	-2		S5			G5T5
<i>Viburnum opulus</i> ssp. <i>trilobum</i>		Highbush Cranberry	5	-3		S5			G5T5



SAVANTA INC.  
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<b>Celastraceae</b>			<b>Staff-tree Family</b>						
<i>Euonymus obovatus</i>		Running Strawberry Bush	6	5		S4			G5
<b>Chenopodiaceae</b>			<b>Goosefoot Family</b>						
<i>Atriplex patula</i>		Halberd-leaf Saltbush	0	-2		S5			G5
<i>Chenopodium album</i> var. <i>album</i>	<i>Chenopodium album</i>	White Goosefoot		1	-1	SNA			G5TNR
<b>Convolvulaceae</b>			<b>Morning-glory Family</b>						
<i>Calystegia sepium</i> ssp. <i>americana</i>		American Bindweed	2	0		SU			G5T5
<i>Convolvulus arvensis</i>		Field Bindweed		5	-1	SNA			GNR
<b>Cornaceae</b>			<b>Dogwood Family</b>						
<i>Cornus alternifolia</i>		Alternate-leaf Dogwood	6	5		S5			G5
<i>Cornus foemina</i>	<i>Cornus racemosa</i>	Grey Dogwood	2	-2		S5			GNR
<i>Cornus sericea</i>	<i>Cornus stolonifera</i>	Red-osier Dogwood	2	-3		S5			G5
<b>Cucurbitaceae</b>			<b>Gourd Family</b>						
<i>Echinocystis lobata</i>		Wild Mock-cucumber	3	-2		S5			G5
<b>Dipsacaceae</b>			<b>Teasel Family</b>						
<i>Dipsacus fullonum</i>	<i>Dipsacus sylvestris</i>	Fuller's Teasel		5	-1	SNA			GNR
<b>Fabaceae</b>			<b>Pea Family</b>						
<i>Lotus corniculatus</i>		Bird's-foot Trefoil		1	-2	SNA			GNR
<i>Melilotus albus</i>		White Sweetclover		3	-3	SNA			G5
<i>Trifolium pratense</i>		Red Clover		2	-2	SNA			GNR
<i>Vicia cracca</i>		Tufted Vetch		5	-1	SNA			GNR
<i>Vicia tetrasperma</i>		Lentil Vetch		5	-1	SNA			GNR
<b>Fagaceae</b>			<b>Beech Family</b>						
<i>Fagus grandifolia</i>		American Beech	6	3		S4			G5
<i>Quercus alba</i>		White Oak	6	3		S5			G5
<i>Quercus bicolor</i>		Swamp White Oak	8	-4		S4			G5
<i>Quercus macrocarpa</i>		Bur Oak	5	1		S5			G5
<i>Quercus palustris</i>		Pin Oak	9	-3		S4			G5
<i>Quercus rubra</i>		Northern Red Oak	6	3		S5			G5
<b>Geraniaceae</b>			<b>Geranium Family</b>						

SAVANTA INC.  
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<i>Geranium maculatum</i>		Wild Crane's-bill	6	3		S5			G5
<i>Geranium robertianum</i>		Herb-robert		5	-2	SNA			G5
<b>Grossulariaceae</b>			<b>Currant Family</b>						
<i>Ribes americanum</i>		Wild Black Currant	4	-3		S5			G5
<i>Ribes cynosbati</i>		Prickly Gooseberry	4	5		S5			G5
<i>Ribes rubrum</i>		Northern Red Currant		5	-2	SNA			G4G5
<i>Ribes triste</i>		Swamp Red Currant	6	-5		S5			G5
<b>Guttiferae</b>			<b>St. John's-wort Family</b>						
<i>Hypericum mutilum</i>		Slender St. John's-wort	6	-3		S4			G5
<i>Hypericum perforatum</i>		Common St. John's-wort		5	-3	SNA			GNR
<b>Hydrophyllaceae</b>			<b>Water-leaf Family</b>						
<i>Hydrophyllum virginianum</i>		Virginia Waterleaf	6	-2		S5			G5
<b>Juglandaceae</b>			<b>Walnut Family</b>						
<i>Carya cordiformis</i>		Bitternut hickory	6	0		S5			G5
<i>Carya ovata</i>		Shagbark Hickory	6	3		S5			G5
<i>Juglans nigra</i>		Black Walnut	5	3		S4?			G5
<b>Lamiaceae</b>			<b>Mint Family</b>						
<i>Lycopus uniflorus</i>		Northern Bugleweed	5	-5		S5			G5
<i>Mentha arvensis</i>		Corn Mint	3	-3		S5			G5
<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>		Self-heal	5	5		S5			G5T5
<i>Stachys hispida</i>	<i>Stachys tenuifolia</i>	Hispid Hedge-nettle	7	-4		S4			G5T4Q
<b>Lythraceae</b>			<b>Loosestrife Family</b>						
<i>Lythrum salicaria</i>		Purple Loosestrife		-5	-3	SNA			G5
<b>Nymphaeaceae</b>			<b>Water-lily Family</b>						
<i>Nuphar variegata</i>	<i>Nuphar luteum</i>	Yellow Cowlily	4	-5		S5			G5T5
<b>Nyssaceae</b>			<b>Sour Gum Family</b>						
<i>Nyssa sylvatica</i>		Black Gum	9	-4		S3			G5
<b>Oleaceae</b>			<b>Olive Family</b>						
<i>Fraxinus pennsylvanica</i>		Red Ash	3	-3		S5			G5

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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
<b>Onagraceae</b>									
<b>Evening-primrose Family</b>									
<i>Circaea lutetiana</i>	<i>Circaea canadensis</i> ssp. ca	Enchanter's Nightshade	3	3		S5			G5
<i>Epilobium ciliatum</i> ssp. <i>ciliatum</i>		Hairy Willow-herb	3	3		S5			G5T5
<i>Ludwigia palustris</i>		Marsh Seedbox	5	-5		S5			G5
<i>Oenothera parviflora</i>		Northern Evening-primrose	1	3		S4?			G4?
<b>Orobanchaceae</b>									
<b>Broom-rape Family</b>									
<i>Epifagus virginiana</i>		Beech-drops	6	5		S5			G5
<b>Oxalidaceae</b>									
<b>Wood Sorrel Family</b>									
<i>Oxalis stricta</i>		Upright Yellow Wood-sorrel	0	3		S5			G5
<b>Plantaginaceae</b>									
<b>Plantain Family</b>									
<i>Plantago lanceolata</i>		English Plantain		0	-1	SNA			G5
<i>Plantago major</i>		Common Plantain		-1	-1	SNA			G5
<b>Polygonaceae</b>									
<b>Smartweed Family</b>									
<i>Persicaria hydropiper</i>	<i>Polygonum hydropiper</i>	Marshpepper Smartweed	4	-5		SNA			GNR
<i>Persicaria pensylvanica</i>	<i>Polygonum pensylvanicum</i>	Pennsylvania Smartweed	3	-4		S5			G5
<i>Persicaria sagittata</i>	<i>Polygonum sagittatum</i>	Arrow-leaved Smartweed	5	-5		S4S5			G5
<i>Persicaria virginiana</i>	<i>Polygonum virginianum</i>	Virginia Knotweed	6	0		S4			G5
<i>Polygonum amphibium</i>	<i>Persicaria amphibia</i> , <i>Persic</i>	Water Smartweed	5	-5		S5			G5
<i>Rumex crispus</i>		Curly Dock		-1	-2	SNA			GNR
<b>Primulaceae</b>									
<b>Primrose Family</b>									
<i>Lysimachia ciliata</i>		Fringed Loosestrife	4	-3		S5			G5
<i>Lysimachia nummularia</i>		Moneywort		-4	-3	SNA			GNR
<b>Ranunculaceae</b>									
<b>Buttercup Family</b>									
<i>Ranunculus abortivus</i>		Kidney-leaf Buttercup	2	-2		S5			G5
<i>Ranunculus acris</i>		Tall Buttercup			-2	SNA			G5
<i>Ranunculus pensylvanicus</i>		Bristly Crowfoot	3	-5		S5			G5
<i>Ranunculus recurvatus</i>		Hooked Buttercup	4	-3		S5			G5
<i>Ranunculus sceleratus</i> var. <i>sceleratus</i>		Cursed Buttercup	2	-5		SU			G5T5
<b>Rhamnaceae</b>									
<b>Buckthorn Family</b>									
<i>Frangula alnus</i>	<i>Rhamnus frangula</i> , <i>Alnus</i>	Glossy Buckthorn		-1	-3	SNA			GNR
<i>Rhamnus cathartica</i>		Common Buckthorn		3	-3	SNA			GNR



SAVANTA INC.  
Table 4: Plant Species List

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
<b>Rosaceae</b>									
<b>Rose Family</b>									
<i>Agrimonia gryposepala</i>		Tall Hairy Groovebur	2	2		S5			G5
<i>Crataegus punctata</i>		Large-fruited Thorn	4	5		S5			G5
<i>Fragaria virginiana</i>		Virginia Strawberry	2	1		S5			G5
<i>Geum aleppicum</i>		Yellow Avens	2	-1		S5			G5
<i>Geum canadense</i>		White Avens	3	0		S5			G5
<i>Geum laciniatum</i>		Rough Avens		-3		S4			G5
<i>Potentilla recta</i>		Sulphur Cinquefoil		5	-2	SNA			GNR
<i>Potentilla simplex</i>		Old-field Cinquefoil	3	4		S5			G5
<i>Prunus avium</i>		Sweet Cherry		5	-2	SNA			GNR
<i>Prunus serotina</i>		Black Cherry	3	3		S5			G5
<i>Prunus virginiana</i>		Choke Cherry	2	1		S5			G5
<i>Rosa multiflora</i>		Multiflora Rose		3	-3	SNA			GNR
<i>Rubus allegheniensis</i>		Alleghany Blackberry	2	2		S5			G5
<i>Rubus hispidus</i>		Bristly Dewberry	6	-3		S4			G5
<i>Rubus idaeus</i> ssp. <i>strigosus</i>	<i>Rubus idaeus</i> ssp. <i>melanocarpus</i>	Red Raspberry	0	-2		S5			G5T5
<i>Rubus occidentalis</i>		Black Raspberry	2	5		S5			G5
<i>Spiraea alba</i>		Narrow-leaved Meadow-sweet	3	-4		S5			G5
<b>Rubiaceae</b>									
<b>Madder Family</b>									
<i>Cephalanthus occidentalis</i>		Common Buttonbush	7	-5		S5			G5
<i>Galium palustre</i>		Marsh Bedstraw	5	-5		S5			G5
<b>Salicaceae</b>									
<b>Willow Family</b>									
<i>Populus deltoides</i> ssp. <i>deltoides</i>		Eastern Cottonwood	4	-1		S5			G5T5
<i>Populus tremuloides</i>		Trembling Aspen		0		S5			G5
<i>Salix bebbiana</i>		Bebb's Willow	4	-4		S5			G5
<i>Salix eriocephala</i>		Heart-leaved Willow	4	-3		S5			G5
<i>Salix x rubens</i>		Reddish Willow		-4	-3	SNA			GNA
<b>Scrophulariaceae</b>									
<b>Figwort Family</b>									
<i>Linaria vulgaris</i>		Butter-and-eggs		5	-1	SNA			GNR
<i>Verbascum thapsus</i>		Common Mullein		5	-2	SNA			GNR
<i>Veronica officinalis</i>		Common Speedwell		5	-2	SNA			G5
<i>Veronica scutellata</i>		Marsh Speedwell	7	-5		S5			G5
<b>Solanaceae</b>									
<b>Nightshade Family</b>									
<i>Solanum dulcamara</i>		Climbing Nightshade		0	-2	SNA			GNR

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
<b>Tiliaceae</b>									
		<b>Linden Family</b>							
<i>Tilia americana</i>		American Basswood	4	3		S5			G5
<b>Ulmaceae</b>									
		<b>Elm Family</b>							
<i>Ulmus americana</i>		White Elm	3	-2		S5			G5
<b>Urticaceae</b>									
		<b>Nettle Family</b>							
<i>Boehmeria cylindrica</i>		False Nettle	4	-5		S5			G5
<i>Pilea pumila</i>		Dwarf Clearweed	5	-3		S5			G5
<i>Urtica dioica</i> ssp. <i>gracilis</i>	<i>Urtica gracilis</i>	American Stinging Nettle	2	-1		S5			G5T5
<b>Verbenaceae</b>									
		<b>Vervain Family</b>							
<i>Verbena hastata</i>		Blue Vervain	4	-4		S5			G5
<i>Verbena urticifolia</i>		White Vervain	4	-1		S5			G5
<b>Vitaceae</b>									
		<b>Grape Family</b>							
<i>Parthenocissus inserta</i>	<i>Parthenocissus vitacea</i>	Inserted Virginia-creeper	3	3		S5			G5
<i>Vitis riparia</i>		Riverbank Grape	0	-2		S5			G5
<b>MONOCOTYLEDONS</b>									
		<b>MONOCOTS</b>							
<b>Alismataceae</b>									
		<b>Water-plantain Family</b>							
<i>Alisma triviale</i>	<i>Alisma plantago-aquatica</i>	Northern Water-plantain	3	-5		S5			G5
<i>Sagittaria latifolia</i>		Broad-leaved Arrowhead	4	-5		S5			G5
<b>Araceae</b>									
		<b>Arum Family</b>							
<i>Arisaema triphyllum</i>		Jack-in-the-pulpit	5	-2		S5			G5
<b>Cyperaceae</b>									
		<b>Sedge Family</b>							
<i>Carex bebbii</i>		Bebb's Sedge	3	-5		S5			G5
<i>Carex crinita</i>		Fringed Sedge	6	-4		S5			G5
<i>Carex hystericina</i>		Porcupine Sedge	5	-5		S5			G5
<i>Carex intumescens</i>		Bladder Sedge	6	-4		S5			G5
<i>Carex lacustris</i>		Lake-bank Sedge	5	-5		S5			G5
<i>Carex lupulina</i>		Hop Sedge	6	-5		S5			G5
<i>Carex lurida</i>		Sallow Sedge	6	-5		S4S5			G5
<i>Carex pensylvanica</i>		Pennsylvania Sedge	5	5		S5			G5
<i>Carex spicata</i>		Spiked Sedge		5	-1	SNA			GNR
<i>Carex stipata</i>		Awl-fruited Sedge	3	-5		S5			G5
<i>Carex vulpinoidea</i>		Fox Sedge	3	-5		S5			G5

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
<i>Scirpus atrovirens</i>		Dark-green Bulrush	3	-5		S5			G5?
<i>Scirpus cyperinus</i>		Wool-grass	4	-5		S5			G5
<b>Dioscoreaceae</b>									
<i>Dioscorea villosa</i>	<i>Dioscorea quaternata</i>	Yam Family Wild Yam-root	7	1		S4			G4G5
<b>Iridaceae</b>									
<i>Iris virginica</i>		Iris Family Southern Blue-flag	5	-5		S5			G5
<b>Juncaceae</b>									
<i>Juncus dudleyi</i>		Rush Family Dudley's Rush	1	0		S5			G5
<i>Juncus effusus</i> var. <i>effusus</i>	<i>Juncus effusus</i> var. <i>solutus</i>	Soft Rush	4	-5		SNA			GNR
<i>Juncus tenuis</i>		Path Rush	0	0		S5			G5
<b>Lemnaceae</b>									
<i>Lemna minor</i>		Duckweed Family Lesser Duckweed	2	-5		S5			G5
<i>Spirodela polyrhiza</i>		Greater Duckweed	4	-5		S5			G5
<i>Wolffia columbiana</i>		Water-meal	4	-5		S4S5			G5
<b>Liliaceae</b>									
<i>Asparagus officinalis</i>		Lily Family Garden Asparagus		3	-1	SNA			G5?
<i>Maianthemum racemosum</i>	<i>Smilacina racemosa</i>	False Solomon's Seal	4	3		S5			G5T
<i>Polygonatum pubescens</i>		Downy Solomon's Seal	5	5		S5			G5
<b>Poaceae</b>									
<i>Agrostis gigantea</i>		Grass Family Redtop		0	-2	SNA			G4G5
<i>Agrostis stolonifera</i>		Redtop		-3		S5			G5
<i>Bromus inermis</i>		Awnless Brome		5	-3	SNA			G5TNR
<i>Dactylis glomerata</i>		Orchard Grass		3	-1	SNA			GNR
<i>Echinochloa crus-galli</i>		Common Barnyard Grass		-3	-1	SNA			GNR
<i>Elymus repens</i>		Quack Grass		3	-3	SNA			GNR
<i>Elymus virginicus</i>		Virginia Wild Rye	5	-2		S5			G5
<i>Festuca rubra</i> ssp. <i>rubra</i>		Red Fescue		1	-1	SNA			G5T5
<i>Glyceria striata</i>		Fowl Meadow Grass	3	-5		S5			G5
<i>Leersia oryzoides</i>		Rice Cut Grass	3	-5		S5			G5
<i>Leersia virginica</i>		White Cut Grass	6	-3		S4			G5
<i>Phalaris arundinacea</i> var. <i>arundinacea</i>	<i>Phalaris arundinacea</i>	Reed Canary Grass	0	-4		S5			GNR
<i>Phleum pratense</i>		Timothy		3	-1	SNA			GNR
<i>Phragmites australis</i> ssp. <i>australis</i>		European Reed				SNR			GNR



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
<i>Poa compressa</i>		Canada Blue Grass	0	2		SNA			GNR
<i>Poa palustris</i>		Fowl Meadow Grass	5	-4		S5			G5
<i>Poa pratensis ssp. pratensis</i>		Kentucky Bluegrass	0	1		SNA			G5T5
<b>Potamogetonaceae</b>									
<i>Stuckenia pectinata</i>	<i>Potamogeton pectinatus</i>	Fennel-leaved Pondweed	4	-5		S5			G5
<b>Sparganiaceae</b>									
<i>Sparganium eurycarpum</i>		Broad-fruited Bur-reed	3	-5		S5			G5
<b>Typhaceae</b>									
<i>Typha angustifolia</i>		Narrow-leaved Cattail	3	-5		SNA			G5
<i>Typha latifolia</i>		Broad-leaved Cattail	3	-5		S5			G5
<i>Typha x glauca</i>		Glaucous Cattail	3	-5		SNA			GNA

**STATISTICS**

**Species Richness**

Total Number of Species:	3274	
Native Species:	2069	63%
Exotic Species:	1205	37%
S1-S3 Species:	595	31%
S4 Species:	610	32%
S5 Species:	722	37%

**Floristic Quality Indices**

Mean Co-efficient of Conservatism (CC)	6.9	
CC 0 - 3 = lowest sensitivity	156	10%
CC 4 - 6 = moderate sensitivity	454	29%
CC 7 - 8 = high sensitivity	449	29%
CC 9 - 10 = highest sensitivity	504	32%
Floristic Quality Index (FQI)	274	

**Weedy and Invasive Species**

Mean Weediness Index:	-1.2	
-1 = low potential invasiveness	590	86%
-2 = moderate potential invasiveness	62	9%
-3 = high potential invasiveness	37	5%

**Wetland Species**

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
Mean Wetness Index				1.0					
upland				845	37%				
facultative upland				362	16%				
facultative				306	14%				
facultative wetland				308	14%				
obligate wetland				434	19%				

*\*See next page for explanation of terms\**

<b>BOTANY LIST: EXPLANATION OF TERMS</b>	
<b>Botanical and Common Name</b>	From Newmaster and Ragupathy (2012). Species requiring confirmation noted (cf)
<b>Co-efficient of Conservatism</b>	This value, ranging from 0 (low) to 10 (high), is based on a species tolerance to disturbance and fidelity to a specific habitat
<b>Wetness Index</b>	This value, ranging from -5 (obligate wetland) to 5 (upland) provides the probability of a species occurring in wetland or upland habitats
<b>Weediness Index</b>	This value, ranging from -1 (low) to -3 (high) quantifies the potential invasiveness of non-native plants. In combination with the percentage of non-native plants, it can be used as an indicator of disturbance
<b>Provincial Status</b>	Provincial ranks are used by the NHIC to set protection priorities for rare species and natural communities. These ranks are not legal designations. S4 and S5 species are generally uncommon to common in the province. Species ranked S1-S3 are considered to be rare in Ontario
<b>Local Status</b>	<b>X:</b> Native species present (collection-based) and all exotic species
	<b>R:</b> Native species locally rare (number of sites): Hamilton-Wentworth (<6 sites), Durham (<10 sites), GTA (<40 sites), Site District 6E7 (<20 sites), Oak Ridges Moraine (20 or fewer sites), Halton (<5 sites); Peterborough (suspected of being rare, 5 or fewer occurrences); CVC/Peel Region (<11 sites)
	<b>U:</b> Native species locally uncommon Hamilton-Wentworth (6-10 sites), Durham (11-20 sites), GTA (41-80 sites), Site District 6E7 (21-40 sites), Halton (5-15 sites)
	<b>E:</b> Presumed Extirpated
	<b>?:</b> More work required to determine status
	<b>H:</b> Historic record
	<b>O:</b> Only old (>20 years) records known (Peterborough)
<b>Record Type</b>	<b>SR: -</b> Sight record



<b>BOTANY LIST: EXPLANATION OF TERMS</b>		
	<b>SRP</b>	Sight record with photograph
<b>VARGA 2005 Rankings</b>	<b>+</b>	Introduced species
	<b>X+</b>	Native species that is introduced in that municipality
	<b>(+)</b>	Possibly introduced species or a native species that is introduced in some municipalities
	<b>X</b>	Common native species or an introduced species that is present
	<b>R</b>	Rare native species
	<b>E</b>	Extirpated native species that has not been re-found at its known locations or its habitat is gone
	<b>SR</b>	Species record based on a sight record (all other species records based on herbaria collections)
	<b>LR</b>	Species record based on a literature record
	<b>U</b>	Uncommon native species
	<b>R6</b>	Number of stations for a rare native species
	<b>H</b>	Historical species not seen since 1950, however its habitat is still present
	<b><u>X</u></b>	Species that occur only in the portion of site district 6E7 outside of the Greater Toronto Area
<b>TRCA Rankings</b>	<b>L5</b>	Able to withstand high levels of disturbance; generally secure throughout the jurisdiction, including the urban matrix. May be of very localized concern in highly degraded areas
	<b>L4</b>	Able to withstand some disturbance; generally secure in rural matrix; of concern in urban matrix
	<b>L3</b>	Able to withstand minor disturbance; generally secure in natural matrix; considered to be of regional concern

<b>BOTANY LIST: EXPLANATION OF TERMS</b>		
<b>TRCA Rankings (Cont'd)</b>	<b>L2</b>	Unable to withstand disturbance; some criteria are very limiting factors; generally occur in high-quality natural areas, in natural matrix; probably rare in the TRCA jurisdiction; of concern regionally
	<b>L1</b>	Unable to withstand disturbance; many criteria are limiting factors; generally, occur in high-quality natural areas in natural matrix; almost certainly rare in the TRCA jurisdiction; of concern regionally
	<b>LX</b>	Extirpated from our region with remote chance of rediscovery. Presumably highly sensitive
	<b>LH</b>	Hybrid between two native species. Usually not scored unless highly stable and behaves like a species (e.g. <i>Equisetum x nelsonii</i> )
	<b>L+</b>	Exotic. Not native to TRCA jurisdiction. Includes hybrids between a native species and an exotic
	<b>L+?</b>	Origin uncertain or disputed, i.e., may or may not be native
	<b>pL</b>	Found in natural cover, but only as planted, not regenerating
<b>Status in Region of Waterloo</b>	<p>* Significant but with the expectation that additional research may prove otherwise</p> <p>+ Significant only if demonstrably indigenous - most populations in Region of Waterloo are thought to be of non-indigenous origin</p> <p># Significant but known Region of Waterloo reports are treated as hypothetical</p> <p>The sensitivity of natural areas can be assessed through application of the Weediness Index. The Weediness Index quantifies the potential invasiveness of non-native plants, and, in combination with the percentage of non-native plants can be used as an indicator of disturbance. Values (ranging from -1 to -3) have been assigned to most non-native species based on the potential impact each species can have in natural areas:</p> <p>-1: little or no impact on natural areas (most non-native plants are in this category)</p> <p>-2: occasional impacts on natural areas, generally infrequent or localized</p> <p>-3: major potential impacts on natural areas</p>	

<b>BOTANY LIST: EXPLANATION OF TERMS</b>		
<b>Status in Regional Municipality of Niagara (Oldham 2010)</b>	<b>R:</b> <b>RH:</b> <b>U:</b> <b>C:</b> <b>DD:</b> <b>I:</b> <b>hyb:</b>	Rare, 10 or fewer post 1980 records Rare Historic, no records post 1980 Uncommon, 11-20 post 1980 records Common, more than 20 post 1980 records Data deficient, further work needed to determine status Introduced Hybrid, no Niagara status assigned
<b>Status in County Haldimand-Norfolk (Sutherland 1987)</b>	<b>R</b> <b>VU</b> <b>U</b> <b>C</b> <b>I</b> <b>X</b> <b>?</b>	Rare, 1-5 sites, number of sites indicated Very Uncommon, 6-8 sites Uncommon, 9-15 sites Common, more than 15 sites Introduced, not native Present in Haldimand-Norfolk, no status assigned Status uncertain
<b>Status in Wellington County (Frank and Anderson 2009)</b>	<b>R1</b> <b>R2</b> <b>R3</b> <b>FACW</b> <b>FAC</b> <b>FACU</b> <b>UPL</b>	1-3 sites 4-6 sites 7-10 sites (Facultative Wetland): usually occurs in wetlands, but occasionally found in non-wetlands (estimated 67-99% probability) (Facultative): equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability) (Facultative Upland): occasionally occurs in wetlands, but usually occurs in non-wetlands (estimated 1-33% probability) (Upland): occurs almost never in wetlands under natural conditions (estimated <1% probability)



<b>BOTANY LIST: EXPLANATION OF TERMS</b>			
<b>Status in Wellington County (Cont'd)</b>	<p>Further refinement of the Facultative categories is denoted by a "+" or "-" to express exaggerated tendencies for those species. The "+" denotes a greater estimated probability occurring in wetlands than species in the general indicator category, but a lesser probability than species occurring in the next higher category. The "-" denotes a lesser estimated probability of occurring in wetlands than species in the general indicator category, but a greater probability than species occurring in the next lower general category.</p> <p>Each wetland category has been assigned a numerical value to facilitate the quantification of the wetness index. The wetland categories and their corresponding values are as follows:</p> <p>OBL: -5            FACW+: -4            FACW: -3            FACW-: -2            FAC+: -1            FAC: 0            FAC-: 1            FACU+: 2            FACU: 3            FACU-: 4            UPL: 5</p>		
<b>Provincial Status</b>	<p>Provincial ranks are used by the NHIC to set protection priorities for rare species and natural communities. These rankings are based on the total number of extant Ontario populations and the degree to which they are potentially or actively threatened with destruction. The ranks are as follows:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%; text-align: center;"><b>S1</b></td> <td> <p><b>Critically Imperiled</b></p> <p>Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.</p> </td> </tr> </table>	<b>S1</b>	<p><b>Critically Imperiled</b></p> <p>Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.</p>
<b>S1</b>	<p><b>Critically Imperiled</b></p> <p>Critically imperiled in the nation or state/province because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the state/province.</p>		

## BOTANY LIST: EXPLANATION OF TERMS

### Provincial Status (Cont'd)

- S2** **Imperiled** - Imperiled in the nation or state/province because of rarity due to very restricted range, very few populations (often 20 or fewer), steep declines, or other factors making it very vulnerable to extirpation from the nation or state/province.
- S3** **Vulnerable** - Vulnerable in the nation or state/province due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation
- S4** **Apparently Secure** - Uncommon but not rare; some cause for long-term concern due to declines or other factors
- S5** **Secure** - Common, widespread, and abundant in the nation or state/province
- SH** **Possibly Extirpated (Historical)** - Species or community occurred historically in the nation or state/province, and there is some possibility that it may be rediscovered. Its presence may not have been verified in the past 20-40 years. A species or community could become NH or SH without such a 20-40 year delay if the only known occurrences in a nation or state/province were destroyed or if it had been extensively and unsuccessfully looked for. The NH or SH rank is reserved for species or communities for which some effort has been made to relocate occurrences, rather than simply using this status for all elements not known from verified extant occurrences.
- SR** **Reported** in Ontario, but without persuasive documentation.
- SX** **Presumed Extirpated** - Species or community is believed to be extirpated from the nation or state/province. Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.
- SE** **Exotic**; not believed to be a native component of Ontario's flora. Numerical rankings after SE follow designations described above
- SNA** Status not assigned.
- SU** Nation or state/province conservation status not yet assessed.

Rank ranges (e.g., S2S3) indicate that the rank is either S2 or S3, but that current information is insufficient to differentiate.

"?" following a rank indicates uncertainty about the assigned rank.

## BOTANY LIST: EXPLANATION OF TERMS

**Q**

**Questionable Taxonomy** - Taxonomic distinctiveness of this entity is questionable; resolution of this uncertainty may result in change from a species to a subspecies or hybrid, or the inclusion of this taxon in another taxon, with the resulting taxon having a lower-priority conservation status

### REFERENCES:

- |  |   |
|--|---|
| <b>Nomenclature</b>  | Newmaster, S.G., and S. Ragupathy. 2012. Flora Ontario – Integrated Botanical Information System (FOIBIS). Phase 1. University of Guelph. Canada. Available at: <a href="http://www.uoguelph.ca/foibis/">http://www.uoguelph.ca/foibis/</a>   |
| <b>Co-efficient of Conservatism, and Wetness &amp; Weediness</b> | Oldham, M.J., W.D. Bakowsky and D.A. Sutherland. 1995. Floristic quality assessment for southern Ontario. OMNR, Natural Heritage Information Centre, Peterborough. 68 pp.   |
| <b>Provincial (Ontario) Status</b>                               | Natural Heritage Information Centre (NHIC). 2016. Provincial status of plants, wildlife and vegetation communities database. <a href="http://www.mnr.gov.on.ca/MNR/nhic/nhic.html">http://www.mnr.gov.on.ca/MNR/nhic/nhic.html</a> . OMNR, Peterborough.  |
| <b>Local Status</b>  | <p>Varga, S., editor. 2005. Distribution and Status of the Vascular Plants of the Greater Toronto Area. Ontario Ministry of Natural Resources, Aurora District. 96 pp.</p> <p>Goodban, A.G. 1995. The Vascular Plant Flora of the Regional Municipality of Hamilton-Wentworth, Ontario. First Edition, Hamilton Region Conservation Authority, Ancaster, Ontario. 86 pp.</p> <p>Ministry of Natural Resources. 2004. List of Rare Vascular Plants On the Oak Ridges Moraine, Excluding Provincially and Nationally Rare Species. Technical Paper 6, Appendix A-1.</p> <p>Goodban, A.G. 2003. Nature Counts Project; Hamilton Natural Areas Inventory 2003, Species Checklist. Hamilton Naturalists Club, Hamilton, Ontario.</p> |

## BOTANY LIST: EXPLANATION OF TERMS

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Frank. R., Anderson A. 2009. The Flora of Wellington County. Wellington County Historical Society. Fergus, Ontario. 145 pp.



Table 5: Targeted Vegetation Survey Results Summary (2016)

SPECIES	PREFERRED HABITAT	HABITAT ON SUBJECT LANDS AND COMMENTS
Eastern Flowering Dogwood	Upland, dry, well-drained sugar maple dominated forests, edges, bluffs, wooded slopes	<p>Few preferred habitat areas are present, the topography being predominantly lowland</p> <p>The possible locations, such as low slopes near and along the Welland River and upland portions (i.e., ridges) of woodlots, were investigated, however, this species was not located</p>
White Wood Aster	Dry to dry-mesic deciduous woods, often on slopes	<p>The possible locations, such as low slopes near and along the Welland River and upland portions (i.e., ridges) of woodlots, were investigated, however, these were either too moist or too disturbed</p>
Swamp Rose-mallow	Edges of marshes, ponds, open areas within swamps	<p>Potentially preferred habitat is present on the Subject Lands (i.e., irrigation ponds with shoreline vegetation, small totally vegetated shallow ponds, open swale locations within treed swamps), however, the species was not located</p>
Butternut	Wide variety of habitats, including upland woods, edges of woodlands, marginal habitats, isolated trees	<p>Potentially preferred habitats are found on the Subject Lands; however, the species was not located</p>
Large Yellow Pond-lily	Aquatic habitats such as shallow ponds, open water surrounded by robust emergent, slow flowing rivers; in open situations	<p>Only one or two small ponds with open marsh vegetation are present in which the plant could have grown; however, the species was not located.</p> <p>Small semi-open ponds within treed swamps appear too shaded for the species</p>
Green Arrow-arum	Aquatic habitats such as shallow ponds, edges of marshes, treed swamps, swales and slow flowing streams; typically, in shaded or partially shaded situations	<p>Several locations where habitat appeared as potentially suitable (e.g., overgrown ponds and depressions within swamps) were checked; however, the species was not located</p>

Table 6: Amphibian Call Count Survey Results (2015)

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	A	X												Y	20
2	A													N	
1	AA						1(4)							Y	13
2	AA													N	
1	B					1(5)			1(1)					Y	>12
2	B	X												Y	12.5
3	B	X												Y	7.5
1	BB					1(1)	1(12)							Y	>5
2	BB													N	
1	C					2(20)	1(4)		1(1)					Y	30
2	C					1(2)								Y	11
3	C	X												Y	7
1	CC	X												Y	24

LEGEND:

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

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

SURVEY ROUND	STATION NUMBER	SPECIES CODE											WATER		
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
2	CC										1 (2)	1 (1)		Y	Deep
3	CC										1 (1)	1 (2)		Y	Deep
1	D						1(3)							Y	25
2	D	X												Y	19
3	D										1 (2)			Y	7
1	DD	X												Y	Deep
2	DD	X												Y	Deep
3	DD										1 (4)	1 (2)		Y	Deep
1	E					1(4)	1(8)							Y	15
2	E					1(2)								Y	4.5
3	E										1 (5)			Y	8

**LEGEND:**

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

CALL CODES	
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1	Calls can be counted without error
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**Notes:**

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+ indicates that the record was noted incidentally during a turtle basking survey conducted on June 23 2015

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	EE	X												Y	24
2	EE													N	
1	F	X												Y	Deep
2	F	X												Y	Deep
3	F	X												Y	Deep
1	FF					1(3)	1(4)							Y	15
2	FF					1(7)								Y	8
3	FF	X												Y	7.5
1	G					2(25)								Y	Deep
2	G	X												Y	Deep
3	G										1(3)			Y	Deep

**LEGEND:**

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

CALL CODES	
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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	GG		1(2)											Y	27
2	GG	X												Y	8
3	GG	X												Y	7
1	H						1(2)							Y	10
2	H													N	
1	HH	X												Y	Deep
2	HH	X												Y	Deep
3	HH									1 (1)	1 (1)			Y	Deep
1	I						1(1)		1(1)					Y	24
2	I	X												Y	Deep
3	I									1 (3)	1 (4)			Y	Deep

**LEGEND:**

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

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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	II	X												Y	Deep
2	II	X												Y	Deep
3	II										1 (1)			Y	Deep
1	J	X												Y	Deep
2	J	X												Y	Deep
3	J										1 (1)	1 (2)		Y	Deep
1	JJ	X												Y	Deep
2	JJ	X												Y	40
3	JJ										1 (1)			Y	25
1	K					1 (6)	1(4)							Y	14
2	K					1(2)								Y	18

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	<i>Anaxyrus americanus</i>
FOTO	Fowler's Toad	<i>Anaxyrus fowleri</i>
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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	K								+2		1 (5)	+4		Y	5
1	KK		1(2)											Y	Deep
2	KK	X												Y	40
3	KK	X												Y	30
1	L	X												Y	39
2	L	X												Y	Deep
3	L										1 (5)			Y	Deep
2	LL	X												Y	Deep
3	LL										1 (1)	1 (1)		Y	Deep
1	M	X												Y	Deep
2	M	X												Y	Deep

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
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		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
3	M											1 (1)		Y	Deep
2	MM	X												Y	15
3	MM													N	
1	N						1(2)							Y	8
2	N													N	
2	NN											1(1)		Y	Deep
3	NN										1 (2)	1 (1)		Y	Deep
1	O					1(1)	1(3)							Y	>13
2	O	X												Y	4
3	O	X												Y	6
2	OO	X												Y	Deep

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
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		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
3	OO										1 (1)	+1		Y	N/A
1	P	X							+2					Y	8
2	P													N	
1	Q							1(1)						Y	Deep
2	Q	X												Y	Deep
3	Q										1 (1)			Y	30
1	R								1(1)					Y	Deep
2	R	X												Y	Deep
3	R	X												Y	32
1	S								1(1)					Y	Deep
2	S	X												Y	50

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
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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	S	X												Y	33
1	T	X				1(2)								Y	Deep
2	T	X												Y	50
3	T									1 (2)				Y	30
1	U						1(5)							Y	18
2	U	X												Y	14
3	U	X												Y	5
1	V	X												Y	23
2	V	X												Y	14
3	V	X												Y	31
1	W	X												Y	17

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	<i>Anaxyrus americanus</i>
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		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)	
2	W	X													Y	Deep
3	W										1 (3)	1 (3)			Y	Deep
1	X	X													Y	20
2	X														N	
3	X	X													Y	20 (refilled)
1	Y	X													Y	Deep
2	Y	X													Y	Deep
3	Y												1 (1)		Y	Deep
1	Z							1(3)							Y	8
2	Z														N	

**LEGEND:**

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

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

**Notes:**

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 + indicates that the record was noted incidentally during a turtle basking survey conducted on June 23 2015

Table 7: Amphibian Egg Mass Survey Results (2016)

SURVEY ROUND	STATION NUMBER	SPECIES CODE											WATER		
		NOAM	AMTO	SPSA	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
1	EM1			5		25	TNTC							Y	47
2	EM1		1						5		1			Y	40
1	EM2			1			11							Y	35
1	EM3						16		1					Y	40
2	EM3													N	Dry
1	EM4						9							Y	45
2	EM4	X												Y	10
3	EM4													N	Dry
1	EM5								2					Y	60
2	EM5	X												Y	12
3	EM5													N	Dry
1	EM6	X												Y	50
2	EM6								2					Y	15
3	EM6													N	Dry



SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	SPSA	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
1	EM7						2		5					Y	40
2	EM7	X												Y	20
3	EM7													N	Dry
1	EM8	X												Y	100
2	EM8	X												Y	No visual
3	EM8	X												Y	No visual

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	<i>Anaxyrus americanus</i>
SPSA	Spotted Salamander	<i>Ambystoma maculatum</i>
GRTR	Gray Treefrog	<i>Hyla versicolor</i>
CHFR	Western Chorus Frog	<i>Pseudacris triseriata</i>
WOFR	Wood Frog	<i>Lithobates sylvaticus</i>
NLRF	Northern Leopard Frog	<i>Lithobates pipiens</i>
PIFR	Pickerel Frog	<i>Lithobates palustris</i>
GRFR	Green Frog	<i>Lithobates clamitans</i>
BULL	American Bullfrog	<i>Lithobates catesbeianus</i>
MIFR	Mink Frog	<i>Lithobates septentrionalis</i>
SPPE	Spring Peeper	<i>Pseudacris crucifer</i>

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	SPSA	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
2	EM9				1									Y	15
3	EM9													N	Dry
2	EM10	X												Y	10
3	EM10													N	Dry
2	EM11										2			Y	30
3	EM11													N	Dry
2	EM12							1						Y	40

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	<i>Anaxyrus americanus</i>
SPSA	Spotted Salamander	<i>Ambystoma maculatum</i>
GRTR	Gray Treefrog	<i>Hyla versicolor</i>
CHFR	Western Chorus Frog	<i>Pseudacris triseriata</i>
WOFR	Wood Frog	<i>Lithobates sylvaticus</i>
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SPPE	Spring Peeper	<i>Pseudacris crucifer</i>

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	SPSA	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
3	EM12													N	Dry
2	EM13				1				9 (+1)		5 (+3)			Y	100
3	EM13										4 (+1)	(+2)		Y	50
2	EM14										1			Y	30
3	EM14													N	Dry

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; numbers following a plus sign (+) indicate that incidental records were contributed from other daytime surveys (i.e. turtle basking surveys)

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOAM	No Amphibians	No amphibians despite survey effort
AMTO	American Toad	<i>Anaxyrus americanus</i>
SPSA	Spotted Salamander	<i>Ambystoma maculatum</i>
GRTR	Gray Treefrog	<i>Hyla versicolor</i>
CHFR	Western Chorus Frog	<i>Pseudacris triseriata</i>
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BULL	American Bullfrog	<i>Lithobates catesbeianus</i>
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SPPE	Spring Peeper	<i>Pseudacris crucifer</i>

TABLE 8: WILDLIFE SPECIES LIST

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
<b>ODONATA</b>							
Emerald Spreadwing	<i>Lestes dryas</i>	S5	G5			R	
Rainbow Bluet	<i>Enallagma antennatum</i>	S4	G5				
Double-striped Bluet	<i>Enallagma basidens</i>	S3	G5				
Tule Bluet	<i>Enallagma carunculatum</i>	S5	G5			C	
Familiar Bluet	<i>Enallagma civile</i>	S5	G5				
Stream Bluet	<i>Enallagma exsulans</i>	S5	G5				
Skimming Bluet	<i>Enallagma geminatum</i>	S4	G5				
Orange Bluet	<i>Enallagma signatum</i>	S4	G5				
Slender Bluet	<i>Enallagma traviatum westfalli</i>	S1	G5			Not listed	
Fragile Forktail	<i>Ischnura posita</i>	S4	G5				
Eastern Forktail	<i>Ischnura verticalis</i>	S5	G5			C	
Common Green Darner	<i>Anax junius</i>	S5	G5			C	
Unicorn Clubtail	<i>Argomphus villosipes</i>	S2S3	G5				X
Black-shouldered Spinyleg	<i>Dromogomphus spinosus</i>	S5	G5				
Common Baskettail	<i>Epithea cynosura</i>	S5	G5				
Prince Baskettail	<i>Epithea princeps</i>	S5	G5			R	
Calico Pennant	<i>Celithemis elisa</i>	S5	G5				
Halloween Pennant	<i>Celithemis eponina</i>	S4	G5				
Eastern Pondhawk	<i>Erythemis simplicicollis</i>	S5	G5			C	
Dot-tailed Whiteface	<i>Leucorrhinia intacta</i>	S5	G5				
Widow Skimmer	<i>Libellula luctuosa</i>	S5	G5			C	
Twelve-Spotted Skimmer	<i>Libellula pulchella</i>	S5	G5				
Wandering Glider	<i>Pantala flavescens</i>	S4	G5				
Eastern Amberwing	<i>Perithemis tenera</i>	S4	G5			C	
Common Whitetail	<i>Plathemis lydia</i>	S5	G5				
Ruby Meadowhawk	<i>Sympetrum rubicundulum</i>	S5	G5				
<b>BUTTERFLIES</b>							
Juvenal's Duskywing	<i>Erynnis juvenalis</i>	S5	G5				
Columbine Duskywing	<i>Erynnis lucilius</i>	S4	G4				
Least Skipper	<i>Ancyloxypha numitor</i>	S5	G5				
European Skipper	<i>Thymelicus lineola</i>	SNA	G5				
Peck's Skipper	<i>Polites peckius</i>	S5	G5				



TABLE 8: WILDLIFE SPECIES LIST

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
Northern Broken-Dash	<i>Wallengrenia egermet</i>	S5	G5				
Little Glassywing	<i>Pompeius verna</i>	S4	G5				
Hobomok Skipper	<i>Poanes hobomok</i>	S5	G5				
Black Swallowtail	<i>Papilio polyxenes</i>	S5	G5				
Eastern Tiger Swallowtail	<i>Papilio glaucus</i>	S5	G5				
Cabbage White	<i>Pieris rapae</i>	SNA	G5			IC	
Bronze Copper	<i>Lycaena hyllus</i>	S5	G5				
Hairstreak spp.	Satyrium spp.						
Summer Azure							
Pearl Crescent	<i>Phyciodes tharos</i>	S4	G5			C	
Eastern Comma	<i>Polygonia comma</i>	S5	G5				
Red Admiral	<i>Vanessa atalanta</i>	S5	G5			C	X
Red-spotted Purple	<i>Limenitis arthemis astyanax</i>	S5	G5T5				
Viceroy	<i>Limenitis archippus</i>	S5	G5				
Eyed Brown	<i>Satyrodes eurydice</i>	S5	G4				
Little Wood-Satyr	<i>Megisto cymela</i>	S5	G5				
Common Ringlet	<i>Coenonympha tullia</i>	S5	G5				
Common Wood-Nymph	<i>Cercyonis pegala</i>	S5	G5			C	
<b>AMPHIBIANS</b>							
Northern Green Frog	<i>Lithobates clamitans</i>	S5	G5			W	X
Northern Leopard Frog	<i>Lithobates pipiens</i>	S5	G5		NAR	W	X
<b>REPTILES</b>							
Midland Painted Turtle	<i>Chrysemys picta marginata</i>	S5	G5T5			W	X
Eastern Gartersnake	<i>Thamnophis sirtalis</i>	S5	G5			W	X
<b>BIRDS</b>							
Canada Goose	<i>Branta canadensis</i>	S5	G5				X
Mallard	<i>Anas platyrhynchos</i>	S5	G5				X
Great Blue Heron	<i>Ardea herodias</i>	S4	G5			U	X
Great Egret	<i>Ardea alba</i>	S2B	G5			R	X
Green Heron	<i>Butorides virescens</i>	S4B	G5			U	X
Turkey Vulture	<i>Cathartes aura</i>	S5B	G5			U	
Osprey	<i>Pandion haliaetus</i>	S5B	G5			O	X
Red-tailed Hawk	<i>Buteo jamaicensis</i>	S5	G5			U	X

TABLE 8: WILDLIFE SPECIES LIST

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNR)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
Virginia Rail	<i>Rallus limicola</i>	S5B	G5			R	X
Killdeer	<i>Charadrius vociferus</i>	S5B, S5N	G5			C	
Spotted Sandpiper	<i>Actitis macularius</i>	S5	G5			C	X
Least Sandpiper	<i>Calidris minutilla</i>	listed in NHIC					X
American Woodcock	<i>Scolopax minor</i>	S4B	G5				
Ring-billed Gull	<i>Larus delawarensis</i>	S5B,S4N	G5			C	X
Herring Gull	<i>Larus argentatus</i>	S5B,S5N	G5			U	X
Caspian Tern	<i>Hydroprogne caspia</i>	S3B	G5			U	X
Common Tern	<i>Sterna hirundo</i>	S4B	G5				X
Mourning Dove	<i>Zenaida macroura</i>	S5	G5			C	
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>	S4B	G5			U	
Eastern Screech-Owl	<i>Megascops asio</i>	S4	G5	NAR	NAR		
Great Horned Owl	<i>Bubo virginianus</i>	S4	G5				
Ruby-throated Hummingbird	<i>Archilochus colubris</i>	S5B	G5				
Belted Kingfisher	<i>Megaceryle alcyon</i>	S4B	G5			U	
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>	S4	G5			U	
Downy Woodpecker	<i>Picoides pubescens</i>	S5	G5			C	
Hairy Woodpecker	<i>Picoides villosus</i>	S5	G5			U	
Northern Flicker	<i>Colaptes auratus</i>	S4B	G5			C	
Eastern Wood-Pewee	<i>Contopus virens</i>	S4B	G5	SC	SC	C	X
Willow Flycatcher	<i>Empidonax traillii</i>	S5B	G5			U	X
Eastern Phoebe	<i>Sayornis phoebe</i>	S5B	G5			U	
Great Crested Flycatcher	<i>Myiarchus crinitus</i>	S4B	G5			C	
Eastern Kingbird	<i>Tyrannus tyrannus</i>	S4B	G5			C	
Yellow-throated Vireo	<i>Vireo flavifrons</i>	S4B	G5				
Blue-headed Vireo	<i>Vireo solitarius</i>	S5B	G5				X
Warbling Vireo	<i>Vireo gilvus</i>	S5B	G5			C	
Red-eyed Vireo	<i>Vireo olivaceus</i>	S5B	G5			C	
Blue Jay	<i>Cyanocitta cristata</i>	S5	G5			C	
Horned Lark	<i>Eremophila alpestris</i>	S4B	G5			C	
Purple Martin	<i>Progne subis</i>	S4B	G5				
Tree Swallow	<i>Tachycineta bicolor</i>	S4B	G5			C	

TABLE 8: WILDLIFE SPECIES LIST

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
Bank Swallow	<i>Riparia riparia</i>	S4B	G5	THR	THR		
Cliff Swallow	<i>Petrochelidon pyrrhonota</i>	S4B	G5			U	X
Barn Swallow	<i>Hirundo rustica</i>	S4B	G5	THR	THR	C	
Black-capped Chickadee	<i>Poecile atricapillus</i>	S5	G5			C	
Tufted Titmouse	<i>Baeolophus bicolor</i>	S4	G5				
White-breasted Nuthatch	<i>Sitta carolinensis</i>	S5	G5			U	
House Wren	<i>Troglodytes aedon</i>	S5B	G5				
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>	S4B	G5			U	
Eastern Bluebird	<i>Sialia sialis</i>	S5B	G5			U	
Wood Thrush	<i>Hylocichla mustelina</i>	S4B	G4	SC	THR	U	X
American Robin	<i>Turdus migratorius</i>	S5B	G5			C	
Gray Catbird	<i>Dumetella carolinensis</i>	S4B	G5			C	
European Starling	<i>Sturnus vulgaris</i>	SNA	G5			C	
Cedar Waxwing	<i>Bombycilla cedrorum</i>	S5B	G5			C	
Blue-winged Warbler	<i>Vermivora cyanoptera</i>	S4B	G5			U	
Tennessee Warbler	<i>Oreothlypis peregrina</i>	S5B	G5				
Nashville Warbler	<i>Oreothlypis ruficapilla</i>	S5B	G5				
Mourning Warbler	<i>Geothlypis philadelphia</i>	S4B	G5				
Common Yellowthroat	<i>Geothlypis trichas</i>	S5B	G5			C	
American Redstart	<i>Setophaga ruticilla</i>	S5B	G5				
Magnolia Warbler	<i>Setophaga magnolia</i>	S5B	G5				
Blackburnian Warbler	<i>Setophaga fusca</i>	S5B	G5				X
Yellow Warbler	<i>Setophaga petechia</i>	S5B	G5			C	
Blackpoll Warbler	<i>Setophaga striata</i>	S4B	G5				
Black-throated Blue Warbler	<i>Setophaga caeruleascens</i>	S5B	G5				X
Yellow-rumped Warbler	<i>Setophaga coronata</i>	S5B	G5				
Black-throated Green Warbler	<i>Setophaga virens</i>	S5B	G5				X
Eastern Towhee	<i>Pipilo erythrophthalmus</i>	S4B	G5				X
Chipping Sparrow	<i>Spizella passerina</i>	S5B	G5			C	
Savannah Sparrow	<i>Passerculus sandwichensis</i>	S4B	G5			C	X
Song Sparrow	<i>Melospiza melodia</i>	S5B	G5			C	
Lincoln's Sparrow	<i>Melospiza lincolni</i>	S5B	G5				
Swamp Sparrow	<i>Melospiza georgiana</i>	S5B	G5			U	

TABLE 8: WILDLIFE SPECIES LIST

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
White-throated Sparrow	<i>Zonotrichia albicollis</i>	S5B	G5				
Scarlet Tanager	<i>Piranga olivacea</i>	S4B	G5				X
Northern Cardinal	<i>Cardinalis cardinalis</i>	S5	G5			C	
Rose-breasted Grosbeak	<i>Pheucticus ludovicianus</i>	S4B	G5			C	
Indigo Bunting	<i>Passerina cyanea</i>	S4B	G5			C	
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	S4	G5			C	
Rusty Blackbird	<i>Euphagus carolinus</i>	S4B	G5	NAR	SC		
Common Grackle	<i>Quiscalus quiscula</i>	S5B	G5			C	
Brown-headed Cowbird	<i>Molothrus ater</i>	S4B	G5			C	
Orchard Oriole	<i>Icterus spurius</i>	S4B	G5			U/R	
Baltimore Oriole	<i>Icterus galbula</i>	S4B	G5			C	
Red Crossbill	<i>Loxia curvirostra</i>	S4B	G5				
American Goldfinch	<i>Spinus tristis</i>	S5B	G5			C	
House Sparrow	<i>Passer domesticus</i>	SNA	G5				
<b>MAMMALS</b>							
Eastern Gray Squirrel	<i>Sciurus carolinensis</i>	S5	G5			Not listed	
Red Squirrel	<i>Tamiasciurus hudsonicus</i>	S5	G5				
Northern Raccoon	<i>Procyon lotor</i>	S5	G5				
White-tailed Deer	<i>Odocoileus virginianus</i>	S5	G5			Not listed	X

**SUMMARY**

Total Odonata:	27
Total Butterflies:	23
Total Other Arthropods	0
Total Amphibians:	2
Total Reptiles:	2
Total Birds:	87
Total Breeding Birds:	50
Total Mammals:	4

**SIGNIFICANT SPECIES**



**TABLE 8: WILDLIFE SPECIES LIST**

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
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Global:	0
National:	5
Provincial:	5
Regional:	0
Local:	4

**EXPLANATION OF STATUS AND ACRONYMS**

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),

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.

**TABLE 8: WILDLIFE SPECIES LIST**

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
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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

**REFERENCES**

**COSSARO Status**

Endangered Species Act, 2007 (Bill 184). Species at Risk in Ontario List (O. Reg. 230/08). Accessed October 7, 2016.

**COSEWIC Status**

COSEWIC. 2016. Canadian Species at Risk. Committee on the Status of Endangered Wildlife in Canada.

**Local Status**

Dwyer, Jill K. 2003. Nature Counts Project Hamilton Natural Areas Inventory 2003. Species Checklists. Hamilton Naturalists Club.  
 Halton Natural Areas Inventory. 2006. Volume 2 Species Checklists (ISBN 0-9732488-7-4).  
 Region of Waterloo. 1996. Regionally Significant Breeding Birds.  
 Toronto and Region Conservation Authority (TRCA). 2016. Revised Fauna Scores and Ranks, February 2016  
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**TABLE 8: WILDLIFE SPECIES LIST**

COMMON NAME	SCIENTIFIC NAME	Provincial Status (S RANK)	Global Status (G RANK)	COSSARO (MNRF)	COSEWIC (Federal)	Niagara Natural Areas Inventory	SWH Indicator Species 7E
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**Significant Wildlife Habitat (SWH) Indicator Species**

Ministry of Natural Resources and Forestry (MNRF). 2015. Significant wildlife habitat criteria schedules for ecoregion 6E. Available at: <https://dr6j45jk9xcmk.cloudfront.net/documents/4775/schedule-6e-jan-2015-access-ver-final-s.pdf>.

Ministry of Natural Resources and Forestry (MNRF). 2015. Significant wildlife habitat criteria schedules for ecoregion 7E. Available at: <https://dr6j45jk9xcmk.cloudfront.net/documents/4776/schedule-7e-jan-2015-access-vers-final-s.pdf>.

Natural Heritage Information Center (NHIC). 2016. Onatrio Species List: All Species.

**Table 9: Snake Survey Results (2015)**

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
23-JU-15	1	STN 9	X														
23-JU-15	1	STN 10	X														
23-JU-15	1	STN 11	X														
23-JU-15	1	STN 12	X														
23-JU-15	1	STN 13	X														
23-JU-15	1	STN 14	X														
23-JU-15	1	STN 15							1								
23-JU-15	1	STN 16	X														

**LEGEND:**

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

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 10: Snake Survey Results (2016)**

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
6-MA-16	EMS Survey	T5				INC - 1											
11-MA-16	1	T1	X														
11-MA-16	1	T2		1													
11-MA-16	1	T3	X														
11-MA-16	1	T4		1													
11-MA-16	1	T5		1													
11-MA-16	1	T6		1													

**LEGEND:**

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

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

**INC** – Indicates an incidental record, in this case: (i) during an amphibian egg mass survey, one Brownsnake was observed on the south side of the railway crossing (on snake transect 5); and (ii) two Northern Watersnakes were recorded at turtle basking station 18

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
11-MA-16	1	T7	X														
11-MA-16	1	T8	X														
11-MA-16	1	T9	X														
11-MA-16	1	T10	X														
11-MA-16	1	T11	X														
25-MA-16	2	T1		1													
25-MA-16	2	T2		3													
25-MA-16	2	T3		2													
25-MA-16	2	T4	X														

LEGEND:

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

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

INC – Indicates an incidental record, in this case: (i) during an amphibian egg mass survey, one Brownsnake was observed on the south side of the railway crossing (on snake transect 5); and (ii) two Northern Watersnakes were recorded at turtle basking station 18

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
25-MA-16	2	T5	X														
25-MA-16	2	T6	X														
25-MA-16	2	T7	X														
25-MA-16	2	T8	X														
25-MA-16	2	T9	X														
25-MA-16	2	T10	X														
25-MA-16	2	T11	X														
25-MA-16	2	T12	X														
25-MA-16	2	T13	X														

LEGEND:

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

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

INC – Indicates an incidental record, in this case: (i) during an amphibian egg mass survey, one Brownsnake was observed on the south side of the railway crossing (on snake transect 5); and (ii) two Northern Watersnakes were recorded at turtle basking station 18

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE														
			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
25-MA-16	2	T14	X														
25-MA-16	2	T15	X														
19-SE-16	Turtle Basking Survey	Turtle Basking Station 18							INC - 2								

LEGEND:

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

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

INC – Indicates an incidental record, in this case: (i) during an amphibian egg mass survey, one Brownsnake was observed on the south side of the railway crossing (on snake transect 5); and (ii) two Northern Watersnakes were recorded at turtle basking station 18



**Table 11: Turtle Basking Survey Results (2015)**

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
23-JN-15	1	1	X								
23-JN-15	1	2	X								
23-JN-15	1	3	X								
23-JN-15	1	4	X								
23-JN-15	1	5	X								
23-JN-15	1	6		3							
23-JN-15	1	7	X								
23-JN-15	1	8	X								
23-JN-15	1	9		9							
23-JN-15	1	10		1							
23-JN-15	1	11	X								
23-JN-15	1	12	X								
23-JN-15	1	13		2							

**LEGEND:**

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

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

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
23-JN-15	1	14		3							
23-JN-15	1	15	X								
23-JN-15	1	16		5							
23-JN-15	1	17		5							

### Turtle Survey Results – Nesting

- Turtle nesting survey completed;
- 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	<i>Chrysemys picta marginata</i>
SNTU	Snapping Turtle	<i>Chelydra serpentina</i>
MATU	Northern Map Turtle	<i>Graptemys geographica</i>
BLTU	Blanding's Turtle	<i>Emydoidea blandingii</i>
SSTU	Spiny Soft-shelled Turtle	<i>Apalone spinifera</i>
WOTU	Wood Turtle	<i>Glyptemys insculpta</i>
STIN	Stinkpot Turtle	<i>Stemotherus odoratus</i>
SPTU	Spotted Turtle	<i>Clemmys guttata</i>

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 12: Turtle Basking Survey Results (2016)**

DATE SURVEYED	SURVEY ROUND	TRANSECT OR STATION NUMBER	SPECIES CODE								
			NOTU	MPTU	SNTU	MATU	BLTU	SSTU	WOTU	STIN	SPTU
06-MA-16	EMS SURVEY			INC - 1							
25-MA-16	1	STN 16		4							
27-MA-16	1	STN 18	X								
19-SE-16	2	STN 18		3	INC - 1						

**LEGEND:**

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

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

**NOTE:**

- 'INC' indicates an incidental record outside of the turtle basking survey station, in this case: (i) during an amphibian egg mass survey (EMS), one dead young-of-the-year Midland Painted Turtle was found in the rough beside the golf cart path that is northeast of turtle nesting transect 2, and (ii) one dead young-of-the-year Snapping Turtle was found on the golf path east of Crowland Avenue (northeast of turtle nesting transect 5);
- A visual turtle nesting habitat / evidence survey was completed (14 transects surveyed);
- Soil auger tests were not permitted on the active golf course, but were conducted on the agricultural fields: soil mapping indicates suitable substrate (low clay content soils) along turtle nesting transects 3, 5, 11, 12, and 14 (sand present in golf course bunkers was too shallow to support nesting); and,
- No nesting evidence (i.e., test digs, claw marks, predated nests) was observed.

**Table 13: Wildlife Road Crossing Survey Results**

SURVEY DATE	SURVEY ROUND	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
23-JU-15	1	R1	None Observed				
23-JU-15	1	R2	None Observed				
23-JU-15	1	R3	None Observed				
23-JU-15	1	R4	None Observed				

**LEGEND:**

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



Table 14: Snag Tree Density Survey Results

AREA IDENTIFICATION	COMMUNITY TYPE	AREA SIZE (HA)	CAVITY TREES	
			# OBSERVED	# / HA
Polygon 1	SWD3	1.0	2	2.0
Polygon 2	H, CUW	0.9	0	0
Polygon 3	FOD7-2	0.9	0	0
Polygon 4	FOD7-2	2.0	3	1.5
Polygon 5	FOD9	0.8	6	7.5
Polygon 6	FOD7-9	5.1	10	2.0
Polygon 7	SDW2-2	2.2	5	2.3
Polygon 8	SWD2-2	8.0	3	0.4
Polygon 9	SWT	1.8	2	1.1
Polygon 10	SWD	1.4	4	2.9
Polygon 11	FOD6-5	4.4	8	1.8
Polygon 12	H	0.8	0	0
Polygon 13	SWD2-2	4.0	1	0.3
Polygon 14	H	0.1	0	0
Polygon 15	SWD2-2	0.7	0	0
Polygon 16	H	0.2	0	0
Polygon 17	SWD5-6	0.8	0	0
Polygon 18	FOD7-5	0.4	0	0
Polygon 19	FOD/SWD	2.4	14	5.8

Table 15: Bat Acoustic Survey Results

DATE 2016	TRANSECT/ POINT COUNT	SURVEY ROUNDS	SPECIES CODE									
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	MISC.
JU 14	BT1	1	X									
JU 14	BP1	1	X									
JU 14	BT2	1	X									
JU 14	BP2	1			X	X						
JU 14	BT3	1	X									
JU 14	BP3	1		X				X				
JU 14	BT4	1	X									
JU 14	BP4	1						X				
JU 14	BT5	1	X									
JU 14	BP5	1	X									
JU 14	BT6	1	X									
JU 14	BP6	1	X									
JU 14	BT7	1	X									
JU 14	BP7	1	X									
JU 14	BT8	1	X									

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary Bat	<i>Lasiurus cinereus</i>
LANO	Silver-haired Bat	<i>Lasionycteris noctivagans</i>
EPFU	Big Brown Bat	<i>Eptesicus fuscus</i>
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>
PESU	Tri-coloured Bat	<i>Perimyotis subflavus</i>
MYLU	Little Brown Bat	<i>Myotis lucifuga</i>
MYSE	Long-eared Bat	<i>Myotis septentrionalis</i>
MYLE	Small Footed Bat	<i>Myotis leibii</i>

DATE 2016	TRANSECT/ POINT COUNT	SURVEY ROUNDS	SPECIES CODE											
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	MISC.		
JU 14	BP8	1	X											
JU 14	BT9	1	X											
JU 14	BP9	1	X											
JU 22	BT1 – SM3	2					X							
JU 22	BP1 – SM3	2	X											
JU 22	BT2	2			X	X								
JU 22	BP2	2				X								
JU 22	BT3	2	X											
JU 22	BP3	2			X									
JU 22	BT4	2				X								
JU 22	BP4	2						X						
JU 22	BT5	2		X										
JU 22	BP5	2						X						
JU 22	BT6	2	X											
JU 22	BP6	2	X											
JU 22	BT7	2	X											
JU 22	BP7	2												
JU 22	BT8	2	X											
JU 22	BP8	2	X											
JU 22	BT9	2			X	X	X							
JU 22	BP9	2				X	X							

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary Bat	<i>Lasiurus cinereus</i>
LANO	Silver-haired Bat	<i>Lasionycteris noctivagans</i>
EPFU	Big Brown Bat	<i>Eptesicus fuscus</i>
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>
PESU	Tri-coloured Bat	<i>Perimyotis subflavus</i>
MYLU	Little Brown Bat	<i>Myotis lucifuga</i>
MYSE	Long-eared Bat	<i>Myotis septentrionalis</i>
MYLE	Small Footed Bat	<i>Myotis leibii</i>

DATE 2016	TRANSECT/ POINT COUNT	SURVEY ROUNDS	SPECIES CODE											
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	MISC.		
JU 27	BT1	3	X											
JU 27	BP1	3	X											
JU 27	BT2	3					X							
JU 27	BP2	3					X							
JU 27	BT3	3					X							
JU 27	BP3	3					X							
JU 27	BT4	3	X											
JU 27	BP4	3					X							
JU 27	BT5	3	X											
JU 27	BP5	3						X						
JU 27	BT6	3					X							
JU 27	BP6	3					X							
JU 27	BT7	3	X											
JU 27	BP7	3												X
JU 27	BT8	3					X							
JU 27	BP8	3		X			X	X						
JU 27	BT9	3					X							
JU 27	BP9	3					X							

**LEGEND:**

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary Bat	<i>Lasiurus cinereus</i>
LANO	Silver-haired Bat	<i>Lasionycteris noctivagans</i>
EPFU	Big Brown Bat	<i>Eptesicus fuscus</i>
LABO	Eastern Red Bat	<i>Lasiurus borealis</i>
PESU	Tri-coloured Bat	<i>Perimyotis subflavus</i>
MYLU	Little Brown Bat	<i>Myotis lucifuga</i>
MYSE	Long-eared Bat	<i>Myotis septentrionalis</i>
MYLE	Small Footed Bat	<i>Myotis leibii</i>



Table 16: Assessment of SWH based on MNRF (2015) for Eco-region 7E

SWH TYPE	COMMENTS	SWH ASSESSMENT
<b>1. SEASONAL CONCENTRATION AREAS OF ANIMALS</b>		
<b><i>INSECTS</i></b>		
Migratory Butterfly Stopover Areas	None expected; the Subject Lands are located >5 km from Lake Ontario shoreline (> 5km).	No
<b><i>REPTILES</i></b>		
Reptile Hibernacula	Snake surveys were conducted during spring emergence. Three snake species were observed in low numbers (Brown Snake, Eastern Garter and Northern Watersnake) were observed within the Subject Lands. No hibernacula have been detected to date and no snake species of concern or congregations have been observed.	No
Turtle Wintering Areas	Turtle basking station 16 (Figure 4, Appendix A) is a natural pond that had greater than five Midland Painted Turtles observed during 2015 surveys. During a September 2016 turtle basking survey, this pond had no water (during a drought year) and suitable overwintering conditions were not present. During the September 2016 turtle basking survey, only turtle basking station 18 had water present and potentially suitable turtle overwintering conditions (muck bottom); however less than 5 turtles were observed at this pond. The only other natural pond (that existed before golf course development) – turtle	No

SWH TYPE	COMMENTS	SWH ASSESSMENT
	<p>basking station 14 – was found to be dry in September 2016 and did not offer overwintering habitat.</p> <p>Congregations of turtles were noted at several man-made ponds, however; these dug ponds are not eligible as SWH according to MNRF (2015).</p>	
<b>BIRDS</b>		
Raptor Wintering Areas	Suitable raptor wintering habitat is not present (>20 ha of a combination of forest and upland habitat).	No
Colonial Bird Nesting Sites  (Bank/Cliff; Tree/ Shrub; or Ground)	<p>There are three groups of birds that are examined within this SWH type based on their preference to nest in either: tree/shrub, bank/cliff, or ground habitat.</p> <p>Northern Rough-winged Swallow and Cliff Swallow were observed within the Subject Lands however, the relevant criteria/thresholds were not met.</p> <p>Probable breeding evidence was recorded for Green Heron, which is an indicator species of colonial nesting (tree/shrub) breeding bird SWH and marsh breeding bird SWH, at breeding bird point count station 26 (Figure 4, Appendix A) during a third round survey. One adult and two juveniles flew in from the north and landed at the small pond just west of point count 26 on July 8, 2015. No Green Heron nests were found in the trees and shrubs in the vicinity of the pond where the birds landed. The origin of the nesting site / breeding habitat is not known and could be as far away as the Welland River. This species, which may nest in a loose colony or solitarily, can fly some distance from the</p>	No

SWH TYPE	COMMENTS	SWH ASSESSMENT
	water to establish a nesting site. Two or more Green Heron nests would be required to meet the colonial nesting (tree/shrub) SWH type.	
Waterfowl Stopover and Staging Areas	Not identified on the Subject Lands.	No
Migratory and Bird and Shorebird Stopover Areas	None are expected; the Subject Lands are >5km from Lake Erie and Lake Ontario shorelines.	No
<b>MAMMALS</b>		
Deer Winter Congregation Areas	These SWH types are identified by the OMNRF. There are no deer yards or congregation areas within the Subject Lands or within 120 m of the site boundary, as per the MNRF NRVIS geographic database.	No
<b>2A. RARE VEGETATION COMMUNITIES</b>		
Bat Maternity Colonies and Hibernacula	This SWH type pertains to Big Brown Bats and Silver-haired Bats. Treed areas proposed for removal do not contain sufficient cavity trees / ha to meet the bat maternity colony SWH criteria. Cavity search transects were also conducted along the edges of treed areas to be retained; again cavity trees / ha remained too low to meet SWH criteria. It is possible	No

SWH TYPE	COMMENTS	SWH ASSESSMENT
	that the interior of the retained treed areas contain SWH however these areas are not proposed for removal.	
Rare Vegetation Types  (Cliff, Talus Slope, Sand Barren, Alvars, Old-Growth Forest, Savannah, And Tallgrass Prairie)	None identified within the Subject Lands	No
Other Rare Vegetation Types	Rare vegetation communities are present on the Subject Lands, including provincially rare (S2S3) Pin Oak deciduous swamp (SWD1-3) and a small inclusion of Buttonbush mineral thicket swamp (SWT2-4) within the central maple mineral swamp (SWD3-5) PSW located north of the rail line. Two other swamp types are dominated by Pin Oak (SWD1-5*, SWD1-6*) but no status rank is provided by NHIC	Yes
<b>2B. SPECIALIZED WILDLIFE HABITAT</b>		
<b>VEGETATION</b>		
Seeps and Springs	No seeps or springs were observed.	No



SWH TYPE	COMMENTS	SWH ASSESSMENT
<b>AMPHIBIANS</b>		
Amphibian Breeding Habitat (Within or < 120m From Woodland)	One amphibian station east of Crowland Avenue meets the woodland breeding amphibian SWH criteria: FF (PSW north of Grassy Brook Road). The SWH area is delineated on Figure 8 (Appendix A).	Yes
Amphibian Breeding Habitat (Wetland > 120m from woodland)	The following amphibian stations east of Crowland Avenue met the open wetland breeding amphibian SWH criteria: I, J, K, W and EM13 (Figure 1, Appendix B). The SWH area is delineated on Figure 8 (Appendix A).	Yes
<b>REPTILES</b>		
Turtle Nesting Areas	No direct evidence of turtle nesting (i.e. claw marks, egg shells, test dig sites) was observed during 2015 and 2016 surveys; however, a young Snapping Turtle and Midland Painted Turtle were recorded (both dead) on golf cart paths east of Crowland Ave. Soil auger tests were not permitted on active golf course lands but were conducted on the agricultural fields. Most of the site east of Crowland Avenue is dominated by tight clay soils that are not suitable for productive turtle nesting (i.e., nest would be drowned during storm events due to lack of suitable substrate). Soil mapping indicates suitable substrate (low clay content soils) along turtle nesting transects 3, 5, 11, 12 and 14 (Figure 4,	No

SWH TYPE	COMMENTS	SWH ASSESSMENT
	Appendix A1); however no nesting evidence was recorded. Sand present in golf course bunkers was too shallow to support nesting.	
<b>BIRDS</b>		
Woodland Raptor Nesting Habitat	<p>No all-natural or conifer plantation woodland/forest stands &gt;30ha with &gt;4 ha of interior habitat and no active stick nests of indicator species identified on the Subject Lands</p> <p>Suitable habitat is not present for this SWH type (i.e. forest of conifer plantation stands &gt;30 ha in size with &gt;4 ha of interior habitat). No active stick nests of the listed indicator species were identified on the Subject Lands.</p>	No
Waterfowl Nesting Areas	One indicator species were observed in low numbers offsite. Observation does not meet the threshold for significance.	No
Bald Eagle and Osprey Habitats	One individual Osprey was observed flying-over during breeding season with no breeding evidence recorded on the Subject Lands. Observation does not meet threshold for significance.	No
Woodland Area – Sensitive Breeding Bird Habitats	No indicator species were observed on the Subject Lands. The Subject Lands do not contain any interior woodland habitat greater than 200 m from the forest edge. This SWH type is not present on the Subject Lands.	No

SWH TYPE	COMMENTS	SWH ASSESSMENT
<b>3. SPECIES OF CONSERVATION CONCERN</b>		
Special Concern and Rare Wildlife Species	<p><b><u>Special Concern Species (COSSARO)</u></b></p> <p><b>Monarch:</b></p> <p>Monarch was observed in low numbers in 2012 and 2014. Large concentrations of Monarch are normally required for designation of provincially significant wildlife habitat for this species. None expected; the Subject Lands are located &gt;5 km from Lake Ontario shoreline (&gt; 5 km).</p> <p><b>Grass Pickerel:</b></p> <p>Grass Pickerel was observed in 2000. Grass Pickerel passes through the Subject Lands at some point during the year due to the proximity of off-site spawning habitat (i.e., upstream of the Subject Lands).</p> <p><b>Eastern Wood-Pewee:</b></p> <p>Eastern Wood-Pewee breeding evidence was recorded in a variety of woodlands on the Subject Lands. These woodlands provide sufficient canopy cover and height to sustain this species. Pewee is known to utilize woodlands close to human housing developments, possibly because it is less sensitive to changes in the lower levels of the forest.</p> <p><b>Wood Thrush</b></p> <p>Wood Thrush breeding evidence was recorded in two woodlands on the Subject Lands. These woodlands provide suitable nesting habitat based on available vegetation structure and layers that this species prefers.</p>	<p>No</p> <p>Yes</p> <p>Yes</p>



SWH TYPE	COMMENTS	SWH ASSESSMENT
Shrub / Early Successional Bird Breeding Habitat	No indicator species observed and one common species, Willow Flycatcher, was observed to be a probable breeder during breeding bird surveys conducted on the Subject Lands in 2015. The Subject Lands do not meet the criteria for this SWH type due to low indicator species diversity, abundance and/or habitat size.	No
Marsh Bird Breeding Habitat	<p>Probable breeding evidence was recorded for Green Heron, which is an indicator species of colonial nesting (tree/shrub) breeding bird SWH and marsh breeding bird SWH, at point count station 26 during a third round survey. One adult and two juveniles flew in from the north and landed at the small pond just west of point count 26 on July 8, 2015. No Green Heron nests were found in the trees and shrubs in the vicinity of the pond where the birds landed. The origin of the nesting site / breeding habitat is not known and could be as far away as the Welland River. This species, which may nest in a loose colony or solitarily, can fly some distance from the water to establish a nesting site.</p> <p>Two other indicator species (Sora and Virginia Rail) were recorded at point count station 24. During 2015 breeding bird surveys 2 individual Virginia Rail were observed during both second and third round surveys and one pair was observed during 2016 crepuscular bird surveys.</p> <p>The SWH criteria for marsh bird breeding habitat are not met due to the lack of nest observations for Green Heron at point count 26; and due to low diversity / abundance of indicator species at point count 24.</p>	No
<b>CRUSTACEAN</b>		
Terrestrial Crayfish	One or more Terrestrial Crayfish chimneys were observed near the edges of wetland vegetation at several golf course ponds. The presence of one or more terrestrial crayfish individuals or their chimneys (burrows) in suitable meadow marsh, swamp or moist	Yes



SWH TYPE	COMMENTS	SWH ASSESSMENT
	terrestrial sites triggers the presence of the terrestrial crayfish SWH type. The Subject Lands are located within the range of both Chimney Crayfish ( <i>Fallicambarus fodiens</i> ; S3G5) and the provincially rare Meadow Crayfish ( <i>Cambarus diogenes</i> ; S3G5) (MNR, 2014). The cultural meadow (CUM1) beside turtle basking station 15 meets the criteria to be considered terrestrial crayfish SWH (one chimney in this ELC unit at UTM 651743 4766354). Single terrestrial crayfish chimneys were observed within four golf course 'rough' areas beside fairways. The latter do not meet the SWH criteria, as they are not located within listed ELC communities.	
Amphibian Movement Corridors	<p>Amphibian movement corridors must be identified when wetland amphibian breeding SWH is identified. Wetland amphibian breeding SWH was identified at four golf course ponds (I, J, W and EMS 13) and at one natural pond (station K; Figure 1, Appendix B).</p> <p>Corridors containing water sources are usually more significant than similar corridors without water because of its importance to a variety of wildlife (MNR 2000). The most important riparian corridors should have at least 15 m of vegetation on both sides of the waterway. North of Grassy Brook Road, the Welland River, and associated PSW units that front this watercourse, would reasonably be considered a movement corridor.</p> <p>South of Grassy Brook Road, the Grassy Brook and Lyons Creek watercourse corridors serve as potential amphibian movement corridors, however, riparian vegetation is discontinuous. The vegetated corridor along the rail line also provides terrestrial linkage and movement corridor functions across the Subject Lands. The golf course ponds south of Grassy Brook Road that met wetland amphibian breeding SWH did so due to low numbers of Bullfrog, which generally do not stray far (2-3 m) from the breeding pond for foraging / overwintering functions. The same is true for a natural pond (station K; Figure 1, Appendix B).</p>	No

**Table 17: Predicted Effects, Mitigation, Enhancement and Net Effects**

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
<b>PPS NATURAL HERITAGE FEATURES</b>						
<b>1. Significant Wetlands</b>	<ul style="list-style-type: none"> <li>Within Ontario, Significant Wetlands are identified by the MNR or by their designates. Other evaluated or unevaluated wetlands may be identified for conservation by the municipality or the conservation authority               <ul style="list-style-type: none"> <li>Lower Grassy Brook and Welland River East Wetland Complexes</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Increased impervious cover related to the installation of buildings, roads and parking areas proposed adjacent to wetland unit</li> </ul>	<ul style="list-style-type: none"> <li>Potential reduction in surface water flows to the wetland features with subsequent drying and vegetation changes</li> <li>Potential reduction in habitat for species dependent upon current moisture regime</li> </ul>	<ul style="list-style-type: none"> <li>A 30 m buffer will be applied to all PSW wetlands</li> <li>A pre and post wetland water balance (to maintain pre development conditions) for the wetland to be completed by MMM Group</li> </ul>	<ul style="list-style-type: none"> <li>The PSW wetlands will be conserved, assuming the successful matching of pre and post development water balances</li> <li>Wetland features and functions will be better protected with a restored buffer (e.g., reduced overland runoff into wetland features)</li> </ul>	
<b>2. Significant Coastal Wetlands</b>	<ul style="list-style-type: none"> <li>Not Present/not applicable</li> </ul>	N/A	N/A	N/A	N/A	N/A
<b>3. Significant Woodlands</b>	<ul style="list-style-type: none"> <li>The majority of treed areas within the Subject Lands meet the definition of significant woodlands</li> </ul>	<ul style="list-style-type: none"> <li>Proposed development will encroach into woodland areas, which will result in a removal of vegetation and in some areas, along with the reduction of significant wildlife habitat (Eastern Wood Pewee, Wood Thrush)</li> <li>Removal of 7.1 ha of upland forest</li> </ul>	<ul style="list-style-type: none"> <li>Removal of habitat for Wood Thrush</li> <li>Encroachment into buffer for Eastern Wood-Pewee. Pewee is known to utilize woodlands close to human housing developments, possibly because it is less sensitive to changes in the lower levels of the forest</li> </ul>	<ul style="list-style-type: none"> <li>Woodlands located within PSW units will be protected by a 30 m buffer</li> <li>Restoration of woodland areas to the west of the Subject Lands. Restoration Plan in <b>Appendix F</b> of EIS will provide additional wooded habitat for Pewee</li> <li>Buffer setback can be enhanced through planting of native species to increase woodland area</li> </ul>	<ul style="list-style-type: none"> <li>A net increase in woodland cover; creation of 8.57 ha woodland cover, versus woodland removal of 7.10 ha</li> <li>Increase in slough forest in the study area</li> <li>Minor increase in area sensitive, woodland interior habitat</li> <li>Habitat increase for Wood Thrush and Eastern Wood-Pewee west of Subject Lands</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring to ensure the restored woodland functions as per the Ecological Restoration Plan</li> </ul>
<b>4. Significant Valleylands</b>	<ul style="list-style-type: none"> <li>The Welland River valley slopes and the river/riparian areas are defined as Significant Valleyland</li> </ul>	<ul style="list-style-type: none"> <li>No encroachment proposed in the valleyland</li> </ul>	<ul style="list-style-type: none"> <li>Valleyland will receive greater protection with the installation of a 30 m buffer</li> </ul>	<ul style="list-style-type: none"> <li>Valleyland will be protected by a 30 m buffer measured from the Welland River PSW</li> </ul>	<ul style="list-style-type: none"> <li>Potential improvements to valleyland feature and associated functions with the installation of a 30 m buffer</li> </ul>	
<b>5. Significant Wildlife Habitat</b>	<ul style="list-style-type: none"> <li>Rare vegetation communities – SWT2-4 (buttonbush mineral thicket swamp), SWD1-3 (pin oak deciduous swamp)</li> <li>Non-woodland (open wetland) amphibian breeding habitat is present at four dug ponds and one natural pond</li> <li>Woodland amphibian breeding habitat is present within a swamp</li> </ul>	<ul style="list-style-type: none"> <li>Localized areas of woodland, wetland and open water habitat removal</li> </ul>	<ul style="list-style-type: none"> <li>Four dug ponds that contain non-woodland open wetland amphibian breeding habitat will be removed. One natural pond that contains this SWH type will be protected</li> <li>Wood Thrush habitat will be removed through the removal of woodland community FOD6-5. Wood Thrush habitat in other areas will be protected (i.e.,</li> </ul>	<ul style="list-style-type: none"> <li>Creation of breeding amphibian habitat west of the Subject Lands</li> <li>Reforested buffers will improve the conservation and recovery and increase woodland area suitable for Wood Thrush and other woodland species</li> <li>The Crowland Avenue EPA woodland (west of the Subject Lands in the proposed restoration</li> </ul>	<ul style="list-style-type: none"> <li>Better connected, more robust habitat Increase wildlife habitat will be established</li> <li>The restoration and creation of habitat will extend across the Subject Lands (i.e., through expanded riparian areas and better buffered woodland features) through disturbed agricultural habitat to the west</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of restoration areas to ensure success over time</li> </ul>

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	<p>that is already identified as PSW</p> <ul style="list-style-type: none"> <li>• Eastern Wood Pewee breeding habitat within various woodlots within the Subject Lands</li> <li>• Wood Thrush breeding habitat identified within various woodlots within the Subject Lands</li> <li>• Provincially rare plant (S3) Black Gum identified in PSW north of Grassy Brook Road</li> <li>• Rare Odonates – S1 to S3 species – Slender Bluet, Unicorn Clubtail, Swamp Darner and Double-striped Bluet</li> </ul>		<p>located within the Grassy Brook PSW)</p> <ul style="list-style-type: none"> <li>• Habitat for Slender Bluet, Double-striped Bluet and Unicorn Clubtail will be removed (i.e., associated with the golf course ponds)</li> </ul>	<p>area) will be enhanced through the planting of a deciduous forest (refer to Restoration Plan, <b>Appendix F</b>) to provide habitat for Wood Thrush</p> <ul style="list-style-type: none"> <li>• A pond will be constructed in the restoration area west of the Subject Lands to provide open water habitat for Odonates (refer to Restoration Plan, <b>Appendix F</b>)</li> <li>• In addition, habitat for Monarch/odonates will be enhanced within the buffer areas (along water-course and wetland edge) through the planting of larval host and nectar producing flowers/ plants that provide a continuous source of nectar from June to late September</li> </ul>	<ul style="list-style-type: none"> <li>• No net negative effect on Significant Wildlife Habitat is predicted</li> <li>• Positive effects are expected through the creation of a more contiguous and diverse NHS</li> </ul>	
<p><b>6. Fish Habitat</b></p>	<ul style="list-style-type: none"> <li>• Present <ul style="list-style-type: none"> <li>- Grassy Brook, Lyon's Creek and Welland River</li> <li>- Grassy Brook and Lyons Creek provide Type 1 Critical warm water fish habitat. Spawning habitat for Grass Pickerel</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Indirect impacts associated with earthworks (e.g., grading, filling) and vegetation removal on the Subject Lands during construction</li> <li>• Potential for decreased surface water runoff quantity and altered runoff locations during post-construction due to stormwater</li> <li>• During construction, spills could occur from equipment and vehicles that could enter into the tributary, impairing water quality and aquatic and riparian vegetation</li> </ul>	<ul style="list-style-type: none"> <li>• No direct effects on fish habitat in Grassy Brook, Lyons Creek and Welland River</li> <li>• Indirect effects on fish habitat could occur due to potential for erosion and sedimentation from the disturbed work area during construction</li> <li>• Increased stormwater flows could result in erosion of the bed and banks of the watercourses within the Subject Lands. Increased erosion from the Subject Lands or within the creek itself could result in negative effects on fish habitat (e.g. infilling of interstitial spaces in gravelly riffles) and mortality, health effects or altered behaviour of aquatic biota (benthic invertebrates and fish)</li> <li>• During construction, water quality and vegetation could be negatively affected due to spills</li> <li>• Potential for decreased surface water quantity to the tributaries due to diversion of surface runoff</li> </ul>	<ul style="list-style-type: none"> <li>• Watercourses will be retained and will be protected with an enhanced buffer to mitigate potential effects to fish habitat and water quality</li> <li>• Implementation of erosion and sediment control measures during construction will provide protection to sensitive fish habitat in Lyons Creek, Grassy Brook and the Welland River</li> <li>• Erosion and sedimentation control measures will be installed prior to construction, or prior to the element of work, which may cause the effect</li> <li>• During construction, the contractor will have spill kits on site, manage spills accordingly, and report spills to the appropriate MOECC Spills Action Centre, if applicable</li> <li>• SWM will be designed to ensure that there will be no changes in base flow and surface water flow to watercourses resulting from an increase in impervious area within</li> </ul>	<ul style="list-style-type: none"> <li>• No net negative effects on fish habitat in Lyon's Creek, Grassy Brook and the Welland River</li> <li>• Enhancements to fish habitat will result from improved riparian systems through and upstream of the Subject Lands</li> <li>• Increased Grass Pickerel habitat will be established in the riparian systems of Grassy Brook and Lyon's Creek, through habitat improvements and through the installation of specialized, innovative spawning structures</li> </ul>	<ul style="list-style-type: none"> <li>• Construction monitoring to ensure effectiveness and maintenance of the sediment and erosion control measures throughout construction</li> <li>• Monitoring of any proposed SWM discharge flows into retained watercourses</li> <li>• Monitoring of restoration areas to ensure successful establishment of restored stream systems</li> </ul>

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
			due to proposed SWM activities	<p>the Subject Lands and from the installation of the SWM ponds</p> <ul style="list-style-type: none"> <li>• SWM ponds to be designed with bottom draw structures that will moderate the temperature of the water released by these ponds; Shading of the pond to aid cooling should be incorporated into the landscape design</li> <li>• Siltation and erosion control procedures should be utilized to reduce the entrance of sediments or other contaminants into the watercourses from SWM Ponds</li> <li>• SWM ponds should be designed to fit into the existing landform as much as possible to minimize grading works</li> <li>• The site plan will be designed such that there is no change anticipated in the post-development storm release rates to the watercourses within the Subject Lands</li> <li>• Grass Pickerel spawning habitat will be created in the upstream reaches of Grassy Brook and Lyon's Creek located in the restoration block west of the Subject Lands (refer to Restoration Plan in <b>Appendix F</b>)</li> <li>• Upstream reaches of both Grassy Brook and Lyons Creek will be enhanced through planting of a 15 m riparian planting zone (Restoration Plan, <b>Appendix F</b>)</li> </ul>		
<p>7. <b>Habitat of Endangered and Threatened Species</b></p>	<ul style="list-style-type: none"> <li>• Present <ul style="list-style-type: none"> <li>- Barn Swallow</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Barn Swallow foraging habitat (2015). Confirmed nesting habitat associated with a residence west of Crowland Road outside of the Subject Lands</li> </ul>	<ul style="list-style-type: none"> <li>• Potential removal of foraging habitat with the conversion of golf course lands to residential use</li> </ul>	<ul style="list-style-type: none"> <li>• Completion of an IGF with MNRF to address potential impacts</li> <li>• Any proposed removal of a residence west of the Subject Lands will need to be addressed through online registration with MNRF and construction of replacement nesting structure prior to demolition</li> </ul>	<ul style="list-style-type: none"> <li>• No net effects to SAR are predicted to occur given the proposed mitigation measures</li> </ul>	<ul style="list-style-type: none"> <li>• Monitoring of any installed Barn Swallow replacement structures to generate an overall benefit in terms of Barns Swallow nesting habitat</li> </ul>

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
8. Significant Areas of Natural and Scientific Interest	<ul style="list-style-type: none"> <li>Not Present</li> </ul>	N/A	N/A	N/A	N/A	N/A
<b>OTHER PROVINCIAL PLANS</b>						
1. Greenbelt Plan	<ul style="list-style-type: none"> <li>Not Present/not applicable</li> </ul>	N/A	N/A	N/A	N/A	N/A
2. Oak Ridges Moraine	<ul style="list-style-type: none"> <li>Not Present/not applicable</li> </ul>	N/A	N/A	N/A	N/A	N/A
<b>OTHER FEATURES AND FUNCTIONS</b>						
1. Other Non-PSW Wetlands	<ul style="list-style-type: none"> <li>Removal of 4.3 ha of non-PSW wetland areas</li> </ul>	<ul style="list-style-type: none"> <li>Development will occur within these localized wetlands pockets</li> </ul>	<ul style="list-style-type: none"> <li>Removal of 4.3 ha of wetland pockets</li> </ul>	<ul style="list-style-type: none"> <li>Removals will be off-set through the creation of slough forest wetland habitat within the restoration block west of the Subject Lands (refer to Restoration Plan in <b>Appendix F</b>)</li> <li>Pockets of wetlands will be associated with the enhanced creek channels for both Grassy Brook and Lyons Creek within the restoration block west of Subject Lands (refer to Restoration Plan in Appendix C)</li> </ul>	<ul style="list-style-type: none"> <li>Overall increase in wetland area and degree of ecological functions</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of restoration areas to ensure the successful establishment of restored stream systems</li> </ul>
2. Regionally and Locally Important Species	<ul style="list-style-type: none"> <li>Six species are considered rare in Niagara region (Oldham, 2010): <ul style="list-style-type: none"> <li>Fennel-leaved Pondweed;</li> <li>Greater Duckweed;</li> <li>Water-meal;</li> <li>Hispid Hedge-nettle;</li> <li>Swamp red currant; and,</li> <li>Cardinal Flower</li> </ul> </li> <li>Two Locally Rare (Niagara Region) bird species: <ul style="list-style-type: none"> <li>Virginia Rail (rare)</li> <li>Orchard Oriole (uncommon/rare)</li> </ul> </li> <li>Locally rare Odonates and Lepidoptera</li> </ul>	<ul style="list-style-type: none"> <li>Removal of some general and specialized habitat areas</li> </ul>	<ul style="list-style-type: none"> <li>Potential removal of some species due to development</li> </ul>	<ul style="list-style-type: none"> <li>The Ecological Restoration Plan (<b>Appendix F</b>) will create diverse, contiguous habitat that will contribute to increased connectivity and movement of wildlife across the broad landscape, including the Subject Lands</li> </ul>	<ul style="list-style-type: none"> <li>All species will be retained in proposed NHS; an increase in diversity is predicted</li> </ul>	<ul style="list-style-type: none"> <li>Monitoring of restoration areas to ensure the successful establishment of restored systems</li> </ul>
3. Environmentally Significant Areas	<ul style="list-style-type: none"> <li>Not Present/ Not Applicable</li> </ul>	N/A	N/A	N/A	N/A	N/A
4. Other – Presence of Species under the ESA	<ul style="list-style-type: none"> <li>Not Present/ Not Applicable</li> </ul>	N/A	N/A	N/A	N/A	N/A



















NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
<p>5. <b>Other - Presence of Species Under the Migratory Birds Convention Act</b></p>	<ul style="list-style-type: none"> <li>The federal <i>Migratory Birds Convention Act</i> (MBCA) prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests</li> </ul>	<ul style="list-style-type: none"> <li>During construction; in particular, tree removal, migratory birds, and eggs and nests of these birds could inadvertently be harmed</li> </ul>	<ul style="list-style-type: none"> <li>Inadvertent harm to migratory birds or their eggs or nests</li> </ul>	<ul style="list-style-type: none"> <li>Tree or vegetation removal should occur outside of the migratory bird-nesting window of April 1 – August 31 (approximate)</li> <li>In 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</li> </ul>	<ul style="list-style-type: none"> <li>With the implementation of the mitigation measures, no net effect is anticipated</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>

**Appendix E – Draft Secondary Plan Schedule (November 2016)**

# Schedule A to the Official Plan Land Use

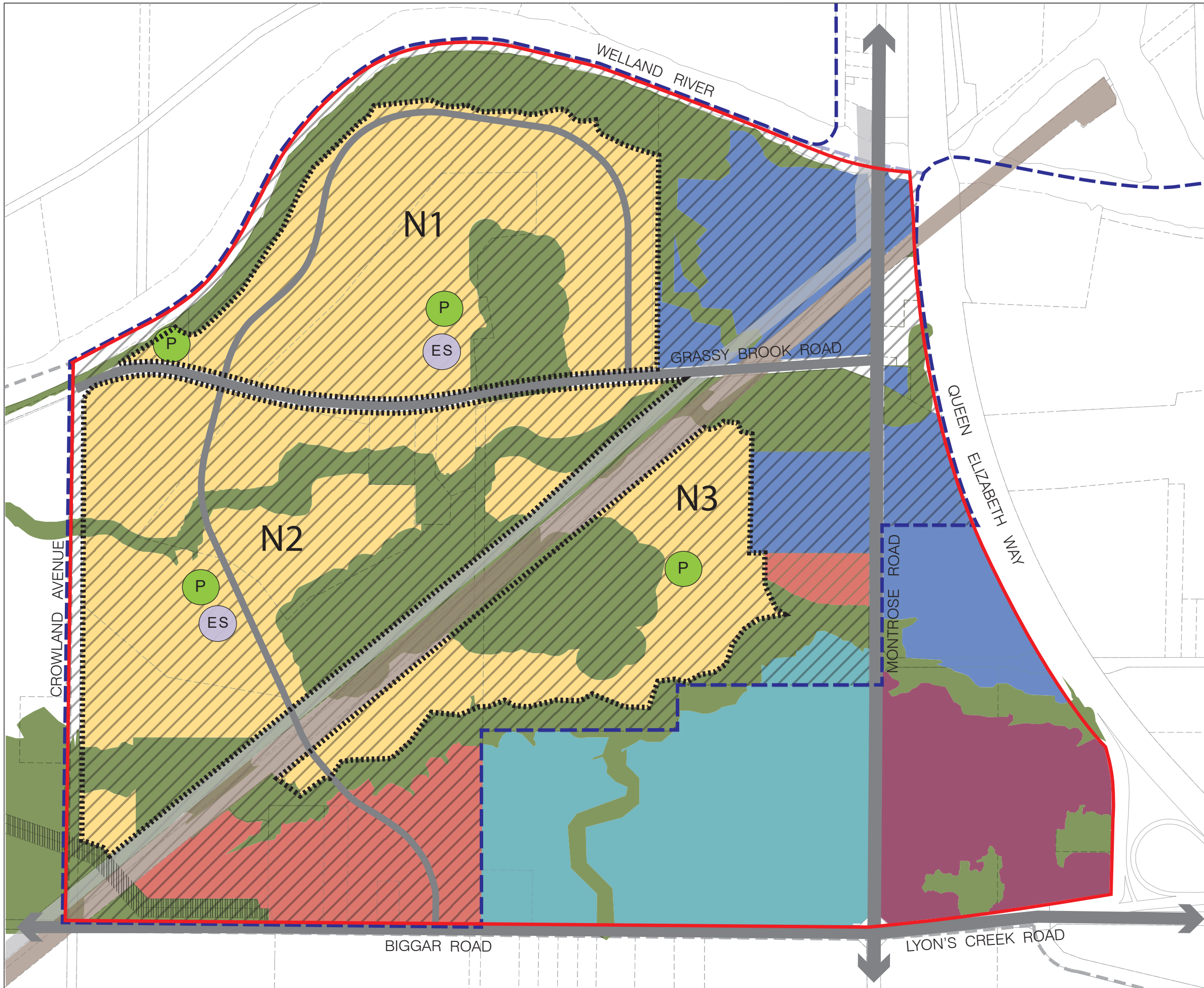
## GRAND NIAGARA SECONDARY PLAN

### Legend

-  Grand Niagara Secondary Plan
-  Urban Area Boundary
-  Lands within the Built Boundary
-  residential low / medium density
-  mixed use
-  proposed elementary school
-  open space / parkland
-  tourist commercial
-  hospital employment campus
-  employment
-  natural heritage system (see Appendix C)
-  neighbourhoods
-  roads
-  rail line
-  utility corridor
-  pipeline easement

**DRAFT**

Scale 1:8,000



**Appendix F – Ecological Restoration Plan**



# **ECOLOGICAL RESTORATION PLAN**

**GRAND NIAGARA  
NIAGARA FALLS, ON**

FEBRUARY 2017





# **Ecological Restoration Plan**

## **Grand Niagara, Niagara Falls ON**

### **Report Prepared for:**

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**Table of Contents**

**1.0 INTRODUCTION ..... 2**

**1.1 Compensation for Removal of Unevaluated Wetlands ..... 4**

**2.0 BACKGROUND..... 5**

**3.0 EXISTING ECOLOGICAL CONDITIONS ..... 6**

**3.1 Physical Setting ..... 6**

**3.2 Biological Setting..... 6**

**3.2.1 Retained Vegetation Communities ..... 6**

**3.2.2 Vegetation Proposed for Removal ..... 7**

**3.2.3 Plant Species and Vegetation Communities of Conservation Concern ..... 8**

**3.2.4 Wildlife Species of Conservation Concern..... 9**

**4.0 ECOLOGICAL RESTORATION TREATMENTS ..... 12**

**4.1 Natural Heritage System Buffers east of Crowland Avenue ..... 12**

**4.1.1 Watercourse Buffers ..... 12**

**4.1.2 Retained Woodland and Wetland Buffers ..... 12**

**4.2 Targeted Restoration Areas West of Crowland Avenue ..... 13**

**4.2.1 Watercourse Restoration Realignment Segments ..... 13**

**4.2.2 Creation of Grass Pickerel Spawning and Nursery Marsh Habitat ..... 14**

**4.2.3 Morris Road EPA Slough Forest and Swamp Creation ..... 15**

**4.2.4 Crowland Avenue Road EPA Forest Restoration ..... 16**

**4.2.5 Crowland Avenue Cultural Savannah / Thicket In-fill Forest Restoration ..... 16**

**4.2.6 Open Wetland Restoration ..... 17**

**4.2.7 Green Heron Habitat Thicket Swamp ..... 18**

**5.0 CONCLUSION ..... 19**

**REFERENCES ..... 20**

## 1.0 INTRODUCTION

This Ecological Restoration Plan (**Appendix F** to the February 2017 EIS report) has been prepared for the Grand Niagara land holdings in Niagara Falls, Ontario, (Subject Lands) (**Figure 1**). This restoration plan identifies opportunities for ecological restoration and improvement (enhancement) in response to proposed community development on the portion of the Subject Lands located east of Crowland Avenue. Ecological enhancement and restoration opportunities have been developed with an understanding of the current and historic ecological features and functions in the area.

The goal of this restoration plan is to:

*Mitigate impacts to terrestrial and aquatic ecosystems resulting from development activities east of Crowland Avenue on the Subject Lands. Predicted ecological outcomes of ecological restoration efforts east and west of Crowland Avenue include retaining, restoring and enhancing biodiversity, and promoting long-term ecological sustainability and functions of natural features.*

The restoration plan objectives are as follows:

- Realign channelized reaches of Grassy Brook and Lyons Creek to provide greater sinuosity and opportunities for the channel to interact with the floodplain (i.e., to refresh proposed new floodplain pools);
- Improve spawning habitat for Grass Pickerel, a Special Concern species in Ontario and Canada;
- Enhance and expand habitat for Monarch, which is a Special Concern species in Ontario and Endangered in Canada;
- Re-create suitable habitat for locally and provincially rare odonates that rely on open pond habitat;
- Establish vegetated buffers for retained woodlands, wetlands and watercourse corridors to improve patch shape and size and to provide associated improvements for species of conservation concern at the provincial and local levels;
- Create larger forest patches that provide >100 m interior habitat (existing conditions provide no interior forest habitat);
- Create habitat to serve the life processes of Snapping Turtle and Bullfrog (and other local open-wetland amphibians and turtles), including pond habitat that suits their habitat preferences, turtle nesting beaches and turtle overwintering habitat;
- Install specialized wildlife habitat features, including: snake hibernaculae, snake basking/foraging piles and bat boxes;

- Source all restoration plant materials from locally propagated plant materials from Seed Zone 37 that are suited to local climate, soil types and soil moisture;
- Minimize potential impacts of restoration activities on flora and fauna (i.e., commence aquatic restoration earthworks after fish spawning periods have concluded and conduct restoration in the autumn to reduce disruption to important life processes like reproduction and hibernation);
- Consider restoration opportunities for infrastructure in the development area east of Crowland Avenue, where appropriate and feasible, such as naturalized side slopes of storm water management ponds and servicing alignments;
- Contribute to the identification of suitable locations for locations for trails, interpretative signage and/or viewing platforms that will reduce potential impacts on natural features and provide opportunities for passive recreation and interaction with nature; and
- Conduct ecological monitoring of the restoration areas for a period of three years' post implementation and perform adaptive management, as practical and appropriate, to facilitate restoration trajectories.

The preliminary natural heritage system (NHS) proposed for the developable area east of Crowland Avenue is shown on **Figure 2**. (The NHS includes retained features and associated buffers as summarized below (justification for buffer widths is provided in the EIS):

- Provincially significant wetlands (30 m buffer). Note: the overall watercourse buffer for the Welland River, which is Type 1 fish habitat, is typically the greater of the 30 m fish habitat setback, the regulatory floodplain, or the limit of the meander belt - the latter (meander belt) requires input from engineering / hydrogeology;
- Welland River (30 m buffer; generally wider due to frontage by a PSW and associated buffer);
- Lyons Creek and Grassy Brook watercourses (15 m buffer; due to overlap with other retained features / buffers the average setback from each side of the watercourse is 50 m for Grassy Brook and 40 m from Lyons Creek);
- Certain retained other non-PSW wetlands (15 m buffer); and
- Retained woodlands (10 m buffer).

Restoration areas are illustrated on **Figure 3** and include: buffers applied to natural heritage features within the NHS east of Crowland Avenue (i.e., buffers of woodlands, wetlands, and watercourses) and restoration areas west of Crowland Avenue (outside the development area).

The remainder of section 1 and section 2 of this report provide further context regarding wetland replication requirements and study background information. Existing ecological conditions and proposed vegetation removal are discussed in section 3. Ecological enhancement / restoration treatments are described in section 4 and final conclusions are offered in section 5.

## 1.1 Compensation for Removal of Unevaluated Wetlands

Ontario Regulation 155/06 “NPCA: Regulation of development, interference with wetlands and alterations to shorelines and watercourses” applies to PSWs, locally significant wetlands, other wetlands that are greater than 2 ha in size and other wetlands that are less than 2 ha in size. Policy 3.24.1(a) of the NPCA (2010) “Policies, procedures and guidelines for the administration of O. Reg 155/06” states that the wetland policies apply to PSWs, locally significant wetlands and other wetlands that meet the criteria below. The wetland must be:

- i. seasonally or permanently covered by shallow water or have a water table close to or at its surface as indicated by the presence of organic soils, hydric soils, or mottles / gley within 45 cm of the soil surface;
- ii. directly contribute to the hydrological function of a watershed through connection with a surface watercourse;
- iii. have hydric soils as indicated by a soil moisture regime of 5 - 9 (Denholm, Schut, & Irvine, 1993); and
- iv. have vegetation dominated by obligate, facultative or water tolerant plant species, as defined according to the co-efficient of wetness reported by the NHIC or by NPCA staff.

In total, 4.3 ha of other non-PSW wetlands are proposed for removal east of Crowland Avenue (note: a portion of this wetland area may not meet the NPCA wetland definition provided above; however, input would be required regarding wetland catchment area in order to determine this definitively). Wetland mitigation within defined restoration areas will match the area proposed for removal (as per NPCA 2010 policy 3.21.1(e)), provide a diversity of wetland types, and mimic native species composition in the wetlands proposed for removal and retention.

Wetland compensation areas proposed west of Crowland Avenue include: deciduous treed swamp; floodplain fish spawning wetlands; riparian marsh; and open wetland restoration areas that include meadow marsh, shallow marsh and shallow aquatic vegetation communities; and shrub thicket swamp. Meadow marsh wetland restoration will also occur east of Crowland Avenue within watercourse and wetland buffers that support suitable soils and water availability. The wetland restoration areas west of Crowland Avenue provide greater than 1:1 area replacement for the other non-PSW wetlands proposed for removal.



## 2.0 BACKGROUND

Ecological studies have been conducted on the Subject Lands since the late 1990s in response to proposed development. Initial investigations pertained to the Grand Niagara Golf Course development and its associated facilities. Construction of the golf course occurred in 2002. Supplementary natural heritage studies were completed by Savanta from 2012 to 2014. In 2015, Savanta was retained to complete an in-depth analysis of the ecological landscape for the proposed development of residential and hospital land uses. Ecological inventories were updated to assist with the identification of environmental constraints and restoration opportunities as part of this EIS. Based on comments received from the NPCA (October 7, 2015), targeted ecological surveys were also carried out in 2016 specific to birds, amphibians, reptiles, bats and Species at Risk.

The following studies were referenced in the preparation of the restoration plan:

- Environmental Impact Assessment (EIA), Stantec Consulting (Formally ESG), 2001;
- Tree Preservation Plan, Stantec Consulting March 7, 2001;
- EIA Addendum Report, Stantec Consulting June 22, 2001;
- Environmental Implementation Report (EIR), Stantec Consulting, March 12, 2003; and
- Ecological Studies Baseline Report, Savanta Inc. May 2016.

### 3.0 EXISTING ECOLOGICAL CONDITIONS

#### 3.1 Physical Setting

The Subject Lands are situated in the Haldimand Clay physiographic region (Chapman and Putnam, 1984). The Lower Welland River and South Niagara Falls watersheds have predominately low groundwater vulnerability due to the thick deposits of the Haldimand Clay Plain (NPCA, 2012), resulting in poorly drained lands. The surface horizons range from 15 cm to 20 cm deep and have a clay loam to clay texture while subsoils are heavy clay.

The Welland River is located immediately north of the Subject Lands. Two intermittent watercourses cross the Subject Lands from west to east (Lyons Creek and Grassy Brook) and join the Welland River further downstream. The Upper and Lower Grassy Brook provincially significant wetland complex also occurs on the Subject Lands; many of the PSW units are associated with the aforementioned watercourses.

#### 3.2 Biological Setting

The Subject Lands occur within the Carolinian or Deciduous Forest Zone, at the northern geographic limit of many warmer climate vegetation species. Dominant upland vegetation communities found within this zone include maple-beech-elm-basswood and butternut-chestnut-white ash-black cherry. The lowland vegetation communities are dominated by single species such as white cedar, willow, tamarack, alder, red or silver maple or black ash (Rowe, 1972). A variety of locally rare species are also known to occur near the Subject Lands, including Black Gum (*Nyssa sylvatica*) and Pignut Hickory (*Carya glabra*).

##### 3.2.1 Retained Vegetation Communities

The following vegetation communities will be retained within the NHS east of Crowland Avenue:

- **Retained Woodlands** – Woodlands will be retained on the Subject Lands that are associated with provincially significant wetland (PSW) units and/or watercourses. A 10 m buffer will be applied to retained woodlands. Woodland buffers are depicted conceptually, until feature staking is completed in association with agencies (buffers are described in section 4.1.2).
- **Provincially Significant Wetlands** – The Upper and Lower Grassy Brook PSW complex occurs on the Subject Lands. East of Crowland Avenue, all PSW units will be retained and a 30 m buffer will be applied to the PSW boundary as shown on OPA 96 (**Figure 2, Appendix C**). PSW buffers are described in section 4.1.2.
- **Retained Non-PSW Wetlands** – The proposed removal of unevaluated wetlands on the Subject Lands east of Crowland Avenue will be mitigated through wetland restoration efforts. Unevaluated wetlands will be retained within the NHS where they are located within a retained woodland, PSW, watercourse or associated buffer. Additional buffers will be applied to two unevaluated wetland units described below.

- Two other non-PSW wetlands that contain provincially and globally rare Pin Oak mineral deciduous swamp (NHIC, 2013) will be retained with a 15 m wetland buffer applied to the ELC boundary of the SWD1-3 and SWD1-5 (**Figure 2**).
- The depiction of buffers applied to the SWD1-3 and SWD1-5 unevaluated wetlands is conceptual until formal staking occurs. Wetland buffers for retained features are discussed in section 4.1.2.

### **3.2.2 Vegetation Proposed for Removal**

Proposed vegetation removals are described below along with associated compensatory mitigation measures. Details regarding vegetation removal and restoration areas are provided in **Table 1**.

#### 3.2.2.1 Other Non-PSW Wetlands

Unevaluated wetlands proposed for removal east of Crowland Avenue are provincially common or apparently common vegetation types (S4 or S5) or are not ranked in Ontario (NHIC, 2016). The other non-PSW wetlands proposed for removal include portions of: mineral deciduous swamp (Green Ash swamp SWD2-2, maple swamp SWD3 and Pin Oak-ash-maple swamp SWD1-6); willow mineral thicket swamp (SWT2-2); mineral meadow marshes (MAM); mineral shallow marshes (MAS); and two dug golf course ponds that support shallow aquatic wetlands (SA) dominated by pondweed or duckweed. Except for the two aforementioned golf course ponds, the remaining golf course ponds do not support wetland vegetation according to the ELC system (they are classified as open aquatic; OAO) and no compensatory mitigation is required. Three open aquatic golf course ponds support significant wildlife habitat for wetland amphibians due to the presence of low numbers of Bullfrog. Suitable breeding habitat will be created for Bullfrog and other open wetland amphibian species west of Crowland Avenue.

In total, 4.3 ha of non-PSW wetlands are proposed for removal east of Crowland Avenue. Compensation will be provided, following NPCA (2010) policy 3.24.1(e), through wetland restoration west of Crowland Avenue that must provide at least one to one area replacement. Approximately 9.0 ha of wetland will be created west of Crowland Avenue (described further in Section 4). Wetland compensatory mitigation areas will include: deciduous swamp, thicket swamp, meadow marsh, shallow marsh and shallow aquatic vegetation communities. The restoration areas will also include specialized wildlife habitat features that will benefit reptiles, amphibians, breeding birds, mammals and insects.

In addition, the 30 m PSW buffers and 15 m watercourse buffers (where they are not already naturally vegetated) will be planted with meadow marsh seed mix where soil conditions and water availability are appropriate.

#### 3.2.2.2 Forest

In total, 7.1 ha of upland forest communities (FOD) are proposed for removal due to development on the Subject Lands east of Crowland Avenue. The woodlands proposed for removal are all deciduous forest types and include Sugar Maple hardwood forest and several lowland forest types (dominated by Pin Oak, Green Ash, Red Maple and elm species).

Woodland will be restored west of Crowland Avenue (7.5 ha) and through the planting of 10 m woodland buffers east of Crowland Avenue (1.1 ha). Woodland restoration areas west of Crowland Avenue include: slough forest (a combination of lowland and upland forest type), upland forest, and in-fill woodland restoration of an existing cultural savannah / thicket to facilitate development of a mixed forest community.

### 3.2.2.3 Other Vegetation

Other vegetation types that will be removed east of Crowland Avenue include cultural meadow, cultural thicket, and hedgerows. NHS buffers and 100 year floodline within the NHS limit, which are not already naturally vegetated, will be planted with native upland meadow seed mix or meadow marsh seed mix (as appropriate based on soils / water availability) and tree / shrub plantings described further in section 4. Considerable increases in the quality of early successional native vegetation will be achieved through the planting of NHS buffers east of Crowland Avenue. These buffers will eventually succeed to augment wetland and woodland patch sizes.

### 3.2.3 Plant Species and Vegetation Communities of Conservation Concern

No Species at Risk (SAR) plant species were identified on the Subject Lands. One provincially rare (S3; NHIC, 2016) species was recorded on-site, east of Crowland Avenue and north of Grassy Brook Road: Black Gum (*Nyssa sylvatica*). This species will be retained in-situ. In addition, provincially and globally rare mineral deciduous Pin Oak swamp occurs on the Subject Lands (SWD1-3 and SWD1-5; **Figure 2**). These two vegetation communities will be retained on the Subject Lands (discussed further in section 3.2.1).

Two plant species with high coefficients of conservation (values of 9 or 10) were recorded on-site: Black Gum and Pin Oak (*Quercus palustris*). Black Gum will be retained and Pin Oak, which is widespread on the Subject Lands, will persist in many retained vegetation communities and will also be planted in restoration areas (some removals are proposed of treed areas that contain Pin Oak).

Five locally rare plant species (Oldham, 2010) occur on the Subject Lands:

- Fennel-leaved Pondweed (*Stuckenia pectinata*);
- Greater Duckweed (*Spirodela polyrrhiza*);
- Water-meal (*Wolffia columbiana*);
- Hispid Hedge-nettle (*Stachys hispida*); and
- Cardinal Flower (*Lobelia cardinalis*).

All of these species will be protected within the retained NHS, except for Water-meal, Greater Duckweed and Fennel-leaved Pondweed. These aquatic species will be collected from existing habitats proposed for removal and transferred to the new open water wetland features west of Crowland Avenue (section 4). Waterfowl are also likely to naturally transport these aquatic plant species to newly created open water features.

Prior studies (ESG, 2003) found eight additional locally rare species (Oldham, 2010), which are listed below. Despite targeted surveys, these species were not re-located during more recent surveys conducted by Savanta.

- Purple Cress (*Cardamine douglassii*);
- Rough Hedge-nettle (*Stachys hispida*);
- Dark-purple Alexanders (*Angelica atropurpurea*);
- Rough Fleabane (*Erigeron strigosus* var. *septentrionalis*);
- Wild Red Currant (*Ribes triste*);
- Rose-twisted Stalk (*Streptopus roseus*);
- Pin Cherry (*Prunus pensylvanica*); and
- Beaked Hazel (*Corylus cornuta*).

### **3.2.4 Wildlife Species of Conservation Concern**

The EIS provides a detailed account of Species at Risk (SAR) and other wildlife of conservation concern at the local, provincial, federal and global scales. This section offers a summary of those observations.

#### Breeding Birds

Four SAR birds were recorded during ecological surveys conducted by Savanta in 2012, 2014, 2015 and 2016 (targeted SAR bird surveys are described in detail in the EIS):

- Bobolink (*Dolichonyx oryzivorus*) - Threatened in Ontario and Canada;
- Barn Swallow (*Hirundo rustica*) - Threatened in Ontario and Canada;
- Eastern Wood-Pewee (*Contopus virens*) - Special Concern in Ontario and Canada; and
- Wood Thrush (*Hylocichla mustelina*) - Special Concern in Ontario and Threatened in Canada.

No breeding evidence was recorded on the Subject Lands for Bobolink or Barn Swallow. There is no suitable breeding habitat on-site for Bobolink. No nesting sites were observed for Barn Swallow; however, suitable foraging habitat is present (i.e., woodland edges and water bodies). The creation of open water features and improved woodland edges is expected to augment foraging opportunities for Barn Swallow.

Probable breeding evidence was recorded for both Eastern Wood-Pewee (*Contopus virens*), and Wood Thrush (*Hylocichla mustelina*). Each species was observed in 7 locations on the Subject Lands. While the majority of Wood Thrush and Eastern Wood-Pewee habitat will be retained east of Crowland Avenue, adjacent site alteration will cause disturbances likely to affect Wood Thrush. Forest restoration areas west of Crowland Avenue may attract and sustain Wood Thrush. Eastern Wood-Pewee is more tolerant to disturbances and will likely remain post-development. Buffers assigned to the NHS will help to reduce impacts of adjacent development and, over time, will increase habitat patch size. Riparian plantings along Grassy Brook and Lyons Creek will also improve landscape connectivity.



Habitat restoration west of Crowland Avenue is expected to benefit four locally uncommon or rare bird species that were recorded on the Subject Lands (Oldham, 2010):

- American Woodcock (*Scolopax minor*);
- Virginia Rail (*Rallus limicola*);
- Eastern Screech-Owl (*Otus asio*); and
- Orchard Oriole (*Icterus spurius*).

### Insects

Monarch (*Danaus plexippus*) was observed, which is Special Concern in Ontario and Endangered in Canada. Three provincially rare insects were also recorded (NHIC, 2016):

- Slender Bluet (*Enallagma traviatum*) (S1);
- Unicorn Clubtail (*Arigomphus villosipes*) (S2S3);
- Swamp Darner (*Epiasechna heros*) (S2S3);
- Double-Striped Bluet (*Enallagma basidens*) (S3); and
- Terrestrial Crayfish (*Fallicambarus sp.*) (S3).

Six locally rare insect species and one historical species were observed (Oldham, 2010):

- Emerald Spreadwing (*Lestes dryas*);
- Slender Spreadwing (*Lestes rectangularis*);
- Prince Baskettail (*Epiptera cynosura*);
- Spot-winged Glider (*Pantala hymenaea*);
- Cherry-faced Meadowhawk (*Sympetrum internum*);
- Tawny-edged Skipper (*Polites themistocles*); and
- Acadian Hairstreak (*Satyrium acadicum*).

The Species at Risk butterfly (Monarch) and one local species of interest (Tawny-edged Skipper) rely on open habitat meadow areas for feeding and reproduction. Both species will continue to utilize areas of the NHS that retain suitable open habitat. The planted NHS buffers will be planted with native upland meadow and meadow marsh that will provide increased habitat for Monarch and other open-country fauna.

Three of the provincially rare species (Unicorn Clubtail, Double-striped Bluet and Slender Bluet) and all the locally rare species, except Cherry-faced Meadowhawk and Emerald Spreadwing, were found at constructed golf course ponds. The open water restoration area west of Crowland Avenue has been designed to provide suitable habitat for these species (i.e., large pond at least 1.0 ha in size with a shallow, weedy littoral zone and a smaller deep water zone). The locally rare species that utilize pond habitats may also be attracted to the smaller floodplain fish spawning marsh / pools along the riparian corridors west of Crowland Avenue (restoration areas are described in section 4).

The remaining provincially rare insect, Swamp Darner, and two locally rare species (Emerald Spreading and Cherry-faced Meadowhawk) were found in the treed swamp PSW north of Grassy Brook Road. To retain these species, particularly Swamp Darner, it will be essential that

the pre-development wetland water balance be maintained. Swamp Darner is sensitive to changes to the wetland water regime - drying conditions would likely result in this species becoming extirpated from this location. Fencing is recommended around this isolated swamp to reduce intrusion of people and pets into this sensitive unit and to guide wildlife towards the enhanced wildlife crossing / linkage that connects to the NHS south of Grassy Brook Road.

Terrestrial Crayfish SWH was found adjacent to one pond, which will be retained on the Subject Lands. There is likely already a source population of Terrestrial Crayfish associated with the EPAs west of Crowland Avenue.

### Reptiles

Snapping Turtle a Special Concern in Ontario and Canada was observed. A deceased young of the year of this species was observed on a golf cart path east of Crowland Avenue, near the club house. The open wetland restoration area west of Crowland Avenue has been designed to provide suitable habitat for Snapping Turtle and other local turtle species. Turtle nesting beaches are also proposed in this area; these features will increase the availability for nesting in the area. Enhanced wildlife crossings proposed where roads cross the NHS will help to encourage reptiles and other small to medium-sized mammals to move through culverts under the roads rather than over roads (turtles generally suffer high road mortality) (COSEWIC, 2008).

### Mammals

Four bat species were found during 2016 acoustic monitoring surveys: Big Brown Bat (*Eptesicus fuscus*), Silver-haired Bat (*Lasionycteris noctivagans*), Eastern Red Bat (*Lasiurus borealis*) and Hoary Bat (*Lasiurus cinereus*). No Species at Risk bat species were found within the Subject Lands during these targeted acoustic surveys.

According to the Province's SWH criteria for bat maternity colonies in eco-region 7E (MNRF, 2015), habitat for Big Brown Bats and Silver-haired Bats are to be considered. Bat habitat assessments found one hedgerow met the criteria for candidate bat maternity colony SWH due to the number of cavity trees. None of the woodlands on the Subject Lands met all criteria for the bat maternity colony SWH type due to low densities of suitable trees per hectare and/or low numbers of bat passes recorded.

Bat SWH is not present on-site, however, due to the decline of bat species across Ontario, bat boxes are proposed in targeted locations to improve habitat availability (section 4).

## 4.0 ECOLOGICAL RESTORATION TREATMENTS

Restoration areas are illustrated on **Figure 3**. Preliminary plant species lists for each the NHS buffer types, described below, are provided in **Table 2**. Preliminary plant species lists for the restoration areas west of Crowland Avenue are provided in **Table 3**.

### 4.1 Natural Heritage System Buffers East of Crowland Avenue

#### 4.1.1 Watercourse Buffers

Human activities (i.e., agriculture, golf course) on the watercourses east of Crowland Avenue have limited the riparian vegetation buffer zones along most watercourse corridors. A lack of riparian cover reduces ecological function and complexity of stream channels (i.e., by decreasing organic inputs into the creeks, reducing shade and increasing water temperatures). In order to enhance the Grassy Brook and Lyons Creek watercourse corridors, a 15 m buffer will be applied east of Crowland Avenue from bankfull channel. Due to the overlap of other retained features and associated buffers the average set back on each side of the watercourse is 50 m for Grassy Brook and 40 m for Lyons Creek. For the Welland River, the regulatory floodplain will be retained plus a minimum 30 m fish habitat buffer. The overall buffer from the Welland River is greater than 30 m along most of the Subject Lands due to frontage by a PSW unit and an associated buffer. Note: Once meander belt calculations have been completed, any refinements to the Welland River buffers can be identified.

Watercourse buffer planting will occur only in disturbed areas (i.e., golf course and agricultural lands) where natural vegetation does not already occur. The interior half of the watercourse buffer will be planted with riparian vegetation selected based on water availability and soil conditions. The target vegetation communities in this area include native meadow or meadow marsh (depending on water availability / soil conditions) with pockets of shrubs and trees. Species will be selected that supply shade and organic inputs to the creeks as well as plant species that support local insect communities. The outer half of the watercourse buffer will be planted with upland vegetation, including native meadow with nodal plantings of trees and shrubs.

Native plant species (forbs, graminoids, shrubs, trees) from Seed Planting Zone 37 will be selected. Where appropriate, seeds and plants collected from the areas proposed for development will be relocated for use within the restoration areas. A nurse crop will be planted to deter the establishment of invasive and non-native species while the native seed germinates. Flora will be selected based on their tolerance to existing soil type (clay), moisture conditions and light requirements.

#### 4.1.2 Retained Woodland and Wetland Buffers

Within the retained natural heritage system (NHS) east of Crowland Avenue, a 10 m buffer will be applied to retained staked woodlands, a 30 m buffer will be applied to PSW units, and 15 m to certain other non-PSW wetlands (i.e., two provincially rare Pin Oak swamp units).

Woodland and wetland buffers will be planted with meadow marsh or upland meadow seed mix (depending on soil conditions) and tree / shrub stock. Planted vegetation will be native to Seed

Planting Zone 37 and will complement the existing vegetation communities. Plant stock will be salvaged and relocated from areas proposed for development where practical. A nurse crop will be planted to deter the establishment of invasive and non-native species while the native seed germinates.

The upland portion of PSW buffers will also be examined at detailed design for the placement of specialized wildlife habitat features, including: raptor perches (dead snags), constructed snake hibernacula, snake basking / foraging piles, and bat boxes or artificial bark. Bat boxes or artificial bark will be placed on the edge of retained features on large branches or trunks with good southerly sun exposure or on standing snags at the feature edge (per Toronto Zoo, 2016). The other specialized wildlife habitat features will be placed in more secluded areas set back from trails and roads.

The planting of NHS buffers will result in the creation of interior woodland habitat > 100 m from edge (0.4 ha) for the central PSW unit located south of the rail line. No interior woodland habitat occurs under existing conditions.

## **4.2 Targeted Restoration Areas West of Crowland Avenue**

### ***4.2.1 Watercourse Restoration Realignment Segments***

Grassy Brook crosses the northern portion of the Subject Lands from west to east and a tributary of Lyons Creek crosses the southern portion of the site from west to east. A review of aerial imagery identified historic meander sites within the stream corridors of both watercourses that have been channelized. In most locations along the creek corridors, riparian vegetation has been cleared up to the margins of the watercourses to facilitate farming. Channelization of the watercourses promotes bank and channel bed erosion and entrenchment resulting in decreased watercourse stability, loss of connection to the floodplain and an overall decline in ecological function and habitat availability. Through the application of best management practices, the restoration plan will improve environmental conditions within Grassy Brook and the Lyons Creek Tributary, with a focus on providing spawning and nursery habitat for Grass Pickerel, which is known to inhabit both watercourses on a seasonal basis.

Within channelized areas, local realignments will use historic meander locations, where possible, with suitable substrate and floodplain connectivity to help facilitate the successful realignment of the channels. The local channel realignment segments will be designed using natural channel design principles, with incorporation of bioengineering materials to provide bank stability and increase riparian and aquatic habitat features within the system. The substrate, instream vegetation and water depth of the realigned segments will be designed to complement the existing features and habitat present throughout the watercourse. Only small portions of each watercourse will be realigned to enhance the system and promote a natural state of equilibrium. For each watercourse, a 15 m buffer will be applied east of Crowland Avenue measured from the bankfull channel. Watercourse buffers are described further in section 4.1.1.

Within the Grassy Brook watercourse, two channelized segments of the creek west of Crowland Avenue will be realigned to restore the historic meander. Two channelized sections of the Lyons Creek watercourse west of Crowland Avenue have also been selected for realignment. The realigned segments will naturalize these portions of the watercourses and increase the width of

vegetated riparian areas to improve overall water quality. Specifically, the most westerly realignment segment of Lyons Creek will be directed towards the Morris Road EPA (through a restored deciduous swamp). Currently, this segment of the reach runs as a ditch along Biggar Road for approximately 110 m. Realigning this segment away from the roadside is anticipated to reduce the nutrient and sediment load into the system from the resultant road runoff. Other realignments will occur along agricultural lands, where the watercourses were previously channelized for agricultural purposes. The stream is degraded and contains little to no natural sinuosity with little bank stabilizing vegetation, resulting in severe bank erosion.

Restoration techniques will improve fish habitat for warmwater fish species, including common baitfish, Grass Pickerel and Northern Pike (*Esox lucius*). To promote a diversity of habitat functions, woody debris installation is proposed within the Grassy Brook and Lyons Creek Tributary to provide cover for fish, periphyton attachment sites and benthic invertebrate production areas. Root wad and log revetments will be secured along stream banks within the channel during channel realignment. Woody debris materials will be recovered from the developable area and repurposed as stream habitat. Other structures, such as live crib walls will also be considered to provide additional instream habitat, depending on watercourse depths and suitability.

#### **4.2.2 Creation of Grass Pickerel Spawning and Nursery Marsh Habitat**

Grassy Brook and the Lyons Creek Tributary have both been identified as habitat for Grass Pickerel, which is designated as Special Concern in Ontario and Canada. As intermittent watercourses, the primary functions for Grass Pickerel appear to be provision of spawning and nursery habitat. Grass Pickerel typically occur in wetland-associated streams with organic substrates and occasionally occupy creeks used for agricultural drainage. Specific habitat requirements include permanent pool habitat, low flow velocity and an abundance of aquatic vegetation for refuge and spawning. Occupied watercourses are generally less than 2 m in depth and may contain woody debris cover to facilitate ambush predation. Grass Pickerel typically spawn in early spring and spawning habitat typically consists of flooded terrestrial and wetland vegetation on the margins of watercourses or in the adjacent floodplain. The hydrology of potential spawning areas must provide wetted habitat for a period of at least five weeks to provide suitable spawning, incubation and early nursery habitat for Grass Pickerel. Spawning typically occurs at water temperatures between 8°C to 12°C, with eggs hatching 11 days to 15 days later (COSEWIC, 2005).

Realigning segments of the Grassy Brook and Lyons Creek channels will leave several previously channelized corridors disconnected from the watercourses. These areas provide suitable substrate for the development of wetland pools designed to function as refuge sites and nursery areas Grass Pickerel (**Figure 4**). The online Grass Pickerel pools will be created along the meander bends using J-hooks to provide back-eddies into the pool. This will allow the pool to stay hydrologically connected while the watercourse is wet. When the water levels decrease, there is no chance for Grass Pickerel to be isolated and stranded in the online pools. The online pools will provide a refuge pool behind the J-Hook, which is composed of gravel and woody debris for increased habitat function. Along the margin of the pools, emergent and terrestrial vegetation will be planted to provide suitable spawning and nursery habitat. Shallower areas will support facultative plant species tolerant of seasonal flooding, as Grass Pickerel spawning sites are often associated with flooded terrestrial vegetation (DFO, 2016b).



A total of three floodplain pools are proposed along the existing corridors of Grassy Brook and Lyons Creek and are illustrated on **Figure 3**. The pool features will be installed outside of the Grass Pickerel spawning season (late March to early May) and buffered by an approximately 30 m riparian zone. The riparian zone (outside of the spawning pools and channel) will be planted with native meadow marsh seed mix. Ministry of Natural Resources and Forestry (MNR) and Fisheries and Oceans Canada (DFO) will be consulted regarding Grass Pickerel habitat creation, as well as channel realignment and other proposed restoration measures.

#### **4.2.3 Morris Road EPA Slough Forest and Swamp Creation**

The EPA forest northwest of the Morris Road and Biggar Road intersection (referred to as the Morris Road EPA) is the focus of a targeted restoration area. The Morris Road EPA is a mixture of lowland forest and treed swamp that is considered a regionally significant woodland and a provincially significant wetland. The canopy is dominated by Red Oak, Sugar Maple, Shagbark Hickory, Black Cherry, Ironwood and ash species (the latter are dead or declining). Under existing conditions, the Morris Road EPA does not contain any interior woodland habitat (i.e. >100 or >200 m from edge).

The creation of a slough forest (2.8 ha) is proposed on the east side of the Morris Road EPA where aerial imagery shows evidence of surficial pooling that would support the creation of this specialized forest type. The clay and silty clay soil profiles of the Haldimand Clay Plain support naturally occurring slough forests, such as the Heartland Forest located 3 km northeast of the Subject Lands. Slough forests are topographically diverse, containing upland ridges and lowland troughs that support a variety of moisture conditions. The slough forest restoration area is expected to support upland and lowland forest types dominated by oak, maple and hickory species. Targeted micro-grading will also be conducted in the slough forest restoration area to create depressional areas to support temporary vernal pools suitable for woodland pool-breeding amphibians (discussed further in section 4.2.3.1).

The creation of a mineral deciduous swamp (1.2 ha) is proposed outside the southeast corner of the Morris Road EPA that will border the slough forest restoration area. The deciduous swamp will be situated adjacent to the riparian area of Lyons Creek (targeted grading may be required to improve water retention to support a swamp dominated by maple and oak species). The slough forest and swamp restoration areas were strategically placed in order to create 0.3 ha of interior forest habitat >100 m from edge. The overall restoration of lands adjacent to the Morris Road EPA will also provide a north-south connection between the Lyons Creek and Grassy Brook watercourse corridors.

Planted species will be native to Seed Planting Zone 37, simulate species composition in areas proposed for removal on the developable lands, and complement species composition in the adjacent Morris Road EPA. Mulch will be applied to tree and shrub beds and rodent guards will be applied to tree plantings to prevent stem damage. Groundcover species will be seeded throughout the remainder of the rehabilitation area (beyond tree / shrub plantings), except for within created vernal pool areas.

A variety of guidelines will be referenced for forest habitat restoration, including guidelines available from Society for Ecological Restoration (2016), Toronto Region Conservation Authority (2004a and 2004b) and Conservation Halton (2010). These resources will be supplemented

with Savanta's ecological restoration experience.

#### 4.2.3.1 Salamander Habitat Creation

Ecological surveys of the Subject Lands identified suitable habitat for pool-breeding salamanders in several of the woodland features. *Ambystoma* salamanders, such as Spotted Salamander (*Ambystoma maculatum*) and Blue-spotted Salamander (*Ambystoma laterale*), generally live in deciduous forests among moist, loose soil and under logs or leaf litter. During the early spring, these species migrate to woodland ponds and wetlands to breed and deposit eggs on submerged woody debris and vegetation.

The creation of vernal pools within the slough forest restoration area (section 4.2.3) will provide suitable habitat for woodland pool-breeding salamanders and other amphibians that utilize similar conditions, such as Wood Frog (*Lithobates sylvaticus*), Western Chorus Frog (*Pseudacris triseriata*), Spring Peeper (*Pseudacris crucifer*), and Gray Treefrog (*Hyla versicolor*). Woody debris recovered from the development area will also be distributed in the slough forest restoration area to provide refugia for adult salamanders.

#### 4.2.4 Crowland Avenue Road EPA Forest Restoration

Forest restoration is proposed to connect the Lyons Creek watercourse and the Crowland Avenue EPA (**Figure 3, Appendix C**). The Crowland Avenue EPA is located northwest of Crowland Avenue and Biggar Road and contains regionally significant woodland, a provincially significant wetland and significant wildlife habitat.

Restoring the area between the Crowland Avenue EPA and Lyons Creek will improve landscape connectivity and create interior woodland habitat >100 m from edge (0.03 ha). No interior woodland habitat occurs under existing conditions.

Planted species will be native to Seed Planting Zone 37 and will include species that are appropriate for the target upland forest community, mimic and replicate species composition in areas proposed for removal on the development lands, and will complement species composition in the adjacent Crowland Avenue EPA and Lyons Creek watercourse corridor.

#### 4.2.5 Crowland Avenue Cultural Savannah / Thicket In-fill Forest Restoration

West of Crowland Avenue, an existing cultural vegetation complex borders the south side of Lyons Creek. This area is a mixture of White Pine cultural savannah and Grey Dogwood cultural thicket (CUS1-4 / CUT1-4) that is cut off from the Crowland Avenue EPA woodlot, located due south, by a pipeline easement. The cultural savannah community is composed of widely spaced young White Pine (*Pinus strobus*) trees that were originally planted in somewhat regular rows, but have since been left unmanaged. The spaces between the pines are covered by cultural thicket - which is dominated by Grey Dogwood and White Meadowsweet (*Spiraea alba* var. *alba*) - and old field meadow.

Targeted in-fill restoration is proposed within the CUS1-4 / CUT1-4 in order to increase species diversity and facilitate the development of a mixed forest (FOM) over time. In-fill activities include select thinning of White Pine, planting of oak species, and planting herbaceous species

within open meadow portions that are preferred by Monarch and pollinator insects (refer to **Table 3**).

#### **4.2.6 Open Wetland Restoration**

Development of the Subject Lands east of Crowland Avenue will result in the removal of nine golf course ponds. Four of the dug / golf course ponds support open wetland amphibian breeding SWH due to the presence of low numbers of Bullfrog (*Lithobates catesbeiana*). Reptiles and calling amphibians were recorded in a variety of golf course ponds, though SWH thresholds were not crossed.

In order to mitigate for the loss of open wetland habitat east of Crowland Avenue, the construction of a naturalized open wetland is proposed northeast of the Morris Road EPA. The open wetland restoration will be a 2 ha area comprised of an open pond wetland (1 ha of shallow aquatic and open water) and a surrounding shallow marsh mixed with meadow marsh (1 ha). The pond will be designed to meet the specialized habitat needs of Bullfrog, Snapping Turtle, several provincially rare insects (Double-striped Bluet, Slender Bluet and Unicorn Clubtail) and locally rare insects observed at golf course ponds east of Crowland Avenue. The pond may also benefit a variety of other wildlife species that depend on open water wetlands, such as other turtles, amphibians, watersnakes, odonates, and marsh birds (i.e., Virginia Rail).

The open pond wetland (1.0 ha) will contain a broad littoral shoreline area (water depth of 0.3 to 0.6 m) that will cascade down to a smaller deep-water zone that reaches depths of 2 m to 3 m. The open water portion of the wetland will be lined with organic sediment to a minimum depth of 30 cm to provide sufficient overwintering habitat for species that burrow into muck for hibernation. Floating logs will be installed along the pond margins to provide basking sites.

The littoral pond fringe will be planted with emergent and submergent vegetation with high wildlife value (**Table 3**). Cattail species (*Typha sp.*) will not be planted in order to allow the planted species to establish without the competition and overcrowding characteristic of cattails.

Amphibians and turtles presently located in golf course ponds proposed for removal will be relocated to a retained natural pond within the NHS east of Crowland Avenue and to the open wetland restoration area west of Crowland Avenue (**Figure 3**). In the event that site alteration commences before the open wetland restoration area is implemented, Savanta will work with the MNR to identify a local site for release of rescued wildlife.

##### **4.2.6.1 Turtle Nesting Beaches**

Snapping Turtle nesting areas generally occur along sand or gravel banks above the waterline where clutches are buried to a depth up to 18 cm (COSEWIC, 2008), while Blanding Turtle clutches are buried to 12 cm depth (Standing et al., 1999), and Midland Painted Turtle nesting occurs at 10 cm depth (Toronto Zoo, 2017). The high clay soil content of the restoration area is not conducive to Snapping Turtle nesting. To create opportunities for nesting habitat, 2 to 3 sand/gravel nesting beaches will be created along south and southeast-facing slopes adjacent to the open wetland restoration area. The nesting beaches will extend to a minimum depth of 55 cm and will match existing grades to ensure sufficient drainage of the nesting area (COSEWIC, 2008).

#### **4.2.7 Green Heron Habitat Thicket Swamp**

Green Heron (*Butorides virescens*) is an indicator species of marsh and colonial nesting breeding bird SWH. Probable Green Heron breeding evidence was recorded on the Subject Lands during 2015 surveys; however, no nests were observed. Green Herons typically occupy dense thickets with abundant overhanging branches to conceal nest sites and occasionally occupy reed or cattail marshes and orchards. Platform stick nests are built on large branches at heights of 1.5 m to 9 m (Cornell Lab of Ornithology, 2015).

Green Heron nesting habitat is likely to occur in Willow (*Salix sp.*) and Buttonbush (*Cephalanthus occidentalis*) communities near watercourses. To encourage Green Heron colonization, 0.3 ha of thicket swamp will be planted between the Morris Road EPA woodland (fronting the open wetland restoration area) and the Grassy Brook watercourse corridor. Plant species have been selected specifically to suit the habitat preferences of Green Heron (**Table 3**). The open wetland restoration area will also provide suitable foraging habitat for this species.

## 5.0 CONCLUSION

The natural heritage system (NHS) proposed east of Crowland Avenue and ecological restoration works west of Crowland Avenue have been designed to mitigate the impacts of the proposed development on the Subject Lands. The NHS east of Crowland Avenue includes the following buffers: provincially significant wetlands (30 m), Welland River (30 m and wider in some areas due to frontage by a PSW and associated buffer), Lyons Creek and Grassy Brook watercourses (15 m; due to overlap with other retained features / buffers average set back from each side of the watercourse is 50 m for Grassy Brook and 40 m for Lyons Creek), certain retained unevaluated wetlands (15 m), and retained woodlands (10 m). The restoration plan provides greater than 1:1 replacement area for the proposed removal of other, non-PSW wetlands and woodlands due to development of the Subject Lands.

The NHS and restoration activities will maintain, restore and enhance ecological features and functions (including a diversity of restored vegetation communities and specialized wildlife habitats), improve landscape connectivity and forest / wetland patch size, create interior forest habitat >100 m from forest edge (in two locations west of Crowland Avenue and in one location east of Crowland Avenue), and improve habitats for species of conservation concern (i.e., Grass Pickerel, Barn Swallow, Eastern Wood-Pewee, Wood Thrush, Green Heron, bats, turtles, open wetland and woodland amphibians, and provincially rare insects).

Measures are also provided to facilitate wildlife movement within the NHS; i.e., enhanced wildlife crossings to guide small and medium-sized animals through culverts beneath roadways; and a wildlife linkage to connect the NHS portions that are separated by Grassy Brook Road.

Cumulatively, this restoration plan provides mitigation for predicted development impacts and strategically amasses upland and wetland vegetation around existing high quality Environmental Protection Areas west of Crowland Avenue. The Plan increases and improves wetland extent and ecological functions, with the establishment of innovative fish spawning habitat within the Grassy Brook and Lyons watercourses west of Crowland Avenue and the result of the proposed Plan is the establishment of an enhanced, robust and interconnected natural heritage system.

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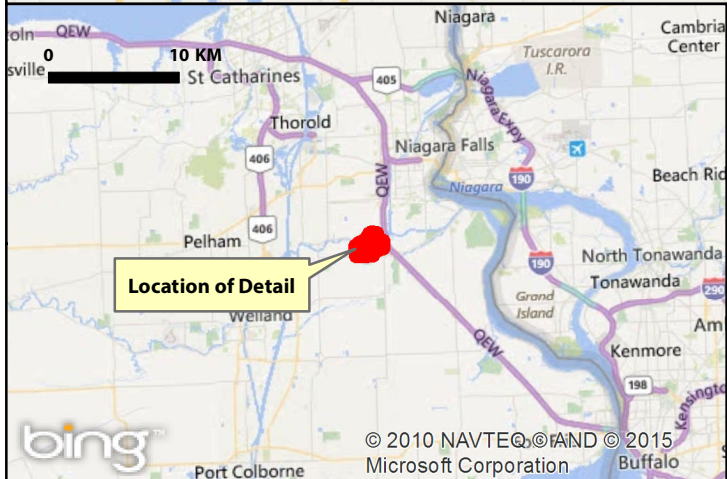
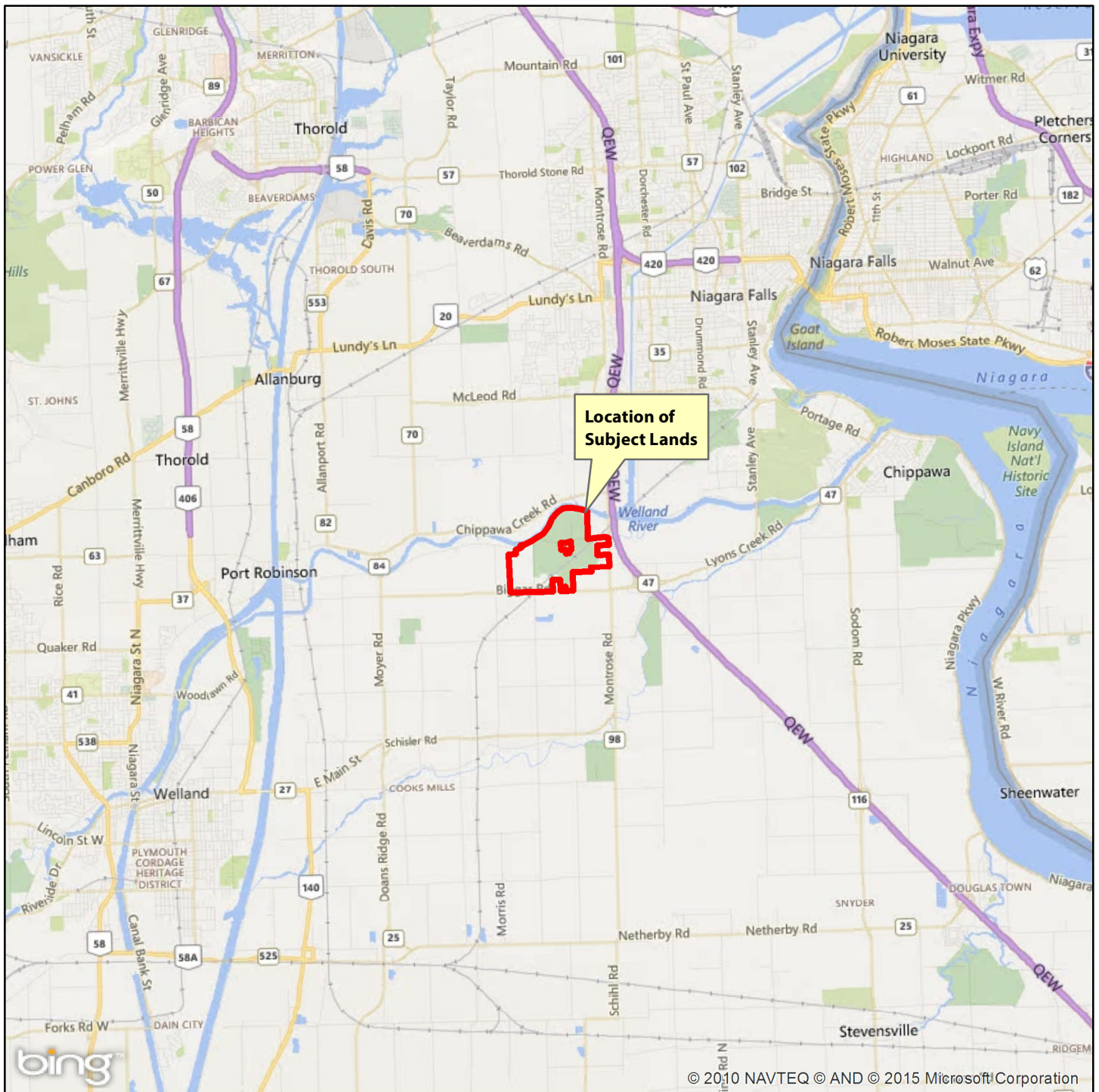
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**FIGURES**



**Grand Niagara**

Figure 1 Location of Subject Lands

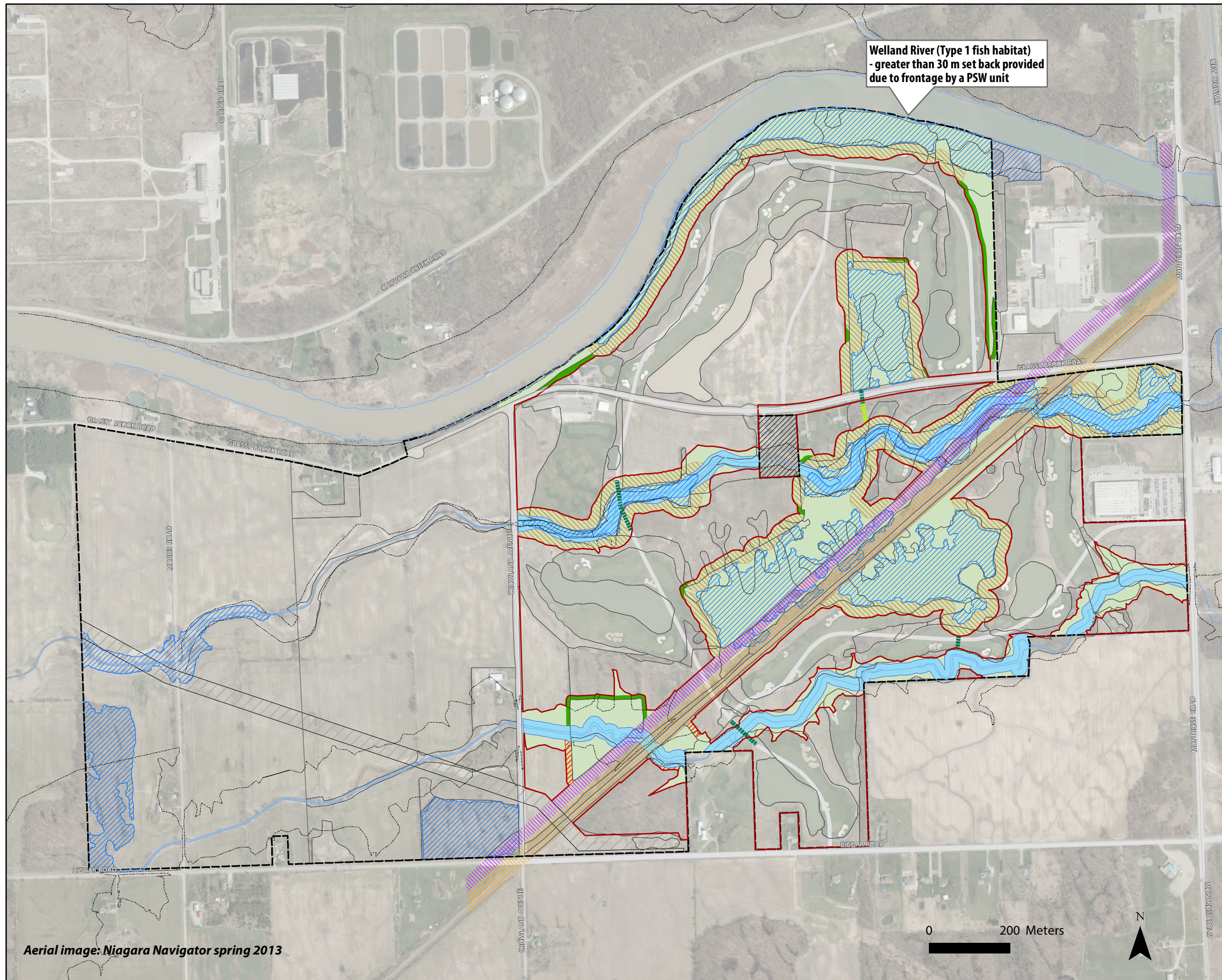
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**SAVANTA**





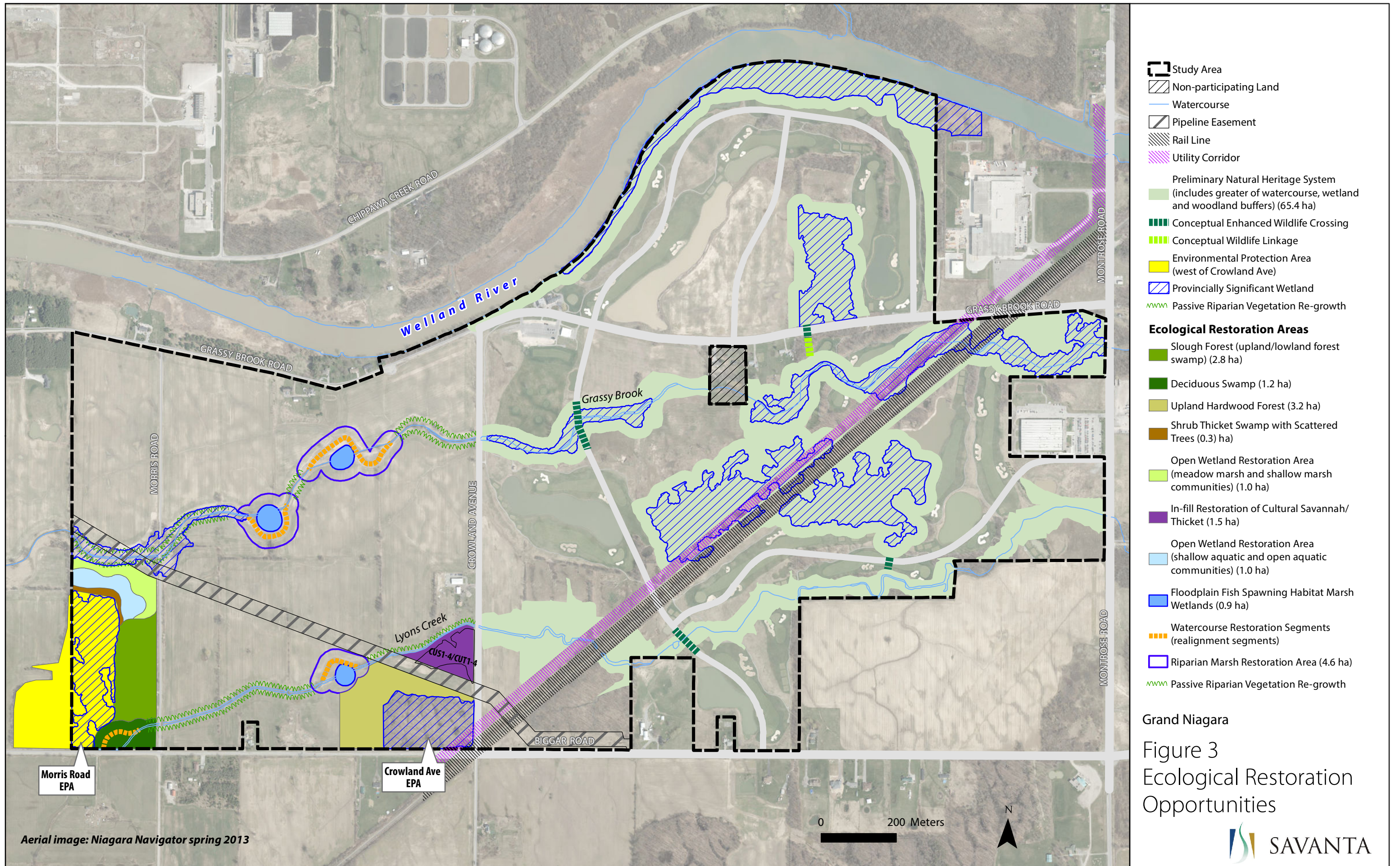
Welland River (Type 1 fish habitat)  
 - greater than 30 m set back provided  
 due to frontage by a PSW unit

- Study Area
  - Non-participating Land
  - Ecological Land Classification
  - Pipeline Easement
  - Rail Line
  - Utility Corridor
  - 100 Year Floodline
- Preliminary Natural Heritage System**
- Preliminary NHS Limit (includes greater of wetland, watercourse and woodland buffers and 100 year floodline)
  - Preliminary Natural Heritage System
  - Watercourse 15m Buffer
  - Provincially Significant Wetland
  - 15m Unevaluated Wetland Buffer
  - 30m Provincially Significant Wetland Buffer
  - 10m Woodland Buffer
  - Conceptual Wildlife Linkage
  - Conceptual Enhanced Wildlife Crossing

Grand Niagara  
 Figure 2  
 Preliminary Natural  
 Heritage System

Aerial image: Niagara Navigator spring 2013



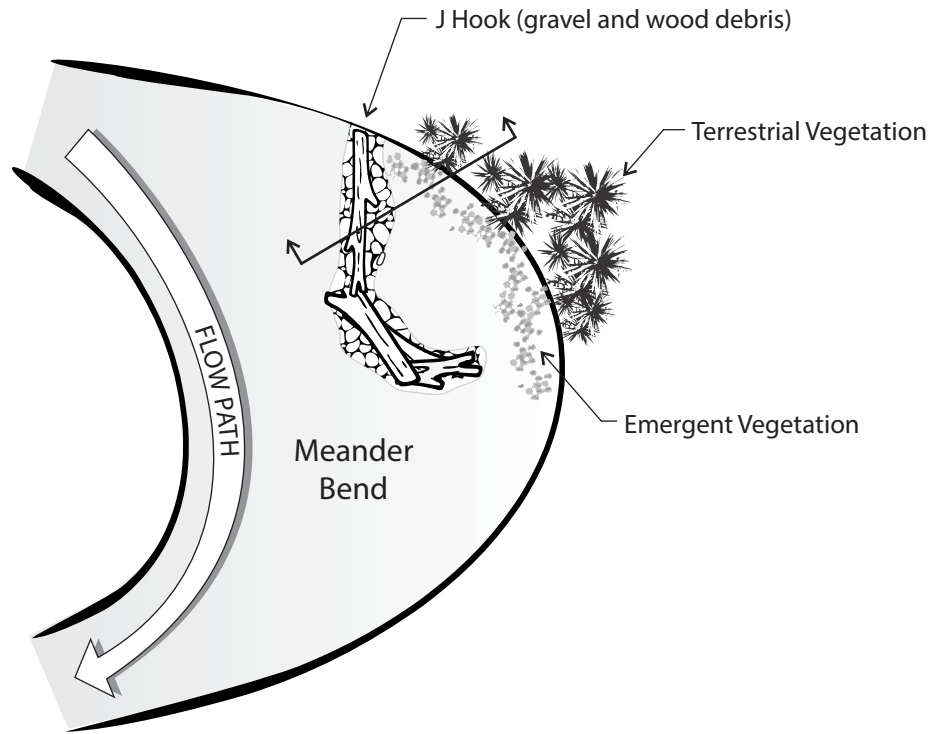


Grand Niagara  
 Figure 3  
 Ecological Restoration  
 Opportunities





### Plan View



### Cross Section

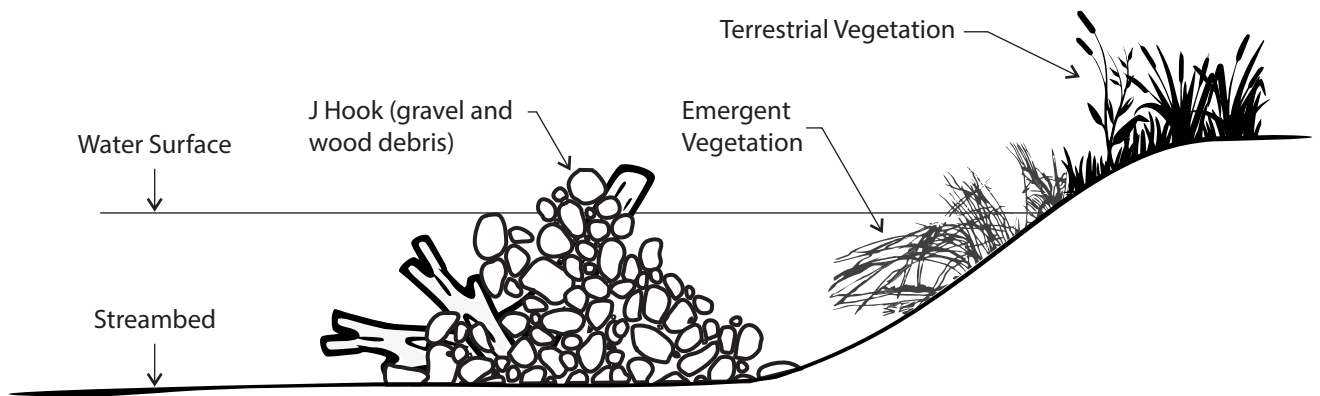


Figure 4 Grass Pickerel Habitat Enhancement Feature



**TABLES**

**Table 1: Proposed Woodland and Wetland Vegetation Removal & Restoration**

VEGETATION REMOVAL		VEGETATION RESTORATION	
ELC Type	Area (ha)	ELC Type	Area (ha)
<b>1. FOREST</b>			
FOD	0.75	Slough forest restoration area (target FOD6, FOD7 or FOD9)	2.80
FOD6-5	3.33	Crowland Avenue EPA forest restoration area (target FOD6 or FOD9)	3.20
FOD7-2	0.68	In-fill woodland restoration of cultural savannah / thicket (target FOM)	1.45
FOD7-6	0.42	NHS 10 m woodland buffers (FOD type that complements adjacent forest)	1.12
FOD7-9	1.89		
<b>TOTAL REMOVAL</b>	<b>7.10</b>	<b>TOTAL RESTORATION</b>	<b>8.57</b>
<b>2. WETLAND</b>			
MAM2-11	0.96	Open wetland marsh restoration area (MAM, MAS)	1.0
MAM2-2	0.57	Open wetland pond restoration area (SA; excludes 0.3 ha open water area that is 2 m to 3 m deep and will not support wetland vegetation)	1.0
SAF1-3	0.06	Riparian marsh restoration areas (MAM, MAS)	4.6
SAS1-1	1.44	Floodplain fish spawning habitat marsh wetlands (MAS2)	0.9
SWD1-6	0.10	Deciduous swamp (target SWD1 or SWD3)	1.2
SWD2-2	1.01	Shrub thicket swamp (SWT)	0.3
SWT2-2/MAM2-2 /MAS2-1	0.16		
<b>TOTAL REMOVAL</b>	<b>4.30</b>	<b>TOTAL RESTORATION</b>	<b>9.00</b>



## Notes:

- NHS 15 m unevaluated wetland buffers are in areas that are not expected to support wetland seed mix; these areas will be planted with upland meadow seed mix, cover crop, and tree/shrub plantings.
- NHS 15 m watercourse buffers, which are not already naturally vegetated, will be planted with native upland meadow or meadow marsh seed mix depending on soils / water availability, cover crop and tree/shrub plantings.
- NHS 30 m provincially significant wetland buffers, which are not already naturally vegetated, will be planted with native upland meadow or meadow marsh seed mix depending on soils / water availability, cover crop and tree/shrub plantings.
- Portions of the retained 100-year floodline located outside of buffers applied to the watercourses, woodlands and wetlands, which are not already naturally vegetated, will be planted with native meadow seed mix and cover crop.

**Table 2: Proposed NHS Buffer Preliminary Plant Species Lists**

TREES	SHRUBS	HERBACEOUS
<p><b>1. Grassy Brook and Lyons Creek Watercourse Buffer (15 m)</b></p> <p>Note:</p> <ul style="list-style-type: none"> <li>- Only the area of this buffer that is not naturally vegetated will be planted</li> <li>- Woody stock planting density: 2 trees / 100m<sup>2</sup> and 6 shrubs / 100 m<sup>2</sup></li> </ul>		
<p>Shagbark Hickory (<i>Carya ovata</i>)</p> <p>Swamp White Oak (<i>Quercus bicolor</i>)</p> <p>Pin Oak (<i>Quercus palustris</i>)</p> <p>Basswood (<i>Tilia americana</i>)</p>	<p>Common Elderberry (<i>Sambucus canadensis</i>)</p> <p>Nannyberry (<i>Viburnum lentago</i>)</p> <p>Buttonbush (<i>Cephalanthus occidentalis</i>)</p>	<p>Native upland meadow and/or meadow marsh seed mixes will be applied depending on soil conditions / water availability.</p> <p>Approx. 75% of the planted area is expected to support wetland meadow marsh. Seed mix may include:</p> <ul style="list-style-type: none"> <li>- Canada Anemone (<i>Anemone canadensis</i>)</li> <li>- New England Aster (<i>Symphyotrichum novae-angliae</i>)</li> <li>- Tall Goldenrod (<i>Solidago altissima</i>)</li> <li>- Virginia Wild Rye (<i>Elymus virginicus</i>)</li> </ul>
<p><b>2. Retained Woodland Buffer (10 m)</b></p> <p>Note:</p> <ul style="list-style-type: none"> <li>- Only the area of this buffer that is not naturally vegetated will be planted</li> <li>- Woody stock planting density: 3 trees / 100m<sup>2</sup> and 10 shrubs / 100 m<sup>2</sup></li> </ul>		
<p>Pin Oak (<i>Quercus palustris</i>)</p> <p>Northern Red Oak (<i>Quercus rubra</i>)</p> <p>Shagbark Hickory (<i>Carya ovata</i>)</p> <p>Sugar maple (<i>Acer saccharum</i>)</p> <p>Black Cherry (<i>Prunus serotina</i>)</p>	<p>Wild Red Raspberry (<i>Rubus idaeus ssp. strigosus</i>)</p> <p>Red-osier Dogwood (<i>Cornus stolonifera</i>)</p> <p>Nannyberry (<i>Viburnum lentago</i>)</p> <p>Common Elderberry (<i>Sambucus canadensis</i>)</p> <p>Poison Ivy (<i>Toxicodendron rydbergii</i>)</p>	<p>Native upland meadow seed mix will be applied, which will include species such as:</p> <ul style="list-style-type: none"> <li>- Enchanter's Nightshade (<i>Circaea lutetiana</i>)</li> <li>- Rough-leaf Goldenrod (<i>Solidago rugosa</i>)</li> <li>- Large-leaved Aster (<i>Eurybia macrophylla</i>)</li> </ul>
<p><b>3. Retained Wetland Buffer (PSW - 30 m; targeted retained unevaluated wetland - 15 m)</b></p> <p>Note:</p> <ul style="list-style-type: none"> <li>- Only the area that is not naturally vegetated will be planted</li> <li>- Woody stock planting density: 2 trees / 100m<sup>2</sup> and 6 shrubs / 100 m<sup>2</sup></li> </ul>		
<p>Pin Oak (<i>Quercus</i>)</p>	<p>Pale Dogwood (<i>Cornus</i>)</p>	<p>Native upland meadow and/or meadow marsh</p>

TREES	SHRUBS	HERBACEOUS
<p><i>palustris</i>)</p> <p>Northern Red Oak (<i>Quercus rubra</i>)</p> <p>Swamp White Oak (<i>Quercus bicolor</i>)</p> <p>Shagbark Hickory (<i>Carya ovata</i>)</p>	<p><i>obliqua</i>)</p> <p>Buttonbush (<i>Cephalanthus occidentalis</i>)</p> <p>White Meadowsweet (<i>Spiraea alba</i>)</p>	<p>seed mixes will be applied depending on soil conditions / water availability.</p> <p>Approx. 30% to 40% of the planted area is expected to support wetland meadow marsh. Seed mix may include:</p> <ul style="list-style-type: none"> <li>- White Panicked Aster (<i>Symphotrichum lanceolatum</i>)</li> <li>- Spotted Joe Pye Weed (<i>Eupatorium maculatum</i>)</li> <li>- Soft-stemmed Bulrush (<i>Schoenoplectus tabernaemontani</i>)</li> <li>- Broad-fruited Burreed (<i>Sparganium eurycarpum</i>)</li> </ul>

**Table 3: Restoration Areas West of Crowland Avenue Preliminary Plant Species Lists**

TREES	SHRUBS	HERBACEOUS
<p><b>1. Morris Road EPA Open Wetland Marsh and Pond Restoration Area</b> Woody stock planting density: 1 tree / 100m<sup>2</sup> and 4 shrubs / 100 m<sup>2</sup></p>		
<p>Pin Oak (<i>Quercus palustris</i>)</p>	<p>Pale Dogwood (<i>Cornus obliqua</i>) Buttonbush (<i>Cephalanthus occidentalis</i>) Willow shrub species (<i>Salix sp.</i>)</p>	<p>Spotted Jewelweed (<i>Impatiens capensis</i>) Broad-fruited Burreed (<i>Sparganium eurycarpum</i>) Soft-stemmed Bulrush (<i>Schoenoplectus tabernaemontani</i>) Variegated Pond-lily (<i>Nuphar variegata</i>) Broad-leaved Arrowhead (<i>Sagittaria latifolia</i>) Water-plantain (<i>Alisma plantago-aquatica</i>)  <u>Note:</u> - Collect &amp; distribute native floating aquatic vegetation from golf course ponds proposed for removal</p>
<p><b>2. Morris Road EPA Shrub Thicket Swamp Restoration Area</b> Woody stock planting density: 1 tree / 100m<sup>2</sup> and 15 shrubs / 100m<sup>2</sup></p>		
<p>Sycamore (<i>Platanus occidentalis</i>) Pin Oak (<i>Quercus palustris</i>) Freeman's Maple (<i>Acer x freemanii</i>)</p>	<p>Pale Dogwood (<i>Cornus obliqua</i>) Red-osier Dogwood (<i>Cornus stolonifera</i>) Buttonbush (<i>Cephalanthus occidentalis</i>) Spicebush (<i>Lindera benzoin</i>) Willow shrub species (<i>Salix sp.</i>)</p>	<p>White Panicked Aster (<i>Symphyotrichum lanceolatum</i>) Tall Goldenrod (<i>Solidago altissima</i>) Virginia Wild Rye (<i>Elymus virginicus</i>) Spotted Joe Pye Weed (<i>Eupatorium maculatum</i>)</p>
<p><b>3. Morris Road EPA Slough Forest and Deciduous Swamp Restoration Area</b> Woody stock planting density: 4 trees / 100m<sup>2</sup> and 10 shrubs / 100m<sup>2</sup></p>		

TREES	SHRUBS	HERBACEOUS
Swamp White Oak ( <i>Quercus bicolor</i> ) Pin Oak ( <i>Quercus palustris</i> ) Red Oak ( <i>Quercus rubra</i> ) Shagbark Hickory ( <i>Carya ovata</i> ) Black Cherry ( <i>Prunus serotina</i> ) Red Maple ( <i>Acer rubrum</i> ) Freeman's Maple ( <i>Acer x freemanii</i> )	Pale Dogwood ( <i>Cornus obliqua</i> ) Buttonbush ( <i>Cephalanthus occidentalis</i> ) Spicebush ( <i>Lindera benzoin</i> ) Willow shrub species ( <i>Salix sp.</i> ) White Meadowsweet ( <i>Spiraea alba</i> ) Winterberry ( <i>Ilex verticillata</i> )	Sensitive Fern ( <i>Onoclea sensibilis</i> ) Jack-in-the-pulpit ( <i>Arisaema triphyllum</i> ) Fowl Mannagrass ( <i>Glyceria striata</i> ) Hop Sedge ( <i>Carex lupulina</i> ) Virginia Smartweed ( <i>Persicaria virginiana</i> ) Virginia Wild Rye ( <i>Elymus virginicus</i> ) Spotted Jewelweed ( <i>Impatiens capensis</i> )
<b>4. Crowland Avenue EPA Forest Restoration</b> Woody stock planting density: 5 trees / 100m <sup>2</sup> and 6 shrubs / 100m <sup>2</sup>		
Shagbark Hickory ( <i>Carya ovata</i> ) Swamp White Oak ( <i>Quercus bicolor</i> ) Pin Oak ( <i>Quercus palustris</i> ) Red Maple ( <i>Acer rubrum</i> ) Sugar Maple ( <i>Acer saccharum</i> ) American Beech ( <i>Fagus grandifolia</i> )	Choke Cherry ( <i>Prunus virginiana</i> ) Grey Dogwood ( <i>Cornus foemina</i> ) Wild Red Raspberry ( <i>Rubus idaeus ssp. strigosus</i> ) Alternate-leaved Dogwood ( <i>Cornus alternifolia</i> )	Large-leaved Aster ( <i>Eurybia macrophylla</i> ) May-apple ( <i>Podophyllum peltatum</i> ) Enchanter's Nightshade ( <i>Circaea lutetiana</i> ) White Avens ( <i>Geum canadense</i> ) Yellow Avens ( <i>Geum aleppicum</i> ) Rough-leaf Goldenrod ( <i>Solidago rugosa</i> )
<b>5. Crowland Avenue Cultural Savannah / Thicket In-fill Restoration</b> Woody stem planting density: 1 tree / 100m <sup>2</sup> and 5 shrubs / 100m <sup>2</sup>		
Northern Red Oak ( <i>Quercus rubra</i> ) Shagbark Hickory ( <i>Carya ovata</i> ) White Pine ( <i>Pinus strobus</i> ) Sugar maple ( <i>Acer</i> )	Choke Cherry ( <i>Prunus virginiana</i> ) Grey Dogwood ( <i>Cornus foemina</i> ) Wild Red Raspberry ( <i>Rubus idaeus ssp. strigosus</i> )	Canada/Tall Goldenrod ( <i>Solidago canadensis / altissima</i> ) Black-eyed Susan ( <i>Rudbeckia hirta</i> ) Canada Anemone ( <i>Anemone</i> )



TREES	SHRUBS	HERBACEOUS
<p><i>saccharum</i>) Black Cherry (<i>Prunus serotina</i>) Beech (<i>Fagus grandifolia</i>)</p>	<p>American Hazelnut (<i>Corylus americana</i>) Round-leaved Serviceberry (<i>Amelanchier sanguinea</i>) Smooth Rose (<i>Rosa blanda</i>)</p>	<p><i>canadensis</i>) Common Milkweed (<i>Asclepias syriaca</i>) Evening Primrose (<i>Oenothera biennis</i>) Grass-leaved Goldenrod (<i>Euthamia graminifolia</i>) Meadow/Open Field Sedge (<i>Carex granularis</i>) Virgins Bower (<i>Clematis virginiana</i>) Wild Bergamot (<i>Monarda fistulosa</i>)</p>
<p><b>6. Floodplain Fish Spawning &amp; Wetland Restoration Area</b> Woody stock planting density: 6 shrubs / 100 m<sup>2</sup></p>		
<p>No trees</p>	<p>Grey Dogwood (<i>Cornus foemina</i>) White Meadowsweet (<i>Spiraea alba</i>) Willow shrub species (<i>Salix sp.</i>)</p>	<p><b>Meadow Marsh Species:</b> Tall Goldenrod (<i>Solidago altissima</i>) Virginia Wild Rye (<i>Elymus virginicus</i>) Spotted Jewelweed (<i>Impatiens capensis</i>) White Panicked Aster (<i>Symphyotrichum lanceolatum</i>) Rough-leaf Goldenrod (<i>Solidago rugosa</i>) Spotted Joe Pye Weed (<i>Eupatorium maculatum</i>) Purple-stemmed Aster (<i>Symphyotrichum puniceum</i>)  <b>Shallow marsh species:</b> Soft-stemmed Bulrush (<i>Schoenoplectus tabernaemontani</i>) Variegated Pond-lily (<i>Nuphar variegata</i>)</p>

TREES	SHRUBS	HERBACEOUS
		Broad-leaved Arrowhead ( <i>Sagittaria latifolia</i> )  Broad-fruited Burreed ( <i>Sparganium eurycarpum</i> )  Sedge species (e.g., <i>Carex</i> <i>stipata</i> , <i>vulpinoides</i> , <i>hystericina</i> , etc.)