APPENDIX C1

Natural Heritage

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APPENDIX C1.1

Existing Conditions Report

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SAVANTA
A GEI Company

Kirby Road Extension Class EA, Vaughan ON

Natural Heritage Existing Conditions

MAY 2019

SAVANTA
A GEI Company

Kirby Road Extension Class EA, Vaughan, ON

Natural Heritage Existing Conditions

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1.0 INTRODUCTION

1.1 Project Overview

Savanta Inc. (Savanta) was retained by Rizmi Holdings Limited (Rizmi) to complete this Natural Heritage Existing Conditions Report, as part of the Class Environmental Assessment (Class EA) for the Kirby Road Extension between Dufferin Street and Bathurst Street in Vaughan, Ontario (**Figure 1**, **Appendix A**). Rizmi, as the owner of much of the land that may be required for the proposed road extension, and the proponent of a proposed residential and commercial development on a portion of lands, is acting as the proponent for the Class EA process on behalf of the City of Vaughan. The process is being undertaken in accordance with the requirements of the Municipal Class EA (MEA 2015).

This report summarizes the results of desktop data collection and natural heritage field investigations undertaken within the Subject Lands between 2010 and 2017. The significance and sensitivity of identified natural features is assessed in accordance with the definitions in the Provincial Policy Statement (PPS)(MMAH 2014), and the Oak Ridges Moraine Conservation Plan (ORMCP)(MMAH 2017). The information regarding natural heritage features in the Study Area provides input to an assessment of constraints and opportunities for the proposed road extension. This input informs the evaluation of alternatives being led by Schaeffers Consulting Engineers (Schaeffers).

This report provides interim input, ahead of the selection of a preferred alternative alignment. The results of some ongoing studies in preparation by other technical team members related to hydrology/stormwater management, geotechnical and hydrogeological assessments were not available for review. As such, potential impacts of the proposed road alignment on the natural features and functions associated with the Subject Lands is not fully assessed in this report. The results of studies completed by other technical team members will require review to validate predicted impacts associated with alternatives.

1.2 Subject Lands

The Subject Lands for the proposed road extension consist of those lands between Dufferin Street to the west and Bathurst Street to the east that encompass the alternative alignments for the proposed Kirby Road Extension (**Figure 1**, **Appendix A**). A portion of the Subject Lands (hereinafter called the "Rizmi Lands", as depicted on **Figure 1**, **Appendix A**) has previously been the subject of a Minister's Order (Ontario Municipal Board File No. R000-232).

Rizmi owns approximately 141 ha of land located between Dufferin Street to the west, King Vaughan Road approximately 1500 m to the north, Bathurst Street to the east and the Maple Downs Golf Course and the Pardes Shalom Cemetery to the south. These broader lands have

been the subject of considerable environmental investigations over the years and detailed field investigations were completed on these lands as part of this study. A portion of the Subject Lands is located outside Rizmi's land holdings and this area has been the Subject of more recent field studies that occurred in the spring and summer of 2017 (**Figure 1**, **Appendix A**).

As noted above, the Subject Lands are located within the ORM, and the proposed road extension is subject to the ORMCP. However, the Rizmi Lands are exempted from the requirements of the ORMCP as a result of a Minister's Order (February 2015) that defines areas available for development and those lands that were to be deemed to be subject to proposed conservation. This agreement between the Province and Rizmi was issued by the Minister of Municipal Affairs and Housing pursuant to the *Oak Ridges Moraine Conservation Act*. The Minister's Order designates the Subject Lands for residential development, and effectively excludes it from the Oak Ridges Moraine Conservation Plan (ORMCP). **Appendix E** illustrates that planning context applicable to the Rizmi lands.

1.3 Natural Heritage Planning Considerations

This work has been completed with consideration for relevant municipal and provincial standards and best practices. These are summarized in the following subsections.

1.4 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.

Section 2.1 of the PPS which deals with policies specific to Natural Heritage was relied up to guide the identification of features or significance associated with the Subject Lands.

Eight types of natural features are defined in the Provincial Policy Statement (PPS):

- Significant wetlands;
- Significant coastal wetlands;
- Habitat of endangered and threatened species;
- Fish habitat;
- Significant woodlands;
- Significant valleylands;
- Significant Areas of Natural and Scientific Interest (ANSI); and
- Significant wildlife habitat.

These are discussed in detail in section 4.0 of this report.

1.5 The Oak Ridges Moraine Conservation Plan (2017)

The Subject Lands occurs within the Oak Ridges Moraine (ORM) physiographic region and is designated as “Natural Core Area”, “Natural Linkage Area” and “Countryside Area” on the Oak Ridges Moraine Conservation Plan (ORMCP) Land Use Designation Map (Map 3).

However, the ORMCP does apply to the Rizmi Lands based on a Minister’s Order. The ORMCP is considered with respect to adjacent impacts from the proposed development of the Subject Lands

According to Section 41(5) of the ORMCP infrastructure may be permitted to cross a key natural heritage feature or key hydrologic feature if it can be demonstrated that,

a. The need for the project has been demonstrated and there is no reasonable alternative;
b. The planning, design and construction practices adopted will keep any adverse effects on the ecological integrity of the Plan Area to a minimum;
c. The design practices adopted will maintain, and where possible improve or restore, key ecological and recreational linkages, including the trail system referred to in section 39;
d. The landscape design will be adapted to the circumstances of the site and use native plant species as much as possible, especially along rights of way; and
e. The long-term landscape management approaches adopted will maintain, and where possible improve or restore, the health, diversity, size and connectivity of the key natural heritage feature or a key hydrologic feature.

The ORMCP defines Key Natural Heritage Features (KNHF) and Hydrologically Sensitive Features (HSF) and stipulates where development is/is not permitted. The Subject Lands were reviewed and considered for the presence of the natural features and functions as they related to these definitions.

Key Natural Heritage Features; in Section 22(1) are defined as one or more of the following:

- Wetlands;
- Significant portions of the habitat of endangered, rare and threatened species;
- Fish habitat;
- Areas of natural and scientific interest (life science);
- Significant valleylands;
- Significant woodlands;

- Significant wildlife habitat; and/or
- Sand barrens, savannahs and tallgrass prairies.

Hydrologically Sensitive Features; in Section 26(1) are defined as:

- Permanent and intermittent streams;
- Wetlands;
- Kettle Lakes; and
- Seepage areas and springs.

These features are discussed in detail in section 5.0 of this report.

1.6 Provincial 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 itemized 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 (MNR 2007).

Species at Risk are discussed in more detail throughout the report, including confirmation of Natural Heritage Information Centre (NHIC) records, MNRF records and species and/or their habitat observed during field investigations.

1.7 York Region Official Plan (2010)

The Official Plan for York Region was approved by the Municipal Affairs and Housing on September 07, 2010 and has been appealed to the Ontario Municipality Board (OMB) and partially approved. The modified York Region Official Plan (YROP) was consolidated on June 20, 2013. “The YROP is a document that outlines policies of the Regional Municipality of York to guide economic, environmental and community building decisions.”

Map 2 (Regional Greenlands) shows that portions of the Subject Lands are designated as part of the “Region Greenlands System”; Map 3 (Environmentally Significant Areas and Areas of Natural and Scientific Interest identify that portions of the Subject Lands include

Environmentally Significant Areas (ESA) and Life Science Areas of Natural and Scientific Interest (ANSI); and Map 4 (Key Hydraulic Features) do not identify any of these specific features on the Subject Lands. Map 5 (Woodlands) identifies portions of the Subject Lands as woodlands.

The Region of York interactive map was accessed to confirm the presence of natural heritage features. The mapping indicates that the following features area located within the Subject Lands:

- Woodlands;
- Greenlands;
- ORMCP designations;
- ESAs; and
- Life and Earth Science ANSIs.

1.8 City of Vaughan Official Plan (2010)

The Vaughan Official Plan (VOP) 2010 has been partially approved by the Ontario Municipal Board on June 15, 2015. *"The Official Plan addresses the City's long-term planning requirements to the year 2031, in addition to consolidating all former land use policy into one document, this Plan brings the City into conformity with recent Provincial and Regional land use policy direction."*

The VOP identifies the following natural heritage designations to be present within and immediately adjacent to the Subject Lands:

- Natural Core Area and Natural Linkage Area;
- ESA;
- ANSI;
- ORM Natural Core, Natural Linkage and Countryside; and
- Category 1 and 2 Landform Conservation Area.

1.9 Toronto and Region Conservation Authority (TRCA)

The TRCA conducts reviews of planning processes associated with future development of properties within its jurisdictional boundaries. In addition, the TRCA provides planning and technical advice to planning authorities to assist them in fulfilling their responsibilities regarding natural hazards, natural heritage and other relevant policy areas pursuant to the Planning Act, as both a watershed-based resource management agency and through planning advisory services, in addition to their Regulatory responsibilities.

The TRCA administers the *Development, Interference with Wetlands, Alterations to Shorelines and Watercourses Permit* process, under Ontario Regulation 166/06 (O.Reg. 166/06). This regulation defines the areas of interest that allow conservation authorities to:

- Prohibit, regulate, or provide permission for straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream, watercourse or changing or interfering with a wetland; and
- Prohibit, regulate, or provide permission for development if the control of flooding, erosion, dynamic beaches, pollution or the conservation of land may be affected by the development.

TRCA administers The Living City Policies (LCP) for Planning and Development in the Watersheds of TRCA (2014), issued under Section 20 of the Conservation Authorities Act. The LCP contains the principles, goals, objectives, and policies for the administration of TRCA's legislated and delegated roles and responsibilities in the planning and development approvals process. It includes sections pertaining to the TRCA's role under the Planning Act (LCP Section 7) and policies associated with their administration of O. Reg. 166/06 (LCP Section 8).

The Subject Lands are not located within the mapped TRCA Regulatory Limit, although the Subject Lands may contain unmapped features that the TRCA deems to meet the requirements of the Regulation.

1.10 The Federal Fisheries Act

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

In terms of potential involvement of the DFO, the amended federal *Fisheries Act*, (November 25th, 2013) shifted the onus to the proponent to ensure that a project is in compliance with the federal *Fisheries Act*. The Fisheries and Oceans Canada (DFO) website page "Self-Assessment: Does DFO need to review my project" lists project activities and criteria where DFO review is not required [http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html].

2.0 SUMMARY OF DATA COLLECTION APPROACHES AND METHODS

2.1 Background References

Savanta has relied, in part, upon supporting background information to provide insight into the overall character of the lands within the Subject Lands. These include:

- Ministry of Natural Resources and Forestry (MNRF) Land Information Ontario (LIO) database;
- MNRF Natural Heritage Information Centre (NHIC) Rare Species (2016) and Vegetation Communities (2013) data;
- Ontario Breeding Bird Atlas Data;
- MNRF wetlands and fisheries information;
- TRCA natural areas, species of concern and hazard land mapping;
- Region of York Official Plan;
- City of Vaughan Official Plan;
- City of Vaughan Natural Heritage Network Study;
- Oak Ridges Moraine Conservation Plan;
- ESA studies, natural areas reports; and
- Various provincial wildlife atlases (i.e., butterflies, amphibians, reptiles, breeding birds, mammals).

2.1.1 LIO Natural Features Summary

Based on the MNRF LIO geographic database, the natural heritage features listed below are present within or adjacent to the Subject Lands (**Figure 2**, **Appendix A**):

- McGill Area Environmental Significant Area (ESA);
- Woodlands;
- King-Vaughan wetland complex;
- Non-evaluated wetlands;
- Maple Spur Channel Regionally Significant Earth Science Area of Natural and Scientific Interest (ANSI);
- Maple Spur Candidate Provincially Significant Earth Science ANSI; and
- Maple Uplands and Kettle Wetlands Regionally Significant Life Science ANSI.

2.1.2 NHIC Database

The NHIC database was accessed in November 2017 to search for records of provincially significant plants, vegetation communities and all forms of wildlife within the Subject Lands. The database provides occurrence data by 1 km area blocks, with a total of six different blocks overlapping portions of the Subject Lands. The search revealed records for four

species, three of which had a "Last Observed" date of 1955 and older or unknown/blank, as summarized in **Table 1** (**Appendix B**). These records are not addressed as current occurrences. Two records from 2001 indicate that Butternut (*Juglans cinerea*), an Endangered tree species, was observed at two locations in, or within the vicinity of, the Subject Lands. Butternut occurrences in the Subject Lands are addressed further in section 3.4.2.

2.1.3 Ontario Breeding Bird Atlas

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

A total of 116 bird species were recorded in the atlas square (17PJ26) that overlaps with the Subject Lands. Of the species reported in the atlas square, three are Threatened in Ontario: Barn Swallow (*Hirundo rustica*), Bobolink (*Dolichonyx oryzivorus*) and Eastern Meadowlark (*Sturnella magna*); and, two are listed as Special Concern: Canada Warbler (*Cardellina canadensis*) and Eastern Wood-Pewee (*Contopus virens*). This information assisted in defining the search effort and target species for studies within the Subject Lands.

2.2 Consultation and Agency Correspondence

Ontario Ministry of Natural Resources and Forestry (MNRF)

The MNRF Aurora District *Information Request Form* (IRF) pertaining to Species at Risk and natural heritage features within the Subject Lands was submitted on November 10, 2015. A response letter was received on November 12, 2015. MNRF identified the following species as present / potentially present on the Subject Lands:

- Butternut (*Juglans cinerea*) – Endangered in Ontario and Canada;
- Jefferson Salamander (*Ambystoma jeffersonium*) – Endangered in Ontario and Canada.
- American Ginseng (*Panax quinquefolius*) – Endangered in Ontario and Canada;
- Snapping Turtle (*Chelydra serpentina*) – Special Concern in Ontario and Canada;
- Eastern Wood-Pewee (*Contopus virens*) – Special Concern in Ontario and Canada; and
- Wood Thrush (*Hylocichlia mustelina*) – Special Concern in Ontario and Threatened in Canada.

In November 2016, Savanta followed up with MNRF to confirm historical Jefferson Salamander observations in the Subject Lands. MNRF reviewed their files and confirmed that the record for this species in the Subject Lands was an error and that the closest record was from over 7 km away. Therefore, this species has not been previously recorded in the Subject Lands.

In addition, MNRF also indicated the following species had the potential to occur on or near the property and required further assessment or field studies to determine presence:

- Eastern Small-footed Myotis (*Myotis leibii*) – Endangered in Ontario and Canada;
- Little Brown Myotis (*Myotis lucifugus*) – Endangered in Ontario and Canada;
- Northern Myotis (*Myotis septentrionalis*) – Endangered in Ontario and Canada;
- Bobolink (*Dolichonyx oryzivorus*) – Threatened in Ontario and Canada; and
- Eastern Meadowlark (*Sturnella magna*) - Threatened in Ontario and Canada.

After the MNRF response was provided to the IRF, another bat was listed Endangered in Ontario: Tricolored Bat (*Perimyotis subflavus*). Similar to the other bat species listed above, it is expected that MNRF would require surveys to determine presence.

MNRF also confirmed that occupied Redside Dace (Clinostomus elongatus) habitat is present in the Don River East Branch approximately 2 km south of the Subject Lands. MNRF correspondence is included in Appendix C. However, the MNRF Aurora District (Emily Funnel) confirmed at a meeting on Dec. 13, 2018 that the Subject Lands do not provide contributing habitat for Redside Dace.

2.3 Technical Methods and Field Studies

The Rizmi Lands portion of the Subject Lands was the subject of ecological investigations in the late 1990s (Ecoplans Limited 1999). In order to update the baseline of information, the Rizmi owned portions of the Subject Lands were investigated by Savanta on a series of field visits completed between 2010 and 2016. In addition, Savanta conducted studies within the entire Subject Lands including the portion that lies outside of the Rizmi lands in the spring and summer of 2017.

These comprehensive field investigations included a site reconnaissance visit, winter wildlife survey, breeding bird surveys, raptor nest assessment, bat surveys, waterfowl surveys, nocturnal bird surveys, Ecological Land Classification and botanical inventories, breeding amphibian surveys, insect surveys, headwater drainage feature assessment, fish habitat assessment and benthic invertebrate surveys. The surveys, dates and protocols employed are summarized in **Table 2** (**Appendix B**). The methods and findings are discussed in section 3.

3.0 ENVIRONMENTAL SETTING AND CHARACTERISTICS

3.1 Designated Features

This section of the report identifies designated environmental areas reported from background references and databases. These are depicted on **Figure 2** (**Appendix A**).

Oak Ridges Moraine

The ORM is an ecologically and hydrologically important geological landform that was formed through the advancement and retreat of glaciers, and the deposition of stratified sediment. It is this deposition of sand and gravel within the Subject Lands that supported historic aggregate extraction activities.

King-Vaughan Wetland Provincially Significant Wetland Complex

The Subject Lands includes one of the 23 wetland units mapped in the King-Vaughan Wetland Provincially Significant Wetland (PSW) Complex. Most of the wetland units in this complex occur north of the Subject Lands. A review of general landscape features and wetland mapping identifies a series of kettle wetlands beginning just north of the Subject Lands. These features are concentrated south of the King-Vaughan Road on both the west and east sides of Dufferin Street. The PSW complex is dominated by swamp (83%) with some marsh communities present (17%). The majority of the PSW is palustrine (outflow with no defined inflow), with the rest as isolated units (reliant on surface water and /or groundwater inputs). Clay, loam and silt soils are present.

Maple Uplands and Kettle Wetlands Regionally Significant Life Science ANSI

The Maple Uplands and Kettle Wetlands Regionally Significant ANSI is comprised of forests dominated by a mixture of Maple, Beech, Birch, Hemlock and/or White Pine. The Maple Uplands and Kettle Wetlands Regionally Significant Life Science ANSI has the largest forest interior habitat (200 m from forest edge, closed canopy tree cover, successional habitat excluded) in the Don River Watershed. In particular, the forest present on and north and south of the Subject Lands is noted as having the largest interior habitat (92 ha).

Maple Spur Channel Regionally Significant Earth Science ANSI

The Maple Spur ANSI is located within the western portion of the Subject Lands, extending west to northwest. Large sand or gravel deposits, 30 m to 60 m above the Halton Till Plain to the south, are present, some of which were extracted from the former aggregate extraction lands.

McGill Area Environmentally Significant Area

The McGill Area ESA has been designated by Toronto and Region Conservation Authority (TRCA) and includes the King-Vaughan Wetland Complex, Maple Uplands and Kettle Wetlands Life Science ANSI, Cook's Area Life Science ANSI and the Maple Spur of the Oak Ridges Moraine Earth Science ANSI described above.

3.2 Physical Conditions

The physical baseline conditions described in the following sections were summarized from various background reports, including Don River Watershed Plan reports and the background natural heritage reference materials developed as part of the City's Official Plan process (AECOM 2010).

3.2.1 Physiography and Soils

The Subject Lands are located within the ORM, which is dominated by sand, sand-gravel, and diamicton (poorly sorted glacial material) deposits. In 1996, Terraprobe completed a "Preliminary Aggregate Resource Study" of the Rizmi Lands. The report noted that the Rizmi Lands are situated within a specific sub-area of the moraine known as the Maple Spur. The Maple Spur consists of a hummocky ridge of Kame-outwash material, comprising mostly of sand. The northern terminus of the deposit is found on the western half of the property. The kame deposits are surrounded by a large and extensive deposit of glacial till, all of which are underlain by shale bedrock of the Georgian Bay formation.

3.2.2 Groundwater

Broad level TRCA mapping from the Don River Watershed studies shows that the Halton Aquitard overlays the Oak Ridge's Aquifer in some places from Kirby Road and east of Dufferin Street to just south of Langstaff Road. Bedrock groundwater flow is predominately lateral towards regional discharge zones such as Lake Ontario. Regional groundwater flow in the aquifers within the general area is south-southeast from the ORM towards Lake Ontario, except where major river valleys exist. Locally, groundwater flow paths bend into river valleys and isolated topographic depressions (AECOM 2010).

AECOM (2010) defines the hydrogeological character of most of the Subject Lands as "Highly Sensitive", with moraine and fringe areas. The southwestern margin of the Subject Lands is assigned a "Moderately Sensitive" designation, with thin till over moraine.

Several groundwater discharges were observed in April and June 2016 near the southern border of the Subject Lands (**Figure 3**, **Appendix A**). These discharges were resulting in

surface water flow within a defined channel and were flowing into the wetland at the downstream end of the headwater drainage feature discussed previously.

Groundwater seepage was also observed along the edges of the organic swamp thicket wetland at the upstream end of the headwater drainage feature. The seepage zones associated with this wetland are shown on **Figure** (**Appendix A**).

3.2.3 Surface Water Features

There is one surface water drainage feature in the Subject Lands, and it has been the subject of a Headwater Drainage Feature Assessment and a Fluvial Geomorphological Assessment, as discussed in the following sections.

3.2.3.1 Headwater Drainage Feature Assessment

A headwater drainage feature assessment (HDFA) was conducted in the Subject Lands on August 11, 2011 to identify and classify potential headwater drainage features. The Evaluation, Classification and Management of Headwater Drainage Features: Interim Guidelines (TRCA and CVC 2009) was used to assess headwater drainage features. Given the time of year the assessment took place, this was not considered to be a full HDFA assessment, but it was sufficient to identify permanency of watercourses. An updated HDFA assessment will be completed during the spring and summer of 2019 prior to detailed design of the preferred road alternative.

The only surface water drainage feature observed in the Subject Lands was the drainage channel emanating from the King-Vaughan Wetland Complex and flowing towards the TransCanada Pipeline corridor running along the southern boundary. Reaches were determined based on the features of the drainage feature such as riparian vegetation, in-stream vegetation, bank width and height etc. Seven reach segments were identified in the drainage that traverses the central portion of the Subject Lands (**Figure 3**, **Appendix A**). These reaches are described in **Table 3** (**Appendix B**). This drainage feature has been altered from its original alignment and there is a culvert between reaches 3 and 4. The headwaters of the drainage feature commence at the north end of a wetland feature within a wooded area. Reaches 1 and 2 were the only portions of the feature where water was present during the assessment. Water was also present within a small wetland area at the connection of Reaches 5 and 6, which also formed part of the original watercourse. While a reddish tint to the sand was observed in this area, no other indicators of ground water discharge were apparent. This feature is considered to be a headwater drainage feature, and as noted previously, likely formed the headwaters of Patterson Creek, although since construction of the TransCanada Pipeline at the southern end of the Subject Lands, there has been no direct surface water connection with Patterson Creek. Therefore, the primary function of this watercourse is to convey flow to the wetland at the southern end of the

Subject Lands where it pools and either infiltrates into the ground, evapotranspirates or evaporates.

An additional headwater drainage feature was observed in April and June 2016 in the meadow marsh area northwest of the pooled area upstream from the pipeline corridor. This drainage consisted of groundwater discharge running within a defined channel, before draining into the swamp thicket noted above. In April 2016, the ground of the swamp thicket was wet with standing water leading to the pooled area, although in June, the pooled area was dry.

3.2.3.2 Fluvial Geomorphological Assessment

A fluvial geomorphological assessment of the surface water drainage feature in the Subject Lands was completed by GEO Morphix Ltd. in 2015 and an addendum letter in response to comments from TRCA was completed on November 28, 2018. The scope of the work in 2015 included historical aerial photography review, reach delineation and completion of Rapid Geomorphic Assessment (RGA) and Rapid Stream Assessment Technique (RSAT). A complete copy of their report and addendum letter are provided in **Appendix D**, while the results are summarized below.

The historical aerial photograph review, which examined aerial photographs taken between 1946 and 2015, concluded that the drainage feature, originally identified as the East Tributary of Patterson Creek, has experienced significant changes over the period covered by the imagery, including realignment, channelization, removal of tree cover and the disruption of channel and flow continuity by TransCanada Pipeline corridor at the southern end of the Subject Lands (GEO Morphix Ltd. 2016).

Geomorphic field investigations were conducted on November 2, 2015. Within the shrub thicket wetland where the drainage feature originates, no defined flow pattern was observed. The downstream reach runs within a constructed, V-shaped valley feature, with no bankfull indicators and limited evidence of stable channel morphology. Watercress was observed in the channel at the upstream end of the reach, indicating a likely source of groundwater input. Due to the unstable nature of the primarily sand embankments, ongoing channel adjustments according to sediment supply are anticipated to occur. The channel is bisected by an access road with a partly embedded 1200-mm diameter culvert. Downstream from the culvert, the valley was considerably lower (1.5 m to 2.0 m) with a defined low flow channel (on average 1.15 m wide and 0.42 m deep), which was considered to be the bankfull channel. At the downstream end of this reach, the channel makes a sharp turn into the wooded area and continues as a constructed valley feature (approximately 5 m wide and 1 m deep) within the wooded area. The low flow channel has no riffle:pool development and averaged approximately 1.90 m wide and 0.15 m deep. This reach discharges to the wetland basin upstream from the TransCanada Pipeline corridor. The top of the pipeline is located

approximately 2 m above the wetland bed and there was no evidence of flow spilling over the top of the pipeline. (GEO Morphix Ltd. 2016)

The RGA analysis found all three reaches to be in regime, while the lower reach (upstream from the wetland) is aggrading and the upper reaches (within the channelized area) are degrading. The RSAT analysis found that the two lower reaches were in good condition, while the upper reach was in fair condition.

3.3 Aquatic Ecology

3.3.1 Aquatic Habitat Assessment

The Subject Lands are located within the Patterson Creek subwatershed of the overall Don River watershed. As discussed in section 3.2.3.2, the historically realigned surface water drainage feature in the Subject Lands is not hydraulically connected with downstream reaches of Patterson Creek, a tributary of the East Don River. Patterson Creek, the mapped portions of which commence on the lands south of the Subject Lands, is designated as intermittent coldwater habitat.

Surface water features in the Subject Lands were most recently examined in the field on October 27 and November 26, 2015, and April 29, 2016. Surface water features downstream from the Subject Lands were most recently examined on June 8, 2016.

In the northwestern part of the Subject Lands, two potential locations were examined to determine if headwater features are present. Some areas of sporadic wetland vegetation were noted in the hay field in this area, however no defined flow paths were observed during the fall 2015 visits. A meadow marsh (MAM2-12) wetland unit was located at the south end of the hay field, suggesting some seasonal contributions of water due to topography. Tile drainage was installed in this meadow marsh area in spring 2016 to facilitate agricultural activities on the property.

Through the thicket swamp, very slow flow to standing water is braided through the extensive vegetation, but eventually coalesces into a single channel at the southern edge of the woodland. From that point, the drainage feature is well-defined and flows through a realigned channel along the eastern edge of the open area, previously cleared for aggregate extraction activities. The channel has a trapezoidal form similar to a municipal drain, suggesting that it was constructed sometime in the past to divert flow away from an original flow path and move it away from aggregate extraction areas. The defined channel extends through the west edge of the FOM2-3 forest unit and loses definition in the swamp thicket (SWT2-2) wetland unit near the southern boundary of the Subject Lands.

During the fall 2015 visits, standing water and minor, sluggish flow was noted at various discontinuous locations throughout the ditched portion of the channel. Water disappeared at locations marked by sandy substrates, suggesting that surface water may infiltrate beneath the channel bed at these locations. At the southern right-angled bend in the channel, there was evidence of potential groundwater expression, with orange stained substrate, and in some cases, orange flocculent, present. This, coupled with an oily sheen, suggests possible interception of groundwater. Both the flocculent and oily sheen may be due to the presence of bacteria with an affinity for iron or other mineral-rich waters. As the defined channel extends southward, however, standing water no longer occurs and there is no evidence of such deposits.

While the defined channel portion contains water at certain times of the year, flow does not exit the site. Immediately to the south of the SWT2-2 thicket, a small basin-like area is present, surrounded by an FOD3-1 unit. It marks the termination of defined drainage at a 2.5 m high berm at the Trans-Canada Pipeline corridor. Standing water was noted in the SWT3 ELC unit, flanked by ELC units FOM6-2 and FOM3-2. The berm at the pipeline corridor is an effective dam to downstream flow progression, and there is evidence of extensive pooling at the upstream side of the berm, including woody debris piles against the berm, a dense mat of moss-covered ground debris and the lack of a defined channel, replaced instead by a broader basin-like appearance. There is no culvert present at the berm, and no evidence, such as erosion or rills through the pipeline corridor, to suggest that water breaches the berm.

It is expected that water pools seasonally during the spring at the upstream side of the berm and gradually infiltrates, evapotranspirates or evaporates as drier conditions develop as the season progresses. During a site visit in late April 2016, the pool upstream from the berm was approximately 1 m deep. By early June 2016, it was dry.

There is no direct fish habitat present in the Subject Lands. The berm represents a distinct and definite barrier to any fish movement to reaches upstream of the berm. Further, the berm also acts as a flow barrier for any drainage coming from the upstream catchment area. The lack of a culvert at the berm and the height of the berm itself create an effective flow dam that prevents flows moving to reaches downstream of the TCPL corridor.

The area downstream from the berm on the adjacent property, which is owned by the City of Vaughan, was investigated on June 8, 2016 to determine if a watercourse was present immediately downstream from the berm. The presence of such a feature could provide evidence of a direct, subsurface hydraulic connection from the reach in the Subject Lands. Immediately south of the pipeline corridor, although the area is a low point, there was no evidence of surface water drainage present, such as a defined channel, groundwater inputs, or wetland indicator plant species. The area is low and may receive surface water runoff from the surrounding tablelands within the wooded area, but there was no evidence that pooled

water from the Subject Lands flows over, infiltrates through or beneath the pipeline embankment and re-emerges to continue as a surface drainage feature. The first evidence of surface water within the low-lying area of the woodland was found approximately 150 m downstream from the pipeline in the form of wet soils with some standing water. Spotted Touch-me-not, a plant species often encountered on the banks of watercourses or in groundwater seepage areas, was found at this location and locations further downstream. Downstream from this location, the woodland valley floor alternated between dry and standing water. The standing water had a wider wetted perimeter further downstream and the depressional feature within the valley floor became more pronounced. The first flowing water was observed within a channel approximately 320 m downstream from the pipeline crossing. Flow was observed within the channel downstream to the Woodland Acres Crescent road crossing of the feature.

Based on these observations, the downstream watercourse appears to originate in the woodland approximately 320 m downstream from the pipeline. Those origins appear to be a combination of groundwater inputs and surface water drainage from the tablelands within the woodland.

Based on mapping from Fisheries and Oceans Canada (DFO 2015), entitled *Distribution of Fish Species at Risk, Toronto and Region Conservation Authorit*y, this watercourse forms part of the headwaters of the Don River East Branch, although the watercourse is not shown on this mapping until approximately 500 m downstream from the Woodland Acres Crescent Road crossing. The watercourse is identified as Occupied or Recovery habitat for Redside Dace (*Clinostomus elongatus*) approximately 2.5 km downstream from Woodland Acres Crescent Drive.

Based on the overall observations within and outside of the Subject Lands, the drainage feature in the Subject Lands should not be considered as part of Redside Dace Regulated habitat (per Section 29.1 of the O.Reg. 242/08), given that there is no direct surface water connection to the downstream watercourse which eventually flows into Occupied or Recovery habitat for the species. The surface drainage feature in the Subject Lands does not meet the requirements to be considered Contributing Habitat, since it does not appear to "augment or maintain the baseflow, coarse sediment supply or surface water quality" of the downstream occupied Redside Dace habitat in the East Don River.

3.3.2 Benthic Invertebrate Survey

The Subject Lands were sampled for benthic invertebrates (benthos), on May 30, 2012 by Entomogen. The complete report from Entomogen is provided in **Appendix D** and the results are summarized below.

Suitable sampling sites were limited by low water levels. Samples were successfully taken from two locations – A1 and A6 (**Figure 3**, **Appendix A**). Sampling followed the methodology recommended in the Ontario Benthos Biomonitoring Network (OBBN) Protocol Manual. Travelling kick and sweep sampling was conducted using "D" framed kick nets (500 µm). One sample was collected from each site. Specimens were initially preserved in 95% ethanol (to obtain a dilution of approximately 70% to 80%) and transferred to fresh 70% ethanol once in the lab. Samples were sorted under magnification using a dissecting microscope. Picked individuals were identified to a mix of Classes, Orders, and Families in accordance with the Ministry of the Environment Rapid Bioassessment Levels and were enumerated.

A total of 39 different taxa were observed across the two sites. A family by site matrix is provided in **Table 4** (**Appendix B**). Both sites possessed good diversity, with a variety of invertebrates found. Site A1 had both the highest abundance as well as diversity, with over 800 specimens in that sample. The most abundant benthic invertebrate families at Site A1 included *Ceratopogonidae* (Biting Midges), accounting for 19.7% of the sample, and *Chironomidae* (Non-Biting Midges), accounting for 14.4% of the sample. Samples from site A1 also contained salamander larva indicating that this area is also a breeding area for salamanders.

Area A2, which had 251 specimens collected, was also dominated by *Ceratopogonidae*, accounting for 47.8% of the sample, and *Chironomidae*, accounting for 28.7% of the sample.

3.4 Terrestrial Ecology: Habitat Assessment and Species Occurrences

3.4.1 Landscape Ecology

The Subject Lands occur in a setting characterized by a mix of rural/agricultural properties, residential subdivisions, golf courses, cemeteries and natural cover. The natural landscape is comprised of a network of 37% woodlands, 1% wetlands, and 19% cultural meadows. Forest cover is concentrated along the tributaries to the East Branch of the Don River and associated steep slopes.

Broadly speaking, the main regional cores and corridors are associated with the Oak Ridges Moraine and Greenbelt lands. While the larger regional landscape units allow for connectivity and wildlife movement primarily in the east-west direction (i.e., ORM/Greenbelt), at a more local scale, patches of natural cover and associated linkages contribute to local connectivity in a north-south direction. The largest of these local linkages is associated with the East Don River, west of Dufferin Street and west of the Subject Lands (wooded areas designated as ESA/ANSI). Roads and residential development affect these local connections. The Don River extends north into the broad east-west Oak Ridges Moraine and south via "Urban River Valley" connections with eventual outlet into Lake Ontario (MMA 2017).

The larger and more extensive regional corridors facilitate connectivity and wildlife movement through the contiguous Greenbelt. Another existing corridor that likely functions at a regional scale are the open portions of the Parkway Belt West, south of the Study Area and adjacent to Highway 407. These open areas are used for hydroelectric transmission include natural open space that facilitates a level of connectivity. Other semi-natural features on the landscape that contribute to the effectiveness of regional corridors include golf courses (e.g. Maple Downs Golf Course, Eagles Nest Golf Course) and cemeteries (Pardes Shalom Cemetery).

Even at the regional scale, the linkages and connectivity discussed above are affected by the high degree of transportation infrastructure development.

The local landscape is dominated by existing development, open space/natural areas, disturbed quarry areas, farmland, a golf course and an existing and established road network. The Subject Lands provide opportunity for wildlife movement/linkage in an east to west direction with the existing Kirby Road allowance helping to facilitate this movement between Dufferin and Bathurst Streets. However, beyond the Subject Lands these connections are limited with existing residential development immediately west of Dufferin Street and East of Bathurst Street. The tributary of East Patterson Creek provides limited north to south connection beyond the Subject Lands due to the pipeline berm which borders the southern boundary of the Study Area and prevents hydrological connection to the Don River valley to the south and east.

The combination of woodlands, meadows, valley, and watercourse provide a north-south habitat connection through the site and surrounding landscape, and these features and associated habitat functions are anticipated to be impacted by the road. Impacts to connectivity will be mitigated through the use of enhanced wildlife crossing to facilitate the minor movement of wildlife on a local scale for large, and small to medium sized wildlife (frogs, toads, snakes, turtles, raccoons, skunks, rabbits, squirrels, opossums, voles, etc.).

3.4.2 Vegetation Communities and Vascular Plants

Vegetation assessments completed on the Subject Lands consisted of spring, summer and fall vascular plant inventories and the application of the Ecological Land Classification (ELC) system. The purpose of these surveys was to document natural and anthropogenic vegetation features on the Subject Lands and to determine their provincial and regional significance. Survey dates are provided in **Table 2** (**Appendix B**).

Ecological Land Classification

Table 5 (**Appendix B**) provides brief descriptions of the ELC types recognized on the Subject Lands. Current vegetation community types are depicted on **Figure 4** (**Appendix A**).

The Subject Lands consist primarily of active agricultural land, open meadows, disturbed areas, former aggregate extraction lands and forest habitat. Natural areas are comprised primarily of forested uplands, with pockets of tree and shrub swamp located in the bottomlands and/or along drainage features. Deciduous forest communities dominate woodland areas, with mixed communities present as well. Vegetation communities have been and continue to be affected by ongoing site practices. Single family residential homes are present in the northwest southeast corners of the Subject Lands, while a small industrial/commercial facility is present in the southeast corner.

Vascular Plants

A total of 290 species of vascular plants were recorded from the Subject Lands (**Table 6**, **Appendix B** and **Table 1**, **Appendix E**). Of that number, 197 (or 68%) species are native, and 93 (or 32%) species are exotic. The majority of the native species are found in the natural forests and wetlands.

The majority of the native species, 178 (or 90%) are ranked S5 (secure in); 18 species (or 9%) are ranked S4 (apparently secure in Ontario); and one species is ranked S2 (Imperiled) discussed below). Thirteen species are considered rare in York Region (Varga et al. 2005). None of the regionally rare species are considered rare in Ontario. One of the species recorded from the Subject Lands (Small Yellow Water-crowfoot, *Ranunculus gmelinii*) had a co-efficient of conservation (CC) value of 10. 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.

A total of 17 locally rare species (L1 – L3), were observed within the Subject Lands and are highlighted on Table 6 (Appendix B).

One Species at Risk plant was recorded on the Subject Lands: Butternut (*Juglans cinerea*), which is Endangered in Ontario and Canada, and ranked as S2 (imperilled in Ontario). Detailed survey locations are maintained on file to protect the confidentiality around Species at Risk. A Butternut inventory and health assessment conducted in 2017 documented 23 trees, of which 20 were Category 1, three were Category 2, and none were Category 3. The results of the Butternut survey will be reviewed with the MNRF.

An NHIC search was conducted for the Subject Lands using the MNRF Biodiversity Explorer. No rare species have been historically documented (within the last 20 years) on or in the vicinity of the Subject Lands.

MNRF Evaluated Wetlands/Provincially Significant Wetlands

The Land Information Ontario (LIO) database was accessed to determine if any wetlands known to the MNRF occur on or in the vicinity of the Subject Lands. Such wetlands could include PSWs, MNRF evaluated wetlands, unevaluated wetlands, or wetlands identified as "other".

One of the 23 wetland units mapped in the King-Vaughan Provincially Significant Wetland Complex occurs within the Subject Lands. This unit, defined as an organic thicket swamp ecosite (SWT3) was further delineated through field verification, and is shown on **Figure 11** (**Appendix A**).

3.4.3 Birds

Breeding bird surveys were conducted in 2010 to 2012, 2014 and 2015 (**Appendix E**) on the entire Rizmi lands, which extend east to Bathurst Street and again more recently in 2017 (**Appendix B**) within the entire Subject Lands. Survey protocols were based on a combination of protocols 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 are provided in **Table 2** (**Appendix B**).

Surveys were conducted between dawn and five hours after dawn with suitable wind conditions, no thick fog or precipitation. Point count (PC) stations were located in various vegetation communities within the Subject Lands to help determine the presence, variety and abundance of bird species. Each point count station was surveyed for 10 minutes. All birds that were heard or observed within the 100 m radius point count station were recorded. Point count stations for all years are shown in **Figure 5** (**Appendix A**).

During breeding bird surveys, vegetation was assessed for potential presence of Species at Risk habitat. If suitable habitat was encountered or individuals were observed standard protocols were utilized (in consultation with the Ministry of Natural Resources and Forestry; MNRF).

If present on the Subject Lands, 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.

2017 Survey Results

A total of 17, point count stations were surveyed within the Subject Lands and are illustrated on **Figure 5** (**Appendix A**). All historic observations (2010-2015) are summarized in **Appendix E**.

A total of 63 bird species were observed within the Subject Lands. Of this total, 11 species are confirmed, 36 are probable and 15 are possible breeders on the Subject Lands. The remaining species is considered a non-breeder, flyover or migrant. All species observed on the Subject Lands in 2017 are listed in **Table 7** (**Appendix B**).

A total of 62 (100%) of the confirmed, probable or possible breeders are provincially ranked S5 (secure in Ontario), S4 (apparently secure in Ontario) or SNA (species not native to Ontario). No bird species are considered provincially rare (S1-S3; NHIC 2016).

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

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

The location of observations and survey findings pertaining to threatened and endangered species are maintained on file to protect the confidentiality around Species at Risk and will be addressed directly with the MECP. Due to the sensitive nature of this information, all correspondence and outcomes will remain with the MECP.

Bobolink: Confirmed breeding evidence was recorded for Bobolink within a continuous habitat polygon that included point count stations 15 and 16 (**Figure 5**, **Appendix A**). This continuous habitat patch included adjoining off-site lands to the north of the Subject Lands. Breeding evidence observations included 11 birds, fledged young and adults with food. Possible breeding evidence was recorded in a cultural meadow near the eastern boundary of the Subject Lands.

Bank Swallow: Up to 35 individuals were observed on June 8, 9, 2017, within the mineral aggregate portion of the Subject Lands. The birds were attempting to excavate holes for

breeding. Two areas were of interest to this species: one was a man-made pile of sand with a roughly 45º slip on its eastern face; the other was a sand slip where excavations had left an exposed face, again on a roughly 45º angle. In both cases, the birds appeared to be unable to excavate effectively for nesting purposes (i.e., the slip was not vertical enough for stabilization of hole excavation) and thus only possible breeding evidence was recorded (i.e., not probable or confirmed). On the second visit, most of the birds had left the vicinity and no further evidence of nesting was observed. Neither surface appeared to have been altered significantly.

Barn Swallow: Multiple birds were observed foraging over the agricultural fields on the eastern half of the Subject Lands. No nesting structure was observed that was associated with breeding by this species. It was determined that these birds were coming from off-site nesting areas to forage over the lands.

Wood Thrush: Probable or confirmed breeding evidence was recorded at seven locations on the Subject Lands. Confirmed breeding evidence was recorded near point count station 2. Possible breeding evidence was observed in the east end of the site where marginal habitat and area exists for the species. This species was also heard off-site.

Eastern Wood-Pewee: Probable breeding evidence was recorded at 15 locations on the Subject Lands. Eastern Wood-Pewee was also recorded off-site. The species occupied mature mixed and deciduous forest stands, as well as a mature conifer plantation that is succeeding to mature deciduous forest.

Fifteen species that exhibited breeding evidence on the Subject Lands in 2017 are listed as indicator species according to the Province's significant wildlife habitat (SWH) criteria for ecoregion 6E (MNRF 2015). SWH assessment is discussed further in section 4.8.

- Waterfowl nesting SWH: one indicator species was recorded: Hooded Merganser (*Lophodytes cucullatus*). The SWH criteria are not met due to low indicator species diversity/abundance.

- Seeps and springs SWH: Groundwater seepage evidence was observed during vegetation surveys along the slopes of the organic thicket swamp wetland (SWT3), and near a willow thicket swamp wetland near the southern boundary of the Subject Lands. Hydrogeological studies were conducted by Terraprobe, in an effort to characterize the seepage as input to a determination of the presence and location of this SWH type.

- Colonial nesting breeding bird habitat (bank/cliff) SWH: SWH criteria are not met since breeding evidence for Northern Rough-winged Swallow (*Stelgidopteryx serripennis)*

and Cliff Swallow *(Petrochelidon pyrrhonota)* was associated with man-made structures; these are not eligible for identification as SWH.

- Woodland area sensitive breeding bird SWH: The forests used by these species are generally >60 years of age, with interior habitat >200 m from edge, and with three or more indicator species breeding. This SWH type is confirmed to be present on the Subject Lands for four bird species with breeding evidence in 2017: Yellow-bellied Sapsucker (*Sphyrapicus varius*), Red-breasted Nuthatch (*Sitta canadensis*), Ovenbird (*Seiurus aurocapilla*) and Scarlet Tanager (*Piranga olivacea*). The woodland area-sensitive breeding bird SWH polygon is mapped on **Figure 11** (**Appendix A**).

- Shrub/early successional breeding bird SWH: habitat criteria is not met for this SWH type due to low habitat patch size (i.e., less than 10 ha). This SWH type is not present on the Subject Lands.

- Open country bird breeding SWH: The minimum habitat criterion was not met for this SWH type. Open country on the Subject Lands are Class 1 or 2 agricultural land and have been in use for agriculture more recently than 5 years ago. This SWH type is not present on the Subject Lands.

- Raptor wintering area SWH: the habitat criteria for this SWH type are met due to the presence of a mosaic of woodland and cultural meadow >20 ha in size along with additional habitat off-site to the north that appears suitable based on desktop analysis. One indicator species was recorded (Red-tailed Hawk) during breeding season, however, no winter raptor surveys were conducted.

- Rare wildlife SWH: two Special Concern bird species were recorded that are indicator species for the rare wildlife SWH type: Eastern Wood-Pewee and Wood Thrush. Rare wildlife SWH polygons are consistent for both species and are mapped on **Figure 11** (**Appendix A**).

2015 Survey Results

One survey was conducted on July 8, 2015 and included 10 point-count locations that were placed in all represented habitats in the Rizmi owned portion of the Subject Lands (**Figure 5**, **Appendix A**). A total of 37 bird species were observed within the Subject Lands. Of this total, five species are confirmed, 16 are probable and 16 are possible breeders in the Subject Lands. The observed breeding bird species are discussed in the sections below. All species observed in the Subject Lands are listed in **Table 2** (**Appendix E**).

A total of 37 (100%) of the confirmed, probable or possible breeders are provincially ranked S5 (secure in Ontario), S4 (apparently secure in Ontario) or SNA (species not native to Ontario).
Four Species at Risk were recorded on the Subject Lands:

- Bobolink (Threatened in Ontario and Canada);
- Bank Swallow (Threatened in Ontario and Canada);
- Wood Thrush (Special Concern in Ontario and Threatened in Canada); and
- Eastern Wood-Pewee (Special Concern in Ontario and Canada).

Bobolink and Eastern Meadowlark: The Subject Lands were screened for potentially suitable habitat for Bobolink and Eastern Meadowlark (two Threatened species that rely on grassland/open habitats). Post-breeding Bobolinks were observed in several polygons within the Subject Lands, one of which provided potentially suitable breeding habitat for Bobolink. The suitability/use of the latter polygon was to be confirmed during 2017 surveys within the normal breeding period, as per the MNR (2012) *Bobolink survey protocol*. Possible breeding evidence was recorded based on the July 8, 2015, survey. Pairs and fledged young that were recorded on the Subject Lands in 2015, which would normally constitute probable/confirmed breeding evidence, are believed to have come from breeding territories off-site. The 2017 breeding bird/grassland SAR surveys within the locations noted in 2015 found no suitable breeding habitat or occurrences of Bobolink/Eastern Meadowlark. Breeding evidence was recorded in two different polygons in 2017, as described previously.

Bank Swallow: Probable breeding evidence was recorded for six Bank Swallows that were observed at aggregate stockpiles (which served as a nest site) in a disturbed area. The presence of active, heavy machinery prevented a count of nests.

Eastern Wood-Pewee: Possible breeding evidence was recorded for Eastern Wood-Pewee in wooded areas at or near point count stations 1, 2, 3, 4, 5 and 8.
Wood Thrush: Possible breeding evidence was also recorded for Wood Thrush at point count station 4 (mature woodland) and off-site to the northwest of the Subject Lands.

SWH indicator species observations in 2015 were similar to those noted during complete, two-round breeding bird surveys in 2017.

2014 Survey Results

A targeted search for Species at Risk birds and associated habitats was conducted in the Subject Lands on May 28, 2014. Formal point count stations were not utilized, rather area searches were conducted across much of the Subject Lands. The search area is shown on

Figure 5 (**Appendix A**). All species observed on the Subject Lands in 2014 are listed in **Table 3** (**Appendix E**).

A total of 52 bird species were recorded, of which 49 species are confirmed, probable or possible breeders on the Subject Lands. The remaining three bird species are considered non-breeders, flyovers or migrants.

A total of 46 (94%) of the species that demonstrated breeding evidence in the Subject Lands are provincially ranked S5 (common and secure) and S4 (apparently common and secure) or SNA (introduced species not native to Ontario). Three Species at Risk birds were also recorded in 2014 that were observed previously during the 2010-2012 period:

Eastern Wood-Pewee: eight territories were detected, with all birds observed being singing males within suitable breeding habitat.

Bank Swallow: A breeding colony was found in a slip on an exposed mound in the aggregate pit area, with a total of 35 holes counted, with 20 to 30 birds observed using the holes.

Wood Thrush: Four territories were detected.

SWH indicator species observations in 2014 were similar to those noted during complete, two-round breeding bird surveys in 2017.

2010 – 2012 Survey Results

Eight bird surveys were conducted from 2010-2012, from which a total of 67 species of birds were observed in the Subject Lands (**Table 4**, **Appendix E)**. Of these, 57 species exhibited evidence of breeding on the Subject Lands, with the remaining 10 species considered non-breeders, flyovers or migrants.

Four Species at Risk were recorded with breeding evidence on the Subject Lands:

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

Observations of the species noted above are similar to records from subsequent years (described previously).

3.4.4 Insects (Lepidoptera and Odonata)

Insect surveys were conducted within the Subject Lands in the summer of 2017. Previous surveys were conducted within a portion of the Subject Lands by Entomogen Inc. (Entomogen) in 2011. Insect surveys were conducted to identify the presence and abundance of two, targeted insect Orders: Butterflies (*Lepidoptera*) and Dragonflies (*Odonata*).

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.

2017 Survey Results (Savanta)

Survey dates are provided in **Table 2** (**Appendix B**) and survey locations are illustrated on **Figure 5** (**Appendix A**).

There were 29 butterfly and 19 dragonfly species recorded on the Subject Lands during the 2017 insect surveys, as listed in **Table 8** (**Appendix B**). In addition, two bumblebee species, one moth, one wasp and three tiger beetle species were recorded during insect and breeding bird surveys.

All but one species observed are provincially ranked S5 (secure in Ontario), S4 (apparently secure in Ontario) or SNA (species not native to Ontario). One species Common Sootywing (*Pholisora catullus*) is provincially rare (S3; NHIC 2016) and globally common (G5). One individual was recorded August 8, 2017, near point count station 14. The hostplant is Lamb's Quarters (*Chenopodium album*), a widespread non-native plant common in fields, pastures, roadsides and gardens.

Monarch (*Danaus plexippus*) is Special Concern in Ontario and Endangered in Canada. Monarch was observed during all three insect surveys at various old field/meadow locations on the Subject Lands, with peak numbers (8 individuals) recorded on August 8, 2017. Common Milkweed (*Asclepias syriaca*) is widespread in open areas across the site, particularly in the sandy areas of field margins, old meadows and the eastern end of the aggregate area, providing areas for reproduction of this species. Vegetation surveys noted Common Milkweed as occasional within cultural meadow units on the Subject Lands.

Both Monarch and Common Sootywing are considered under the rare species SWH type (MNRF 2015). Significant Wildlife Habitat is discussed further in section 4.8:

- Candidate rare species SWH is noted for Monarch on the Subject Lands; and

- Only one Common Sootywing individual was recorded on the Subject Lands.

Due to low abundance of the species, SWH is not present on the Subject Lands for this species.

2011 Survey Results (Entomogen)

The complete report from Entomogen is provided in **Appendix D.** The results are summarized below.

Sampling was completed on three occasions in 2011 (June 19, July 19, August 30) on warm, sunny, near windless days to reasonably sample the diversity of insects present. Specimens were collected by hand or using sweep nets. Type specimens were collected, and photographs were taken for identification purposes. The first survey may have under-represented some species of dragonfly and damselfly, which emerge in late May and early June.

A total of 23 lepidopteran species and 17 odonate species were collected during the surveys. All species observed in the Subject Lands are ranked S4 (secure in Ontario) or S4 (apparently secure in Ontario) or SNA (not native to Ontario). Species at Risk and locally rare species observed (according to Halton Region Checklist and Toronto Entomological Society information) include:

- Monarch: Special Concern in Ontario and Endangered in Canada;
- Black-tipped Darner (*Aeshna tuberculifera*), locally rare;
- Racket-tailed Emerald (*Dorcordulia liberal),* locally rare; and
- Northern Bluet (*Enallagama cyathigerum),* locally rare.

The full list of insect species observed by Entomogen is provided in **Appendix D**.

3.4.5 Amphibians

Amphibian call-count surveys (AMC) and amphibian egg mass surveys (EMS) were conducted across several years on the Subject Lands:

- AMC and EMS completed across the Subject Lands in 2017;
- AMC and EMS completed on a portion of the Subject Lands in 2016; and
- AMC surveys completed on a portion of the Subject Lands in 2010.

These surveys were conducted to identify the presence and abundance of amphibian species in open water, marsh, swamp and vernal pool habitats, to contribute to an understanding of wetland diversity and quality. Species at Risk and/or significant wildlife habitat may be

identified through these methods. Six amphibian stations were surveyed in 2010, four stations in 2016 and five stations in 2017. All amphibian survey stations are shown on **Figure 6** (**Appendix A**). Survey dates are listed in **Table 2**, **Appendix B**.

Survey Methods

1. Amphibian Call-count Survey (AMC)

Call-count surveys conducted in 2010, 2016 and 2017 followed standard protocols outlined in the Great Lakes Marsh Monitoring Program (BSC 2003). Surveys were conducted on warm nights with little wind. Surveys commenced one half hour before dusk and ended before midnight. Visits were 15 days apart and as per protocols, the first occurred with a minimum nighttime air temperature of 5°C, the second visit with a minimum of 10°C and the third visit with a minimum of 17°C. If noise from plane, road traffic and/or trains was present, monitoring was delayed and began during a quiet period.

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

The standard call levels are:

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

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

2. Amphibian Egg Mass Survey (EMS)

In 2017, an early spring (April) EMS was conducted only at amphibian stations that provided suitable habitat for pool-breeding salamanders and early-calling woodland amphibians (i.e., Western Chorus Frog and Wood Frog). In 2016, three-round EMS (April, May, June) was conducted at all 2016 AMC stations during daylight hours.

Egg Mass Surveys were conducted within suitable amphibian breeding habitat (i.e., pools with suitable hydroperiod). Survey effort 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 EMS 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. Logs or debris in the vicinity of each pool were also checked for presence of adult salamanders (all items were returned to their original location/position to maintain microhabitat conditions).

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.

2017 Survey Results

Three-rounds of evening AMC surveys were completed in April, May and June 2017, and one daytime EMS was completed in April 2017. Survey stations were identified using a preliminary review of aerial photography and/or previously identified survey points. Stations were verified in the field to confirm the presence of suitable breeding habitat.

The five amphibian stations surveyed in 2017 are illustrated on **Figure 6** (**Appendix A**). Compared to previous surveys conducted in 2010 and 2016, in 2017 no suitable amphibian breeding habitat was found at stations A, C, E or F. Two new stations were established in 2017: station H monitored an off-site pond south of the Subject Lands, and station I monitored a pond associated with a farmstead in the northeast portion of the Subject Lands (not part of the Subject Lands prior to 2017). The small pond identified as station I was found in May, as such first round AMC/EMS could not be conducted at this station in 2017.

Six amphibian species were recorded within the Subject Lands during the AMC and EMS assessments (American Toad, Spring Peeper, Green Frog, Gray Treefrog, Wood Frog, and Spotted Salamander). Detailed results of the AMC and EMS surveys are provided in **Table 9** and **Table 10** (**Appendix B**), respectively. All amphibian species recorded on the Subject Lands are listed in **Table 8** (**Appendix B**). All of the amphibian species are provincially ranked S5 (secure in Ontario) or S4 (apparently secure in Ontario) (NHIC 2016).

The results of AMC and EMS assessments were pooled for each station and analyzed for the presence of significant wildlife habitat (SWH) according to the MNRF (2015) SWH criteria schedules. A summary is offered here and SWH is discussed further in section 4.8:

- Breeding amphibian SWH for woodland or wetland types is not present on the Subject Lands. To meet the SWH criteria, surveys must record at least 20 individuals or egg masses, or call code 3 (full chorus) each of two or more indicator frog/toad species; or 20 individuals or egg masses of one indicator salamander species. These thresholds for indicator species diversity/abundance were not met on the Subject Lands.

- Low numbers of Spotted Salamander egg masses were noted at amphibian station B (pond immediately off-site to the north of the Subject Lands - observations made from participating property only) and station D (within a pool at the southern edge of the organic thicket swamp SWT3). The observation of 5 Spotted Salamander egg masses noted from the edge of the Subject Lands in station B is likely a low estimate; the pond is located on non-participating property and as such could not be surveyed thoroughly. Station B is identified as candidate woodland amphibian breeding SWH.

2016 Survey Results

Three rounds of AMC and three rounds of EMS surveys were completed in April, May and June within the Rizmi portion of the Subject Lands in 2016. Four amphibian species were recorded in total (Spring Peeper, Gray Treefrog, Green Frog, and Northern Leopard Frog). Three of the species observed are locally rare, L1-L3 (TRCA 2014): Spring Peeper (L2), Gray Treefrog (L2) and Northern Leopard Frog (L3). All of the species observed are common and secure or apparently secure in Ontario (S5 or S4; NHIC 2016) and are listed in **Table 8** (**Appendix B**).

2010 Survey Results

Three amphibian species were recorded within the Subject Lands during three rounds of AMC assessments conducted within the Subject Lands (American Toad, Green Frog and Spring Peeper). No formal egg mass surveys were conducted on the Subject Lands in 2010.

3.4.6 Reptiles

These surveys helped to identify the presence and abundance of often-elusive reptile species and their habitats. Species at Risk and/or significant wildlife habitat may be identified through these methods.

Snake Transect Surveys

Visual encounter snake transect surveys were completed on the Subject Lands during the spring emergence period in April and during the period when snakes return to hibernacula (i.e., about September 2017). During these periods, the probability of observing snake species is generally higher. Survey dates are provided in **Table 2** (**Appendix B**).

Transect surveys were conducted along with scanning rocks/debris piles for basking snakes and wildlife road crossing surveys. Cover boards which help detect more common snake species are most effective when placed near known/potential hibernacula, i.e., old standing structures, stone foundations, rocky slopes, rock crevices. Cover boards need to be left on-site for several years before attracting snakes and, as such, were not used for baseline data collection for the Subject Lands.

Snake surveys were conducted on mild spring mornings (minimum 10ºC) and relatively cool autumn days (no greater than 25ºC) between 8:00 AM and 2:00 PM, with sunny or partially overcast conditions. Data recorded during snake surveys included: species observed and locations (UTM coordinates), air 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).

A total of sixteen snake transects were surveyed on the Subject Lands in April 2017 and are illustrated on **Figure 7** (**Appendix A**). During subsequent vegetation surveys, three potential snake hibernacula were found and, as a result, snake survey transects were adjusted to target these locations and other areas of interest during September 2017 snake surveys. The Fall snake surveys also included transects along the internal roads in the western portion of the Subject Lands (associated with the aggregate recycling area). Fall snake transects and area searches are shown on **Figure 7** (**Appendix A**).

No snakes were observed during spring 2017 snake surveys. During Fall 2017 snake surveys, low numbers (1 to 2 individuals) of one snake species, Eastern Gartersnake (*Thamnophis sirtalis sirtalis),* were recorded within the Subject Lands. This species is common and secure in Ontario (NHIC 2016). The results of snake transect surveys and wildlife road-crossing surveys are provided in **Table 11** and **Table 12** (**Appendix B**), respectively.

Three potential snake hibernacula sites (overwintering areas) were identified. One potential snake hibernacula was associated with the foundation/cellar of a rural outbuilding in the eastern portion of the Subject Lands (AS3; **Figure 7**, **Appendix A**). The two other potential snake hibernacula were found in wooded areas east of the aggregate portion of the Subject Lands during a vegetation survey on September 21, 2017 (AS2 and AS4; **Figure 7**, **Appendix A**). Of the three potential hibernacula sites, snakes were observed only in the vicinity of the potential hibernacula (small mammal burrow in a south-facing slope) located in the woods

east of the aggregate portion of the Subject Lands (AS4; **Figure 7**, **Appendix A**). No snakes were observed entering/exiting any of the potential hibernacula.

Snake species abundance/diversity was not sufficient to confirm the presence of snake hibernacula SWH (MNRF 2015). Candidate snake hibernacula SWH is identified for the potential hibernacula located at AS3 (old cellar / foundation) and AS4 (small mammal burrow in south-facing slope) (**Figure 7**, **Appendix A**). AS2 is not identified as SWH because it is a rock pile that does not extend underground.

3.4.7 Winter Wildlife

Winter wildlife field surveys were conducted on February 26, 2012. The purpose of the investigation was to establish presence/absence and relative importance of winter wildlife habitat within the Subject Lands by recording wildlife tracks, trails, signs, species observations, and other significant habitat details.

Winter wildlife surveys that were conducted along transects throughout a portion of the Subject Lands are depicted in **Figure 8** (**Appendix A**). Transect locations were determined through an inspection of ortho-photography. Vegetation communities, and ground observations were distributed across the property to ensure that the ecological variability was adequately sampled. Surveys were concentrated along existing access routes, trails, habitat edges, hedgerows, and streams, as long as habitat was safely accessible by snowshoes. Unique transects were established for each vegetation community type, and long transects were broken up into transect segments so that it is easier to identify where an observation took place.

Whenever possible, fieldwork was conducted at least 12 hrs to 24 hrs after moderate (less than 15 cm accumulation in 24 hrs) snowfall. Fieldwork was conducted 24 hrs to 48 hrs after larger snow events (greater than 15 cm accumulation in 24 hrs).

Wildlife tracks were recorded within 2 m to 3 m on either side of each transect, and all other evidence or ‘signs’ of wildlife (scat, browse, nests, hibernacula, etc.) were recorded. ‘Trails’ are defined as numerous overlapping tracks that are difficult to discern from one another, which creates a trail system. In many cases, trails are used by many different wildlife species.

The Significant Wildlife Habitat Technical Guide (MNR 2000), as well as the Resources Inventory Standards Committee (RISC) Species Inventory Methods Manual, were used as guidance documents for the survey methodology (RISC 2014). The provincial and global status of species identified in the Subject Lands was referenced in the NHIC database (NHIC 2014).

Ten mammal and three bird species were identified during this winter survey of the Subject Lands (**Table 5**, **Appendix B**). All species observed are considered provincially and globally common (S5/G5; NHIC 2016).

3.4.8 Bats

On May 11 and 12, 2016, suitable bat roosting tree density surveys were completed for the Subject Lands.

Bat roosting tree density surveys are completed in association with qualitative assessments as snags are indicators of high quality potential maternity roost habitat. Bat maternity colonies are considered by the MNRF to be a type of significant wildlife habitat (as per the Provincial Policy Statement; MMAH 2015). Further, the four provincially protected bat species are known to establish maternity roosts in trees, both within woodlands and hedgerows.

Survey Methods

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

Using the above criteria, several areas were identified to be searched on the Subject Lands **Figure 9** (**Appendix A**).

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

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

These results were then used to assess the quality and potential of the area to provide bat

maternity roost habitat. Areas with ≥10 suitable roosting trees/ha determined to provide the greatest potential bat maternity roost habitat in accordance with MNRF guidelines.

Survey Results

The results of the surveys are presented on **Table 13** (**Appendix B**) by area number, corresponding with the locations shown in the field map presented on **Figure 9**.

Based on the results above, candidate Significant Wildlife Habitat for Bat Maternity Colonies is present within most of the polygons on the Subject Lands, apart from the small communities identified as Polygons 5, 6, 9, 11, 12 and 13.

Given that suitable roosting trees were identified within numerous polygons on the Subject Lands, follow-up acoustic monitoring surveys in June were undertaken to determine which species of bats are present on the Subject Lands.

Acoustic Monitoring Surveys

Surveys to detect bat species were carried out on the Subject Lands on June 6, 2016; and from June 22 to July 4, 2017; and from July 10 to July 15, 2017. Acoustic monitoring surveys were completed using Wildlife Acoustics *Songmeter SM3BAT* recording units. The methods and results of these surveys are provided below.

Surveys were completed in and adjacent to natural features meeting criteria provided in "Survey Protocols for Species at Risk Bats within Treed Habitats: Little Brown Myotis, Northern Myotis, and Tri-Coloured Bat" (MNRF 2017), and as described in Province's Significant Wildlife Habitat Criterion Schedule for Ecoregion 6E (MNRF 2015).

Stations for passive detectors 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 ≥10 cm Diameter at Breast Height (DBH) trees with peeling bark, leaf clusters, and cavities, along the edges of woodlands, hedgerows, as well as areas where trees are proposed to be removed.

Surveys were conducted starting at sunset and ending at sunrise when temperatures were >10°C with low winds and no precipitation (**Figure 9**, **Appendix A**). Survey dates are provided in **Table 2** (**Appendix B**). **Table 14** (**Appendix B**) summarizes the dates and times of bat acoustic surveys.

Survey Results

Bat species can be identified using sonographic characteristics from calls used by bats to echolocate. These ultrasonic calls can be detected, recorded, and analyzed by biologists trained in bat sonogram interpretation to reasonably predict the species of bats present. All ultrasonic recordings were filtered to eliminate recordings with high levels of noise or with no bat calls, and then further analyzed using *SonoBat's* auto-classification tool. Any calls with a positive identification were manually vetted by a wildlife ecologist with training in bat species identification by sonogram. All species of bats can make calls that range in frequencies and sonogram shape, depending on the behavior at the time of call recording. Echolocation calls are not unique to species and vary between social echolocation calls, and foraging calls in addition to the search phase calls currently used to identify to species. Calls recorded during a bat's search phase are the most reliable for an accurate species identification.

During passive acoustic surveys, six bat species were confirmed to be present on the Subject Lands, Big Brown Bat *(Eptesicus fuscus),* Hoary Bat (*Lasiurus cinereus*), Silver-haired Bat *(Lasionycteris noctivagans),* Eastern Red Bat *(Lasiurus borealis)*, Eastern Small-footed Bat *(Myotis leibii),* and Little Brown Bat *(Myotis lucifugus).* During the 15 evenings of acoustic surveys, a total of 10530 low frequency calls and 92 high frequency calls were recorded; with a cumulative total of 10622 passes by all species. Of the low frequency calls, 5283 calls were confirmed to be Big Brown Bat, 191 confirmed calls were Hoary Bat, 106 confirmed calls were Silver-haired, and the remaining 4950 low frequency calls were not identifiable to species (**Table 15**, **Appendix B**). Of the high frequency calls, eight calls were confirmed to be Eastern Red bat, five calls were confirmed to be Eastern Small-footed Bat, and six were confirmed to be Little Brown Bat. The remaining 73 high frequency calls were not identifiable to species and did not show characteristics of Myotis calls.

Eastern Small-footed and Little Brown Bat are listed as Endangered in Ontario where the species and its habitat is protected under the general habitat regulation of Ontario's Endangered Species Act. These protected bat species were observed using the deciduous forests (FOD) where WOOD1, WOOD2, WOOD3, WOOD9 and WOOD11 SM3 passive recorders were located (**Figure 9**, **Appendix A**). Individuals and the habitat of this species are protected under the Act. Consultation with the MECP may be required to address any potential impacts to habitat for these species.

According to the Province's SWH criteria for Bat Maternity Colonies in Ecoregion 6E (MNRF 2015), habitat for Big Brown Bats and Silver-haired Bats are to be considered. A total of 5283 calls were recorded from Big Brown Bats and 106 calls were recorded from Silver-haired Bats on the Subject Lands. **Table 16** in **Appendix B** provides a summary of the Big Brown Bat and Silver-haired Bat calls recorded at each monitoring station.

Four monitoring stations (WOOD1, WOOD8, WOOD9, WOOD12) were situated in forest communities where habitat density plots were not undertaken.

In addition, though the presence of Big Brown Bats and Silver-haired Bats in sufficient numbers at WOOD12 indicates a potential for presence of Significant Wildlife Habitat for Bat Maternity Colonies, cultural woodland communities do not meet SWH criteria for candidate maternity colonies (**Figure 9**, **Appendix A**).

4.0 ANALYSIS OF ECOLOGICAL & NATURAL HERITAGE SIGNIFICANCE UNDER THE PPS (2014)

The MNRF Natural Heritage Reference Manual (NHRM) (MNR 2010) provides guidance regarding the interpretation of significance of natural heritage features and associated functions. Sections 4.1 through 4.8 below provide a detailed discussion regarding criteria met for designation as the above noted features. Section 4.9 provides a summary of the natural features found in and adjacent to the Subject Lands and their ecological functions.

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).

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.

4.1 Significant Wetlands

Within Ontario, Significant Wetlands are identified by the MNRF or by their designates. Other evaluated or unevaluated wetlands may be identified for conservation by the municipality or the conservation authority.

As noted in section 3.1, the Subject Lands contain a provincially significant wetland (PSW) unit that is part of the King-Vaughan PSW complex. The PSW unit on the Subject Lands is an organic thicket swamp (SWT3; **Figure 4**, **Appendix A**).

There are also wetland units within the Subject Lands that have not been evaluated in accordance with the Ontario Wetland Evaluation System (2014). At the southern end of the drainage feature on-site, there is a wetland unit comprised of a disturbed mineral meadow marsh (removed in 2016) and willow mineral thicket swamp **(**SWT2-2; **Figure 4**, **Appendix A**). The thicket swamp portion receives direct inflow from the King-Vaughan PSW unit (SWT3, via the surface water drainage feature in the Subject Lands. The meadow marsh portion, which was removed in 2016, is a zone of groundwater discharge, with surface water flowing towards the adjacent willow mineral thicket swamp (SWT2-2). Groundwater upwelling

continues to emerge where the meadow marsh was once located and still flows into the willow thicket swamp.

4.2 Significant Coastal Wetlands

Significant coastal wetlands are not present within or adjacent to the Subject Lands.

4.3 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 MECP through the *Information Gathering Form* (IGF) process. Due to the sensitive nature of this information, all correspondence and outcomes will remain with the MECP and its jurisdiction. Two endangered species, three threatened species and two species of special concern were recorded within the Subject Lands and are discussed below.

Butternut

Two Butternut trees were recorded during the early investigations, however were noted to be dead in 2015. Three additional trees, one of which was dead, were observed in 2016. And additional three mature trees were observed during 2017 botanical surveys. Butternut receives general habitat protection under the ESA, 2007.

The general habitat of Butternut includes suitable areas within up to a 50 m radius centered on the trunk or stem of the Butternut. This area is intended to protect the critical root zone of individual trees, immediate habitat conditions surrounding the tree that support the growth and persistence of the tree over its lifetime (25 m) and the surrounding habitat conditions and the core seedling establishment areas up to 50 m from a parent tree. Should any of the proposed alignments (or associated construction zones) of Kirby Road extension approach a 50 m radius around each live tree, then a full Butternut Health Assessment may be required to confirm what mitigation and permitting requirements may be needed if removal or development within the 50 m radius is proposed.

Bank Swallow

A Bank Swallow nest colony (239 nest holes counted) was first recorded in 2012 within an aggregate pile in the Subject Lands. Due to slumping of this original nest site, the Bank Swallow colony moved to another aggregate pile on-site where breeding evidence was observed in 2014 (35 nest holes counted of which 25 appeared to be in active use by 20 to 30 birds) and 2015 (6 birds observed near nest site, however nest holes could not be counted due to active heavy machinery nearby).

Up to 35 individuals were observed in 2017 within the aggregate portion of the Subject Lands. The birds were unsuccessfully attempting to excavate holes for breeding (habitat characteristics/slope were unsuitable). The Subject Lands do not appear to provide suitable breeding habitat for this species. The potential for the Subject Lands to provide foraging habitat for this species will be addressed specifically with the MECP through the SAR *Information Gathering Form.*

Barn Swallow

Multiple birds were observed foraging over the Subject Lands during 2010, 2011, 2015 and 2017 surveys. However, no nesting structure was observed that was associated with breeding by this species. It was determined that these birds were coming from off-site nesting areas to forage over the lands. This species may nest in small outbuilding structures associated with the residence in the northwest corner of the Subject Lands or on other residences along Bathurst.

Potential impacts to Barn Swallow foraging habitat will be addressed under specific assessment by the MECP through the SAR *Information Gathering Form* process.

Bobolink

Breeding habitat for Bobolink was confirmed within the Subject Lands during 2017 surveys. Probable and confirmed breeding evidence was noted in one habitat polygon in the northeast portion of the Subject Lands, and possible breeding evidence was recorded within on cultural meadow at the east end of the Subject Lands. This species was previously observed within the Subject Lands in 2011 and 2015. Surveys following the MNRF (2012) *Bobolink survey protocol* were conducted in 2017 only. Potential impacts to Bobolink breeding habitat will be addressed under specific assessment by the MECP through the SAR *Information Gathering Form* process.

Eastern Meadowlark

Eastern Meadowlark was not recorded during any surveys on the Subject Lands, including targeted breeding bird surveys in 2017.

American Ginseng

American Ginseng (*Panax quinquefolius*) typically occurs in quality, undisturbed, mesic deciduous forests of Beech, Sugar Maple, White Ash, Red Oak and Hemlock, on gentle east and north-facing slopes and ravines. The soil is well drained and humus and calcium-rich, with little or no sunlight, and a good layer of leaf litter.

The shrub understory is usually relatively open, with a tall tree canopy maximizing air circulation. There is little competition from herbaceous ground cover, which typically consists of Jack-in-the-Pulpit, False Solomon's Seal, May-apple, and Baneberry.

The Subject Lands appears to provide most, if not all, of the habitat conditions required by American Ginseng, including topographic conditions and forest conditions (i.e., deciduous and mixed forest units). This species was not observed on the Subject Lands despite several years of botanical inventory surveys.

Redside Dace

The MNRF indicated Redside Dace is present in the East Branch of the Don River approximately 2.5 km downstream of the Subject Lands. However, at a meeting with the MNRF on Dec. 13, 2018 the MNRF (Emily Funnel) verified that this habitat contributing habitat for Redside Dace is not present within the Subject Lands. There is no connection between the surface water drainage feature on the Subject Lands to the downstream occupied Redside Dace habitat, as discussed previously in Section 3.5. Therefore, the surface water drainage feature on the Subject Lands are not considered to be Regulated Contributing Habitat for Redside Dace.

Eastern Small-footed Myotis and Little Brown Myotis

Eastern Small-footed Myotis was recorded in 2017 in the large contiguous woodland that extends north-south through the Subject Lands. The forest communities on the Subject Lands contain suitable roosting trees for bats and therefore the forests should be considered habitat for Eastern Small-footed Myotis.

Little Brown Myotis was identified during 2017 field investigations in woodlands east of Dufferin Street. These woodlands contain suitable roosting trees for bats, and therefore provide habitat for Little Brown Myotis.

Therefore, the Subject Lands are providing habitat for Endangered bat species and this habitat in Ontario is protected under Section 10 of the Endangered Species Act. Additional discussions will be held with MECP to determine the requirements to address this species under Endangered Species Act, 2007.

4.4 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).

As discussed in section 3.3.1, neither direct nor indirect fish habitat is not present in the Subject Lands.

4.5 Significant Woodlands

Under the PPS (MMAH 2015), significant woodlands are treed or forested areas which are *"ecologically important in terms of features, such as species composition, age of trees and stand history; functionally important due to its contribution to the broader landscape because of its location, size or due to the amount of forest cover in the planning area; or economically important due to site quality, species composition, or past management history"*. Significant woodlands are to be identified using criteria established by the MNRF.

The York Region Official Plan 2010 identifies Woodlands on and adjacent to the Subject Lands but does not specifically identify those woodlands within York Region that are considered Significant. The 2005 York Region Significant Woodlands Study reported woodland cover in York Region to be 23.1% of the landscape cover, with essentially all (about 98%) (22.5% of the landscape) of that cover being determined to be significant (North-South Environmental Inc. 2005). The mean patch size of significant woodlands in York Region was determined in that background work to be 12.28 ha.

The City of Vaughan Official Plan 2010 identifies a series of Core Features, which includes woodlands (including those identified as significant), on and adjacent to the Subject Lands, but does not specifically identify those woodlands within the City of Vaughan that are considered significant. The 2005 York Region Significant Woodlands Study reported woodland cover in Vaughan to be 12.1%, with 11.6% (or 96% of the total woodland area) being deemed to be Significant with a mean patch size of 7.0 ha for significant woodlands and a mean patch size of 5.86 ha for all woodlands (North-South Environmental Inc. 2005). North-South Environmental Inc. (2014) indicated that woodland cover within the City of Vaughan was 11%.

The woodlands on the Subject Lands have been examined and mapped in terms of ELC community types. These woods include some larger blocks, which are contiguous with woodlands, which extend beyond the limits of the Subject Lands. Patch sizes were measured, and each patch was considered in terms of the presence of other indicators of potential significance. Forest interior occurs within the larger patches adjacent to the Subject Lands, as shown on **Figure 11** (**Appendix A**). About 25 ha of interior forest greater than 100 m from the woodland edge are depicted along with about 2 ha of deeper interior (i.e., greater than 200 m from the woodland edge) occur in these same woodlands.

Apart from the larger contiguous forest blocks, there are several smaller disconnected patches on the Subject Lands ranging in size from 0.6 ha to 6.7 ha. The larger and contiguous forested areas are more significant in terms of the degree of features and functions present.

The woodlands on the Subject Lands were delineated and analyzed using NHRM criteria. Size thresholds (woodlands with greater than 4 ha with land cover between 5% to 15%) were met for most of the woodlands within the Subject Lands. In addition, many of these woodlands provide habitat for the Eastern Wood-Pewee, a bird species of Special Concern. Significant Woodlands determined to be present on and adjacent to the Subject Lands, based on NHRM criteria, are shown in **Figure 10** (**Appendix A**).

4.6 Significant Valleylands

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

The City of Vaughan Official Plan (2010) includes valley and stream corridors within its Core Feature area but does not specifically identify significant valleylands. The City's Natural Heritage Network Study (North-South Environmental Ltd. 2014) includes mapping with a "crest of slope screening layer for valleylands", but no valleylands are depicted as being present in the Subject Lands.

None of the features in the Subject Lands meet standard and accepted definitions of significant valleylands.

4.7 Significant Areas of Natural and Scientific Interest (ANSIs)

As noted in section 3.1, regionally significant earth and life science ANSIs are present within and adjacent to the Subject Lands, as shown in **Figure 2** (**Appendix A**). However, the NHRM (MNR 2010) states that for the purposes of the PPS policies, significant ANSIs include only ANSIs identified as provincially significant. Therefore, there are no significant ANSIs present within or adjacent to the Subject Lands.

4.8 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 (MNRF 2015). The Subject Lands are

located in eco-Region 6E and were therefore assessed using the 6E Criterion Schedule (MNRF 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.

A variety of SWH indicator species (MNRF 2015) were recorded on the Subject Lands. **Table 17** (**Appendix B**) discusses all SWH types relevant to the Subject Lands based primarily on the Savanta 2017 data. SWH types that were confirmed to be present or that are potentially present (i.e., candidate SWH) pending further study, are summarized below. Confirmed and candidate SWH polygons/locations are illustrated on **Figure 11** (**Appendix A**).

Confirmed SWH types:

- Bat maternity colonies SWH: The Subject Lands provide large diameter trees (>25 cm DBH) in suitable densities to provide habitat. This SWH type is confirmed to be present on the Subject Lands.

- Woodland area-sensitive breeding bird SWH: Breeding evidence was recorded for 3 or more listed species in the same forest patch which contains forest interior habitat > 200 m from edge (Yellow-bellied Sapsucker, Red-breasted Nuthatch, Ovenbird and Scarlet Tanager). This SWH type is confirmed to be present on the Subject Lands.

- Rare wildlife SWH (Special Concern species and provincially rare species S1-S3):
    - Two Special Concern bird species were observed within the Subject Lands: Eastern Wood-Pewee and Wood Thrush. Confirmed rare wildlife SWH is present and the SWH polygons are consistent for both species.

Candidate SWH types:

- Raptor wintering area SWH: Forest and upland meadow / fallow field communities meet the habitat size criteria of 20 ha. Candidate raptor wintering SWH is present.

- Seeps and springs SWH: Groundwater discharge areas (seeps) have been noted in the organic thicket swamp community (SWT3) and in the disturbed meadow marsh/willow thicket swamp near the south boundary of the Subject Lands (the meadow marsh was removed in 2016 however groundwater continues to flow into the willow thicket swamp SWT2-2). Three wildlife species identified as requiring this habitat type were observed at one or both locations: White-tailed Deer, Wild Turkey and Spotted Salamander. Candidate seeps and springs SWH is identified for these two locations. Hydrogeological studies will confirm the character of the seepage and will allow confirmation of the presence of this SWH is present. The hydrogeological work will contribute to the delineation of any relevant SWH polygons and their associated recharge areas.

- Woodland amphibian breeding SWH: Amphibian species diversity/abundance on the Subject Lands did not meet the criteria for this SWH type. One pond (amphibian station B; **Figure 6**, **Appendix A**) located just past the northern boundary of the Subject Lands is identified as candidate SWH for woodland amphibian breeding habitat. A variety of calling amphibian species were recorded from this pond over the years of study, including call code 2 and call code 3 abundance levels. This pond provides suitable habitat for pool-breeding salamanders; however, access was not available to confirm species diversity/abundance of non-calling amphibians. As such, amphibian station B (off-site pond) is identified as candidate woodland amphibian breeding SWH.

- Snake hibernacula SWH: Two potentially suitable snake hibernacula were found in September 2017. Habitat criteria are met for this SWH type.

- Rare wildlife SWH (Special Concern species and provincially rare species S1-S3):

  One Special Concern insect species was recorded on the Subject Lands: Monarch. This species was observed during all three rounds of 2017 insect surveys at various old field/meadow locations. Candidate rare wildlife SWH is identified for this species.

4.9 Summary of Ecological and Natural Heritage Significance

Of the eight types of significant natural heritage features defined in the PPS (MMAH 2014), the following occur in part, within the Subject Lands:

- Habitat of Endangered and Threatened Species;

- Significant Wetlands;

- Significant Woodlands;

- Significant Wildlife Habitat (relevant SWH criteria are met for habitat size, vegetation and indicator species; MNRF 2015):
    - Bat Maternity Colonies;
    - Area-Sensitive Bird Breeding Habitat; and
    - Special Concern Species Habitat (Eastern Wood-Pewee and Wood Thrush).

- Candidate Significant Wildlife Habitat (habitat criteria are met however data is insufficient to confirm Significance):
    - Raptor Wintering Area;
    - Seeps and Springs;
    - Woodland Amphibian Breeding Habitat;
    - Snake Hibernacula; and
    - Special Concern Species (Monarch).

5.0 OAK RIDGES MORAINE CONSERVATION PLAN

The Subject Lands was reviewed and considered for the presence of Key Natural Heritage Features (KNHFs) and Hydrologically Sensitive Features (HSFs), as defined by the ORMCP Technical Papers.

5.1 Key Natural Heritage Features

5.1.1 Wetlands

ORM wetlands are those that meet the following criteria:

- all wetlands regardless of size, evaluated as provincially significant in accordance with the Ontario Wetland Evaluation System (OWES) and accepted by MNRF;
- all other identified wetlands 0.5 hectares or greater in size; and
- all other identified wetlands less than 0.5 hectares in size except where it can be demonstrated by a qualified person to the satisfaction of the approval authority that the wetland does not constitute or provide one or more of the following features or functions:
    - a wetland feature having one or more of the following characteristics;
        - permanent or intermittent surface water connection between the wetland and an adjacent key hydrologic feature;
        - significant recharge to the underlying aquifer (generally considered to be any small wetland underlain by at least 3 metres of mineral soil having a hydraulic conductivity of 10-4cm/s or more); or
        - direct hydraulic connections between the wetland and an underlying aquifer (e.g., along fracture zones or granular soil conduits);
    - KNHF other than a wetland (e.g. significant wildlife habitat);
    - important ecological linkages to adjacent KNHFs or between two or more adjacent KNHFs; or
    - habitat for a diverse range of native plant and animal species with emphasis on moraine rare species.

Wetlands in the Subject Lands are shown on **Figure 4** (**Appendix A**). The organic thicket swamp community (SWT3) on the Subject Lands is a PSW unit (part of the King-Vaughan PSW complex) and meets the ORMCP criteria.

There are several wetland units along the southern boundary of the Subject Lands that have not been evaluated in accordance with the OWES (2014), including a mineral meadow marsh community (removed in 2016) and a willow thicket swamp wetland (SWT2-2). The willow thicket swamp unit receives direct inflow from the King-Vaughan PSW, via the surface water drainage feature in the Subject Lands. The area where meadow marsh was located (the wetland was removed in 2016), is a zone of groundwater discharge with groundwater and surface water flowing towards the adjacent willow thicket swamp (SWT2-2). The combined size of this contiguous wetland unit is 0.5 ha.

Another meadow marsh wetland (MAM2-12) is located in an agricultural field in the northwest portion of the Subject Lands. In some years, the meadow marsh appears to drain into the upper end of organic thicket swamp (SWT3) PSW unit. During field studies in 2016, however, it was determined that the meadow marsh wetland (MAM2-12) had been altered through the installation of drainage tile in the area to facilitate ongoing agricultural practices. Based on the latest Ecological Land Classification survey (2015) the remaining MAM2-12 is 0.34 ha in size.

5.1.2 Significant Portions of the Habitat of Endangered, Rare and Threatened Species

According to the ORMCP, "habitat of endangered, rare and threatened species":

> *(a) is an area where individuals of an endangered species, a rare species or a threatened species live or have the potential to live and find adequate amounts of food, water, shelter and space to sustain their population, including an area where a species concentrates at a vulnerable point in its annual or life cycle and an area that is important to a migratory or non-migratory species, and*
>
> *(b) has been further identified, by the Ministry of Natural Resources or by any other person, according to evaluation procedures established by the Ministry of Natural Resources as amended from time to time.*
>
> "Significant", as defined in the ORMCP, means "identified as significant by the Ministry of Natural Resources, using evaluation procedures established by that Ministry, as amended from time to time".

Significant portions of habitat are those natural areas that are required for reproduction, foraging, nesting, shelter, migration, hibernation and other essential life processes.

The ORMCP Technical Paper 6 confirms that endangered, rare and threatened species will include the following:

- Provincially rare; and

- Special Concern, Threatened or Endangered, as defined on the MNRF Species at Risk in Ontario (SARA) list.

Provincially Rare Species

One provincially rare species was noted on the Subject Lands. One Common Sootywing, which is provincially rare (S3), was recorded during 2017 insect surveys. Only one individual was observed, and habitat on-site is not considered significant wildlife habitat for this species (**Table 17**, **Appendix A**).

Special Concern, Threatened or Endangered Species

Butternut (Endangered in Ontario and Canada): As noted previously, the Subject Lands contain 23 live Butternut trees.

Redside Dace (Endangered in Ontario and Canada): This fish species is known to occupy the East Branch of the Don River downstream of the Subject Lands. As previously discussed, the Subject Lands do not provide Regulated Contributing habitat for this species.

Little Brown Myotis (Endangered in Ontario and Canada): Six high frequency calls recorded on the Subject Lands during acoustic monitoring surveys were confirmed to be this species. Suitable habitat occurs in the deciduous forests (FOD) where WOOD1, WOOD2, WOOD3, WOOD9 and WOOD11 SM3 passive recorders were located (**Figure 9**, **Appendix A**).

Eastern Small-footed Myotis (Endangered in Ontario and Canada): Five high frequency calls recorded on the Subject Lands confirmed the presence of this species. Suitable habitat occurs in the deciduous forests (FOD) where WOOD1, WOOD2, WOOD3, WOOD9 and WOOD11 SM3 passive recorders were located (**Figure 9**, **Appendix A**).

Tri-colored Bat (Endangered in Ontario and Canada): This species was not recorded on the Subject Lands despite targeted acoustic monitoring in 2017.

Northern Myotis (Endangered in Ontario and Canada): This species was not recorded on the Subject Lands despite targeted acoustic monitoring in 2017.

Bobolink (Threatened in Ontario and Canada): This species was recorded on the Subject Lands in 2017 through surveys that followed the MNRF (2012) *Bobolink survey protocol*. Confirmed and probable breeding evidence was recorded in a continuous habitat polygon in the northeast portion of the Subject Lands. Possible breeding evidence was recorded in a cultural meadow towards the eastern boundary of the Subject Lands.

Eastern Meadowlark (Threatened in Ontario and Canada): This species was not recorded on the Subject Lands despite targeted breeding bird surveys in 2017.

Barn Swallow (Threatened in Ontario and Canada): Foraging Barn Swallow were noted over the Subject Lands. No suitable nesting habitat was observed on the Subject Lands.

Bank Swallow (Threatened in Ontario and Canada): A Bank Swallow nest site / colony was recorded on the Subject Lands in 2012 and 2014. The nest site degraded over time and no nest excavation success was noted during breeding bird surveys in 2017.

Monarch (Special Concern in Ontario and Endangered Canada): The habitat of this species on the Subject Lands is identified as candidate significant wildlife habitat (MNRF 2015). Targeted surveys are recommended in summer 2018 to map Milkweed abundance and determine whether all life stages of Monarch are present.

Wood Thrush (Special Concern in Ontario and Threatened in Canada): The habitat of this species on the Subject Lands is confirmed significant wildlife habitat (MNRF 2015). Confirmed SWH for this species is delineated on **Figure 11** (**Appendix A**).

Eastern Wood- Pewee (Special Concern in Ontario and Canada): The habitat of this species on the Subject Lands is confirmed significant wildlife habitat (MNRF 2015). Confirmed SWH for this species is delineated on **Figure 11** (**Appendix A**).

5.1.3 Fish Habitat

As noted previously, the surface water drainage feature traversing the Subject Lands is not considered to provide direct or indirect fish habitat, given lack of a direct surface water connection to downstream fish habitat.

5.1.4 Areas of Natural and Scientific Interest (Life Sciences)

As noted previously, the Maple Uplands and Kettle Wetlands Regionally Significant Life Science ANSI is present in portions of the Subject Lands (**Figure 11**, **Appendix A**).

5.1.5 Significant Valleylands

The ORMCP Technical Paper 1 refers to significant valleylands as including:

> "all streams with well-defined valley morphology (i.e. floodplains, meander belts and valley slopes) having an average width of 25 m or more;

> all spillways and ravines with the presence of flowing or standing water for a period of no less than two months in an average year. Such features must be greater than 50 m in length; 25 m in average width with a well-defined morphology (i.e. two valley walls of 15% slope or greater with a minimum height of 5 m, and valley floor), and having an overall area of 0.5 ha or greater.
>
> additional features identified by the approval authority, that are consistent with one or more of the functions described above. "

A Minister's Order (2015) identified three areas within the Study Area to be considered as Valley and Stream Corridor under the Vaughan OPA 600. This includes a wooded area in the southwest corner and a wooded slope near the mid-point and the eastern end around the surface water drainage feature. OPA 600 indicates that "valley corridors may or may not have a defined watercourse channel" which is different than the PPS valleyland definition, which notes that the feature would have flowing or standing water for at least some portion of the year. Two of the areas designated as Valley and Stream Corridor in the Ministers Order are not associated with a watercourse feature, and therefore, would not be considered valleylands under the PPS. Only the Valley and Stream Corridor designated at the eastern end of the Subject Lands is associated with a watercourse and therefore, this feature is considered a valleyland under the PPS (MMAH 2014).

Significant Valleylands should be defined and designated by the planning authority. General guidelines for determining significance of these features are presented in the NHRM (MNR 2005) 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-cultural values, with additional guidance on the evaluation of significance provided in Attachment A.7 of the NHRM (MNR 2010).

The watercourse on the Subject Lands has been historically realigned and channelized around the former aggregate extraction area. Natural woodland cover is present on the eastern side of the watercourse feature. The western side currently consists primarily of early successional meadow, associated with former aggregate uses. The large forested area adjacent to the east provides ecological linkage functions, that are unrelated to valleyland form. The ecological functionality of the watercourse and its associated valley form interrupted by the presence of a pipeline, which prevents the downstream movement of surface water off the Subject Lands. The valley does not assist in maintaining downstream hydrology or water quality, although it does appear to contribute to groundwater recharge.

Based on this assessment, the valleyland on the Subject Lands is not considered to be significant.

5.1.6 Significant Woodlands

The ORMCP Technical Paper #7 - Identification and Protection of Significant Woodlands identifies significant woodlands as having either:

- tree crown cover of over 60% of the ground, determinable from aerial photography ("forest" of Lee et al. 1998); or

- a tree crown cover of over 10% of the ground, determinable from aerial photography ("treed community" of Lee et al. 1998), together with on-ground stem estimates of:
    - 1,000 trees of any size per hectare, or
    - 750 trees measuring over five centimetres in diameter, per hectare, or
    - 500 trees measuring over 12 centimetres in diameter, per hectare, or
    - 250 trees measuring over 20 centimetres in diameter, per hectare (based on the Forestry Act of Ontario, 1998).

- And, which have a minimum average width of 40 metres or more measured to crown edges.

- And, which are:
    - 4 hectares or larger in size located in the Countryside or Settlement Areas of the ORMCP; or
    - 0.5 hectare or larger in size located in the Natural Core or Natural Linkage Areas of the ORMCP; or
    - 0.5 hectare or larger located within or intersecting with a key natural heritage feature or hydrologically sensitive feature or their vegetation protection zone.

Woodlands on and adjacent to the Subject Lands are considered to be Significant Woodlands, as discussed in Section 4.5 and shown on **Figure 10** (**Appendix A**).

5.1.7 Significant Wildlife Habitat

Guidance with respect to evaluating significant wildlife habitat is provided in the ORMCP Technical Paper 2 which generally defers the evaluation of significance to the provincial Significant Wildlife Habitat Technical Guide (MNR 2000) and it's supporting document the Significant Wildlife Habitat Ecoregion Criteria Schedules (2015).

An assessment of all SWH types relevant to the Subject Lands is provided in **Table 17** (**Appendix B**). As noted in section 4.8 of this report, confirmed SWH is present on the Subject Lands for woodland area-sensitive breeding birds, two Special Concern bird species (Eastern Wood-Pewee and Wood Thrush), and bat maternity colonies. Candidate SWH has been identified on the Subject Lands for one Special Concern insect species (Monarch), wintering raptor habitat, seeps and springs, snake hibernacula, and woodland amphibian breeding habitat (for an off-site pond immediately north of the Subject Lands).

Confirmed SWH polygons are mapped on **Figure 11** (**Appendix A**).

5.1.8 Sand Barrens, Savannahs, or Tallgrass Prairies

These features do not exist on or adjacent to the Subject Lands.

5.2 Hydrologically Sensitive Features

5.2.1 Permanent and Intermittent Streams

As noted previously, an intermittent surface water drainage feature runs through a portion of the Subject Lands. The feature originates in the King-Vaughan Wetland Complex and flows south before encountering the TransCanada Pipeline corridor at the southern end of the Subject Lands where further downstream flow is prevented by the berm. Water pools upstream from the berm where it is either infiltrated into the ground or evaporated.

The portion of the feature between the upstream and downstream wetlands does exhibit characteristics consistent with the definition of an intermittent stream provided in Appendix 1 of ORMCP Technical Paper 12 (Hydrological Evaluations for Hydrologically Sensitive Features). The portions of the feature on the Subject Lands also meet the *Conservation Authorities Act* definition of a watercourse. Neither the ORMCP Technical Paper 12, nor the *Conservation Authorities Act* watercourse definition provide any criteria regarding connection of surface water drainage features to other downstream surface water features, since under normal circumstances, continuity of downstream flow in watercourse features is typical.

However, given that the feature does not have a direct surface water connection to any downstream permanent or intermittent stream, and therefore does not provide any of the contributing functions normally attributed to headwater intermittent streams, its value is significantly reduced compared to that which may be provided by typical hydraulically connected intermittent streams. The feature is essentially an isolated drainage feature that does not function as a typical watercourse connected to a larger drainage network and therefore, should not necessarily be managed as a typical watercourse.

Therefore, for the purposes of this assessment, it is not considered to be an intermittent stream. However, this drainage feature does provide local functions (flow conveyance from and to the upstream and downstream wetlands, including groundwater discharges, localized habitat for benthic invertebrates and salamanders).

However, regardless of the unconnected nature of the drainage feature, TRCA has indicated that they consider it to be a watercourse and therefore, it will be regulated under Ontario Regulation 166/06.

5.2.2 Wetlands

As discussed in section 5.1.1, wetlands are present on the Subject Lands and within 120 m of the Subject Lands, as shown on **Figure 4** (**Appendix A**).

5.2.3 Kettle Lakes

There are no kettle lakes on or within 120 m of the Subject Lands.

5.2.4 Seepage Areas and Springs

Evidence of groundwater seeps was noted in the PSW unit (organic thicket swamp SWT3) and in the meadow marsh unit/adjacent willow thicket swamp wetland near the southern boundary of the Subject Lands (the latter meadow marsh unit was removed in 2016). Wetlands are shown on **Figure 9** (**Appendix A**). Several areas of groundwater discharge associated with the surface water drainage feature were also observed with evidence provided by the presence of watercress and iron hydroxide precipitates. Hydrogeological studies will confirm the presence of groundwater discharge areas.

5.3 Summary of ORM KNHFs and HSFs Subject to Impact Assessment

Of the eight types of Key Natural Heritage Features and four types of Hydrologically Sensitive Features defined in the ORMCP, the following occur in part, upon the Subject Lands:

- Wetlands;
- Significant Portions of the Habitat of Endangered, Rare and Threatened Species;
- Significant Woodland;
- Watercourse;
- Confirmed Significant Wildlife Habitat
    - Bat maternity colonies;

- Woodland area-sensitive breeding bird habitat; and,
- Rare wildlife habitat of two Special Concern bird species (Eastern Wood-Pewee and Wood Thrush).

5.4 Constraint Mapping/Ranking

Three constraint levels (high, medium and low) have been assigned to natural heritage features identified within the Subject Lands to identify both opportunities and constraints for analysis of each respective road alignment and ultimately the preferred alignment. These represent relative degrees of importance/sensitivity based on data collected, analysis of ecological and natural heritage significance under the PPS and the ORMCP. However, they do not represent municipal/agency interpretations of constraints associated with features such as significant woodland and significant wetland.

Constraint rankings are described in more detail in the sections that follow and are illustrated on **Figure 12** (**Appendix A**).

5.4.1 High Constraint Features

High constraint features are generally considered unsuitable for development/removal and include natural features and functions frequently designated for protection through provincial (PPS), municipal, regional or other regulatory agency policies and may also be areas assessed for ecological functions that cannot be easily replaced or mitigated through modifications or habitat restoration elsewhere. This applies to areas where no encroachment is generally recommended other than minor adjustments to feature boundaries (i.e., Provincially significant wetlands, habitat of some threatened and endangered species, significant valleylands, fish habitat). The following features are identified as high constraint features within the Subject Lands:

- Woodlands that are identified to provide habitat for threatened and endangered species;
- Woodlands that provide significant wildlife habitat;
- Significant woodlands;
- Larger and more intact and forest blocks with deep interior habitat;
- Significant wetlands.
- ANSIs and/or natural core areas of the ORMCP; and
- One provincially significant wetland identified as part of the King-Vaughan complex.

5.2.2 Medium Constraint Features

Medium constraint should be assigned to woodlands/natural areas within the Subject Lands that have not been assigned a high level of ecological significance and will include but not be limited to smaller and isolated woodland patches, that are not contiguous with larger forest blocks. Medium constrained areas can provide some development potential providing environmentally sound designs are utilized and existing ecological functions are maintained. Some of these features and functions may be more easily restored and/or enhanced on the landscape. Moderately constrained areas may include but are not limited to: important and larger terrestrial corridor linkage components; cultural woodlands and marginal wetlands.

The following features are identified as potential medium constraint features within the Subject Lands:

- Cultural woodland areas that do not meet the criteria to be deemed significant under the PPS; and
- Unevaluated wetlands (MAM2-12 and SWT2-2).

5.2.3 Low Constraint Features

Low constraint features represent areas with limited and localized natural features and functions that may be addressed through avoidance, mitigation and/or removal subject to further analysis and discussion (cultural meadows/cultural thickets).
The following features are identified as potential low constraint features within the Subject Lands:

- Cultural cover types, including the open meadow (CUM1-1) on flat topography in eastern and northern portion of the Subject Lands and the cultural thicket in the south central portion of the Subject Lands (CUT1-7);
- Hedgerows; and
- Agricultural lands, residential lands and disturbed areas.

6.0 SUMMARY OF EXISTING NATURAL CONDITIONS AND RECOMMENDATIONS

This Natural Heritage Existing Conditions Report presents and discusses the natural heritage features and associated functions on, and adjacent to, the Subject Lands and identifies those features considered to be significant under the PPS (MMAH 2014) and Key Natural Heritage Features and Hydrologically Sensitive Features under the ORMCP.

The composite of Natural Heritage policy related definitions is depicted on **Figure 11** (**Appendix A**). These areas represent a variety of natural features and associated functions which reflect a level of significance. The Subject Lands are located partially within the ORMCP area, contain ANSI's, PSWs, Habitat of Endangered and Threatened Species, areas of Significant Woodland, Significant Wildlife Habitat and the presence of Special Concern species as well as provincially and locally rare flora and fauna.

Consultation is ongoing directly with MECP to address any potential impacts to species at risk, including Little Brown Myotis, Eastern Small-footed Myotis, Bobolink, Bank Swallow, Barn Swallow and Butternut and to determine requirements under the *ESA*. Due to the sensitive nature of this information, all correspondence and outcomes will remain with the MNR.

Data collected and analysis of significance of features contained within this report will inform the selection of the preferred route location for the proposed Kirby Road extension within the Subject Lands. General aspects that would be considered in a more detailed review of that alignment would include potential effects on woodland edges, significant features (i.e., PSWs, Species at Risk habitats) and engineering and grading requirements to achieve municipal standards. In the same regard, the servicing of these lands will require consideration of preferred alignments for water and sewage pipes and associated utilities (i.e., to avoid and to minimize potential effects on retained natural features and functions).

The existing ecological features and functions identified within the Subject Lands have been considered according to their relative ecological importance as High, Medium and Low constraints **Figure 11** (**Appendix A**). This information will be considered by the technical team and agencies, along with other technical aspects including social economic, engineering and geotechnical constraints to determine a preferred route alignment for the proposed Kirby Road extension.

In addition, a number of detailed studies are being completed by other members of the technical consulting team related to hydrology/stormwater management, geotechnical and hydrogeological assessments. Those studies will be reviewed to validate impact predictions and supplement avoidance and mitigation measures to prevent or minimize negative impacts on the identified significant natural heritage features on or within 120 m of the Subject Lands

as part of the detailed impact assessment that will be carried out the short list of preferred road alignments for Kirby Road.

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REFERENCES AND BACKGROUND MATERIAL

AECOM 2010. Natural Heritage in the City. City of Vaughan, April 2010.

Bird Studies Canada (BSC) 2003. Marsh Monitoring Program training kit and instructions for surveying marsh birds, amphibians and their habitats. Long Point Bird Observatory and Environment Canada, 41 pp.

Bird Studies Canada (BSC), Canadian Wildlife Service, Ontario Nature, Ontario Field Ornithologists and Ontario Ministry of Natural Resources 2001-2005. Ontario Breeding Bird Atlas Website.

Bird Studies Canada (BSC) 2006. Marsh habitat and vegetation guide.

Bird Studies Canada (BSC) 2014. Marsh monitoring bird surveys overview.

Cadman, M.D., H.J. Dewar, and D.A. Welsh 1998. The Ontario Forest Bird Monitoring Program (1987-1997): Goals, methods and species trends observed. Technical Report Series No. 325, Canadian Wildlife Service.

Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Courturier (eds.) 2007. Atlas of the Breeding Birds of Ontario, 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, Toronto, xxii + 706 pp.

Catling, P., Brownell, V. 2000. Damselflies and Dragonflies (Odonata) of Ontario: resource guide and annotated list.

Caverhill, B., Johnson, B., Phillips, J., & Nadeau, E. 2011. Blanding's Turtle (*Emydoidea landingii*) and Snapping Turtle (Chelydra serpentina) Habitat Use and Movements in the Oakland Swamp Wetland Complex, and Their Response to the Provincial Highway 24 Exclusion Fence and Aquatic Culvert Ecopassage. Toronto Zoo Adopt-a-Pond-Programme.

Chapman, L.J. and D.F. Putnam 1984. The physiography of southern Ontario, 3rd Edition. Ontario Geological Survey, Special Volume 2. Accompanied by Map P. 2715 (coloured), scale 1:600,000.

City of Vaughan 2010. City of Vaughan Official Plan. www.vaughan.ca/projects/policy_planning_projects/official_planning_2010/Pages/default.aspx

Credit Valley Conservation Authority (CVC) and Toronto and Region Conservation Authority (TRCA) 2009. The Evaluation, Classification and Management of Headwater Drainage Features: Interim Guidelines. www.trca.on.ca/dotAsset/79274.pdf

Department of Fisheries and Oceans (DFO) 2013. Fisheries Act.

Department of Fisheries and Oceans (DFO) 2015. Distribution of Fish Species at Risk: Toronto and Region Conservation Authority. www.dfo-mpo.gc.ca/Library/356763_Toronto andRegion_EN.pdf

Ecoplans Limited 1999. Rizmi Holdings Woodlot Assessment Lot 30, Concession 2 City of Vaughan. June 1999. 23 pp + appendices.

GEO Morphix Ltd 2016. Upper East Patterson Creek Geomorphic Assessment. Prepared for Rizmi Holdings Ltd. January 18, 2016. 8 pp. + Appendices.

Government of Ontario 2017(b) consolidation. Planning Act, R.S.O. 1990, c P.13. www.ontario.ca/laws/statute/90p13

Hall, P.W., C.D. Jones, A. Guidotti, B. Hubley 2014. The ROM Field Guide to The Butterflies of Ontario. Royal Ontario Museum. Toronto, Ontario.

Lee, H.T., W.D. Bakowsky, J. Riley, J. Bowles, M. Puddister, P. Uhlig and S. McMurray 1998. Ecological land classification for Southwestern Ontario: first approximation and its application. Ontario Ministry of Natural Resources, South Central Region, Science Development and Transfer Branch. Technical Manual ELC-005.

Migratory Birds Convention Act 1994. Environment Canada. laws-lois.justice.gc.ca/eng/acts/M-7.01

Ministry of Municipal Affairs and Housing (MMAH) n/d. Oak Ridges Moraine Conservation Plan (ORMCP) Technical Paper #7 – Identification and Protection of Significant Woodlands. www.mah.gov.on.ca/AssetFactory.aspx?did=4892

Ministry of Municipal Affairs and Housing (MMAH) n/d. Oak Ridges Moraine Conservation Plan (ORMCP) Technical Paper #12 – Hydrological Evaluations for Hydrologically Sensitive Features. www.mah.gov.on.ca/AssetFactory.aspx?did=4898

Ministry of Municipal Affairs and Housing (MMAH) 2002, updated 2017. Oak Ridges Moraine Conservation Plan (ORMCP). www.mah.gov.on.ca/AssetFactory.aspx?did=11177

Ministry of Municipal Affairs and Housing (MMAH) 2014. Provincial Policy Statement. www.mah.gov.on.ca/Page10679.aspx

Ministry of Natural Resources and Forestry (MNRF) 2000. Significant Wildlife Habitat Technical Guide. 151 pp. Ontario Ministry of Natural Resources, 2000a. Significant Wildlife Habitat Technical Guide. 151p.

Ministry of Natural Resources and Forestry (MNRF) 2007 Ontario Benthos Biomonitoring Network: Procedural Manual. desc.ca/sites/default/files/OBBN2007finalapril18c.pdf

Ministry of Natural Resources and Forestry (MNRF) 2007. Endangered Species Act.

Ministry of Natural Resources and Forestry (MNRF) 2010. Natural Heritage Reference Manual (NHRM).

Ministry of Natural Resources and Forestry (MNRF) 2011. Bats and Bat Habitats: Guidelines for Wind Power Projects. Second Edition.

Ministry of Natural Resources and Forestry (MNRF) 2012. Bobolink survey methodology.

Ministry of Natural Resources and Forestry (MNRF) 2014. Ontario Wetland Evaluation System – Southern Manual. dr6j45jk9xcmk.cloudfront.net/documents/2685/stdprod-103924.pdf

Ministry of Natural Resources and Forestry (MNRF) 2015. Significant Wildlife Habitat Criteria Schedules For Ecoregion 6E. www.townofnemi.on.ca/wp-content/uploads/2016/02/NEMI-OP-App-C-schedule-6e-jan-2015-access-ver-final-s.pdf

Ministry of Natural Resources and Forestry (MNRF) Guelph District 2016. Bat and Bat Habitat Surveys of Treed Habitats.

Ministry of Natural Resources and Forestry (MNRF) 2016. Land Information Ontario (LIO). www.javacoeapp.lrc.gov.on.ca/geonetwork/srv/en/main.home

Ministry of the Environment (MOE) 1998. Sampling Protocols for the Rapid Bioassessment of Streams and Lakes Using Benthic Macroinvertebrates. http://agrienvarchive.ca/download/sampling_protoc_bioassess98.pdf

Municipal Engineers Association (MEA) 2000, amended 2015. Municipal Class Environmental Assessment. www.municipalclassea.ca/manual/page1.html

Natural Heritage Information Centre (NHIC) 2013. Provincial status of plants, wildlife and vegetation communities databases. Ontario Ministry of Natural Resources, Peterborough. http://www.mnr.gov.on.ca/MNR/nhic/nhic.html/

Natural Heritage Information Centre (NHIC) 2016. Provincial status of plants, wildlife and vegetation communities database. OMNR, Peterborough.

Natural Heritage Information Centre (NHIC) 2017. Natural Heritage Viewer.

Needham, J.G., M.J. Westfall, Jr., M. M. May 2014. Dragonflies of North America. Third Edition. Scientific Publishers. Gainesville, FLA.

North-South Environmental Inc. 2005. York Region Significant Woodlands Study. November 2005. 57 pp + appendices.

North-South Environmental Inc. 2014. Phase 2-4 Natural Heritage Network Study City of Vaughan. Prepared for City of Vaughan. May 2014. 78 pp.

Ontario Nature 2017. Ontario Reptile and Amphibian Atlas Program. www.ontarionature.org/protect/species/herpetofaunal_atlas.php

Ontario Road Ecology Group (OREG) 2010. Restoration, Roads and Wildlife 2010 Final Report.

Toronto Region and Conservation Authority (TRCA) 2007. Stormwater Management Pond Planting Guidelines. www.trca.on.ca/dotAsset/40023.pdf

Toronto and Region Conservation Authority (TRCA) 2007. Terrestrial Natural Heritage System Strategy

Toronto and Region Conservation Authority (TRCA) 2009. Don River Watershed Plan Beyond Forty Steps.

Toronto and Region Conservation Authority (TRCA) 2009. Don River Watershed Plan Terrestrial Natural Heritage – Report on Current Conditions and Refinement of a Target System (2009);

Toronto and Region Conservation Authority (TRCA) 2009. Don River Watershed Plan Geology and Groundwater Resources – Report on Current Conditions (2009);

Toronto and Region Conservation Authority (TRCA) 2009. Don River Watershed Plan – Report on Aquatic Conditions (2009);

Toronto and Region Conservation Authority (TRCA).2009. Don River Watershed Implementation Guide (2009);

Toronto and Region Conservation Authority (TRCA) 2014. The Living City Policies for Planning and Development in the Watersheds of Toronto and Region Conservation Authority. drive.google.com/file/d/0BxjqkzmOuaaRYWxqSGdUaHp5UE0/view

Toronto and Region Conservation Authority (TRCA) 2014. Toronto and Region Conservation Species and Natural Cover Distribution
trca.ca/wp-content/uploads/2016/04/L1_L3_Species.jpg

Toronto and Region Conservation Authority (TRCA) 2016. Revised Fauna Scores and Ranks, February 2016.

Toronto Entomologists' Association 2017. Ontario Butterfly Atlas.
www.ontarioinsects.org/atlas_online.htm

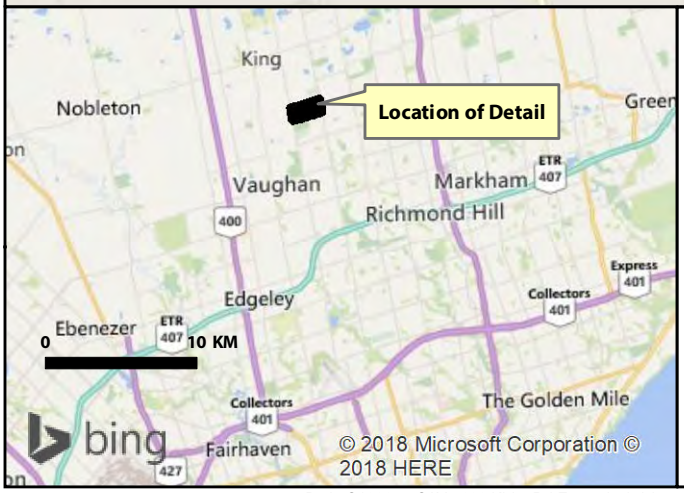
Varga, S., D. Leadbeater, J. Webber, B. Crins, D. Banville, E. Ashley, G. Miller, C. Kingsley, C. Jacobsen, K. Mewa, L. Tebby, E. Mosley and E. Zajc 2000. Distribution and Status of the Vascular Plants of the Greater Toronto Area. Ontario Ministry of Natural Resources, Aurora District.

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.

York Region 2010, updated in 2016. The Regional Municipality of York Official Plan, 2016 Office Consolidation.

APPENDICES

Appendix A – Figures



Kirby Road EA Existing Natural Heritage Conditions Report

Figure 1
Project Location and Study Area

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DUFFERIN STREET
JEFFERSON SIDEROAD
KING VAUGHAN ROAD
DUFFERIN STREET
BATHURST STREET
CARRIAGE HOUSE COURT
KEELE STREET
ELGIN MILLS ROAD WEST
TESTON ROAD

Rizmi Lands Boundary
Subject Lands / Study Area
Expansion Area
120m Adjacent Lands
King-Vaughan wetland complex (MNR LIO)
Other MNR wetlands
Regional Greenlands (York OP, 2013)
ESA (TRCA)

ANSI (MNRF LIO)
Maple Spur - ORM Earth Science, Regionally Significant
Maple Spur - ORM Earth Science, Provincially Significant
Maple Uplands and Kettles - Life Science, Provincially Significant
Philips Lake - Life Science, Provincially Significant
Thompson Lake - Life Science, Provincially Significant
Jefferson Forest - Life Science, Provincially Significant

ORM Land Use Designation
Natural Core Area
Natural Linkage Area
Countryside Area
Settlement Area

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 2
Natural Heritage Features Desktop Analysis

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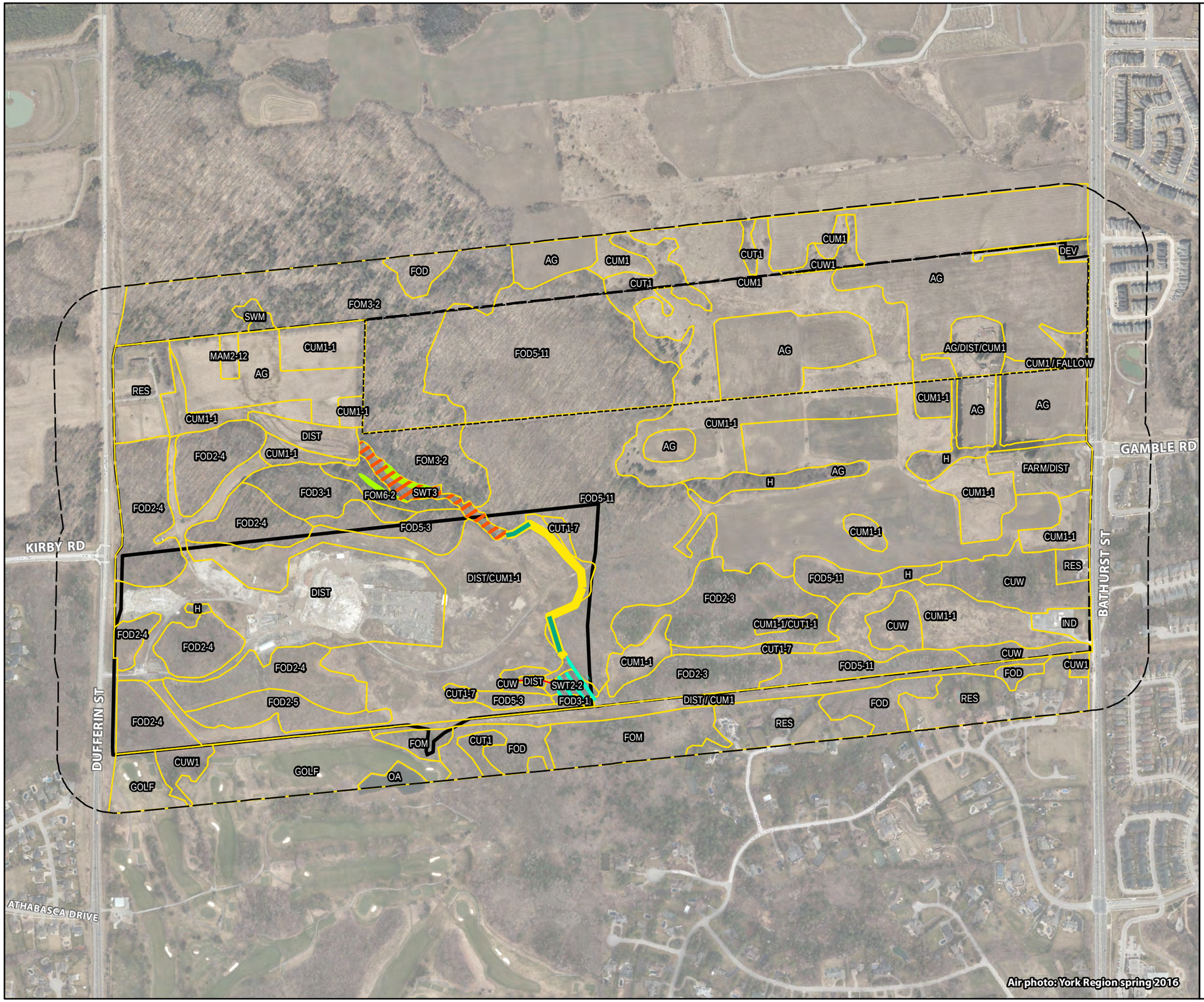

ELC Legend

CUM1	Mineral Cultural Meadow
CUM1-1	Dry - Moist Old Field Meadow
CUT1	Mineral Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Poplar Cultural Thicket
CUW	Cultural Woodland
CUW1	Mineral Cultural Woodland
FOD	Deciduous Forest
FOD2-3	Dry-Fresh Hickory Deciduous Forest
FOD2-4	Dry-Fresh Oak- Hardwood Deciduous Forest
FOD2-5*	Dry-Fresh Oak-Sugar Maple Deciduous Forest
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FOD5-3	Dry-Fresh Sugar Maple - Oak Deciduous Forest
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FOM	Mixed Forest
FOM3-2	Dry-Fresh Sugar Maple- Hemlock Mixed Forest
FOM6-2	Fresh-Moist Hemlock- Hardwood Mixed Forest
MAM2-12*	Mixed Mineral Meadow Marsh
OA	Open Aquatic
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp
SWT3	Organic Thicket Swamp

AG	Agricultural
DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Groundwater Discharge Channel
- Benthic Invertebrate Sampling Locations
- Headwater Assessment Points
- SWT3
- SWT2-2

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 3
Headwater Drainage Features and Benthic Invertebrate Sampling Locations

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Air photo: York Region spring 2016

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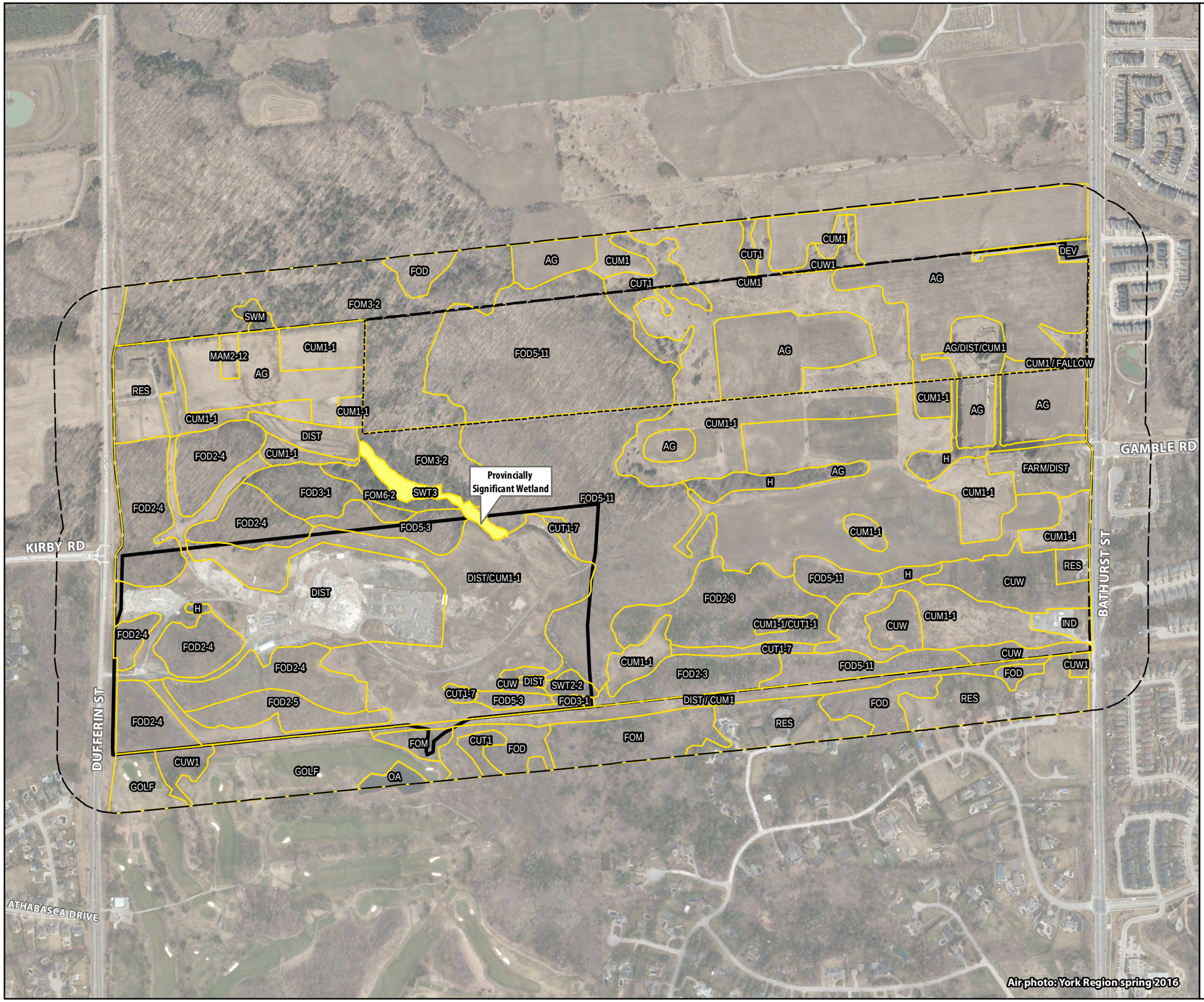

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SWT3	Organic Thicket Swamp

AG	Agricultural
DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 4
Ecological Land Classification (2017)

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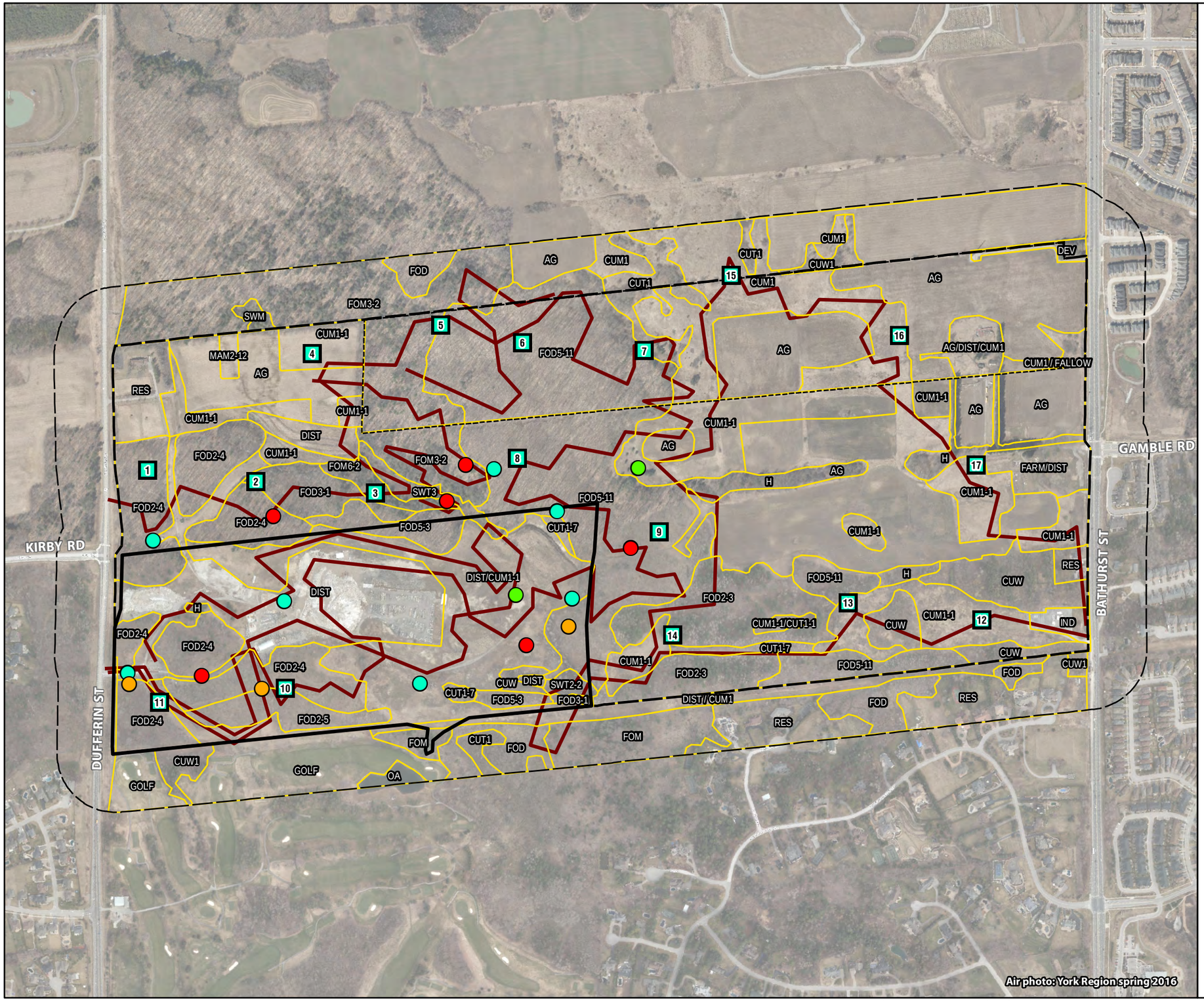

ELC Legend

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AG	Agricultural
DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Insect Area Search

Breeding Bird Point Count Stations

- 2010
- 2011
- 2012
- 2015
- 2017

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 5
Breeding Bird and Insect Habitat Assessment

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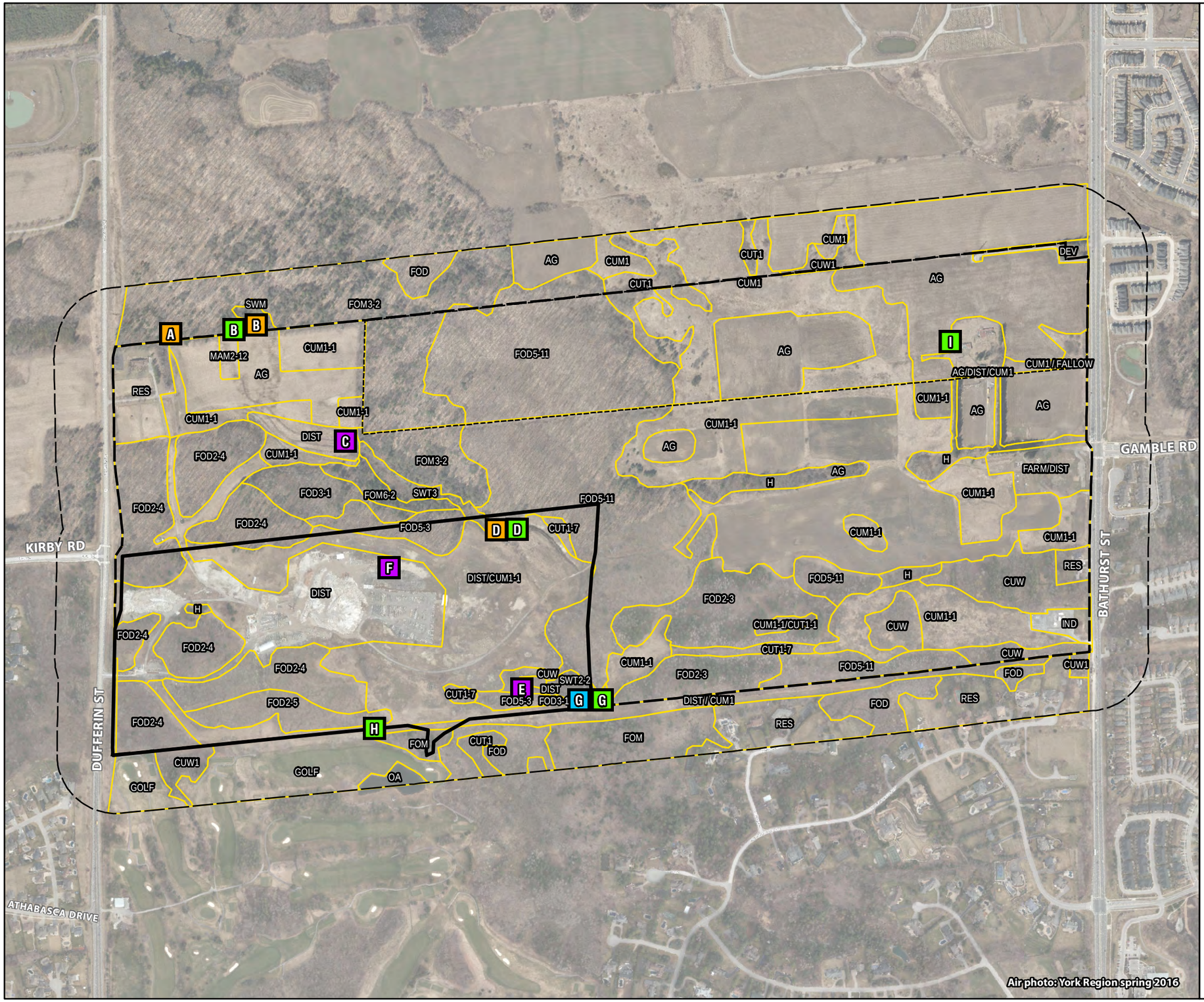

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SWT3	Organic Thicket Swamp

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DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification

Breeding Amphibian Call Survey Stations

- 2010
- 2016
- 2010 and 2016
- 2017

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 6
Amphibian Survey Stations (2010, 2016 and 2017)

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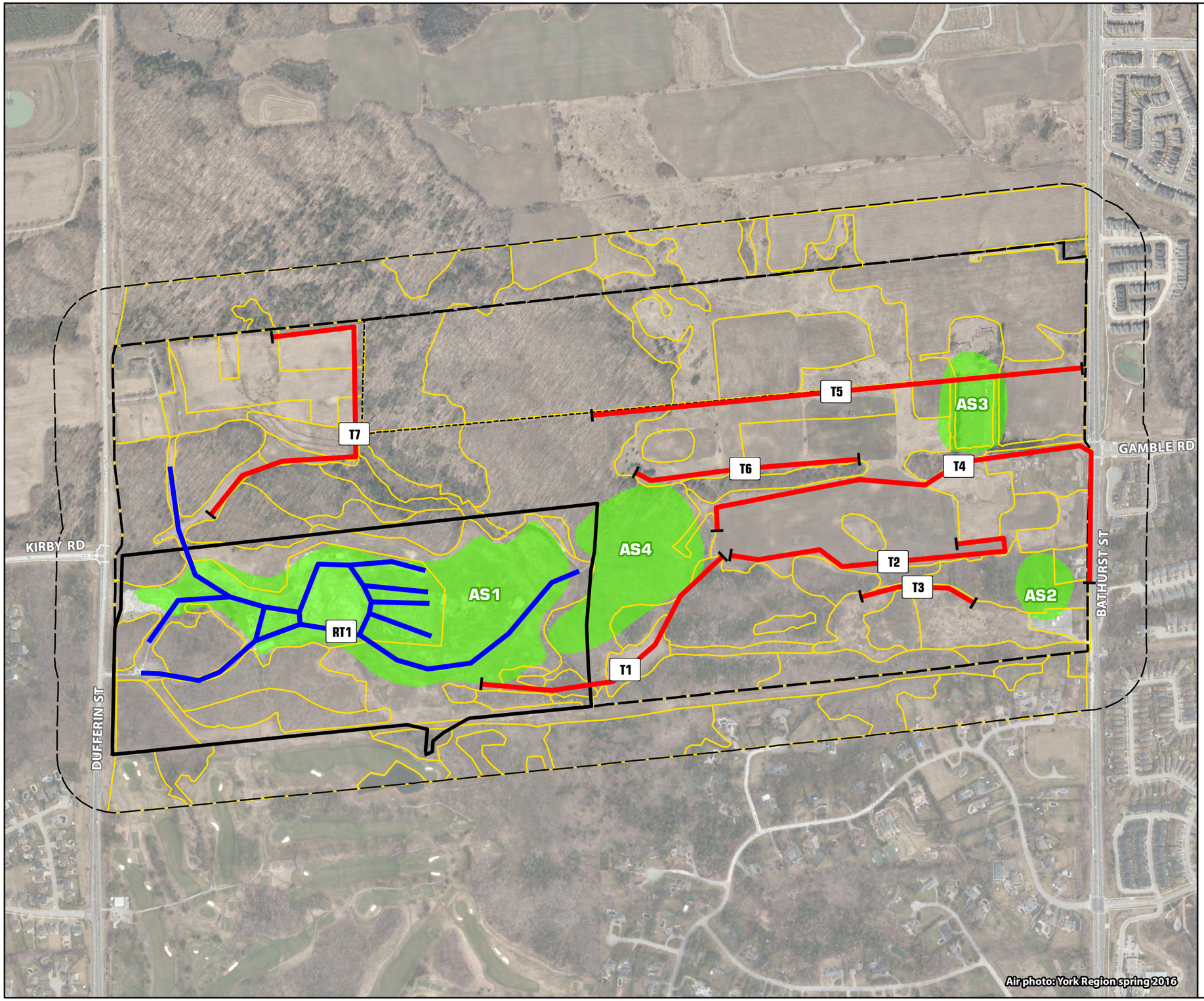

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AG	Agricultural
DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Snake Transect Location
- Road Mortality Survey
- Area Search Zones

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 7
Snake Transect Locations (2017)

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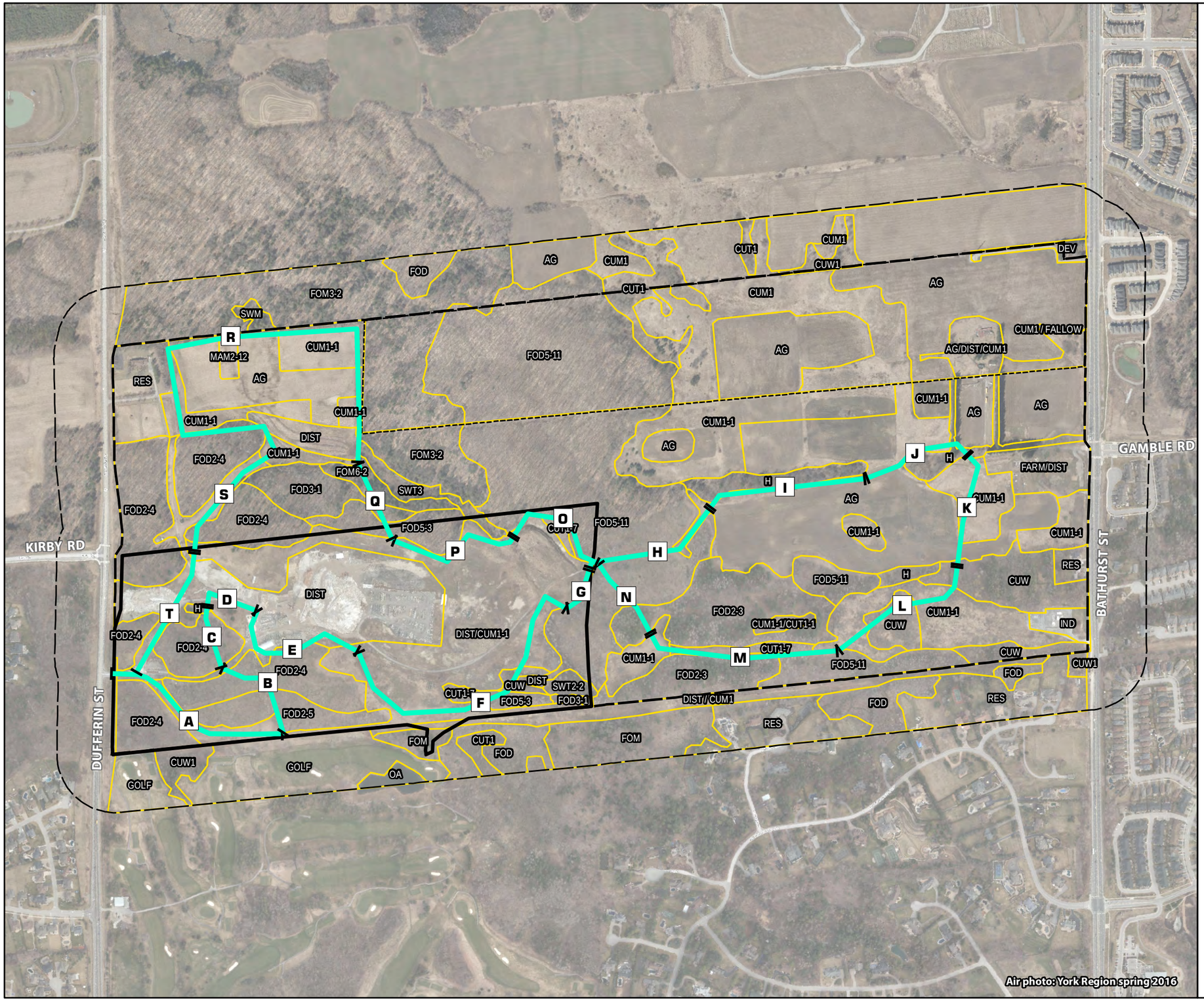

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DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Winter Wildlife Transect

See Winter Wildlife Results Table 4 Appendix B for additional Information.

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 8
Winter Wildlife Transects

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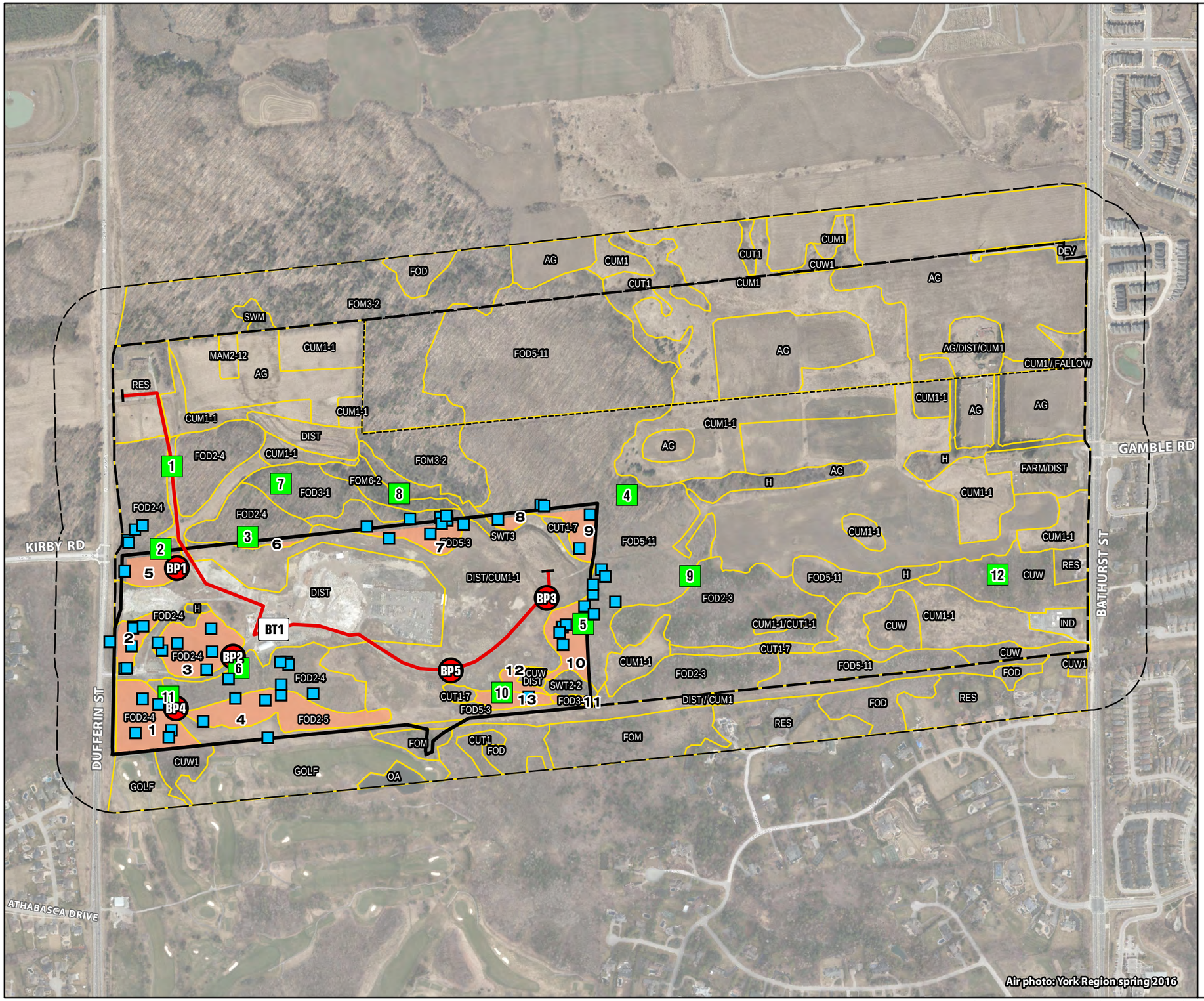

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IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Snag Location (2016)
- SM3 Location (2017)
- Point Count Station (2016)
- Mobile Transect (2016)
- Snag Density Survey Polygon

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 9
Bat Habitat Assessment and Acoustic Survey (2016, 2017)

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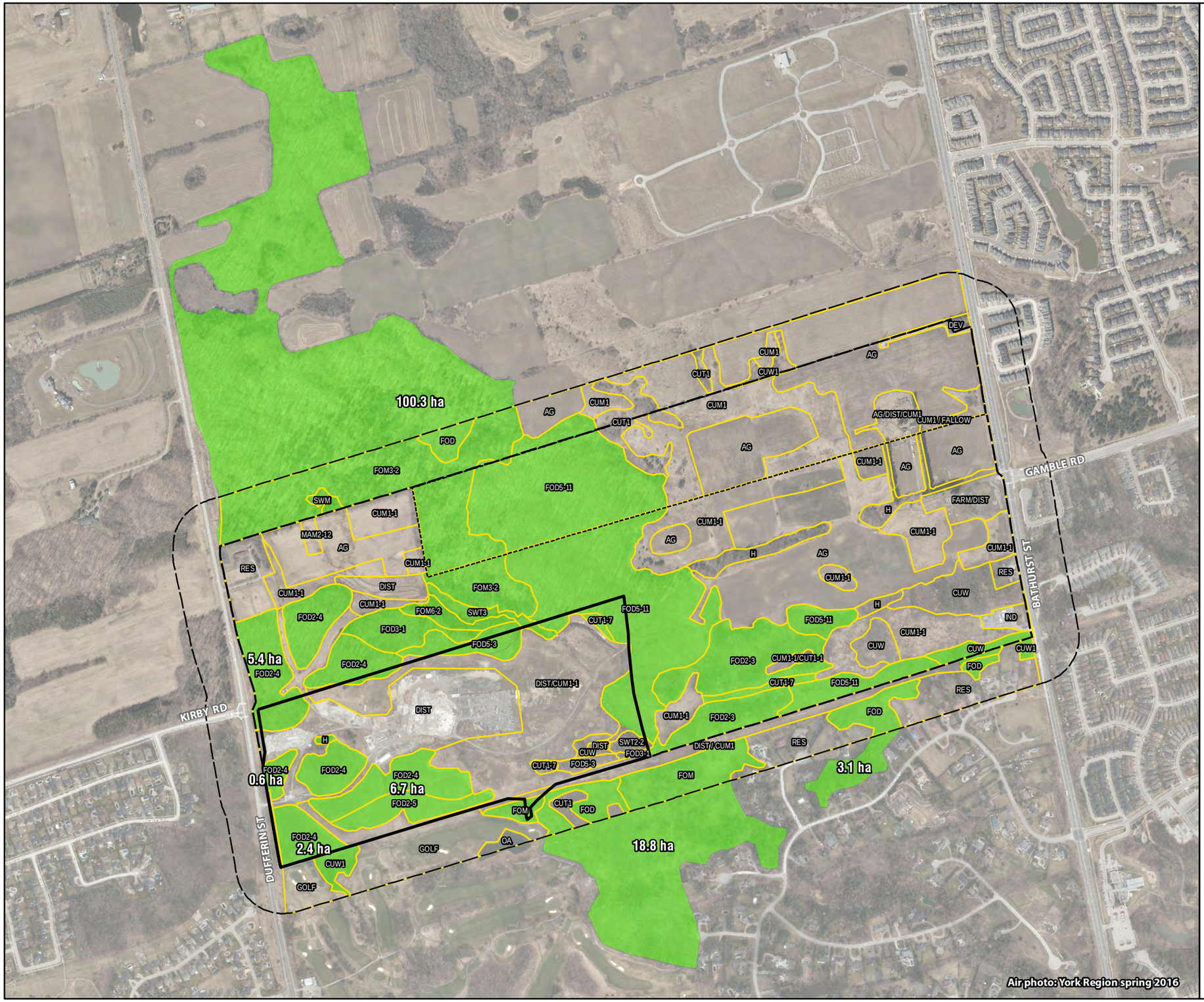

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RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification
- Significant Woodland (as determined through ORM Technical Paper 7)

Note: The Rizmi Lands, in the southwest portion of the Study Area, are not subject to the Oak Ridges Moraine Conservation Plan (ORMCP). Significant Woodland delineation was completed on the Rizmi Lands only to complete woodland patch size calculations for the rest of the Study Area. As per ORM Technical Paper 7, where a portion of a woodland lies outside of the ORMCP area the whole woodland shall be measured in area calculations.

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 10
Significant Woodlands

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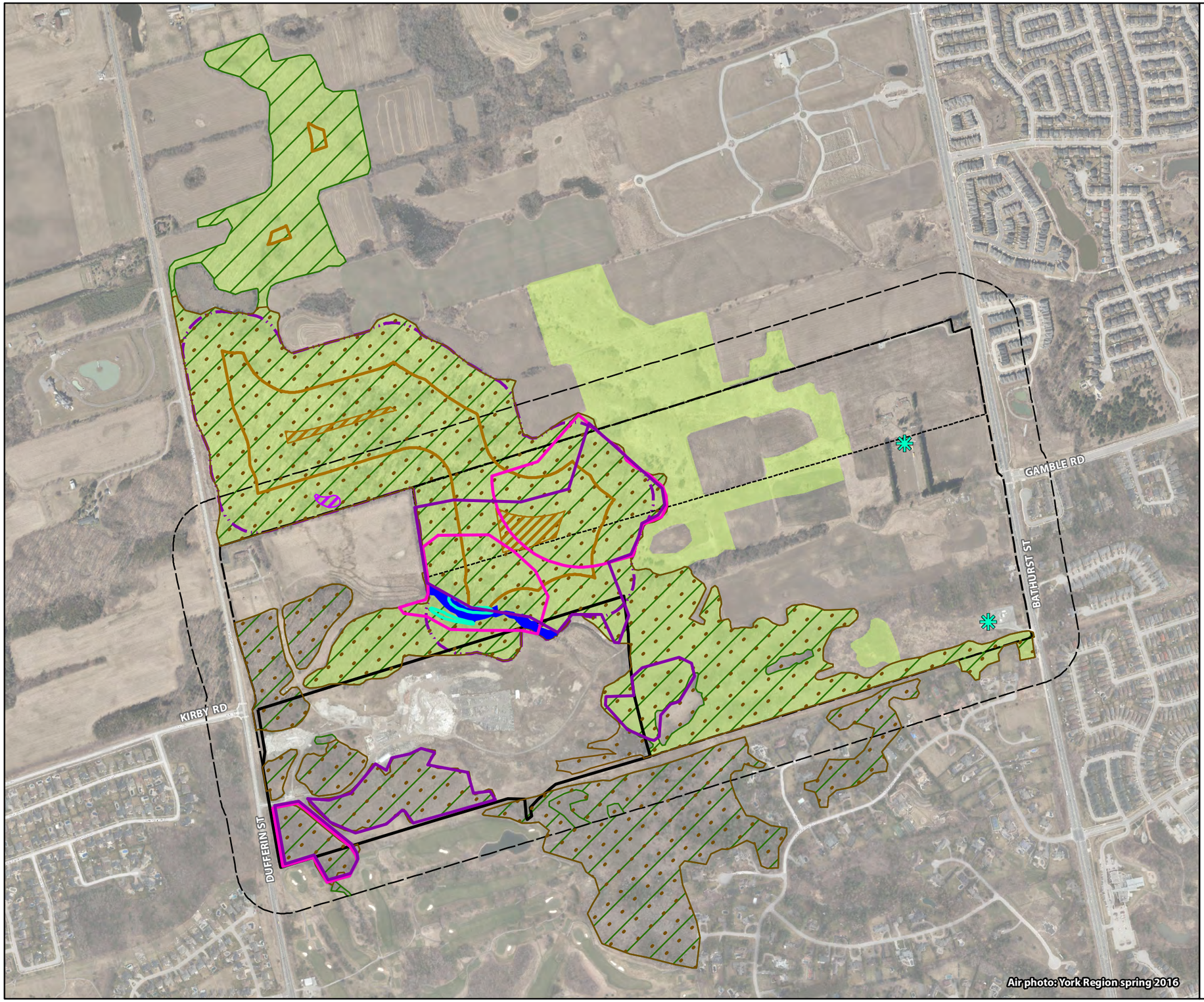

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Candidate Area-sensitive Woodland Bird SWH
- Candidate Reptile Hibernacula
- Candidate Raptor Wintering SWH
- Bats Maternity Colonies SWH
- Interior Woodland 100 m
- Interior Woodland 200 m
- Provincially Significant Wetland
- Seeps and Springs
- Significant Woodland (as determined through ORM Technical Paper 7)
- Eastern Wood-Peewee SWH Special Concern
- Wood Thrush SWH Special Concern
- Woodland Amphibian Breeding SWH (Off-site Pond)

Kirby Road Extension Class EA

Figure 11
Natural Heritage Features

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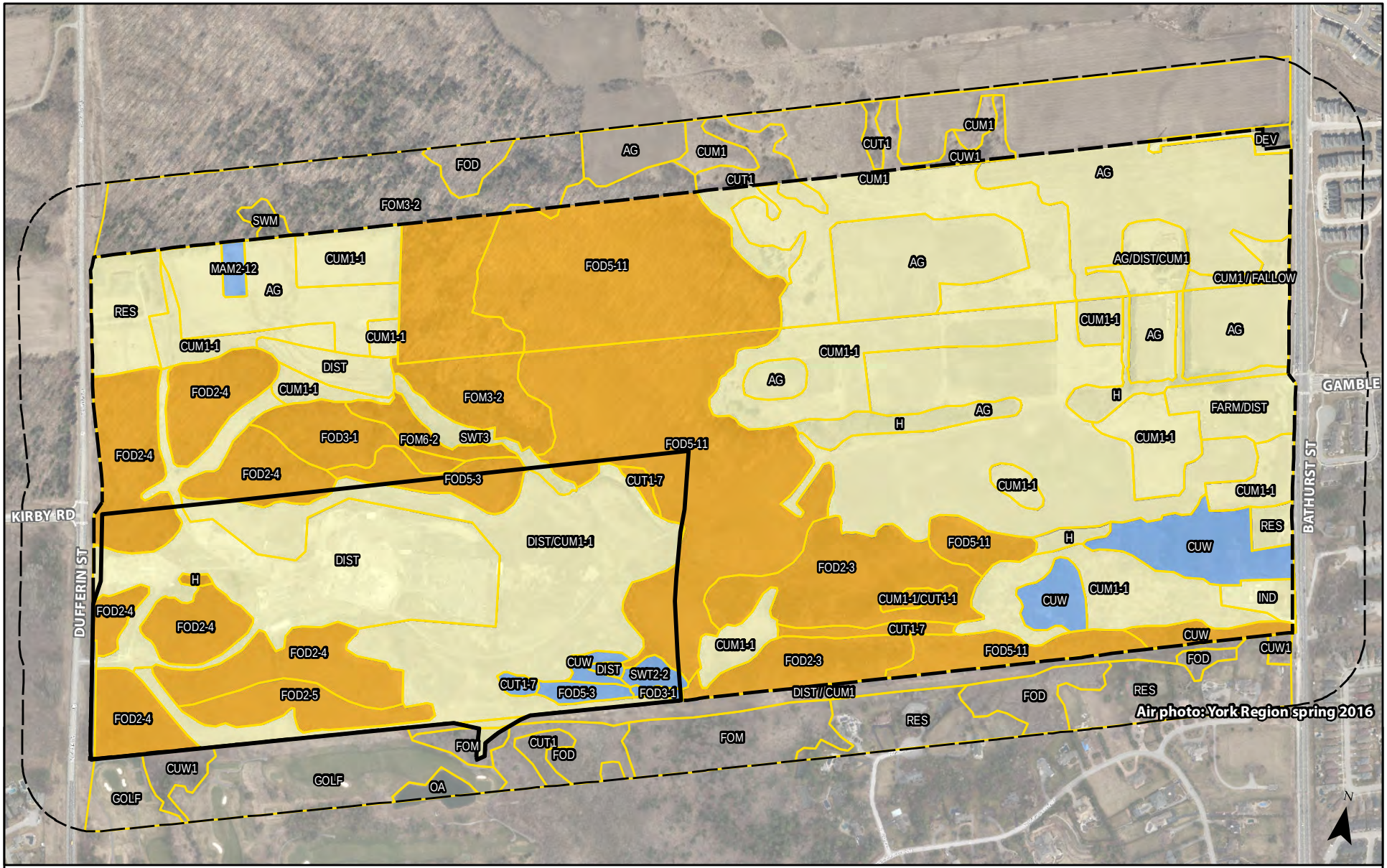

Kirby Road

Figure 12
Constraints

Rizmi Lands Boundary
Subject Lands / Study Area
120m Adjacent Lands
Ecological Land Classification

Constraints
High
Medium
Low

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Appendix B – Tables

Table 1: Natural Heritage Information Centre (NHIC) Data

Common Name	Scientific Name	Provincial Status (S Rank)	Global Status (G Rank)	COSSARO (MNRF)	COSWEIC (Federal)	Last Observed	Extirpated
UTM 1KM Grid ID: 17PJ2061							
Shining Branch Hawthorn	*Crataegus magniflora*	S3	G3G5			1955	
Scarlett Beebalm	*Monarda didyma*	S3	G5			1948	
UTM 1KM Grid ID: 17PJ2161							
Shining Branch Hawthorn	*Crataegus magniflora*	S3	G3G5			1955	
Scarlett Beebalm	*Monarda didyma*	S3	G5			1948	
UTM 1KM Grid ID: 17PJ2261							
Butternut	*Juglans cinerea*	S3?	G4	END	END	2001	
Shining Branch Hawthorn	*Crataegus magniflora*	S3	G3G5			1955	
Scarlett Beebalm	*Monarda didyma*	S3	G5			1948	
Painted Skimmer	*Libellula semifasciata*	S2	G5				
UTM 1KM Grid ID: 17PJ2262							
Shining Branch Hawthorn	*Crataegus magniflora*	S3	G3G5			1955	
Scarlett Beebalm	*Monarda didyma*	S3	G5			1948	

Table 1: Natural Heritage Information Centre (NHIC) Data

UTM 1KM Grid ID: 17PJ2162							
Shining Branch Hawthorn	*Crataegus magniflora*	S3	G3G5			1955	
Scarlett Beebalm	*Monarda didyma*	S3	G5			1948	
Restricted Species						2001	
UTM 1KM Grid ID: 17PJ2062							
Shining Branch Hawthorn	*Crataegus magniflora*	S3	G3G5			1955	
Scarlett Beebalm	*Monarda didyma*	S3	G5			1948	
Restricted Species						2001	
Butternut	*Juglans cinerea*	S3?	G4	END	END	2004	

Table 2: Savanta Field Studies and Natural Inventories

FIELD DATE(S)	NATURE OF INVESTIGATION
2010	
April 12 and July 5	Incidental wildlife observations
April 13 and 21	Early breeding bird surveys, raptor nest assessment
April 16 and 30	ELC and plant inventory
May 4, July 4, 5	Breeding bird surveys, waterfowl surveys, and nocturnal bird surveys
April 12, May 4 and June 30	Amphibian call count surveys
2011	
June 19, July 19 and Aug. 30	Insect surveys
June 5, June 26, and July 12	Breeding bird surveys
April 16, 30, June 24, July 5, and Oct. 12	ELC and botanical investigations
August 11	Headwater Drainage Feature Assessment
2012	
Feb. 26	Winter wildlife snow track survey
May 30	Benthic survey
June 6	Breeding bird surveys
August 11	Headwater Drainage Feature Assessment
Sept. 9	Species at Risk reconnaissance/ inspection

Table 2: Savanta Field Studies and Natural Inventories

FIELD DATE(S)	NATURE OF INVESTIGATION
2014	
May 28	Breeding bird survey; Species at Risk verification
2015	
July 9	Breeding bird survey; Species at Risk update inspections
Oct 27 and Nov 26	Aquatic Habitat Assessment
Oct 29 and 30	ELC update, preliminary staking of LIO significant wetland, Butternut tree review
2016	
April 29, May 20, June 23	Calling amphibian surveys
April 29, May 20, June 6	Amphibian egg mass surveys
April 29	Aquatic Habitat Assessment update
May 11 and 12	Bat habitat assessment and acoustic surveys
June 8	Assessment of connectivity of drainage features from the Subject Lands to the City of Vaughan lands to the south
2017	
April 27	First round amphibian call count survey First round amphibian egg mass survey First round snake visual encounter survey
April 28	First round amphibian egg mass survey Second round snake visual encounter survey
May 29	Spring botanical survey of expanded study area (north-west parcel, 2017) Preliminary vegetation mapping of expanded study area (north-west parcel, 2017) Second round amphibian call count survey

Table 2: Savanta Field Studies and Natural Inventories

FIELD DATE(S)	NATURE OF INVESTIGATION
June 8, 9	First round breeding bird survey
June 22	Deploy bat detectors (SM3)
June 27	Relocate bat detectors (SM3) Second round breeding bird survey
June 30	Second round breeding bird survey First round insect survey
July 4	Retrieve bat detectors (SM3)
July 10	Deploy bat detectors (SM3)
July 21	Retrieve bat detectors (SM3)
August 10	Summer botanical inventory and ELC of expanded study area (north-west parcel, 2017)
September 14	Third round snake visual encounter survey First round wildlife road-crossing survey
September 21	Second round wildlife road-crossing survey
September 22	Fall botanical Inventory of expanded study area (north-west parcel, 2017)
September 28	Fourth round snake visual encounter survey Third round wildlife road-crossing survey

Table 3: Observations of Headwater Drainage Features on the Subject Lands

Drainage Feature Unit and Sub Reach	Date of Field Work (Date, Weather, and Surveyor)	Flow Assessment (Flow Types and Attribute)		Fish and Fish Habitat Assessment		Vegetation and Wetland Assessment (Form, Species, Density & Functions)		Linkage		Channel Form	Habitat Classification (Based on fish habitat & flow characteristics)	Drainage Features Management Recommendations
		Surface Flows	Ground water Flows	Attributes/ Species/ Abundance/ Size	Life Cycle and Habitat Functions	Riparian	Instream	Connections (Up and Downstream Reaches)	Functions			
A1	11 AU 2011 29ºC, 0 cloud cover; Melanie Adamson	Intermittent	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Terrestrial grasses, and wildflowers	Cattails	Upstream: Wetland within forested area Downstream: Reach A2	Some nutrient and organic inputs	Bank height: 1.8m Bank width: 1.8m Stable bank and channel of sand with some gravel	Not fish habitat	
A2	11 AU 2011 29ºC, 0 cloud cover; Melanie Adamson	Intermittent	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Terrestrial grasses and wildflowers	Cattails, sedges	Upstream: Reach A1 Downstream: Reach A3	Conveyance	Bank height: 1.8m Bank width: 1.8m Steep sandy bank on east side with signs of instability; stable hard packed sand bed with some clay and gravel	Not fish habitat	
A3	11 AU 2011 29ºC, 0 cloud cover; Melanie Adamson	Ephemeral	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Terrestrial grasses and wildflowers	Jewelweed, goldenrod	Upstream: Reach A2 Downstream: Reach A4 with culvert between, but not a barrier to fish movement	Conveyance	Bank height: 3m Bank width: 0.3m Steep sandy bank on east side with signs of instability; stable hard	Not fish habitat	

Table 3: Observations of Headwater Drainage Features on the Subject Lands

Drainage Feature Unit and Sub Reach	Date of Field Work (Date, Weather, and Surveyor)	Flow Assessment (Flow Types and Attribute)		Fish and Fish Habitat Assessment		Vegetation and Wetland Assessment (Form, Species, Density & Functions)		Linkage		Channel Form	Habitat Classification (Based on fish habitat & flow characteristics)	Drainage Features Management Recommendations
		Surface Flows	Ground water Flows	Attributes/ Species/ Abundance/ Size	Life Cycle and Habitat Functions	Riparian	Instream	Connections (Up and Downstream Reaches)	Functions			
										packed sand bed with some clay and little gravel		
A4	11 AU 2011 29ºC, 0 cloud cover; Melanie Adamson	Ephemeral	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Terrestrial grasses and wildflowers	Immature willow spp.	Upstream: Reach A3 with culvert between, but not a barrier to fish movement Downstream: Reach A5	Conveyance	Bank height: 1.8m Bank width: 1.8m Vegetated stable banks stable hard packed sand bed with little to no gravel	Not fish habitat	
A5	11 AU 2011 29ºC, 0 cloud cover; Melanie Adamson	Ephemeral	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Terrestrial grasses and wildflowers	None	Upstream: Reach A4 Downstream: Reach A6 and small wetland area	Conveyance	Bank height: 2.1m Bank width: 2.1m Vegetated stable banks stable hard packed sand bed with little to no gravel	Not fish habitat	
A6	11 AU 2011 29ºC, 0 cloud cover; Melanie Adamson	Ephemeral	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Ferns, dogwood shrubs, poplar trees	Mature poplar trees	Upstream: Reach A5 and small wetland area Downstream: Reach A7	Conveyance	Bank height: 1.8m Bank width: 1.8m Vegetated	Not fish habitat	

Table 3: Observations of Headwater Drainage Features on the Subject Lands

Drainage Feature Unit and Sub Reach	Date of Field Work (Date, Weather, and Surveyor)	Flow Assessment (Flow Types and Attribute)		Fish and Fish Habitat Assessment		Vegetation and Wetland Assessment (Form, Species, Density & Functions)		Linkage		Channel Form	Habitat Classification (Based on fish habitat & flow characteristics)	Drainage Features Management Recommendations
		Surface Flows	Ground water Flows	Attributes/ Species/ Abundance/ Size	Life Cycle and Habitat Functions	Riparian	Instream	Connections (Up and Downstream Reaches)	Functions			
										stable banks stable hard packed sand bed		
A7	11 AU 2011 29°C, 0 cloud cover; Melanie Adamson	Ephemeral	Nil	None observed	Indirect habitat: seasonal flow conveyance only	Riverbank grape, ferns, sumac, green ash, poplar	Red osier dogwood, purple loosestrife, horsetail	Upstream: Reach A6 Downstream: Wetland	Conveyance	Bank height: less than 0.3m Bank width: 3m Banks are not well defined and bed is loose sand	Not fish habitat	

Table 4: Benthic Invertebrate Survey Results (Sampled on May 30, 2012)

CLASS	ORDER	FAMILY	A1	A6	TOTAL
ANNELIDA	HIRUDINEA	GLOSSIPHONIIDAE	16		16
ANNELIDA	OLIGOCHAETA		22	10	32
ARACHNOIDEA	TROMBIDIFORMES	UNIONICOLIDAE	1		1
CRUSTACEA	CLADOCERA	DAPHNIA	31		31
CRUSTACEA	COPEPODA		6	4	10
GASTROPODA	BASOMMATOPHORA	LYMNAEIDAE	52		52
GASTROPODA	BASOMMATOPHORA	PLANORBIIDAE	9	2	11
GASTROPODA	SORBEOCONCHA	HYDROBIIDAE	1		1
HYDROZOA	ANTHOMEDUSAE	HYDRIDAE	1		1
INSECTA	COLEOPTERA	DYTISCIDAE	110	5	115
INSECTA	COLEOPTERA	ELMIDAE	5	16	21
INSECTA	COLEOPTERA	HALIPLIDAE	21		21
INSECTA	DIPTERA	CERATOPOGONIDAE	159	120	279
INSECTA	DIPTERA	CHAOBORIDAE	31		31
INSECTA	DIPTERA	CHIRONOMIDAE	116	72	188
INSECTA	DIPTERA	CULICIDAE	1	2	3
INSECTA	DIPTERA	STRATIOMYIDAE	1		1
INSECTA	DIPTERA	TABANIDAE		5	5
INSECTA	DIPTERA	Unknown pupa	6	2	8
INSECTA	EPHEMEROPTERA	BAETIDAE	49	3	52
INSECTA	EPHEMEROPTERA	SIPHLONURIDAE	14		14
INSECTA	HEMIPTERA	CORIXIDAE	2		2
INSECTA	HEMIPTERA	GERRIDAE	2	2	4
INSECTA	HEMIPTERA	NOTONECTIDAE	15		15
INSECTA	MEGALOPTERA	CORYDALIDAE		1	1
INSECTA	ODONATA	AESHNIDAE	11	2	13

Table 4: Benthic Invertebrate Survey Results (Sampled on May 30, 2012)

CLASS	ORDER	FAMILY	A1	A6	TOTAL
INSECTA	ODONATA	LESTES	18	1	19
NEMATODA			6		6
PELECYPODA	VENEROIDA	PISIDIIDAE	91		91
TURBELLARIA			1		1
Terrestrial Drop-in			8	4	12
TOTAL			**806**	**251**	**1057**

Table 5: Ecological Land Classification (ELC) Community Types

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
FOREST (FO)		
Mixed Forest (FOM)		
FOM6-2 Fresh-Moist Hemlock-Hardwood Mixed Forest	• Located at the base of slope, this unit contains many large and medium-sized tree of Hemlock, Maple, Beech and White Pine • The understorey especially the herb layer, is poorly developed. There is considerable disturbance from recently cut-out access roads	Not ranked
FOM3-2 Dry-Fresh Sugar Maple-Hemlock Mixed Forest	• Similar in maturity and general structure to the FOD5-11 but with reduced diversity. • Mature canopy of Sugar Maple, with common associations of Large-tooth Aspen, Eastern Hemlock, and White Pine. • Understory generally open, with a species composition of Sugar Maple saplings, Maple-leaf Viburnum and American Witch-hazel. • Herbaceous layer often consisting of Wild Sarsaparilla, White Trillium, Hairy Solomon's Seal, Large-leaved Aster, and Wild Lily-of-the-valley. • Effective soil texture was very fine sand with a moisture regime of 3 to 4.	S4S5
Deciduous Forest (FOD)		
FOD2-4 Dry-Fresh Oak-Hardwood Deciduous Forest	• The most common forest type on the Subject Lands • Red Oak is followed by Sugar Maple, with secondary of Beech, White Ash, White Birch, Black Cherry, Basswood and Large-tooth Aspen • The shrub layer is relatively sparse • Herbs are very well represented by successive cohorts of wildflowers from spring ephemerals to later maturing species	Not ranked
FOD2-5* Dry-Fresh Oak Sugar Maple Deciduous Forest	• A mature stand of Sugar Maple and Red Oak on rolling tableland • Associate tree species include White Ash, Black Cherry, Beech and Trembling Aspen • The shrub layer is relatively well developed and consisting mostly of the canopy species' saplings • Herb cover is composed of Dog's-tooth Violet, White Trillium, Pennsylvania Sedge and many others, mostly spring ephemerals	Not ranked
FOD3-1 Dry-Fresh Poplar Deciduous Forest	• Trembling Aspen is beginning to deteriorate in this stand, also disturbed by tree falls, access lanes and occasional trash • Herbaceous flora mostly contains typical spring ephemerals, such as White Trillium, False Solomon's Seal, Dog's-tooth Violet, and several others	S5
FOD5-3 Dry-Fresh Sugar Maple-Oak Deciduous Forest	• A small unit composed of the two co-dominants: Sugar Maple and Red Oak, accompanied by Ironwood, Basswood, Beech and Bitternut Hickory • Maple-leaved Viburnum, Alternate-leaved Dogwood and Witch-hazel grow in the shrub layer	S5

Table 5: Ecological Land Classification (ELC) Community Types

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
	• Herbs are well represented by species such as Pennsylvania Sedge, False Solomon's Seal, Blue Cohosh, and Christmas Fern	
FOD5-11* Dry-Fresh Sugar Maple- Hardwood Deciduous Forest	• Mature canopy commonly consisting of Sugar Maple with varying associations of White Ash, American Beech, Red Maple, Red Oak, and Large-tooth Aspen. • Understory generally open, with a species composition of Sugar Maple and Ironwood saplings, Maple-leaf Viburnum, Canada Fly Honeysuckle, and American Witch-hazel. • Herbaceous layer diverse, with abundance of White Trillium, and common associations of Pennsylvania Sedge, Dewey's Sedge, Long-stalked Sedge, Rough-leaved Mountain Rice, Hairy Solomon's Seal, Large Tick-trefoil, and Bracken Fern, among others • Effective soil texture was very fine sand with a moisture regime of 3 to 4	Not ranked
CULTURAL (CU)		
Cultural Thicket (CUT)		
CUT1-7* Poplar Cultural Thicket	• This type is represented by several areas that used to open, but have been invaded by abundant saplings and young trees of Poplar (Trembling Aspen, Large-tooth Aspen, White Poplar, Cottonwood) • The herb layer remains composed of old field meadow species, for example Tall Goldenrod, Awnless Brome, and various aster species	Not ranked
Cultural Woodland (CUW)		
CUW Cultural Woodland	• These are various combinations of young trees, their saplings and true shrubs, including Black Locust, Manitoba Maple, Scots Pine, Aspen, White Ash, Black Walnut, Sumac and Common Buckthorn • Herb cover is of the old field meadow composition	Not ranked
Cultural Meadow (CUM)		
CUM1 Mineral Cultural Meadow	• Open meadow with sparse cover of woody species • Herbaceous layer containing an abundance of Smooth Brome, Kentucky Bluegrass, and Yellow Bedstraw, with common associations of Tufted Vetch, Black Medic, and Tall Goldenrod • Effective soil texture sandy clay loam with a moisture regime of 2	Not ranked
Cultural Thicket (CUT)		

Table 5: Ecological Land Classification (ELC) Community Types

ELC TYPE	COMMUNITY DESCRIPTION	S-RANK / G-RANK (NHIC, 2013)
CUT1 Mineral Cultural Thicket	• Composed of varying densities of tree regeneration, the canopy of which was typically 6 to 8 m in height. • Canopy contains abundance of White Ash, often associated with White Pine. • The herbaceous layer includes Wild Strawberry, Yellow Bedstraw, New England Aster, Tall Goldenrod, Kentucky Bluegrass, Smooth Brome, and Wild Bergamot	Not ranked
SWAMP (SW)		
Thicket Swamp (SWT)		
SWT2-2 Willow Mineral Thicket Swamp	• Tall shrub community is dominated by various willow species and saplings of Balsam Poplar • The herbaceous layer is dominated by Purple Loosestrife and Scouring Rush	S5
SWT3 Organic Thicket Swamp	• A very complex, floristically and structurally, tall shrub thicket of Red Osier Dogwood, Willow, and saplings and young trees of Yellow Birch, Green Ash and Hemlock • Heavily flooded in the spring, with Marsh Marigold abundant	Not ranked
MARSH (MA)		
Meadow Marsh (MAM)		
MAM 2-11* Rush Mineral Meadow Marsh	• Located is a small depression, this meadow is dominated by Jointed Rush, with other species growing mostly around the periphery: Canada Bluejoint, Cattail, Perfoliate Thoroughwort, and Scouring Rush	Not ranked

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

SCIENTIFIC NAME	COMMON NAME	SPECIES FAMILY	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS (S-RANK)	GLOBAL STATUS (G-RANK)	COSSARO (MNRF)	COSEWIC (FEDERAL)	LOCAL STATUS TRCA RANKING (TRCA 2014)	LOCAL STATUS YORK (VARGA 2005)	LOCAL STATUS GTA (VARGA 2005)
Picea abies	Norway Spruce	PINE (PINACEAE)		5	-1	SNA	GNR			L+	X	X
Pinus strobus	Eastern White Pine	PINE (PINACEAE)	4	3		S5	G5			L4	X	X
Tsuga canadensis	Eastern Hemlock	PINE (PINACEAE)	7	3		S5	G5			L4	X	X
Chenopodium album	Common Lamb's-Quarters	AMARANTH		1	-1	SNA	G5T5			L+	X	X
Achillea millefolium	Common Yarrow	ASTER (ASTERACEAE)		3	-1	SNA	G5			L+	X	X
Ambrosia artemisiifolia	Common Ragweed	ASTER (ASTERACEAE)		3		S5	G5			L5	X	X
Arctium minus	Common Burdock	ASTER (ASTERACEAE)		5	-2	SNA	G?T?			L+	X	X
Artemisia vulgaris	Common Wormwood	ASTER (ASTERACEAE)		5	-1	SNA	GNR			L+	X	X
Cichorium intybus	Wild Chicory	ASTER (ASTERACEAE)		5	-1	SNA	GNR			L+	X	X
Cirsium arvense	Canada Thistle	ASTER (ASTERACEAE)		3	-1	SNA	GNR			L+	X	X
Cirsium vulgare	Bull Thistle	ASTER (ASTERACEAE)		4	-1	SNA	G5			L+	X	X
Erigeron annuus	Annual Fleabane	ASTER (ASTERACEAE)		1		S5	G5			L5	X	X
Erigeron canadensis	Canada Horseweed	ASTER (ASTERACEAE)		1		S5	G5			L5	X	X
Eurybia macrophylla	Large-Leaved Aster	ASTER (ASTERACEAE)	5	5		S5	G5			L5	X	X
Euthamia graminifolia	Grass-Leaved Goldenrod	ASTER (ASTERACEAE)	2	-2		S5	G5			L5	X	X
Helianthus annuus	Common Sunflower	ASTER (ASTERACEAE)		1	-1	SNA	G5T			L+		X
Inula helenium	Elecampane	ASTER (ASTERACEAE)		5	-2	SNA	GNR			L+	X	X
Nabalus altissimus	Tall Rattlesnakeroot	ASTER (ASTERACEAE)	5	3		S5	G5?			L5	X	X
Solidago altissima var.	Tall Goldenrod	ASTER (ASTERACEAE)	1	3		S5	GNR			L5	X	X
Solidago caesia var. caesia	Blue-Stemmed Goldenrod	ASTER (ASTERACEAE)	5	3		S5	G5			L5	X	X
Solidago canadensis	Canada Goldenrod	ASTER (ASTERACEAE)	1	3		S5	G5T5			L5	X	X
Solidago nemoralis var.	Grey-Stemmed Goldenrod	ASTER (ASTERACEAE)	2	5		S5	G5T?			L5	X	X
Sonchus arvensis ssp.	Field Sow-Thistle	ASTER (ASTERACEAE)				SNA	GNR			L+	X	X
Symphyotrichum cordifolium	Heart-Leaved Aster	ASTER (ASTERACEAE)	5	5		S5	G5			L5	X	X
Symphyotrichum ericoides	White Heath Aster	ASTER (ASTERACEAE)				S5	G5T5			L5	X	X
Symphyotrichum lanceolatum	White Panicled Aster	ASTER (ASTERACEAE)	3	-3		S5	G5T5			L5	X	X
Symphyotrichum novae-	New England Aster	ASTER (ASTERACEAE)	2	-3		S5	G5			L5	X	X
Symphyotrichum urophyllum	Arrow-Leaved Aster	ASTER (ASTERACEAE)	6	5		S4	G4G5			L4	U	U
Symphyotrichum x	Amethyst Aster	ASTER (ASTERACEAE)				HYB	GNR			L5	X	X
Taraxacum officinale	Common Dandelion	ASTER (ASTERACEAE)		3	-2	SNA	G5			L+	X	X
Tussilago farfara	Coltsfoot	ASTER (ASTERACEAE)		3	-2	SNA	GNR			L+	X	X
Berberis thunbergii	Japanese Barberry	BARBERRY		4	-3	SNA	GNR			L+	X	X
Caulophyllum giganteum	Giant Blue Cohosh	BARBERRY				S4S5	G4G5			L4	X	X
Podophyllum peltatum	May-Apple	BARBERRY	5	3		S5	G5			L5	X	X
Galium aparine	Common Bedstraw	BEDSTRAW (RUBIACEAE)	4	3		S5	G5			L5	U	U
Galium lanceolatum	Lanceleaf Wild Licorice	BEDSTRAW (RUBIACEAE)	8			S5	G5			L3	R10	R
Galium triflorum	Three-Flowered Bedstraw	BEDSTRAW (RUBIACEAE)	4	2		S5	G5			L5	X	X
Galium verum	Yellow Bedstraw	BEDSTRAW (RUBIACEAE)		5	-1	SNA	GNR			L+	X	X
Mitchella repens	Partridgeberry	BEDSTRAW (RUBIACEAE)	6	2		S5	G5			L3	X	X
Fagus grandifolia	American Beech	BEECH (FAGACEAE)	6	3		S4	G5			L4	X	X
Quercus rubra	Northern Red Oak	BEECH (FAGACEAE)	6	3		S5	G5			L4	X	X
Betula papyrifera	Paper Birch	BIRCH (BETULACEAE)		2		S5	G5			L4	X	X
Carpinus caroliniana ssp.	Blue-Beech	BIRCH (BETULACEAE)	6			S5	G5T			L4	X	X
Ostrya virginiana	Eastern Hop-Hornbeam	BIRCH (BETULACEAE)	4	4		S5	G5			L5	X	X
Hydrophyllum virginianum	Virginia Waterleaf	BORAGE (BORAGINACEAE)	6	-2		S5	G5			L5	X	X
Epifagus virginiana	Beechdrops	BROOM-RAPE	6	5		S5	G5			L4	X	X
Rhamnus cathartica	European Buckthorn	BUCKTHORN		3	-3	SNA	GNR			L+	X	X
Fallopia convolvulus	Eurasian Black Bindweed	BUCKWHEAT		1	-1	SNA	GNR			L+	X	X
Persicaria maculosa	Spotted Lady's-Thumb	BUCKWHEAT		-3	-1	SNA	G3G5			L+	X	X
Actaea pachypoda	White Baneberry	BUTTERCUP	6	5		S5	G5			L4	X	X
Actaea rubra ssp. rubra	Red Baneberry	BUTTERCUP	5	5		S5	G5			L5	X	X
Anemone americana	Round-Lobed Hepatica	BUTTERCUP	6	5		S5	GNR			L2	R5	R
Ranunculus abortivus	Kidney-Leaved Buttercup	BUTTERCUP	2	-2		S5	G5			L5	X	X
Ranunculus acris	Common Buttercup	BUTTERCUP			-2	SNA	G5			L+	X	X
Thalictrum dioicum	Early Meadow-Rue	BUTTERCUP	5	2		S5	G5			L5	X	X
Daucus carota	Wild Carrot	CARROT (APIACEAE)		5	-2	SNA	GNR			L+	X	X
Osmorhiza claytonii	Hairy Sweet Cicely	CARROT (APIACEAE)	5	4		S5	G5			L4	U	X
Rhus typhina	Staghorn Sumac	CASHEW	1	5		S5	G5			L5	X	X
Ribes cynosbati	Eastern Prickly Gooseberry	CURRANT	4	5		S5	G5			L5	X	X
Cornus alternifolia	Alternate-Leaved Dogwood	DOGWOOD (CORNACEAE)	6	5		S5	G5			L5	X	X
Cornus stolonifera	Red-Osier Dogwood	DOGWOOD (CORNACEAE)	2	-3		S5	G5			L5	X	X
Circaea canadensis ssp.	Canada Enchanter's	EVENING-PRIMROSE	3	3		S5	G5T5			L5	X	X
Epilobium ciliatum ssp.	Northern Willowherb	EVENING-PRIMROSE	3	3		S5	G5T?			L5	X	X
Verbascum thapsus ssp.	Common Mullein	FIGWORT		5	-2	SNA	GNR			L+	X	X
Geranium robertianum	Herb-Robert	GERANIUM		5	-2	S5	G5			L+?	X	X
Aralia nudicaulis	Wild Sarsaparilla	GINSENG (ARALIACEAE)	4	3		S5	G5			L5	X	X
Echinocystis lobata	Wild Cucumber	GOURD (CUCURBITACEAE)	3	-2		S5	G5			L5	X	X
Parthenocissus vitacea	Thicket Creeper	GRAPE (VITACEAE)	3	3		S5	G5			L5	X	X
Vitis riparia	Riverbank Grape	GRAPE (VITACEAE)		-2		S5	G5			L5	X	X
Monotropa uniflora	Indian Pipe	HEATH (ERICAEAE)	6	3		S5	G5			L3	U	U
Pyrola elliptica	Shinleaf	HEATH (ERICAEAE)	5	5		S5	G5			L4	X	X
Lonicera canadensis	Canada Fly Honeysuckle	HONEYSUCKLE	6	3		S5	G5			L3	X	X
Lonicera dioica	Limber Honeysuckle	HONEYSUCKLE	5	3		S5	G5			L3	X	X
Valeriana officinalis	Common Valerian	HONEYSUCKLE		2	-1	SNA	GNR			L+	XSR	X
Amphicarpaea bracteata	American Hog Peanut	LEGUME (FABACEAE)	4			S5	G5			L5	X	X
Hylodesmum glutinosum	Large Tick-Trefoil	LEGUME (FABACEAE)	6	5		S4	G5			L3	R6	U
Lotus corniculatus	Garden Bird's-Foot Trefoil	LEGUME (FABACEAE)		1	-2	SNA	GNR			L+	X	X
Medicago lupulina	Black Medick	LEGUME (FABACEAE)		1	-1	SNA	GNR			L+	X	X
Melilotus albus	White Sweet-Clover	LEGUME (FABACEAE)		3	-3	SNA	GNR			L+	X	X
Securigera varia	Purple Crown-Vetch	LEGUME (FABACEAE)		5	-2	SNA	GNR			L+	X	X
Trifolium pratense	Red Clover	LEGUME (FABACEAE)		2	-2	SNA	GNR			L+	X	X
Vicia cracca	Tufted Vetch	LEGUME (FABACEAE)		5	-1	SNA	GNR			L+	X	X
Tilia americana	Basswood	MALLOW (MALVACEAE)	4	3		S5	G5			L5	X	X
Acer negundo	Manitoba Maple	MAPLE (SAPINDACEAE)		-2		S5	G5			L+?	X	X
Acer platanoides	Norway Maple	MAPLE (SAPINDACEAE)		5	-3	SNA	GNR			L+	X	X
Acer rubrum	Red Maple	MAPLE (SAPINDACEAE)	4			S5	G5			L4	X	X
Acer saccharinum	Silver Maple	MAPLE (SAPINDACEAE)	5	-3		S5	G5			L4	X	X
Acer saccharum	Sugar Maple	MAPLE (SAPINDACEAE)	4	3		S5	G5			L5	X	X
Dirca palustris	Eastern Leatherwood	MEZEREUM	7			S4	G4			L3	U	U
Apocynum androsaemifolium	Spreading Dogbane	MILKWEED	3	5		S5	G5T?			L5	X	X
Asclepias syriaca	Common Milkweed	MILKWEED		5		S5	G5			L5	X	X
Clinopodium vulgare	Wild Basil	MINT (LAMIACEAE)	4	5		S5	GNR			L5	X	X

SCIENTIFIC NAME	COMMON NAME	SPECIES FAMILY	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	PROVINCIAL STATUS (S-RANK)	GLOBAL STATUS (G-RANK)	COSSARO (MNRF)	COSEWIC (FEDERAL)	LOCAL STATUS TRCA RANKING (TRCA 2014)	LOCAL STATUS YORK (VARGA 2005)	LOCAL STATUS GTA (VARGA 2005)
Leonurus cardiaca ssp.	Common Motherwort	MINT (LAMIACEAE)		5	-2	SNA	GNR			L+	X	X
Monarda fistulosa var.	Wild Bergamot	MINT (LAMIACEAE)	6	3		SU	G5T5?			L5	U	X
Sambucus racemosa ssp.	Red Elderberry	MOSCHATEL (ADOXACEAE)	5	2		S5	G5			L5	X	X
Viburnum acerifolium	Maple-Leaved Viburnum	MOSCHATEL (ADOXACEAE)	6	5		S5	G5			L3	X	X
Viburnum lantana	Wayfaring Viburnum	MOSCHATEL (ADOXACEAE)		5	-1	SNA	GNR			L+	X	X
Viburnum opulus ssp. opulus	Cranberry Viburnum	MOSCHATEL (ADOXACEAE)			-1	SNA	G5			L+	X	X
Alliaria petiolata	Garlic Mustard	MUSTARD (BRASSICAEAE)			-3	SNA	GNR			L+	X	X
Erysimum cheiranthoides	Wormseed Wallflower	MUSTARD (BRASSICAEAE)		3	-1	SNA				L+	X	X
Hesperis matronalis	Dame's Rocket	MUSTARD (BRASSICAEAE)		5	-3	SNA	G4G5			L+	X	X
Thlaspi arvense	Field Pennycress	MUSTARD (BRASSICAEAE)		5	-1	SNA	GNR			L+	XSR	X
Urtica dioica ssp. gracilis	Slender Stinging Nettle	NETTLE (URTICAEAE)	2	-1		S5	G5T?			L5	XSR	X
Solanum dulcamara	Bittersweet Nightshade	NIGHTSHADE			-2	SNA	GNR			L+	X	X
Solanum ptychanthum	Eastern Black Nightshade	NIGHTSHADE	3	5		S5	G5			L5	X	X
Elaeagnus umbellata	Autumn Olive	OLEASTER		3	-3	SNA	GNR			L+	X	X
Fraxinus americana	White Ash	OLIVE (OLEACEAE)	4	3		S4	G5			L5	X	X
Fraxinus pennsylvanica	Red Ash	OLIVE (OLEACEAE)	3	-3		S4	G5			L5	X	X
Cerastium pumilum	European Chickweed	PINK		5	-1	SNA	GNR					X
Silene noctiflora	Night-Flowering Catchfly	PINK		5	-1	SNA	GNR			L+	X	X
Stellaria graminea	Grass-Leaved Starwort	PINK		5	-2	SNA	GNR			L+	X	X
Plantago lanceolata	English Plantain	PLANTAIN			-1	SNA	G5			L+	X	X
Plantago rugelii	Rugel's Plantain	PLANTAIN	1			S5	G5			L5	X	X
Veronica officinalis	Common Speedwell	PLANTAIN		5	-2	SNA	G5			L+	X	X
Sanguinaria canadensis	Bloodroot	POPPY (PAPAVERACEAE)	5	4		S5	G5			L5	X	X
Lysimachia borealis	Northern Starflower	PRIMROSE	6	-1		S5	G5T?			L3	X	X
Agrimonia gryposepala	Hooked Agrimony	ROSE (ROSACEAE)	2	2		S5	G5			L5	X	X
Fragaria virginiana ssp.	Wild Strawberry	ROSE (ROSACEAE)				SU	G5T5			L5		
Geum aleppicum	Yellow Avens	ROSE (ROSACEAE)	2	-1		S5	G5			L5	X	X
Geum canadense	White Avens	ROSE (ROSACEAE)	3			S5	G5			L5	X	X
Malus baccata	Siberian Crabapple	ROSE (ROSACEAE)				SNA	GNR			L+		X
Malus pumila	Common Apple	ROSE (ROSACEAE)		5	-1	SNA	G5			L+	X	X
Potentilla recta	Sulphur Cinquefoil	ROSE (ROSACEAE)		5	-2	SNA	GNR			L+	X	X
Prunus serotina var. serotina	Black Cherry	ROSE (ROSACEAE)	3	3		S5	G5			L5	X	X
Prunus virginiana var.	Chokecherry	ROSE (ROSACEAE)	2	1		S5	G5T?			L5	X	X
Rubus allegheniensis	Alleghany Blackberry	ROSE (ROSACEAE)	2	2		S5	G5			L5	X	X
Rubus idaeus ssp. strigosus	North American Red	ROSE (ROSACEAE)		-2		S5	G5T5			L5	X	X
Rubus occidentalis	Black Raspberry	ROSE (ROSACEAE)	2	5		S5	G5			L5	X	X
Celastrus scandens	Climbing Bittersweet	SPINDLE TREE	3	3		S5	G5			L3	X	X
Hypericum perforatum ssp.	Common St. John's-Wort	ST. JOHN'S-WORT		5	-3	SNA	GNR			L+	X	X
Viola labradorica	Labrador Violet	VIOLET (VIOLACEAE)				S5	G5			L5	X	X
Viola pubescens	Downy Yellow Violet	VIOLET (VIOLACEAE)				S5	G5			L5	X	X
Carya cordiformis	Bitternut Hickory	WALNUT (JUGLANDACEAE)	6			S5	G5			L4	X	X
Juglans cinerea	Butternut	WALNUT (JUGLANDACEAE)	6	2		S2?	G4	END	END	L3	X	X
Juglans nigra	Black Walnut	WALNUT (JUGLANDACEAE)	5	3		S4?	G5			L5	R	X
Populus grandidentata	Large-Toothed Aspen	WILLOW (SALICACEAE)	5	3		S5	G5			L4	X	X
Populus tremuloides	Trembling Aspen	WILLOW (SALICACEAE)				S5	G5			L5	X	X
Salix x fragilis	Hybrid Crack Willow	WILLOW (SALICACEAE)		-1	-3	HYB	GNR			L+	X	X
Hamamelis virginiana	American Witch-Hazel	WITCH-HAZEL	6	3		S4S5	G5			L3	U	X
Oxalis stricta	European Wood-Sorrel	WOOD SORREL		3		S5	G5			L5	X	X
Asparagus officinalis	Garden Asparagus	ASPARAGUS		3	-1	SNA	G5?			L+	X	X
Maianthemum canadense	Wild Lily-Of-The-Valley	ASPARAGUS				S5	G5T5			L4	X	X
Maianthemum racemosum	Large False Solomon's Seal	ASPARAGUS	4	3		S5	G5T			L5	X	X
Polygonatum pubescens	Hairy Solomon's Seal	ASPARAGUS	5	5		S5	G5			L4	X	X
Trillium grandiflorum	White Trillium	BUNCHFLOWER	5	5		S5	G5			L4	X	X
Smilax tamnoides	Bristly Greenbrier	CATBRIER (SMILACACEAE)	6			S5	G5Q			L4	U	U
Streptopus lanceolatus var.	Eastern Rose Twisted-Stalk	COLCHICUM	7			S5?	G5T5			L3	X	X
Uvularia grandiflora	Large-Flowered Bellwort	COLCHICUM	6	5		S5	G5			L3	X	X
Agrostis stolonifera	Creeping Bentgrass	GRASS (POACEAE)		-3		SNA	G5			L+?	X	X
Bromus inermis	Smooth Brome	GRASS (POACEAE)		5	-3	SNA	G4G5T?			L+	X	X
Dactylis glomerata	Orchard Grass	GRASS (POACEAE)		3	-1	SNA	GNR			L+	X	X
Elymus repens	Quackgrass	GRASS (POACEAE)		3	-3	SNA	GNR			L+	X	X
Festuca subverticillata	Nodding Fescue	GRASS (POACEAE)	6	2		S4	G5			L4	U	U
Lolium arundinaceum	Tall Fescue	GRASS (POACEAE)		2	-1	SNA	GNR			L+	X	X
Oryzopsis asperifolia	Rough-Leaved Mountain	GRASS (POACEAE)	6	5		S5	G5			L4	X	X
Phalaris arundinacea var.	Reed Canary Grass	GRASS (POACEAE)		-4		S5	G5TNR			L+?	X	X
Phleum pratense ssp.	Common Timothy	GRASS (POACEAE)		3	-1	SNA	GNR			L+	X	X
Poa compressa	Canada Bluegrass	GRASS (POACEAE)		2		SNA	GNR			L+	X	X
Poa palustris	Fowl Bluegrass	GRASS (POACEAE)	5	-4		S5	G5			L5	X	X
Poa pratensis ssp. pratensis	Kentucky Bluegrass	GRASS (POACEAE)		1		SNA	G5T5			L+	X	X
Schizachne purpurascens	Purple False Melic	GRASS (POACEAE)	6	2		S5	G5			L4	X	X
Setaria pumila ssp. pumila	Yellow Foxtail	GRASS (POACEAE)			-1	SNA	GNR			L+	X	X
Erythronium americanum	Yellow Trout Lily	LILY (LILIACEAE)	5	5		S5	G5T5			L5	X	X
Juncus bufonius	Toad Rush	RUSH (JUNCACEAE)	1	-4		S5	GNR			L5	X	X
Carex arctata	Drooping Woodland Sedge	SEDGE (CYPERACEAE)	5	5		S5	G5?			L5	X	X
Carex cristatella	Crested Sedge	SEDGE (CYPERACEAE)	3	-4		S5	G5			L5	X	X
Carex deweyana var.	Dewey's Sedge	SEDGE (CYPERACEAE)	6	4		S5	G5			L4	X	X
Carex laxiflora	Loose-Flowered Sedge	SEDGE (CYPERACEAE)	5			S5	G5			L4	U	U
Carex leptonervia	Finely-Nerved Sedge	SEDGE (CYPERACEAE)	5			S5	G4			L3	X	U
Carex peckii	Peck's Sedge	SEDGE (CYPERACEAE)	6	5		S5	G4G5			L4	X	X
Carex pedunculata	Long-Stalked Sedge	SEDGE (CYPERACEAE)	5	5		S5	G5			L5	X	X
Carex pensylvanica	Pennsylvania Sedge	SEDGE (CYPERACEAE)	5	5		S5	G5			L4	X	X
Carex radiata	Eastern Star Sedge	SEDGE (CYPERACEAE)	4	5		S5	G4			L5	X	X
Athyrium filix-femina var.	Northeastern Lady Fern	ATHYRIACEAE	4			S5	G5T5			L5	X	X
Pteridium aquilinum var.	Eastern Bracken Fern	BRACKEN FERN	2	3		S5	G5T			L4	X	X
Dendrolycopodium	Round-Branched Tree-	CLUBMOSS	7			S5	G5			L2	U	U
Equisetum hyemale ssp.	Common Scouring-Rush	HORSETAIL	2	-2		S5	G5T5			L5	X	X
Dryopteris carthusiana	Spinulose Wood Fern	WOOD FERN	5	-2		S5	G5			L5	X	X
Dryopteris marginalis	Marginal Wood Fern	WOOD FERN	5	3		S5	G5			L4	X	X

Common Name	Scientific Name	Species Order	Species Family	Provincial Status (S Rank)	Global Status (G Rank)	COSSARO (MNRF)	COSEWIC (Federal)	Highest Breeding Evidence
Hooded Merganser	Lophodytes cucullatus	Anseriformes	Anatidae	S5B,S5N	G5			PO-H
Wild Turkey	Meleagris gallopavo	Galliformes	Phasianinae	S5	G5			PO-H
Mourning Dove	Zenaida macroura	Columbiformes	Columbidae	S5	G5			PR-T
Ruby-throated Hummingbird	Archilochus colubris	Apodiformes	Trochilidae	S5B	G5			PO-H
Killdeer	Charadrius vociferus	Charadriiformes	Charadriidae	S5B, S5N	G5			CO-FY
Ring-billed Gull	Larus delawarensis	Charadriiformes	Laridae	S5B,S4N	G5			OB-X
Turkey Vulture	Cathartes aura	Accipitriformes	Cathartidae	S5B	G5			PO-H
Red-tailed Hawk	Buteo jamaicensis	Accipitriformes	Accipitridae	S5	G5			PO-H
Great Horned Owl	Bubo virginianus	Strigiformes	Strigidae	S4	G5			PO-H
Red-bellied Woodpecker	Melanerpes carolinus	Piciformes	Picidae	S4	G5			PR-T
Yellow-bellied Sapsucker	Sphyrapicus varius	Piciformes	Picidae	S5B	G5			CO-CF
Downy Woodpecker	Picoides pubescens	Piciformes	Picidae	S5	G5			PR-A
Hairy Woodpecker	Picoides villosus	Piciformes	Picidae	S5	G5			CO-FY
Northern Flicker	Colaptes auratus	Piciformes	Picidae	S4B	G5			PR-P
Pileated Woodpecker	Dryocopus pileatus	Piciformes	Picidae	S5	G5			PO-H
Eastern Wood-Pewee	Contopus virens	Passeriformes	Tyrannidae	S4B	G5	SC	SC	PR-T
Eastern Phoebe	Sayornis phoebe	Passeriformes	Tyrannidae	S5B	G5			PR-T
Great Crested Flycatcher	Myiarchus crinitus	Passeriformes	Tyrannidae	S4B	G5			PR-T
Eastern Kingbird	Tyrannus tyrannus	Passeriformes	Tyrannidae	S4B	G5			PR-P
Warbling Vireo	Vireo gilvus	Passeriformes	Vireonidae	S5B	G5			PR-T
Red-eyed Vireo	Vireo olivaceus	Passeriformes	Vireonidae	S5B	G5			PR-T
Blue Jay	Cyanocitta cristata	Passeriformes	Corvidae	S5	G5			PR-T
American Crow	Corvus brachyrhynchos	Passeriformes	Corvidae	S5B	G5			PO-H
Horned Lark	Eremophila alpestris	Passeriformes	Alaudidae	S4B	G5			PR-A
Tree Swallow	Tachycineta bicolor	Passeriformes	Hirundinidae	S4B	G5			PR-T
Northern Rough-winged Swallow	Stelgidopteryx serripennis	Passeriformes	Hirundinidae	S4B	G5			PO-H
Bank Swallow	Riparia riparia	Passeriformes	Hirundinidae	S4B	G5	THR	THR	PR-T
Cliff Swallow	Petrochelidon pyrrhonota	Passeriformes	Hirundinidae	S4B	G5			PO-H
Barn Swallow	Hirundo rustica	Passeriformes	Hirundinidae	S4B	G5	THR	THR	PR-T
Black-capped Chickadee	Poecile atricapillus	Passeriformes	Paridae	S5	G5			PR-T
Red-breasted Nuthatch	Sitta canadensis	Passeriformes	Sittidae	S5	G5			PR-T
White-breasted Nuthatch	Sitta carolinensis	Passeriformes	Sittidae	S5	G5			PR-A
House Wren	Troglodytes aedon	Passeriformes	Troglodytidae	S5B	G5			PR-T
Wood Thrush	Hylocichla mustelina	Passeriformes	Turdidae	S4B	G4	SC	THR	CO-NE
American Robin	Turdus migratorius	Passeriformes	Turdidae	S5B	G5			PR-T
Gray Catbird	Dumetella carolinensis	Passeriformes	Mimidae	S4B	G5			PR-T
Brown Thrasher	Toxostoma rufum	Passeriformes	Mimidae	S4B	G5			PR-T
European Starling	Sturnus vulgaris	Passeriformes	Mimidae	SNA	G5			PO-H
Cedar Waxwing	Bombycilla cedrorum	Passeriformes	Bombycillidae	S5B	G5			PR-T
American Goldfinch	Spinus tristis	Passeriformes	Fringillidae	S5B	G5			PR-P
Ovenbird	Seiurus aurocapilla	Passeriformes	Parulidae	S4B	G5			PR-T
Mourning Warbler	Geothlypis philadelphia	Passeriformes	Parulidae	S4B	G5			PR-T
Common Yellowthroat	Geothlypis trichas	Passeriformes	Parulidae	S5B	G5			PR-T
Hooded Warbler	Setophaga citrina	Passeriformes	Parulidae	S4B	G5	NAR	NAR	PO-S

American Redstart	Setophaga ruticilla	Passeriformes	Parulidae	S5B	G5			PO-S
Yellow Warbler	Setophaga petechia	Passeriformes	Parulidae	S5B	G5			PO-S
Chestnut-sided Warbler	Setophaga pensylvanica	Passeriformes	Parulidae	S5B	G5			PR-T
Pine Warbler	Setophaga pinus	Passeriformes	Parulidae	S5B	G5			PR-T
Eastern Towhee	Pipilo erythrophthalmus	Passeriformes	Emberizidae	S4B	G5			PR-T
Chipping Sparrow	Spizella passerina	Passeriformes	Emberizidae	S5B	G5			CO-FY
Field Sparrow	Spizella pusilla	Passeriformes	Emberizidae	S4B	G5			CO-CF
Savannah Sparrow	Passerculus sandwichensis	Passeriformes	Emberizidae	S4B	G5			CO-CF
Song Sparrow	Melospiza melodia	Passeriformes	Emberizidae	S5B	G5			CO-FS
Scarlet Tanager	Piranga olivacea	Passeriformes	Cardinalidae	S4B	G5			PR-T
Northern Cardinal	Cardinalis cardinalis	Passeriformes	Cardinalidae	S5	G5			PR-P
Rose-breasted Grosbeak	Pheucticus ludovicianus	Passeriformes	Cardinalidae	S4B	G5			CO-NE
Indigo Bunting	Passerina cyanea	Passeriformes	Cardinalidae	S4B	G5			PR-T
Bobolink	Dolichonyx oryzivorus	Passeriformes	Icteridae	S4B	G5	THR	THR	CO-CF
Red-winged Blackbird	Agelaius phoeniceus	Passeriformes	Icteridae	S4	G5			PR-P
Common Grackle	Quiscalus quiscula	Passeriformes	Icteridae	S5B	G5			PO-H
Brown-headed Cowbird	Molothrus ater	Passeriformes	Icteridae	S4B	G5			PR-P
Orchard Oriole	Icterus spurius	Passeriformes	Icteridae	S4B	G5			PR-T
Baltimore Oriole	Icterus galbula	Passeriformes	Icteridae	S4B	G5			CO-FY

COMMON NAME	SCIENTIFIC NAME	SRANK	GLOBAL STATUS	COSSARO	COSEWIC	Local Status TRCA
2010, 2011, 2012, 2014, 2015, and 2016						
ODONATA						
Familiar Bluet	*Enallagma civile*	S5	G5			
Spring Northern Bluet	*Enallagma vernale.*	S4	G4			
Lance-Tipped Darner	*Aeshna constricta*	S5	G5			
Variable (Interrupted) Darner	*Aeshna interrupta interrupta*	S5	G5			
Black-Tipped Darner	*Aeshna tuberculifera*	S4	G4			
Shadow Darner	*Aeshna umbrosa*	S5	G5			
Common Green Darner	*Anax junius*	S5	G5			
Common Baskettail	*Epitheca cynosura*	S5	G5			
Dot-tailed Whiteface	*Leucorrhinia intacta*	S5	G5			
Widow Skimmer	*Libellula luctuosa*	S5	G5			
Twelve-Spotted Skimmer	*Libellula pulchella*	S5	G5			
Four-spotted Skimmer	*Libellula quadrimaculata*	S5	G5			
Blue Dasher	*Pachydiplax longipennis*	S5	G5			
Eastern Amberwing	*Perithemis tenera*	S4	G5			
Common Whitetail	*Plathemis lydia*	S5	G5			
White-faced Meadowhawk	*Sympetrum obtrusum*	S5	G5			
Band-winged Meadowhawk	*Sympetrum semicinctum*	S4	G5			
Yellow-legged Meadowhawk	*Sympetrum vicinum*	S5	G5			
Black Saddlebags	*Tramea lacerata*	S4	G5			
BUTTERFLIES						
Silver Spotted Skipper	*Epargyreus clarus*	S4	G5			
Dreamy Duskywing	*Erynnis icelus*	S5	G5			
Columbine Duskywing	*Erynnis lucilius*	S4	G4			
Wild Indigo Duskywing	*Erynnis baptisiae*	S4	G5			
Common Sooty Wing	*Pholisora catullus*	S3	G5			
European Skipper	*Thymelicus lineola*	SNA	G5			
Peck's Skipper	*Polites peckius*	S5	G5			
Tawny-edged Skipper	*Polites themistocles*	S5	G5			
Northern Broken-Dash	*Wallengrenia egermet*	S5	G5			
Little Glassywing	*Pompeius verna*	S4	G5			
Hobomok Skipper	*Poanes hobomok*	S5	G5			
Dun Skipper	*Euphyes vestris*	S5	G5			
Black Swallowtail	*Papilio polyxenes*	S5	G5			
Eastern Tiger Swallowtail	*Papilio glaucus*	S5	G5			
Cabbage White	*Pieris rapae*	SNA	G5			
Clouded Sulphur	*Colias philodice*	S5	G5			
Eastern Tailed Blue	*Everes comyntas*	S5	G5			
Silvery Blue	*Glaucopsyche lygdamus*	S5	G5			
Pearl Crescent	*Phyciodes tharos*	S4	G5			
Northern Crescent	*Phycoides pascoensis*	S5	G5			
Mourning Cloak	*Nymphalis antiopa*	S5	G5			
Red Admiral	*Vanessa atalanta*	S5	G5			
Red-spotted Purple	*Limenitis arthemis astyanax*	S5	G5T5			
Viceroy	*Limenitis archippus*	S5	G5			
Northern Pearly Eye	*Enodia anthedon*	S5	G5			
Little Wood-Satyr	*Megisto cymela*	S5	G5			
Common Ringlet	*Coenonympha tullia*	S5	G5			
Common Wood-Nymph	*Cercyonis pegala*	S5	G5			
Monarch	*Danaus plexippus*	S4B, S2N	G4	SC	END	
MOTHS						
Toothed Somberwing	*Euclidia cuspidea*	S5	G5			
OTHER ARTHROPODS						
Six-spotted Tiger Beetle	*Cicindela sexguttata*	S5	G5			
Beautiful Tiger Beetle	*Cicindela formosa*	S4	G5T4			
Festive Tiger Beetle	*Cicindela scutellaris*	S5	G5			
Common Eastern Bumblebee	Bombus impatiens	S4S5	G5			
Red-belted Bumblebee	Bombus rufocinctus	S4	G4G5			
Sand Wasp sp.	Bembix americana	S5	G5			

COMMON NAME	SCIENTIFIC NAME	SRANK	GLOBAL STATUS	COSSARO	COSEWIC	Local Status TRCA
AMPHIBIANS						
American Toad	*Anaxyrus americanus*	S5	G5			L4
Gray Treefrog	*Hyla versicolor*	S5	G5			L2
Spring Peeper	*Pseudacris crucifer*	S5	G5			L2
Northern Green Frog	*Lithobates clamitans*	S5	G5			L4
Wood Frog	*Lithobates sylvatica*	S5	G5			L2
Northern Leopard Frog	*Lithobates pipiens*	S5	G5		NAR	L3
REPTILES						
Eastern Gartersnake	*Thamnophis sirtalis*	S5	G5			L4
BIRDS						
Canada Goose	*Branta canadensis*	S5	G5			L5
Wood Duck	*Aix sponsa*	S5	G5			L4
Mallard	*Anas platyrhynchos*	S5	G5			L5
Wild Turkey	*Meleagris gallopavo*	S5	G5			L3
Turkey Vulture	*Cathartes aura*	S5B	G5			L5
Osprey	*Pandion haliaetus*	S5B	G5			L3
Cooper's Hawk	*Accipiter cooperii*	S4	G5			L4
Red-shouldered Hawk	*Buteo lineatus*	S4B	G5	NAR	NAR	L2
Red-tailed Hawk	*Buteo jamaicensis*	S5	G5			L5
Killdeer	*Charadrius vociferus*	S5B, S5N	G5			L4
Spotted Sandpiper	*Actitis macularius*	S5	G5			L4
American Woodcock	*Scolopax minor*	S4B	G5			L3
Ring-billed Gull	*Larus delawarensis*	S5B,S4N	G5			L4
Rock Pigeon	*Columba livia*	SNA	G5			
Mourning Dove	*Zenaida macroura*	S5	G5			L5
Black-billed Cuckoo	*Coccyzus erythropthalmus*	S5B	G5			L3
Ruby-throated Hummingbird	*Archilochus colubris*	S5B	G5			L4
Belted Kingfisher	*Megaceryle alcyon*	S4B	G5			L4
Red-bellied Woodpecker	*Melanerpes carolinus*	S4	G5			L4
Downy Woodpecker	*Picoides pubescens*	S5	G5			L5
Hairy Woodpecker	*Picoides villosus*	S5	G5			L4
Northern Flicker	*Colaptes auratus*	S4B	G5			L4
Pileated Woodpecker	*Dryocopus pileatus*	S5	G5			L3
Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC	L4
Alder Flycatcher	*Empidonax alnorum*	S5B	G5			L3
Eastern Phoebe	*Sayornis phoebe*	S5B	G5			L5
Great Crested Flycatcher	*Myiarchus crinitus*	S4B	G5			L4
Eastern Kingbird	*Tyrannus tyrannus*	S4B	G5			L4
Red-eyed Vireo	*Vireo olivaceus*	S5B	G5			L4
Gray Jay	*Perisoreus canadensis*	S5	G5			
Blue Jay	*Cyanocitta cristata*	S5	G5			L5
American Crow	*Corvus brachyrhynchos*	S5B	G5			L5
Common Raven	*Corvus corax*	S5	G5			L4
Tree Swallow	*Tachycineta bicolor*	S4B	G5			L4
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B	G5			L4
Bank Swallow	*Riparia riparia*	S4B	G5	THR	THR	L3
Black-capped Chickadee	*Poecile atricapillus*	S5	G5			L5
Red-breasted Nuthatch	*Sitta canadensis*	S5	G5			L4
White-breasted Nuthatch	*Sitta carolinensis*	S5	G5			L4
Brown Creeper	*Certhia americana*	S5B	G5			L3
House Wren	*Troglodytes aedon*	S5B	G5			L5
Gray-cheeked Thrush	*Catharus minimus*	S4B	G5			
Swainson's Thrush	*Catharus ustulatus*	S4B	G5			
Wood Thrush	*Hylocichla mustelina*	S4B	G4	SC	THR	L3
American Robin	*Turdus migratorius*	S5B	G5			L5
Gray Catbird	*Dumetella carolinensis*	S4B	G5			L4
Brown Thrasher	*Toxostoma rufum*	S4B	G5			L3
European Starling	*Sturnus vulgaris*	SNA	G5			L+
Cedar Waxwing	*Bombycilla cedrorum*	S5B	G5			L5
Ovenbird	*Seiurus aurocapilla*	S4B	G5			L2
Mourning Warbler	*Geothlypis philadelphia*	S4B	G5			L3
Common Yellowthroat	*Geothlypis trichas*	S5B	G5			L4
American Redstart	*Setophaga ruticilla*	S5B	G5			L3
Blackburnian Warbler	*Setophaga fusca*	S5B	G5			L3

COMMON NAME	SCIENTIFIC NAME	SRANK	GLOBAL STATUS	COSSARO	COSEWIC	Local Status TRCA
Yellow Warbler	*Setophaga petechia*	S5B	G5			L5
Yellow-rumped Warbler	*Setophaga coronata*	S5B	G5			L3
Eastern Towhee	*Pipilo erythrophthalmus*	S4B	G5			L3
Chipping Sparrow	*Spizella passerina*	S5B	G5			L5
Field Sparrow	*Spizella pusilla*	S4B	G5			L3
Song Sparrow	*Melospiza melodia*	S5B	G5			L5
Swamp Sparrow	*Melospiza georgiana*	S5B	G5			L4
Scarlet Tanager	*Piranga olivacea*	S4B	G5			L3
Northern Cardinal	*Cardinalis cardinalis*	S5	G5			L5
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	S4B	G5			L4
Indigo Bunting	*Passerina cyanea*	S4B	G5			L4
Red-winged Blackbird	*Agelaius phoeniceus*	S4	G5			L5
Common Grackle	*Quiscalus quiscula*	S5B	G5			L5
Brown-headed Cowbird	*Molothrus ater*	S4B	G5			L5
Orchard Oriole	*Icterus spurius*	S4B	G5			L5
Baltimore Oriole	*Icterus galbula*	S4B	G5			L5
American Goldfinch	*Spinus tristis*	S5B	G5			L5
MAMMALS						
Masked Shrew	*Sorex cinereus*	S5	G5			L3
Eastern Small-footed Myotis	*Myotis leibii*	S2S3	G4	END		
Little Brown Myotis	*Myotis lucifugus*	S4	G3	END	END	L4
Silver-haired Bat	*Lasionycteris noctivagans*	S4	G3G4			
Eastern Red Bat	*Lasiurus borealis*	S4	G3G4			LX
Big Brown Bat	*Eptesicus fuscus*	S4	G5			L4
Hoary Bat	*Lasiurus cinereus*	S4	G3G4			LX
Eastern Cottontail	*Sylvilagus floridanus*	S5	G5			L4
Eastern Chipmunk	*Tamias striatus*	S5	G5			L4
Eastern Gray Squirrel	*Sciurus carolinensis*	S5	G5			L5
Red Squirrel	*Tamiasciurus hudsonicus*	S5	G5			L4
Deer Mouse	*Peromyscus maniculatus*	S5	G5			L4
Meadow Jumping Mouse	*Zapus hudsonicus*	S5	G5			L3
Coyote	*Canis latrans*	S5	G5			L4
Red Fox	*Vulpes vulpes*	S5	G5			L4
Northern Raccoon	*Procyon lotor*	S5	G5			L5
White-tailed Deer	*Odocoileus virginianus*	S5	G5			L4
2017						
ODONATA						
Familiar Bluet	*Enallagma civile*	S5	G5			
Spring Northern Bluet	*Enallagma vernale.*	S4	G4			
Lance-Tipped Darner	*Aeshna constricta*	S5	G5			
Variable (Interrupted) Darner	*Aeshna interrupta interrupta*	S5	G5			
Black-Tipped Darner	*Aeshna tuberculifera*	S4	G4			
Shadow Darner	*Aeshna umbrosa*	S5	G5			
Common Green Darner	*Anax junius*	S5	G5			
Common Baskettail	*Epitheca cynosura*	S5	G5			
Dot-tailed Whiteface	*Leucorrhinia intacta*	S5	G5			
Twelve-Spotted Skimmer	*Libellula pulchella*	S5	G5			
Four-spotted Skimmer	*Libellula quadrimaculata*	S5	G5			
Blue Dasher	*Pachydiplax longipennis*	S5	G5			
Eastern Amberwing	*Perithemis tenera*	S4	G5			
Common Whitetail	*Plathemis lydia*	S5	G5			
White-faced Meadowhawk	*Sympetrum obtrusum*	S5	G5			
Band-winged Meadowhawk	*Sympetrum semicinctum*	S4	G5			
BUTTERFLIES						
Silver Spotted Skipper	*Epargyreus clarus*	S4	G5			
Dreamy Duskywing	*Erynnis icelus*	S5	G5			
Columbine Duskywing	*Erynnis lucilius*	S4	G4			
Wild Indigo Duskywing	*Erynnis baptisiae*	S4	G5			
Common Sooty Wing	*Pholisora catullus*	S3	G5			
European Skipper	*Thymelicus lineola*	SNA	G5			
Peck's Skipper	*Polites peckius*	S5	G5			
Tawny-edged Skipper	*Polites themistocles*	S5	G5			
Northern Broken-Dash	*Wallengrenia egermet*	S5	G5			
Little Glassywing	*Pompeius verna*	S4	G5			

COMMON NAME	SCIENTIFIC NAME	SRANK	GLOBAL STATUS	COSSARO	COSEWIC	Local Status TRCA
Hobomok Skipper	*Poanes hobomok*	S5	G5			
Dun Skipper	*Euphyes vestris*	S5	G5			
Black Swallowtail	*Papilio polyxenes*	S5	G5			
Eastern Tiger Swallowtail	*Papilio glaucus*	S5	G5			
Cabbage White	*Pieris rapae*	SNA	G5			
Clouded Sulphur	*Colias philodice*	S5	G5			
Eastern Tailed Blue	*Everes comyntas*	S5	G5			
Silvery Blue	*Glaucopsyche lygdamus*	S5	G5			
Pearl Crescent	*Phyciodes tharos*	S4	G5			
Northern Crescent	*Phycoides pascoensis*	S5	G5			
Mourning Cloak	*Nymphalis antiopa*	S5	G5			
Red Admiral	*Vanessa atalanta*	S5	G5			
Red-spotted Purple	*Limenitis arthemis astyanax*	S5	G5T5			
Viceroy	*Limenitis archippus*	S5	G5			
Northern Pearly Eye	*Enodia anthedon*	S5	G5			
Little Wood-Satyr	*Megisto cymela*	S5	G5			
Common Ringlet	*Coenonympha tullia*	S5	G5			
Common Wood-Nymph	*Cercyonis pegala*	S5	G5			
Monarch	*Danaus plexippus*	S4B, S2N	G4	SC	END	
MOTHS						
Toothed Somberwing	*Euclidia cuspidea*	S5	G5			
OTHER ARTHROPODS						
Six-spotted Tiger Beetle	*Cicindela sexguttata*	S5	G5			
Beautiful Tiger Beetle	*Cicindela formosa*	S4	G5T4			
Festive Tiger Beetle	*Cicindela scutellaris*	S5	G5			
Common Eastern Bumblebee	*Bombus impatiens*	S4S5	G5			
Red-belted Bumblebee	*Bombus rufocinctus*	S4	G4G5			
Sand Wasp sp.	*Bembix americana*	S5	G5			
AMPHIBIANS						
Spotted Salamander	*Ambystoma maculatum*	S4	G5			L1
American Toad	*Anaxyrus americanus*	S5	G5			L4
Gray Treefrog	*Hyla versicolor*	S5	G5			L2
Spring Peeper	*Pseudacris crucifer*	S5	G5			L2
Northern Green Frog	*Lithobates clamitans*	S5	G5			L4
Wood Frog	*Lithobates sylvatica*	S5	G5			L2
Northern Leopard Frog	*Lithobates pipiens*	S5	G5		NAR	L3
REPTILES						
Eastern Gartersnake	*Thamnophis sirtalis*	S5	G5			L4
BIRDS						
Hooded Merganser	*Lophodytes cucullatus*	S5B,S5N	G5			L3
Wild Turkey	*Meleagris gallopavo*	S5	G5			L3
Mourning Dove	*Zenaida macroura*	S5	G5			L5
Ruby-throated Hummingbird	*Archilochus colubris*	S5B	G5			L4
Killdeer	*Charadrius vociferus*	S5B, S5N	G5			L4
Ring-billed Gull	*Larus delawarensis*	S5B,S4N	G5			L4
Turkey Vulture	*Cathartes aura*	S5B	G5			L5
Red-tailed Hawk	*Buteo jamaicensis*	S5	G5			L5
Great Horned Owl	*Bubo virginianus*	S4	G5			L4
Red-bellied Woodpecker	*Melanerpes carolinus*	S4	G5			L4
Yellow-bellied Sapsucker	*Sphyrapicus varius*	S5B	G5			L3
Downy Woodpecker	*Picoides pubescens*	S5	G5			L5
Hairy Woodpecker	*Picoides villosus*	S5	G5			L4
Northern Flicker	*Colaptes auratus*	S4B	G5			L4
Pileated Woodpecker	*Dryocopus pileatus*	S5	G5			L3
Eastern Wood-Pewee	*Contopus virens*	S4B	G5	SC	SC	L4
Eastern Phoebe	*Sayornis phoebe*	S5B	G5			L5
Great Crested Flycatcher	*Myiarchus crinitus*	S4B	G5			L4
Eastern Kingbird	*Tyrannus tyrannus*	S4B	G5			L4

COMMON NAME	SCIENTIFIC NAME	SRANK	GLOBAL STATUS	COSSARO	COSEWIC	Local Status TRCA
Warbling Vireo	*Vireo gilvus*	S5B	G5			L5
Red-eyed Vireo	*Vireo olivaceus*	S5B	G5			L4
Blue Jay	*Cyanocitta cristata*	S5	G5			L5
American Crow	*Corvus brachyrhynchos*	S5B	G5			L5
Horned Lark	*Eremophila alpestris*	S4B	G5			L3
Tree Swallow	*Tachycineta bicolor*	S4B	G5			L4
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	S4B	G5			L4
Bank Swallow	*Riparia riparia*	S4B	G5	THR	THR	L3
Cliff Swallow	*Petrochelidon pyrrhonota*	S4B	G5			L5
Barn Swallow	*Hirundo rustica*	S4B	G5	THR	THR	L4
Black-capped Chickadee	*Poecile atricapillus*	S5	G5			L5
Red-breasted Nuthatch	*Sitta canadensis*	S5	G5			L4
White-breasted Nuthatch	*Sitta carolinensis*	S5	G5			L4
House Wren	*Troglodytes aedon*	S5B	G5			L5
Wood Thrush	*Hylocichla mustelina*	S4B	G4	SC	THR	L3
American Robin	*Turdus migratorius*	S5B	G5			L5

Table 9: Amphibian Call Count Survey Results (2010/2016/2017)

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
2010															
1	A	X												No Access	No Access
2	A	X												No Access	No Access
3	A	X												No Access	No Access
1	B	X												No Access	No Access
2	B		2(20)											No Access	No Access
3	B										1(1)			No Access	No Access
1	C		1(2)											No Access	No Access
2	C		1(4)											No Access	No Access
3	C	X												No Access	No Access

LEGEND:

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

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

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling. TNTC indicates "too numerous to count"

Table 9: Amphibian Call Count Survey Results (2010/2016/2017)

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	D	X												Y	NA
2	D		1(4)											Y	NA
3	D	X												Y	NA
1	E	X												Y	NA
2	E	X												Y	NA
3	E										1(2)			Y	NA
1	F					1(1)								Y	NA
2	F	X												Y	NA
3	F													N	Dry
2016															
1	A	X												No Access	No Access

LEGEND:

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

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

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling. TNTC indicates "too numerous to count"

Table 9: Amphibian Call Count Survey Results (2010/2016/2017)

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	A	X												No Access	No Access
3	A	X												No Access	No Access
1	B					2 (10)								No Access	No Access
2						2 (TNTC)								No Access	No Access
3	B				1 (4)									No Access	No Access
1	D	X												Y	15
2	D	X												Y	20
3	D	X												Y	15
1	G	X												Y	50
2	G	X												Y	20
3	G													N	Dry

LEGEND:

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

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

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling. TNTC indicates "too numerous to count"

Table 9: Amphibian Call Count Survey Results (2010/2016/2017)

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	FOTO	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
2017															
1	B					2(10)								Y	No Access
2	B				1(3)						1(2)			Y	No Access
3	B				1(2)						1(3)			Y	No Access
1	D		1(4)											Y	20
2	D	X												Y	15
3	D	X												Y	10
1	G	X												Y	10
2	G	X												Y	15
3	G	X												Y	≤15
1	H		1(4)			1(2)								Y	No access

LEGEND:

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

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

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling. TNTC indicates "too numerous to count"

Table 9: Amphibian Call Count Survey Results (2010/2016/2017)

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	H				2(6)									Y	No Access
3	H				1(4)						1(2)			Y	No Access
2	I	X												Y	60
3	I	X												Y	>30

Note: In 2017, no suitable amphibian breeding habitat was found at stations A, C, E or F. Two new stations were established (compared to prior survey years): station H monitored an off-site pond south of the Subject Lands, and station I monitored a small pond associated with a farmstead in the northeast portion of the Subject Lands (not part of the study area prior to 2017). The small pond associated with station I was found after the April call count surveys were complete, as such no first round AMC survey (April) was conducted in 2017.

LEGEND:

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

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

Note: For each species, the first number is the call code and the second number, which is in brackets, is the number of individuals of that species heard calling. TNTC indicates "too numerous to count"

Table 10: Amphibian Egg Mass Survey Results

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	SPSA	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
2016															
1	D	X												Y	15
2	D	X												Y	20
3	D								2		1			Y	15
1	G	X												Y	50
2	G	X												Y	20
3	G													N	DRY

LEGEND:

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

Table 10: Amphibian Egg Mass Survey Results

SURVEY ROUND	STATION NUMBER	SPECIES CODE												WATER	
		NOAM	AMTO	SPSA	GRTR	SPPE	CHFR	WOFR	NLFR	PIFR	GRFR	BULL	MIFR	Present (Y/N)	Depth (CM)
2017															
1	B			5							1			Y	32
1	D			1				1						Y	20
1	G	X												Y	10
1	I	X												Y	80

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

LEGEND:

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

Table 11: Snake Survey Results

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
AP-27-2017	1	ST1	X														
AP-27-2017	1	ST2	X														
AP-27-2017	1	ST3	X														
AP-27-2017	1	ST4	X														
AP-27-2017	1	ST5	X														

LEGEND:

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

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

Table 11: Snake Survey Results

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
AP-27-2017	1	ST6	X														
AP-27-2017	1	ST7	X														
AP-27-2017	1	ST8	X														
AP-27-2017	1	ST9	X														
AP-27-2017	1	ST10	X														

LEGEND:

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

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

Table 11: Snake Survey Results

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
AP-27-2017	1	ST11	X														
AP-27-2017	1	ST12	X														
AP-27-2017	1	ST13	X														
AP-27-2017	1	ST14	X														
AP-27-2017	1	ST15	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
BRSN	DeKay's Brownsnake	*Storeria dekayi*
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QUSN	Queensnake	*Regina septemvittata*

DATE	
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January	JA
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May	MA
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July	JL
August	AU
September	SE
October	OC
November	NO
December	DE

Table 11: Snake Survey Results

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
AP-27-2017	1	ST16	X														
AP-28-2017	2	ST1	X														
AP-28-2017	2	ST2	X														
AP-28-2017	2	ST3	X														
AP-28-2017	2	ST4	X														

LEGEND:

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

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Table 11: Snake Survey Results

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
AP-28-2017	2	ST5	X														
AP-28-2017	2	ST6	X														
AP-28-2017	2	ST7	X														
AP-28-2017	2	ST8	X														
AP-28-2017	2	ST9	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
MISN	Eastern Milksnake	*Lampropeltis triangulum*
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Table 11: Snake Survey Results

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
AP-28-2017	2	ST10	X														
AP-28-2017	2	ST11	X														
AP-28-2017	2	ST12	X														
AP-28-2017	2	ST13	X														
AP-28-2017	2	ST14	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
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Table 11: Snake Survey Results

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			NOSN	EAGA	MISN	BRSN	RBSN	NWSN	RISN	BLRA	BUGA	FOSN	HOSN	MASS	RNSN	SGSN	QUSN
AP-28-2017	2	ST15	X														
AP-28-2017	2	ST16	X														
SE-14-2017	3	T1	X														
SE-14-2017	3	T2	X														
SE-14-2017	3	T3	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
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Table 11: Snake Survey Results

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
SE-14-2017	3	T4	X														
SE-14-2017	3	T5	X														
SE-14-2017	3	T6	X														
SE-14-2017	3	T7		1													
SE-14-2017	3	AS1	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
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BRSN	DeKay's Brownsnake	*Storeria dekayi*
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Table 11: Snake Survey Results

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
SE-14-2017	3	AS2	X														
SE-14-2017	3	AS3	X														
SE-28-2017	4	T1	X														
SE-28-2017	4	T2	X														
SE-28-2017	4	T3	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
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Table 11: Snake Survey Results

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
SE-28-2017	4	T4	X														
SE-28-2017	4	T5	X														
SE-28-2017	4	T6	X														
SE-28-2017	4	T7	X														
SE-28-2017	4	AS1	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
EAGA	Eastern Gartersnake	*Thamnophis sirtalis sirtalis*
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Table 11: Snake Survey Results

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
SE-28-2017	4	AS2	X														
SE-28-2017	4	AS3	X														
SE-28-2017	4	AS4	X														

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOSN	No Snakes	No snakes despite survey effort
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DATE	
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February	FE
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April	AP
May	MA
June	JN
July	JL
August	AU
September	SE
October	OC
November	NO
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Table 12: Wildlife Road Crossing Survey Results

SURVEY DATE	SURVEY ROUND	TRANSECT NO.	SPECIES OBSERVED	UTM OF OBSERVATION		INDIVIDUALS	
				EASTING	NORTHING	QTY	STATUS
14-SE-17	1	R1	Eastern Gartersnake	620992	4861371	1	Dead
21-SE-17	2	R1	Eastern Gartersnake	620519	4861255	1	Dead
21-SE-17	2	R1	Monarch	621306	4861618	1	Alive
28-SE-17	3	R1	Eastern Gartersnake	620935	4861359	1	Dead
28-SE-17	3	R1	Eastern Gartersnake	620941	4861359	1	Dead

LEGEND:

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

Table 13: Cavity Density Survey Results

AREA IDENTIFICATION	COMMUNITY TYPE	AREA SIZE (ha)	# OF CAVITY TREES OBSERVED	# OF CAVITY TREES/HECTARE
Polygon 1	FOD2-4	1.4	5 (in 10 plots)	10
Polygon 2	FOD2-4	0.4	7	17.5
Polygon 3	FOD2-4	1.4	6 (in 10 plots)	12
Polygon 4	FOD2-4 FOD2-5	4.4	10 (in 10 plots)	20
Polygon 5	FOD2-4	0.7	5	7.1
Polygon 6	FOD2-4	0.1	0	0
Polygon 7	FOD5-3	0.4	10	25
Polygon 8	FOD5-11	0.1	1	10
Polygon 9	FOD5-11	0.7	4	5.7
Polygon 10	FOD5-11	0.8	12	15
Polygon 11	FOD3-2	0.1	0	0
Polygon 12	CUW	0.2	0	0
Polygon 13	FOD5-3	0.3	2	6.7

Table 14: Bat Acoustic Survey Dates and Conditions (2016/2017)

SURVEY ROUND	DATE	TIME		EQUIPMENT USED	AIR TEMP (C°)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS	MOON PHASE
		START	END							
2016										
1	JU 6	21:13	22:34	Echo Meter Touch	15	82	65	2	N/A	Waxing Crescent (3%)
2017										
1	JU22	21:00	5:35	SM3Bat	19.5	80	100	1	N/A	Waxing Crescent (4%)
2	JU23	21:00	5:35	SM3Bat	22.7	70	75	1	N/A	New (1%)
3	JU24	21:00	5:35	SM3Bat	18.3	65	25	0	N/A	New (1%)
4	JU25	21:00	5:35	SM3Bat	15	82	75	1	N/A	Waxing Crescent (3%)
5	JU26	21:00	5:35	SM3Bat	13	88	100	0	N/A	Waxing Crescent (9%)
6	JU27	21:00	5:35	SM3Bat	15	66	50	0	N/A	Waxing Crescent

LEGEND:

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

Table 14: Bat Acoustic Survey Dates and Conditions (2016/2017)

SURVEY ROUND	DATE	TIME		EQUIPMENT USED	AIR TEMP (C°)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS	MOON PHASE
		START	END							
										(16%)
7	JU28	21:00	5:35	SM3Bat	20	51	25	0	N/A	Waxing Crescent (25%)
8	JU29	21:00	5:35	SM3Bat	20	95	100	0	N/A	Waxing Crescent (35%)
9	JU30	21:00	5:35	SM3Bat	22	83	75	1	N/A	Waxing Crescent (45%)
10	JL1	21:00	5:35	SM3Bat	18	76	50	1	N/A	First Quarter (55%)
11	JL2	21:00	5:35	SM3Bat	17	82	75	1	N/A	First Quarter (65%)
12	JL10	21:00	5:35	SM3Bat	19	94	100	1	N/A	Full Moon (99%)
13	JL11	21:00	5:35	SM3Bat	22	81	75	1	N/A	Waning Gibbous (95%)
14	JL12	21:00	5:35	SM3Bat	20	98	100	0	N/A	Waning Gibbous (90%)
15	JL13	21:00	5:35	SM3Bat	17	94	100	1	N/A	Waning Gibbous

LEGEND:

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

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

Table 14: Bat Acoustic Survey Dates and Conditions (2016/2017)

SURVEY ROUND	DATE	TIME		EQUIPMENT USED	AIR TEMP (C°)	HUMIDITY (%)	CLOUD COVER (%)	BEAUFORT WIND SPEED	PRECIPITATION COMMENTS	MOON PHASE
		START	END							
										(83%)
16	JL14	21:00	5:35	SM3Bat	19	80	75	1	N/A	Waning Gibbous (74%)
17	JL15	21:00	5:35	SM3Bat	20	52	25	0	N/A	Last Quarter (65%)

LEGEND:

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

Table 15: 2016/2017 Bat Acoustic Survey Results

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE									
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	UNID
2016												
06-JUN	1	BT1		X								
06-JUN	1	BP2				X						
06-JUN	1	BP3		X		X						
06-JUN	1	BP4				X						X
06-JUN	1	BP5		X		X						
2017												
JU-22-2017	1	WOOD1				X						
JU-22-2017	1	WOOD2		X	X	X						
JU-22-2017	1	WOOD3				X						
JU-22-2017	1	WOOD4		X	X	X						
JU-22-2017	1	WOOD5		X		X						
JU-22-2017	1	WOOD6				X						
JU-23-2017	2	WOOD1				X						

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
LABO	Eastern Red bat	*Lasiurus borealis*
PESU	Tri-coloured bat	*Perimyotis subflavus*
MYLU	Little Brown Myotis	*Myotis lucifugus*
MYSE	Northern Myotis	*Myotis septentrionalis*
MYLE	Eastern Small-footed Myotis	*Myotis leibii*
UNID	Unidentified Bat	

Table 15: 2016/2017 Bat Acoustic Survey Results

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE									
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	UNID
JU-23-2017	2	WOOD2		X		X						
JU-23-2017	2	WOOD3			X	X						
JU-23-2017	2	WOOD4			X	X						
JU-23-2017	2	WOOD5				X						
JU-23-2017	2	WOOD6				X						
JU-24-2017	3	WOOD1				X			X			
JU-24-2017	3	WOOD2		X		X						
JU-24-2017	3	WOOD3			X	X						
JU-24-2017	3	WOOD4		X		X						
JU-24-2017	3	WOOD5		X		X						
JU-24-2017	3	WOOD6				X						
JU-25-2017	4	WOOD1			X	X						
JU-25-2017	4	WOOD2		X	X	X						
JU-25-2017	4	WOOD3			X	X					X	
JU-25-2017	4	WOOD4		X		X						
JU-25-2017	4	WOOD5		X		X						
JU-25-2017	4	WOOD6		X		X						

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
LABO	Eastern Red bat	*Lasiurus borealis*
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UNID	Unidentified Bat	

Table 15: 2016/2017 Bat Acoustic Survey Results

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE									
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	UNID
JU-26-2017	5	WOOD1			X	X					X	
JU-26-2017	5	WOOD2				X						
JU-26-2017	5	WOOD3		X		X	X		X		X	
JU-26-2017	5	WOOD4		X		X						
JU-26-2017	5	WOOD5		X		X						
JU-26-2017	5	WOOD6		X		X						
JU-27-2017	6	WOOD1			X	X						
JU-27-2017	6	WOOD2		X		X						
JU-27-2017	6	WOOD3		X		X					X	
JU-27-2017	6	WOOD4				X	X					
JU-27-2017	6	WOOD5	X									
JU-27-2017	6	WOOD6				X						
JU-27-2017	1	WOOD8										X
JU-27-2017	1	WOOD11		X	X	X			X			
JU-27-2017	1	WOOD12		X		X						
JU-28-2017	2	WOOD8										X
JU-28-2017	2	WOOD11		X	X	X						
JU-28-2017	2	WOOD12		X		X						

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
LABO	Eastern Red bat	*Lasiurus borealis*
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MYLE	Eastern Small-footed Myotis	*Myotis leibii*
UNID	Unidentified Bat	

Table 15: 2016/2017 Bat Acoustic Survey Results

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE									
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	UNID
JU-29-2017	3	WOOD8				X						
JU-29-2017	3	WOOD11		X	X	X	X					
JU-29-2017	3	WOOD12		X		X						
JU-30-2017	4	WOOD8		X	X	X						
JU-30-2017	4	WOOD11		X	X	X						
JU-30-2017	4	WOOD12		X	X	X						
JL-01-2017	5	WOOD8				X						
JL-01-2017	5	WOOD11		X	X	X						
JL-01-2017	5	WOOD12		X	X	X						
JL-02-2017	6	WOOD8										X
JL-02-2017	6	WOOD11		X	X	X						
JL-02-2017	6	WOOD12		X	X	X						
JL-03-2017	7	WOOD8										X
JL-03-2017	7	WOOD11		X	X	X						
JL-03-2017	7	WOOD12		X		X						
JL-04-2017	8	WOOD8										X
JL-04-2017	8	WOOD11		X		X						
JL-04-2017	8	WOOD12		X		X						

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
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UNID	Unidentified Bat	

Table 15: 2016/2017 Bat Acoustic Survey Results

SURVEY DATES	SURVEY ROUND	TRANSECT/ POINT COUNT/SM3BAT	SPECIES CODE									
			NOBA	LACI	LANO	EPFU	LABO	PESU	MYLU	MYSE	MYLE	UNID
JL-10-2017	1	WOOD9		X	X	X						
JL-11-2017	2	WOOD9		X	X	X	X				X	
JL-12-2017	3	WOOD9		X	X	X						
JL-13-2017	4	WOOD9		X		X						
JL-14-2017	5	WOOD9		X		X						
JL-15-2017	6	WOOD9		X		X						

LEGEND:

SPECIES CODE	COMMON NAME	SCIENTIFIC NAME
NOBA	No Bats	No recorded despite survey effort
LACI	Hoary bat	*Lasiurus cinereus*
LANO	Silver-haired bat	*Lasionycteris noctivagans*
EPFU	Big Brown bat	*Eptesicus fuscus*
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MYSE	Northern Myotis	*Myotis septentrionalis*
MYLE	Eastern Small-footed Myotis	*Myotis leibii*
UNID	Unidentified Bat	

Table 16. Significant Wildlife Habitat Analysis for Bat Species in Ecoregion 6E.

STATION	BIG BROWN BAT PASSES	SILVER-HAIRED BAT PASSES	HABITAT ASSESSMENT POLYGON	SWH CRITERIA
WOOD1	179		NA	Unknown
WOOD2	371	15	Polygon 5	Minimum habitat criteria not met
WOOD3	261	5	Polygon 6	Minimum habitat criteria not met
WOOD4	1172	8	Polygon 9	Minimum habitat criteria not met
WOOD5	13	-	Polygon 10	Minimum species abundance not met
WOOD6	16	-	Polygon 3	Minimum species abundance not met
WOOD8	-	-	NA	Unknown
WOOD9	-	16	NA	Minimum species abundance not met
WOOD10	20	-	Polygon 12, 13	Minimum habitat criteria not met
WOOD11	2471	53	Polygon 1, 4	Confirmed
WODD12	60	5	NA	Minimum habitat criteria not met

Table 17: Significant Wildlife Habitat Assessment Based on Criteria for Eco-Region 6E (MNRF 2015)

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands	Predicted Impacts	Mitigation and Enhancement
SEASONAL CONCENTRATION AREAS OF ANIMALS							
Insects							
Migratory Butterfly Stopover Areas	Yes	No The Subject Lands are located outside of 5 km from Lake Ontario	No	N/A	Not present	N/A	N/A
Reptiles							
Turtle Wintering Areas	No	No No suitable ecosites present	No	No	Not present	N/A	N/A
Reptile Hibernaculum	Yes	Yes	Yes	Yes	Candidate SWH Two potential snake hibernacula (AS3 and AS4) found in mid-September. No congregations of snakes (at least two species, or > 5 individuals of one species) recorded. Additional surveys recommended at a future stage of the EA process	N/A	N/A
Birds							
Waterfowl Stopover and Staging Areas (terrestrial)	No	No	No	N/A	Not present	N/A	N/A
Waterfowl Stopover and Staging Areas (aquatic)	No	No	No	N/A	Not present	N/A	N/A
Shorebird Migratory Stopover Areas	No	No	No	N/A	Not present	N/A	N/A
Migratory Landbird Stopover Areas	Yes	No The woodlots are not within 5 km of Lake Ontario	No	N/A	Not present	N/A	N/A

Table 17: Significant Wildlife Habitat Assessment Based on Criteria for Eco-Region 6E (MNRF 2015)

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands	Predicted Impacts	Mitigation and Enhancement
Raptor Wintering Areas	Yes	Yes ELC ecosites present in minimum 20ha size	Targeted surveys recommended in winter 2017/2018	Yes Red-tailed Hawk (breeding season)	Candidate SWH Targeted surveys to be completed at a future stage of the EA process	Removal of woodland and/or cultural meadow/fallow agricultural fields	To be determined following completion of recommended winter surveys
Colonial Bird Nesting Sites (bank/cliff; tree/shrub; or ground)	No	No	No	N/A	Not present	N/A	N/A
Mammals							
Bat Hibernacula	No	No	No	N/A	Not present	N/A	N/A
Bat Maternity Colonies	Yes	Yes Large diameter (>25 cm DBH) trees in suitable densities to provide habitat were identified on-site	Yes	Yes Big Brown Bat and Silver-haired Bat	Confirmed SWH Bat maternity SWH polygons are mapped on **Figure 11** (**Appendix A**)	Removal of woodlands providing maternity roost habitat for bats	For every 5 suitable trees removed, place 1 replacement bat roosting box on poles in suitable location Open habitat associated with SWM Facilities and parks to contain native plant species that will support night-flying insect species to provide foraging opportunities for bats
Deer Yarding Areas	N/A – MNRF to determine	N/A – MNRF to determine	No	N/A	Not present – determined by MNRF	N/A	N/A
Deer Winter Congregation Areas	N/A – MNRF to determine	N/A – MNRF to determine	No	N/A	Not present – determined by MNRF	N/A	N/A
RARE VEGETATION COMMUNITIES							

Table 17: Significant Wildlife Habitat Assessment Based on Criteria for Eco-Region 6E (MNRF 2015)

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands	Predicted Impacts	Mitigation and Enhancement
Rare Vegetation Types (cliffs, talus slopes, sand barrens, alvars, old-growth forests, savannahs, and tallgrass prairies)	No	No Vegetation types were not identified on the Subject Lands	ELC conducted	N/A	Not present	N/A	N/A
Other Rare Vegetation Types	No	No No S1, S2 or S3 vegetation communities were identified within the Subject Lands	ELC conducted	N/A	Not present	N/A	N/A
SPECIALIZED WILDLIFE HABITAT							
Seeps and Springs							
Seeps and Springs	Yes	Yes Seepage areas present on each side of tributary (along the SWT3 community) and, at another location near the southern boundary of the Subject Lands (removed MAM2-2 and existing SWT2-2 community)	Yes (Hydrogeology report)	Yes Wild Turkey Spotted Salamander White-tailed Deer	Candidate SWH The presence of this SWH type to be confirmed through hydrogeological studies (Terraprobe). If this SWH type is confirmed, Terraprobe will delineate SWH polygons to include protection of relevant recharge areas	Lowered water table could change hydroperiod of seeps; change in habitat availability	Refer to groundwater mitigation
Amphibians							
Woodland Amphibian Breeding Habitats (within or < 120m from woodland)	Yes	Yes	Yes	Yes	Candidate SWH identified for amphibian station B located off-site just past the northern boundary of the Subject Lands This SWH type is not present on the Subject Lands. Minimum indicator species abundance/diversity threshold not met	N/A	N/A

Table 17: Significant Wildlife Habitat Assessment Based on Criteria for Eco-Region 6E (MNRF 2015)

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands	Predicted Impacts	Mitigation and Enhancement
Wetland Amphibian Breeding Habitats (wetland >120m from woodland)	No	No	No	N/A	Not present	N/A	N/A
Reptiles							
Turtle Nesting Areas	No	No	No	No	Not present	N/A	N/A
Birds							
Waterfowl Nesting Area	Yes	Yes	Yes	Yes Hooded Merganser Minimum diversity and/or abundance not met	Not present	N/A	N/A
Bald Eagle and Osprey Habitats	No	No	No	N/A	Not present	N/A	N/A
Woodland Raptor Nesting Habitat	Yes	No Greater than 30 ha woodland is present on-site however minimum interior habitat (>200m from edge) threshold of 10 ha is not met	No	N/A	Not present	N/A	N/A
Woodland Area-Sensitive Bird Breeding Habitat	Yes	Yes	Yes	Yes Four breeding indicator species observed in 2017 in the same woodland patch that contains interior woodland habitat > 200m from edge (Yellow-bellied sapsucker, Red-breasted	Confirmed SWH Woodland area-sensitive breeding bird SWH polygon is shown on **Figure 11** (**Appendix A**)	Removal of woodlands reducing forest interior patch size	N/A

Table 17: Significant Wildlife Habitat Assessment Based on Criteria for Eco-Region 6E (MNRF 2015)

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands	Predicted Impacts	Mitigation and Enhancement
				Nuthatch, Ovenbird, Scarlet Tanager)			
SPECIES OF CONSERVATION CONCERN							
Marsh Bird Breeding Habitat	Yes	Yes	Yes	No Minimum species diversity and/or abundance not met and were not within wetland feature	Not present	N/A	N/A
Open Country Bird Breeding Habitat	Yes	No Size criteria for cultural meadows in the Subject Lands and Adjacent Lands are not met	No	N/A	Not present	N/A	N/A
Shrub/Early Successional Bird Breeding Habitat	Yes	No Size criteria for cultural thickets in the Subject Lands are not met	No	N/A	Not present	N/A	N/A
Terrestrial Crayfish	Yes	Yes	Yes	No	Not present	N/A	N/A
Special Concern and Rare Wildlife Species	N/A	N/A	Yes Breeding bird and insect surveys completed in 2017	Yes Eastern Wood-Pewee, Wood Thrush, Monarch, Common Sootywing (S3)	Confirmed SWH: Eastern Wood-Pewee and Wood Thrush rare wildlife SWH polygons are consistent and mapped on **Figure 11** (**Appendix A**) Candidate SWH: Monarch rare wildlife SWH, recommend targeted surveys in 2018 to map Milkweed and determine whether all life stages of Monarch are present Not SWH: Common Sootywing is provincially rare in Ontario (S3). Only one individual was recorded despite three rounds of insect surveys in 2017. SWH not present	• Reduction of forest patch size due to woodland edge removal/refinement • Reduction of Monarch habitat	N/A

Table 17: Significant Wildlife Habitat Assessment Based on Criteria for Eco-Region 6E (MNRF 2015)

Significant Wildlife Habitat (SWH) Type	ELC Ecosite(s) Present	Habitat Criteria Met	Targeted Field Studies Required	Wildlife Species Present	SWH Type Present within the Subject Lands	Predicted Impacts	Mitigation and Enhancement
ANIMAL MOVEMENT CORRIDORS							
Amphibian Movement Corridors	N/A	No	No	N/A	Not present No amphibian breeding SWH present on the Subject Lands Candidate woodland amphibian breeding SWH at station B, which is located off-site immediately north of the Subject Lands, would not include delineation of amphibian movement corridor SWH on the Subject Lands. Suitable habitat for the life processes of woodland amphibians is available in the large woodland / wetland patch located north of the Subject Lands that contains station B	N/A	N/A
Deer Movement Corridors	N/A	No No deer wintering habitat identified by MNRF	No	N/A	Not present	N/A	N/A

Appendix C – Agency Correspondence

Ministry of
Natural Resources
and Forestry
Aurora District Office
50 Bloomington Road
Aurora, Ontario L4G 0L8

Ministère des
Richesses naturelles
et des Forets

Telephone: (905) 713-7400
Facsimile: (905) 713-7361

Ontario

Nov 12, 2015

Eva Lee
Savanta Inc.
647-530-3660
evalee@savanta.ca

Re: Request for Information for Kirby Road Extension Scoped Class EA

Dear Ms. Lee,

In your email dated Nov 10, 2015 you requested information on natural heritage features and element occurrences occurring on or adjacent to the above mentioned location. There are Species at Risk recorded for your study area.

Butternut	END
American Ginseng	END
Jefferson Salamander	END
Snapping Turtle	SC
Wood Thrush	SC
Eastern Wood-Pewee	SC

Additionally, the species listed below have the potential to occur in your study and may require further assessment or field studies to determine presence:

Eastern Small-footed Myotis	END
Little Brown Myotis	END
Northern Myotis	END
Eastern Meadowlark	THR
Bobolink	THR

Natural heritage features recorded in the vicinity of your area include:

- Provincially Significant King-Vaughan Wetland Complex
- Other Identified Wetlands
- Occupied Redside Dace Habitat (Don River East Branch), about 2km South of property area

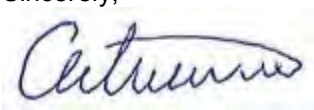
These species may receive protection under the *Endangered Species Act 2007* and thus, an approval from MNRF may be required if the work you are proposing could cause harm to these species or their habitats. If the Species at Risk in Ontario List is amended, additional species may be listed and protected under the *ESA 2007* or the status and protection levels of currently listed species may change.

Absence of information provided by MNRF for a given geographic area, or lack of current information for a given area or element, does not categorically mean the absence of sensitive species or features. Many areas in Ontario have never been surveyed and new plant and animal species records are still being discovered for many localities. For these reasons, the MNRF cannot provide a definitive statement on the presence, absence or condition of biological elements in any part of Ontario.

This species at risk information is highly sensitive and is not intended for any person or project unrelated to this undertaking. Please do not include any specific information in reports that will be available for public record. As you complete your fieldwork in these areas, please report all information related to any species at risk to our office. This will assist with updating our database and facilitate early consultation regarding your project.

If you have any questions or comments, please do not hesitate to contact ESA.aurora@ontario.ca.

Sincerely,



Catherine Wisniowski
Wildlife Technician
Ontario Ministry of Natural Resources and Forestry, Aurora District

Appendix D – External Reports

GEO Morphix Ltd.
348 Bronte Street South, Unit 2
Milton, Ontario L9T 5B6
T 416.920.0926
e balance@geomorphix.com

Rizmi Property
City of Vaughan, Ontario

Upper East Patterson Creek
Geomorphic Assessment

Prepared for: Rizmi Holdings Limited
11333 Dufferin Street
PO Box 663
Maple, Ontario L6A 1S5

Prepared by: GEO Morphix Ltd.

Project No.: 15080

Date: January 18, 2016

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Appendices

1 Introduction

A Municipal Class Environment Assessment is proposed by the City of Vaughan to determine the preferred alternative to extend Kirby Road to Gamble Road in the Town of Richmond, between Dufferin and Bathurst Streets. The ultimate alignment of this arterial road will be determined with consideration to numerous factors as required in the Class EA process. One consideration is East Patterson Creek, which is addressed in this report.

The east tributary of Patterson Creek originates in a wetland located near the north part of the Rizmi Stone & Aggregates property at 11333 Dufferin Street in the community of Maple. A significant portion of channel within the property limits has apparently been modified in the past. The alterations, however, do not affect fish habitat due to a significant barrier to fish passage along the southern property line. The watercourse currently conveys flows to the south property line where it terminates in a wetland. The following report provides a geomorphic assessment of East Patterson Creek to fulfill a Class EA requirement to document natural heritage features, as well as to support the decision-making process with respect to actions that affect the watercourse.

It is understood that the future of the channel within the property has yet to be determined as it is not considered to be direct fish habitat. Potential outcomes include removal, retain in its current alignment, realignment, enhancement, or a combination of these alternatives. GEO Morphix will provide appropriate support once the preferred solution has been determined in the Class EA study.

2 Historical Conditions

A series of historical aerial photographs were reviewed to determine changes to the channel and surrounding land use/cover. This information, in part, provides an understanding of the historical factors that have contributed to current channel morphodynamics. Historical aerial photographs from 1946 (scale 1:20,000) and 1954 (scale 1:63,360), and orthophotography from 1970, 1999, 2002, 2005, 2007, 2011, 2012 and 2013, and Google Earth Pro satellite imagery from 2015 were reviewed to complete the historical assessment.

In 1946, the upper East Patterson Creek drainage area was largely forested, with the exception of a clearing for agriculture at the upper extent of the drainage area. At the current location of the Rizmi Stone & Aggregates field operations, there was a clearing but no apparent activity. The drainage route within the subject property could not be identified due to tree cover, but there was an intermittently-forested corridor with a watercourse that extended in a southeasterly direction from the subject property towards Bathurst Street. The channel planform could not be determine on the aerial photography. Outside of the forested area to the north beyond the drainage area, the land was used exclusively for agriculture. The area beyond the property to the south was also used for agriculture.

There were no significant changes in land use through 1954. The surrounding land to the south, however, was transformed to a golf course, Maple Downs Golf Course. By 1970, Rizmi operations extended approximately 0.4 km to the east from the previously cleared area, as suggested by the heavily disturbed landscape and the access road connecting the disturbed area to Dufferin Street. Also between 1954 and 1970, the TransCanada Pipeline was constructed along the south property boundary and across the channel. The watercourse is visible along the east side of an internal road at the eastern end of the disturbed area, but the Pipeline clearly prevents flow conveyance

beyond the property as evidenced by the ponded water at the Pipeline crossing. The lack of tree cover along the section of channel along the internal road as well as its linear alignment also suggest that it was channelized to enhance drainage function. East of the Rizmi property along the north side of the Pipeline was a private runway.

Rizmi operations appeared to have slowed by 1999. The channel alignment was the same as it was in 1970, but the pond at the Pipeline had visual characteristics of a wetland. Another notable change within the property was a linear clearing through the forest leading to the general area of the channel origin, north of the cleared aggregate extraction area. There was also limited clearing on the east side of the internal road and channel, as well as a culvert in the channel next to this recently cleared area for access the east side. Southeast of the property, the land was developed for residential use.

Surrounding land use remained generally unchanged in 2011. Between 2007 and 2011, a portion of the channel within the Rizmi property was again realigned to travel along the margin of the cleared area. The previously installed culvert was removed due to the channel realignment, and a new culvert was constructed at the new channel crossing location. Activity within the property also appears to have increased during this period. There were no notable changes in 2012 and 2013.

Overall, the portion of East Patterson Creek within the Rizmi property experienced significant changes over the period covered by historical imagery. These changes include realignment and straightening (i.e., channelization), removal of tree cover, and the disruption of channel and flow continuity as a result of the TransCanada Pipeline.

3 Existing Conditions

3.1 Watershed Characteristics

Channel morphology and planform are largely governed by the flow regime and the availability and type of sediments (i.e., surficial geology) within the stream corridor. Physiography, riparian vegetation and land use also physically influence the channel. These factors are explored as they not only offer insight into existing conditions, but also potential changes that could be expected in the future as they relate to a proposed activity.

East Patterson Creek is situated in the Upper East Don Subwatershed. The channel within the property limits is a headwater feature that originates from a generally linear wetland feature located mostly within the property. In total, the channel travels in a southerly direction for approximately 6 km, where it joins West Patterson Creek, then continues for another 1.5 km to the confluence with the East Don River.

The subject site is located in a southward extending lobe of the Oak Ridges Moraine physiographic region, which is bounded by the South Slope physiographic region to the west, south and east. Beyond the South Slope is the Peel Plain (Chapman and Putnam, 1984), where Patterson Creek joins the East Don River. With respect to surficial geology, the subject area is characterized by ice-contact stratified deposits consisting of sand and gravel, minor silt, clay and till (OGS, 2010). The surficial geology generally changes in the downstream direction in concert with the physiographic regions: the South Slope is comprised of clay to silt-textured till (derived from glaciolacustrine deposits or shale) and the Peel Plain is generally characterized by glaciolacustrine deposits (OGS, 2010). The predominantly sand and gravel composition of the surficial material

allows the channel to readily adjust, although the degree of adjustment would also be influenced by the flow regime as well as other factors such as vegetation control.

The catchment area for the channel within the subject property is largely forested with the exception of the area cleared for the Rizmi Stone & Aggregates operations. Downstream of the property to Bathurst Street, the channel travels through a forested corridor surrounded by low-density residential dwellings. The forested channel corridor continues beyond Bathurst Street, although housing density increases.

3.2 Reach Delineation

Rivers and streams are frequently segmented into reaches to provide meaningful lengths of channel for study. Reaches are delineated based on changes such as hydrology, channel gradient, confinement, planform (i.e., channel pattern), geology, surrounding land use and anthropogenic disturbances (e.g., crossing structures, dams, straightening/channelization, armouring). Each reach can then be studied as a unit that is expected to function in generally uniform manner throughout its length.

Within the Rizmi property, East Patterson Creek was divided into three reaches. The downstream channel reach (EPC-1) is approximately 100 m in length, the middle reach (EPC-2) is 130 m, and the upstream reach (EPC-3) is 200 m. Forest cover was one consideration when delineating the reaches: the Reach EPC-1 channel lies just within the west forest margin, while Reaches EPC-2 and EPC-3 are just outside the west forest margin. Despite the apparently limited differences between reaches, tree cover is a significant factor that governs channel form and function, and hence the two reaches. Reaches EPC-2 and EPC-3 are differentiated primarily by channel morphology. Wetland features are located downstream of Reach EPC-1 and upstream of Reach EPC-2. The reach delineation was verified in the field, as discussed below.

3.3 Reach Assessments

Site observations and channel measurements were collected on November 2, 2015. The field investigation was completed for the full length of channel between the wetland at the upstream extent of the channel and the south property limit. A photographic record of site conditions is provided in Appendix A. On the day of the site visit, the temperature was 10°C and there was no precipitation. There was, however, 7 mm of rain from October 31 to November 1.

3.3.1 General Observations

Within the Rizmi property, East Patterson Creek originates in a wetland feature located in a forested area to the north just beyond an open, disturbed area created by site activities. The channel travels along the perimeter of the clearing before entering the forested area. It continues just within the forest boundary to a wetland feature at the south limit of the property. The reaches identified in Section 3.2 were confirmed to be correct. The following is a description of each reach from upstream to downstream.

The wetland at the upstream end of the section of channel under study is comprised of a dense thicket of shrubs (red-osier dogwood). There was no define flow pattern within the wetland.

Reach EPC-3 is in a constructed valley feature containing a low-flow channel. The valley had a 'V' shape except towards the downstream end of the reach. The channel had no bankfull indicators

and there was limited evidence of a stable channel morphology. The bed was composed of mostly silt and sand, and its morphology was partly controlled by vegetation. Three knickpoints were observed, which suggests that the channel gradient is high relative to those of the two downstream reaches. Groundwater input, evidenced by the watercress towards the upstream end of the reach, as well as water from the wetland contributed to total flow. Wetted flow width varied due to the high degree of channel confinement, ranging from 0.1 to 1.5 m. The channel characteristics were largely governed by the composition of the valley materials, which was sand. The northeast embankment (left embankment viewed in the downstream direction) was comprised of exposed sand with limited woody vegetation. Due to the unstable nature of the embankments, in particular that to the northeast, the channel will likely continue to adjust according to the sediment supply. Mature trees lied beyond the sandy embankment. The southwest side of the channel was open with primarily grasses.

Reaches EPC-3 and EPC-2 were divided by a partly embedded 1200 mm CSP culvert, constructed for access across the channel. Reach EPC-2 continues as a constructed valley feature, but with appreciably different physical characteristics. Here, the valley top width was roughly 3.9 m wide and the valley depth was 1.5 to 2.0 m. The east side of the valley was populated by mature trees, while the east side was dominated by grasses within an open (i.e., cleared) area.

The Reach EPC-2 channel likely formed naturally following valley excavation. The low-flow channel is considered to be the bankfull channel, although it still may be adjusting to the annual range of flows given that the valley was constructed between 2007 and 2011. The bankfull channel was on average 1.15 m wide and 0.42 m deep. There was a 0.22 m high knickpoint mid-reach that cut into till. Upstream of the knickpoint, the bed was characterized by sand, gravel and small cobbles, while downstream of the knickpoint, the bed was comprised of mostly sand, but also exposed till. This longitudinal change in bed characteristics can be explained by differences in bed gradient.

At the downstream end of Reach EPC-2, the channel turns at nearly a right angle to travel south into Reach EPC-1. There was evidence of the former channel location (before the realignment of Reaches EPC-3 and EPC-2), in the form of a linear depression across the cleared area, that aligned with Reach EPC-1. Although the former channel was decommissioned, surface runoff apparently continued to enter the Reach EPC-1 channel at the upstream end of this reach as indicated by the minor erosion and headcutting.

Reach EPC-1 travels in a southerly direction and continues as a constructed valley feature approximately 5 m wide and just over 1 m deep. Both sides of the valley was vegetated with mature trees; however, the woody riparian buffer on the west side was limited. Tree cover over the channel was dense, and there were frequent observations of woody debris within the constructed valley, mostly as broken individual tree limbs that did not significantly affect flow pattern. The low-flow channel had no riffle-pool development, and averaged 1.90 m wide and 0.15 m deep. The increase in width-to-depth ratio, relative to that of Reach EPC-2, can be explained by the decrease in channel gradient and the increase in discharge. Both the bed and banks were comprised of sand, which would be expected due to the lower gradient and the typical downstream fining found in natural watercourses.

At the downstream end of the Reach EPC-1 channel was a wetland feature. This wetland was contained in a basin (roughly 70 wide and 50 m wide) that was bounded in the downstream (south) end by a raised natural gas pipeline corridor (i.e., TransCanada Pipeline), which was essentially a large berm. The top of the Pipeline was approximately 1.5 to 2.0 m above the wetland bed, and therefore a considerable volume of water would be required for flows to spill

over the Pipeline corridor. There was no evidence of a flow path over the Pipeline, although it would clearly be located across the lowest point. The impact of the lack of surface flow continuity to the watercourse downstream (south) of the Pipeline corridor could not be assessed due to property constraints.

3.3.2 Rapid Field Assessments

Rapid field assessments were completed as reconnaissance-level evaluations to determine the condition of each reach with respect to channel stability and general stream health:

- Channel instability was semi-quantified through the application of the Ontario Ministry of the Environment's (2003) Rapid Geomorphic Assessment (RGA). Observations were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether the channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40) or adjusting (score >0.41).
- The Rapid Stream Assessment Technique (RSAT) was also employed to provide a broader view of the system and consider the ecological functioning of the watercourse (Galli, 1996). Observations were made of channel stability, channel scouring or sediment deposition, instream and riparian habitats, and water quality. The RSAT score ranks the channel as maintaining a poor (<13), fair (13-24), good (25-34) or excellent (35-42) degree of stream health.

A summary of the rapid assessments is provided in Table 1. Completed field sheets are found in Appendix B.

Table 1: Rapid field assessment summary

Reach	RGA*			RSAT**		
	Score	Condition	Dominant Form of Adjustment	Score	Condition	Limiting Feature(s)
EPC-1	0.11	In regime	Aggradation	26	Good	Physical instream habitat
EPC-2	0.12	In regime	Degradation	28	Good	Riparian habitat conditions
EPC-3	0.09	In regime	Degradation	22	Fair	Riparian habitat conditions

* Ontario Ministry of the Environment (2003)
** Galli (1996)

3.3.3 Detailed Geomorphic Assessment

Within the property limits, Reach EPC-1 was determined to be relatively natural and certainly the most aged since realignment. As such, this reach was selected for further investigation – i.e., detailed geomorphic assessment. This detailed assessment serves as the basis for any required channel modifications such as realignment or stabilization.

The detailed assessment involved temporarily setting up eight representative cross sections for the purpose of determining average bankfull channel dimensions (e.g., width, average bankfull depth, maximum depth, and bank angles). The bankfull level was determined using standard protocols and accepted field indicators. A survey of the bed profile was also completed to determine slope and compute bankfull hydraulics. A modified Wolman (1954) pebble count was completed to characterize the bed materials. A summary of measured and computed values is presented in Table 2.

Table 2: Bankfull parameters of the reference channel

Channel parameter	Results
Measured	
Average bankfull channel width (m)	1.89
Average bankfull channel depth (m)	0.15
Average width-to-depth ratio	14.7
Channel gradient (%)	0.42
D_{50} (mm)	<2
D_{84} (mm)	<2
Manning's n roughness coefficient	0.034
Computed	
Bankfull channel discharge (m^3/s) *	0.14
Average bankfull velocity (m/s)	0.53
Unit stream power at bankfull discharge (W/m^2)	3.2
Tractive force at bankfull (N/m^2)	5.98
Critical shear stress (N/m^2) **	1.46
Flow competency for D_{50} (m/s) ***	0.27
Flow competency for D_{84} (m/s) ***	0.27

* Based on Manning's equation
** Based on Shields diagram from Miller et al. (1997)
*** Based on Komar (1987)

The Reach EPC-1 reference channel has a lower width-to-depth ratio than the two upstream reaches due to the lower channel gradient. Despite the relatively low unit stream power, the bed (comprised of sand) is fully mobile under bankfull flow conditions. It is expected that the Reach EPC-1 channel length would decrease slowly over time as the bed material is transported and deposited in the wetland. The receiving wetland would consequently increase in size, but only in the upstream direction due to the raised pipeline crossing.

4 Conclusions

East Patterson Creek within the Rizmi property has been significantly altered, and impacted both directly and indirectly, over the period covered by historical imagery. It also no longer functions

as potential fish habitat as a result of the construction of the TransCanada Pipeline. In-channel flows now therefore infiltrate and contribute to groundwater.

If the preferred alternative solution, resulting from the Class EA study, is assessed to be restoration, realignment or enhancement, we would be pleased to provide design services. Concurrently or independently, we can also investigate potential hazards associated with a dynamic channel.

5 References

Chapman, L.S. and Putnam, D.F. 1984. The Physiography of Southern Ontario. Ontario Geological Survey, Special Volume 2. Ontario Ministry of Natural Resources, Toronto.

Galli, J. 1996. Rapid Stream Assessment Technique, Field Methods. Metropolitan Washington Council of Governments.

Komar, P.D. 1987. Selective gravel entrainment and the empirical evaluation of flow competence. Sedimentology, 34: 1165-1176.

Miller, M.C., McCave, I.N., and Komar, P.D. 1977. Threshold of sediment motion under unidirectional currents. Sedimentology, 24: 507-528.

Ministry of the Environment (MOE). 2003. Ontario Ministry of the Environment. Stormwater Management Guidelines.

Ontario Geological Survey [OGS]. 2010. Surficial geology of Southern Ontario. Ontario Geological Survey, Miscellaneous Release--Data 128-REV.

Appendix A
Photographic Record of Site Conditions

Photo 1	
	EPC-3: Near upstream extent of reach, viewed upstream. The channel was confined by sandy valley wall to the east and a vegetated valley wall to the west.
Photo 2	
	EPC-3: Mid-reach viewed upstream at a knickpoint.

Photo 3	
	EPC-3: Reach viewed upstream from downstream end of reach.
Photo 4	
	1200 mm CSP culvert between Reaches EPC-2 and 3.

Photo 5	
	ECP-2: Channel viewed in the downstream direction. Coarse substrate was found mostly in the upstream portion of the reach. Note the channel confinement.
Photo 6	
	EPC-2: Mid-reach knickpoint in exposed till.

Photo 7	
	EPC-2: Channel viewed in the downstream direction towards end of reach.
Photo 8	
	EPC-1: Mid-reach channel viewed in the downstream direction. Note the limited channel definition and lack of morphological variability, and confinement between valley walls.

Photo 9	
	ECP-1: Channel viewed downstream towards downstream end of reach. Note the absence of flow and limited channel definition.
Photo 10	
	EPC-1: Wetland at property line with raised pipeline in background (see fence line). No culvert was found.

Appendix B
Rapid Assessment Field Sheets

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: PN15080

Date:	Nov 2, 2015	**Stream/Reach:**	EPC-1
Weather:	sun + 10°C	**Location:**	Kirby Rd + Dufferin St.
Field staff:	CH/ER	**Watershed/Subwatershed:**	East Patterson Crk
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 1 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 11 | **Channel Zone** (Table 4): 1 | **Flow Type** (Table 5): 2 | ☒ Groundwater | Evidence: watercress

Riparian Vegetation

Dominant Type: (Table 6): 1
Species: _____

Coverage:
- ☐ None
- ☐ Fragmented
- ☒ Continuous

Channel widths
- ☐ 1-4
- ☒ 4-10
- ☐ > 10

Age Class (yrs) :
- ☐ Immature (<5)
- ☒ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 2

Aquatic/Instream Vegetation

Type (Table8): /
Coverage of Reach (%): /

Woody Debris
- ☐ Present in Cutbank
- ☒ Present in Channel
- ☐ Not Present

Density of WD:
- ☒ Low
- ☐ Moderate
- ☐ High

WDJ/50m: 1

Water Quality

Odour (Table 16): 1
Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): 1
Sinuosity (Degree) (Table 10): 1
Gradient (Table 11): 1
Number of Channels (Table 12): 1
Entrenchment (Table 13): 2
Type of Bank Failure (Table 14): /
Downs's Classification (Table 15): S

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☒	☐	☐	☐	☐	☐
~~Pool Substrate~~	☐	☐	☐	☐	☐	☐	☐
Bank Material	☐	☒	☐	☐	☐	☐	☐

see detailed assessment

Bankfull Width (m)				**Wetted Width (m)**	
Bankfull Depth (m)				**Wetted Depth (m)**	

Riffle/Pool Spacing (m): NA | **% Riffles:** NA | **% Pools:** NA | **Meander Amplitude:** NA

Pool Depth (m): NA | **Riffle Length (m):** NA | **Undercuts (m):** None

Velocity (m/s): ∅ | / | / | **Wiffle ball / ADV / Estimated**

Bank Angle
- ☒ 0 – 30
- ☐ 30 – 60
- ☐ 60 – 90
- ☐ Undercut

Bank Erosion
- ☒ < 5%
- ☐ 5 – 30%
- ☐ 30 – 60%
- ☐ 60 – 100%

Comments: No riffle-pools, poor BF indicators

Notes:

Completed by: CH Checked by: _____

GEO | MORPHIX

Rapid Geomorphic Assessment

Project Code/Phase: PN15080

Date:	Nov 2, 2015	Stream/Reach:	EPC-1
Weather:	Sun ~ 10°C	Location:	Kirby Rd
Field Staff:	CH / ER	Watershed/Subwatershed:	E. Patterson Crk

Process	No.	Geomorphic Indicator: Description	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	1/4
	2	Coarse materials in riffles embedded	NA		
	3	Siltation in pools	NA		
	4	Medial bars		✓	
	5	Accretion on point bars	NA		
	6	Poor longitudinal sorting of bed materials	✓		
	7	Deposition in the overbank zone		✓	
		Sum of indices =	1	3	0.25
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	NA		0/3
	2	Exposed sanitary / storm sewer / pipeline / etc.	NA		
	3	Elevated storm sewer outfall(s)	NA		
	4	Undermined gabion baskets / concrete aprons / etc.	NA		
	5	Scour pools downstream of culverts / storm sewer outlets	NA		
	6	Cut face on bar forms	NA		
	7	Head cutting due to knick point migration		✓	
	8	Terrace cut through older bar material	NA		
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =	0	3	0
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.		✓	1/5
	2	Occurrence of large organic debris	✓		
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends	NA		
	5	Basal scour on both sides of channel through riffle	NA		
	6	Outflanked gabion baskets / concrete walls / etc.	NA		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.	NA		
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	NA		
		Sum of indices =	1	4	0.2
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	0/6
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed	NA		
		Sum of indices =	0	6	0

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.11

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☑ 0.00 - 0.20	☐ 0.21 - 0.40	☐ 0.41

Completed by: CH Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN15080

Date:	Nov 2, 2015	Stream/Reach:	EPC-1
Weather:	Sun + 10°C	Location:	Kirby Rd
Field Staff:	CH / ER	Watershed/Subwatershed:	E. Patterson Crk

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11

NA

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

NA

NA

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☑ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☑ 7 ☐ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☐ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) =				
Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			26	

Completed by: CH Checked by: _____

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: PN15080

Date:	Nov 2, 2015	**Stream/Reach:**	EPC-2
Weather:	sun + 10°C	**Location:**	Kirby Rd + Dufferin St
Field staff:	CH/ER	**Watershed/Subwatershed:**	East Patterson Crk
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 4 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 6 | **Channel Zone** (Table 4): 1 | **Flow Type** (Table 5): 2 | ☒ Groundwater | Evidence: iron staining

Riparian Vegetation

Dominant Type: (Table 6): 3
Species: _____

Coverage:
- ☐ None
- ☐ Fragmented
- ☒ Continuous

Channel widths
- ☐ 1-4
- ☒ 4-10
- ☐ > 10

Age Class (yrs):
- ☒ Immature (<5)
- ☐ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 2

Aquatic/Instream Vegetation

Type (Table8): 1 | Coverage of Reach (%): <5

Woody Debris
- ☐ Present in Cutbank
- ☐ Present in Channel
- ☒ Not Present

Density of WD:
- ☐ Low
- ☐ Moderate
- ☐ High

WDJ/50m:

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): 1
Sinuosity (Degree) (Table 10): 1
Gradient (Table 11): 2
Number of Channels (Table 12): 1
Entrenchment (Table 13): 2
Type of Bank Failure (Table 14): 1
Downs's Classification (Table 15): E

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
Riffle Substrate	☐	☑	☑	☑ small	☐	☑ till	☐
~~**Pool Substrate**~~	☐	☐	☐	☐	☐	☐	☐
Bank Material	☑ silt	☑	☐	☐	☐	☐	☐

Bankfull Width (m)	1.3	1.0		**Wetted Width (m)**	0.3	0.25	
Bankfull Depth (m)	0.4	0.45		**Wetted Depth (m)**	0.1	0.15	

Riffle/Pool Spacing (m): NA | **% Riffles:** NA | **% Pools:** NA | **Meander Amplitude:** N/A

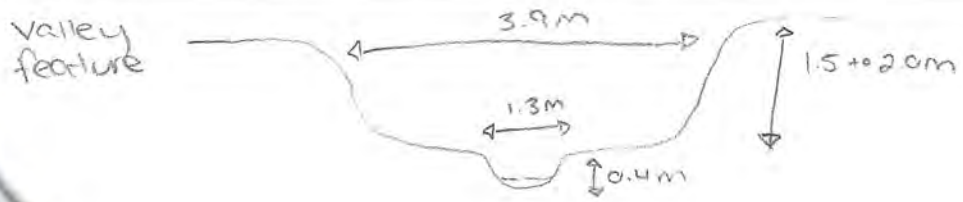
Pool Depth (m): NA | **Riffle Length (m):** NA | **Undercuts (m):** / | **Comments:** KP + exposed till

Velocity (m/s): / | / | / | **Wiffle ball / ADV / Estimated** | coarse bed material u/s of KP

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☒ 60 – 90
- ☐ Undercut

Bank Erosion
- ☐ < 5%
- ☐ 5 – 30%
- ☒ 30 – 60%
- ☐ 60 – 100%

Notes:
CSP @ crossing = 1.2m



Completed by: CH | Checked by: _____

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Rapid Geomorphic Assessment

Project Code/Phase: pn15080

Date:	Nov 2, 2015	Stream/Reach:	EPC-2
Weather:	Sun + 10°C	Location:	Kirby Rd
Field Staff:	CH/ER	Watershed/Subwatershed:	East Patterson

Process	No.	Geomorphic Indicator: Description	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	0/5
	2	Coarse materials in riffles embedded	N/A		
	3	Siltation in pools	N/A		
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone		✓	
		Sum of indices =	0	5	0.0
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	N/A		2/6
	2	Exposed sanitary / storm sewer / pipeline / etc.	N/A		
	3	Elevated storm sewer outfall(s)	N/A		
	4	Undermined gabion baskets / concrete aprons / etc.	N/A		
	5	Scour pools downstream of culverts / storm sewer outlets		✓	
	6	Cut face on bar forms		✓	
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock	✓		
		Sum of indices =	2	4	0.33
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.		✓	0/5
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends	N/A		
	5	Basal scour on both sides of channel through riffle	N/A		
	6	Outflanked gabion baskets / concrete walls / etc.	N/A		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.	N/A		
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	N/A		
		Sum of indices =	0	5	0
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	1/6
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form	N/A		
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed	✓		
		Sum of indices =	1	5	0.17

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.13

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☑ 0.00 - 0.20	☐ 0.21 - 0.40	☐ 0.41

Completed by: ET/ES Checked by: _____

Rapid Stream Assessment Technique **Project Number:** PN15080

Date:	Nov 2, 2015	Stream/Reach:	tPC-2
Weather:	Sun + 10°C	Location:	Kirby Rd
Field Staff:	CH/ER	Watershed/Subwatershed:	East Patterson

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☑ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)	N/A
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt	
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent	
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank	
	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand	
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☑ 7 ☐ 8	

EPC-2
PN15080

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Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant. velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
N/A	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☑ 3 ☐ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

NA
NA
NA

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface N/A
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☑ 6	☐ 7 ☐ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☑ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 27

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
			✓	

Completed by: ET/ER Checked by: _____

GEO MORPHIX
Geomorphology Earth Science Observations

Reach Characteristics

Project Code/Phase: PN15080

Date:	Nov 2, 2015	**Stream/Reach:**	EPC-3
Weather:	sun + 10°C	**Location:**	Kirby Rd
Field staff:	CH / ER	**Watershed/Subwatershed:**	East Patterson Crk
UTM (Upstream)		**UTM (Downstream)**	

Land Use (Table 1): 4 | **Valley Type** (Table 2): 2 | **Channel Type** (Table 3): 6 | **Channel Zone** (Table 4): 1 | **Flow Type** (Table 5): 2 | ☒ Groundwater | Evidence: watercress

Riparian Vegetation

Dominant Type: (Table 6) | Species: _____

Coverage:
- ☐ None
- ☐ Fragmented
- ☒ Continuous

Channel widths:
- ☐ 1-4
- ☒ 4-10
- ☐ > 10

Age Class (yrs) :
- ☐ Immature (<5)
- ☒ Established (5-30)
- ☐ Mature (>30)

Encroachment: (Table 7): 3

Aquatic/Instream Vegetation

Type (Table8): 2 | Coverage of Reach (%): 40

Woody Debris
- ☐ Present in Cutbank
- ☐ Present in Channel
- ☒ Not Present

Density of WD:
- ☐ Low
- ☐ Moderate
- ☐ High

WDJ/50m: NA

Water Quality

Odour (Table 16): 1

Turbidity (Table 17): 1

Channel Characteristics

Sinuosity (Type) (Table 9): 1 | **Sinuosity (Degree)** (Table 10): 1 | **Gradient** (Table 11): 2 | **Number of Channels** (Table 12): 1

Entrenchment (Table 13): 2 | **Type of Bank Failure** (Table 14): 1 | **Downs's Classification** (Table 15): e

	Clay/Silt	Sand	Gravel	Cobble	Boulder	Parent	Rootlets
~~Riffle~~ Substrate	☐	☒	☒ some	☐	☐	☐	☐
~~Pool Substrate~~	☐	☐	☐	☐	☐	☐	☐
Bank Material	☐	☒	☐	☐	☐	☐	☒

Bankfull Width (m)	1.4			**Wetted Width (m)**	0.8		
Bankfull Depth (m)	0.35			**Wetted Depth (m)**	0.1		

Riffle/Pool Spacing (m): NA | **% Riffles:** NA | **% Pools:** NA | **Meander Amplitude:** NA

Pool Depth (m) D/S of KP: 0.3 | **Riffle Length (m):** NA | **Undercuts (m):** / | **Velocity (m/s):** / / /

Wiffle ball / ADV / Estimated

Comments: 3 knickpoints, no riffle-pool development

Bank Angle
- ☐ 0 – 30
- ☐ 30 – 60
- ☒ 60 – 90
- ☐ Undercut

Bank Erosion
- ☐ < 5%
- ☐ 5 – 30%
- ☐ 30 – 60%
- ☒ 60 – 100%

Notes: sandy VWC along UB; saplings in channel @ D/S extent; wetland u/s of VWC

Completed by: CH | Checked by: _____

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Rapid Geomorphic Assessment

Project Code/Phase: PN15080

Date:	Nov 2, 2015	Stream/Reach:	EPC-3
Weather:	Sun + 10°C	Location:	Kirby Rd
Field Staff:	CH/ER	Watershed/Subwatershed:	East Patterson

Process	No.	Geomorphic Indicator	Present? Yes	Present? No	Factor Value
Evidence of Aggradation (AI)	1	Lobate bar		✓	0/7
	2	Coarse materials in riffles embedded		✓	
	3	Siltation in pools		✓	
	4	Medial bars		✓	
	5	Accretion on point bars		✓	
	6	Poor longitudinal sorting of bed materials		✓	
	7	Deposition in the overbank zone		✓	
		Sum of indices =	0	7	0.0
Evidence of Degradation (DI)	1	Exposed bridge footing(s)	N/A		1/5
	2	Exposed sanitary / storm sewer / pipeline / etc.	N/A		
	3	Elevated storm sewer outfall(s)	N/A		
	4	Undermined gabion baskets / concrete aprons / etc.	N/A		
	5	Scour pools downstream of culverts / storm sewer outlets	N/A		
	6	Cut face on bar forms		✓	
	7	Head cutting due to knick point migration	✓		
	8	Terrace cut through older bar material		✓	
	9	Suspended armour layer visible in bank		✓	
	10	Channel worn into undisturbed overburden / bedrock		✓	
		Sum of indices =	1	4	0.20
Evidence of Widening (WI)	1	Fallen / leaning trees / fence posts / etc.		✓	0/5
	2	Occurrence of large organic debris		✓	
	3	Exposed tree roots		✓	
	4	Basal scour on inside meander bends	N/A		
	5	Basal scour on both sides of channel through riffle	N/A		
	6	Outflanked gabion baskets / concrete walls / etc.	N/A		
	7	Length of basal scour >50% through subject reach		✓	
	8	Exposed length of previously buried pipe / cable / etc.	N/A		
	9	Fracture lines along top of bank		✓	
	10	Exposed building foundation	N/A		
		Sum of indices =	0	5	0.0
Evidence of Planimetric Form Adjustment (PI)	1	Formation of chute(s)		✓	1/7
	2	Single thread channel to multiple channel		✓	
	3	Evolution of pool-riffle form to low bed relief form		✓	
	4	Cut-off channel(s)		✓	
	5	Formation of island(s)		✓	
	6	Thalweg alignment out of phase meander form		✓	
	7	Bar forms poorly formed / reworked / removed	✓		
		Sum of indices =	1	6	0.14

Additional notes:

Stability Index (SI) = (AI+DI+WI+PI)/4 = 0.09

Condition	In Regime	In Transition/Stress	In Adjustment
SI score =	☑ 0.00 - 0.20	☐ 0.21 - 0.40	☐ 0.41

Completed by: KT/ER Checked by: _____

Rapid Stream Assessment Technique **Project Number:** pn15080

Date:	Nov 2, 2015	Stream/Reach:	EPC-3
Weather:	Sun + 10°C	Location:	Kirby Rd
Field Staff:	C+IER	Watershed/Subwatershed:	East Patterson

Evaluation Category	Poor	Fair	Good	Excellent
Channel Stability	• < 50% of bank network stable • Recent bank sloughing, slumping or failure frequently observed	• 50-70% of bank network stable • Recent signs of bank sloughing, slumping or failure fairly common	• 71-80% of bank network stable • Infrequent signs of bank sloughing, slumping or failure	• > 80% of bank network stable • No evidence of bank sloughing, slumping or failure
N/A	• Stream bend areas highly unstable • Outer bank height 1.2 m above stream bank (2.1 m above stream bank for large mainstem areas) • Bank overhang > 0.8-1.0 m	• Stream bend areas unstable • Outer bank height 0.9-1.2 m above stream bank (1.5-2.1 m above stream bank for large mainstem areas) • Bank overhang 0.8-0.9 m	• Stream bend areas stable • Outer bank height 0.6-0.9 m above stream bank (1.2-1.5 m above stream bank for large mainstem areas) • Bank overhang 0.6-0.8 m	• Stream bend areas very stable • Height < 0.6 m above stream (< 1.2 m above stream bank for large mainstem areas) • Bank overhang < 0.6 m
	• Young exposed tree roots abundant • > 6 recent large tree falls per stream mile	• Young exposed tree roots common • 4-5 recent large tree falls per stream mile	• Exposed tree roots predominantly old and large, smaller young roots scarce • 2-3 recent large tree falls per stream mile	• Exposed tree roots old, large and woody • Generally 0-1 recent large tree falls per stream mile
	• Bottom 1/3 of bank is highly erodible material • Plant/soil matrix severely compromised	• Bottom 1/3 of bank is generally highly erodible material • Plant/soil matrix compromised	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material	• Bottom 1/3 of bank is generally highly resistant plant/soil matrix or material
	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally trapezoidally-shaped	• Channel cross-section is generally V- or U-shaped	• Channel cross-section is generally V- or U-shaped
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4 ☐ 5	☐ 6 ☐ 7 ☐ 8	☐ 9 ☐ 10 ☐ 11

Channel Scouring/ Sediment Deposition	• > 75% embedded (> 85% embedded for large mainstem areas)	• 50-75% embedded (60-85% embedded for large mainstem areas)	• 25-49% embedded (35-59% embedded for large mainstem areas)	• Riffle embeddedness < 25% sand-silt (< 35% embedded for large mainstem areas)
	• Few, if any, deep pools • Pool substrate composition: > 81% sand-silt	• Low to moderate number of deep pools • Pool substrate composition: 60-80% sand-silt	• Moderate number of deep pools • Pool substrate composition: 30-59% sand-silt	• High number of deep pools (> 61 cm deep) (> 122 cm deep for large mainstem areas) • Pool substrate composition: < 30% sand-silt
	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits common	• Streambed streak marks and/or "banana"-shaped sediment deposits uncommon	• Streambed streak marks and/or "banana"-shaped sediment deposits absent
	• Fresh, large sand deposits very common in channel • Moderate to heavy sand deposition along major portion of overbank area	• Fresh, large sand deposits common in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits uncommon in channel • Small localized areas of fresh sand deposits along top of low banks	• Fresh, large sand deposits rare or absent from channel • No evidence of fresh sediment deposition on overbank
N/A	• Point bars present at most stream bends, moderate to large and unstable with high amount of fresh sand	• Point bars common, moderate to large and unstable with high amount of fresh sand	• Point bars small and stable, well-vegetated and/or armoured with little or no fresh sand	• Point bars few, small and stable, well-vegetated and/or armoured with little or no fresh sand
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☑ 6	☐ 7 ☐ 8

EPC-3
PN 1508C

GEO | MORPHIX

Evaluation Category	Poor	Fair	Good	Excellent
Physical Instream Habitat	• Wetted perimeter < 40% of bottom channel width (< 45% for large mainstem areas)	• Wetted perimeter 40-60% of bottom channel width (45-65% for large mainstem areas)	• Wetted perimeter 61-85% of bottom channel width (66-90% for large mainstem areas)	• Wetted perimeter > 85% of bottom channel width (> 90% for large mainstem areas)
	• Dominated by one habitat type (usually runs) and by one velocity and depth condition (slow and shallow) (for large mainstem areas, few riffles present, runs and pools dominant, velocity and depth diversity low)	• Few pools present, riffles and runs dominant, velocity and depth generally slow and shallow (for large mainstem areas, runs and pools dominant, velocity and depth diversity intermediate)	• Good mix between riffles, runs and pools • Relatively diverse velocity and depth of flow	• Riffles, runs and pool habitat present • Diverse velocity and depth of flow present (i.e., slow, fast, shallow and deep water)
	• Riffle substrate composition: predominantly gravel with high percentage of sand • < 5% cobble	• Riffle substrate composition: predominantly small cobble, gravel and sand • 5-24% cobble	• Riffle substrate composition: good mix of gravel, cobble, and rubble material • 25-49% cobble	• Riffle substrate composition: cobble, gravel, rubble, boulder mix with little sand • > 50% cobble
	• Riffle depth < 10 cm for large mainstem areas	• Riffle depth 10-15 cm for large mainstem areas	• Riffle depth 15-20 cm for large mainstem areas	• Riffle depth > 20 cm for large mainstem areas
	• Large pools generally < 30 cm deep (< 61 cm for large mainstem areas) and devoid of overhead cover/structure	• Large pools generally 30-46 cm deep (61-91 cm for large mainstem areas) with little or no overhead cover/structure	• Large pools generally 46-61 cm deep (91-122 cm for large mainstem areas) with some overhead cover/structure	• Large pools generally > 61 cm deep (> 122 cm for large mainstem areas) with good overhead cover/structure
	• Extensive channel alteration and/or point bar formation/enlargement	• Moderate amount of channel alteration and/or moderate increase in point bar formation/enlargement	• Slight amount of channel alteration and/or slight increase in point bar formation/enlargement	• No channel alteration or significant point bar formation/enlargement
	• Riffle/Pool ratio 0.49:1 ≤ ; ≥ 1.51:1	• Riffle/Pool ratio 0.5-0.69:1; 1.31-1.5:1	• Riffle/Pool ratio 0.7-0.89:1; 1.11-1.3:1	• Riffle/Pool ratio 0.9-1.1:1
N/A	• Summer afternoon water temperature > 27°C	• Summer afternoon water temperature 24-27°C	• Summer afternoon water temperature 20-24°C	• Summer afternoon water temperature < 20°C
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☑ 4	☐ 5 ☐ 6	☐ 7 ☐ 8

Water Quality	• Substrate fouling level: High (> 50%)	• Substrate fouling level: Moderate (21-50%)	• Substrate fouling level: Very light (11-20%)	• Substrate fouling level: Rock underside (0-10%)
	• Brown colour • TDS: > 150 mg/L	• Grey colour • TDS: 101-150 mg/L	• Slightly grey colour • TDS: 50-100 mg/L	• Clear flow • TDS: < 50 mg/L
	• Objects visible to depth < 0.15 m below surface	• Objects visible to depth 0.15-0.5 m below surface	• Objects visible to depth 0.5-1.0 m below surface	• Objects visible to depth > 1.0 m below surface
	• Moderate to strong organic odour	• Slight to moderate organic odour	• Slight organic odour	• No odour
Point range	☐ 0 ☐ 1 ☐ 2	☐ 3 ☐ 4	☐ 5 ☐ 6	☑ 7 ☐ 8

Riparian Habitat Conditions	• Narrow riparian area of mostly non-woody vegetation	• Riparian area predominantly wooded but with major localized gaps	• Forested buffer generally > 31 m wide along major portion of both banks	• Wide (> 60 m) mature forested buffer along both banks
	• Canopy coverage: < 50% shading (30% for large mainstem areas)	• Canopy coverage: 50-60% shading (30-44% for large mainstem areas)	• Canopy coverage: 60-79% shading (45-59% for large mainstem areas)	• Canopy coverage: > 80% shading (> 60% for large mainstem areas)
Point range	☐ 0 ☑ 1	☐ 2 ☐ 3	☐ 4 ☐ 5	☐ 6 ☐ 7

Additional notes:

Total overall score (0 - 42) = 22

Ranking	Poor (<13)	Fair (13-24)	Good (25-34)	Excellent (>35)
		✓		

Completed by: KT/ER Checked by: _____

Savanta Inc.

Rizmi Milani – Benthic Invertebrate Sampling 2012
Project # 7039

Prepared by: Candice Kerling, Ecologist

Prepared for: Antonette Zimic, Project Manager

Date: July 26th, 2012

Entomogen Inc. visited the Rizmi Milani property in Vaughn on May 30th, 2012 to conduct aquatic sampling. We examined the area for suitable sites to sample, but the water levels were very low. Samples were taken from 2 sites – A1 and A6, as requested by Savanta (Figure 1). No other suitable sits were observed on the Rizmi property at the time of sampling.

Figure 1. Potential sample sites suggested by Savanta. Sites were visited to determine suitability.

Samples were taken using the methodology recommended in the Ontario Benthos Biomonitoring Network (OBBN) Protocol Manual. Travelling kick and sweep sampling was conducted using "D" framed kick nets (500 µm). One sample was collected from each site. Specimens were initially preserved in 95% ethanol (to obtain a dilution of approximately 70-80%) and transferred to fresh 70% ethanol once in the lab.

Samples were sorted under magnification using a dissecting microscope. Picked individuals were identified to a mix of Classes, Orders, and Families in accordance with the Ministry of the Environment Rapid Bioassessment Levels and enumerated. A total of 39 different taxa were observed across the two sites. A family by site matrix can be seen below (Table 1).

Both sites had good diversity, with a variety of different invertebrates found. Site A1 had both the highest abundance as well as diversity, with over 800 specimens in that sample. It should also be noted that samples from site A1 contained salamander larva, indicating that this area is also a breeding ground for salamanders.

Table 1. Identification of samples taken from Rizmi, May 30th 2012.

Class	Order	Family	A1	A6	TOTAL
ANNELIDA	HIRUDINEA	GLOSSIPHONIIDAE	16		16
ANNELIDA	OLIGOCHAETA		22	10	32
ARACHNOIDEA	TROMBIDIFORMES	UNIONICOLIDAE	1		1
CRUSTACEA	CLADOCERA	DAPHNIA	31		31
CRUSTACEA	COPEPODA		6	4	10
GASTROPODA	BASOMMATOPHORA	LYMNAEIDAE	52		52
GASTROPODA	BASOMMATOPHORA	PLANORBIIDAE	9	2	11
GASTROPODA	SORBEOCONCHA	HYDROBIIDAE	1		1
HYDROZOA	ANTHOMEDUSAE	HYDRIDAE	1		1
INSECTA	COLEOPTERA	DYTISCIDAE	110	5	115
INSECTA	COLEOPTERA	ELMIDAE	5	16	21
INSECTA	COLEOPTERA	HALIPLIDAE	21		21
INSECTA	DIPTERA	CERATOPOGONIDAE	159	120	279
INSECTA	DIPTERA	CHAOBORIDAE	31		31
INSECTA	DIPTERA	CHIRONOMIDAE	116	72	188
INSECTA	DIPTERA	CULICIDAE	1	2	3
INSECTA	DIPTERA	STRATIOMYIDAE	1		1
INSECTA	DIPTERA	TABANIDAE		5	5
INSECTA	DIPTERA	Unknown pupa	6	2	8
INSECTA	EPHEMEROPTERA	BAETIDAE	49	3	52
INSECTA	EPHEMEROPTERA	SIPHLONURIDAE	14		14
INSECTA	HEMIPTERA	CORIXIDAE	2		2
INSECTA	HEMIPTERA	GERRIDAE	2	2	4
INSECTA	HEMIPTERA	NOTONECTIDAE	15		15
INSECTA	MEGALOPTERA	CORYDALIDAE		1	1
INSECTA	ODONATA	AESHNIDAE	11	2	13
INSECTA	ODONATA	LESTES	18	1	19
NEMATODA			6		6
PELECYPODA	VENEROIDA	PISIDIIDAE	91		91
TURBELLARIA			1		1
Terrestrial Drop-in			8	4	12
Total			806	251	1057

Savanta Inc.

Rizmi/Vaughan Lepidoptera and Odonata Surveys, Final Report 2011

Project # 7039

Prepared by: Candice Kerling, Ecologist

Prepared for: Antonette Zimic, Project Manager

Date: September 13th, 2011

All Lepidoptera and Odonate surveys have been completed for the Rizmi/Vaughan property. The conditions for surveys were as follows:

Insect Survey #1: June 19, 2011
Weather: Sunny, cool, low wind Temperature: 17-22° C
Insect Survey #2: July 19, 2011
Weather: Sunny, hot and humid, low wind Temperature: 20-25° C
Insect Survey #3: August 30, 2011
Weather: Sunny, cool, low wind Temperature: 20-28° C

The three insect surveys were completed between June and August to make sure the full diversity of insects present was observed. It should be noted that the June survey should have occurred in early June to observe the species with early emergence and short flight periods. As the survey was not completed until late June it is possible that some species present may have been missed. Specimens were collected by hand or using sweep nets. Type specimens were collected when necessary, and photographs were taken for identification purposes. All species observed are apparently secure (uncommon but not rare) or secure based on the Natural Heritage Information Centre rankings.

Insects of interest and locally rare species (according to Halton Region Checklist, and Toronto Entomological Society) observed include:

Monarch Butterflies – *Danaus plexippus* (S4B, S2N, common);
Black-tipped Darner – *Aeshna tuberculifera* (S4, locally rare);
Racket-tailed Emerald – *Dorcordulia liberal* (S5, locally rare);
Nothern Bluet – *Enallagama cyathigerum* (S5, locally rare).

The full list of Lepidoptera and Odonates observed can be seen below in Tables 1 and 2.

Entomogen Inc. 6 Clark Street St. Catharines, ON L2R 5G2 **T** 905.641.3468 **F** 905.641.5413www.entomogen.ca

Table 1. Rizmi/Vaughan 2011 Lepidoptera Survey Results.

Species	Common Name	S-rank	Local Rank	# Observed	Survey
Alypia octomaculata	8 Spotted Forester	S5	-	10	June, July
Anceloxpha numitor	Least Skipper	S5	Common	>100	June, July
Cercyonis pegala	Common Wood Nymph	S5	Common	4	Jun, Aug
Coenonympha tullia	Common Ringlet	S5	Common	>35	June, Aug
Colias philodice	Clouded Sulphur	S5	Common	>50	Aug
Ctenucha virginica	Virginia Ctenucha Moth	S5	Common	15	June, July, Aug
Danaus plexippus	Monarch	S4B, S2N	Common	18	June, July
Erynnis juvenalis	Juvenal's Duskywing	S5	Common	4	June
Everes comyntas	Eastern Tailed Blue	S5	Common	7	Aug
Glaucopsyche lygdamus	Silvery Blue	S5	Common	2	June
Limenitis archippus	Viceroy	S5	Common	12	June, Aug
Limenitis arthemis arthemis	White Admiral	S5	Common	2	June
Limenitis arthemis asthyanx	Red-spotted Purple	S5	Common	1	June
Malacosoma americanum	Eastern Tent Caterpillar Moth	S5	Common	>250	Aug
Megisto cymela	Little Wood Satyr	S5	Common	>25	June, Aug
Nymphalis antiopa	Mourning Cloak	S5	Common	2	June
Papilio glaucus	Eastern Tiger Swallowtail	S4S5	Common	9	June, July
Papilio polyxenes	Black Swallowtail	S5	Common	6	June, July, Aug
Phyciodes tharos	Early Pearl Crescent	S4	Common	>75	June, Aug
Pieris rapae	Cabbage White	SNA	Common	>100	July, Aug
Polygonia interrogationis	Question Mark	S5	Common	1	July
Thymelicus lineola	European Skipper	SNA	Common	>75	June, July, Aug
Xanthotype spp.	Buttercup geometer moth	S4S5	-	25	June

Table 2. Rizmi/Vaughan 2011 Odonata Survey Results.

Species	Common Name	S-rank	Local Rank	# Observed	Survey
Aeshna constricta	Lance-tipped Darner	S5	Common	>10	June, July
Aeshna tuberculifera	Black-tipped Darner	S4	Rare	>25	Aug
Anax junius	Common Green Darner	S5	Common	>50	June, July, Aug
Celithemis elisa	Calico Pennant	S5	Common	>25	June
Dorcordulia liberal	Racket-tailed Emerald	S5	Rare	>15	June
Enallagma civile	Familiar Bluet	S5	Common	>50	June
Enallagma cyathigerum	Northern Bluet	S5	Rare	1	June
Epitheca cynosura	Common Baskettail	S5	Uncommon	>50	June
Ischnura verticalis	Eastern Forktail	S5	Common	5	June
Lestes rectangularis	Slender Spreadwing	S5	Common	>20	July
Leucorrhinia intacta	Dot-tailed Whiteface	S5	Common	>25	June
Libellula luctuosa	Widow Skimmer	S5	Common	7	June, July
Libellula pulchella	Twelve-spotted Skimmer	S5	Common	>50	June, July, Aug
Sympetrum semicinctum	Banded Meadowhawk	S5	Uncommon	>30	July, Aug
Sympetrum rubicundulum	Ruby Meadowhawk	S5	Common	>50	June, July, Aug
Plathemis lydia	Common Whitetail	S5	Common	>25	June, July
Tramea lacerata	Black Saddlebags	S4	Common	>25	June, July, Aug

GEO Morphix Ltd.

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Milton, Ontario, Canada L9T 6P4
T 416.920.0926

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November 28, 2018

Schaeffers Consulting Engineers
6 Ronrose Drive
Vaughan, ON
L4K 4R3

Attention: Leonid Groysman

Re: Kirby Road Extension Crossing for East Patterson Creek
Response to TRCA Comments dated September 12, 2018
City of Vaughan, Ontario
GEO Morphix Project No. PN15080

This letter is in response to several comments received from the Toronto Region Conservation Authority (TRCA, September 12, 2018) regarding the Kirby Road Extension between Dufferin and Bathurst Streets in the City of Vaughan. Specifically, we address comments related to the geomorphic assessment completed by GEO Morphix (report dated January 18, 2016 and letter dated June 4, 2018). We have provided each comment in italics below as well as a subsequent written response. Supporting materials have also been included as attachments.

Response to TRCA Comments

- *Comment #4 – For example: S3.2.3.2:*
  - *a) Please provide a drawing showing the location of the different reaches.*

A reach map was included under the GEO Morphix letter dated June 4, 2018. Reaches are also outlined on the new figure included in this letter (**Attachment A**).

  - *b) Please provide a figure showing the location of the observed watercress in the channel.*
  - *c) Please identify all wetland features on a figure with their size in hectares.*
  - *d) Please provide a figure showing the location of observed groundwater staining and the area described as "basin-like".*

The locations of watercress, wetlands, and iron staining were not specifically mapped as part of the geomorphological assessment. These were general, reach level observations collected during the field reconnaissance. The exact locations were not mapped, as they were not significant with respect to the geomorphological assessment.

- *Comment #18 – Please provide a location map.*

A location map was included under the GEO Morphix letter dated June 4, 2018. The location is also outlined on the new figure included in this letter (**Attachment A**).

- *Comment #19 – Please provide a figure showing the location of all observations: e.g. barrier to fish passage and referenced wetlands, knick points, culverts and pipeline. Historical photos are recommended to improve clarity.*

The new figure included in this letter (**Attachment A**) shows the location of knick points and one (1) observed culvert. It should be noted that knick points in this case are small in scale and, as such, are not a relevant constraint with respect to proposed crossing locations. The locations of fish barriers were not specifically mapped as part of the geomorphological assessment. These were general observations collected during the field reconnaissance. Although these items may be of interest to other disciplines, they are not significant from a geomorphological perspective. The term wetland was used to indicate wet areas without a defined channel/vegetation controlled. Further, the location of the pipeline was not specifically mapped as it was located immediately downstream of the study site. As requested, historical photographs of the site have been included under **Attachment B**.

- *Comment #20 – Please note that TRCA has not yet concluded that this channel does not constitute fish habitat.*

Noted.

- *Comment #21 – Please provide a figure showing the breakdown of reaches within the watercourse.*

A reach map was included under the GEO Morphix letter dated June 4, 2018. Reaches are also outlined on the new figure included in this letter (**Attachment A**).

- *Comment #22 – In the second last paragraph, please revise the text to clarify the meaning of "fining".*

Fining is a common term used in geomorphological assessments. We have not revised the report text, but instead provide a description here to clarify. Downstream fining of sediment is observed in most creek systems as a result of collective sediment sorting (i.e. smaller grains are transported farther downstream while larger grains are deposited preferentially upstream). The finer sediments observed along reach EPC-1 were therefore expected given that it was the farthest downstream reach.

- *Comment #23 – Please provide a figure identifying the location of the referenced 8 cross sections.*

The new figure included in this letter (**Attachment A**) shows the location of the eight (8) cross-sections.

- *Comment #24 – Please note that the construction of the Trans Canada Pipeline doesn't necessarily preclude the possibility that the channel constitutes fish habitat.*

Noted.

- *Comment #25 – Please note that TRCA's Crossing Guideline for Valley and Stream Corridors recommends that new crossings are designed to span the meander belt width or the 100-year channel migration limit. These limits must be identified to support an assessment of crossing alternatives.*

The new figure included in **Attachment A** shows the extent of the meander belt width and/or erosion hazard setback in relation to the proposed crossing locations.

Additional field work was completed on November 16, 2018 to verify the location of the channel centreline in the vicinity of each crossing location. Specifically, a RTK and Total Station survey was completed to field-truth the MNRF stream layer (see figure in **Attachment A**).

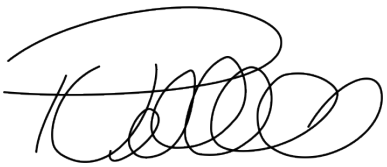
We understand that crossing Option 5 has been selected as the preferred approach. It should be noted that in the vicinity of the Option 5 crossing, a channel centreline could not be mapped by Total Station or RTK GPS survey. The existing MNRF stream layer shown near Option 5 (**Attachment A**) also does not accurately characterize this particular section. Based on our field observations, the area is vegetation controlled with a low-gradient, evidence of aggradation, and no defined low-flow channel. As such, there is limited erosion potential.

From a geomorphological perspective, there is no future concern of erosion in the vicinity of crossing Option 5. Still, we have provided a meander belt width in this area based on the largest channel meander amplitude measured upstream of the Option 5 crossing using the MNRF stream layer. Given that the feature is vegetation controlled and lacks defined bed and banks in this section, the meander belt width is an extremely conservative estimate of the erosion hazard. For further discussion on the application of the meander belt width and erosion hazard, please refer to our June 4, 2018 memo.

Option 5 is an appropriate approach for the future road crossing. If required at detailed design, a low-flow channel could be created as part of the crossing design.

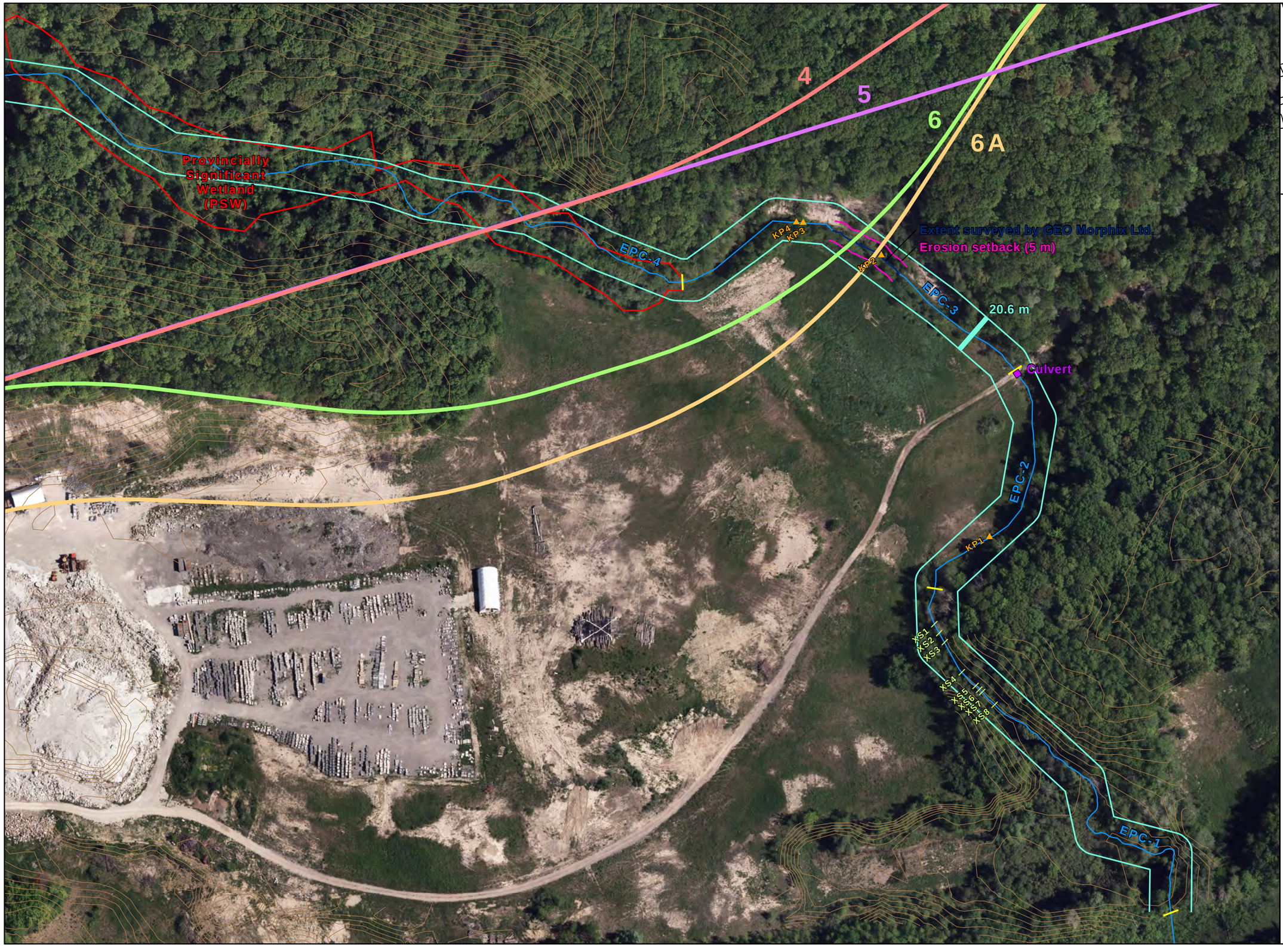
If you have any questions or concerns, please contact the undersigned.

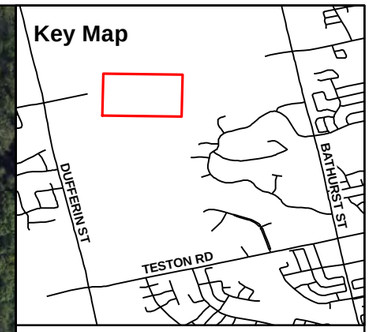
Respectfully submitted,



Paul Villard, Ph.D., P.Geo., CAN-CISEC
Director, Principal Geomorphologist

Attachment A





Legend

- Knick point
- Cross section
- Reach break
- Centreline of watercourse
- Meander belt width (20.6 m)
- 1 m Contour

Road Alignment Options

- 4
- 5
- 6
- 6A

N

0 50
Metres

Knick point, Cross section, Reach break and Meander belt width: GEO Morphix Ltd., 2018.
Watercourse: MNR, 2010, Schaeffers Consulting Engineers, 2018, and GEO Morphix Ltd., 2018.
Contours, Road Alignment Options, and PSW: Schaeffers Consulting Engineers, 2018.
Imagery: York Region, 2017.

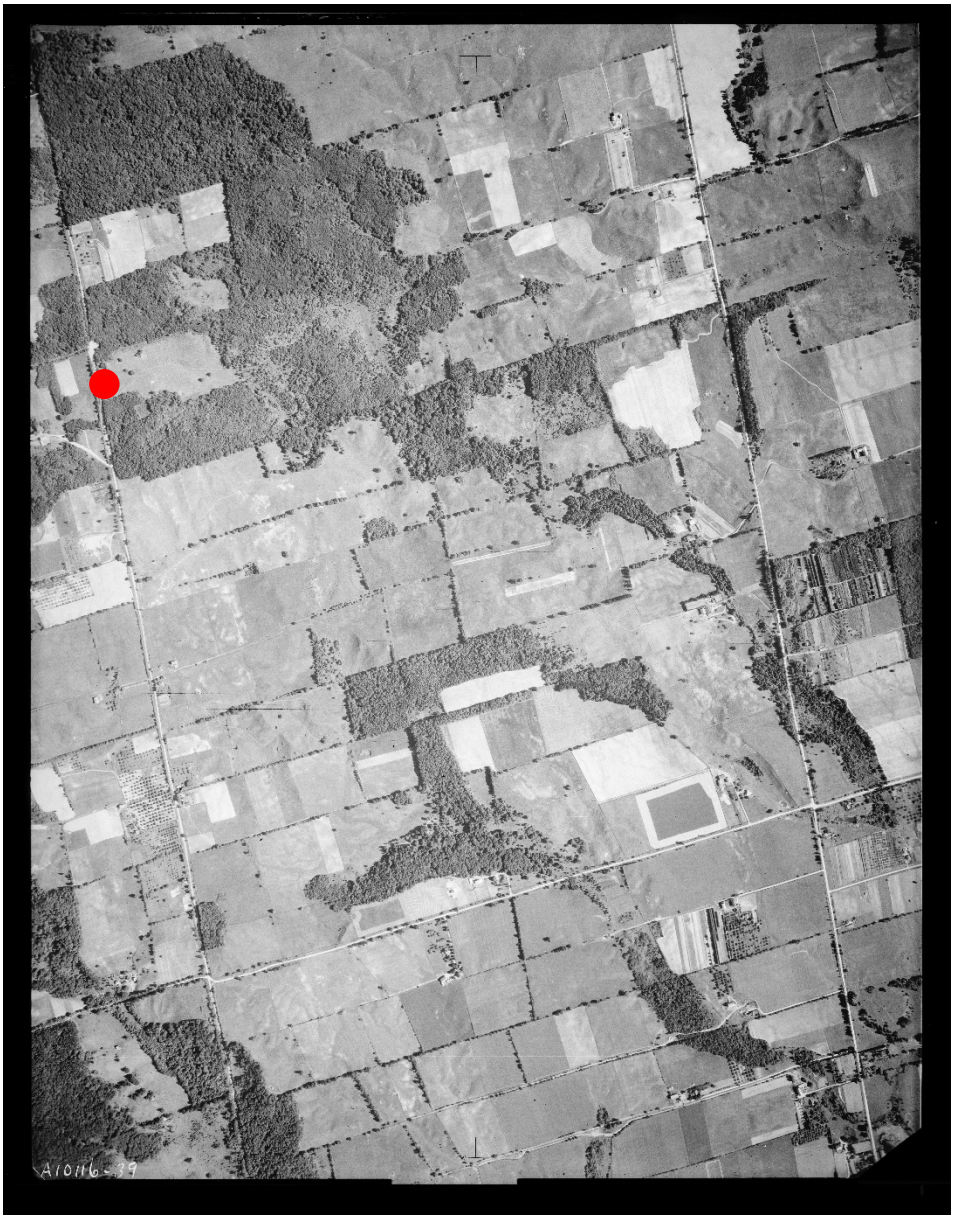
GEO MORPHIX

Planning Level Meander Belt Width Delineation

Upper East Patterson Creek

Vaughan, Ontario

Attachment B



Location: 11333 Dufferin Street, Maple, ON
Year: 1946
Scale: 1:20,000
Source: NAPL

Location: 11333 Dufferin Street, Maple, ON
Year: 1954
Scale: 1:63,360
Source: Hunting Survey Corporation Limited

Location: 11333 Dufferin Street, Maple, ON
Year: 1970
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 1999
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 2002
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 2005
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 2007
Scale: Orthoimagery
Source: York Region

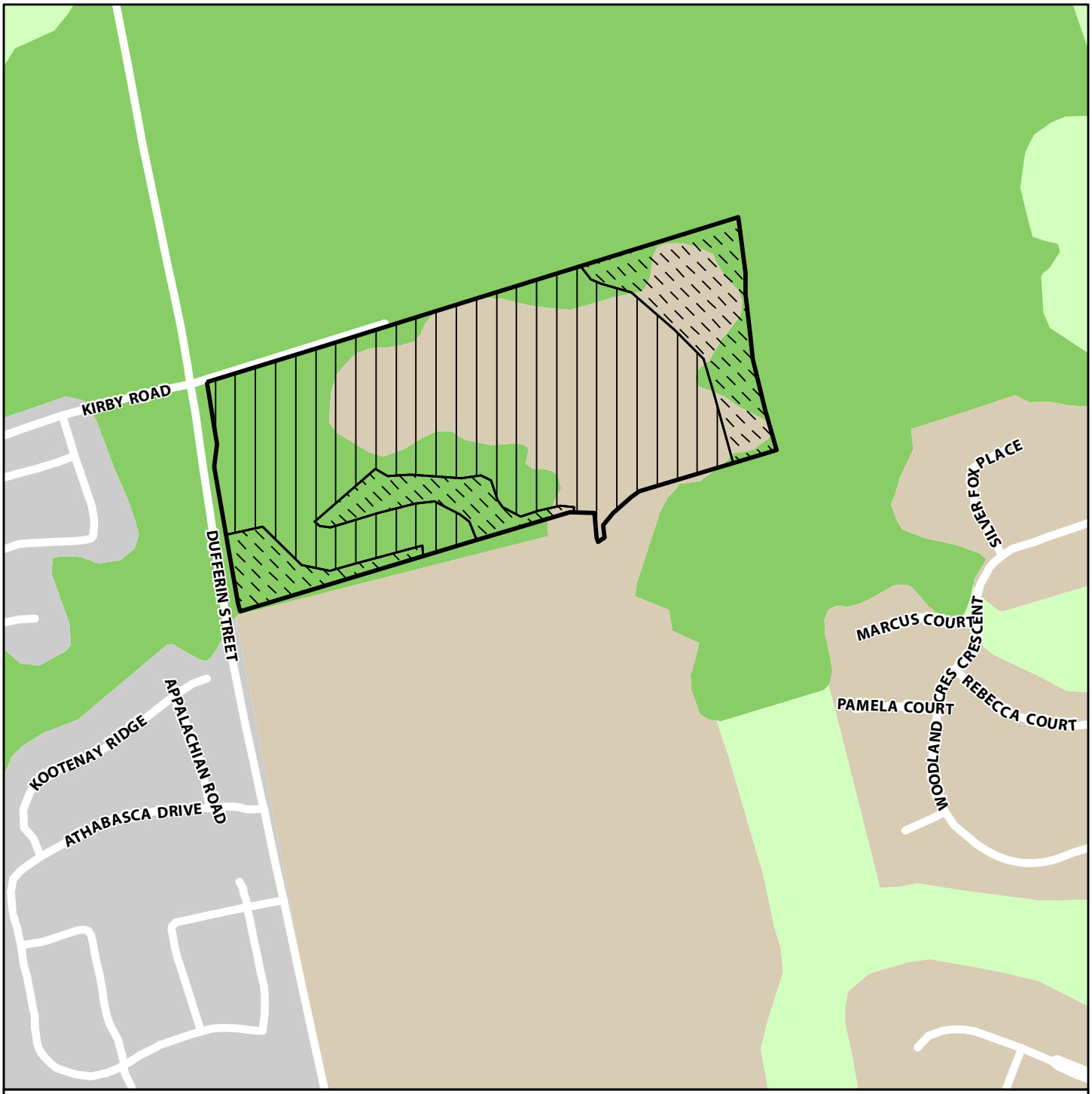
Location: 11333 Dufferin Street, Maple, ON
Year: 2011
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 2012
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 2013
Scale: Orthoimagery
Source: York Region

Location: 11333 Dufferin Street, Maple, ON
Year: 2015
Scale: N/A
Source: Google Earth Pro

Appendix E – Planning Framework



Subject Lands

Schedule F2 to OPA 600.
As per Ministers Order (February 2015)

Low Density Residential, Schedule F2 to OPA 600

Valley and Stream Corridor, Schedule F2 to OPA 600

ORM Landuse Designations

Countryside Area

Natural Core Area

Natural Linkage Area

Settlement Area

Kirby Road Extension Class EA

Appendix E
Planning Framework

0 100 M

1:10,000

N

SAVANTA

Path: S:\8869 - SAV 7688 Kirby Rd Extension\gis\mxd\2019 05 08\Appendix E Planning Framework.mxd Date Saved: May 8, 2019

APPENDIX C1.2

Species at Risk Discussion

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SAVANTA

September 9, 2018

Schaeffers Consulting
Engineers
6 Ronrose Drive
Concord, Ontario
L4K 4R3

Attention: Leonid Groysman

Dear Mr. Groysman:

Re: Species at Risk Discussion – Kirby Road EA

We have reviewed the June 7, 2018 letter from Mr. Strong of the Ministry of Natural Resources and Forestry (MNRF), Aurora District regarding the Environmental Assessment (EA) for the Kirby Road extension. MNRFs comments addressed key areas of the EA:

- Timelines related to why the PIC was pushed forward and the lack of time provided for review of materials and agency comment preparation;

- Oak Ridges Moraine Conservation Plan (ORMCP) conformity: Section 41 of the ORMCP advocates avoidance of natural features (particularly within the Natural Core designation) and minimizing disturbance in these areas if avoidance is not possible justification for why avoidance was not possible and for demonstration of conformity or justification for non-conformity; and

- Species at risk (SAR): All alignments will result in impacts to threatened and endangered SAR. However, the type and magnitude of impacts to SAR varies between each alignment.

This letter addresses threatened and endangered species (SAR). Specifically, anticipated impacts to and preliminary general mitigation measures for impacts to species at risk associated with the preferred road alignment - “Alignment 5”. It is our understanding that responses to the other issues (timelines and ORMCP conformity) will be provided by Schaeffers Consulting Engineers (Schaeffers) and Lucas and Associates respectively.

Background

Schaeffers led the assessment of nine alignment alternatives, developed for the extension of Kirby Road. That long-list of alternatives was assessed using desktop analyses to identify a short-list of alignment alternatives. Through that screening process, three road alignments were short-listed after the June 2017 Public Open House (PIC): Alignments 4, 5, and 6. In response to agency feedback and a site meeting in August 2017, a fourth alignment (Alignment 6a) was added to the

short-list. Those four alignments were carried forward for more detailed review and screening by the assessment team led by Schaeffers.

Savanta Inc. (Savanta) completed the Kirby Road Extension Class EA Existing Conditions Natural Heritage Report in March 2018. The report included a summary of available desktop and secondary source data and natural heritage field investigations between 2010 and 2017 and an analysis of the significance and sensitivity of identified natural features in accordance with the definitions in the Provincial Policy Statement (PPS) and the Oak Ridges Moraine Conservation Plan (ORMCP). This baseline natural heritage information was used by Savanta to inform the assessment and ranking of road alternatives with respect to natural heritage factors.

Schaeffers led the detailed, comprehensive evaluation of alternatives in spring 2018 with multi-disciplinary input across four primary factors: natural heritage, social, economic and transportation. Savanta completed the evaluation and scoring exercise for natural heritage factors across the four short listed alignments: 4, 5, 6 and 6a. Based on the outcome of this assessment, Alignment 6a was determined to be the most preferred for natural heritage factors and Alignment 5 was determined to be the least preferred. Our detailed natural heritage screening table, which also outlines anticipated and potential impacts and general mitigation measures is attached.

Although Alignment 5 ranked least preferred for natural environment, it was carried forward based on the advantages and disadvantages and scoring across the four factors. Based on that outcome, this letter provides some preliminary discussion regarding predicted SAR impacts associated with the preferred alignment. Information presented includes: additional activities required to assess presence/absence; potential impacts to SAR; and preliminary opportunities to mitigate impacts during the design of the proposed alignment.

Endangered Species Act (ESA) and Species at Risk (SAR) – General

Several threatened and endangered species: Butternut (*Juglans cinerea),* Bobolink (*Dolichonyx oryzivorus*), Eastern Small-footed and Little Brown Myotis (*Myotis leibii* and *Myotis lucifugus*) have been identified within the study area that will be impacted by all of the proposed road alignments. Based on a detailed comparative analysis of the four short listed road alignments differences between the magnitude of impacts to SAR were noted and Alignments 4 and 5 were predicted to result in greater impacts to SAR due to: the relatively larger amounts of direct forest removal; increased length of intrusion, resulting in increased habitat fragmentation; and an increase in predicted impacts associated with road use (e.g., light/noise).

Under the *Endangered Species Act* (ESA)(*2007*), a Permit may be issued authorizing the impact on an endangered or threatened species, where the Minister is of the opinion that three conditions can be met:

- Achievement of an overall benefit to the species within a reasonable timeframe;
- Reasonable alternatives have been considered including alternatives that would not adversely affect the species; and
- Conditions of a Permit will require reasonable steps to minimize adverse effects on individuals of a species.

Endangered Species Act (ESA) and Species at Risk (SAR) – Preferred Alternative

Alignment 5 has been identified by the assessment team led by Schaeffers, as the preferred alternative. A summary of SAR species observed within the Subject Lands, predicted impacts, anticipated next steps under the ESA and proposed mitigation measures with respect to the preferred alternative are provided in **Table 1** (attached). In addition, some discussion is provided for two additional species not observed to date within the Subject Lands: Eastern Whip-poor-will and American Ginseng that were identified at a meeting with the MNRF in October of 2017, as potentially occurring within the Subject Lands.

In addition to specific mitigation measures outlined in **Table 1**, the following general mitigation options should be explored to minimize potential impacts to sensitive features and SAR species:

- Narrowing of the road width through sensitive features/habitats;
- Use of retaining walls and/or increased grade slopes through sensitive features to reduce total footprint in these areas;
- Use of appropriate erosion and sedimentation measures;
- Use of wildlife exclusion measure (fencing, etc.) during construction and as permanent mitigation measures to avoid wildlife ingress onto the road; and
- Integrate wildlife passage structures into the design at key locations to maintain connectivity.

Although commitments to mitigate and provide compensation must be identified through the EA process, more detailed consideration for mitigation and compensation will be addressed through preliminary and detailed design, including but not limited to key design features such as culverts, retaining walls and crossing structures. The general list provided above does not address all potential mitigation measures required with respect to features and other wildlife.

Registration and/or permitting under the ESA is also anticipated to generate mitigation and compensation requirements (i.e., as Permit conditions). These measures are not known at this time and will be developed in consultation with the appropriate agency or Ministry; any measures required through these processes may include or be in addition to the general mitigation opportunities identified here.

Summary

The evaluation of short-listed alternatives included an assessment within four primary factors: natural heritage, social, economic and transportation. Savanta provided input to the EA team regarding natural heritage. Alignment 6a was the preferred alternative for natural heritage factors and Alignment 5 was the least preferred. Based on the outcome of the Schaeffer-led comprehensive evaluation process, Alignment 5 was selected as the preferred based on the advantages and disadvantages and scoring across the four factors.

In consideration of its selection, a preliminary review of SAR anticipated to be impacted, potential impacts and preliminary consideration for requirements under the ESA (registration/permitting), mitigation and compensation have been prepared (**Table 1**). Additional studies have been identified for two species: American Ginseng and Eastern Whip-poor-will.

Savanta is available to meet with the regulatory authorities to discuss this further, should that be beneficial. We are available to provide additional detailed input and to work through ESA requirements further as the EA proceeds.

Yours truly,

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Attachments (2)

- Table 1: SAR Observations, Predicted Impacts and Mitigation Measures
- Natural Environment Net Effects Analysis for Road Alignments (Schaeffers)

References:

Ministry of Natural Resources (MNR) 2007. Endangered Species Act, S.O. Chapter 6. 57 pp.

Ministry of Natural Resources (MNR) 2013. Survey Protocol for Eastern Whip-poor-will (*Caprimulgus vociferous*) in Ontario. Ontario Ministry of Natural Resources, Species at Risk Branch, Peterborough. 10 pp

Table 1: SAR Observations, Predicted Impacts and Mitigation Measures – Preferred Alternative (Alignment 5)

SAR SPECIES	SURVEY/LEVEL OF EFFORT TO DATE	PRESENCE/ ABSENCE CONFIRMED	PREDICTED IMPACT	EXPECTED PROCESS UNDER THE ESA.	PROPOSED MITIGATION AND/OR COMPENSATION
Bobolink	• Breeding bird surveys and SAR bird screening surveys: - May 4, July 4 and 5, 2010; June 5, June 26 and July 12, 2011; - May 28, 2015 (SAR verification); - July 9, 2015 (SAR verification update surveys); and - June 8, 9, June 30, 2017	• Probable and confirmed breeding habitat within the CUM1-1 ELC communities located in the north eastern portion of the Subject Lands	• Direct removal of cultural meadow/Bobolink habitat • Approximate length of road through cultural meadow: 38 m	• Completion of an Information Gathering Form (IGF) with the MNRF • Registration under Section 23.2 of O. Reg 242/08 (General) of the ESA	**Mitigation:** • Minimize/narrow Right-of-Way (ROW) to the extent possible through confirmed habitat **Compensation:** • Enhancement of existing Bobolink habitat that will be retained in the vicinity the proposed road alignment • Per the requirements of Registration under Section 23.2 of O.Reg 242/08: Develop a compensation plan for the creation and maintenance of minimum 1:1 area of replacement habitat for Bobolink within Eco-region 6E
Butternut	• ELC and Botanical Inventory surveys: - April 16 and 30, 2010; - April 16 and 30, June 24, July 5 and October 12, 2011; - October 29 and 30, 2015 (ELC and Butternut review); - May 29, August 10 and September 22, 2017; and - September 21 and 22, 2017 (Butternut Health Assessment Surveys)	• Twenty-three Butternut trees were observed within the Subject Lands. - 20 are Category 2[1] trees; and - 3 are Category 2[1] trees	• The proposed road alignment will result in the direct removal of seven Category 1 Butternut trees and impact the habitat (i.e., lands within 50 m of a Butternut tree) of one Category 1 and one Category 2 Butternut trees	• Completion of an IGF with the MNRF • Submission of a Butternut Health Assessment (BHA) report to the MNRF (Completed: August 2018) • All trees that will be removed are Category 1 trees (non-retainable). No protective measures or mitigation would be required under section 23.7 of the O.Reg 242/08 of the ESA • The Category 2 tree that is within 50 m of the proposed road alignment will require further review. The determination of required compensation and mitigation measures required under section 23.7 of the O.Reg 242/08 of the ESA will be determined through detailed design	• No mitigation or compensation required for the Category 1 trees • Impacts to Category 2 trees are addressed by giving the Minister notice of the activity by submitting a notice of butternut impact form. Mitigation and compensation measures may be required
Eastern Small-footed Myotis	• Bat habitat assessment and acoustic surveys: - May 11 and 12, 2016; and	• Confirmed habitat in two FOD2-4 woodlands within the Subject Lands	• The proposed road alignment will result in the direct removal of 1.93 ha of woodland that provides habitat for Eastern Small-footed Myotis	• Completion of an IGF with the MNRF • Permit under 17(2)(c) of the ESA	**Mitigation:** • Minimize/narrow Right-of-Way (ROW) to the extent possible through confirmed habitat • Minimize the removal of trees where possible

[1] Category 1 — the Butternut tree is affected by Butternut canker to such an advanced degree that retaining the tree would not support the protection or recovery of Butternut trees in the area in which the tree is located.
[2] Category 2 — the Butternut tree is not affected by Butternut canker or the Butternut tree is affected by Butternut canker but the degree to which it is affected is not too advanced and retaining the tree could support the protection or recovery of Butternut trees in the area in which the tree is located.

Table 1: SAR Observations, Predicted Impacts and Mitigation Measures – Preferred Alternative (Alignment 5)

SAR SPECIES	SURVEY/LEVEL OF EFFORT TO DATE	PRESENCE/ ABSENCE CONFIRMED	PREDICTED IMPACT	EXPECTED PROCESS UNDER THE ESA.	PROPOSED MITIGATION AND/OR COMPENSATION
	- June 22, 27, July 4, July 10 and July 21, 2017				• Restrict tree removal to periods outside the active period for bats, approximately October 1st to March 31st, or as agreed to be appropriate by the MNRF • Restoration of temporary work spaces as soon as possible to pre-construction conditions where appropriate • Measures as determined through the permitting process under 17(2)(c) of the ESA **Compensation:** • Creation of bat replacement habitat structures • Measures as determined through the permitting process under 17(2)(c) of the ESA to achieve Overall Benefit for the Species
Little Brown Myotis	• Bat habitat assessment and acoustic surveys: • May 11 and 12, 2016; and • June 22, 27, July 4, July 10 and July 21, 2017	• Confirmed habitat in two FOD2-4 woodlands within the Subject Lands	• The proposed road alignment will result in the direct removal of 1.93 ha of woodland that provides habitat for Little Brown Myotis	• Completion of an IGF with the MNRF • Permit under 17(2)(c) of the ESA	**Mitigation:** • Minimize/narrow Right-of-Way (ROW) to the extent possible through confirmed habitat • Minimize the removal of trees where possible • Restrict tree removal to periods outside the active period for bats, approximately October 1st to March 31st, or as agreed to be appropriate by the MNRF • Restoration of temporary work spaces as soon as possible to pre-construction conditions where appropriate • Measures as determined through the permitting process under 17(2)(c) of the ESA **Compensation:** • Creation of bat replacement habitat structures • Measures as determined through the permitting process under 17(2)(c) of the ESA to achieve Overall Benefit for the Species
American Ginseng	• ELC and Botanical Inventory surveys: - April 16 and 30, 2010; - April 16 and 30, June 24, July 5 and October 12, 2011; - October 29 and 30, 2015 (ELC and Butternut review); and	• This species was not observed within the Subject Lands during surveys conducted by Savanta between 2010-2017 • The MNRF has identified this species as requiring further study	• To be determined • Potentially suitable habitats are impacted by the preferred alignment • Additional assessment is required to confirm presence/absence of this species	• Presence is unknown at this time • There is no registration for this species at this time. If present and impacted by the proposed alignment, a permit would be required	• Confirmation of species presence/absence is required to determine if species specific mitigation, permitting and/or compensation is required **Next Steps:** • Targeted surveys will be conducted along the proposed road alignment to confirm presence/absence of this species

Table 1: SAR Observations, Predicted Impacts and Mitigation Measures – Preferred Alternative (Alignment 5)

SAR SPECIES	SURVEY/LEVEL OF EFFORT TO DATE	PRESENCE/ ABSENCE CONFIRMED	PREDICTED IMPACT	EXPECTED PROCESS UNDER THE ESA.	PROPOSED MITIGATION AND/OR COMPENSATION
	- May 29, August 10 and September 22, 2017				
Eastern Whip-poor-will	• Breeding bird surveys and SAR bird screening surveys - May 4, July 4 and 5, 2010; June 5, June 26 and July 12, 2011; - May 28, 2015 (SAR verification); - July 9, 2015 (SAR verification update surveys); and - June 8, 9, June 30, 2017	• This species was not observed within the Subject Lands during breeding bird surveys conducted by Savanta between 2010-2017 • No targeted surveys were completed for this species • The MNRF has identified this species as requiring further study	• To be determined • Potentially suitable habitats are impacted by the preferred alignment • Additional assessment is required to confirm presence/absence of this species	• Presence is unknown at this time • There is no registration for this species at this time. If present and impacted by the proposed alignment, a permit would be required	• Confirmation of species presence/absence is required to determine if species specific mitigation, permitting and/or compensation is required. **Next Steps:** • Targeted surveys following the MNR protocol for Eastern Whip-poor-will surveys (MNR 2013); to be completed between May 18 and June 30

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
NATURAL ENVIRONMENT FACTOR					
Terrestrial Features Aspect					
Wetlands	Effects on Provincially Significant Wetland and other wetlands	**Provincially Significant Wetlands** **Potential Direct Impacts** • Proposed bridge footings and retaining wall will encroach into wetland riparian area (buffer) and potential seepage/recharge area; • Direct loss of wetland riparian vegetation below bridge footings/retaining wall and surrounding area of disruption due to construction; **Potential Indirect Impacts** • Erosion/sedimentation; • Potential to affect hydrologic regime of wetland; • Bridge will shade wetland vegetation below which may result in a change to wetland composition/water evaporation; • Introduction of salt/sand and contaminants from roads will affect wetland; and • Localized effect on wildlife and vegetation during construction; **Potential Mitigation Measures** • Narrowing road width through sensitive features; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in these areas;	**Provincially Significant Wetlands** **Potential Direct Impacts** • Proposed bridge footings and retaining wall will encroach into wetland riparian area (buffer) and potential seepage/recharge area; • Direct loss of wetland riparian vegetation below bridge footings/retaining wall and surrounding area of disruption due to construction; **Potential Indirect Impacts** • Erosion/sedimentation; • Potential to affect hydrologic regime of wetland; • Bridge will shade wetland vegetation below which may result in a change to wetland composition/water evaporation; • Introduction of salt/sand and contaminants from roads will affect wetland; and • Localized effect on wildlife and vegetation during construction; **Potential Mitigation Measures** • Narrowing road width through sensitive features; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in these areas;	**Provincially Significant Wetlands** **Potential Direct Impacts** • Avoids crossing of PSW; • Retaining wall and road alignment encroaches into 30m PSW buffer area. • Direct loss of wetland riparian vegetation and surrounding area of disruption due to construction; **Potential Indirect Impacts** • Erosion/sedimentation; • Potential to affect hydrologic regime of wetland; • Introduction of salt/sand and contaminants from roads will affect wetland; and • Localized effect on wildlife and vegetation during construction; **Potential Mitigation Measures** • Revise road geometry to avoid wetland buffer, if feasible • Use of retaining walls and / or increased grade slopes through buffer to reduce footprint requirement in these areas.	**Provincially Significant Wetlands** **Potential Direct Impacts** • Avoids the King-Vaughan PSW (SWT3); • Avoids 30m PSW buffer area. **Potential Indirect Impacts** • Erosion/sedimentation; • Potential to affect hydrologic regime of wetland; • Introduction of salt/sand and contaminants from roads will affect wetland; and • Localized effect on wildlife and vegetation during construction; **Potential Mitigation Measures** • No wetland specific mitigation identified. • Use of appropriate erosion and sedimentation measures; • Complete a feature-based water balance of the PSW to understand function and dependence of the PSW on buffer areas

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		• Use of structure(s) to cross PSW to minimize direct removals and maintain portion or all existing hydrologic connectivity. • Use of appropriate erosion and sedimentation measures; • Consider wildlife passage structure(s) if feasible to maintain connectivity, where appropriate; • Complete a feature-based water balance of the PSW to inform design and mitigation options. **Other Wetlands** No other wetland units are impacted by this alignment. **Aspect Rank** • Direct impacts associated with Alternative 4 and 5 are the same through the PSW.	• Use of structure(s) to cross PSW to minimize direct removals and maintain portion or all existing hydrologic connectivity. • Use of appropriate erosion and sedimentation measures; • Consider wildlife passage structure(s) if feasible to maintain connectivity, where appropriate; • Complete a feature-based water balance of the PSW to inform design and mitigation options. **Other Wetlands** No other wetland units are impacted by this alignment. **Aspect Rank** • Direct impacts associated with Alternative 4 and 5 are the same through the PSW.	• Use of appropriate erosion and sedimentation measures; • Complete a feature-based water balance of the PSW to understand function and dependence of the PSW on buffer areas potentially impacted. **Other Wetlands** No other wetland units are impacted by this alignment. **Aspect Rank** • Direct impacts associated with Alternative 6 are slightly greater than 6A, but much less than either Alternative 4 or 5	potentially impacted. **Other Wetlands** No other wetland units are impacted by this alignment. **Aspect Rank** • Alternative 6A has no anticipated direct impacts
		Significant Effect (2)	**Significant Effect (2)**	**Moderate Effect (3)**	**Minimal Effect (4)**
Vegetation	• Encroachment on Designated Environmentally Sensitive Areas / Areas of Natural and Scientific Interest • Effects on Significant Terrestrial	**Designated Features** *King-Vaughan Provincially Significant Wetland* • PSW (SWT3) buffer/riparian area will be fragmented by this alignment; • A portion of the wetland riparian area/buffer will be removed within the construction footprint (bridge	**Designated Features** *King-Vaughan Provincially Significant Wetland* • PSW (SWT3) buffer/riparian area will be fragmented by this alignment; • A portion of the wetland riparian area/buffer will be removed within the construction footprint (bridge	**Designated Features** *King-Vaughan Provincially Significant Wetland* • Avoids the King-Vaughan PSW (SWT3); • Alignment and retaining wall encroaches into 30m PSW buffer area. Also, impacts due to construction footprint (grading).	**Designated Features** *King-Vaughan Provincially Significant Wetland* • Avoids the King-Vaughan PSW (SWT3);

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
	Features (encroachment, reduction of area) • Fragmentation/ Connectivity of features • Species at Risk (rare, endangered and threatened) • Opportunities for enhancement	footings, retaining wall, road and associated grading); *Significant Woodlands* • Approximate length through woodland: **933 m**; • 5 Significant Woodlands patches will be directly impacted by this alignment; • Significant direct removal of woodlands will occur within the road footprint and grading limits, largely through the western portion of the alignment; • A total of 8 ELC units will be impacted including wetland, woodland and meadow; and • Alignment will bisect the broader contiguous central woodland at its narrowest point. • Approximate length of hedgerow removed: 0 m • Removal of a hedgerow at the eastern edge of the corridor. • Edge effects and impacts along forest communities. • Potential increased introduction of invasive species. • Potential impacts associated with salt and other contaminants from the introduction of a roadway through these features. Impacts to the following ELC communities: • SWT3; • FOD2-4 (in 2 areas);	footings, retaining wall, road and associated grading); *Significant Woodlands* • Longest length through woodlands (**1069 m**); • 5 Significant Woodland patches will be directly impacted by this alignment; • Greatest amount of direct removal of woodlands will occur as a result of road footprint and grading limits, largely through the western portion of the alignment; • Bisects the broader central woodland at its widest point; • A total of 8 ELC units will be impacted including wetland, woodland and meadow; • Approximate length of hedgerow removed: 372 m • Removal of a hedgerow at the eastern edge of the corridor. • Edge effects and impacts along forest communities. • Potential increased introduction of invasive species. • Potential impacts associated with salt and other contaminants from the introduction of a roadway through these features Impacts to the following ELC communities: • SWT3; • FOD2-4 (in 2 areas);	*Significant Woodlands* • Approximate length through woodland: **661 m;** • 4 Significant Woodlands patches will be directly impacted by this alignment; • Moderate direct removal of woodlands will occur within the road footprint and grading limits through the western portion of the alignment - compared to Options 4 and 5 - effects are primarily associated with edge; • Bisects the broader central woodland at its narrowest point; and • A total of 6 ELC units will be impacted including woodland, thicket and meadow. • Approximate length of hedgerow removed: 153 m • Removal of a hedgerow at the eastern edge of the corridor. • Edge effects and impacts along forest communities. • Potential increased introduction of invasive species. • Potential impacts associated with salt and other contaminants from the introduction of a roadway through these features. Impacts to the following ELC communities:	*Significant Woodlands* • Shortest crossing length through woodlands (**274 m**); • Least amount of direct removal of/impact to woodlands as of result of road footprint and grading limits, largely at the western most point of the alignment near Dufferin Street and through the large central contiguous woodland patch. • Bisects the broader central woodland at its narrowest point; and • A total of 4 ELC units will be impacted including woodland, thicket and meadow. • Approximate length of hedgerow removed: 153 m • Removal of a hedgerow at the eastern edge of the corridor. • Edge effects and impacts along forest communities. • Potential increased introduction of invasive species. • Potential impacts associated with salt and other contaminants from the introduction of a roadway through these features. Impacts to the following ELC communities: - FOD2-4 (in 1 area along edge of feature); - FOD5-11; - CUT1-7; - CUM1-1; and - Hedgerow.

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		• FOD5-3; • FOD3-1; • Edge of FOD6-2; • FOD5-11; • CUM1-1; and • Hedgerow. *Areas of Natural and Scientific Interest* • Maple Spur ORM Earth Science Provincially Significant ANSI; • Maple Uplands and Kettles Life Science Provincially Significant ANSI; *Oak Ridges Moraine Conservation Plan* • Natural Core area and Natural Linkage area. *Regional Greenlands (York OP, 2013)* • Impact to woodlands identified as Regional Greenlands in the York OP. **Potential Mitigation Measures** • Narrowing road width through sensitive features; • Consider minor geometric design changes to minimize encroachment areas; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in sensitive areas (north side);	• FOD5-3; • FOD3-1; • Edge of FOD6-2; • FOD5-11; • CUM1-1; and • Hedgerow. *Areas of Natural and Scientific Interest* • Maple Spur ORM Earth Science Provincially Significant ANSI; • Maple Uplands and Kettles Life Science Provincially Significant ANSI; *Oak Ridges Moraine Conservation Plan* • Natural Core area and Natural Linkage area. *Regional Greenlands (York OP, 2013)* • Impact to woodlands identified as Regional Greenlands in the York OP. **Potential Mitigation Measures** • Narrowing road width through sensitive features; • Consider minor geometric design changes to minimize encroachment areas; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in sensitive areas (north side);	- FOD2-4 (in 2 areas along edge of feature); - FOD5-3 (along edge of feature); - FOD5-11; - CUT1-7; - CUM1-1; and - Hedgerow. *Areas of Natural and Scientific Interest* • Maple Spur ORM Earth Science Provincially Significant ANSI; • Maple Uplands and Kettles Life Science Provincially Significant ANSI; *Oak Ridges Moraine Conservation Plan* • Natural Core area and Natural Linkage area. *Regional Greenlands (York OP, 2013)* • Impact to woodlands identified as Regional Greenlands in the York OP. **Potential Mitigation Measures** • Narrowing road width through sensitive features; • Consider minor geometric design changes to minimize encroachment areas; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in sensitive areas (north side); • Use of appropriate erosion and	*Areas of Natural and Scientific Interest* • Maple Spur ORM Earth Science Provincially Significant ANSI; • Maple Uplands and Kettles Life Science Provincially Significant ANSI; *Oak Ridges Moraine Conservation Plan* • Natural Core area and Natural Linkage area. *Regional Greenlands (York OP, 2013)* Impact to woodlands identified as Regional Greenlands in the York OP. **Potential Mitigation Measures** • Narrowing road width through sensitive features; • Consider minor geometric design changes to minimize encroachment areas; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in sensitive areas (north side); • Use of appropriate erosion and sedimentation measures.

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		• Use of appropriate erosion and sedimentation measures. **Aspect Rank** Direct Impacts are slightly less than Alternative 5. Significant amount of woodland removal/impacts.	• Use of appropriate erosion and sedimentation measures. **Aspect Rank** Similar impact to Alternative 4 but greatest amount of direct impact to woodland features.	sedimentation measures. **Aspect Rank** Less direct impacts when compared to Alternatives 4 and 5 - shorter length through woodlands, smaller amount of woodland removal.	**Aspect Rank** Least amount of direct removal of woodlands and associated impacts as compared to all other Alternatives.
		Significant Effect (2)	**Very Significant Effect (1)**	**Moderate Effect (3)**	**Minimal Effect (4)**
Wildlife Habitat	• Effects on Significant Wildlife Habitat (encroachment, reduction of area) • Fragmentation/ Connectivity of features • Species at Risk (rare, endangered and threatened) • Opportunities for enhancement	**Species at Risk (SAR):** • Direct impact to confirmed habitat for two Endangered bat species: Little Brown Myotis and Eastern Small-footed Myotis in two locations: • Moderate impact and total length within meadow feature CUM1-1, identified as Bobolink (Threatened) breeding habitat, approximate length through cultural meadow: **167 m**; and • Moderate amount of potential impact to Category 1 Butternut trees (Endangered) – 3 trees. **Significant Wildlife Habitat (SWH):** • Significant impact to woodlands identified as SWH for species of Conservation Concern (Eastern Wood -Pewee, Wood Thrush) and Bat maternity colonies resulting in direct loss and fragmentation of woodlands/habitat; and • Reduction in interior woodland breeding bird habitat due to encroachment into/removal of woodland features in large	**Species at Risk (SAR):** • Direct impact to confirmed habitat for two Endangered bat species: Little Brown Myotis and Eastern Small-footed Myotis in two locations. • Least amount of impact and total length within meadow feature CUM1-1, identified as Bobolink (Threatened) breeding habitat, Approximate length through cultural meadow: **38 m**; and • Significant amount of potential impact to Category 1 Butternut trees (Endangered) – 7 trees. **Significant Wildlife Habitat (SWH):** • Greatest amount of impact to woodlands identified as SWH for species of Conservation Concern (Eastern Wood -Pewee, Wood Thrush) and Bat maternity colonies resulting in direct loss and fragmentation of woodlands/habitat; and • Reduction in interior woodland breeding bird habitat due to encroachment into/removal of	**Species at Risk (SAR):** • Direct impact to confirmed habitat for two Endangered bat species: Little Brown Myotis and Eastern Small-footed Myotis in two locations. • Longest length (**178m)** and most amount of impact within meadow feature identified as Bobolink (Threatened) habitat; • Moderate amount of potential impact to Category 1 Butternut trees (Endangered) – 4 trees. **Significant Wildlife Habitat (SWH):** • Direct loss and fragmentation of woodlands adjacent to Dufferin Street (identified as SWH for bat maternity colonies); • Moderate direct loss/impact to woodlands identified as SWH for Species of Conservation Concern (Eastern Wood -Pewee and Wood Thrush) - compared to Options 4 and 5 – effects primarily associated with edge;	**Species at Risk (SAR):** • Direct impact to confirmed habitat for two Endangered bat species: Little Brown Myotis and Eastern Small-footed Myotis in one location and affects edge of habitat in one location. • Moderate amount of impact and total length within meadow feature, identified as Bobolink (Threatened) breeding habitat - approximate length through cultural meadow: **173 m**; • Moderate amount of potential impact to Category 1 Butternut trees (Endangered) – 4 trees. **Significant Wildlife Habitat (SWH):** • Least amount of impact to woodlands identified as SWH for species of Conservation Concern (Eastern Wood-Pewee and Wood Thrush) and Bat maternity colonies resulting in less fragmentation and direct loss of vegetation/habitat; • Reduction in interior woodland breeding bird habitat due to encroachment into/removal of woodland features in large contiguous central woodland.

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		contiguous central woodland. **General Wildlife:** • Direct removal of woodland, wetland and meadow features resulting in loss of wildlife habitat and vegetation; and • Fragmentation of woodlots resulting in loss of wildlife habitat and connectivity. **Potential Mitigation Measures** • Narrowing road width through sensitive features, where feasible; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in these areas; • Use of appropriate erosion and sedimentation measures; and • Integrate wildlife passage structure(s) into the design at key locations to maintain connectivity. **Aspect Rank** Direct Impacts are slightly less than Alternative 5. Significant amount of removal/impact to woodlands identified to provide SWH habitat. Moderate impact to Bobolink habitat	woodland features in large contiguous central woodland. **General Wildlife:** • Direct removal of woodland, wetland and meadow features resulting in loss of wildlife habitat and vegetation; and • Fragmentation of woodlots resulting in loss of wildlife habitat and connectivity. **Potential Mitigation Measures** • Narrowing road width through sensitive features, where feasible; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in these areas; • Use of appropriate erosion and sedimentation measures; and • Integrate wildlife passage structure(s) into the design at key locations to maintain connectivity. **Aspect Rank** Similar impact to Alternative 4 but greatest amount of direct impact and removal to woodland features identified to provide SWH habitat. Shortest length within cultural	• Reduction in interior woodland breeding bird habitat due to encroachment into/removal of woodland features in large contiguous central woodland. **General Wildlife:** • Direct removal of woodland and meadow features resulting in loss of wildlife habitat and vegetation; and • Fragmentation of woodlots resulting in loss of wildlife habitat and connectivity. **Potential Mitigation Measures** • Narrowing road width through sensitive features, where feasible; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in these areas; • Use of appropriate erosion and sedimentation measures; and • Integrate wildlife passage structure(s) into the design at key locations to maintain connectivity. **Aspect Rank** Less direct impacts when compared to Alternatives 4 and 5 - shorter length through woodlands and smaller amount of removal /impacts to woodlands identified to provide SWH habitat. Longest length and most impacts	**General Wildlife:** • Direct removal of woodland and meadow features resulting in loss of wildlife habitat and vegetation; and • Fragmentation of woodlots resulting in loss of wildlife habitat and connectivity. **Potential Mitigation Measures** • Narrowing road width through sensitive features, where feasible; • Use of retaining walls and / or increased grade slopes through sensitive features to reduce total footprint in these areas; • Use of appropriate erosion and sedimentation measures; and • Integrate wildlife passage structure(s) into the design at key locations to maintain connectivity. **Aspect Rank** Least amount of direct removal of woodlands identified to provide SWH habitat and associated impacts as compared to all other Alternatives. Moderate impact to Bobolink habitat and

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		and Category 1 Butternut trees. All Alternatives affect SAR bat habitat equally except for Alternative 6A which will result in least amount of impact/removal of woodlands identified to provide habitat for SAR bats.	meadow and least effect on Bobolink habitat. Significant impact to Category 1 Butternut trees. All Alternatives affect SAR bat habitat equally except for Alternative 6A which will result in least amount of impact/removal of woodlands identified to provide habitat for SAR bats.	predicted to Bobolink habitat. Moderate impact to Category 1 Butternut trees. All Alternatives affect SAR bat habitat equally except for Alternative 6A which will result in least amount of impact/removal of woodlands identified to provide habitat for SAR bats.	Butternut trees. Least amount of impact/removal of woodlands identified to provide habitat for SAR bats.
		Significant Effect (2)	**Very Significant Effect (1)**	**Moderate Effect (3)**	**Moderate Effect (3)**
Aquatic Features Aspect					
Surface Water Quantity and Quality	Degree of interference with water quality, thermal regime or baseflow	• Crosses at PSW not within creek channel. • Small drainage feature originates from PSW. Changes to hydrologic inputs from wetland can impact flows to drainage feature. i.e. grading within wetland buffer, retaining wall within wetland buffer. • No impacts to thermal regime anticipated as this watercourse does not provide direct or contributing fish habitat.	• Crosses at PSW not within creek channel. Small drainage feature originates from PSW. Changes to hydrologic inputs from wetland can impact surface water flows to downstream drainage feature. i.e. grading within wetland buffer, retaining wall within wetland buffer. • No impacts to thermal regime anticipated as this watercourse does not provide direct or contributing fish habitat.	• Crosses East Patterson Creek at an area where there is narrow intermittent riparian habitat. No impacts to downstream flows anticipated. • No impacts to thermal regime anticipated as this watercourse does not provide direct or contributing fish habitat.	• Crosses East Patterson Creek at an area where there is narrow intermittent riparian habitat. No impacts to downstream flows anticipated. • No impacts to thermal regime anticipated as this watercourse does not provide direct or contributing fish habitat.
		Moderate Effect (3)	**Moderate Effect (3)**	**Minimal Effect (4)**	**Minimal Effect (4)**
Aquatic Habitat	Effects on extent (area) and function of riparian habitat	**Fish and Fish Habitat** • There is no direct fish habitat within the study area; • No direct impacts to the contributing habitat present in the HDF; • No riparian fish habitat is impacted. • Crosses at PSW (SWT3) not	**Fish and Fish Habitat** • There is no direct fish habitat within the study area; • No direct impacts to the contributing habitat present in the HDF; • No riparian fish habitat is impacted.	**Fish and Fish Habitat** • There is no direct fish habitat within the study area; • Direct impacts to the contributing habitat present in the HDF; • There is no riparian habitat associated with the HDF / Narrow and intermittent riparian habitat impacted by crossing.	**Fish and Fish Habitat** • There is no direct fish habitat within the study area; • Direct impacts to the contributing habitat present in the HDF; • There is no riparian habitat associated with the HDF / Narrow and intermittent riparian habitat impacted by crossing.

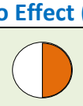
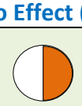
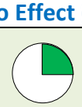
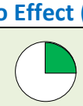
Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		watercourse. **Potential Mitigation Measures** • No mitigation measures are identified for aquatic habitat as no impacts are anticipated with this alignment. **Aspect Rank** • Direct impacts associated with Alternative 4 and 5 are the same – crosses at PSW not watercourse.	• Crosses at PSW (SWT3) not watercourse. **Potential Mitigation Measures** • No mitigation measures are identified for aquatic habitat as no impacts are anticipated with this alignment. **Aspect Rank** • Direct impacts associated with Alternative 4 and 5 are the same – crosses at PSW not watercourse.	**Potential Mitigation Measures** • Maintain contributions from headwater drainage feature to downstream watercourse. **Aspect Rank** • Direct impacts associated with Alternative 6 and 6A are the same – moderate effects to watercourse can be mitigated.	**Potential Mitigation Measures** • Maintain contributions from headwater drainage feature to downstream watercourse. **Aspect Rank** • Direct impacts associated with Alternative 6 and 6A are the same – moderate effects to watercourse can be mitigated.
		No Effect (5)	**No Effect (5)**	**Minimal Effect (4)**	**Minimal Effect (4)**
Surface Drainage Aspect					
Watercourses	• Requirements for crossing of East Patterson Creek (reduction of area)	• Small drainage feature originates from PSW (SWT3); impacts to the PSW with this Alignment will impact hydrologic inputs to the drainage feature. • 50 m single span bridge structure and retaining wall required for crossing over the wetland. Potential grading impact within wetland buffer area. **Potential Mitigation Measures** • Maintain hydraulic / hydrologic connection of the wetland across the road (e.g. structure). **Aspect Rank** • Direct impacts associated with	• Small drainage feature originates from PSW (SWT3); impacts to the PSW with this Alignment will impact hydrologic inputs to the drainage feature. • 50 m single span bridge structure and retaining wall required for crossing over the wetland. Potential grading impact within wetland buffer area. **Potential Mitigation Measures** • Maintain hydraulic / hydrologic connection of the wetland across the road (e.g. structure). **Aspect Rank** • Direct impacts associated with	• Alignment will cross the small drainage feature that originates in the PSW (SWT3); • Direct impact to portions downstream of the Alignment. • Open bottom culvert crossing over the watercourse. Avoids the need for wetland crossing. Outside of TRCA regulatory limits. • Crossing the watercourse at a perpendicular angle through a disturbed area is preferred from geomorphological perspective. **Potential Mitigation Measures** • Maintain connectivity (e.g. structure, maintain inputs downstream) **Aspect Rank**	• Alignment will cross the small drainage feature that originates in the PSW (SWT3); • Direct impact to portions downstream of the Alignment. • Open bottom culvert crossing over the watercourse. Avoids the need for wetland crossing. Outside of TRCA regulatory limits. • Crossing the watercourse at a perpendicular angle through a disturbed area is preferred from geomorphological perspective. **Potential Mitigation Measures** • Maintain connectivity (e.g. structure, maintain inputs downstream) **Aspect Rank**

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		Alternative 4 and 5 are the same - encroachment of bridge footings and retaining wall in wetland buffer. • Potential impacts to hydrologic inputs of wetland to downstream drainage feature/watercourse.	Alternative 4 and 5 are the same - encroachment of bridge footings and retaining wall in wetland buffer. • Potential impacts to hydrologic inputs of wetland to downstream drainage feature/watercourse.	• Direct impacts associated with Alternative 6 and 6A are the same – moderate effects to watercourse can be mitigated.	• Direct impacts associated with Alternative 6 and 6A are the same – moderate effects to watercourse can be mitigated.
		Moderate Effect (3)	**Moderate Effect (3)**	**Minimal Effect (4)**	**Minimal Effect (4)**
Stormwater Management	• Effects on catchment area • Operation and maintenance requirements • Opportunities to enhance roadway stormwater management measures, including coordination with/use of adjacent future development facilities	• Five culverts for minor depressions and one bridge for East Patterson Creek. • Small footprint impact on the drainage areas. • Shorter road length requires less SWM infrastructure. • Culverts can be designed to accommodate wildlife passage.	• Four culverts for minor depressions and one bridge for East Patterson Creek. • Smallest footprint impact on the drainage areas. • Shortest road length requires least SWM infrastructure. • Culverts can be designed to accommodate wildlife passage.	• Five culverts for minor depressions and one culvert for East Patterson Creek. • Greater footprint impact on the drainage areas. • Longer road length requires more SWM infrastructure. • Moderate Impacts on proposed SWM solutions by the super elevation in the road which is caused by additional curvature of the road. • Culverts can be designed to accommodate wildlife passage.	• Five culverts for minor depressions and one culvert for East Patterson Creek. • Greatest footprint impact on the drainage areas. • Longest road length requires more SWM infrastructure. • Moderate impacts on proposed SWM solutions by the super elevation in the road which is caused by additional curvature of the road. • Culverts can be designed to accommodate wildlife passage.
		Minimal Effect (4)	**No Effect (5)**	**Moderate Effect (3)**	**Moderate Effect (3)**
Groundwater Aspect					
Recharge/Discharge Areas	• Degree of interference with groundwater recharge/discharge areas	• Direct encroachment into PSW (SWT3) riparian area (buffer) which can result in the disruption to the ground water regime associated with the wetland. **Potential Mitigation Measures** • Completion of a feature-based water balance analysis to determine wetland function and develop	• Direct encroachment into PSW (SWT3) riparian area (buffer) which can result in the disruption to the ground water regime associated with the wetland. **Potential Mitigation Measures** • Completion of a feature-based water balance analysis to determine wetland function and	• No major impact anticipated. Potential impact to groundwater regime associated with PSW due to close proximity of road works (footprint and grading). **Potential Mitigation Measures** • Completion of a feature-based water balance analysis to determine wetland function and	• No impact anticipated. Potential to impact groundwater regime associated with PSW due to close proximity or road works (footprint and grading). **Potential Mitigation Measures** • Completion of a feature-based water balance analysis to determine wetland function and develop appropriate

Natural Environment Net Effect Analysis for Road Alignments

Criteria	Measures	Alternative Road Alignments			
		Alignment 4 Minor Northerly Diversion with Wetland Crossing to Minimize Impacts to Forest	**Alignment 5** Direct Extension with Wetland Crossing	**Alignment 6** South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest	**Alignment 6A** Modified South to North Minor Jog Diversion to Avoid Wetland and Minimize Impacts to Forest
		appropriate mitigation measures. • Maintain hydraulic / hydrologic connectivity across road (e.g. structure) **Aspect Rank** Similar effects for both Alternatives 4 and 5. Impacts within wetland buffer can result in disruption to ground water regime of wetland.	develop appropriate mitigation measures. • Maintain hydraulic / hydrologic connectivity across road (e.g. structure) **Aspect Rank** Similar effects for both Alternatives 4 and 5. Impacts within wetland buffer can result in disruption to ground water regime of wetland.	develop appropriate mitigation measures. **Aspect Rank** Potential to affect groundwater regime of wetland as minor encroachment into wetland buffer area.	mitigation measures. **Aspect Rank** No direct impact anticipated as no encroachment into wetland or buffer area is proposed.
		Moderate Effect (3)	**Moderate Effect (3)**	**Minimal Effect (4)**	**Minimal Effect (4)**
Groundwater Quality	Effects on vulnerable areas (area)	No significant difference between alternative designs.	No significant difference between alternative designs.	No significant difference between alternative designs.	No significant difference between alternative designs.
		No Effect (5)	**No Effect (5)**	**No Effect (5)**	**No Effect (5)**
NATURAL ENVIRONMENT RANKING	Average Symbol				
	Average Score	3.22	3.11	3.67	3.89
Summary	Alternatives 4 and 5 will result in the most amount of impact to adjacent natural heritage features with Alternative 5 resulting in the most amount of impact. Alternative 6 and 6A will result in relatively equal amounts of impact to adjacent features with Alternative 6 resulting in more encroachment into adjacent woodland and PSW buffer area than Alternative 6A. Alternative 6A is the preferred as it avoids most woodlands and the PSW and associated riparian area, Alternative 5 is least preferred as it will result in the greatest amount of removal of woodlands and encroaches within PSW riparian areas.				

APPENDIX C1.3

Detailed Impact Assessment for Alignment 5A

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Predicted Effects, Mitigation, Enhancement and Net Effects – Preferred Alignment 5A, Kirby Road Extension EA

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
Significant Natural Heritage Features						
1. Significant Wetlands	• One unit of the King-Vaughan Wetland PSW Complex is located partially within the northeastern corner of the Subject Lands. The unit consists of an Organic Thicket Swamp (SWT3) • The wetland receives surface water inputs from the upstream agricultural field. Prior to 2016, a portion of the field consisted of meadow marsh (MAM), but tile drainage was installed in spring 2016 as part of the agricultural practices on this field, effectively removing the meadow marsh • Seeps have been noted in the forest units adjacent to the wetland and this groundwater input may also maintain wetland characteristics within the unit • The wetland drains to the south via an excavated, channelized surface water drainage feature, although this flow stops at the TransCanada Pipeline corridor at the southern end where it pools before evaporating or infiltrating. There is no direct hydraulic connection with any downstream watercourse	• No direct footprint impacts on the wetland will occur • Construction of retaining wall adjacent to and within PSW buffer resulting in potential indirect impact to wetland hydrology • Potential indirect effects due to construction of the proposed development adjacent to the wetland (i.e., ground disturbance, vegetation removal, use of heavy equipment) • Long-term increase in impervious surfaces related to the installation of the road adjacent to the wetland • Alteration to the surface water drainage channel that drains water from the wetland • Surface water runoff from the adjacent road	• Potential indirect effects due to erosion and sedimentation from the construction site could potentially result in impaired water quality within the wetland and smothering of vegetation due to deposited sediment • Accidental spills of potentially contaminating materials (e.g., fuel, oil) from construction equipment could potentially result in negative effects to vegetation and wildlife within and downstream from the wetland • Alterations in water delivery to the wetland via surface and/or groundwater pathways due to changes in stormwater runoff and infiltration in the catchment area could potentially result in changes to the form and function of the wetland (i.e., reduction in habitat for species dependent on current moisture regime). Degree of change to be assessed. • Depending on the nature of the proposed alterations to the downstream surface water drainage feature (which is confirmed through additional engineering), alterations in water levels within the wetland could potentially occur. Water level changes could alter the existing vegetation community and hydrological functions of the wetland • Direct runoff from roads adjacent to the wetland setback could potentially result in effects on water quality within the wetland (e.g., due to contaminants such as road runoff contaminants such as salt or sand)	• A 30-m setback is generally proposed between the wetland boundary and the proposed adjacent road, except in vicinity of retaining wall. • Use of retaining wall and increased grade slopes through buffer to reduce footprint requirement in these areas. • The buffer will be vegetated to provide riparian functions to the wetland. No other construction or site alteration will occur within the 30-m buffer other than the proposed retaining wall. • Proposed retaining wall will be constructed from the outside side of the wetland (adjacent to the road) and backfilled on from the road side, so as not to disrupt the wetland. • Barriers (e.g., temporary fencing) will be proposed at the limit of the 30-m setback, to prevent accidental encroachment into the setback area during construction • Erosion and sedimentation control measures will be used throughout construction to avoid/minimize the potential for off-site sedimentation within the wetland • A spill prevention and response plan will be prepared to identify measures to avoid	• No net effects on the wetland are predicted during construction provided the mitigation measures (ESC, spill prevent and response measures) are implemented • No long-term net effects on the wetland are predicted due to adjacent development provided that stormwater management and/or LID measures are effective in maintaining the water balance. • No net effects on the wetland due to the downstream surface water channel alterations are anticipated, provided the design of the alteration maintains existing water levels within and surface water flows from the wetland	• Monitoring during construction is recommended to confirm that erosion and sedimentation control measures and spill prevention and response measures are installed and functioning as designed. Remedial measures should be implemented as soon as possible, if deficiencies or unanticipated negative effects are identified during monitoring • Monitoring of vegetation survival and growth within areas of the 30-m buffer that were planted to confirm targets for survival, vegetation species and form are met • Post-construction monitoring of vegetation communities within the wetland is recommended to confirm that water balance is being maintained

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
				negative effects due to accidental spills during construction on the Subject Lands • Stormwater management, potentially including Low Impact Development (LID) measures will be used to maintain water balance to the wetland (if necessary, based on results of water balance assessment) • Alterations to the downstream surface water drainage feature should not alter the invert elevation at the wetland discharge point to prevent changes in wetland outflow • The 30-m buffer from the wetland will assist in mitigating potential impaired quality of surface runoff from the road. The adjacent road will not drain directly to the wetland		
2. Significant Woodlands	• Significant woodlands are present on and within 120 m of the Subject Lands. A total of 64 ha of significant woodland is present within the Study Area • Woodlands on and adjacent to the Subject Lands have been identified as significant based on various criteria including size, interior habitat and the presence of watercourses and wetlands • Some woodlands on and adjacent to the Subject Lands provide Significant Wildlife Habitat and habitat for endangered species	• Vegetation clearing within significant woodlands to facilitate construction of the proposed road • Development and site alteration adjacent to slopes within residual woodlands • Creation of new edge within the retained woodlands	• Removal of 3.20 ha of significant woodland on the Subject Lands and associated loss of woodland function (e.g., wildlife habitat) • Potential effects on residual woodland due to clearing and site alteration • Potential changes in form and function of residual woodland on and adjacent to the Subject Lands due to edge effects associated with removal of existing woodland area (e.g., sunscald, windthrow, increased light penetration) • Potential alterations in the significant of woodlands on the adjacent lands due to decrease in woodland size associated with removal of parts of the woodlands within the Study Area • Potential alterations in water balance within the residual woodlands • Potential construction-related impacts	• Pre-stressing trees along the proposed new edge over a pre-construction period • Trees removed from significant woodlands will be felled away from the retained woodland • Tree protection measures (e.g., hoarding, temporary fencing at the dripline) may be used to avoid effects on residual woodland trees during construction • New lighting along the streetscape will be directed away from natural vegetation communities to limit impacts to wildlife activity; • Where trees are proposed for removal, appropriate	• Permanent loss of 3.20 ha of Significant Woodlands on the Subject Lands • TRCA and the Municipality to track the land area removed from the natural system from this road infrastructure project and work together to explore avenues to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means • Permanent increase in woodland area and/or function in off-site woodlands, if off-site compensation is	• Woodland compensation areas will be monitored to confirm that compensation is meeting targets (e.g., vegetation survival rates and coverage)

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
			from on-site grading and other machinery include: o Soil compaction and potential for micro-drainage changes that could cause localized ponding and inundation of rooting systems; o Introduction of non-native plant species I the disturbed margins of the developed footprint, displacing some native flora; and, • Stress/dieback (root impact, contaminants, increased sediment).	arboricultural best management practices should be utilized, and care should be taken to prevent damage to the trunks and root systems of nearby trees. Minimizing use of heavy equipment and will prevent inadvertent damage to retained woodlot features; • Off-site compensation may be necessary to address predicted loss of significant woodland area within the Study Area. • Compensation ratio and required area of woodland compensation determined according the TRCA Guideline for Determining Ecosystem Compensation (2018) is 19.4 ha • Disturbed areas along the north edge of road adjacent to core woodland and wetland buffer have been identified as potential woodland compensation areas. • According to the TRCA compensation guideline land based compensation does not need to be addressed on an individual project basis. TRCA and the Municipality can track the land area removed from the natural system from all infrastructure projects and work together to explore avenues to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means. • Stormwater management will consider water balance needs of residual woodlands to ensure they are maintained	undertaken	

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
3. Significant Wildlife Habitat	• Bat Maternity Colony SWH is present within woodlands on the Subject Lands	• Removal of woodland on the Subject Lands for the proposed road construction • Development and site alteration adjacent to residual woodlands • Creation of new woodland edge	• Removal of 3.20 ha of Bat Maternity Colony SWH on the Subject Lands (i.e., woodland removal) • Overall reduction in the suitability of the Subject Lands for supporting bat maternity colonies • Potential direct disturbance of bats during tree removal	• Road alignment has been modified to reduce the amount of woodland and SWH that will be impacted • For every 5 suitable trees removed, one replacement bat habitat replacement structure should be installed in a suitable location on or adjacent to the Subject Lands • Public access to roosting areas should be discouraged by fencing or signage • Available open space adjacent to the woodland should be planted with native vegetation to increase habitat for night-flying insects and therefore foraging opportunities for bats • Mitigation to prevent negative impacts on residual woodlands, as outlined in other sections, will assist in mitigating effects on this SWH in residual woodlands on the Subject Lands • New lighting along the streetscape will be directed away from natural vegetation communities to limit impacts to wildlife activity. • Tree removal should occur outside the primary bat roosting periods (April to end of September)	• Permanent removal of 3.20 ha of Bat Maternity Colony SWH on the Subject Lands, but replaced with suitable roosting habitat where possible and supplemented with bat habitat replacement structures in other areas within the Study Area and adjacent lands.	• Monitoring of bat replacement habitat structures is recommended to confirm effectiveness
	• Seeps and Springs SWH is present within the area immediately adjacent to the King-Vaughan Significant Wetland unit in the northeast corner of the Subject Lands and Adjacent lands • The recharge areas associated with the seeps and springs SWH	• Placement of retaining wall within the recharge area including • Increased imperviousness due to road construction	• Potential reductions in the volume of groundwater recharge within the catchment area and associated reductions in groundwater discharge volume or alterations to hydroperiod of discharge • Reductions in seepage volume or changes in timing could negatively impact wildlife habitat functions (e.g., drinking water, winter/early spring forage)	• Hydrogeological studies and water balance to be completed to confirm if impacts to the seepage area are expected • If impacts are predicted, LID or stormwater management measures will be required to ensure groundwater balance is maintained to provide	• No long-term net effects on the seepage due to adjacent development are anticipated provided that stormwater management and/or LID measures are effective in maintaining water balance. This will be confirmed through a	

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	to be defined based on the results of hydrogeological assessments			continued wildlife habitat functions associated with the seepage • Fencing should be considered in to discourage public access into the area	water balance exercise	
	• Area Sensitive Breeding Bird Habitat SWH is present in the north central area of the Subject Lands and on the adjacent lands • Deep interior habitat (i.e. greater than 200 m from the forest edge) is present on the Adjacent Lands and this is considered sensitive to impacts	• Removal of woodland on the Subject Lands for the proposed development (ELC unit FOD5-11)	• Removal of 1.14 ha of woodland supporting this type of SWH, although no change in the actual surface area of deep interior woodland • Therefore, minor reduction in the suitability of the Subject Lands for supporting area sensitive bird species that may use edge habitat within the area sensitive SWH polygon	• Compensation plantings and/or ecological restoration may be required to provide a long-term enhancement to interior forest • Discouraging public access into the SWH through fencing, prevention of trail creation and signage • Woodland removals to be timed to avoid disrupting habitat when migratory bird breeding is occurring • New lighting along the streetscape will be directed away from natural vegetation communities to limit impacts to wildlife activity.	• Minor negative impacts due to loss of some edge habitat and encroachment of public activities into the SWH, although no impacts on the size of deep interior forest on the adjacent lands • Planting of disturbed areas along the north edge of road adjacent to core woodland and wetland buffer have been identified as potential woodland compensation areas • TRCA and Municipality to work together to explore compensation to address land area removed from the natural system resulting from road infrastructure to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means. • Compensation measures could result in long-term increase in the size of deep interior forest that may benefit area sensitive breeding birds	• Monitoring of the success of compensation area plantings should be completed to ensure targets are being met
	• Special Concern Birds species SWH is present within and adjacent to the Study Area	• Removal of 3.20 ha of woodland on the Subject Lands that	• Removal of 3.20 ha of woodland that provides SWH for Eastern Wood Pewee and Wood Thrush	• Road alignment has been modified to reduce the amount of woodland and SWH that will	• Removal of 3.20 ha of SWH on the Subject Lands; compensation	• Monitoring of revegetation success in compensation areas is recommended to

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	based on habitat for Eastern Wood-Pewee and Wood Thrush, both listed as Special Concern in Ontario • Impact to SWH habitat for Eastern Wood Pewee and Wood Thrush resulting from the proposed road construction • Habitat is present in woodlands on and adjacent to the Study Area	provide SWH habitat for Eastern Wood Pewee resulting from the proposed road construction • Development and site alteration adjacent to residual woodlands • Creation of new edge within the residual woodlands	• Overall reduction in the suitability of the Study Area for supporting this special concern bird species • Direct disturbance of birds during tree removal	be impacted. Alignment will impact SWH for Eastern Wood Pewee and Wood Thrush • Use of mitigation measures required to prevent negative impacts on residual woodlands as described in significant woodland section above • New lighting along the streetscape will be directed away from natural vegetation communities to limit impacts to wildlife activity. • Woodland removals should be timed to avoid disrupting habitat when migratory bird breeding is occurring	activities could limit these effects • Short to medium term impact to Eastern Wood Pewee and Wood Thrush are anticipated due to reductions in habitat on the Subject Lands unless compensation habitat is sufficiently developed • Planting of disturbed areas along the north edge of road adjacent to core woodland and wetland buffer have been identified as potential woodland compensation areas • TRCA and Municipality to work together to explore compensation to address land area removed from the natural system resulting from road infrastructure to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means.	confirm effectiveness
	• Candidate Raptor Wintering area SWH. Not confirmed within the Study Area based on surveys to date • ELC ecosite present that is greater than 20 ha in size • Additional study is required to confirm this SWH	• Potential removal of candidate SWH habitat for winter raptors from the proposed road construction	• Potential overall reduction in the suitability of the Study Area for supporting winter raptor habitat	• Road alignment has been modified to reduce the amount of woodland that will be impacted. • Woodland removals should be timed to avoid disrupting winter habitat (roosting) • New lighting along the streetscape will be directed away from natural vegetation communities to limit impacts to wildlife activity.	• Planting of disturbed areas along the north edge of road adjacent to core woodland and wetland buffer have been identified as potential woodland compensation areas • TRCA and Municipality to work together to explore compensation to address land area removed from the natural system resulting from road infrastructure to off-set	• 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
					these losses through existing municipal land acquisition and ecological restoration programs or other means.	
	• Candidate Reptile Hibernaculum • Two potential snake hibernacula (AS3 and AS4, Figure 7, Appendix A of NHEC report) found in mid-September. No congregations of snakes (at least two species, or > 5 individuals of one species) recorded.	• Potential hibernacula AS3 is associated with a rural outbuilding foundation. This building will not be removed as a result of the road construction. • Potential hibernacula AS4 will not be directly impacted as it is associated with an area of woodlot FOD5-11 that will not be removed	• No direct removal of candidate reptile hibernacula areas predicted • Impacts to reptile movement patterns as a result of the new road	• Incorporation of wildlife passage structure(s) into the design at key locations to maintain connectivity.	• No effects are predicted if wildlife passage and connectivity is maintained	N/A
	• Candidate Candidate SWH identified for amphibian station B (Figure 6, Appendix A, NHEC report) located off-site just past the northern boundary of the Study Area • This SWH type is not present within the Study Area. Minimum indicator species abundance/diversity threshold not met	• N/A	• N/A	• N/A	• N/A	N/A
4. Fish Habitat	• Not present - the intermittent surface water drainage feature on the Subject Lands does not have a direct surface water hydraulic connection with downstream reaches of Patterson Creek that may provide direct fish habitat, due to the barrier provided by the TransCanada Pipeline corridor	• 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
5. Habitat of Endangered and Threatened Species	• Myotis bat species (Endangered) were identified on the Subject Lands during acoustic studies in 2016 and 2017. Myotis species found in association with woodlands within the Study Area	• Removal of woodlands to facilitate construction of the proposed road	• Removal of habitat for Endangered Myotis on the Subject Lands • Potential effects on bats due to tree removal within the breeding and juvenile growth period	• Tree removal will not occur between April 1 and September 30 to prevent disruption to bats during critical reproductive and juvenile growth periods. If tree removal is required during this period, bat surveys will be completed by a qualified biologist. If no species at risk bats are observed, the tree(s) can be removed within 24 hours • Mitigation to prevent impacts on residual trees on the Subject lands will also assist in mitigating further impacts on this species • Consultation will occur with MECP to identify other avoidance, mitigation and/or overall benefit measures	• Removal of habitat for Endangered Myotis on the Subject Lands • Compensation may be required to ensure an overall benefit for the species	• Consultation will occur with MECP to identify potential monitoring or management measures with respect to this species
	• One Category 2 (retainable) Butternut (Endangered) tree and 8 Category 1 trees	• Vegetation clearing, excavation and use of heavy equipment within 50 m of Butternut trees	• Potential injury or mortality of trees due to direct effects on roots, or indirect effects due to creation of new edge	• Barriers will be installed at the edge of the work area to prevent/minimize encroachment to Butternut trees • Completion of IGF with MECP • Submission of Butternut health assessment (BHA) to MNRF in August of 2018 • No protective measures or mitigation for removal of Category 1 trees under section 23.7 of O. Reg 242/08 of the ESA • Category 2 tree will require further discussion with MECP to determine required mitigation and compensation measures required under section 23.7 of O.Reg 242/08 of the ESA	• Discussions will occur with the MECP to confirm mitigation and permitting requirements.	

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	• Bobolink • Probable and confirmed breeding bird habitat within the CUM1-1 in the northeastern portion of the Study Area	• No impact predicted as confirmed by Emily Funnel (MNRF Aurora) during a Dec. 13, 2018 meeting • Breeding bird habitat located outside of road alignment	• N/A	• N/A	• N/A	• N/A
6. Significant Areas of Natural and Scientific Interest	• Portions of the Subject Lands are located within the Maple Uplands and Kettles Provincially Significant Life Science ANSI. Woodlands within this ANSI will be impacted by the proposed road construction, • Woodlands associated with the Maple Uplands and Kettles Life Science ANSI contain significant woodlands and wetlands, habitat for threatened and endangered species and significant wildlife habitat. Associated impacts with these features are discussed at length in this table in sections 1,2, 3 and 5.	The proposed road alignment will result in the removal of 3.20 ha of woodlands located within the ANSI boundary. Potential impacts include: • Development and site alteration adjacent to residual woodlands and wetland; • Increased pedestrian use of the woodlands/wetland area due to possible trails; • Increase in lighting from road, and • Construction activity adjacent to woodlands/wetland.	Direct removal of 3.20 ha of significant woodland and associated loss of woodland function (e.g., wildlife habitat). Indirect impacts are similar to those associated with table sections 1,2,3 and 5	• Off-site compensation may be necessary to address predicted loss of significant woodland within the ANSI. • Please refer to table sections 1, 2, 3 and 5 for Avoidance, mitigation and/or restoration measures with respect to woodlands, PSW, SHW and habitat for threatened and endangered species.	• Permanent loss of 3.20 ha of Significant Woodlands within the ANSI • TRCA and the Municipality to track the land area removed from the natural system from this road infrastructure project and work together to explore avenues to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means • Permanent increase in woodland area and/or function in off-site woodlands, if off-site compensation is undertaken	• Woodland compensation areas will be monitored to confirm that compensation is meeting targets (e.g., vegetation survival rates and coverage)
Other Provincial Plans						
Oak Ridges Moraine Conservation Plan	• The Subject Lands occurs within the Oak Ridges Moraine (ORM) physiographic region and includes the designations “Natural Core Area”, “Natural Linkage Area” and “Countryside Area” identified on the Land Use Designation Map included in the 2017 ORMCP	The proposed road alignment will result in the removal of 3.20 ha of woodlands located within the ORMCP Natural Core Area. • Development and site alteration adjacent to	Direct removal of 3.20 ha of significant woodland and associated loss of woodland function (e.g., wildlife habitat). Indirect impacts are similar to those associated with table sections 1,2,3 and 5	• Off-site compensation may be necessary to address predicted loss of significant woodland within the ANSI. • Please refer to table sections 1, 2, 3 and 5 for Avoidance, mitigation and/or restoration measures with respect to woodlands, PSW, SHW and	• Permanent loss of 3.20 ha of Significant Woodlands within the ORMCP Natural Core Area • TRCA and the Municipality to track the land area removed from the natural system from	• Woodland compensation areas will be monitored to confirm that compensation is meeting targets (e.g., vegetation survival rates and coverage)

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	• The proposed road construction will result in the removal of 3.20 ha of woodland within the ORMCP Natural Core Area which are identified to contain Key Natural Features (significant woodlands, ANSI, wetlands, SWH, habitat) and Key Hydrologic Features (PSW, seepage areas)	residual woodlands and wetland; • Increased pedestrian use of the woodlands/wetland area due to possible trails; • Increase in lighting from road; and, • Construction activity adjacent to woodlands/wetland.		habitat for threatened and endangered species.	this road infrastructure project and work together to explore avenues to off-set these losses through existing municipal land acquisition and ecological restoration programs or other means • Permanent increase in woodland area and/or function in off-site woodlands, if off-site compensation is undertaken	
Other Features and Functions						
1. Other Wetlands	• One unevaluated wetland unit (Willow Mineral Thicket Swamp, SWT2-2) is present in the southeastern corner of the Study Area. The feature is maintained by seepage water from an adjacent area and inputs from the surface water drainage feature draining the King-Vaughan Wetland PSW Complex	• No direct footprint impacts on the wetland will occur • Potential indirect effects due to increased impervious cover related to the installation of the road the significant King-Vaughan Wetland PSW, which provides surface water to this wetland • Alteration to surface water inputs to the wetland due to alterations to the surface water drainage channel supporting the wetland	• Potential indirect effects due to erosion and sedimentation from the construction site could potentially result in impaired water quality within the wetland and smothering of vegetation due to deposited sediment • Accidental spills of potentially contaminating materials (e.g., fuel, oil) from construction equipment could potentially result in negative effects to vegetation and wildlife within and downstream from the wetland • Alterations in surface and/or groundwater delivery to the wetland due to changes in stormwater infiltration and runoff in the catchment area could potentially result in changes to the form and function of the wetland (i.e., reduction in habitat for species dependent on current moisture regime). Water balance investigations to be completed before predicted effects can be confirmed	• Erosion and sedimentation control measures will be used throughout construction to avoid/minimize the potential for off-site sedimentation within the wetland • A spill prevention and response plan will be prepared to identify measures to avoid negative effects due to accidental spills during construction on the Subject Lands • Stormwater management, potentially including Low Impact Development (LID) measures will be used to maintain water balance to the PSW that provides surface water to this feature	• No net effects on the wetland are anticipated to occur during construction provided the mitigation measures (ESC, spill prevent and response measures) are implemented • No net effects on the wetland due to adjacent development are anticipated provided that stormwater management and/or LID measures are effective in maintaining water balance	• Monitoring during construction is recommended to confirm that erosion and sedimentation control measures and spill prevention and response measures are installed and functioning as designed. Remedial measures should be implemented as soon as possible if deficiencies or unanticipated negative effects are identified during monitoring • Post-construction monitoring of vegetation communities within the wetland is recommended to confirm that water balance is being maintained
2. Tributary to East Patterson Creek	• There is no direct fish habitat present within the drainage feature identified as a tributary to East Patterson Creek. A	• Earthwork (e.g., grading, filling) and vegetation removal on the Subject Lands in	• Erosion and sedimentation from the disturbed work area during construction could result in increased turbidity and suspended solids within the watercourse.	• No direct alteration to this drainage feature • ESC measures will be used throughout construction to	• Potential for effects due to erosion and sedimentation and/or accidental spills during	• A construction monitoring program) will be developed and implemented to ensure that the ESC measures are

NATURAL HERITAGE FEATURES AND ASSOCIATED FUNCTIONS	SIGNIFICANT CHARACTERISTICS AND SENSITIVITY	IMPACTOR	PREDICTED EFFECTS	AVOIDANCE, MITIGATION AND/OR RESTORATION	NET EFFECTS	MONITORING AND MANAGEMENT
	berm associated with the Trans Canada Pipeline (TCPL) located downstream at the south east limit of the Subject Lands represents a distinct and definite barrier to any fish movement to reaches upstream of the berm. Further, the berm also acts as a flow barrier for any drainage coming from the upstream catchment area. The lack of a culvert at the berm and the height of the berm itself create an effective flow dam that prevents flows moving to reaches downstream of the TCPL corridor.	proximity to this drainage feature • Use of heavy equipment during construction and associated potential for accidental spills of potentially toxic materials (e.g., fuel, oil, hydraulic fluid); • Changes in surface water runoff due to increased imperviousness with potential alteration in surface water quality	Increased sediment load could cause negative effects and mortality, health effects or altered behaviour of aquatic biota (benthic macroinvertebrates). • Accidental spills during construction could impair water quality and have negative effects on aquatic biota and vegetation. • Alteration in water delivery (e.g., timing, volume of discharge) to the watercourse via surface and /or groundwater pathways due to changes in infiltration could potentially result in negative impacts on aquatic biota. • Pumping of groundwater from excavations may be required, depending on the depth of excavation and groundwater level at the time. If pumping is necessary, negative impacts to water quality and increased water quantity may occur. Increased erosion may result within this drainage feature due to discharge of pumped water.	avoid/minimize the potential for negative effects on aquatic biota. • A spill prevention and response plan will be prepared and implemented to identify measures to avoid negative effects due to accidental spills during construction. • Should pumping of groundwater be required during excavation, mitigation measures will be provided (e.g., sedimentation filter bags) to ensure that discharge quality criteria are met. Water should be discharged at the edge of the identified buffer areas 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 effects..	construction will be minimized. • Mitigation measures will prevent negative effects on riparian habitats, and associated aquatic habitat functions, due to adjacent site alteration. • No net effects on aquatic habitat are anticipated due to changes in surface water or groundwater conveyance and infiltration provided water balance is maintained.	installed correctly and maintained in good working order throughout construction. • Monitoring of adherence to and effectiveness of the spill prevention and response measures is recommended throughout the construction period.

APPENDIX C1.4

Ecosystem Compensation for Alignment 5A

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SAVANTA
A GEI Company

May 2, 2019

Schaeffers Consulting
Engineers
6 Ronrose Drive
Concord, ON
L4K 4R3

Attention: Leonid Groysman

Dear Mr. Groysman:

Re: Kirby Road Extension EA Compensation Area Calculations: Methodology and Results

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In consideration of potential impacts of the preferred Kirby Road Alignment 5A, Savanta was asked by the Toronto Region Conservation Authority (TRCA) to establish restoration replacement ratios (in hectares) for forest vegetation communities that will be removed as part of the proposed road construction. The methodology employed followed the criteria outlined in the TRCA Guideline for Determining Ecosystem Compensation (2018).

Methodology

Section 2.1.1 of the TRCA Guideline (2018) recommends that the following factors be considered when determining compensation: forest vegetation types (identified through the application of ecological land classification (ELC)); area of impact; and basal area. These are discussed below.

1. ELC Vegetation Types and Areas of Impact

In order to determine the ELC vegetation communities and areas of impact/removal (in hectares), the preferred Alignment 5A was over laid on the ELC mapping. Please see attached Figure 1 for ELC communities impacted by the proposed road alignment and Figure 4 for ELC communities identified within the Subject Lands (based on ELC surveys conducted by Savanta in 2010, 2011, 2015 and 2017).

2. Basal Area for Each Vegetation Type Impacted

Savanta conducted basal area surveys of the impacted vegetation communities on March 8,11 and 13, 2019.

Using a BAF 2 metric prism, a minimum of 3 plots (prism sweeps) were completed within each impacted vegetation type. This provided a minimum sample size of 10% coverage to determine the tree tallies. If only a portion of a feature was identified for removal, the average basal area was calculated based on the entire feature, and not just the portion being removed.

3. Compensation Ratio and Total Area of Compensation for Each Vegetation Type

The compensation ratio of each vegetation type proposed for removal was determined using Table 1 of the TRCA Guideline (2018). This compensation ratio was then multiplied by the area of removal to determine the required area of compensation (in hectares) for each forest vegetation type. The results of these calculations are outlined as follows.

Results

Six ELC forest polygons were surveyed, representing the following forest vegetation types (**Figure 4**):

FOD5 -11 Dry-Fresh Maple-hardwood Deciduous Forest
FOM3 - 2 Dry-Fresh Sugar Maple-Hemlock Mixed Forest
FOM6 - 2 Fresh-Moist Hemlock-hardwood Mixed Forest
FOD5 - 3 Dry-Fresh Sugar Maple-Oak Deciduous Forest
FOD2- 4 Dry-Fresh Oak-Hardwood Deciduous Forest
FOD3 - 1 Dry-Fresh Poplar deciduous Forest

Table 1 below presents the raw survey data, converted to basal area and compensation for each forest type.

Table 1: **Average Basal Area and Compensation Ratio for Each Forest Type**

ELC POLYGON	NUMBER OF PRISM SWEEPS	AVERAGE BASAL AREA (M^2/HA)	COMPENSATION RATIO (HA:HA)
FOD5-11	8	35.3	1:7
FOM3-2	6	35.3	1:7
FOM6-2	5	34.0	1:7
FOD5-3	6	26.0	1:5
FOD2-4	12	28.0	1:6
FOD3-1	7	27.7	1:6
TOTAL AVERAGE		**31.1**	**1:6**

Based on the above numbers, compensation areas have been calculated for preferred road Alignment 5A and are provided in Table 2 below.

Table 2: Compensation Ratio and Area for Alignment 5A

ELC Forest Polygon	Average Measured Basal Area (M^2/Ha)	Compensation Ratio (Ha:Ha)	Measured Area Of ELC Type Within Option 5A To Be Removed (Ha)	Area Required For Compensation (Ha)
FOD5-11	35.3	1:7	1.14	7.98
FOD5-3	26.0	1:5	0.14	0.70
FOD2-4	28.0	1:6	1.92	11.52
		TOTAL:	**3.20**	**20.2**

In conclusion, based on the application of the methodology within the TRCA Compensation Guideline (2018), the total area of compensation for removal of 3.20 ha of woodland vegetation within the Study Area is 19.4 ha.

Sincerely,
SAVANTA INC.
A GEI Company

Chris Zoladeski
Senior Botanist
1-800-810-3281 Ext 1050
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Attachments (2)

Figure 1: ELC Vegetation Communities Impacted by Preferred Road Alignment 5A
Figure 4: Ecological Land Classification (2017)

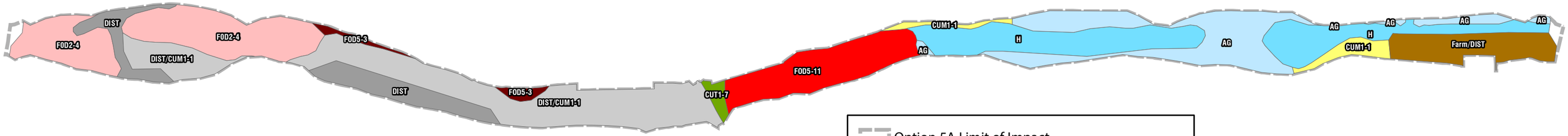

Figure 1
ELC Vegetation Communities Impacted by Preferred Road Alignment 5A

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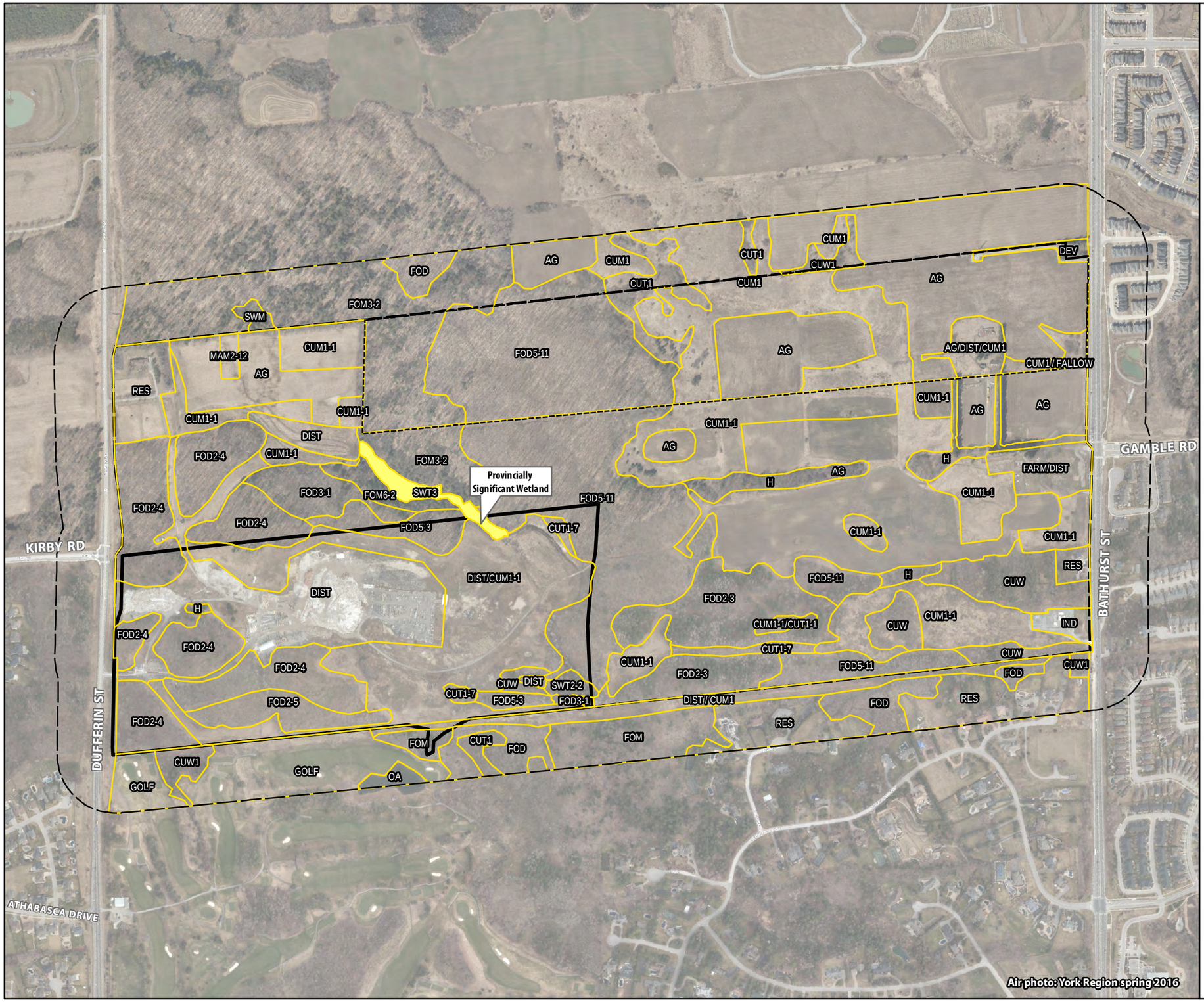

ELC Legend

CUM1	Mineral Cultural Meadow
CUM1-1	Dry - Moist Old Field Meadow
CUT1	Mineral Cultural Thicket
CUT1-1	Sumac Cultural Thicket
CUT1-7*	Poplar Cultural Thicket
CUW	Cultural Woodland
CUW1	Mineral Cultural Woodland
FOD	Deciduous Forest
FOD2-3	Dry-Fresh Hickory Deciduous Forest
FOD2-4	Dry-Fresh Oak- Hardwood Deciduous Forest
FOD2-5*	Dry-Fresh Oak-Sugar Maple Deciduous Forest
FOD3-1	Dry-Fresh Poplar Deciduous Forest
FOD5-3	Dry-Fresh Sugar Maple - Oak Deciduous Forest
FOD5-11*	Dry-Fresh Maple-Hardwood Deciduous Forest
FOM	Mixed Forest
FOM3-2	Dry-Fresh Sugar Maple- Hemlock Mixed Forest
FOM6-2	Fresh-Moist Hemlock- Hardwood Mixed Forest
MAM2-12*	Mixed Mineral Meadow Marsh
OA	Open Aquatic
SWM	Mixed Swamp
SWT2-2	Willow Mineral Thicket Swamp
SWT3	Organic Thicket Swamp

AG	Agricultural
DEV	Developed
DIST	Disturbed
FARM	Farm
GOLF	Golf
H	Hedgerow
IND	Industrial
RES	Residential

**Not included in the Southern Ontario ELC Guide.*

- Rizmi Lands Boundary
- Subject Lands / Study Area
- Expansion Area
- 120m Adjacent Lands
- Ecological Land Classification

Kirby Road EA Existing Natural Heritage Conditions Report

Figure 4
Ecological Land Classification (2017)

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1:8,000

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