

2115881 Ontario Limited, North Waterloo

Environmental Impact Study

Prepared for:

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Project No. 1506 | September 2020

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Aquatic, Terrestrial and Wetland Biologists

2115881 Ontario Limited, North Waterloo
Environmental Impact Study

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Report submitted on June 6, 2020
Report revised and resubmitted on September 29, 2020

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1.0 Introduction

Natural Resource Solutions Inc. (NRSI) was retained as part of a team by 2115881 Ontario Limited to prepare an Environmental Impact Study (EIS) for the proposed residential development of the subject property located on Conservation Drive in north Waterloo, Ontario.

The subject property is approximately 28.64ha in area and is bounded to the south by Conservation Drive, Roy Schmidt Road to the east, agricultural fields and natural features to the west and north as shown on Map 1. Habitat within the subject property is comprised mainly of agricultural fields, with wetlands and woodlands associated with Beaver Creek along the western portion of the property.

The City of Waterloo formally refers to this planning area as the Beaver Creek Meadows District. Natural features within and adjacent to the subject property are Core Environmental Features in the Region of Waterloo's Official Plan (OP) (2015), Core and Supporting Natural Features in the City of Waterloo's OP (2014). The wetlands in the study area are designated as Provincially Significant Wetlands (PSW) and comprise a portion of the Sunfish Lake – Laurel Creek PSW Complex. The low-lying habitats along Beaver Creek are floodplain. Both the PSW, watercourses and their associated floodplain are regulated by the Grand River Conservation Authority (GRCA) and are subject to Ontario Regulation 150/06. The presence of these natural features, in addition to lands containing known and potential habitat for Species At Risk (SAR) that are afforded protection under the *Endangered Species Act* (ESA) (2007), have triggered the requirement for an EIS.

Technical studies such as planning, stormwater management, engineering, hydrogeological and geotechnical have been prepared by the study team and have been used to supplement the natural feature characterization and assess potential impacts to the natural features. The study team includes:

- GSP Group (Planning)
- Meritech (Engineering and Stormwater Management)
- Natural Resource Solutions Inc. (Terrestrial, Wetland and Aquatic Biology)
- Stantec (Surface and Groundwater Monitoring)

- LVM (Geotechnical)

The natural features in the area have been well studied through the North Waterloo Scoped Subwatershed Study (NWSSS, Ecoplans et al. 2013) and 6 years (2014-2019) of pre-construction biological monitoring completed by NRSI (NRSI 2016a, 2017, 2018, 2019, 2020) and pre-construction surface water and groundwater monitoring by Stantec (2018). Pre-construction monitoring was completed as per the City of Waterloo's Development Monitoring Protocol (1999).

The first draft of this EIS (NRSI 2016b) was prepared and submitted in July 2016. Comments were received from the reviewing agencies of the City of Waterloo, Region of Waterloo and the GRCA. Since then, the study team has revised the draft plan, completed further field investigations and analysis and had meetings and discussions with the reviewers to address comments and questions. This report represents the revised EIS, incorporating all updates and changes and provides further clarification and information as requested in the comments of the reviewers. This report contains an updated characterization of existing natural features based on the additional years of the above noted pre-construction biological monitoring (2014-2019) as well as site specific investigations of particular features of interest such as the north hedgerow (HR2) and the Core Environmental Feature boundary at the west property limits in the central portion of the subject property. The report provides an updated constraints analysis and re-assessment of potential impacts and mitigation measures. Field survey data presented in this report is current up to and including the 2019 monitoring year.
This EIS has been prepared in accordance with the City of Waterloo's OP (2016), Region of Waterloo's OP (2015), Greenlands Network Implementation Guidelines (GNIG) (2016), Section 15 – 17 of the NWSSS (Ecoplans et al. 2013), and the GRCA's EIS Guidelines and Submission Standards for Wetlands (2005).

A few changes have occurred on-site since the first draft submission of the EIS (NRSI 2016b). The residence at Conservation Drive and Beaver Creek Road has been demolished under approval in 2018. NRSI consulted with the Ministry of Natural Resources and Forestry (MNRF) in advance of the structure removal to ensure compliance with the ESA (2007) with respect to SAR bats. Similarly, the single

residence fronting onto Conservation Drive was demolished under approval in early 2020. The former residence at the east subject property limits fronting onto the Roy Schmidt Road allowance burned down in 2015.

For the purposes of this report, the term 'subject property' refers to the lands owned by the client, including the area where the development is proposed to occur. The term 'study area' refers to the subject property plus the surrounding area up to 1km, for which additional information was collected and reviewed (as could be gathered without direct access to these areas). Legacy data collected from agencies and wildlife atlases was gathered for the study area to ensure that all natural features were considered.

1.1 Proposed Undertaking

The proposed development is a mixed use neighbourhood, including an internal road network, a mixture of residential density types, a school block, stormwater management, trails and parkland as shown on the Draft Plan of Subdivision prepared by GSP Group (2020) and included as Map 2. The development plan follows the land use structure of the Beaver Creek Meadows District Plan (TPP 2016). The Draft Plan (Map 2) has been revised from the original submission in 2016 based on agency reviewing comments and through subsequent team meetings and discussions.

1.2 Project Scoping

In order to determine a study approach for this EIS, existing natural heritage information was gathered and reviewed to identify key natural heritage features and species that are known or have the potential to occur within the study area. Background information on the natural heritage features within the study area was gathered from the NWSSS (Ecoplans et al. 2013) and the pre-construction biological monitoring reports prepared by NRSI (NRSI 2016a, 2017, 2018, 2019, 2020).

For the purposes of this report, SAR are those listed on the Species at Risk in Ontario List (MECP 2019). These include species identified by the Committee on the Status of Species at Risk in Ontario (COSSARO) as provincially Endangered, Threatened, or Special Concern. Species listed by COSSARO as Endangered or Threatened are protected by the *Endangered Species Act* (*ESA)*, 2007, which includes protection to their habitat, and are referred to herein as regulated SAR.

Species considered Special Concern are included in the definition of Species of Conservation Concern (SCC), which includes the following:

- species designated provincially as Special Concern,
- species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the NHIC, and
- species that are designated federally as Threatened or Endangered by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC) but not provincially by the COSSARO. If these species are listed under the *Species at Risk Act* (SARA) under Schedule 1 they are protected by the federal Act but not provincially by the ESA.

NRSI completed a preliminary screening of SAR and SCC for the subject property based on the known available habitats. The following information sources were referenced to develop the list of SAR and SCC known and having the potential to be present in the subject property:

- Aerial photography of the site,
- Species lists, vegetation community mapping, study methods and management recommendations contained in the NWSSS (Ecoplans et al. 2013), and
- Correspondence received from the GRCA, Region of Waterloo, City of Waterloo and the MNRF

NRSI initially consulted with the MNRF in 2015 and 2016 with respect to SAR and SCC. A SAR/SCC screening and survey methodology memo was prepared and reviewed by the MNRF. This screening was completed by comparing the habitat requirements for significant species that are known from the study area against the ELC communities identified in the NWSSS and NRSI monitoring plans. This comparison allowed it to be determined which species have the potential to occur within the subject property, and identify those species with potential to be impacted by the proposed development.

Based on the findings of the background review, including the SAR and SCC screening, a Terms of Reference (TOR) for the EIS was prepared by NRSI and submitted on November 27, 2015 to the City of Waterloo, and distributed to the Region of Waterloo,

the GRCA, and the MNRF. The TOR was edited based on the comments received from reviewers and finalized on January 21, 2015. A copy of the final TOR for the EIS is appended to this report (Appendix I).

An updated SAR/SCC Assessment inclusive of all biological survey results to-date (2014-2019) is provided in Appendix II.

1.3 Relevant Policies, Legislation, and Planning Studies

Information on the natural heritage features within the subject property was collected and assessed for significance in accordance with municipal and provincial guidance documents and legislation. To help scope the field program and direct the impact analysis, guide the layout of development, and identify areas to be protected, natural features were evaluated against relevant policies, legislation, and planning studies outlined in Table 1. The specific implications of these documents to the study are discussed in further detail in Section 4.0 of this report.

Table 1. Relevant Policies, Legislation and Planning Studies

Policy/Legislation	Description	Project Relevance
City of Waterloo Official Plan (2016)	• Commits to maintain, enhance, and restore the City's Natural System through land-use planning policies, restoration initiatives, sound management, stewardship, education, and acquisition. • The City's Natural System consists of Landscape Level Systems, Core Natural Features, Supporting Natural Features, Fish Habitat, Restoration Areas, and Linkages. The Natural System forms part of the broader Greenlands Network identified through the Region of Waterloo Official Plan. • As outlined in Section 8.2 of the OP, development or site alteration may occur on lands contiguous to the Natural System if it is demonstrated through an EIS that there will be no adverse impacts on the feature or its ecological functions.	• The subject property is primarily designated as Low Density Residential. • The natural features at the west of the property are designated as Open Space, containing both Core Natural Feature and Supporting Natural Feature which are afforded protection under the City's OP. Beaver Creek is a Supporting Natural Feature while the Core Natural Feature is made up of the PSWs and Significant Woodlands. This includes the portion of the wetland shown as Supporting Natural Feature on Official Plan Schedule A4, as recommended through the NWSSS.
Endangered Species Act (MNRF 2007)	• The original ESA, written in 1971, underwent a year-long review which resulted in a number of changes which came into force in 2007. • The ESA prohibits killing, harming, harassing, or capturing SAR and protects their habitats from damage and destruction.	• Based on information available through background documents and field surveys, including the SAR/SCC screening, several SAR and SCC were identified as having suitable habitat within the study area.
Fish and Wildlife Conservation Act (MNRF 1997)	• The FWCA provides protection for certain bird species, not protected under the MBCA (e.g., raptors), as well as furbearing mammals and their dens or habitual dwellings, asides from the Red Fox (*Vulpes vulpes*) and Striped Skunk (*Mephitis mephitis*).	• The timing of construction activities, especially vegetation clearing and site grading must have consideration for bird nesting and den sites for fur-bearing mammals.

Policy/Legislation	Description	Project Relevance
GRCA Ontario Regulation 150/06 (2013)	• Regulation issued under *Conservation Authorities Act,* R.S.O. 1990. • Through this regulation, the GRCA has the responsibility to regulate activities in natural and hazardous areas (i.e. areas in and near rivers, streams, floodplains, wetlands, and slopes). • GRCA requires that an EIS be undertaken in accordance with their *EIS Guidelines and Submission Standards for Wetlands* where development is proposed within 120m of PSW or 30m of non-PSW (GRCA 2005). • Section 7.0 of the Regulation identifies the general policies associated with the CA's 'Regulation Area'. • The Regulation identifies that Development, interference or alteration within a Regulated Area may be permitted, where it can demonstrated, through an EIS that "*there are no negative or adverse hydrological or ecological impacts on the wetland."*	• The proposed development footprint location is adjacent to the GRCA regulated Sunfish Lake – Laurel Creek PSW Complex (Map 1). • A regulation limit of 120m from the GRCA confirmed wetland boundaries apply. • In accordance with this policy, the proposed development must demonstrate no negative impacts to the regulated natural features or their ecological functions.
Migratory Birds Convention Act (CWS 2013)	• The MBCA protects migratory game birds, insectivorous birds, and several other migratory non-game birds from persecution in the form of harassment. • The schedule of on-site work must consider MBCA windows, with timing of breeding bird season typically occurring between May 1 and July 31, however, this is a guideline, since the MBCA applies to nesting bird species. • "Incidental take" is considered illegal, with the exception of a permit obtained by the Canadian Wildlife Service (CWS).	• The timing of construction activities, especially vegetation clearing and site grading must have consideration for the MBCA timing windows.
Provincial Policy Statement (OMMAH 2014)	• Issued under the authority of Section 3 of the Planning Act and came into effect on April 30, 2014, replacing the 2005 PPS (OMMAH 2005).	• Based on the background review and detailed information from the NWSSS, monitoring reports and SAR/SCC screening, several natural features afforded

Policy/Legislation	Description	Project Relevance
	• One of the key goals of the PPS is the *"effective use of land and resources, with development primarily focused in settlement areas."* • Section 2.1 of the PPS – Natural Heritage establishes clear direction on the adoption of an ecosystem approach and the protection of resources that have been identified as 'significant'. This section also identifies that natural features are to be protected for the long term. • Section 2.1.5 of the PPS identifies that development and site alteration shall not be permitted within the area outlined in sub-sections a) – f) *"unless it has been demonstrated that there will be no negative impacts on the natural features or their functions."* • The Natural Heritage Reference Manual (OMNR 2010) and the Significant Wildlife Habitat Technical Guide (OMNR 2000, OMNR 2012) were prepared by the MNRF to provide guidance on identifying natural features and in interpreting the Natural Heritage sections of the PPS.	consideration within the PPS have been identified in the stud area, including: o Significant Wetland, o Significant Woodland, o Significant Wildlife Habitats, and o Habitat for endangered and threatened species
Regional Municipality of Waterloo Tree By-Law Number 08-026 (2008)	• The by-law regulates the destruction or injuring of trees within woodlands, • Enactment of this by-law is aimed at sustaining a healthy natural environment within the Region, while also having regard for good forestry practices, • Statutes of protection aims that no person shall destroy or injure a tree, or cause another person to destroy or injure a tree, of a protected species that is located in a woodland	• The proposed development area contains only planted isolated trees, therefore, trees within development envelope are not protected under the Regions By-Law, • The development proposal will be maintained outside of the adjacent natural feature containing any woodland habitat.
Regional Municipality of Waterloo Official Plan (2015)	• The updated Regional Official Plan (ROP) includes policies related to the natural environment.	• The Regions OP identifies the natural features within the southwest corner and south and west of the property to be 'Core Environmental Features'

Policy/Legislation	Description	Project Relevance
	• It provides a much more detailed policy framework than the previous ROPP that protects environmental features; therefore, the ROP 2015 is referred to throughout this report as the most current guidance for delineating and protecting Core Environmental Features within the study area.	• Beaver Creek, which is situated just inside of the subject property, is associated with the Core Environmental Feature that makes up the southwest corner of the property.
North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013)	• The Subwatershed Study provides recommendations on conservation, enhancement, mitigation measures, and management practices of natural features and functions that have the potential to be impacted by development. • Core Areas and Watercourses are to be retained in their entirety, with no alterations to watercourses. • Development setbacks and buffers are recommended, to be confirmed during the EIS phase.	• Core Natural Areas and Watercourses exist within the west portion of the subject property.

2.0 Field Methods

The pre-construction biological monitoring program that was undertaken by NRSI within the study area, including the 2115881 Ontario Ltd. subject property, encompassed a number of monitoring components based on City of Waterloo requirements and agency recommendations provided during development of the NWSSS (Ecoplans et al. 2013) TOR. The terrestrial field surveys were undertaken to characterize the natural heritage features and identify significant and sensitive features and species that have potential to be adversely affected by the proposed development. The methods and dates of each monitoring program component are described in detail below and are summarized in Table 2. Vegetation communities identified in the subject property are shown on Map 3, with specific biological monitoring locations shown on Map 4.

During the field work program, all incidental observations of wildlife were documented, including actual direct observations, as well as signs (i.e. tracks, scat, dens, nests, etc.). In addition to NRSI's characterization of natural heritage features, Stantec has undertaken pre-construction surface and groundwater monitoring in the subwatershed area since 2011.

Table 2. Field Survey Summary

Survey Type	Protocol	Date					
		2014	2015	2016	2017	2018	2019
American Badger Survey	NWSSS (Ecoplans et al. 2013)	N/A	October 23	N/A	N/A	N/A	N/A
Barn Swallow Habitat Investigation & Descriptions Surveys	MNRF Guelph District Guidance (G. Buck, pers. comm. 2012a)	June 23	July 2	June 23	June 27	June 26	June 28
Bat Habitat Assessments (cavity trees and structures)	MNRF 2015c	October 17	N/A	May 27	N/A	N/A	N/A
Breeding Bird Surveys	OBBA 2001	June 16	June 5	June 6	June 6/7	June 4	June 11
		July 4	June 23	June 17	June 16	June 18	June 21
Benthic Sampling	Ontario Benthos Biomonitoring Network (OBBN) Protocol Manual (Jones et al. 2007)	May 22[1]	May 20	June 2	June 7	June 5	June 5
		October 9	September 30	October 24	October 24	October 26	October 23
Ecological Land Classification (verification and refinement; documentation of significant species)	Lee et al. 1998	June 4	June 5	June 6	June 6	June 14	June 12
		September 25	October 1	September 12	September 13	September 20	October 8
Evening Calling Anuran Surveys	BSC 2009	April 21[1]	April 16	April 18	April 11	April 26	April 28
		May 15	May 25	May 17	May 18	May 16	May 22
		June 19	June 16	June 21	June 22	June 18	June 18
Nocturnal Bird Surveys	Common Nighthawk Survey Protocol (G. Buck, pers. comm. 2012b)	N/A	May 28	May 26	June 1	May 28	June 12
			June 4	June 23	June 8	June 5	June 17
			June 30	N/A	July 8	June 25	June 24

Survey Type	Protocol	Date					
		2014	2015	2016	2017	2018	2019
Pre-Construction Monitoring & Disturbance Data Sheet	City of Waterloo Pre-Construction Monitoring (City of Waterloo 1999)	June 4	June 5	June 6	June 6	June 14	June 12
		September 25	October 1	September 12	September 13	September 20	October 8
Road Crossing Mortality Surveys[1]	NWSSS (Ecoplans et al. 2013)	May 1	N/A	N/A	N/A	N/A	N/A
		May 13					
		May 27					
		June 3					
		June 12					
Snake Cover Board Surveys	N/A	June 17	N/A	N/A	N/A	N/A	N/A
		June 23					
		July 4					
		September 9					
		September 25					
Tree Inventory	Waterloo Region Tree By-Law 08-026	N/A	N/A	May 4	N/A	July 31	March 28
Turtle Nest and Nesting Surveys	MNRF 2015d; MNRF 2016	June 4	May 25	May 26	N/A	N/A	N/A
		June 19	June 16				
Vegetation Plot Monitoring	NRSI Vegetation Plot Monitoring standardized methods (GRCA approved, K. Smith, pers. comm. 2014), adapted from Terrestrial Monitoring – Plot Establishment & Data Collection (City of Waterloo 2002)	July 30	July 14	July 28	N/A	N/A	July 11/12

Survey Type	Protocol	Date					
		2014	2015	2016	2017	2018	2019
Winter Wildlife Surveys	Greenlands Network Implementation Guidelines (Region of Waterloo 2016)	N/A	N/A	N/A	N/A	N/A	January 22 February 14

[1]Survey(s) completed by MMM Group prior to NRSI's involvement in the project; methods detailed in NWSSS (Ecoplans et al. 2013)

2.1 Vegetation

2.1.1 Vegetation Communities

Vegetation communities within and adjacent to the subject property were characterized as per the Ecological Land Classification System (ELC) for southern Ontario (Lee et al. 1998) and presented in the NWSSS (Ecoplans et al. 2013). Vegetation community boundaries were verified and refined during the pre-construction monitoring program conducted by NRSI (2014-2019). ELC mapping is shown on Map 3. Detailed descriptions of ELC vegetation communities are presented in Section 3.6.1 (Table 3).

2.1.2 Vascular Flora

Detailed vegetation inventories within the subject property were conducted during the NWSSS (Ecoplans et al. 2013). Comprehensive summer-season vegetation inventories were completed by NRSI biologists during the pre-construction biological monitoring, in Years 1-3 (2014-2016) (NRSI 2016a, 2017), and Year 6 (2019) within the 2 vegetation monitoring plots (Map 4). All significant vascular flora species (i.e. federally, provincially, regionally) observed during all visits to the property were documented. A complete list of plant species observations within the vegetation monitoring plots is appended to this report (Appendix III) while a full list of plants in the subwatershed study area can be found in the NWSSS, Appendix 2E (Ecoplans et al. 2013). Further discussion of additional plant survey efforts is discussed in the following sections, and results are discussed in Section 3.6.2.

2.1.3 Vegetation Monitoring Plots

The GRCA requested vegetation plot monitoring be implemented for the proposed development. Permanent plot vegetation monitoring was completed within the subject property during the summer season (2014-2016, 2019) following the methods for vegetation monitoring taken from the City of Waterloo's *Terrestrial Monitoring – Plot Establishment & Data Collection* (2002). Monitoring was carried out at 2 locations within the subject property as shown on Map 4. Data recorded included species, size, abundance, and health of canopy trees, and comprehensive documentation of understorey trees, shrubs, and herbaceous plants. NRSI previously recommended in the 2016 pre-construction monitoring report that vegetation plot monitoring be discontinued until the construction period, or after a time of 3 years, in order to minimize

impacts to the sensitive natural features and organic substrates and allow vegetation to recover (NRSI 2017). GRCA staff concurred with NRSI's recommendation, and the vegetation plot monitoring was suspended in 2017 and 2018. GRCA further clarified that one year of vegetation plot monitoring is required in the year immediately prior to construction, and the other year of required pre-construction data can rely on the 2014-2016 monitoring events (C. Tinney, pers. comm. 2019). Accordingly, vegetation plot monitoring was reinstated in 2019. A complete list of plant species observations within the vegetation monitoring plots is appended to this report (Appendix III) and results are discussed in Section 3.6.3.

During the vegetation plot monitoring in 2019, NRSI biologists experienced difficulty surveying plot VEG-002 such that trampling disturbance was widespread and unavoidable. A discretionary decision was made to abandon the vegetation monitoring plot to limit further damage to the sensitive wetland habitat and substrates, and in an effort to maintain the baseline data collection integrity whereby the vegetation disturbances were not related to any development activities. Vegetation monitoring plot VEG-002 was relocated to a more appropriate location in the same ELC community in an area less sensitive to trampling and with relatively more stable substrates. The relocated VEG-002 will be surveyed for the remainder of the monitoring program.

2.1.4 Vegetation Surveys for Enhancement / Management Needs

Wandering transects were established within and adjacent to the natural features on the subject property to assess enhancement and/or management needs as development proceeds. Transects surveys were conducted during spring and fall (2014 - 2019) to determine the presence of litter, footpaths, and any other forms of disturbance (i.e. dumping of yard waste, forts, invasive species establishment, etc.) using a standardized form to collect data. This information will inform the baseline condition of the interior and buffering habitats of the natural features to be used as a comparative condition for future monitoring. It will also be used to identify areas to target refuse removal and enhancement or restoration activities. In addition, the vegetation surveys identified federally (Government of Canada 2018), provincially (MECP 2019, MNRF 2019), and regionally significant plant species (Richardson and Martin 1999).

The results of the vegetation surveys for enhancement/management needs are discussed in Section 3.6.4 in this report with significant species locations shown on Map 3.

2.1.5 Terrestrial Feature Monitoring

As outlined in the City of Waterloo's Development Monitoring Protocol document (1999) for pre-construction surveys, terrestrial feature monitoring was conducted within the subject property in spring and fall (2014-2019). NRSI biologists walked through the natural features within the subject property and documented the following using a standardized data form:

- General health of vegetation and trees
- Evidence of soil movement
- Evidence of human disturbance or encroachment
- General fish and wildlife observations
- Overall conditions

The results of the terrestrial feature monitoring are discussed in conjunction with the vegetation surveys for enhancement/management needs (Section 3.6.4).

2.1.6 Fixed Photo Plot Monitoring

A total of 16 fixed photo monitoring plots were established throughout and adjacent to the natural features within the subject property (Map 4). Each plot was assessed by NRSI (2014-2019) during the spring and fall seasons through a qualitative photo inventory method. In order to facilitate comparison of baseline conditions with future conditions, the same orientation will be used in subsequent monitoring. The photo monitoring was conducted in accordance with the City of Waterloo's Development Monitoring Protocol guidance document for pre-construction monitoring of terrestrial features (1999). This guidance document specifies spring and fall photo plot monitoring.

Photos documented the current condition of the natural features and their edges to record the health and character of the vegetation, presence of any refuse, footpaths, erosion, or other forms of disturbance. These photos will help establish baseline conditions and document future disturbances, restoration success, or other changes over time.

2.1.7 Dripline and Wetland Boundary Flagging and Survey

Boundaries of woodlands and wetlands have been revised and updated by NRSI from the NWSSS (Ecoplans et al. 2013) findings. Woodland dripline and wetland boundary refinements over the course of the pre-construction biological monitoring program (2014-2019) are summarized as follows:

- Wetland boundary in the northwest corner of the subject property was re-flagged in the field by NRSI, and reviewed and approved by GRCA staff in November 2015.
- Woodland dripline boundary of the Significant Woodland at the west subject property limits in the central portion of the property was refined based on a small area of poplar trees projecting outward from the natural feature edge. Woodland dripline boundary was reviewed and approved by Region of Waterloo staff on September 27, 2018.
- Remaining woodland dripline boundaries in the subject property updated and surveyed by NRSI in May 2018, not reviewed by Region of Waterloo staff. Comparison to the woodland dripline boundaries presented in the NWSSS (Ecoplans et al. 2013), Figure 4.3a, are generally consistent with the updated boundaries.

The revised natural feature boundaries are shown on Map 3, and have been used on all maps and development plans herein.

2.1.8 Tree Inventory

An initial inventory of trees in the northern hedgerow (HR2) was carried out on May 4, 2016 and was re-visited on March 28, 2019 to update the tree inventory. All trees were reviewed based on size, health and condition. Any trees which were 10cm diameter at breast height (dbh) or greater were tagged, assessed and added to the inventory. Any trees which had died or fallen since the first inventory were also noted and removed from the inventory. This resulted in a current total of 39 trees assessed. The location of the trees was re-recorded using a backpack SxBlue II GNSS GPS unit with sub-meter accuracy. Further tree inventory work to refine the Significant Woodland limits at the west property boundary was carried out on July 31, 2018 according to the same

methods described, but these trees were not tagged. The results of the tree inventory inform various sections of this report, and are discussed in conjunction with the applicable content.

2.2 Avifauna

2.2.1 Breeding Birds

Breeding bird surveys were completed within the existing Wildlife Survey Units (WSUs) as defined in the NWSSS (Ecoplans et al. 2013) as well as within the agricultural and cultural areas in the subject property (Map 4). Surveys were conducted during the peak breeding bird season, consistent with the NWSSS (Ecoplans et al. 2013) methods, and the Ontario Breeding Bird Atlas (OBBA) Guide for Participants (OBBA 2001) standardized protocol.

Following the standardized protocol, point counts for breeding birds were completed twice each breeding season and timed at least 10 days apart, in 2014-2019. Random wandering transect surveys were also completed in between point count stations to document incidental bird species in each habitat unit. Surveys were completed during the early morning between sunrise and 1000hrs, for a duration of 10 minutes. Supplementary data was also recorded at each station, including the survey time, air temperature, wind speed (as per Beaufort Wind Scale), cloud cover, and precipitation.

Monitoring results from avifauna surveys, including incidental observations are provided in Appendix IV and are discussed in Section 3.7. The results in Appendix IV have been presented in two separate tables; cumulatively for all bird species documented during the breeding bird season, and those documented incidentally outside of the breeding bird season during all other visits to the subject property. This approach is consistent with the presentation of bird survey results in the NWSSS (Ecoplans et al. 2013).

2.2.2 Common Nighthawk

The potential presence of Common Nighthawk (*Chordeiles minor*), a SCC, within the study area was identified based on data obtained from the MNRF, and initially circulated to NRSI by GRCA reviewing staff. Suitable habitat for this species, albeit marginal, is present in the subject property; therefore, surveys were conducted in 2015-2019

according to MNRF guidance including up to 3 evening surveys, spaced 7 days apart, on evenings during the appropriate lunar phase, between late May and early July (G. Buck, pers. comm. 2012b). Monitoring locations are shown on Map 4.

2.2.3 Barn Swallow

Barn Swallow (*Hirundo rustica*), a provincially Threatened species, was noted as occurring within the study area in the NWSSS (Ecoplans et al. 2013). Barn swallow surveys were conducted in 2014-2019 according to the Guelph District MNRF Barn Swallow Survey Protocol (G. Buck, pers. comm. 2012a) which includes a third survey later during the breeding bird season. A third survey visit was conducted within the cultural areas in the subject property to determine if any Barn Swallows were nesting in the existing structures on-site. Structures that have yet to be removed within the proposed development scenario are limited to the existing vacant residence on Conservation Drive. Prior to the removal of the other structures, targeted Barn Swallow surveys were conducted each year. Wildlife survey units where surveys were conducted are shown on Map 4.

2.3 Amphibians

Evening amphibian call surveys were completed at the 3 permanent monitoring stations located at wetland units within the subject property (Map 4). Surveys were conducted on 3 separate dates during the amphibian breeding season, in April, May, and June (2014-2019), consistent with the Marsh Monitoring Program (MMP) amphibian monitoring standardized protocol (BSC 2009). A minimum of 15 days between visits was coordinated to correspond with peak vocalization periods for early, mid, and late-season breeding species. Surveys occurred between one half-hour after sunset and midnight, on evenings with appropriate weather conditions, as specified in the protocol. Surveys were not conducted during rain events (light rain is acceptable) (BSC 2009).

Following this protocol, 3 minute point counts were conducted at each monitoring station to identify presence and relative abundance (based on calling intensity) of anuran (frog and toad) species within each wetland unit. A three-level calling code system was utilized to record relative levels of calling intensity for each identified species:

- Calling Code 1 is used when number of calling males can be estimated and calls do not overlap,
- Calling Code 2 is used when some calls overlap but number of calling males can still be estimated, and
- Calling Code 3 is used when males are calling at full chorus and it isn't possible to estimate the number of individuals.

Supplementary data was also recorded at each station, including the survey time, air and water temperature, pH, wind speed (as per Beaufort Wind Scale), cloud cover, direction surveyors were facing, and background noise levels.

The significant sub-population of Western Chorus Frog (*Pseudacris triseriata*), a federally Threatened species, was recorded within the study area during the NWSSS (Ecoplans et al. 2013). The anuran call surveys described above are adequate to monitor for the presence and abundance of Chorus Frog.

Anuran call count monitoring results are provided in Appendix V and discussed in Section 3.8.

2.4 Reptiles

Extensive surveys for snake species using cover boards were undertaken during the NWSSS (Ecoplans et al. 2013). NRSI also completed snake cover board surveys in 2014. No significant species were observed during any these surveys; therefore, no further cover board surveys were conducted in 2015-2019.

Significant turtle species with the potential to be using the habitats within the study area include Snapping Turtle (*Chelydra serpentina*) (SCC) and Blanding's Turtle (*Emydoidea blandingii*) (Threatened) as described in the NWSSS (Ecoplans et al. 2013). Targeted visual surveys for turtle SAR and Significant Wildlife Habitat (SWH) related to turtles (potential turtle nesting areas) were conducted according to MNRF guidance for turtle nesting surveys (MNRF 2015d, MNRF 2016). Based on the lack of results of the turtle survey efforts to-date, no further targeted turtle surveys have been recommended by the MNRF as confirmed during a consultation meeting held on March 19, 2018.

During all visits to the subject property, any incidental sightings of snake or turtle species were documented, as well as any evidence of hibernation, nesting, or basking areas that may qualify as SWH according to the Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000) and criteria tables (MNRF 2015a).

2.5 Mammals and Other Wildlife

The isolated landscape trees and buildings within the subject property were considered for their suitability to provide roosting habitat for the following SAR bats: Little Brown Myotis (*Myotis lucifugus*), Northern Long-eared Bat (*Myotis septentrionalis*), Eastern Small-footed Myotis (*Myotis leibii*), and Tri-colored Bat (*Perimyotis subflavus*). Isolated trees and any existing buildings are proposed for removal or have been removed. A detailed bat habitat assessment was initially conducted on October 17, 2014 for all structures within the subject property, with a follow-up assessment on May 27, 2016 for identified candidate bat habitat at the former residence in the southeast corner of the subject property. The follow-up assessment was completed to verify the habitat conditions were unchanged since 2014, and as due diligence in support of the structure's demolition. The former residence was demolished in 2018.

American Badger (*Taxidea taxus jacksoni*) (Endangered) was surveyed for in the NWSSS (Ecoplans et al. 2013) with no sightings or evidence found. Since submission of the TOR, the MNRF requested targeted den surveys for American Badger, as time has passed since the NWSSS American Badger surveys which were completed in 2010 – 2011, and the species has the potential to move into the site (D. Marriott, pers. comm. 2015a). A targeted American Badger den survey was conducted within the subject property on October 23, 2015 as per the NWSSS methods (Ecoplans et al. 2013), focusing on the edges of natural features abutting agricultural areas.

Winter wildlife surveys were completed in 2019 according to the GNIG (Region of Waterloo 2016). These surveys consisted of two visits between January 1 and February 29 with suitable weather conditions (i.e. within 24-72 hrs of a snowfall of at least 2cm) to document overwintering use by resident wildlife.

Incidental observations of all mammals, insects, and any other wildlife species were recorded during all field visits. This included direct observations, as well as observations of tracks, scat, vocalizations, etc. Habitat features that may qualify as SWH according to the Significant Wildlife Habitat Technical Guide (SWHTG, OMNR 2000) and criteria tables (MNRF 2015b) were documented, evaluated and confirmed as SWH. Confirmed SWH are shown on Map 5.

2.6 Road Crossing Mortality Monitoring

Road crossing mortality monitoring was completed by MMM Group during spring 2014. Monitoring events occurred in May and June and generally focused on Conservation Drive from Beaver Creek Road to the property frontage at the Erbsville Kartway (Map 4). Methods implemented were consistent with the NWSSS (Ecoplans et al. 2013). Additionally, incidental road crossing mortality inspections were completed by NRSI during the annual spring and fall pre-construction monitoring events (2014-2019), focused on the Beaver Creek watercourse corridor crossing of Conservation Drive.

2.7 Aquatic Habitat Description

Beaver Creek was well studied and documented in the NWSSS (Ecoplans et al 2013) with targets and thresholds provided for its protection and enhancement. That information was relied upon to provide a description of the aquatic habitat and fish species for this EIS. NRSI has completed benthic sampling on downstream reaches of Beaver Creek as part of the pre-construction monitoring for the North Waterloo study area between 2015 and 2020. The methods and results of the monitoring program are reported in the annual reports submitted to the City of Waterloo, Region of Waterloo and GRCA. See NRSI 2016a – 2020 for details, with a summary provided in this report.

Fish community sampling was performed as part of the NWSSS (Ecoplans et al. 2013) using a multi-pass sampling approach following the sampling protocols described by the Ministry of Transportation Environmental Guide for Fish and Fish Habitat (2009) and the fish community composition assessment protocol as described in the Ontario Stream Assessment Protocol (Stanfield 2013). The results of these fish sampling events have been incorporated into the assessment of the local fish community for the purposes of this EIS. A full list of fish species known from Beaver Creek is provided in Appendix VI.

Benthic macro-invertebrate monitoring was performed at three stations (BTH-001, BTH-002, and BTH-003) as part of the NWSSS (Ecoplans et al. 2013) (Map 4). These stations have continued to be sampled annually by NRSI. Spring sampling for benthic invertebrate monitoring was performed by MMM Group in 2014 as part of the NWSSS and by NRSI in spring and fall in all subsequent years (2015-2019). Two stations (BTH-001 and BTH-003) are located on Beaver Creek and one station (BTH-002) on Laurel Creek. These stations were established in accordance with the *Ontario Benthos Biomonitoring Network Protocol Manual* (OBBN) protocol (Jones et al. 2007). Each station is comprised of 3 sub-stations: 2 from riffle habitat and 1 from pool habitat. For wadable streams, such as the areas of Beaver Creek and Laurel Creek, the OBBN protocol employs a "Travelling Transect Kick and Sweep" method, where each sub-sample is made up by sampling 10 linear meters of stream transect over a 3 minute period (Jones et al. 2007; EC 2011).

The benthic invertebrate data was analyzed using a number of metrics in order to characterize the general condition of the watercourse. The metrics used for the assessment of watercourse condition were selected to reflect the metrics and indices used for the NWSSS (Ecoplans et al. 2013) and recommended by the OBBN Protocol. A total of 11 metrics and indices were calculated in order to assess the water quality within each monitoring station. These metrics include:

- Taxa Richness – the number of taxa generally increases with habitat diversity and water quality (Jones et al. 2007),
- EPT Taxa Richness – the number of taxa from orders sensitive to pollution, specifically the orders Ephemeroptera, Plecoptera, and Tricoptera (Barbour et al. 1999; Weber 1973),
- Percent EPT – percent composition of a community by taxa from orders sensitive to pollution, specifically the orders Ephemeroptera, Plecoptera, and Tricoptera (Barbour et al. 1999; Weber 1973),
- Percent *Oligochaetes* – percent composition of a community by aquatic worms, a group tolerant to pollutants (Jones et al. 2007),
- Percent Diptera – percent composition of a community by fly larvae which provides a context for other analysis (Jones et al. 2007),

- Percent *Chironomidae* – percent composition of a community by larval midges, a highly tolerant family (Jones et al. 2007),
- Dominant/Subdominant Taxa – highest and second highest number of taxa sampled,
- Percent Functional Feeding Groups – the percent composition of a community by Collector-filterers, Collector-gatherers, Predators, Scrapers, and Shredders. Feeding groups can provide an indication of habitat conditions (Merritt et al. 2008),
- Shannon Wiener Index (H') – an index used to measure the diversity in categorical data, taking into account the number of species and evenness of the species. Calculated as:
    - $H' = -\sum(p_i)\,(lnp_i)$
    - Where "p_i "is the proportion of individuals in the ith taxon (EC 2011),
- BI – a measure of water quality based on the species-level "tolerance values" and the number of individuals of each species and the total number of individuals within the sample. Calculated as:
    - $BI = \sum \frac{x_i t_i}{n}$
    - Where "x_i" is the number of individuals within the ith taxon, "t_i" is the tolerance value of the ith taxon, and n is the total number of individuals within the sample (Hilsenhoff 1987).
- FBI – a measure of water quality based on the family-level "tolerance values" and the number of individuals within each family and the total number of individuals within the sample. Calculated as:
    - $FBI = \sum \frac{x_i t_i}{n}$
- Where "x_i" is the number of individuals within the ith family, "t_i" is the tolerance value of the "ith" family, and n is the total number of individuals within the sample (Hilsenhoff 1988).

3.0 Existing Conditions

3.1 Soils, Terrain and Drainage

The study area is located in the physiographic region known as the Waterloo Moraine or the Waterloo Sand Hills (Chapman and Putnam 1984). This region is characterized by irregular hummocky to steeply rolling land comprised of a number of layers of ice contact and glacial outwash sands and gravels, separated by layers of silt and clay rich tills. These soils were deposited over the course of numerous advances and retreats of glacial ice lobes during the Wisconsinan glacial period. As the glacial ice melted and retreated, melt water eroded and cut through the layers. Modern action and erosion by watercourses and the deposition of wetland organic soils further created a complex pattern of surficial soils in the study area.

The tills in the study area are dominated by silts and clays in variable compositions and also with sand. In general, the tills are described as hard and dense with low permeability and are known as aquitards, forming a barrier protecting the underlying aquifer layers of water bearing sand and gravel layers or bedrock. The aquifer layers of the Waterloo moraine are important in Waterloo Region as a water supply for the Cities of Kitchener and Waterloo.

The subject property soils and groundwater conditions were investigated by LVM and are described in their Geotechnical Engineering Report (2015). Their findings indicate that the ground surface slopes down from east to west (Elevation 363.1m to Elevation 354.8m) and from north to south (Elevation 357.6m to Elevation 351.9m). The site is split, with roughly half of the site going west to Beaver Creek and the remainder draining to the southeast corner of the site where it drains towards Green Acre Trailer Park and eventually to the Laurel Creek Reservoir (Meritech 2016).

Subsurface stratigraphy comprises topsoil overlying sand, silt and glacial till, interpreted as the Upper Maryhill Till. Topsoil ranged in depth from 150mm to 1070mm across the site, with a thick layer of sand with some silt underlying this at all borehole locations. The sand layer ranged from 2.7m to 5.0m in thickness and extended beyond the depth of some of the boreholes. Silt and till were encountered below the sand layer and

extended beyond the depth of the remaining boreholes. Alluvial and organic soil deposits were noted in the low lying area of wetlands along Beaver Creek.

Refer to the Geotechnical Engineering Report for further details (LVM 2015).

3.2 Groundwater

Stantec completed hydrogeological monitoring to accompany this application (Stantec 2016a, 2018) with information from those reports included in this EIS. Stantec found that groundwater levels at the monitoring wells varies seasonally and responds synchronously (all at once) across the site to precipitation events. The flow of groundwater is interpreted to be generally from topographic highs in the northeast towards the lower lying lands in the southwest. Based on the permeability of the surficial soils, the majority of the site is identified as a potential groundwater recharge area where precipitation can infiltrate to the shallow groundwater layer, and potentially to the deeper aquifers where there is no intervening layer of impermeable till. Figure 5.8 of the NWSSS (Ecoplans et al 2013) indicates that approximately the eastern half of the subject property is a Potential Groundwater Recharge Area with groundwater discharge occurring off-site in the lower reaches of Beaver Creek just above its confluence with Laurel Creek, as well as into Laurel Creek.

The NWSSS indicated variable hydraulic gradients along both Beaver Creek and Laurel Creek and did not consistently indicate areas of groundwater recharge or discharge. This observation was substantiated during the 2012 groundwater and surface water monitoring year, which was a below average precipitation year. In 2012, groundwater levels were lower than those previously measured and accompanied by a lack of groundwater discharge within Laurel and Beaver Creeks during that time of drought (Stantec 2016a).

Shallow groundwater was encountered on-site at depths ranging from 0.8m to 6.99m in the boreholes and at the installed standpipes. The stabilized groundwater level was interpreted to occur between Elevation 350.9 m and 354.2 m in the NWSSS (Ecoplans et al 2013), roughly 3.0 to 6.0m in depth across the site. Based on the results of the geotechnical investigation, there are shallow groundwater levels at the south and east

portions of the property with groundwater elevations nearer to the surface near Beaver Creek on the west side of the site. The groundwater monitoring program found that in years with above average precipitation (2013, 2014) there was an increase in the spring groundwater levels above what had been predicted in the NWSSS (Stantec 2016a). Further details will be provided in the Stantec report.

3.3 Beaver Creek

3.3.1 Aquatic Habitat

Beaver Creek is well described in the NWSSS (Ecoplans et al. 2013). Reaches B4 and B5 are nearest the subject property, with B5 being immediately adjacent to the west subject property boundary, and B4 being downstream (south) of the property and Conservation Drive.

Reach B5 flows just west of the property through forest, swamp and thicket habitats which extend onto the subject property. Bankfull widths are in the range of 3.4m to 6.0m. Banks have moderate to steep slopes and have some evidence of erosion, with height ranging from 0.8m to 2.0m. Wetted widths were found to be 2.2m to 4.0m, with low-velocity flows over a low gradient and average water depths of 0.1m to 0.4m. Morphology is described as mostly flats with some scattered, small but deep pools. Substrates comprise mainly sand and silt, with a lesser distribution of coarser substrates. Some woody debris, cobble and boulders are present to provide fish cover. Filamentous algae is the only vegetation that is noted (Ecoplans et al. 2013).

Reach B4 extends for 200m downstream of Conservation Drive through a narrow riparian corridor within open agricultural fields. Bankfull widths are in the range of 4.0m to 7.0m, and bank height is between 1.0m and 2.0m. The banks have mostly moderate slopes with some evidence of erosion. Wetted widths were noted to be in the range of 2.8m to 4.5m, and flows had a low velocity over a low gradient. Water depths ranged from 0.1m to 0.4m. Morphology is described as predominantly flats with some small pools and short riffles. Substrates comprise mostly sand and silt, with some coarser substrates in the riffles. Wood debris and some cobble and boulders provide cover, and filamentous algae was noted (Ecoplans et al. 2013).

3.3.2 Fish Community

A collective total of 14 species of fish were captured in Reaches B4, and B5a during sampling in 2006 and 2009 for the NWSSS (Ecoplans et al. 2013). These species are listed in Appendix VI. The species captured were all common and secure in Ontario, and 11 of the 14 species can be considered habitat generalists. Rainbow darter (*Etheostoma caeruleum*) is considered a habitat specialist, preferring fast-flowing gravel and cobble riffles of creeks and small rivers with a preferred water temperature of 19.8°C (Eakins - OFFLHD as cited in Ecoplans et al. 2013). Longnose Dace (*Rhinichthys cataractae*) also prefer fast-flowing riffles. While some of the fish captured prefer cool water temperatures, none are indicative of coldwater habitat.

The NWSSS (Ecoplans et al. 2013) indicates that there appears to be suitable habitat for Brown Trout (*Salmo trutta*) and Brook Trout (*Salvelinus fontinalis*) in Beaver Creek. This is based on instream temperatures, substrates of gravel that are suitable for spawning, and observations of local groundwater discharge. There has also been evidence of potential spawning, although spawning has not been confirmed recently. Brown Trout spawning was previously documented from 1984 to 1994 by the MNRF and GRCA in the lower reaches of Laurel Creek and in Beaver Creek near the confluence. Since that observation, there have only been observations of potential adult trout and 'scrapes' that may or may not be redds. There has been no recent confirmation of Brook Trout or Brown Trout using Beaver Creek as habitat, although suitable characteristics within the creek suggests potential use by these coldwater species.

3.3.3 Benthic Invertebrate Community

The NWSSS (Ecoplans et al. 2013) identifies Beaver Creek as providing 'Good' aquatic habitat conditions and 'Good' to 'Fair' water quality. Benthic invertebrate sampling was carried out at a station on Beaver Creek just downstream of the subject property (on the Northgate property). The results of benthic macro-invertebrate monitoring program, completed between 2014 and 2019 are generally consistent with those findings (see NRSI 2016a-2020). Overall, the benthic macro-invertebrate community appears to exhibit a moderate to high benthic taxonomic richness with well-distributed benthic groups that include both sensitive EPT (Ephemeroptera, Plecoptera, Trichoptera) species and more tolerant Dipteran and Oligochaete species. As found in the NWSSS,

the higher proportions of EPT taxa were observed in the lower section of Beaver Creek, near the confluence with Laurel Creek and south of the Subject Property, where cobble/gravel substrates and riffle habitat are present. Dipteran species were commonly found in upper Beaver Creek, in the vicinity of the Subject Property, where dominant substrates were comprised mainly of silt and sand. The Family Biotic Index (FBI) and Biotic Index (BI) indicate a range of water qualities from 'Excellent' to 'Very Poor', varying considerably between years and individual sampling events from 2014 and 2019. However, averaged results over the course of the six years of monitoring indicate that water quality is 'Fairly Poor' to 'Good'.

3.4 Vegetation

3.4.1 Vegetation Communities

Existing ELC mapping was field verified by NRSI and refined during the 2014-2019 pre-construction monitoring program. ELC with6666in the subject property is largely the same as reported in the NWSSS with minor refinements as reported in the pre-construction monitoring reports (NRSI 2016, 2017a, 2018, 2019). A summary of ELC communities identified within the subject property is provided in Table 3 and shown on Map 3.

Table 3. Vegetation Communities Identified within the Study Area (adapted from Ecoplans et al. 2013)

ELC Ecosite Type	ELC Description	Environmental Characteristics
Wetland		
SWM4-1	White Cedar – Hardwood Organic Mixed Swamp	A small portion of this community extends into the northwest corner of the property. This mid-aged mixed swamp community is dominated by Trembling Aspen (*Populus tremuloides*), Black Ash (*Fraxinus nigra*), Yellow Birch (*Betula alleghaniensis*), and Eastern White Cedar (*Thuja occidentalis*) in the canopy. The sub-canopy and understorey are comprised of Eastern White Cedar, Black Ash, and Red-osier Dogwood (*Cornus stolonifera*). Groundcover flora is characterized by Spotted Jewelweed (*Impatiens capensis*), Sensitive Fern (*Onoclea sensibilis*), Wild Black Currant (*Ribes americanum*), Dwarf Raspberry (*Rubus pubescens*), Ostrich Fern (*Matteuccia struthiopteris* var. *pensylvanica*), and Wild Sarsaparilla (*Aralia nudicaulis*). A habitat inclusion exists on the outer edge of this vegetation community, Fresh-Moist Lowland Deciduous Forest (FOD7), and is dominated by Manitoba Maple (*Acer negundo*), Green

ELC Ecosite Type	ELC Description	Environmental Characteristics
		Ash (*Fraxinus pensylvanica*), Red-osier Dogwood, and Nannyberry (*Viburnum lentago*).
SWM6-1	Birch – Conifer Organic Mixed Swamp	A large portion of the wetland habitats on-site are comprised of this vegetation community. This mid-aged mixed swamp community is dominated by Yellow Birch, Trembling Aspen, Eastern White Cedar, Tamarack (*Larix laricina*), White Elm (*Ulmus americana*) in the canopy. The sub-canopy and understorey area comprised of Eastern White Cedar, Yellow Birch, and Alternate-leaved Dogwood (*Cornus alternifolia*). Groundcover flora is characterized by Dwarf Raspberry, Bulblet Fern (*Cystopteris bulbifera*), Sensitive Fern, Field Horsetail (*Equisetum arvense*), Spotted Jewelweed, and Fowl Manna Grass (*Glyceria striata*). A Habitat inclusion exists on the outer edge of this vegetation community, Dry-Fresh Poplar Deciduous Forest (FOD3-1), and is dominated by Trembling Aspen, Black Walnut (*Juglans nigra*), Choke Cherry (*Prunus virginiana* ssp. *virginiana*), and Woodbine (*Parthenocissus vitacea*). Seven regionally significant species were observed within this community, or within the FOD3-1 inclusion: Meadow Horsetail (*Equisetum pratense*), Northern Beech Fern (*Phegopteris connectilis*), Virginia Creeper (*Parthenocissus quinquefolia*), Virginia Stickseed (*Hackelia virginiana*), White Spruce (*Picea glauca*), Eastern Cottonwood (*Populus deltoides* ssp. *deltoides*), Bristle-stalked Sedge (*Carex leptalea*).
SWDO3	Organic Deciduous Swamp	A small portion of this community extends into the subject property, and it is associated with low-lying riparian habitats of Beaver Creek. This mid-aged deciduous swamp community is dominated by Trembling Aspen, Black Ash, Balsam Poplar (*Populus balsamifera*), and Freeman's Maple (*Acer* X *freemanii*) in the canopy. The sub-canopy and understorey are comprised of Alternate-leaved Dogwood, Common Elderberry (*Sambucus canadensis*), Riverbank Grape (*Vitis riparia*), and Silky Dogwood (*Cornus amomum ssp. obliqua*). Groundcover flora is characterized by Spotted Jewelweed, Sensitive Fern, Rice Cut Grass (*Leersia oryzoides*), Dwarf Raspberry, and False Nettle (*Boehmeria cylindrica*).
SWT2/CUP3	Mineral Thicket Swamp / Coniferous Plantation	A large portion of the wetland habitats on-site are comprised of this vegetation community. This young-aged thicket swamp and coniferous plantation mosaic community is dominated by Tamarack, Norway Spruce (*Picea abies*), White Spruce, Trembling Aspen, and Balsam Poplar in the canopy. The sub-canopy and understorey are comprised of Silky Dogwood, Eastern White Cedar, and several Willow (*Salix* spp.) species. Groundcover flora is characterized by a variety of sedges (*Carex* spp.), Soft Rush (*Juncus effusus* var. *solutus*), Fringed Brome (*Bromus ciliatus*), Common Boneset (*Eupatorium*

ELC Ecosite Type	ELC Description	Environmental Characteristics
		perfoliatum), Grass-leaved Goldenrod (*Euthamia graminifolia*), and Spotted Jewelweed. A single regionally significant species was observed within this community, White Spruce, which is associated with the Coniferous Plantation.
Hedgerow		
HR2	Deciduous Hedgerow	This deciduous hedgerow community along the north property limits is dominated by European Buckthorn (*Rhamnus cathartica*), Manitoba Maple (*Acer negundo*), Sweet Cherry (*Prunus avium*), American Basswood (*Tilia americana*), Black Cherry (*Prunus serotina*), and White Ash (*Fraxinus americana*) in the canopy and sub-canopy. The understorey layer is comprised of Riverbank Grape, Wild Red Raspberry (*Rubus idaeus* ssp. *melanolasius*), Woodbine, Red-osier Dogwood, and Hawthorn (*Crataegus* spp.). Groundcover flora is characterized by Wild Strawberry (*Fragaria virginiana*), White Avens (*Geum canadense*), Quack Grass (*Elymus repens*), Star-flowered Solomon's Seal (*Maianthemum stellatum*), Garlic Mustard (*Alliaria petiolata*), and Dame's Rocket (*Hesperis matronalis*). Of the 39 trees inventoried and verified as present in 2019 within HR2, 13 are in Good condition, 25 are in Fair condition, and 1 is dead. A single regionally significant species was observed within this community, Hackberry (*Celtis occidentalis*).

3.4.2 Vascular Flora

A total of 131 vascular plant species were documented within the vegetation monitoring plots (Appendix III). Approximately 17% of the vascular plant species observed are non-native species.

NRSI biologists documented and mapped all regionally, provincially, and federally significant plant species observed during the pre-construction biological monitoring program in 2014-2019. Significant species observed within the subject property are shown on Map 3. Several regionally significant plants (Richardson and Martin 1999) were observed including: Hackberry, Meadow Horsetail, Northern Beech Fern, Virginia Creeper, Virginia Stickseed and White Spruce, Bristle-stalked Sedge, and Eastern Cottonwood. Of these, Hackberry, Meadow Horsetail, Virginia Creeper, and Bristle-

stalked Sedge were not previously identified in the NWSSS (Ecoplans et al. 2013). Black Walnut was not mapped due to its prolific presence throughout suitable edge habitats within the subject property. White Spruce individuals are likely planted specimens, or reproducing from the planted specimens, given the coniferous plantation context, as reported in the NWSSS (Ecoplans et al. 2013) and confirmed by NRSI biologists.

A single provincially and federally Endangered species, Butternut (*Juglans cinerea*), was observed within the subject property at the east property limits nearby the burned down former residence. This species prefers rich-moist woodlands, stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands (Reznicek et al. 2011). Butternut was not previously identified in the NWSSS (Ecoplans et al. 2013). A genetic test was completed in 2019 by the Ontario Forest Research Institute (OFRI) to determine the hybridity status of the individual. The results showed that the tree was a hybrid and therefore not protected under the ESA (2007). Due to the confirmed hybridity of the Butternut, this individual is not considered significant.

3.4.3 Vegetation Monitoring Plots

A total of 2 vegetation monitoring plots were established within the scope of the pre-construction biological monitoring program for the subject property and surveyed in summer 2014-2016, and 2019. The purpose of the monitoring was to establish baseline conditions, for comparison with subsequent monitoring events (i.e. during and post-construction monitoring). The results among all monitoring events were found to be generally consistent with the detailed vegetation community characterization reported in the NWSSS (Ecoplans et al. 2013). Refer to the Pre-Construction Biological Monitoring Program reports (NRSI 2016a, NRSI 2017) for further details and discussion. As the vegetation monitoring plot surveys were suspended in 2017 and 2018 to avoid trampling disturbance to the sensitive natural features, the habitat conditions were confirmed to be unchanged upon reinstatement of these surveys in 2019. Note that vegetation monitoring plot VEG-002 was relocated in 2019 to avoid further disturbance to the natural feature and substrates resulting from the survey methods, as the former plot location was particularly sensitive to human presence in general.

Within Vegetation Monitoring Plot #1 (VEG-001), no significant plant species were observed. This monitoring plot is characterized as an early successional stand of poplars surrounded by coniferous plantation. It was noted as having a moderate level of disturbance throughout, supporting several non-native and invasive species, of which European Buckthorn and Glossy Buckthorn (*Frangula alnus*) are notably establishing as observed during the 2019 survey in comparison to the preceding surveys.

Within Vegetation Monitoring Plot #2 (VEG-002), surveyed in 2014-2016, two regionally significant plant species were observed, Meadow Horsetail and Northern Long Beech Fern. This monitoring plot was noted as having standing water, with groundwater seepage throughout, and complex microtopography. Vegetation species recorded in the plot were comprised almost entirely of native species. This plot was abandoned in 2019 and relocated to a new location more appropriate for long-term monitoring.

Within Vegetation Monitoring Plot #2 (VEG-002), surveyed in 2019, a single regionally significant species was observed, Bristle-stalked Sedge. Some groundwater seepage was evident. The monitoring plot has a complex microtopography, and a small tributary of Beaver Creek flows to the south of the plot. Vegetation species recorded in the plot were comprised almost entirely of native species.

In order to evaluate the quality of the vegetation communities on-site, the Floristic Quality Index (FQI) was calculated for each vegetation plot and is shown in Table 4 below (NRSI results in bold font). These results have been aggregated for the vegetation monitoring plot surveys completed by NRSI from 2014-2016, and 2019. The same analysis was completed in the NWSSS (Ecoplans et al. 2013) for the entire ELC community and is shown for comparison.

Table 4. Floristic Quality Index by Vegetation Plot and Community

	VEG-001 SWT2/CUP3	SWT2/CUP3 NWSSS	**VEG-002 (2014-2016) SWM6-1**	**VEG-002 (2019) SWM6-1**	SWM6-1 NWSSS
Total species	**78**	54	**55**	**40**	92
FQI (native species)	**20.71**	25.96	**35.58**	**31.31**	37.53
FQI (incl. non-native)	**12.91**	22.32	**34.38**	**29.88**	34.51
Wetness index	**0.71**	-2.41	**-1.95**	**-2.15**	-0.84

3.4.4 Vegetation Surveys for Enhancement / Management Needs and Terrestrial Feature Monitoring

Results of the vegetation surveys for enhancement and management needs are presented in the Pre-Construction Biological Monitoring Program reports (NRSI 2016a, 2017, 2018, 2019). Notable disturbances within the subject property include small areas of historic refuse dumping and invasive species establishment. Refer to the above-referenced reports for further details, mapping and discussion. The following Table 5 provides a high-level summary of findings. Refer to Section 5.0 of this report for recommendations to address the identified disturbances.

Table 5. Disturbance Areas and Management/Enhancement Recommendations

Wildlife Survey Unit(s)	Disturbance Identified	Description of Disturbance	Management/Enhancement Recommendations
2115881 Ontario Ltd. Property			
1	Invasive species (Phragmites)	Stand of Phragmites at far southwest corner of property near Beaver Creek culvert at Conservation Drive. This stand extends off-property to the west.	Removal of Phragmites through herbicide application if possible. A coordinated effort should be initiated among local landowners for successful long-term control. It is anticipated that Phragmites invasion along Conservation Dr. will be removed by the scheduled road improvements. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
1	Invasive species (White Poplar)	An early establishment of young-aged White Poplars adjacent to Conservation Drive.	Removal of White Poplar through cutting, e, mature trees), and herbicide application if possible. It is anticipated that White Poplar invasion along Conservation Dr. will be removed by the scheduled road improvements. Replacement of White Poplar with suitable native species such as Trembling Aspen or Balsam Poplar. Edge management and buffer recommendations are included in this EIS. An invasive species management plan will be developed for the property.
3	Refuse dumping	Historic farm dump – metal, glass, etc.	Removal of refuse and proper disposal.
	Invasive species (Dog-strangling	An early establishment in the naturalized lawn area	Since the house was removed in 2020, this entry is no longer applicable.

Wildlife Survey Unit(s)	Disturbance Identified	Description of Disturbance	Management/Enhancement Recommendations
	Vine (*Vincetoxicum rossicum*))	of the existing residence. This is the first observation of this aggressive invasive species since NRSI's involvement in the project (2014). Several individuals were in seed.	

3.4.5 Fixed Photo Plot Monitoring

No notable changes in the pre-construction conditions were documented during the fixed photo plot monitoring (2014-2019). Photographic documentation of the fixed photo plot monitoring applicable to the subject property is provided in the Pre-Construction Biological Monitoring Program report (NRSI 2016a, 2017, 2018, 2019). Refer to the above-referenced report for further details and discussion.

3.4.6 Tree Inventory

3.4.6.1 North Hedgerow (HR2)

A tree inventory for the north hedgerow (HR2) was conducted in 2016 and updated in 2019. A total of 42 trees were assessed in 2016, however, a number of those in fair to good condition at the time of the initial inventory were ash or elm which do not have a long life expectancy due to Emerald Ash Borer (*Agrilus planipennis*) and Dutch Elm Disease, respectively. In 2019, a total of 39 trees were re-assessed. A summary of the updated tree data results is provided in Table 6 below, and shown on Map 6a. Full details of the tree inventory are appended to this report (Appendix VII).

Table 6. North Hedgerow (HR2) Tree Inventory Data, March 2019

Common Name	Scientific Name	Tree Health				
		Good	Fair	Very Poor	Dead	Total
Native Species						
Sugar Maple	*Acer saccharum* ssp. *saccharum*		1			1
American Basswood	*Tilia americana*	1				1
White Elm	*Ulmus americana*	5	2			7
Manitoba Maple	*Acer negundo*	1	2			3
Black Cherry	*Prunus serotina*		3			3
White Ash	*Fraxinus americana*	4	6			10

Common Hackberry	*Celtis occidentalis*		1			1
Native Species Total		11	15			26
Non-Native Species						
Common Apple	*Malus domestica*		3			3
Common Pear	*Pyrus communis*	1				1
Sweet Cherry	*Prunus avium*	1	4			5
Hawthorn	*Crataegus* sp.		3			3
Non-Native Species Total		2	10			12
Snag (identification not possible)					1	1
Total		13	25	1	1	39

3.4.6.2 Peninsula of Wooded Area (FOD3-1)

A tree inventory for the peninsula of wooded area (FOD3-1) beyond the significant woodland dripline was conducted in 2018. A total of 15 trees were assessed in 2018, which consisted predominantly of Trembling Aspen. A summary of the updated tree data results is provided in Table 7 below, and shown on Map 6b. Full details of the tree inventory are appended to this report (Appendix VII).

Table 7. Peninsula of Wooded Area (FOD3-1) Tree Inventory Data, July 2018

Common Name	Scientific Name	Tree Health				
		Good	Fair	Poor	Dead	Total
Native Species						
Manitoba Maple	*Acer negundo*		1	1		2
Green Ash	*Fraxinus pennsylvanica*	2				2
Trembling Aspen	*Populus tremuloides*	1	5	4	1	11
Native Species Total		3	6	5	1	15
Total		3	6	5	1	15

3.5 Avifauna

A total of 71 bird species were documented during the pre-construction monitoring (2014-2019 combined), including incidental observations, within the subject property. Of the 72 documented bird species, 51 of these species exhibited signs of breeding, such as being in suitable breeding habitat, males singing, territories established, females carrying food or nest materials, and the presence of fledged young. Refer to Appendix IV for a list of bird species documented during the breeding bird season in 2014-2019; also included is a separate list of bird species documented incidentally outside of the breeding bird season in 2014-2019 during all other visits to the subject property.

Of the documented bird species, several are designated as federally, provincially, or regionally significant. A total of 2 regulated bird SAR, 3 bird SCC, and 21 regionally significant bird species (Martin 1996) were observed within the subject property (2014-2019) and are discussed in further detail below.

Barn Swallow (*Hirundo rustica*)

Barn Swallow, a regulated SAR, is listed as Threatened provincially (MECP 2019), affording individuals and their habitat protection under the ESA (2007). Barn Swallow can be found in farmlands or rural areas near bodies of water and nest in buildings or other man-made structures (OMNR 2000). Barn Swallow was documented foraging during breeding bird surveys at 4 Wildlife Survey Units (WSU-3, WSU-4, WSU-5, WSU-6, WSU-7, WSU-8), over 2014-2019. Observations were predominantly incidental with no evidence of breeding documented. No nests were observed on or in any of the buildings or structures on-site during the targeted Barn Swallow surveys. Suitable nesting habitat for this species is present outside of the subject property, and observations within the subject property are interpreted as foraging individuals only.

Bank Swallow (*Riparia riparia*)

Bank Swallow, a regulated SAR, is listed as Threatened provincially (MECP 2019), affording individuals and their habitat protection under the ESA (2007). Preferred breeding habitat for Bank Swallow includes sand, clay or gravel river banks or steep riverbank cliffs, lakeshore bluffs of easily crumbled sand or gravel, gravel pits, road-cuts, and grassland or cultivated fields that are close to water (OMNR 2000). Bank Swallow was documented incidentally with no breeding evidence in 3 Wildlife Survey Units (WSU-4, WSU-5, WSU-8), over 2014-2019. It is likely that these individuals were passing over the site or foraging. Breeding habitat for this species does not exist within the subject property.

Eastern Wood-pewee (*Contopus virens*)

Eastern Wood-pewee, a SCC, is listed as Special Concern both provincially and federally (MECP 2019, Government of Canada 2018). Breeding habitat for this species includes a wide variety of wooded habitats such as open, deciduous, mixed or coniferous forest predominated by oak with little understorey, forest clearings, edges,

farm woodlots, and parks (OMNR 2000). Eastern Wood-pewee was documented incidentally and displaying breeding evidence within 2 Wildlife Survey Units (WSU-3, WSU-5, WSU-6) and within adjacent lands, over 2014-2019. The highest breeding evidence was recorded as 'S' (singing male), suggesting a possible breeding status.

Common Nighthawk (*Chordeiles minor*)

Common Nighthawk, a SCC, is listed as Special Concern provincially (MECP 2019) and Threatened federally (Government of Canada 2018). This species' breeding habitat includes open ground, clearings in dense forests, ploughed fields, gravel beaches or barren areas with rocky soils, open woodlands, and flat gravel roofs (OMNR 2000). Common Nighthawk was documented as flyovers (i.e. no breeding evidence) at WSU-4 during targeted surveys; aerial displays and flight patterns characteristic of territorial behavior were observed on adjacent lands only. This species was observed in 2015 and 2016 only, with the highest breeding evidence recorded as 'T' (permanent territory) documented on adjacent lands, suggesting a probable breeding status. Suitable nesting habitat for this species on-site is limited to forest edges, with other suitable preferred nesting habitat found off-site within the local area (i.e. flat gravel roof at Creekside Church to the west of the subject property). Any available nesting habitat for this species within the subject property is considered marginal and unfavorable and would likely be subjected to nest predation. Further discussion relating to Common Nighthawk SWH is provided in Section 4.4 of this report.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald Eagle, a SCC, is listed as Special Concern provincially (MECP 2019) and Not at Risk federally (Government of Canada 2018). Bald Eagle was documented as a flyover at WSU-2 during the 2019 winter wildlife survey. Bald eagle is not using the site as winter habitat or nesting habitat but are becoming more common in the Province and are known from the local area along the Grand River corridor throughout the year.

In addition to the species discussed above, a total of 21 regionally significant bird species have been observed to-date (Appendix IV). Of these 21 species observed, 10 species displayed evidence of breeding, as summarized in Table 8 below.

Table 8. Regionally Significant Breeding Bird Species Observations (2014-2019)

Scientific Name	Common Name	Location(s) Observed	Highest Breeding Evidence[1]
Dryocopus pileatus	Pileated Woodpecker	WSU-2	Possible
Empidonax alnorum	Alder Flycatcher	WSU-1	Possible
Empidonax minimus	Least Flycatcher	WSU-1	Possible
Geothylpis philadelphia	Mourning Warbler	WSU-3	Possible
Melanerpes carolinus	Red-bellied Woodpecker	WSU-1,3	Possible
Pooecetes gramineus	Vesper Sparrow	WSU-3, 5	Possible
Sphyrapicus varius	Yellow-bellied Sapsucker	WSU-2	Possible
Sialia sialis	Eastern Bluebird	WSU-4, 5	Probable
Toxostoma rufum	Brown Thrasher	WSU-3, 5, 6, 7, 8	Probable
Vermivora cyanoptera	Blue-winged Warbler	WSU-1, 2	Possible

[1]OBBA 2001

3.6 Amphibians

Amphibian breeding activity throughout the subject property has been variable throughout the pre-construction monitoring (2014-2019). No federally, provincially, or regionally significant amphibian species have been documented to-date, and all amphibian species recorded were previously documented in the NWSSS (Ecoplans et al. 2013).

The NWSSS (Ecoplans et al. 2013) reported the federally significant Western Chorus Frog sub-population (*Pseudacris triseriata* pop.2) within the subject property. This species was recorded in two locations on or in the vicinity of the subject property, including the wetland at the northwest limit of the property and the wetland immediately north of Conservation Drive, during 3 of the years of the study (2007, 2008, 2011), but not since.

Appendix V summarizes the results of the evening amphibian call surveys within the subject property (2014-2019). Incidental amphibian observations made by NRSI biologists during all other field surveys conducted throughout the subject property during the pre-construction monitoring program (2014-2019) are listed in Table 9.

Table 9. Incidental Amphibian Observations (2014-2019)

Scientific Name	Common Name	Location(s) Observed
Anaxyrus americanus	American Toad	WSU-1, 2, 3, 4, 5
Hyla versicolor	Gray Treefrog	WSU-1, 2, 3
Lithobates clamitans melanota	Northern Green Frog	WSU-1, 2, 3
Lithobates pipiens	Northern Leopard Frog	WSU-1, 2, 3, 5
Lithobates sylvatica	Wood Frog	WSU-2, 3
Pseudacris crucifer	Spring Peeper	WSU-1, 2, 3

3.7 Reptiles

Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was the only reptile species observed within the subject property during the pre-construction monitoring surveys (2014-2019) and during the NWSSS (Ecoplans et al 2013). No federally, provincially, or regionally significant reptile species were documented.

During the pre-construction monitoring surveys (2014-2019), and targeted visual surveys for turtle SAR and SWH, NRSI biologists did not observe or document habitat use by any turtle species within the subject property. As well, the NWSSS (Ecoplans et al. 2013) and roadside mortality surveys completed by others (MMM Group) did not document any turtle species within the subject property prior to 2014.

The NWSSS (Ecoplans et al. 2013) reports that Blanding's Turtle was observed in the Laurel Creek Reservoir and to the west of the reservoir in 2009 and 2013 respectively. The reservoir has been identified as Category 1 habitat, where the confirmed turtle sightings were made.

3.8 Mammals

According to the Mammal Atlas of Ontario (Dobbyn 1994), 40 mammal species are reported from within 10km of the study area. Direct or indirect evidence of 11 mammal species were observed during the field surveys. Refer to Appendix VIII for a complete list of mammal species reported and observed from the subject property (2014-2019).

The detailed bat habitat assessment identified suitable habitat features within the subject property, including an existing residence and two isolated landscape trees. Since the initial and follow-up bat habitat assessments in 2014 and 2016 respectively, the existing

residence has been demolished. Demolition occurred in 2018 and was carried out in compliance with the ESA (2007), and according to MNRF consultation and recommendations. Refer to the 2017 Pre-construction Biological Monitoring Report (NRSI 2018) for a more fulsome description. Targeted bat surveys of the isolated landscape trees are not required, as determined through MNRF consultation, as long as tree removal avoids the key roosting period for regulated SAR bats (May 1 – August 31), where possible (D. Marriott, pers. comm. 2015b).

Continued compliance with the ESA (2007) as it applies to regulated SAR bats will be ensured at the time of the removal of the remaining building, and isolated landscape trees within the subject property.

As a result of the targeted American Badger den survey, no candidate dens were observed within the subject property.

During the June 5, 2015 field survey, a Virginia Opossum (*Didelphis virginiana*) was observed dead alongside Conservation Drive at the Beaver Creek crossing. Virginia Opossum is a regionally significant mammal species (RMOW 1985). Virginia Opossum was not documented elsewhere within the subject property or adjacent lands during the pre-construction monitoring (2014-2019). This species prefers lowland to upland deciduous wooded areas, preferably near water and farmland (OMNR 2000); suitable habitat for this species is present within the habitats along the southwest corner of the property.

3.9 Insects

Monarch Butterfly was observed within the subject property in several WSUs during the pre-construction monitoring (2014-2019). Monarch Butterfly SWH (i.e. Special Concern and Rare Wildlife Species) has been considered for the subject property based on these observations. Milkweed (*Asclepias* spp.) species, namely Common Milkweed (*Asclepias syriaca*), is the host plant for Monarch and is present occasionally throughout the subject property, restricted to natural feature edges and weedy/early successional habitats such as along property boundaries or agricultural field edges. Monarch is a SCC, however, due to lack of expansive habitats for Milkweed throughout the subject property, as well

as abundance of nectaring sources and habitat availability throughout southern Ontario, SWH for Monarch has not been identified within the subject property.

Table 10 lists incidental insect species observations by NRSI biologists during all field surveys conducted during the pre-construction monitoring (2014-2019).

Table 10. Incidental Insect Observations (2014-2019)

Scientific Name	Common Name	Location(s) Observed
Calopteryx maculata	Ebony Jewelwing	WSU-2
Colias philodice	Clouded Sulphur	WSU-3
Danaus plexippus	Monarch	WSU-2, 3, 4, 5
Phyciodes cocyta	Northern Crescent	WSU-1

3.10 Wildlife Road Crossing Mortality Monitoring

Road crossing mortality monitoring conducted by MMM Group in 2014 at Conservation Drive resulted in relatively few documented mortalities, consisting entirely of frogs. Non-identifiable frogs were the most abundant mortality observation (n=11), followed by Northern Leopard Frog (n=6). Non-identifiable frogs are individuals that could not be identified from mortality remains, or where an observation of a frog was made, but species could not be determined (i.e. existing roadway too far away to identify).

NRSI biologists regularly inspected the Beaver Creek Road crossing at Conservation Drive for any wildlife mortality during the annual spring and fall terrestrial feature monitoring surveys. Notable mortality events, such as significant species or a significant number of individuals of a common species, have not been documented to-date by NRSI (2014-2019) with the exception of the single Virginia Opossum as described above.

4.0 Functional Analysis

In this section the findings of the ecological, hydrological, hydrogeological studies are compiled to provide an understanding of the quality and sensitivity of the ecosystems present on the property and the interactions between the biological and physical environment. The physical processes contributing to the maintenance of the natural features and their functions are discussed at the subject property scale, with reference to the subwatershed study for landscape-level context. This description takes into account the current quality and condition of the natural features based on land management practices and existing impacts such as clearing, grading, tree cutting, trails, dumping, filling and invasive plant and insect species.

4.1 Quality and Sensitivity of Ecosystems

The study area landscape is typical of rural southern Ontario; dominated by agricultural lands with natural features, primarily watercourses and wetlands, retained in blocks where land was unsuitable for farming. On the subject property, natural features are limited to wetlands in the low-lying parts of the site that were not cleared or drained historically for agriculture. Small portions of upland habitats flank the wetlands. This fragmented landscape pattern has remained unchanged for over 80 years, as far back as aerial photographs could be obtained, and likely much longer. The wetlands in the northwest and west-central parts of the site are primarily forested with mixed swamp vegetation on organic soils, while the wetlands in the southwest part of the property were cleared historically and have since been naturalized through a mix of planted conifer trees and natural regeneration of thicket swamp, sedge meadow and cattail marsh.

The central portion of the wetland (SWM6-1) contains a relatively rich and diverse mixture of plant species, with high FQI and also some large tree specimens. Disturbance in this community is low, while the southern wetland lobe (SWT2/CUP3) had a lower diversity of plant species, a lower FQI and more non-native species which is a reflection of the historical high disturbance (clearing and agriculture) of this feature. Agricultural tilling occurs up to the wetland edge along most of its length with a narrow fringe of Dry-Fresh Poplar Deciduous Forest (FOD3-1) present in some locations. The wetland habitats in the southwest are directly connected to Beaver Creek (off-site) and

provides a dense vegetated buffer, groundwater discharge, water storage and overhead canopy to protect the aquatic habitat.

The wetland in the northwest corner of the subject property (SWM4-1) is only a very small portion of the larger wetland finger that extends onto the site from the west. The on-site portion of the wetland is buffered from the agricultural edge by the Fresh-Moist Lowland Deciduous Forest (FOD7) community. As a whole, this wetland community has a high diversity of species and the highest FQI documented in the subwatershed study area (Ecoplans et al. 2013). The lowland forest edge community is more disturbed and has more non-native species. The wetland drains to the west through an intermittent drainage tributary to Beaver Creek. The off-site portion of this wetland has experienced recent disturbances related to clearing and drainage for agriculture which has reduced its total area and narrowed the vegetated connection to Beaver Creek.

4.2 Wetland Water Balance

The subject property surface drainage is divided with the western half flowing towards the wetlands and Beaver Creek, while the eastern half flows south towards Conservation Drive and ultimately Laurel Creek. Groundwater flow pattern was interpolated to flow from northeast to south and southwest, generally in the direction of Beaver Creek and Laurel Creek.

The surface soils on-site are primarily sands, which have a high capability for infiltration of rainfall. This is observed in the response of the groundwater elevation to rainfall events, as recorded at the monitoring wells described in the Groundwater and Surface Water Monitoring Program report prepared by Stantec (2018). Under the current agricultural land use, the majority of precipitation which falls on the site during the growing season is taken up by crops and lost to evapotranspiration (ET), with a smaller component infiltrating into the soil and very little running off. To manage water balance for future developments, the NWSSS (Ecoplans et al. 2013) prepared a groundwater recharge (infiltration) target for the catchments of the subwatershed including the subject property. These are shown in Table 11 as it pertains to the subject property.

Table 11. Target Infiltration for on-Site Catchments

Description	Catchment	Area (ha)	Existing Infiltration Rate (mm/yr)	Target Infiltration Rate (mm/yr)	Target Annual Infiltration (m^3/yr)
East part of site	3101/3107	11.6	183.4	281.6	32,606
West part of site	3913	11.8	222.15	265.2	31,283
Total		23.3			63,889

The wetlands on-site are supported through a combination of groundwater discharge and surface water runoff. Areas of groundwater seepage were observed along the eastern edge and throughout the wetlands on the property both during current field surveys and the NWSSS (Ecoplans et al 2013). While seepage was consistently noted throughout the wetlands, the NWSSS (Ecoplans et al 2013) found that groundwater expression into Beaver Creek was occasional and minor, although increasing in the northern sections of the creek.

4.3 Species At Risk

Through the field surveys and analysis in the NWSSS (Ecoplans et al 2013) and the pre-construction monitoring program (2014-2019) supporting this study, no regulated SAR were confirmed to be using habitats within the subject property. The subject property does contain protected general habitat for Blanding's Turtle. Further discussion is provided below.

Blanding's Turtle

NRSI has consulted with MNRF/MECP relating to Blanding's Turtle throughout the pre-construction monitoring program (2014-2019) and this EIS in order to make a determination of protected general habitat presence and its extent within the subject property.

The most sensitive category of protected habitat for Blanding's Turtle is Category 1, which includes the nest or overwintering sites. Blanding's Turtle requires organic substrates and water depths of approximately 0.9m for overwintering sites (Ernst and Lovich 2009); suitable overwintering habitat is not found within the subject property. Wetlands within the subject property do not contain sufficient permanent water for overwintering and depths within Beaver Creek (off-site) are also too shallow. As such,

this category of habitat was determined not to be present on the subject property in consultation with MNRF (D. Marriot, pers. comm. 2015c).

Category 2 habitat includes the wetland complex extending up to 2km from a known occurrence, and an area of 30m beyond those wetlands. The wetlands on-site plus 30m are therefore Category 2 habitat. Category 3 habitat is the area between 30m and 250m around suitable wetlands/waterbodies identified as Category 2 and provides movement corridors between wetlands.

No nesting by Blanding's Turtle or any other turtles has been documented within the subject property as confirmed through targeted turtle nest and nesting surveys completed in 2014-2016 according to MNRF protocol (MNRF 2015d, MNRF 2016). NRSI biologists did not observe or document any turtle species within the subject property during any surveys conducted to-date (2014-2019). In consultation with MNRF, nesting habitat was determined not to be present on the subject property (Marriot, D. pers. comm. 2017).

An Information Gathering Form (IGF) was submitted to MNRF and review comments were received on July 8, 2016 (G. Buck pers. comm. 2016). MNRF response comments to the IGF included items to be addressed in the EIS impact analysis to avoid potential impacts to the species. These included consideration of the location and design of the stormwater management facility, wetland buffer dimensions, maintaining wetland water balance and potential for conflict with SWM pond clean out (G. Buck pers comm 2016). Subsequently, NRSI prepared a Comprehensive Mitigation Plan for Blanding's Turtle (NRSI 2019) which encompasses the subject property as well as other active developer owned lands within the protected general habitat area of this species (2km). The Mitigation Plan was prepared in consultation with multiple property owners and was submitted to MECP in April 2019, as they are currently the responsible Ministry for administering the ESA (2007). The plan includes fencing of Category 2 habitats and eco-passage measures to maintain connectivity of Blanding's Turtle habitats while protecting turtles from potential road crossing impacts. MECP reviewed and accepted the Mitigation Plan and agreed that it will prevent and avoid impacts to Blanding's Turtles that may occur as a result of the proposed development on this property and others

nearby (M. Karam, pers. comm. 2019). The Mitigation Plan was updated with further detail (NRSI 2020) and outlines a comprehensive approach to mitigating impacts to Blanding's turtle among the developer properties and is included in Appendix IX of this report.

4.4 Significant Wildlife Habitat

Within the NWSSS (Ecoplans et al. 2013), confirmed and candidate SWH types were identified following guidance within the Natural Heritage Reference Manual (NHRM) (OMNR 2010), the Significant Wildlife Habitat Technical Guide (SWHTG (OMNR 2000) and the SWH Ecoregion Criteria Schedules (MNRF 2015b). In the SWHTG, SWH is grouped into 5 broad categories:

i. Seasonal Concentration Areas,
ii. Rare Vegetation Communities
iii. Specialized Wildlife Habitat,
iv. Habitats of Species of Conservation Concern, and
v. Animal Movement Corridors.

The following 2 SWH types were confirmed for the subject property within the NWSSS (Ecoplans et al. 2013) based on the site-specific field surveys for the subject property:

- Seasonal Concentration Areas (Amphibian Breeding Habitat (Woodland)), and
- Habitat for Species of Conservation Concern (Special Concern and Rare Wildlife Species).

Amphibian Breeding Habitat (Wetland) and Turtle Wintering Area SWH were identified as candidate SWH types in the NWSSS (Ecoplans et al. 2013), and have been ruled out by NRSI as not occurring within the subject property as determined through extensive field surveys during the pre-construction monitoring (2014-2019). A more fulsome assessment of confirmed SWH types within the subject property is provided in the following sections and discussed in each of the pre-construction monitoring reports (NRSI 2016a, 2017, 2018, 2019).

Findings from the detailed field surveys conducted during the pre-construction monitoring in 2014-2019 were used to further identify confirmed and candidate SWH

within the subject property. Confirmed SWH identified by NRSI within the subject property during 2014-2019 are shown on Map 5 of this report and include:

- Seeps and Springs (not previously reported in the NWSSS),
- Amphibian Breeding Habitat (Woodland), and
- Special Concern and Rare Wildlife Species (Eastern Wood-pewee)

Candidate SWH types are not included in Map 5 of this report and are limited to Bat Maternity Colonies within the forested vegetation communities.

4.4.1 Specialized Wildlife Habitat

Amphibian Breeding Habitat (Woodland)

During the pre-construction biological monitoring program (2014-2019), Amphibian Breeding Habitat (Woodland) has been confirmed within the subject property. The SWT2/CUP3 vegetation community in the southwest portion of the subject property and extending off-property meets the criteria for this type of SWH based on the number of species and individuals observed. NRSI's 2014-2019 survey results in community SWM6-1 did not satisfy the significance criteria for amphibian breeding habitat (woodland) SWH that was confirmed during the NWSS (Ecoplans et al. 2013).

Seeps and Springs

Seeps and Springs SWH has been confirmed within the wetlands on the subject property. Suitable seepage areas were observed within the following vegetation communities: SWM4-1, SWM6-1, and SWT2/CUP3 and are associated with groundwater discharge in the wetlands. Seeps and Springs occur regularly within these low-lying areas in the study area.

4.4.2 Habitat for Species of Conservation Concern

Confirmed habitat for Species of Conservation Concern may be considered Significant Wildlife Habitat (OMNR 2000). Based on the results of wildlife-specific field surveys, habitat for 1 SCC; Eastern Wood-pewee was confirmed as SWH within the subject property (refer to Section 3.7 for further discussion). Given the observations of a singing male Eastern Wood-peewee in suitable wooded habitat within the subject property, this is treated as confirmed habitat for this species.

Common Nighthawk SWH has been considered for the subject property based on species observations in 2015 and 2016 as discussed in Section 3.7, however due to the lack of breeding evidence over time for habitats within the subject property, SWH for Common Nighthawk is not present within the subject property.

4.5 Key Wildlife Habitat Functions

Table 11 provides a summary of the key attributes and species notes for each of the WSUs within the subject property. For the purposes of this report, confirmed SWH types provided in Table 12 are based on NRSI field survey results during the pre-construction monitoring (2014-2019). Some additional wildlife attributes were identified in the NWSSS (Ecoplans et al. 2013), and those are indicated in the table with a reference to that study but have not been confirmed otherwise by NRSI. The reader is referred to the NWSSS Table 4.20 (Ecoplans et al. 2013) for further details.

Table 12. Summary of Wildlife Habitat and Findings (2014–2019)

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
1	6	Wetland mosaic of thicket swamp and plantation, with inclusions of meadow marsh, shallow marsh and cultural meadow. Contiguous with swamp/riparian areas to the north. Total unit size: 1.87ha Notable wildlife habitat elements: • SWH - Amphibian Breeding Habitat (Woodland) • SWH – Seeps and Springs • Specialized habitat for Lepidoptera/Odonata (sedge meadow) (NWSSS) • Habitat diversity and continuity/proximity to additional natural areas	Birds[2] • Moderate breeding bird diversity (30 species with breeding evidence) • 17 migrant/non-breeding species • 4 Regionally Significant: Least Flycatcher, Alder Flycatcher, Blue-winged Warbler, Red-bellied Woodpecker • Predominantly edge or interior/edge species Amphibians • 5 common species: American Toad, Spring Peeper, Northern Leopard Frog, Green Frog, Gray Treefrog Plants • 1 Regionally Significant: White Spruce
2	7	Diverse mosaic of riparian and adjacent habitats – mixed swamp, thicket swamp and deciduous forest. Total unit size: 1.95ha Notable wildlife habitat elements: • SWH – Seeps and Springs • Habitat diversity and continuity/proximity to additional natural areas	Birds[2] • Moderate breeding bird diversity (34 species with breeding evidence) • 30 migrant/non-breeding species • 3 Regionally Significant: Yellow-bellied Sapsucker, Pileated Woodpecker, Blue-winged Warbler • Predominantly edge or interior/edge species Amphibians • 6 common species: Spring Peeper, Gray Treefrog, American Toad, Wood Frog, Northern Leopard Frog, Northern Green Frog Plants

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
			• 7 Regionally Significant: Meadow Horsetail, Northern Beech Fern, Virginia Creeper, Virginia Stickseed, White Spruce, Bristle-stalked Sedge, Eastern Cottonwood Insects 1 SCC: Monarch Butterfly
3	8	Small narrow finger of deciduous swamp with a short reach of unnamed intermittent watercourse. Adjacent lands are primarily agricultural, with riparian swamp extending off-site to the west. Total unit size: 0.18ha Notable wildlife habitat elements: • SWH – Special Concern and Rare Wildlife Species • SWH – Seeps and Springs • Cavity trees and downed woody debris	Birds[2] • Moderate breeding bird diversity (37 species with breeding evidence) • 27 migrant/non-breeding species • 1 SCC: Eastern Wood-pewee • 4 Regionally Significant: Brown Thrasher, Vesper Sparrow, Mourning Warbler, Red-bellied Woodpecker • Predominantly edge or interior/edge species Amphibians • 6 common species: Spring Peeper, Gray Treefrog, American Toad, Wood Frog, Northern Leopard Frog, Northern Green Frog Insects • 1 SCC: Monarch Butterfly
4	N/A	Agricultural field actively planted with row crops. Limited wildlife function. Notable wildlife habitat elements: • Common Nighthawk observed on occasion in general area, not nesting	Birds[2] • Low breeding bird diversity (15 species with breeding evidence) • 25 migrant/non-breeding species • Predominantly edge species Amphibians • 1 common species: American Toad Insects • 1 SCC: Monarch Butterfly

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
5	N/A	Isolated narrow deciduous hedgerow (HR2) dominated by common edge species vegetation. Limited wildlife function. No linkage connection to other habitats to the east. Total unit size: 0.25ha Notable wildlife habitat elements: • None	Birds[2] • Moderate breeding bird diversity (35 species with breeding evidence) • 19 migrant/non-breeding species • 3 Regionally Significant: Eastern Bluebird, Brown Thrasher, Vesper Sparrow • Predominantly edge species Amphibians • 2 common species: American Toad, Northern Leopard Frog Plants • 1 Regionally Significant: Hackberry Insects • 1 SCC: Monarch Butterfly
6	N/A	Former residential property; structure burned down in fire (2015). Species notes are reflective of 2019 field season conditions. Notable wildlife habitat elements: • None	Birds[2] • Low breeding bird diversity (6 species with breeding evidence) • No migrant/non-breeding species • Predominantly edge species Amphibians • No species documented
7	N/A	Former residential property with landscape trees. Structure was demolished in early 2020. Species notes are reflective of 2019 field season) conditions. Notable wildlife habitat elements: • None	Birds[2] • Low breeding bird diversity (8 species with breeding evidence) • No migrant/non-breeding species • Predominantly edge or interior/edge species Amphibians • No species documented
8	N/A	Former residential property with existing structures and landscape trees. Structures were demolished in 2018. Species notes are reflective of 2019 field season conditions.	Birds[2] • Low breeding bird diversity (4 species with breeding evidence) • No migrant/non-breeding species

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
		Notable wildlife habitat elements: • None	• Predominantly edge or interior/edge species <u>Amphibians</u> • No species documented

Source: [1]NWSSS (Ecoplans et al. 2013) with additions from this study

[2]Bird diversity is characterized by qualitative descriptors of richness (i.e. low/moderate/high), relative to other habitats in the NWSSS and relative to what would be expected in a habitat of similar size/composition within the Region; there are no numeric thresholds, rather these are qualitative rankings based on professional judgement and experience (J. Gross, pers. comm. 2017). For the purposes of this report, diversity thresholds are defined as follows: Low (0-20 species), Moderate (21-38 species), Moderate-High (39-49 species), High (50+ species) and is generally consistent with thresholds as reported in the NWSSS.

4.6 Ecological Linkages

Beaver Creek

As part of identifying the Natural Heritage System in the study area, the NWSSS (Ecoplans et al 2013) identifies the Beaver creek corridor as the primary existing ecological linkage. The main function of this corridor is to provide wildlife movement opportunities along Beaver Creek between the wetland/woodlands south of Conservation Drive and the wetland/woodlands on the subject property, and farther north. The current vegetated zone along Beaver Creek is variable in width, being wide (up to 200m) and well-shaded with forest and wetland vegetation on-site and in ESPA 80 to the south, but with gaps and narrow disturbed sections (<20m and ploughed), notably to the south of Conservation Drive.

As the Beaver Creek corridor is wide and well vegetated on the subject property lands, the onus for linkage enhancement will fall on the improvements to Conservation Drive during its reconstruction and widening and the management of the corridor through the development of lands to the south. On-site the wetland/woodland corridor will be maintained and protected with a buffer as well as other management recommendations, which will retain its linkage function.

The Class EA for Beaver Creek Road and Conservation Drive Upgrades reported that although the NWSSS (Ecoplans et al. 2013) identified a high abundance of amphibian road mortality along Conservation Drive at Beaver Creek, this area was not considered to be a significant amphibian movement corridor since the Beaver Creek corridor is quite narrow and surrounded by agricultural lands (Stantec 2016b). The existing crossing structure at Conservation Drive is a large corrugated steel pipe encased in concrete (3.1m wide x 1.8m high) which conveys flows and provides aquatic connectivity but there is no terrestrial wildlife movement opportunity. The preferred design alternative for transportation improvements along Conservation Drive requires the construction of a larger culvert structure at Beaver Creek to accommodate regional flood levels, which will also provide an opportunity to include a terrestrial wildlife crossing including wildlife funnel walls, as recommended in the NWSSS (Stantec 2016b).

Deciduous Hedgerow (HR2)

The hedgerow along the north property limits was identified as an existing but degraded ecological linkage in the NWSSS (Ecoplans et al. 2013). This hedgerow is approximately 300m in length consisting of a single row of scattered deciduous trees and shrubs with large gaps of open meadow vegetation. It provides connection to the west (i.e. WSU-3) within the subject property but does not provide linkage to any feature to the east. Its function as a corridor is poor due to its narrow width, invasive species presence, and discontinuity to the east. Dominant tree species include White Elm, White Ash, Manitoba Maple, and Sweet Cherry. The NWSSS (Ecoplans et al. 2013) identified the hedgerow as a linkage and an enhancement opportunity to connect with the large forested block approximately 225m east of the subject property limits. It was identified as a Low constraint in the NWSSS (Ecoplans et al. 2013) but was recommended as an area to be retained and enhanced as it provides a supporting linkage function in the Beaver Creek subwatershed. This area is also identified as a trail connection as part of the Avon Trail, which stretches from Conestoga in the north to St. Mary's in the south, passing through Waterloo Region.

4.7 Physical Constraints

The Regional floodline for Beaver Creek was determined in the NWSSS (Ecoplans et al 2013) and is shown on the Draft Plan (Map 2). The floodline is contained within the forested wetland and the proposed development is sufficiently setback from this constraint. There were no other physical constraints present on the subject property such as steep slopes or erosion prone areas.

4.8 Aquatic Habitat

A small portion of Beaver Creek crosses the southwest corner of the subject property immediately upstream (north) of Conservation Drive. Beaver Creek is a headwater tributary of Laurel Creek and flows in a southerly direction into Laurel Creek just upstream of the Laurel Creek Reservoir. It has been previously classified as a potential coldwater stream, although it has been degraded in a number of areas (Ecoplans et al. 2013). Reaches B4 and B5 are nearest the property and provide habitat for a variety of fish species including seven minnow species, two darter species, two sunfish species, as well as Brook Stickleback (*Culaea inconstans*) and White Sucker (*Catosomus commersonii*). Most of these fish species prefer a cool-water thermal regime, while the

two sunfish and Fathead Minnow (*Pimephales promelas*) prefer warm water. As direct fish habitat, Beaver Creek is protected under Canada's *Fisheries Act*, and the *Planning Act* per the Provincial Policy Statement and the City of Waterloo Official Plan.

Beaver Creek has a range of functions that make it a significant natural feature. Most of its length occurs within treed corridors and wetlands, with some parts encroached upon by existing agricultural land use. The NWSSS (Ecoplans et al. 2013) includes management objectives to protect and enhance the riparian attributes, and to create a wider riparian corridor and linkage along Beaver Creek. The creek is also sensitive to development, such that encroachment into the existing natural corridor may have impacts to the creek by reducing shading and temperature mitigation, removing the source of large woody debris that adds complexity to the aquatic habitat, reducing the source of allocthonous inputs (organic material such as leaves) that support the stream ecosystem, and affecting recharge of shallow groundwater that contributes to baseflow and water temperature mitigation. Maintaining a 30m buffer as recommended in the subwatershed study will largely avoid these impacts (Ecoplans et al. 2013).

Based on the presence of suitable habitat and water temperatures as well as the known historical presence of coldwater fish species, the Grand River Fisheries Management Plan objective for Laurel Creek and Beaver Creek is to be able to provide cold water fish habitat. To meet this objective, the water quality target for storm water discharge from the proposed development should be for the support of a coldwater fish community. The NWSSS provides cold water temperature targets for Laurel Creek and Beaver Creek upstream of the reservoir, as being:

- Less than 22^{o}C from April 1 to October 31, and;
- Between 4^{o}C and 14^{o}C from November 1 to March 31.

Pre-construction monitoring by Stantec (Stantec 2018) has shown that water temperatures in Beaver Creek meets the temperature targets for cold water for at least the period from April 1 to October 31, with the highest recorded water temperature being 20°C in 2016 and 2017.

In addition, land use changes anywhere within the Beaver Creek subwatershed can affect the hydrology of the creek, and stormwater management measures must have regard for such potential impacts. In particular, groundwater recharge should be maintained or enhanced, and surface water runoff should be controlled and treated for water quantity and quality. Implementation of best practices for construction is also key to avoiding impacts.

4.9 Buffers

Buffers are an important means to protect natural heritage features. The functioning of the buffer depends on the adjacent land use as well as the dimensions, characteristics and management of the buffer. Buffers are required for natural features such as woodlands, wetlands and watercourses to protect them from impacts during development. As described in Section 1.0, the natural features located on the subject property have a number of designations including PSW, CEF, and Significant Woodland. These will be retained and buffered during development. NRSI identified several confirmed SWH types associated with these retained natural features as well. These features are afforded protection under the Provincial Policy Statement (2014), the Regional Official Plan (2015), the City of Waterloo Official Plan (2016), and are regulated by the GRCA under Ontario Regulation 150/06. Development or alteration of these areas is strictly prohibited by these policies.

The NWSSS (Ecoplans et al. 2013) provides recommendations on development setbacks and buffer management measures for the natural features in the study area. The rationale for these measures is based on:

- Functional analysis of natural heritage features and functions, including considerations of the specific requirements and sensitivities of: vegetation communities and flora, wildlife breeding, foraging and movement habitat; and aquatic resources.
- Anticipated land uses in a future urban context, including roads, trails, development and required infrastructure.
- Relevant policy guideline documents (i.e. NHRM (OMNR 2010); Greenlands Network Implementation Guideline. IV. Guideline for Determining Buffers around

Environmental Features (Region of Waterloo 2016)); How Much Habitat is Enough? (Environment Canada 2013)).

- Relevant scientific literature regarding potential impacts (e.g., abiotic and direct/indirect biological 'edge effects', occupancy related effects) and functional buffer widths.

The NWSSS (Ecoplans et al. 2013) recommended the following development setbacks as a minimum for features present on the study area lands:

- PSW wetland: 30m
- Upland Woodlands: 10m
- Beaver Creek: 30m
- Hedgerows: 5m

The future development setback is to be the greater of the combined recommended setbacks.

The NWSSS (Ecoplans et al. 2013) provides guidance on how and when reduced buffers may be considered, as described in Section 14.2.2 which states:

> *"There is potential for minor deviation in the recommended setbacks, where it is demonstrated through an EIS that: on average, the recommended setback width is met; and that the recommended setback/buffer in a proposed development or land use change will achieve the intended buffer objectives and appropriate level of environmental protection."*

This approach is supported in the Region of Waterloo Official Plan (2015) policy 7.C.10, which states:

> *"The location, width, composition and use of buffers will be in accordance with the approved EIS, with buffers being a minimum of 10 meters…"*

The final development setback (and buffer management recommendations) has been determined via site-specific work, completed within the scope of this EIS, including field survey data collected during the pre-construction monitoring (2014-2019), with further consideration into the following:

- Species composition and diversity,
- Species sensitivity and requirements,
- Habitat sensitivity, including dependence on surface or groundwater inputs,
- Feature form and function, and
- Enhancement opportunities (e.g. corridor widening)

Section 14.2.2.1 of the NWSSS (Ecoplans et al. 2013) indicates that development and site alteration within buffer areas is to be limited and subject to detailed study in an EIS as follows:

- Part of SWM facilities and associated grading,
- Recreational trails and associated grading, and
- Site alteration associated with grading incursions to transition natural topography as required to achieve sound engineering practice and design

These are to be restricted to areas where the existing land use is active agriculture (i.e. crop lands).

These recommended buffers and site-specific considerations were used to inform the limits of development as shown on Map 7 and were used to develop the layout of the Draft Plan. Buffers are discussed further in the impact analysis section (Section 5) of this report.

5.0 Impact Analysis and Recommendations

5.1 Approach to Impact Analysis

The boundaries of significant natural features, sensitivities and buffer recommendations were provided to the study team to guide the development layout. This information was combined with other physical and planning constraints to come up with a suitable development plan for the property which respected the natural environment. The details of the undertaking are shown on Map 2, the revised Draft Plan of Subdivision prepared by GSP Group (2020). Further details of the proposed development, including stormwater management, preliminary grading and servicing is provided by Meritech Engineering (2020) under separate cover.

Potential impacts arising from the proposed undertaking are determined by comparing the layout and details of the proposed undertaking with the existing natural features, buffers and their ecological functions. Where the development proposal overlaps with the natural features or their buffers, impacts may arise. The following is a description of the types of impacts which will be discussed:

- Direct impacts to the natural features on the subject lands associated with disruption or displacement caused by the actual proposed 'footprint' of the undertaking.
- Indirect impacts associated with changes in site conditions such as drainage and water quantity/quality.
- Induced impacts are those associated with post-development activities such as subsequent demand on the resources created by increased habitation/use of the area and vicinity.

The sections below describe the impact anticipated and the corresponding avoidance and mitigation measures.

5.2 Description of the Proposed Undertaking

The development of the subject property was guided by a number of planning and engineering studies over the past many years. The Beaver Creek Meadows District Plan informed land use and community design at a block plan level including transportation network, servicing and institutional uses. The Class Environmental Assessment for Conservation Drive and Beaver Creek Road provides planned upgrades

to the major roads in the study area as well as a preferred option for servicing and stormwater management. The NWSSS (Ecoplans et al. 2013) established the natural environment existing conditions and sensitivities and recommended buffers, environmental targets and land management activities to protect and enhance the natural heritage system in the study area. Within the framework of these overarching studies, and based on comments received from reviewers, the details of the development proposed on the subject property were refined and focused by the study team.

A mixed-use development is proposed on the subject property including a variety of residential densities, commercial development, a school site, road network, parks, trails and stormwater management facility as shown on Map 2. Access to the site will be from a main entrance at a roundabout at the intersection of Conservation Drive and Beaver Creek Road. Internal roads connect to existing subdivision to the east. Water and wastewater servicing will be through connections to proposed infrastructure in Conservation Drive and Beaver Creek Road (Stantec 2016b). A stormwater management pond will be located along the western side of the property, with an outlet to the wetland on-site. Buffers have been provided from the wetland and woodland boundaries to the limits of the development including the stormwater management facility. Standard measures to maximize infiltration of surface water have been provided throughout the site.

5.3 Direct Impacts and Mitigation Measures

The layout of the development has been designed to avoid any direct impacts to natural environment features. The development totals 28.64 ha and has been placed in the central area of the property which is currently agricultural fields with annual row crops and is outside of the wetlands, woodlands, tributaries and their buffers. The stormwater management pond has been designed and placed to ensure that no structures or grading will occur within the wetland. The natural features and their buffers have been retained in large blocks, identified as Open Space on the draft plan, totaling 5.15ha of the site. These lands will be dedicated to the City. Other open space land uses including stormwater management, community trail and park and total 2.59ha as shown on Map 2.

5.3.1 Vegetation Removal

Vegetation removal is limited to small areas of trees within the northern hedgerow (HR2) and the wooded peninsula of FOD3-1.

The north hedgerow was identified in the NWSSS (Ecoplans et al. 2013) as an ecological linkage to be enhanced, and where a community multi-use trail (Avon Trail) connection is required.

The study team has been challenged with a number of overlapping constraints along the northern property limit since the study began. Retaining and buffering this northern property line has proved quite difficult due to existing grades and engineering requirements related to development on the property. The northern part of the property is heavily constrained by the need to meet existing grades at the property limit in combination with creating a multi-use trail that meets City standards, providing lots that meet density targets and are buildable, as well as the ability to construct a gravity sewer network that can function and tie into the main trunk at Conservation Drive. Meritech Engineering and the study team have worked through numerous iterations of servicing plans, grading plans and Draft Plans of Subdivision to try to achieve all of these requirements. It should be recognized that the NWSSS (Ecoplans et al. 2013) identified this line as a linkage based solely on landscape level ecological principles without the level of detail that is now known about the topography and the specific development requirements.

The current revised Draft Plan (Map 2) provides a 5m wide hedgerow buffer on the subject lands at the rear of Block 3 to use for an ecological linkage, with a 3m wide strip (Block 39) adjacent for the multi-use trail for a total of an 8m wide corridor. The 8m total width will taper to 5m in width in the eastern extent of the property. The 5m wide portion of the corridor at the rear of Blocks 1, 2 and part of 3 will contain the 3m wide multi-use trail with a narrow strip on the north side to contribute to the linkage. The two widths are proposed in recognition of existing trees in the western extent of the corridor while the eastern extent is open farm land with no trees. The fact that the property line is the City boundary with the Township of Woolwich and lands to the north are rural should be factored into the consideration of this linear strip functioning as an ecological linkage into

the future. The rural lands will not be developed in the near future and will continue to provide ample open space for the movement of wildlife in an east west direction. If development does occur on these lands, it is expected that a similar approach will be taken on the north side to allocate width to the linkage.

The tree inventory of the original EIS (NRSI 2016b) was updated in 2019 for this EIS including tree location, species, health and condition as shown on Map 6a and a summary is provided below in Table 13. Full details of the tree inventory are appended to this report (Appendix VII).

Based on the preliminary details of a Grading Plan prepared by Meritech it is expected that a few trees along the property line can be retained. Twenty-three of 39 trees will be removed due to excessive cut or fill.

Table 13. Summary of Trees to be Removed from Northern Hedgerow (HR2)

Common Name	Scientific Name	Tree Health			
		Good	Fair	Very Poor	Total
Native Species					
Sugar Maple	*Acer saccharum* ssp. *saccharum*		1		1
American Basswood	*Tilia americana*				0
White Elm	*Ulmus americana*	3	1		4
Manitoba Maple	*Acer negundo*		2		2
Black Cherry	*Prunus serotina*		2		2
White Ash	*Fraxinus americana*	1	3		4
Common Hackberry	*Celtis occidentalis*				0
Native Species Total		4	9		13
Non-Native Species					
Common Apple	*Malus domestica*		3		3
Common Pear	*Pyrus communis*		1		1
Sweet Cherry	*Prunus avium*	1	4		5
Hawthorn	*Crataegus* sp.		1		1
Non-Native Species Total		1	9		10
Total		5	18		23

Mitigation: A Rehabilitation and Enhancement Plan be prepared for the north hedgerow (HR2) in coordination with the Trail Plan and Grading Plan being prepared by the study team. The Plan is to take into account existing trees to be retained and measures to enhance its function as a linkage. See Section 5.6.6 Enhancement of Natural Features in this report for further details.

5.3.1.1 Encroachment into Wooded Peninsula FOD3-1 (Block 35 SWM pond)

Due to the natural topographic slope in this area, the SWM pond will require a substantial berm along its western edge, between it and the significant woodland. The pond design has been revised to not include any retaining wall, and therefore a substantial berm is required. The resulting design requires fill to be placed within a portion of the wooded peninsula, requiring the removal of some trees.

NRSI reviewed and inventoried the trees in this area in detail, by recording species, size, health and dripline radius. The trees in this aera are primarily Trembling Aspen, 26 cm in diameter on average, and are mostly in fair to poor condition. This area is part of a small wooded FOD3-1 projection which has been isolated from the core area of the natural feature by tree cutting on the neighbouring property. Refer to Map 6b for further details.

The Region of Waterloo's Greenlands Network Implementation Guideline (2016) provides guidance on interpreting boundaries of CEFs including 'Peninsulas'. Peninsulas are projections that differ significantly in habitat character from the main body of a CEF or Supporting Environmental Feature and are excluded unless they appear to provide some significant supporting ecological function (Region of Waterloo 2016).

The small 'Peninsula' of wooded area is mapped as Dry-Fresh Poplar Deciduous Forest (FOD3-1), which is quite different in structure and composition from the main wooded area which is Yellow Birch-Conifer Organic Mixed Swamp (SWM6-1) (Map 3). The wetland community is noted to provide SWH as shown on Map 5 and discussed in Section 4.4.1. The FOD3-1 community does not provide any significant habitat functions, as determined through multi-year surveys during the pre-construction monitoring (2014-2019).

The area was reviewed in the field on September 26, 2018 by NRSI, City and Regional environmental planning staff, and GSP Group. As the projection is composed primarily of declining tree species, it is distinctly different from the main body of the woodland and it does not provide significant ecological function, it was discussed that the boundary of the CEF be revised to remove this projection. The new recommended boundary and 10m buffer is shown on Map 7 and the Draft Plan and is defined based on providing a more block like shape to the CEF using the presence of the poplar and Black Cherry trees which are in better condition, and the SWM6-1 wetland community. The trembling aspen trees which have been excluded from the boundary are recommended to be considered for retention within the buffer, where grading permits and trees are in adequate condition.

A Vegetation Management Plan will be prepared at the detailed design stage which will make specific recommendations about tree retention and removal, replacement plantings using a 2:1 ratio, retention of regenerating trees and shrubs as well as other recommendations for the management of this area. Recommendations for removal of hazard trees will take into account the fact that there are no residential lots or public trails in this area that would be at risk of falling trees.

> *Mitigation: A Vegetation Management Plan be prepared at detailed design stage to review and specify measures for removal and retention of trembling aspen and other plants in the buffer, as well as recommend a planting plan for this area in coordination with the SWM pond design.*

5.3.2 Bird Nest Destruction

The *Migratory Birds Convention Act* (MBCA) protects migratory birds, their eggs and nests from being harmed or destroyed. Based on the habitats to be removed (agricultural fields, isolated trees), and the guidance of the Canadian Wildlife Service (CWS), a timing restriction window on vegetation clearing from May 1 to July 31 is appropriate. If clearing must occur within this time frame, nest searches are an

acceptable mitigation method to avoid impacts to birds and their nests in these simple types of habitats (CWS 2018a,b).

> *Mitigation: To protect birds and their nests, during the time period from May 1 to July 31 it is recommended that no clearing of trees and vegetation occur within the subject property. If clearing must occur within this time frame, a nest search must be carried out by a qualified biologist within 48 hrs of clearing.*

5.4 Indirect Impacts and Mitigation Measures

The following outlines potential sources of indirect impacts associated with the proposed development:

- Encroachment into Buffers
- Changes to Water Balance
- Water Quality
- Erosion of Watercourses
- Sedimentation and Erosion During Construction
- Indirect Impacts to Wildlife Habitat

5.4.1 Encroachment into Buffers

The Draft Plan has been revised and several areas of previous buffer encroachment have been removed such that the 10m dripline setback and 30m wetland setback are respected at Block 28 (Street Towns), Block 32 (Park) and Block 4 (Residential). The only areas where the recommended 30m setback from the wetland boundary or 10m setback from the woodland dripline is reduced is at Block 35 (Stormwater Management) where grading for the SWM pond berm will extend into the outer 15m of the wetland buffer. The multi-use trail will also be constructed in the outer 5m of the buffers as shown on the Draft Plan (Map 2).

The NWSSS (Ecoplans et al. 2013) indicates the main potential impacts to wetlands in a development scenario to be addressed by buffers are protection of vegetation, wildlife habitat, occupancy related effects, water balance and water quality. Buffers are one tool in protecting natural features and are part of a suite of mitigation and management measures that are incorporated into the development proposal to minimize and avoid

impacts. Other measures to be considered in combination with the buffers include infiltration of precipitation, stormwater management, naturalization plantings, fencing, trail system and homeowner education.

In total an area of 1350m^2 of the outer 15m wetland buffer will be encroached into by grading associated with the berm and spreader swale for the SWM pond. This encroachment is considered minor in area and in level of disturbance. The encroachment area will be disturbed temporarily and then vegetated or naturalized with plantings and will not have any permanent impervious structures within it. The infiltration function of the buffer will remain and be enhanced through vegetation while the habitat value will be improved.

The trail system has been located within the outer 5m of the buffer to the wetland and woodland, as well as along SWM access road, sidewalks and parks, as shown on the Draft Plan (Map 2). Where the trail is adjacent to natural areas, the alignment avoids sensitive core areas (Provincially Significant Wetlands, woodlands, groundwater seepage areas, significant species locations, etc.) and locates the trail in what is currently agricultural field.

The proposed encroachment into buffers for grading and trails are not considered to be detrimental to the natural features. These encroachments do not diminish the function or ability of the buffer to protect the form and function of the wetland present based on the following factors:

- The vegetation form of the wetland and woodland will always be directly protected. A minimum no-touch of buffer of 5m from dripline of woodlands or 15m from wetland boundary is always achieved.
- Buffer width overall is sufficient to increase natural cover area through the cessation of agriculture, naturalization and proposed buffer plantings,
- Buffer plantings will improve the closure of the existing edge, protecting from sunlight and wind effects,
- Buffer plantings provide an opportunity to create adjacent upland habitat for wildlife such as foraging habitat for snakes, mammals, lepidoptera and birds,

- Stormwater management plan with focus on infiltration will provide surface water treatment to address potential for water quality impacts and will maintain and improve the existing water balance,
- Sediment and erosion control plan will be prepared to prevent impacts to the natural features and buffers,
- Rear yard fencing along the development limit will minimize and prevent human encroachment,
- A formal trail system will be provided outside of natural areas to focus human activity outside of the natural feature itself, and,
- Homeowner education brochure and signage will be provided.

5.4.1.1 Blanding's Turtle Habitat

The wetland on-site plus the adjacent 30m lands are Category 2 habitat for Blanding's turtle. This category of habitat is considered to have a moderate level of tolerance to alteration before its function is compromised (MNRF 2013b). The Draft Plan of Subdivision shows the stormwater management pond block being placed within the outer 15m of the 30m wetland buffer. The details of the SWM pond design prepared by Meritech show that the open water portion of the facility is well outside of the 30m buffer, but portions of the outer berm and pipe outlet to the level spreader swale are within the outer 5-15m of the wetland buffer (see Meritech SWM report Figure 9). Therefore, the only encroachment into the Category 2 habitat associated with the proposed SWM pond is grade changes and a small area of riprap at the outlet.

The outlet of the SWM pond is to a level spreader for infiltration. Based on this design, the wetland is provided with a minimum 15m no-touch buffer, followed by 15m in which only grading for the berm and the installation of the outlet are the only disturbances. Beyond the buffer is the zone of approximately 50+m containing the berm, access road/trail and stormwater management pond, prior to the rear of the nearest residential lot lines. The infiltration spreader allows for enhancement of groundwater input and avoids any potential for erosion impacts at the outlet. The stormwater pond and the buffer will be naturally vegetated and will enhance the extent of vegetation associated with the wetland as compared to the current agricultural condition. The placement and construction of the forebay and wetland cell of the stormwater management pond adjacent to the wetland buffer is not anticipated to impact Blanding's turtle as it is outside

of the Category 2 habitat. See also the Blanding's Turtle Mitigation Plan (NRSI 2020) appended to this report for details of fencing.

5.4.1.2 Trails

A formal trail system has been provided along streets, parks, walkways and in the outer 5m of the buffer of natural features. It is expected that the trail will be incorporated into the SWM facility block where possible. Trails will help to focus human activity outside of and along the natural features. The location of proposed trails is shown on the revised Draft Plan of Subdivision (Map 2). City trail standards are 3.0m wide asphalt trail with buffer plantings.

5.4.2 Changes to Water Balance

One of the potential sources of impact to natural features as a result of development is the increase in impervious cover in the catchment which can alter the pattern, volume and flow of groundwater and surface water to natural features. The increase in impervious cover prevents water from soaking into the ground and can speed up the rate at which surface runoff flows across the site. In accordance with the NWSSS (Ecoplans et al. 2013), the existing infiltration rates should be maintained or increased to ensure there is no reduction in base flow to Laurel Creek or Beaver Creek, no change in existing aquifer recharge, and no disruption in the pattern of groundwater recharge (Meritech 2020). This section of the impact analysis will focus on the potential changes to the flow patterns and quantity of groundwater and surface water flows that currently supply wetlands and Beaver Creek. The Preliminary Design Stormwater Management Report (Meritech 2020) addresses this concern and includes a water balance analysis which is summarized here. Refer to the Meritech report for more details.

The soils on-site are generally suitable for infiltration and opportunities to promote groundwater recharge are included in the proposed design. As an initial measure, Low Impact Development (LID) and best management techniques are implemented across the site, where feasible, focusing on retaining rainfall where it lands, minimizing surface runoff. These measures include infiltration galleries in side and rear yards, amended topsoil of a depth of 0.25m in grassed areas, and the connection of roof leaders and sump discharge to a clean water collection (CWC) system for infiltration within the road rights of way. As an end-of-pipe measure, the SWM facility will outlet to an infiltration

trench which will contain the first 25mm of a rain event. These measures combined are shown to meet and exceed the NWSSS post-development infiltration target for this catchment by approximately 30% in Meritech's report (2020). Further details of these measures will be determined at a detailed design phase.

This exceedance of infiltration volume may have an enhancing effect on the wetlands and watercourse, as more water will be delivered to these features through groundwater flow. Much of the precipitation falling on the site is removed from the water cycle through evaporation and transpiration through crops. By promoting infiltration of clean water in the development scenario, an increase in post-development infiltration is predicted, meaning recharge to groundwater will be improved and therefore the groundwater discharge to wetlands and Beaver Creek will be sustained and may increase.

The proposed stormwater management plan includes two primary outlets for the subject property as per the NWSSS (Ecoplans et al. 2013), matching the existing drainage pattern of the site. The west side will outlet to a proposed stormwater management block on the subject property flowing toward Beaver Creek. The east side of the site will outlet to proposed infrastructure south of the intersection of Conservation Drive and Beaver Creek Road, conveying flows to an off-site SWM facility, and with an outlet ultimately to the Laurel Creek reservoir. Water quality and quantity control are required for flows directed to Beaver Creek, while drainage to Laurel Creek reservoir will receive water quality treatment at the shared communal SWM facility downstream of the subject property.

The on-site stormwater facility is located based on existing topography in a low area adjacent to the Beaver Creek wetlands. The facility includes a forebay and a constructed wetland which are sized and designed to attenuate flows up to the regional storm and provide "Enhanced" level of treatment. The pond outlet will be to a level spreader which will promote infiltration.

One of the items requested to be addressed in this water balance analysis is the potential for the development proposal to affect monthly or seasonal water patterns. Through collaboration with the study team, it is understood that water balance cannot be monitored directly as some components cannot be captured (infiltration, evaporation, transpiration etc.). Groundwater and surface water conditions are being monitored, and will continue to be monitored during and post-development. The groundwater monitoring has shown that the water table fluctuates seasonally and in response to precipitation. It is anticipated that these monthly and seasonal variations will continue, as efforts have been made in the proposed design to incorporate infiltration measures wherever feasible across the site, which will maintain the seasonal pattern of groundwater and surface water flows. The pre-development monitoring is continuously recording data and therefore does capture seasonal variations and will be used as a baseline to compare to the during and post-development condition to indicate any changes that cannot be explained by weather, such as drought.

Based on the SWM plan, the water balance to the wetland, Beaver Creek and Laurel Creek will be maintained and enhanced. The groundwater discharge function and SWH seeps and springs of the wetland will be maintained and enhanced.

> *Mitigation – implement stormwater management strategy and design details as provided by Meritech. Continue surface and groundwater monitoring program during and post-development to compare to baseline monitoring to identify any changes that may be related to the development.*

5.4.3 Water Quality

The potential for impacts to water quality may arise as a result of the proposed development from sediment and contaminants which can be transported by water into natural features and have negative effects on plants and wildlife. Potential impacts to in-stream water temperature in Beaver Creek are also included in this section. Treatment of water from the site for quality improvements is provided through a series of stormwater management measures as described by Meritech (2020).

The focus of the SWM strategy on infiltration will help to meet the water quality control targets specified in the NWSSS (Ecoplans et al 2013). Water quality treatment for flows to the Laurel Creek reservoir is provided in the off-site communal SWM facility. For the subject property, flows toward Beaver Creek and its wetlands are treated for water quality through the following measures:

- Lot-level infiltration, reduced lot grading, amended topsoil and third-pipe (CWC) system all contribute to reduced loads to the SWM facility and achieving the Enhanced level of water quality control.
- The on-site facility includes a sediment forebay for the treatment of the most frequent rain events and extended detention wetland to retain runoff for 24 hrs to improve water quality prior to discharge.
- The outlet structure is an orifice-controlled outlet pipe, overflow culvert and an overflow weir to attenuate a range of storm events.
- The majority of annual flows will be directed to Beaver Creek as groundwater, rather than surface water. There will be a time lag between storm events that is anticipated to further "smooth out" the influence of the runoff from the subdivision to the in-stream flows. Volume, timing and temperature of the discharged water will be moderated through this approach.
- In addition, the outflow of the SWM constructed wetland is to a grassed level spreader located in the outer 15m of the buffer to the wetland. This spreader is ±100m away from the creek and will convert a point source discharge to a sheet flow, promoting infiltration and natural treatment, further improving water quality and temperature
- The pre-, during-, and post-development monitoring of groundwater and in-stream flows will identify if there are any changes to water quality parameters such as temperature, dissolved oxygen, phosphorus, and chloride, etc. that may be able to be (partially) mitigated by modifications to the proposed stormwater management facility, should the need arise.

The implementation of this SWM approach will minimize and mitigate the potential for impacts to water quality in Beaver Creek including temperature through the emphasis on

infiltration at the lot level, through conveyance and at the spreader swale at the SWM outlet. The SWM facility will provide an Enhanced level of treatment.

Mitigation – implement stormwater management strategy and design details as provided by Meritech. Continue pre-, during and post construction monitoring of water temperature..

5.4.4 Erosion of Watercourses

Erosion potential of Beaver Creek is addressed in the NWSSS (Ecoplans et al. 2013). Upon development, runoff from impervious surfaces into Beaver Creek has potential to create erosive forces detrimental to the creek channel stability. Ensuring existing infiltration rates are maintained or enhanced will maintain the baseflow to Beaver Creek. The stormwater management strategy meets and exceeds infiltration rates and also meets peak flow target rates as set in the NWSSS. No direct flows into Beaver Creek are proposed and therefore there are no increased risks for creek erosion.

Mitigation – implement stormwater management strategy and design details as provided by Meritech.

5.4.5 Sedimentation and Erosion During Construction

During construction, areas of bare soil will be exposed which have the potential to erode during rainfall events and impact adjacent natural features. In the event of a heavy rain, sediment laden runoff can enter adjacent natural areas by way of overland flow. In order to protect on-site and off-site natural features from potential impacts due to sediment, a sediment and erosion control plan should be developed. Meritech provides an Erosion and Sediment Control (ESC) Plan in their report (2020). The plan lists a number of recommendations regarding construction staging and best management practices as per the NWSSS (Ecoplans et al. 2013) such as timing of works, restricted access to future buffer areas for works and materials storage and implementation of an erosion and sediment control plan. Recommendations for monitoring of ESC measures are provided including weekly and quarterly inspections and reporting.

Mitigation – An Erosion and Sediment Control Plan should be prepared and implemented taking into account the best management practices recommended in the NWSSS (Ecoplans et al. 2013) and the details provided by Meritech.

5.4.6 Indirect Impacts to Wildlife

Potential indirect impacts to wildlife may arise from noise and dust associated with construction activities as well as unnatural lighting associated with the development. During construction activities such as tree clearing and grubbing, dust can be created which can have a harmful effect on wildlife and vegetation, while excessive noise and human activity can cause wildlife to temporarily avoid the area.

Mitigations: Dust and noise associated with construction is anticipated to be temporary. Best practices for limiting dust should be employed. Construction activity should be limited on a daily basis to daytime hours. Significant effects on wildlife and vegetation from dust and noise are not expected.

Lighting designs should include shielding and directional lighting on roads and buildings to avoid lightwash impacts on wildlife.

Maintenance of the stormwater management pond has the potential to impact wildlife such as amphibians and turtles which may take up residence in the pond. It is well documented that painted turtles and snapping turtles move into man-made ponds after construction, and it is possible that the pond may attract Blanding's turtles as well. The wet cells of the pond have been placed outside of the Category 2 habitat of Blanding's turtle which will avoid the need for registering any maintenance works for an exemption under the ESA, but City personnel are advised to consult with MNRF prior to proceeding with maintenance activities. Best management practices should be employed when planning pond clean out. Timing windows to avoid the active turtle season as well as wildlife salvage prior to activities will help avoid impacts to wildlife.

Mitigation: City Engineering staff to consult with MECP prior to pond maintenance to ensure no negative impact to Blanding's Turtle. Assess wildlife use of the pond prior to cleanout. Avoid in-water maintenance of SWM pond during the summer season when turtles may be using the pond. Activities should be restricted to the time outside of May 1 to August 31. Implement wildlife and fish salvage immediately prior to maintenance work, as required.

5.5 Induced Impacts and Mitigation Measures

Induced impacts are described as those that are not directly related to the construction or operation of the facilities in question, but rather arise from the increased use of the natural areas by humans as a result of the development. The simplest example is occupancy effects such as increased use of a natural area by residents and their pets resulting in impacts such as unauthorized trail construction, garbage dumping and wildlife disturbance and mortality.

Mitigation: Once the development is completed, subsequent use of the natural areas by residents is difficult to control. Education with respect to the values and appropriate stewardship of the neighbouring natural areas is one tool that can be used. Dense plantings of native trees and shrubs can be used to discourage human intrusion into sensitive areas where buffers are reduced. Further measures such as rear lot fencing, signage and environmental brochures for homeowners will assist in preventing human induced impacts to the natural areas. The City of Waterloo has a brochure entitled "naturally your Waterloo" that can be purchased and provided to homeowners as a condition of approval. The City also requires a standard chain link fence to be installed along the private-public lands interface which will prevent encroachment.

5.6 Enhancement of Natural Features

A basis for ecological enhancements in the study area is provided in the NWSSS (Ecoplans et al. 2013) in Section 14.4. This section indicates that the primary ecological enhancements in the study area include linkages, buffer management (including habitat creation – general and specialized) and specific wildlife passage measures to reduce roadkill at the Conservation Drive crossing of Beaver Creek. Recommendations for restoration and enhancement measures on-site are provided in this section using the general objectives provided in the NWSSS (Ecoplans et al. 2013) but tailored to the site conditions, species and habitats present and opportunities within the development plan. The combined enhancement opportunities are shown on a Stewardship Management Plan (Map 8). This plan shows how open space land uses have been placed adjacent to the natural features and their buffers which provide expansion of the contiguous green space area and connectivity between naturalized and natural features. A more detailed Rehabilitation and Enhancement Plan will be prepared as a Condition of Approval which will include the details of the plantings, cleanup and management activities described below. An Invasive Species Management Plan will also be prepared as a Condition of Approval which will deal with on-site locations of problematic invasive species such as Phragmites, European and Glossy Buckthorn, and White Poplar, as necessary.

5.6.1 Wetland/Woodland Edge Buffer Enhancement

Pre-development monitoring of the wetland/woodland edges showed that these are generally in good conditions with few disturbances or damage. Agricultural tilling does occur right up to the edges of the wetland and woodland and the edge was noted to be fairly open and susceptible to impacts of erosion, sun and wind. Some minor instances of erosion from runoff from the fields was observed with sandy soils being deposited into the natural feature and some vehicle intrusions into the edge were observed with limited damage to the edge trees. An historic farm dump is located at the rear of the property within the wetland/woodland with debris, scrap metal, glass, etc. having been discarded there in the past.

Through the proposed development, the edge will be stabilized and protected through the implementation of a buffer. The buffer is an opportunity to enhance the wetland/woodland feature and provides a transition zone between the natural

communities and the development protecting them from the influences of the built up areas. Buffer enhancement may include the planting of large caliper trees or smaller tree 'whips' and shrub plantings, all of which will serve to bulk up the size of the woodlot and create a more closed and stable wooded edge. The selection of species for edge plantings should reflect the native species composition of adjacent natural areas. The natural regeneration that occurs at woodlot edges should be considered as well; left alone, the natural succession of trees and shrubs will lend itself to the buffering effect.

As one regionally significant hackberry tree will be removed due to the placement of the trail along the northern property boundary, it is recommended that hackberry be included in stewardship plantings. Due to the presence of Emerald Ash Borer (EAB), within southern Ontario, the use of ash trees (*Fraxinus* spp.) for restoration plantings is not recommended.

Where the buffer is adjacent to the wetland boundary, the focus should be on restoring desirable native wetland species and providing a vegetated buffer to the wetland. The moisture regime of these areas requires careful selection of appropriate species of trees, shrubs and herbaceous vegetation, with a mixture of all three vegetation types being desirable. It is noted that tree cover may not be necessary for buffering the all of the wetland areas. Restoring open meadow on the buffer lands may be important for wildlife species such as snakes, small mammals and edge species of birds which are known to use open areas in conjunction with wooded and wetlands. In these situations, node plantings of shrubs or trees, in addition to herbaceous ground cover will be the best approach. The establishment of dense shrub areas around the wetland edge will provide refuge for wildlife and is generally an aesthetically appealing approach to enhancement plantings, as well as deterring human encroachment through a 'living fence' approach.

Removal of refuse from the farm dump area by hand is recommended to avoid impact to this area. This is recommended to be completed as a condition of approval.

5.6.2 Wildlife Habitat

Although not significant, the removal of isolated trees and existing buildings removes the potential for those to be used by bats. The restoration of the buffers is an opportunity to

provide additional value for these wildlife species. Constructed bat boxes could be installed in the buffer areas and this will be determined at the time of the Rehabilitation and Naturalization Plan, as a Condition of Approval.

5.6.3 Naturalization of Stormwater Management Pond

The effective naturalization of stormwater ponds can hold value in providing native vegetation in proximity to natural areas, while connecting and enhancing ecological linkages. The naturalization approach should reflect the native species composition of nearby natural areas. Native species present at wetland edges will serve as good indicators for what species would naturalize well in a stormwater management pond.

A diverse mix of trees, shrubs and herbaceous species with appropriate tolerances for hydrologic regime, will enhance the aesthetics of these features, in addition to providing wildlife cover and reducing slope erosion. Woody plant material should be planted in a manner that provides at least a 3.0m clearance on either side of access roads for maintenance purposes.

As a mitigative measure to enhance water temperature at the stormwater ponds, where feasible, tree, shrub and herbaceous plantings are recommended to provide shading to the ponds and along cooling trenches.

5.6.4 Invasive Species Removal

Stands of White Poplar are found along the north and south sides of Conservation Drive, nearby to the Beaver Creek crossing. The stand on the subject property is relatively small and young and has invaded the southern edge of Wildlife Survey Unit 1. White Poplar is a non-native tree species that is particularly aggressive and spreads by root suckers. Dense thickets can form along roadsides, fields, forest edges, and other disturbed habitats (Reznicek et al. 2011).

Stand of Phragmites are found at the far southwest corner of property near the Beaver Creek culvert at Conservation Drive. This stand extends off-property to the west. This stand will be a challenge to control in the long-term unless a coordinated effort among landowners is initiated. Removal of portions of the Phragmites stands and the White

Poplar stands are expected to occur as part of the widening of Conservation Drive. Additional control through herbicide application should be considered, if possible.

Invasive species, such as Garlic Mustard (*Alliaria petiolata*) and Glossy Buckthorn exist occasionally throughout the subject lands and are not identified as problematic at this time. Several colonies of Phragmites (*Phragmites australis* ssp. *australis*) were identified within the subject lands as shown on Maps 4a and 4b of the pre-construction monitoring report (NRSI 2016-2020), and appear to be recently established (i.e. within past 5-10 years). Phragmites is found in disturbed habitats, such as roadside ditches, and edges, preferring mesic to hydric soils, and is salt tolerant. Dense stands form through aggressively spreading rhizomes, out-competing native wetland vegetation such as cattails (*Typha* spp.). Given the early onset of establishment, opportunities are present to remove this species and enhance habitats before it becomes fully established.

Mitigation: An Invasive Species Management Plan is recommended to be prepared as a condition of approval.

5.6.5 Park, School Property, Trail

Open and "green" land uses such as the park and stormwater management pond have been placed adjacent to the natural features to provide an opportunity for open space in conjunction with the identified significant natural features. Given the open "green" space associated with the park and stormwater management pond, these are opportunities that can provide habitat and foraging areas for wildlife, as well as for travel through to the adjacent habitats. A Naturalization and Rehabilitation Plan for the northern hedgerow/trail block and any other appropriate areas will be prepared as a Condition of Approval.

5.6.6 Ecological Linkage

<u>Beaver Creek</u>

As described in the EA for the improvements to Conservation Drive prepared by Stantec (2016b) for the City of Waterloo, the crossing of Beaver Creek requires the construction of a larger culvert structure to accommodate regional flood levels. This is an opportunity to enhance the connectivity for wildlife along the Beaver Creek corridor and may include a terrestrial wildlife crossing and barriers to prevent road mortality such as wildlife funnel

walls, as recommended in the NWSSS (Stantec 2016b). The details of these enhancements will be considered and undertaken by others.

Northern Hedgerow

In order to enhance the linkage function of the northern hedgerow (HR2), this area will be planted with a mixture of native trees, shrubs and plants. The Draft Plan has provided a variable width corridor to provide space for plantings as well as to accommodate the multi-use trail and retain existing trees where possible. Once grading for the trail is completed, the 5m wide section of the linkage in the western portion of the property can be re-planted with native trees and shrubs and seeded with a meadow seed mix. The eastern narrower portion can be seeded with a meadow mix and planted with scattered trees and small shrubs. This will match the character of the linkage to the east on Activa's property where it consists of meadow with an occasional tree or shrub. These measures will aim to replicate the existing habitat and enhance its function as a linkage by providing native vegetation with a longer life span. This approach consistent with the NWSSS strategy for this hedgerow which recommends retaining healthy native vegetation and enhancing it via native species vegetation.

A number of regionally significant bird species were observed along this hedgerow during the biological monitoring including Brown Thrasher, Eastern Bluebird and Vesper Sparrow. These species prefer open, shrubby or lightly treed habitats which will continue to be present based on this proposed approach for the linkage. A number of bluebird boxes have been installed by the farmer along the north property fenceline and it is recommended that these be maintained or replaced if the fence is altered or removed during grading. Additional bluebird boxes are recommended to be installed where appropriate. Details of the plantings and enhancement measures will be shown in a Rehabilitation and Enhancement Plan as a Condition of Approval.

6.0 Monitoring Plan

The following outlines an anticipated approach to the monitoring plan for pre-, during- and post-construction monitoring, but this will be refined and finalized at each phase and detailed in a Terms of Reference.

6.1 Pre-Construction Monitoring (Stage I)

The pre-construction monitoring program has been carried out for the past 6 years (2014-2019) as described in the approved Terms of Reference dated January 21, 2015 and includes biological, surface water and groundwater components. The monitoring program methods were developed according to the City of Waterloo Development Monitoring Protocol (1999), Sections 14 to 17 of the NWSSS (Volume 1, November 2013, Ecoplans et al. 2013) and was revised and updated based on comments received from the City of Waterloo, Grand River Conservation Authority, and the Region of Waterloo as well as results of the SAR screening, prepared separately, which was reviewed and approved by MNRF on December 15, 2014.

The results of the pre-construction biological monitoring have been reported annually by NRSI, with monitoring ongoing.

Stantec is continuing monitoring and reporting on the surface water and groundwater separately. The current Stage I program includes surface water flow and depth measurements of Beaver Creek and Laurel Creek, groundwater levels and chemistry. These programs will continue to be carried out until the start of site grading which is the first activity in preparing the site for development and is anticipated to be in 2021.

6.2 During Construction Monitoring (Stage II)

The works associated with construction such as vegetation removal and earth grading have the potential to result in impacts to adjacent natural features. Prior to the onset of area grading, site specific measures will be put in place to control runoff, limit the work zone and ensure that equipment is operated and maintained in an environmentally safe manner. During construction monitoring is anticipated to focus on implementing and monitoring the controls to protect surface water and groundwater as well as buffers to the adjacent woodland/wetland and will include erosion and sediment control measures

as well as water quality in Beaver Creek and functioning of the stormwater management facilities.

The during-construction biological monitoring program is modelled after the pre-construction monitoring program and includes the same biological, hydrological and hydrogeological monitoring conducted previously as well as compliance monitoring. The details of during construction biological monitoring program will be refined following the outcome of this EIS, but are anticipated to follow the same general intent and methods as the pre-construction monitoring. Surface water and groundwater parameters will continue to be measured. In addition, monitoring of protection, enhancement and rehabilitation activities is recommended during the construction phase. Invasive species control, edge management and plantings of native species should all be monitored and assessed for success throughout the process. It is anticipated that these activities will begin to be implemented once approval of the application is received. It is also recommended that the during-construction monitoring include road mortality surveys focusing on the crossing of the Beaver Creek corridor by Conservation Drive. Road mortality surveys should follow the methods implemented in the NWSSS, and be completed in conjunction with the road improvement works for Conservation Drive.

Stormwater management, erosion and sediment control and water monitoring recommendations during construction are provided by Meritech in their report. The results of the monitoring will be reported annually to the City, the Region and GRCA.

6.3 Post Construction Monitoring (Stage III)

Post construction monitoring begins once the site development is mostly completed and the site is generally stable. The City of Waterloo Development Protocol indicates this should start once the project reaches 90% buildout and the site is generally stable. Monitoring frequency is reduced to reflect the stability and maturity of the site. The purpose of this stage of the monitoring is to ensure that the watershed targets are being met with respect to ecological health of the natural features. Areas where it may be necessary to provide any additional mitigation measures will be identified and also the effectiveness of the controls put in place for the operational phase of the development will be monitored.

At this point the natural features will have been documented well by the monitoring program over many years. The original monitoring program will be continued, but the frequency will be decreased for each component as follows:

- Surface water (same parameters) with a minimum of one wet and one dry weather sample (low flow) per year,
- Temperature and chloride monitoring in Beaver Creek,
- Groundwater monitoring (same parameters) with a minimum of one wet and one dry weather sample (low flow) per year,
- Erosion: minimum of six observations per year (same timing as the surface water and water quality sampling) and one survey inspection per year,
- Aquatic habitat: two benthic invertebrate sampling events during the year (spring and fall), every three years (downstream, off-site),
- Terrestrial habitat: confirmation of vegetation community condition twice per year, every three years.
- Rehabilitation measures: Success of plantings, enhancement measures and invasive species control twice per year, every three years.
- Road mortality: completed every three years.
- Stormwater Management Facilities. As described by Meritech (2020).
- Siltation and Erosion Inspections are to continue quarterly and at the time of proposed removal of any E&S Measures.

The results of the post-construction monitoring programs will be reported to the City, Region and the GRCA, being submitted on their own schedules which range from annually to every three years. It is noted that the Region requires two years of post-construction monitoring.

'An outline of the proposed monitoring program for the North Waterloo area is summarized in Tables 14, 15 and 16 below.

Table 14. Pre-Construction Monitoring Summary

	Monitoring Ongoing		
	Component	**Frequency**	**Location**
Aquatic Biology	Benthic sampling	Annually, spring and fall	Beaver Creek, Laurel Creek

Terrestrial Biology	Amphibian surveys	Annually, April, May, June	Established stations
	Breeding Bird surveys	Annually, twice in late May – early July	Established wildlife survey units
	ELC and Vegetation Plots	Every 3 years, summer	Established stations
	Terrestrial feature and photographic monitoring	Annually, spring and fall	Established stations

Table 15. During-Construction Monitoring Summary

	NWSSS and NRSI Recommended Monitoring Program		
	Component	**Frequency**	**Location**
Aquatic Biology	Benthic Sampling	Annually, spring and fall	Beaver Creek, Laurel Creek
	Fish Community	Once, summer	Beaver Creek, Laurel Creek
Terrestrial Biology	Amphibian surveys	Annually, April, May, June	Established stations
	Breeding Bird surveys	Annually, twice in late May – early July	Established wildlife survey units
	ELC and Vegetation Plots	Every 3 years, summer	Established stations
	Rehabilitation measures	At installation, 1 year and 3 years, spring/summer	Specified locations – buffers, treed edges, Phragmites stands
	Road mortality	Every 3 years, spring and fall	Beaver Creek corridor crossing at Conservation Drive
Compliance	Buffer limit fencing	Upon installation, and twice annually, spring and fall	Natural feature buffer limits
	Blanding's turtle fencing	Upon installation, twice annually, spring and fall	Natural feature buffer limits, road rights of way, SWMF property limits

Table 16. Post-Construction Monitoring Summary

	NWSSS and NRSI Recommended Monitoring Program		
	Component	**Frequency**	**Location**
Aquatic Biology	Benthic Sampling	Every 3 years, spring and fall	Beaver Creek, Laurel Creek
	Fish Community	Once, third year, summer	Beaver Creek, Laurel Creek
Terrestrial Biology	Amphibian surveys	Third year, April, May, June	Established stations
	Breeding Bird surveys	Third year, twice in late May – early July	Established wildlife survey units
	ELC and Vegetation Plots	Every 3 years, spring and fall	Established stations
	Rehabilitation measures	Every 3 years, spring/summer	Specified locations – buffers, woodland edges, Phragmites/invasive species stands
	Road mortality	Every 3 years, spring and fall	Beaver Creek corridor crossing at Conservation Drive
Compliance	Buffer limit fencing	At removal	Natural feature buffer limits
	Blanding's turtle fencing	Once annually	Natural feature buffer limits, road rights of way and SWMF property limits

7.0 Summary and Recommendations

This revised EIS provides an update to the characterization of natural features presented in the original submission (2016) incorporating the findings of additional years of pre-construction biological and water monitoring that has been completed specifically on the subject property. The analysis of natural feature significance and ecological functions in the NWSSS (Ecoplans et al. 2013) is further substantiated by this most recent work. The wetland on the subject property contains relatively good quality habitats with some areas of rich and diverse species communities and is supported by groundwater discharge as well as surface water runoff. There are areas which have experienced past impacts but these are regenerating and naturalizing. No Species At Risk were observed on the property although the wetland plus 30m is Category 2 regulated habitat for Blanding's turtle, a Threatened species. A number of species of conservation concern and regionally significant species have been documented using the woodland/wetland. It is a significant natural feature and has been designated provincially significant wetland and contains significant woodlands, significant wildlife habitat for amphibians and species of conservation concern and is part of an ecological linkage providing a travel route for wildlife along the Beaver Creek corridor to off-site habitats to the north and south. Conservation Drive is a barrier to wildlife movement which is being addressed through road improvements as part of a City of Waterloo Class EA. Beaver Creek is an off-site coolwater/warmwater stream that flows through the wetland, draining to Laurel Creek, the reservoir and eventually the Grand River.

The NWSSS (Ecoplans et al. 2013) provides recommendations on management, development setbacks and buffers and these were relied on in order to design the layout of the proposed development, in addition to other physical constraints as well as planning, transportation, grading and servicing considerations. The development layout adheres to the recommended buffer between the natural feature and the developed portions of the subject lands. Encroachment into the outer 15m of the wetland buffer is proposed for grading for the stormwater management facility and to accommodate a public trail. This encroachment is considered minor and is not anticipated to be a negative impact to the wetland, its functions or wildlife species. Buffers will be allowed to naturalize and will be supplemented with plantings. A sparse hedgerow at the north

property boundary has been preserved as a public trail and an east-west connecting linkage and will be enhanced by plantings of trees shrubs and groundcover. Rear lot fencing, a designated trail system and homeowner education are further methods of mitigating the potential for natural area impacts due to residents. A specific mitigation plan has been prepared for Blanding's Turtle and approved by MECP (Appendix IX).

A stormwater management plan has been prepared by Meritech (2020) that meets and exceeds the targets and design objectives for water quantity and water quality control as recommended in the NWSSS. The facility includes a forebay and a constructed wetland with an outlet pipe and weir to attenuate a range of storm events. The SWM facility outlets to an infiltration swale prior to draining to Beaver Creek and adjacent wetlands. The forebay and wetland of the SWM facility are outside of the regulated habitat for Blanding's turtle. Infiltration is a key part of the stormwater management strategy which incorporates lot level infiltration, amended topsoil, a CWC system and end-of-pipe infiltration facility to maintain and enhance infiltration on-site. Post-development infiltration is expected to exceed the NWSSS prescribed target by approximately 30% which will be a benefit and enhancement to the wetlands and Beaver Creek.

Mitigation and compliance monitoring measures are provided by the team of Meritech, Stantec and NRSI to avoid, minimize and alleviate any potential impacts during construction and occupancy. An outline of a pre-, during and post-construction biological monitoring program has been provided which is complemented by the surface water and groundwater monitoring by others as well as environmental compliance and performance monitoring of the stormwater management facility. This program will aim to track and compare the environmental conditions during and post-development and compare those to the pre-development monitoring results and the targets set in the NWSSS (Ecoplans et al. 2013) to identify any changes that may be related to the development and are not due to weather patterns or other natural cycles.

The Stewardship Plan shows how the Draft Plan provides a buffer between natural features and the development and places open space land uses such as stormwater management and parks adjacent to the natural area. Taking into account the layout of the development, the stormwater management plan, the monitoring program and the

stewardship plan, and assuming the recommendations in this EIS and the reports of others are followed, no significant negative impacts to natural features are anticipated as a result of the proposed development.

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MAPS

Map 1

2115881 Ontario Ltd.
Subdivision EIS

Study Area and Natural Features



Legend

- Subject Property
- ESPA #80 (Region of Waterloo, 2015)
- Natural Heritage System (from NWSSS 2013, updated 2016)
- Permanent Watercourse
- Provincially Significant Wetland (PSW)
- Other Wetland (Non-PSW)

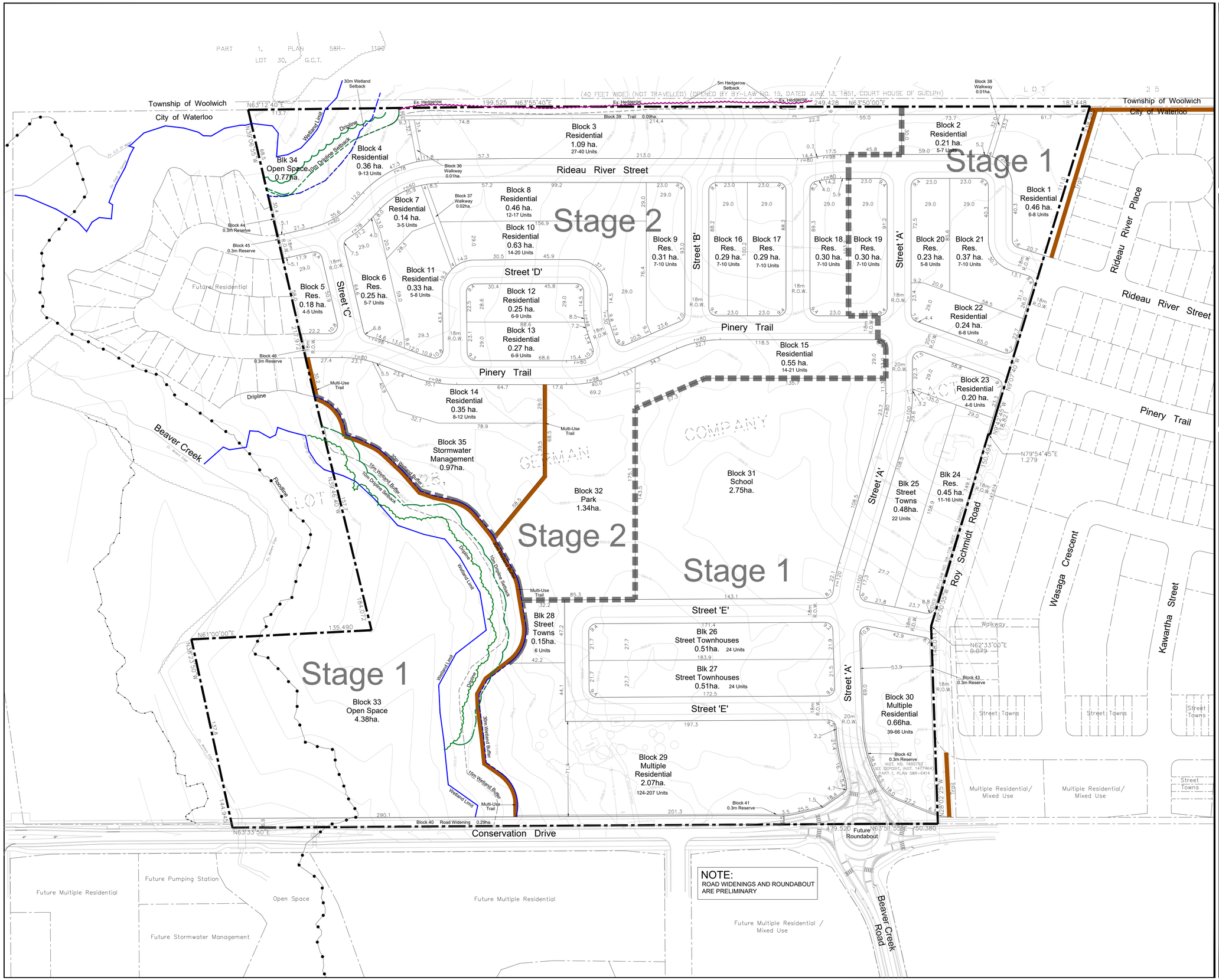
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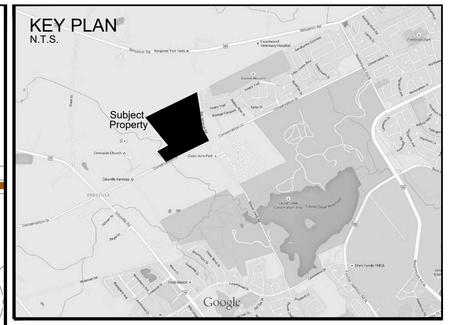
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DRAFT PLAN OF SUBDIVISION

Part of Lot 28
German Company Tract
City of Waterloo
Regional Municipality of Waterloo

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLKS.	UNITS	AREA (ha.)
Residential (single detached)	1-24	192-279	8.51
Street Townhouses	25-28	76	1.50
Multiple Residential	29,30	163-273	2.73
School	31		2.75
Park	32		1.49
Open Space	33,34		5.15
Stormwater Management	35		0.97
Walkway	36-38		0.04
Trail	39		0.09
Road Widening	40		0.29
0.3m Reserve	41-46		0.00
Roads			5.12
Total		431-628	28.64

UNIT BREAKDOWN

Min. Potential Singles	192
13.1m internal lot	*162*
13.75m corner lot	*30*
Max. Potential Singles	279
9.0m internal lot	*249*
12.5m corner lot	*30*
Street Townhouses	76

ADDITIONAL INFORMATION

(UNDER SECTION 51(17) OF THE PLANNING ACT)

INFORMATION REQUIRED BY CLAUSES a,b,c,d,e,f,g,j and I ARE AS SHOWN ON THE DRAFT PLAN.
h) Municipal water supply
i) Well-drained sandy loam on lacustrine deposits
k) All sanitary and storm sewers as required

OWNER'S CERTIFICATE

I AUTHORIZE THE GSP GROUP INC. TO PREPARE AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION TO THE REGIONAL MUNICIPALITY OF WATERLOO.

2112681 ONTARIO LIMITED — August 17, 2016 DATE

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE CORRECTLY SHOWN.

RAYMOND J SIBTHORP, O.L.S. — August 18, 2016 DATE
MacDonald Tamblyn Lord Surveying Limited

GSP group
PLANNING | URBAN DESIGN | LANDSCAPE ARCHITECTURE
gspgroup.ca

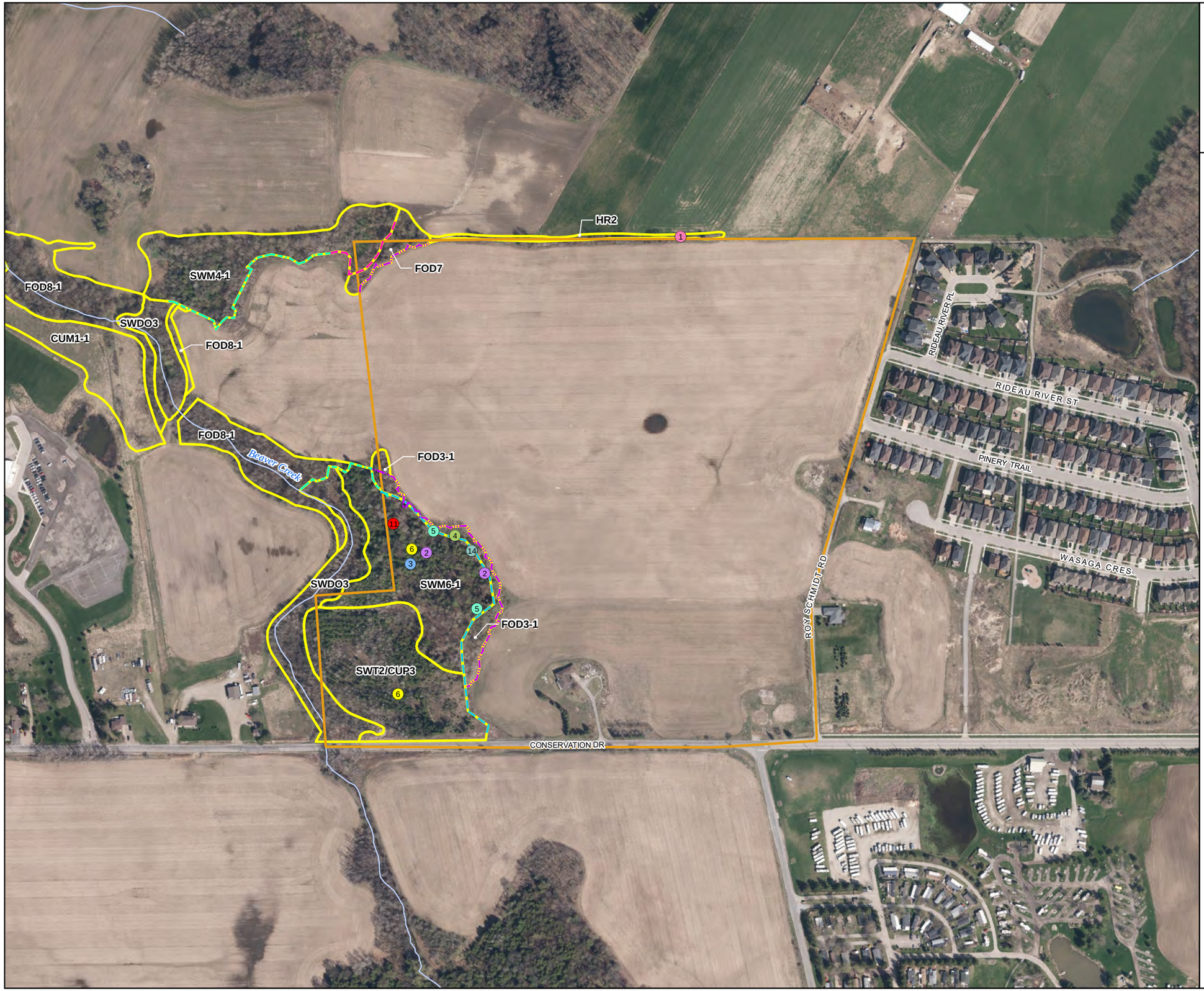
REVISIONS
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August 27, 2019
August 29, 2019
September 3, 2019
February 24, 2020
April 30, 2020
June 25, 2020

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Map 3

2115881 Ontario Ltd.
Subdivision EIS

Vegetation Communities and Significant Plant Species



Legend

- Subject Property
- Woodland Dripline Boundary, Surveyed (NRSI May 2016)
- Wetland Boundary, Surveyed (MNRF and GRCA Confirmed September 2015)
- Wetland Boundary, Surveyed (GRCA Confirmed November 2015)
- Wetland Boundary, Surveyed (NWSS, Ecoplans et al. 2013)
- Watercourse

Regionally Significant Plant Species

- 1 Hackberry (*Celtis occidentalis*)
- 2 Meadow Horsetail (*Equisetum pratense*)
- 3 Northern Beech Fern (*Phegopteris connectilis*)
- 4 Virginia Creeper (*Parthenocissus quinquefolia*)
- 5 Virginia Stickseed (*Hackelia virginiana*)
- 6 White Spruce (*Picea glauca*)
- 11 Bristle-stalked Sedge (*Carex leptalea*)
- 14 Eastern Cottonwood (*Populus deltoides*)

Ecological Land Classification (ELC)

(CUM1-1) Dry - Moist Old Field Meadow
(FOD3-1) Dry - Fresh Poplar Deciduous Forest
(FOD7) Fresh-Moist Lowland Deciduous Forest Ecosite
(FOD8-1) Fresh - Moist Poplar Deciduous Forest
(HR) Hedgerow
(SWDO3) Organic Deciduous Swamp Ecosite
(SWM4-1) White Cedar Organic Mixed Swamp
(SWM6-1) Birch-Conifer Organic Mixed Swamp
(SWT2) Mineral Thicket Swamp/(CUP3) Coniferous Plantation

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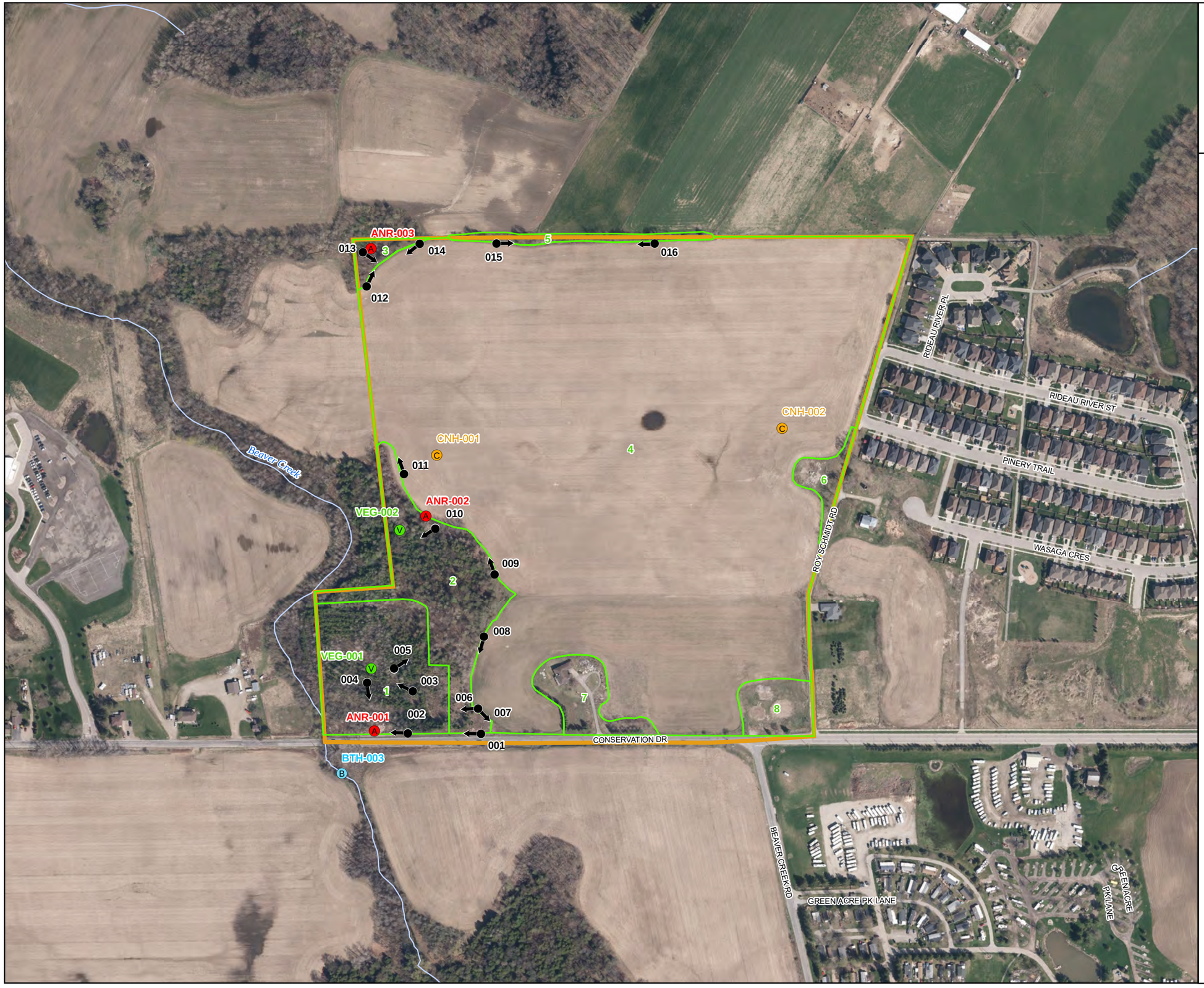
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Map 4

2115881 Ontario Ltd.
Subdivision EIS

Biological Monitoring Locations



Legend

- Subject Properties
- Photo Vegetation Plot Station Location
- Watercourse

Biological Monitoring (NRSI)

- Vegetation Station (VEG)
- Common Nighthawk Station (CNH)
- Benthic Sampling Station (BTH)
- Anuran Call Station (ANR)
- Wildlife Survey Unit (Approx)

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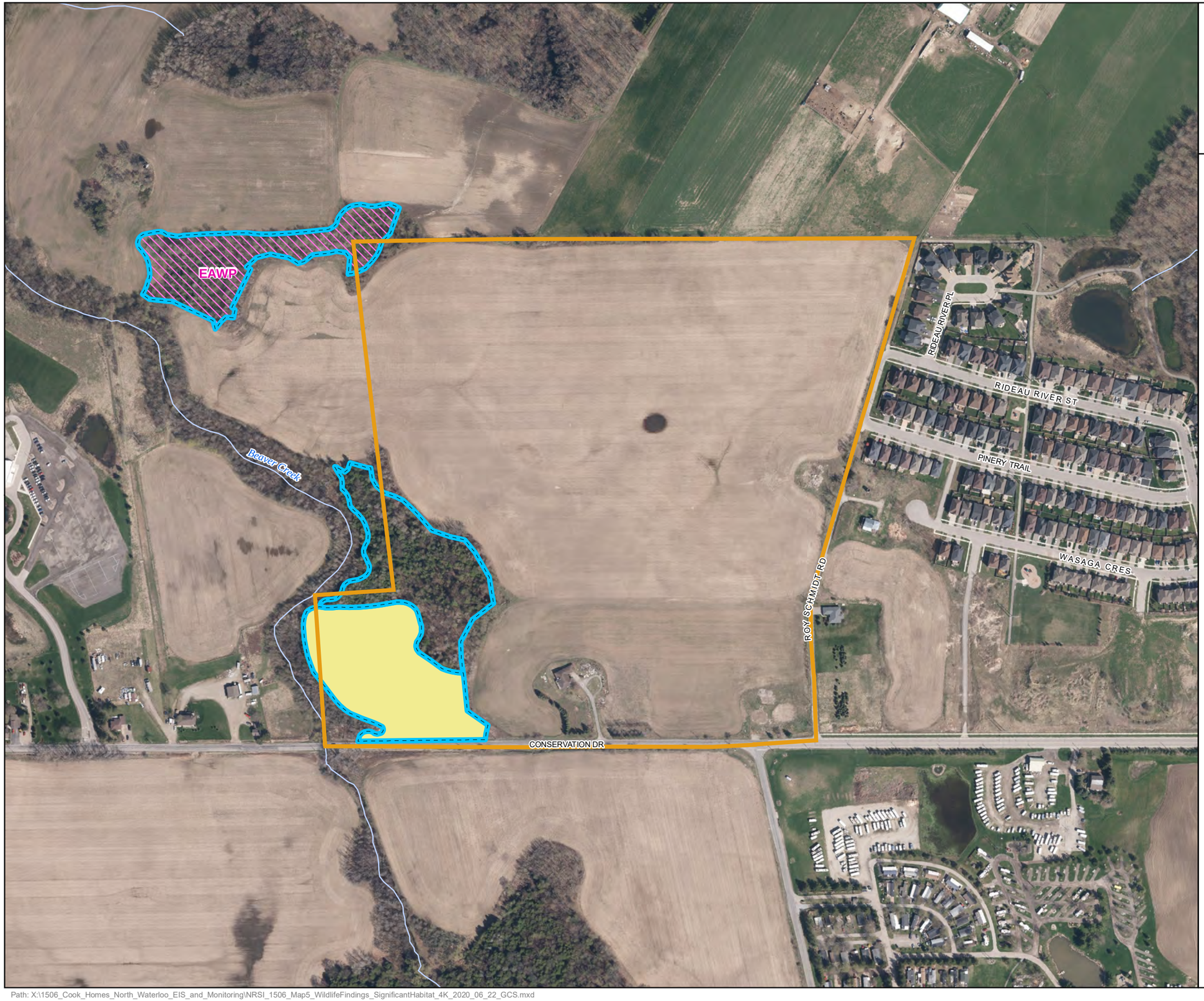
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Map 5

2115881 Ontario Ltd.
Subdivision EIS

Wildlife Findings and Significant Habitats



Legend

- Subject Property
- Permanent Watercourse

Significant Wildlife Habitat

- Seeps and Springs
- Amphibian Breeding Habitat - Woodland

Special Concern and Rare Wildlife Species

- Eastern Wood-pewee (EAWP)

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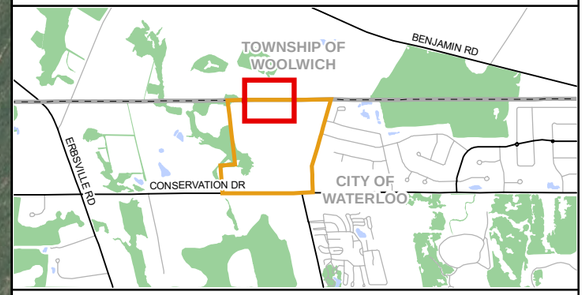
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Map 6A

2115881 Ontario Ltd.
Subdivision EIS

Tree Inventory - North Hedgerow (HR2)



Legend

- Subject Properties
- Inventoried Tree (Crown to Scale)

1638 1639 1636 1635 1634 1633 1640 1629 1624 1626 1627 1628 1641 1642 1625 1644 1643 1645 1613 1619 1618 1617 1616 1614 1612 1611 1609 1608 1607 1606 1610 1646 1604 1605 1647 1602 1648 no tag 1601

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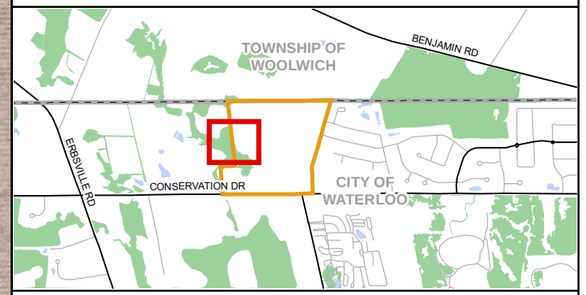
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Map 6B

2115881 Ontario Ltd.
Subdivision EIS

Tree Inventory - Peninsula of Wooded Area (FOD3-1)





Legend

- Subject Properties
- Permanent Watercourse
- Inventoried Tree (Crown to Scale)

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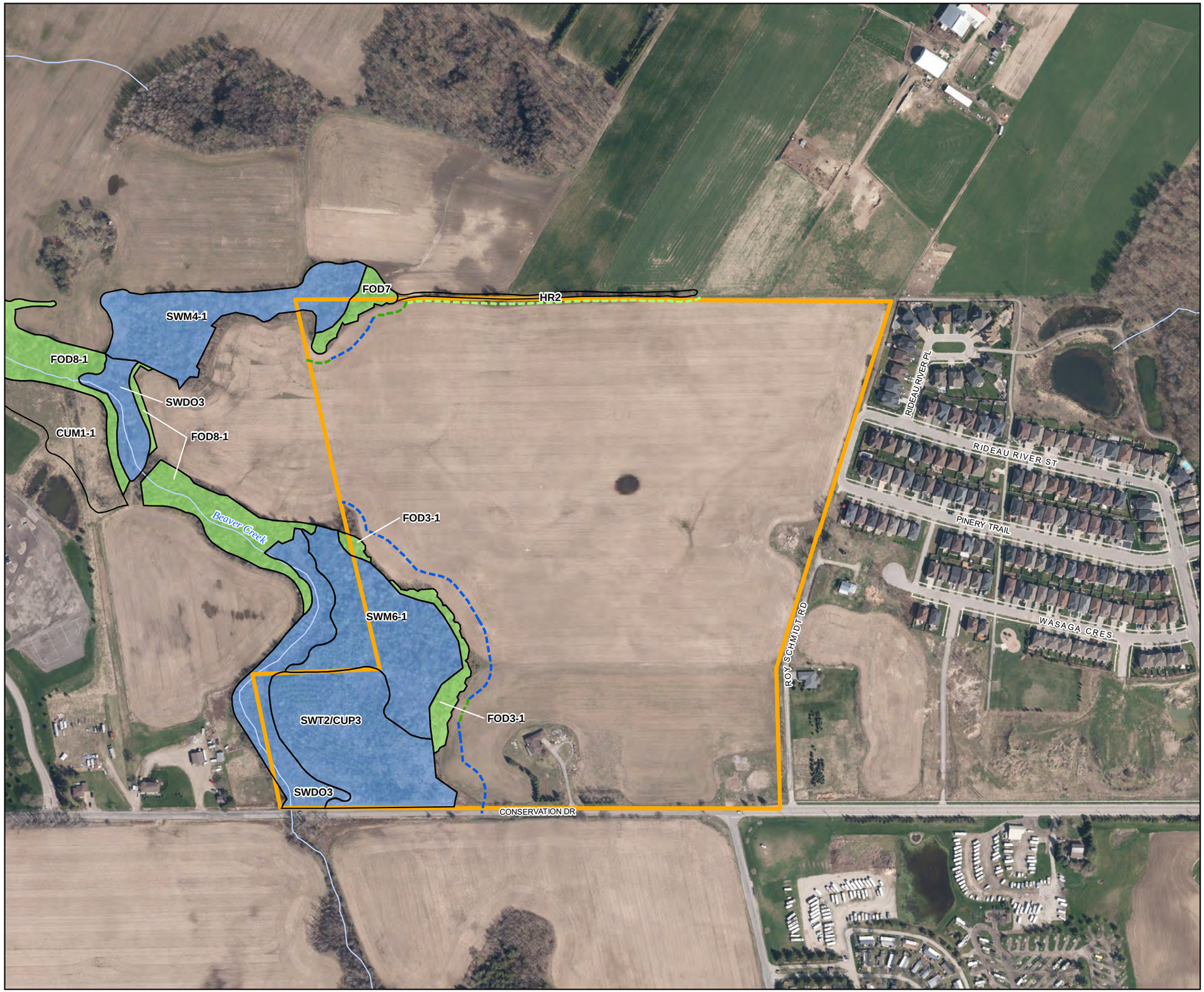
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Date: June 22, 2020

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Map 7

2115881 Ontario Ltd.
Subdivision EIS

Natural Feature Buffers

Legend

- Subject Property
- Ecological Land Classification (ELC)
- Significant Wetland
- Significant Woodland
- Significant Wetland Buffer (30m)
- Significant Woodland Buffer (10m)
- Hedgerow Buffer (5m)
- Watercourse

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Aquatic, Terrestrial and Wetland Biologists

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Project: 1506
Date: June 22, 2020

NAD83 - UTM Zone 17
Size: 11x17"
1:4,000

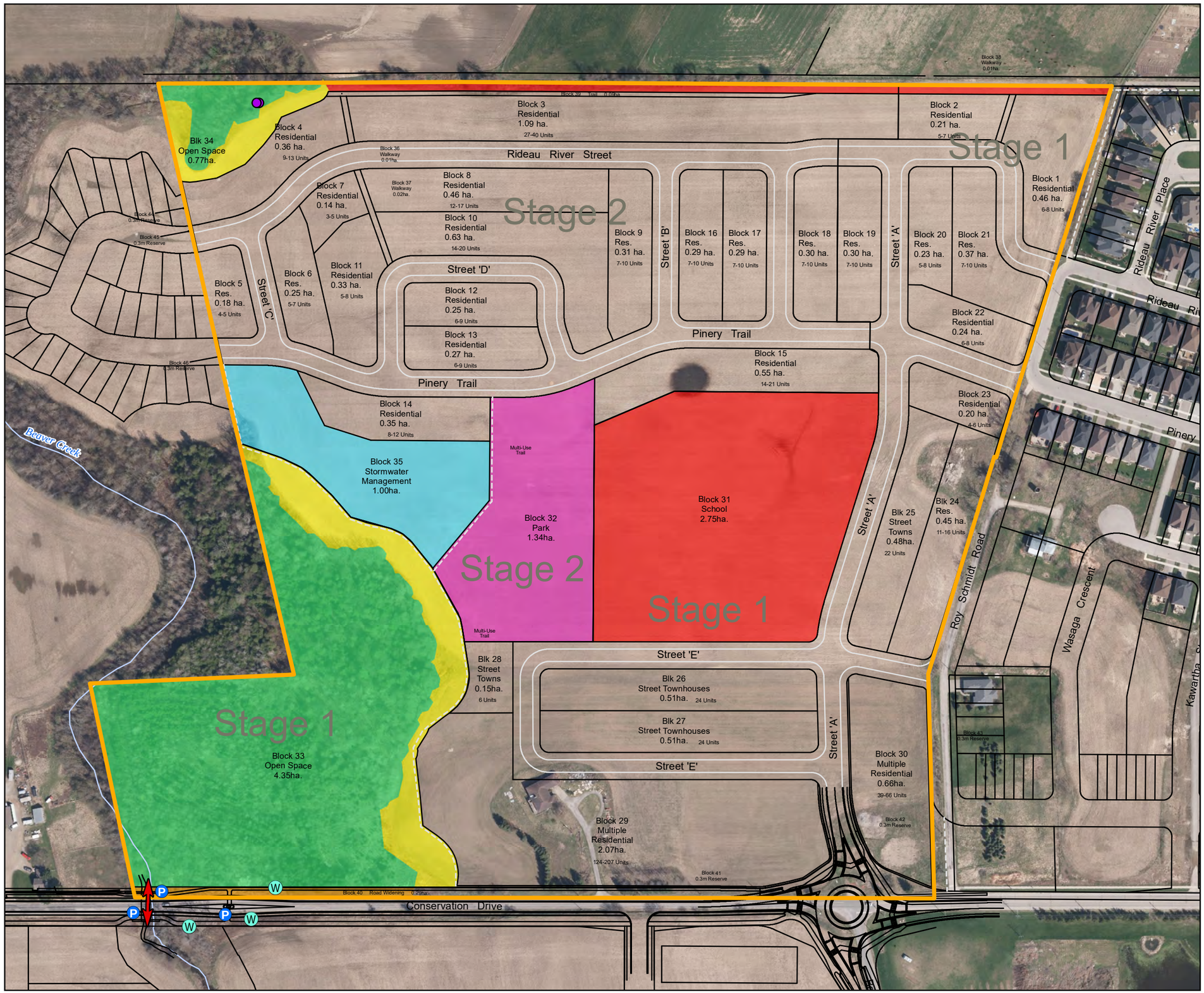
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Map 8

2115881 Ontario Ltd.
Subdivision EIS

Stewardship Plan



Legend

- Subject Property
- Proposed Lot
- Edge of Pavement
- Proposed Trail
- Watercourse
- Ecological Linkage
- Refuse Dump

Stewardship Zones

- Significant Natural Features
- Buffers to be Naturalized
- SWM to be Naturalized
- Park (Open Space)
- School & Trail (semi-open space)
- Invasive Species Management

Invasive Species Management

- (P) Phragmites (*Phragmites australis ssp. australis*)
- (W) White Poplar (*Populus alba*)

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Project: 1506 Date: June 22, 2020	NAD83 - UTM Zone 17 Size: 11x17" **1:2,500**

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APPENDIX I

Terms of Reference

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

January 21, 2015 Project 1531A

Robyn McMullen
Environmental Policy Planner
City of Waterloo
100 Regina Street South
PO Box 337, Station Waterloo
Waterloo, ON, N2J 4A8

Dear Ms. McMullen,

Re: North Waterloo Subwatershed Lands
Pre-Construction Monitoring Program - Terms of Reference

Natural Resource Solutions Inc. (NRSI) and Stantec have been retained by Northgate Corporation, Cook Homes, Activa Holdings, and Erbsville Kartway to carry out the Stage 1 pre-construction monitoring program required by the City of Waterloo. This monitoring is required to document baseline conditions for two years in advance of proposed residential development. The monitoring program will include an ecological monitoring component (to be completed by NRSI), and a surface water and groundwater monitoring component (to be completed by Stantec). The monitoring program is being combined and shared amongst the four landowners in order to be efficient and consistent across the four properties. Activa lands are subject only to the groundwater monitoring, as they do not contain any natural features.

This Terms of Reference (TOR) has been prepared in accordance with Sections 14 to 17 of the North Waterloo Scoped Subwatershed Study (Volume 1, November 2013). The TOR has been revised and updated based on comments received from the City of Waterloo, Grand River Conservation Authority (GRCA), and the Region of Waterloo on an earlier version which was prepared for the Cook Homes property only (NRSI June 6, 2014). This TOR has also been updated to include results of the Species At Risk (SAR) screening, prepared separately, which was reviewed and approved by MNRF on December 15, 2014. Data collected during the subwatershed study and the pre-construction monitoring program will feed into future Environmental Impact Studies (EIS).

The TOR is attached for your review and comment. Please feel free to contact me if you have any questions or comments.

Sincerely,
Natural Resource Solutions Inc.

M. Elaine Gosnell, B.Sc.
Senior Terrestrial and Wetland Biologist

North Waterloo Subwatershed Lands
Northgate, Cook, Erbsville Kartway, and Activa Holdings
Pre-Construction Monitoring Program
Terms of Reference
January 21, 2015

Introduction

The study area lands total approximately 96ha in area and are bounded to the south by Grand River Conservation Authority (GRCA) lands, an existing residential development/Beaver Creek Road to the east, private property to the west and City limits to the north. Map 1 (appended), shows the study area with landowner properties identified. Habitat within the study area is comprised mainly of agricultural fields, with wetlands and woodlands associated with Beaver Creek (tributary of Laurel Creek) in the central portion of the study area.

The wetlands in the study area are designated as provincially significant, and comprise a portion of the Sunfish Lake – Laurel Creek Provincially Significant Wetland (PSW) Complex which extends beyond the study area to the north and west. Woodlands and wetlands south of Conservation Drive are designated as part of an Environmentally Sensitive Policy Area (ESPA) known as Laurel Creek Forest (ESPA #80) which extends outside of the study area to the south and west. These natural feature complexes provide an ecological linkage function between the study area and other natural features in the subwatershed.

Woodlands and wetlands within the study area are designated as Core Environmental Features in the Region of Waterloo Official Plan, and Core or Supporting Natural Features in the City of Waterloo Official Plan (2012). The low lying lands along Laurel and Beaver Creeks are floodplain and are regulated by the GRCA. The Beaver Creek Meadows District Plan, which is anticipated to be completed by spring/summer 2015, will provide detailed land use policies and a land use framework for the area.

Ecological Monitoring Program

Background Information Collection and Review

Existing background information on the biological features on and adjacent to the study area has been collected and reviewed by NRSI and has assisted in guiding the pre-construction monitoring program approach provided in this Terms of Reference (TOR). Background information sources have included the following:

- Aerial photography of the site (2012)
- Species lists, vegetation community mapping, study methods and management recommendations contained in the North Waterloo Scoped Subwatershed Study (NWSSS) (Ecoplans et al. 2013)
- City of Waterloo Development Monitoring protocol (1999)

Ecological Monitoring Program

Field surveys as carried out in the NWSSS and City of Waterloo protocol have been refined in this TOR to be specific to the subject lands, and will be carried out to provide baseline characterization of the biological features within and adjacent to the subject properties. The intent of these surveys is to provide two years of pre-construction

baseline data. The following surveys are proposed, with monitoring locations shown on Map 2:

- Ecological Land Classification of the vegetation communities in the study area will be confirmed and refined according to Lee et al. (1998) and Lee (2008).
- Vegetation surveys to assess enhancement/management needs within natural features and for future buffer lands, including mapping of regionally significant vascular plant species.
- At the request of the GRCA, permanent plot vegetation monitoring will be carried out at 7 locations indicated on Map 2. The methods to be used for vegetation monitoring are taken from the City of Waterloo's *Terrestrial Monitoring - Plot Establishment & Data Collection* (2002) and include recording the species, size, abundance and health of canopy trees, understorey trees, shrubs and herbaceous plants once a year during mid-summer.
- Breeding bird surveys within existing wildlife survey units as well as additional surveys in the agricultural and cultural areas of the property, consistent with the NWSSS methods and standardized Ontario Breeding Bird Atlas protocol (OBBA 2001) will include random (wandering) transects and 10 minute point counts. Surveys will be conducted three times during peak breeding bird season (May 15 to July 31) to account for Barn Swallow (*Hirundo rustica*) monitoring as well (see below).
- Anuran call surveys at existing stations, consistent with the NWSSS and Marsh Monitoring Protocol (MMP) (BSC 2009). New stations will be added on-site to record calling amphibians which were documented in the NWSSS from off-site locations.
- Terrestrial feature monitoring outlined in the City of Waterloo's Development Monitoring Protocol document for pre-construction (Section 2.2.3) will be conducted twice annually (spring and fall) by walking through the entire subject property and documenting the following:
    - General health of vegetation and trees
    - Evidence of soil movement
    - Evidence of human disturbance or encroachment
    - General fish and wildlife observations
    - Overall conditions
- Photo monitoring at fixed locations.
- Dripline flagging will be updated in the field and reviewed with the Region of Waterloo staff and surveyed to provide an up to date boundary of the Core Environmental Features.
- Benthic macro-invertebrate (benthic) sampling is proposed twice annually (spring and fall) at 3 stations in the study area, located at the same sites as used in the subwatershed study. The sampling and assessment will be carried out using the Ontario Benthic Biomonitoring Network Protocol (OBBN) (Jones et al. 2007) and according to the same methods used in the subwatershed study.

NRSI has consulted with the Ministry of Natural Resources and Forestry (MNRF) with respect to Species at Risk (SAR) and Significant Wildlife Habitat (SWH). The MNRF approved SAR screening includes specific surveys related to SAR and SWH as follows:

- Breeding bird monitoring with targeted surveys for Barn Swallow according to the MNRF protocol for Barn Swallow surveys, which includes a third visit during breeding season,

- GRCA correspondence indicated that Common Nighthawk (*Chordeiles minor*) has been observed in the local Waterloo area (Smith, pers. comm. 2014). As suitable habitat for this species is present in the study area, surveys will be conducted according to MNRF guidance including 3 evening surveys, 7 days apart, depending on the lunar cycle, between late May and early July.
- MMP anuran call surveys to continue to monitor Western Chorus Frog (*Pseudacris triseriata pop. 2*) and to identify amphibian SWH,
- Targeted visual surveys for turtle SAR and SWH related to Blanding's Turtle (*Emydoidea blandingii*) and Snapping Turtle (*Chelydra serpentina*) including potential turtle nesting and overwintering areas (to confirm that the habitat conditions for this species is unchanged),
- Compliance with the *Endangered Species Act (2007)* as it applies to SAR bats will be ensured at the time of the removal of buildings and isolated and hedgerow trees within the subject properties, which may include visual exit surveys immediately prior to removal or demolition activities, and
- Any Butternut (*Juglans cinerea*) observed within the proposed construction footprint and adjacent lands will be assessed by a certified butternut health assessor.

The aquatic habitat and fish community in Beaver Creek was well characterized in the NWSSS and it is our opinion that sufficient baseline data has been collected. Fish sampling was carried out in 2006 and 2009, and Brook/Brown Trout spawning surveys were conducted in 2007, 2008, 2009 and 2010 with none observed. The land use in the study area has not changed since these surveys were completed and as such additional aquatic surveys are not proposed as part of this pre-construction monitoring program.

Incidental wildlife observations made during all field visits will be recorded, including direct observations, as well as signs such as dens, tracks, scat, etc.

Wildlife road mortality surveys were carried out during the subwatershed study and provide a sufficient understanding of baseline conditions. As discussed with the City of Waterloo and the GRCA, no further surveys to document road mortality of wildlife will be carried out during the pre-construction period.

Surface Water and Groundwater Monitoring Program

A surface water and groundwater monitoring program has been prepared by Stantec and is appended to this TOR.

Reporting

A pre-construction monitoring report will be prepared for the subject properties on an annual basis. The report will document the existing site conditions including vegetation communities and condition, plant species, wildlife species lists, identification of SAR and SWH, watercourse condition based on the benthic monitoring, wetland functions, and the results of the surface water and groundwater monitoring. This data will be used to characterize the baseline conditions pre-development and will be incorporated into the future EIS reports. The monitoring report will be submitted for agency review.

References

Bird Studies Canada (BSC). 2009. Marsh Monitoring Program Participant's Handbook for Surveying Amphibians. 2009 Edition. Published by Bird Studies Canada in Cooperation with Environment Canada and the U.S. Environmental Protection Agency. February 2009.

City of Waterloo. 1999. City of Waterloo Development Monitoring Protocol. Development Services Department. July 16, 1999.

City of Waterloo. 2002. Terrestrial Monitoring - Plot Establishment & Data Collection.

Ecoplans, MHBC, and Stantec. 2013. North Waterloo Scoped Subwatershed Study. Volume 1. November 2013.

Jones, C., K.M. Somers, B. Craig and T. Reynoldson. 2007. Ontario Benthos Biomonitoring Network Protocol Manual. Ontario Ministry of the Environment, Environment Canada, National Water Research Institute.

Lee, H.T. 2008. Southern Ontario Ecological Land Classification: Vegetation Type List. Southern Information Management and Spatial Analysis Section, OMNR.

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Ontario Breeding Bird Atlas (OBBA). 2001. Guide for Participants. Atlas Management Board, Federation of Ontario Naturalists, Don Mills.

Personal Communication

GRCA Staff. 2014. Kaitlyn Smith, Resource Planner, Grand River Conservation Authority. July 2, 2014.

Maps



Path: X:\1531A_NorthWaterlooLands\NRSI_1531A_Map1_StudyArea_8K_2014_08_26_JO.mxd

Map 1

North Waterloo Lands
Study Area

Legend

- Primary SW Study Area
- Participating Landowners
  - Northgate, 51ha
  - Cook Homes, 29ha
  - Activa, 10ha
  - Erbsville Kartway, 6ha
- Provincially Significant Wetland (PSW)
- Primary Road
- Secondary Road
- ESPA (Region of Waterloo)
  - #80 Laurel Creek Forest

Natural Resource Solutions Inc.
Aquatic, Terrestrial and Wetland Biologists

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Project: 1531A Date: August 26, 2014	NAD83 - UTM Zone 17 Size: 11x17" **1:8,000**

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Map 2

North Waterloo Lands

Monitoring Locations

Legend

- Subject Properties
- Watercourse

Biological Monitoring (NRSI)

- Anuran Call Station (ANR)
- Vegetation Station (VEG)
- Benthic Sampling Station (BTH)
- Wildlife Survey Unit (Approx)

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

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Project: 1531A
Date: January 8, 2015

NAD83 - UTM Zone 17
Size: 11x17"
1:6,000

0 50 100 150 200 250 300 Metres

Surface Water and Groundwater Monitoring Program (Stantec)

July 29, 2014

NORTH WATERLOO
PROPOSED PHASE 1 MONITORING PROGRAM
2014

1.0 STUDY AREA AND CONTEXT

The subject properties comprise a large portion of the Primary Study Area from the North Waterloo Scoped Subwatershed Study. The lands are located in the northwest portion of the City Urban Area and are generally bounded by City limits to the north, Beaver Creek Road / Roy Schmidt Road to the east and Laurel Creek Nature Centre to the south.

The subject properties and adjacent lands are representative of a typical southern Ontario landscape mosaic, consisting of urban, rural residential, institutional (church), natural, agricultural, educational (Laurel Creek Nature Centre), and recreational (Erbsville Kartway) uses.

The broader landscape is predominantly agricultural, with large blocks of natural heritage features. The agricultural areas were generally cleared for agriculture in the early 1800s and have been generally unchanged (notwithstanding year-to-year variations in plough limits and some tree cutting). Rural residential properties have been present on the landscape for many decades; urban residential development is relatively recent and progressing from the south and east toward the north / northwest limits of the City.

The Laurel Creek Forest (ESPA 80) encompasses the forest features south of Conservation Drive and extends beyond the subject properties along Laurel Creek and adjacent features. The Sunfish Lake - Laurel Creek PSW encompasses wetlands north and south of Conservation Drive on the subject properties as part of a large complex of wetlands across the landscape. These designations overlap on the subject properties with additional designations including significant woodlands and natural hazards (i.e., floodplain).

Lands to the north and west of the subject properties, outside the City, are comprised of extensive farmlands designated as Prime Agricultural Areas in the Regional Official Polices Plan (ROPP). Features located on the subject properties extend beyond the City into Woolwich and Wellesley Townships along the Beaver Creek Corridor, providing an ecological link from Laurel Creek (and associated features) to the south and the Laurel Creek Headwaters Environmentally Sensitive Landscape (ESL) in the townships. South and east of the subject properties is the Laurel Creek Conservation Area (CA) and Laurel Creek ESPA 18.

The Study Team is very familiar with the area through extensive surveys and preparation of the North Waterloo Scoped Subwatershed Study for these lands.

2.0 MONITORING STUDY APPROACH

The City of Waterloo requires that monitoring programs be completed for new development applications. These monitoring programs are the responsibility of the developer, and include Stage I, II and III monitoring per the Laurel Creek Watershed Development Monitoring Program. Stage I consists of 2 years of pre-development monitoring, Stage II represents during construction conditions, and Stage III extends for 24 months following substantial completion of the development (i.e., 90% stabilization of the catchment area). Recommended Stage I monitoring components are discussed below. The Stage II and III monitoring programs are to be verified at the draft plan of subdivision application and final engineering design stages (respectively). Monitoring programs will be undertaken by the developer.

2.1 SURFACE WATER MONITORING

Surface water monitoring components prior to development/construction are generally addressed through the City's System Monitoring Program. Monitoring includes water quality (chemistry) and flows (hydrology) where Beaver Creek crosses Conservation Drive (Station #17), and this data will be summarized and discussed in the context of the North Waterloo area monitoring program. Surface water monitoring will be undertaken by Stantec with the monitoring locations shown on Figure 1. Additional monitoring will include:

2.1.1 Surface Water Flow Monitoring

Location. Surface water flow measurements will be completed along Beaver Creek at three (3) drivepoint piezometers (DP1-09, DP3-09 and DP5-09) and along Laurel Creek at two (2) drivepoint piezometers (DP7-09 and DP9-09). The monitoring locations along Laurel Creek will be reviewed in 2014. Sections of Laurel Creek do not exhibit channel flow and there is ponding in the area. The monitoring locations may be modified/replaced based on site conditions to obtain representative flow data. The drivepoint locations are shown on Figure 1.

Timing. Flow measurement will be completed three (3) times annually at the same time as manual water level monitoring is conducted.

Methodology. Surface water flow measurements will be completed using the velocity-area method. Measurements will be obtained at regular intervals across the creek and will include the depth of the tributary and the flow rate recorded using a Marsh-McBirney Inc. Model 201 portable water flow meter.

2.1.2 Water Level Monitoring

Location. Surface water level monitoring will be completed along Beaver Creek at three (3) drivepoint piezometers (DP1-09, DP3-09 and DP5-09) and along Laurel Creek at two (2)

drivepoint piezometers (DP7-09 and DP9-09, or as modified). The drivepoint locations are shown on Figure 1.

Timing. Manual measurements will be collected three (3) times per year and the continuous loggers will be downloaded during each monitoring event.

Methodology. Water level measurements would be collected using a combination of manual and automated techniques.

2.2 GROUNDWATER MONITORING

Groundwater monitoring within the subject properties should include water level measurements and water chemistry analysis under Stage I, II and III conditions.

Due to the expected staged development of the property, it is anticipated that several years may pass between Draft Plan Approval and construction of all stages of the development. The following groundwater monitoring program is recommended for the Stage I monitoring. It is expected that the future monitoring may be reduced in scope based on timing and location of development. Groundwater monitoring will be undertaken by Stantec.

2.2.1 Water Level Monitoring

Location. Groundwater level monitoring will be completed at the 2010 monitoring wells located within the subject lands and within drivepoint piezometers located along Beaver Creek and Laurel Creek including:

- Twelve (12) monitoring wells (MW2-10, MW3-10S, MW3-10D, MW6-10, MW7-10, MW8-10S, MW8-10D, MW10-10, MW11-10, MW12-10S, MW12-10D, MW13-10) including shallow and deep monitoring locations; and
- Three (3) drivepoint piezometers along Beaver Creek (DP1-09, DP3-09 and DP5-09).
- Two (2) drivepoint piezometers along Laurel Creek (DP7-09 and DP9-09, or as modified).

Timing. Manual measurements will be collected three (3) times per year and the loggers will be downloaded during each monitoring event.

Methodology. Water level measurements would be collected using a combination of manual and automated techniques.

2.2.2 Water Chemistry Monitoring

Location. Groundwater quality sampling will be completed at the 2010 monitoring wells located within the subject lands including:

- Twelve (12) monitoring wells (MW2-10, MW3-10S, MW3-10D, MW6-10, MW7-10, MW8-10S, MW8-10D, MW10-10, MW11-10, MW12-10S, MW12-10D, MW13-10) including shallow and deep monitoring locations.

Timing. Water quality samples will be collected once per year in the spring. The 2014 sampling will be completed in August 2014.

Methodology. Groundwater samples will be collected using foot valve / tubing or submersible pump depending on the location. Each well will be purged of three (3) casing volumes prior to sampling. Groundwater samples for metals analysis will be field filtered. Water quality samples would be analyzed for metals, nutrients and general chemistry.

3.0 REPORTING

Results from groundwater and surface water monitoring for Stage I monitoring will be presented in brief annual reports that include an assessment of results, integration of other monitoring data (as relevant) and recommendations for management or changes to future monitoring protocols, as required. Data sheets and representative photographs will be appended.

NORTH WATERLOO SCOPED SUBWATERSHED STUDY

PROPOSED PRE-CONSTRUCTION MONITORING

FIGURE 1



Monitoring Well (Stantec, 2010)
Drive-Point Piezometer (Stantec, 2010)
City Surface Water Station
Water Quality Monitoring Location
Water Level Monitoring Location
Watercourse
Subject Property

NOTES

1. Coordinate System: UTM NAD 83 - Zone 17 (N).
2. Primary Study Area includes 2012 aerial photograph for lands within the City of Waterloo (source: City of Waterloo).
   Secondary Study Area includes 2010 aerial photograph for lands within the Township (source: First Base Solutions).

NORTH

October 2013

Stantec

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE

160330875

\\Cd1004-f01\work_group\01609\active\160310875_ Waterloo North\planning\drawing\Manifold\160340875_base.map [Fig01_ProposedMonitoring Layout]
7/30/2014 5:04:02 PM By: ccoghlan Revised 2013-10-30 By: ccoghlan

APPENDIX II

Species at Risk and Species of Conservation Concern Habitat Assessment Results

2115881 Ontario Ltd., North Waterloo EIS - SAR/SCC Assessment

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[4]	Habitat Preference[5,6,7]	Background Source	Suitable Habitats within Subject Properties (within 120m)	Observed by NRSI
Plants									
Fraxinus nigra	Black Ash	S5	--	T	--	Mucky or peaty soils in swamps, such as river floodplains.	N/A; species uplisted by COSEWIC in November 2018	Yes	No
Juglans cinerea	Butternut	S3?	E	END	Schedule 1	Rich-moist woodlands. Stream banks and swamps, as well as upland beech-maple, oak-hickory, and mixed hardwood stands.	NWSSS (Ecoplans et al. 2013)	Yes	No. A single hybrid Butternut was observed.
Birds									
Chordeiles minor	Common Nighthawk	S4B	SC	T	Schedule 1	Open ground; clearings in dense forests; ploughed fields; gravel beaches or barren areas with rocky soils; open woodlands; flat gravel roofs.	GRCA staff, pers. comm. 2014	Yes, although marginal. Suitable nesting habitat is nearby to the west at Creekside Church.	Yes (in 2015 and 2016). Observed incidentally with no breeding evidence on-site.
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC	--	Open, deciduous, mixed or coniferous forest; predominated by oak with little understory; forest clearings, edges; farm woodlots, parks.	NWSSS (Ecoplans et al. 2013)	Yes	Yes. Breeding individuals not confirmed.
Haliaeetus leucocephalus	Bald Eagle	S2N, S4B	SC	NAR	--	Require large continuous area of deciduous or mixed woods around large lakes, rivers; require area of 255 ha for nesting, shelter, feeding, roosting; prefer open woods with 30 to 50% canopy cover; nest in tall trees 50 to 200 m from shore; require tall, dead, partially dead trees within 400 m of nest for perching.	N/A	No	Yes. Observed incidentally flying overhead with no breeding evidence.
Hirundo rustica	Barn Swallow	S4B	THR	T	--	Farmlands or rural areas; cliffs, caves, rock niches; buildings or other man-made structures for nesting; open country near body of water.	NWSSS (Ecoplans et al. 2013)	Yes. Suitable nesting habitat present.	Yes. No nests observed; breeding individuals not confirmed.
Hylocichla mustelina	Wood Thrush	S4B	SC	T	--	Carolinian and Great Lakes-St. Lawrence forest zones; undisturbed moist mature deciduous or mixed forest with deciduous sapling growth; near pond or swamp; hardwood forest edges; must have some trees higher than 12 m.	NWSSS (Ecoplans et al. 2013)	Yes	No
Setophaga cerulea	Cerulean Warbler	S3B	THR	E	Schedule 1	Mature deciduous woodland of Great Lakes-St.Lawrence and Carolinian forests, sometimes coniferous; swamps or bottomlands with large trees; area sensitive species needing extensive areas of forest (>100 ha).	R. McMullen, pers. comm. 2014	No	No
Riparia riparia	Bank Swallow	S4B	THR	T	--	Sand, clay or gravel river banks or steep riverbank cliffs; lakeshore bluffs of easily crumbled sand or gravel; gravel pits, road-cuts, grassland or cultivated fields that are close to water; nesting sites are limiting factor for species presence.	NWSSS (Ecoplans et al. 2013)	No. Suitable nesting habitat not present.	Yes. Observed incidentally with no breeding evidence.

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[4]	Habitat Preference[5,6,7]	Background Source	Suitable Habitats within Subject Properties (within 120m)	Observed by NRSI
Herpetofauna									
Ambystoma jeffersonianum	Jefferson Salamander	S2	END	E	Schedule 1	Damp shady deciduous forest, swamps, moist pasture, lakeshores; temporary woodland pools for breeding; hides under leaf litter, stones or in decomposing logs.	NWSSS (Ecoplans et al. 2013)	No. Suitable breeding habitat not present.	No
Chelydra serpentina serpentina	Snapping Turtle	S3	SC	SC	Schedule 1	Permanent, semi-permanent fresh water; marshes, swamps or bogs; rivers and streams with soft muddy banks or bottoms; often uses soft soil or clean dry sand on south-facing slopes for nest sites; may nest at some distance from water; often hibernate together in groups in mud under water; home range size ~28 ha.	NWSSS (Ecoplans et al. 2013)	Yes	No
Emydoidea blandingii	Blanding's Turtle (*Great Lakes/St Lawrence population*)	S3	THR	T	Schedule 1	Shallow water marshes, bogs, ponds or swamps, or coves in larger lakes with soft muddy bottoms and aquatic vegetation; basks on logs, stumps, or banks; surrounding natural habitat is important in summer as they frequently move from aquatic habitat to terrestrial habitats; hibernates in bogs.	NWSSS (Ecoplans et al. 2013)	Yes, although suitable overwintering habitat for this species is not present.	No
Graptemys geographica	Northern Map Turtle	S3	SC	SC	Schedule 1	Large bodies of water with soft bottoms, and aquatic vegetation; basks on logs or rocks or on beaches and grassy edges, will bask in groups; uses soft soil or clean dry sand for nest sites; may nest at some distance from water; home range size is larger for females (about 70 ha) than males (about 30 ha) and includes hibernation, basking, nesting and feeding areas; aquatic corridors (e.g. stream) are required for movement; not readily observed.	NWSSS (Ecoplans et al. 2013)	No	No
Pseudacris triseriata pop. 2	Western Chorus Frog *(Great Lakes/St. Lawrence - Canadian Shield Population)*	S3	NAR	T	--	Roadside ditches or temporary ponds in fields; swamps or wet meadows; woodland or open country with cover and moisture; small ponds and temporary pools.	NWSSS (Ecoplans et al. 2013)	Yes	No. Recorded during NWSSS (Ecoplans et al. 2013)
Regina septemvittata	Queensnake	S2	END	E	Schedule 1	Margins of streams with slow currents and gravel bottoms; shorelines with rocks and debris; old quarries; canals; aquatic habitat with overhanging trees, particularly willows.	NWSSS (Ecoplans et al. 2013)	No	No
Thamnophis sauritus septentrionalis	Eastern Ribbonsnake	S3	SC	SC	Schedule 1	Sunny grassy areas with low dense vegetation near bodies of shallow permanent quiet water; wet meadows, grassy marshes or sphagnum bogs; borders of ponds, lakes or streams; hibernates in groups.	NWSSS (Ecoplans et al. 2013)	Yes	No
Mammals									
Myotis leibii	Eastern Small-footed Myotis	S2S3	END	--	--	Roosts in caves, mine shafts, crevices or buildings that are in or near woodland; hibernates in cold dry caves or mines; maternity colonies in caves or buildings; hunts in forests.	NWSSS (Ecoplans et al. 2013)	No	No

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[4]	Habitat Preference[5,6,7]	Background Source	Suitable Habitats within Subject Properties (within 120m)	Observed by NRSI
Myotis lucifugus	Little Brown Myotis	S4	END	E	Schedule 1	Uses caves, quarries, tunnels, hollow trees or buildings for roosting; winters in humid caves; maternity sites in dark warm areas such as attics and barns; feeds primarily in wetlands, forest edges.	NWSSS (Ecoplans et al. 2013)	Yes	No
Myotis septentrionalis	Northern Long-eared Bat	S3	END	E	Schedule 1	Roost under loose bark and in the cavities of trees, hibernate in caves or abandoned mines.	NWSSS (Ecoplans et al. 2013)	Yes	No
Perimyotis subflavus	Tri-colored Bat	S3?	END	E	Schedule 1	Open woods near water; roosts in trees, cliff crevices, buildings or caves; hibernates in damp, draft-free, warm caves, mines or rock crevices.	NWSSS (Ecoplans et al. 2013)	Yes	No
Taxidea taxus jacksoni	American Badger	S2	END	E	Schedule 1	Generally prefer open habitats, whether natural (grasslands) or man-made (agricultural fields, road right-of-ways, golf courses).	NWSSS (Ecoplans et al. 2013)	Yes	No
Insects									
Danaus plexippus	Monarch	S2N, S4B	SC	SC	Schedule 1	Open areas with Milkweed spp. (*Asclepias* spp.)	NWSSS (Ecoplans et al. 2013)	Yes	Yes
Epiaeschna heros	Swamp Darner	S2S3	--	--	--	Heavily wooded ponds, streams and ox-bows including ephemeral pools and ponds.	NWSSS (Ecoplans et al. 2013)	No	No
Euphyes conspicua	Black Dash	S3	--	--	--	Wet sedge meadows.	NWSSS (Ecoplans et al. 2013)	Yes	No

[1]MECP 2019, [2]MNRF2019, [3,4]Government of Canada 2018, [5]OMNR 2000, [6]Reznicek et al. 2011, [7]Layberry et al. 1998

LEGEND
SRANK
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S?# Rank Uncertain
B Breeding
N Non-breeding
COSSARO/COSEWIC
NAR Not at Risk
SC Special Concern
THR/T Threatened
END/E Endandered
SARA Schedule
Schedule 1 Officially Protected under SARA

APPENDIX III

Vegetation Species Observed by Monitoring Plot (2014 – 2016, 2019)

Vegetation Species Observed by Monitoring Plot (2014-2016, 2019)

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed		
										VEG-001 SWT2/CUP3	VEG-002 (2014-2016) SWM6-1	VEG-002 (2019) SWM6-1
Pteridophytes	**Ferns & Allies**											
Dryopteridaceae	**Wood Fern Family**											
Athyrium filix-femina var. angustum	Northern Lady Fern	4	0		S5						X	X
Cystopteris bulbifera	Bulblet Fern	5	-2		S5							X
Dryopteris carthusiana	Spinulose Wood Fern	5	-2		S5						X	X
Dryopteris cristata	Crested Wood Fern	7	-5		S5						X	X
Onoclea sensibilis	Sensitive Fern	4	-3		S5						X	X
Equisetaceae	**Horsetail Family**											
Equisetum arvense	Field Horsetail	0	0		S5					X		
Equisetum pratense	Meadow Horsetail	8	-3		S5				R*		X	
Osmundaceae	**Royal Fern Family**											
Osmunda cinnamomea	Cinnamon Fern	7	-3		S5						X	
Osmunda regalis var. spectabilis	American Royal Fern	7	-5		S5						X	
Thelypteridaceae	**Beech Fern Family**											
Phegopteris connectilis	Northern Long Beech Fern	8	5		S5				R		X	
Thelypteris palustris var. pubescens	Marsh Fern	5	-4		S5						X	X
Gymnosperms	**Conifers**											
Cupressaceae	**Cypress Family**											
Thuja occidentalis	White Cedar	4	-3		S5					X	X	X
Pinaceae	**Pine Family**											
Larix laricina	Tamarack	7	-3		S5						X	
Picea abies	Norway Spruce		5	-1	SE3					X		
Picea glauca	White Spruce	6	3		S5				R+	X		X
Dicotyledons	**Dicots**											
Aceraceae	**Maple Family**											
Acer negundo	Manitoba Maple	0	-2		S5					X		
Acer saccharum ssp. saccharum	Sugar Maple	4	3		S5					X		
Apiaceae	**Carrot or Parsley Family**											
Daucus carota	Wild Carrot		5	-2	SE5					X		
Apocynaceae	**Dogbane Family**											
Apocynum cannabinum var. cannabinum	Indian Hemp		1		S5					X		
Asclepiadaceae	**Milkweed Family**											
Asclepias syriaca	Common Milkweed	0	5		S5					X		
Asteraceae	**Composite or Aster Family**											
Erigeron annuus	Daisy Fleabane	0	1		S5					X		
Erigeron philadelphicus ssp. philadelphicus	Philadelphia Fleabane	1	-3		S5					X		
Eupatorium maculatum ssp. maculatum	Spotted Joe-pye-weed	3	-5		S5					X	X	
Euthamia graminifolia	Flat-topped Bushy Goldenrod	2	-2		S5					X		
Hieracium caespitosum ssp. caespitosum	Field Hawkweed		5	-2	SE5					X		

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed		
										VEG-001 SWT2/CUP3	VEG-002 (2014-2016) SWM6-1	VEG-002 (2019) SWM6-1
Rudbeckia hirta	Black-eyed Susan	0	3		S5					X		
Solidago altissima var. altissima	Tall Goldenrod	1	3		S5					X		
Solidago canadensis	Canada Goldenrod	1	3		S5					X		
Solidago patula	Rough-leaved Goldenrod	8	-5		S5						X	X
Solidago rugosa ssp. rugosa	Rough Goldenrod	4	-1		S5					X	X	
Symphyotrichum lanceolatum var. lanceolatum	Tall White Aster	3	-3		S5					X		
Symphyotrichum lateriflorum var. lateriflorum	Calico Aster	3	-2		S5					X		
Symphyotrichum novae-angliae	New England Aster	2	-3		S5					X		
Symphyotrichum puniceum var. puniceum	Purple-stemmed Aster				S5						X	X
Taraxacum officinale	Common Dandelion		3	-2	SE5					X		
Tussilago farfara	Coltsfoot		3	-2	SE5					X		
Balsaminaceae	**Touch-me-not Family**											
Impatiens capensis	Spotted Touch-me-not	4	-3		S5						X	X
Impatiens pallida	Pale Touch-me-not	7	-3		S5						X	
Betulaceae	**Birch Family**											
Betula alleghaniensis	Yellow Birch	6	0		S5						X	X
Brassicaceae	**Mustard Family**											
Cardamine pensylvanica	Pensylvania Bitter-cress	6	-4		S5							X
Campanulaceae	**Bellflower Family**											
Lobelia siphilitica	Great Lobelia	6	-4		S5						X	X
Caprifoliaceae	**Honeysuckle Family**											
Lonicera tatarica	Tartarian Honeysuckle		3	-3	SE5					X		
Sambucus canadensis	Common Elderberry	5	-2		S5						X	X
Viburnum lantana	Bending Wayfaring-tree		5	-1	SE2					X		
Viburnum lentago	Nannyberry	4	-1		S5					X		
Viburnum opulus	Guelder Rose		0	-1	SE4					X		
Cornaceae	**Dogwood Family**											
Cornus alternifolia	Alternate-leaved Dogwood	6	5		S5						X	X
Cornus amomum ssp. obliqua	Silky Dogwood	5	-4		S5					X	X	
Cornus stolonifera	Red-osier Dogwood	2	-3		S5					X	X	X
Cucurbitaceae	**Gourd Family**											
Echinocystis lobata	Prickly Cucumber	3	-2		S5					X		
Elaeagnaceae	**Oleaster Family**											
Elaeagnus umbellata	Autumn Olive		3	-3	SE3					X		
Fabaceae	**Pea Family**											
Amphicarpaea bracteata	Hog Peanut	4	0		S5						X	
Medicago lupulina	Black Medick		1	-1	SE5					X		
Melilotus alba	White Sweet-clover		3	-3	SE5					X		
Vicia cracca	Tufted Vetch		5	-1	SE5					X		
Fagaceae	**Beech Family**											
Quercus macrocarpa	Bur Oak	5	1		S5							X

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed		
										VEG-001 SWT2/CUP3	VEG-002 (2014-2016) SWM6-1	VEG-002 (2019) SWM6-1
Grossulariaceae	**Currant Family**											
Ribes americanum	Wild Black Currant	4	-3		S5					X		
Ribes cynosbati	Prickly Gooseberry	4	5		S5					X		
Ribes rubrum	Red Currant		5	-2	SE5					X		
Ribes triste	Wild Red Currant	6	-5		S5						X	X
Juglandaceae	**Walnut Family**											
Juglans nigra	Black Walnut	5	3		S4				R+*	X		
Lamiaceae	**Mint Family**											
Clinopodium vulgare	Wild Basil	4	5		S5					X		
Prunella vulgaris ssp. lanceolata	Heal-all	5	5		S5					X	X	
Oleaceae	**Olive Family**											
Fraxinus pennsylvanica	Green Ash	3	-3		S5					X		X
Onagraceae	**Evening-primrose Family**											
Circaea alpina	Smaller Enchanter's Nightshade	6	-3		S5						X	X
Circaea lutetiana ssp. canadensis	Yellowish Enchanter's Nightshade	3	3		S5					X		X
Epilobium parviflorum	Sparse-flowered Willow-herb		3	-1	SE4					X		
Primulaceae	**Primrose Family**											
Lysimachia ciliata	Fringed Loosestrife	4	-3		S5					X	X	X
Lysimachia thyrsiflora	Tufted Loosestrife	7	-5		S5							X
Ranunculaceae	**Buttercup Family**											
Actaea pachypoda	White Baneberry	6	5		S5						X	
Caltha palustris	Marsh-marigold	5	-5		S5							X
Ranunculus acris	Tall Buttercup		-2	-2	SE5					X		
Ranunculus hispidus var. caricetorum	Swamp Buttercup	5	-5		S5						X	X
Ranunculus recurvatus var. recurvatus	Hooked Buttercup	4	-3		S5					X		X
Rhamnaceae	**Buckthorn Family**											
Rhamnus cathartica	European Buckthorn		3	-3	SE5					X		
Frangula alnus	Glossy Buckthorn		-1	-3	SE5					X		
Rosaceae	**Rose Family**											
Agrimonia gryposepala	Tall Hairy Agrimony	2	2		S5					X		
Amelanchier laevis	Smooth Juneberry	5	5		S5					X		
Crataegus punctata	Large-fruited Thorn	4	5		S5					X		
Fragaria virginiana	Wild Strawberry	2	1		S5					X		
Geum aleppicum	Yellow Avens	2	-1		S5						X	
Geum canadense	White Avens	3	0		S5						X	
Geum rivale	Purple Avens	7	-5		S5						X	X
Malus domestica	Apple									X		
Prunus serotina	Black Cherry	3	3		S5					X	X	
Prunus virginiana ssp. virginiana	Choke Cherry	2	1		S5					X	X	
Rubus idaeus ssp. melanolasius	Wild Red Raspberry	0	-2		S5						X	
Rubus pubescens	Dwarf Raspberry	4	-4		S5						X	X
Sorbus aucuparia	European Mountain-ash		5	-2	SE4					X		

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed		
										VEG-001 SWT2/CUP3	VEG-002 (2014-2016) SWM6-1	VEG-002 (2019) SWM6-1
Rubiaceae	**Madder Family**											
Galium aparine	Cleavers	4	3		S5						X	
Galium asprellum	Rough Bedstraw	6	-5		S5							X
Galium mollugo	White Bedstraw		5	-2	SE5					X		
Galium palustre	Marsh Bedstraw	5	-5		S5						X	
Galium triflorum	Sweet-scented Bedstraw	4	2		S5							X
Salicaceae	**Willow Family**											
Populus balsamifera ssp. balsamifera	Balsam Poplar	4	-3		S5					X		
Populus tremuloides	Trembling Aspen	2	0		S5					X		
Salix bebbiana	Long-beaked Willow	4	-4		S5					X		
Salix discolor	Pussy Willow	3	-3		S5					X		
Salix eriocephala	Heart-leaved Willow	4	-3		S5					X		
Saxifragaceae	**Saxifrage Family**											
Chrysosplenium americanum	Golden Saxifrage	8	-5		S5							X
Mitella nuda	Naked Mitrewort	6	-3		S5						X	X
Tiarella cordifolia	False Mitrewort	6	1		S5						X	
Scrophulariaceae	**Figwort Family**											
Chelone glabra	Turtlehead	7	-5		S5						X	
Solanaceae	**Nightshade Family**											
Solanum dulcamara	Bitter Nightshade		0	-2	SE5						X	X
Ulmaceae	**Elm Family**											
Ulmus americana	White Elm	3	-2		S5					X		
Vitaceae	**Grape Family**											
Parthenocissus vitacea	Woodbine	3	3		S5						X	
Vitis riparia	Riverbank Grape	0	-2		S5					X		
Monocotyledons	**Monocots**											
Araceae	**Arum Family**											
Arisaema triphyllum	Jack-in-the-pulpit	5	-2		S5						X	X
Cyperaceae	**Sedge Family**											
Carex aurea	Golden-fruited Sedge	4	-4		S5					X		
Carex bebbii	Bebb's Sedge	3	-5		S5					X		
Carex blanda	Woodland Sedge	3	0		S5					X		
Carex flava	Yellow Sedge	5	-5		S5						X	
Carex gracillima	Graceful Sedge	4	3		S5					X		
Carex granularis	Meadow Sedge	3	-4		S5					X		
Carex hystericina	Porcupine Sedge	5	-5		S5						X	
Carex lacustris	Lake-bank Sedge	5	-5		S5						X	
Carex leptalea ssp. leptalea	Bristle-stalked Sedge	8	-5		S5				R			X
Carex radiata	Radiate Sedge	4	5		S5					X		
Carex utriculata	Beaked Sedge	7	-5		S5						X	
Schoenoplectus tabernaemontani	American Great Bulrush	5	-5		S5						X	
Scirpus atrovirens	Dark-green Bulrush	3	-5		S5					X		

Scientific Name	Common Name	CC[1]	CW[1]	Weed[1]	SRANK[2]	COSSARO[3]	COSEWIC[4]	SARA Schedule[4]	Waterloo Region[5]	NRSI Observed		
										VEG-001 SWT2/CUP3	VEG-002 (2014-2016) SWM6-1	VEG-002 (2019) SWM6-1
Juncaceae	**Rush Family**											
Juncus dudleyi	Dudley's Rush	1	0		S5					X		
Liliaceae	**Lily Family**											
Maianthemum canadense	Wild Lily-of-the-valley	5	0		S5						X	X
Maianthemum stellatum	Star-flowered Solomon's Seal	6	1		S5					X	X	X
Orchidaceae	**Orchid Family**											
Epipactis helleborine	Common Helleborine		5	-2	SE5					X		X
Poaceae	**Grass Family**											
Agrostis gigantea	Redtop		0	-2	SE5					X	X	
Dichanthelium acuminatum var. acuminatum	Acuminate Panic Grass	2	0		S5					X		
Glyceria striata	Fowl Meadow Grass	3	-5		S5						X	X
Leersia oryzoides	Rice Cut Grass	3	-5		S5						X	
Poa compressa	Canada Blue Grass	0	2		S5					X		
Poa pratensis ssp. pratensis	Kentucky Bluegrass	0	1		S5					X		
									Total	**78**	**55**	**40**

[1]Oldham et al., 1995, [2]MNRF 2019, [3]MECP 2019, [4]Government of Canada 2018, [5]Richardson and Martin 1999

LEGEND
SRANK
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SE# Introduced
Region of Waterloo
R Native, Present, Rare
+ Significant only if demonstrably indigenous
* Significant, but additional research may prove otherwise

APPENDIX IV

Avifauna Observed within the Subject Property (2014 – 2019)

Avifauna Observed within Subject Property (2014-2019)

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Breeding Evidence (Br.Ev.) and Abundance (#)															
							2115881 Ontario Ltd. Property															
							WSU-1		WSU-2		WSU-3		WSU-4		WSU-5		WSU-6		WSU-7		WSU-8	
							Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Anatidae	**Ducks, Geese & Swans**																					
Branta canadensis	Canada Goose	S5					X	2	X	2			H	6	X	1	X	2	X	2		
Aix sponsa	Wood Duck	S5				√*																
Anas platyrhynchos	Mallard	S5					X	1					X	1	X	1	P	4			P	2
Phasianidae	**Partridges, Grouse & Turkeys**																					
Meleagris gallopavo	Wild Turkey	S5					H	4	H	1	H	1			H	12						
Columbidae	**Pigeons & Doves**																					
Columba livia	Rock Pigeon	SNA											X	3	P	4	P	6			H	2
Zenaida macroura	Mourning Dove	S5					H	1	H	2	H	1	H	1			S	1	S	1	H	2
Caprimulgidae	**Goatsuckers**																					
Chordeiles minor	Common Nighthawk	S4B	SC	SC	Schedule 1	√*							X	2								
Charadriidae	**Plovers**																					
Charadrius vociferus	Killdeer	S5B, S5N							S	1	S	1	S	1	H	2	A	2	H	1	H	2
Laridae	**Gulls, Terns & Skimmers**																					
Larus delawarensis	Ring-billed Gull	S5B, S4N													X	1			X	1		
Ardeidae	**Herons & Bitterns**																					
Ardea herodias	Great Blue Heron	S4B				√	X	1			X	1	X	3	X	1						
Cathartidae	**Vultures**																					
Cathartes aura	Turkey Vulture	S5B				√	X	1			X	3	X	3							X	1
Accipitridae	**Hawks, Kites, Eagles & Allies**																					
Pandion haliaetus	Osprey	S5B				√							X	1								
Accipiter striatus	Sharp-shinned Hawk	S5	NAR			√							X	1								
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR											H	1						
Alcedinidae	**Kingfishers**																					
Megaceryle alcyon	Belted Kingfisher	S4B				√							X	1								
Picidae	**Woodpeckers**																					
Melanerpes carolinus	Red-bellied Woodpecker	S4				√	S	1			S	2	X	1								
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B				√			H	1												
Picoides pubescens	Downy Woodpecker	S5					S	1	V	2	S	1					H	1			H	1
Picoides villosus	Hairy Woodpecker	S5									P	2										
Colaptes auratus	Northern Flicker	S4B					S	1	S	1	AE	1	X	1	H	1	H	1	X	1	X	1
Dryocopus pileatus	Pileated Woodpecker	S5				√			H	1												
Tyrannidae	**Tyrant Flycatchers**																					
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC							S	1			S	1						
Empidonax alnorum	Alder Flycatcher	S5B				√	S	1														
Empidonax traillii	Willow Flycatcher	S5B					S	1	S	1												
Empidonax minimus	Least Flycatcher	S4B				√	S	1														
Myiarchus crinitus	Great Crested Flycatcher	S4B					S	1	S	1	P	2			S	1	X	1				
Tyrannus tyrannus	Eastern Kingbird	S4B					T	1	S	1	S	1	S	1	P	3	S	1	CF	1		
Vireonidae	**Vireos**																					
Vireo olivaceus	Red-eyed Vireo	S5B							S	1	S	2			S	1	X	1				
Corvidae	**Crows & Jays**																					
Cyanocitta cristata	Blue Jay	S5					S	1	S	1	S	1			A	2	X	1	H	1	H	1
Corvus brachyrhynchos	American Crow	S5B					S	2	S	3	A	4	H	1	FY	4	CF	3	H	3	H	4

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Breeding Evidence (Br.Ev.) and Abundance (#)															
							2115881 Ontario Ltd. Property															
							WSU-1		WSU-2		WSU-3		WSU-4		WSU-5		WSU-6		WSU-7		WSU-8	
							Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Alaudidae	**Larks**																					
Eremophila alpestris	Horned Lark	S5B					P	2	P	2	S	2	S	8	S	2	S	7	S	2	S	3
Hirundinidae	**Swallows**																					
Tachycineta bicolor	Tree Swallow	S4B							H	1	H	1	X	6	N	2	X	2			H	1
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B							H	1			X	3	H	1	H	1	X	1		
Riparia riparia	Bank Swallow	S4B	THR	T									X	3	X	3					X	2
Hirundo rustica	Barn Swallow	S4B	THR	T							X	1	H	4	X	3	X	2	X	3	X	3
Paridae	**Chickadees & Titmice**																					
Poecile atricapillus	Black-capped Chickadee	S5					S	3	S	4	S	1			S	1			P	2	S	1
Sittidae	**Nuthatches**																					
Sitta carolinensis	White-breasted Nuthatch	S5									S	1										
Troglodytidae	**Wrens**																					
Troglodytes aedon	House Wren	S5B					S	2	S	2	S	2			S	1	S	1	S	1	S	1
Turdidae	**Thrushes**																					
Sialia sialis	Eastern Bluebird	S5B	NAR	NAR		√							H	1	P	2						
Turdus migratorius	American Robin	S5B					S	1	S	2	P	2	S	4	S	1	FY	3	FY	3	CF	3
Mimidae	**Mockingbirds, Thrashers & Allies**																					
Dumetella carolinensis	Gray Catbird	S4B					T	1	S	1	S	2	X	1	S	1	S	1	S	1		
Toxostoma rufum	Brown Thrasher	S4B				√			X	1	P	2	X	1	T	2	T	2	H	1	P	2
Sturnidae	**Starlings**																					
Sturnus vulgaris	European Starling	SNA							H	8	H	1	FY	10	S	32	FY	5	H	1	FY	3
Bombycillidae	**Waxwings**																					
Bombycilla cedrorum	Cedar Waxwing	S5B					S	4	S	3	P	2			H	3	X	1	P	4	S	3
Passeridae	**Old World Sparrows**																					
Passer domesticus	House Sparrow	SNA											X	2	H	1	S	3	S	1		
Fringillidae	**Finches & Allies**																					
Carpodacus mexicanus	House Finch	SNA															X	1	X	3	S	1
Spinus tristis	American Goldfinch	S5B					S	2	S	1	P	2	H	2	P	2	P	2	P	4	P	2
Parulidae	**Wood Warblers**																					
Vermivora cyanoptera	Blue-winged Warbler	S4B				√	S	1	S	1												
Geothylpis philadelphia	Mourning Warbler	S4B				√					S	1										
Geothylpis trichas	Common Yellowthroat	S5B					P	3	S	2	P	2			S	1	S	1	S	1		
Emberizidae	**New World Sparrows & Allies**																					
Spizella passerina	Chipping Sparrow	S5B					S	2	S	2	S	2					FY	2	N	6	A	4
Pooecetes gramineus	Vesper Sparrow	S4B				√					S	1			S	1						
Passerculus sandwichensis	Savannah Sparrow	S4B									S	1	S	4	S	1	S	2			S	1
Melospiza melodia	Song Sparrow	S5B					A	4	P	2	P	2	S	4	CF	3	S	3	S	2	S	2
Cardinalidae	**Cardinals, Grosbeaks & Allies**																					
Cardinalis cardinalis	Northern Cardinal	S5					S	2	P	2	S	1			P	2	S	1	S	1	S	1
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B					S	1	S	2	S	1			P	2			S	1		
Passerina cyanea	Indigo Bunting	S4B					S	1	S	1	P	2			P	3	S	1	A	1	S	1
Icteridae	**Blackbirds**																					
Agelaius phoeniceus	Red-winged Blackbird	S4					P	3	P	4	CF	2	X	4	P	5	S	1	S	3	S	1
Quiscalus quiscula	Common Grackle	S5B					CF	3	CF	2	H	1	CF	2	FY	15	CF	1	H	1	H	5

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Breeding Evidence (Br.Ev.) and Abundance (#)													
							2115881 Ontario Ltd. Property													
							WSU-1		WSU-2		WSU-3		WSU-4		WSU-5		WSU-6		WSU-7		WSU-8	
							Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Molothrus ater	Brown-headed Cowbird	S4B					H	2	H	2	S	1	P	4	P	3	P	4	P	2	X	1
Icterus galbula	Baltimore Oriole	S4B					H	1	H	1	S	2			S	1	S	1	CF	3		
						Total	**34**		**36**		**40**		**32**		**41**		**35**		**31**		**29**	

[1]MNRF 2019, [2]MECP 2019, [3]Government of Canada 2018, [4]Martin 1996

LEGEND
SRANK
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO/COSEWIC
NAR Not at Risk
SC Special Concern
THR/T Threatened
SARA Schedule
Schedule 1 Officially Protected under SARA
Waterloo Region
√ Regionally Significant
√* Significant when nesting in natural circumstances

Avifauna Observed within Subject Property (Incidental Observations) (2014-2019)

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Abundance (#)							
							2115881 Ontario Ltd. Property							
							WSU-1	WSU-2	WSU-3	WSU-4	WSU-5	WSU-6	WSU-7	WSU-8
Anatidae	**Ducks, Geese & Swans**													
Branta canadensis	Canada Goose	S5							1	7	1			
Anas platyrhynchos	Mallard	S5					2	1	1			1		
Phasianidae	**Partridges, Grouse & Turkeys**													
Meleagris gallopavo	Wild Turkey	S5						70	1	70	1		1	
Columbidae	**Pigeons & Doves**													
Columba livia	Rock Pigeon	SNA								4	1	1		
Zenaida macroura	Mourning Dove	S5					1	1					1	1
Charadriidae	**Plovers**													
Charadrius vociferus	Killdeer	S5B, S5N							1	1	1			1
Scolopacidae	**Waders**													
Scolopax minor	American Woodcock	S4B						1						
Laridae	**Gulls, Terns & Skimmers**													
Larus delawarensis	Ring-billed Gull	S5B, S4N								1		1		
Phalacrocoracidae	**Cormorants**													
Phalacrocorax auritus	Double-crested Cormorant	S5B	NAR	NAR										1
Ardeidae	**Herons & Bitterns**													
Ardea herodias	Great Blue Heron	S4B				√	1		2	1	1		1	
Cathartidae	**Vultures**													
Cathartes aura	Turkey Vulture	S5B				√	1	1	1		1		1	
Accipitridae	**Hawks, Kites, Eagles & Allies**													
Haliaeetus leucocephalus	Bald Eagle	S2N, S4B	SC	NAR		√		1						
Buteo platypterus	Broad-winged Hawk	S5B				√			1		1			
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR				1						
Buteo lagopus	Rough-legged Hawk	S1B, S4N	NAR	NAR						1				
Strigidae	**Typical Owls**													
Megascops asio	Eastern Screech-Owl	S4	NAR	NAR			1							
Bubo virgianus	Great Horned Owl	S4						1						
Picidae	**Woodpeckers**													
Melanerpes carolinus	Red-bellied Woodpecker	S4				√			1					
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B				√		1						
Picoides pubescens	Downy Woodpecker	S5					1	1						
Picoides villosus	Hairy Woodpecker	S5								1				
Colaptes auratus	Northern Flicker	S4B						1	1			1		1
Dryocopus pileatus	Pileated Woodpecker	S5				√		1						

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Abundance (#) 2115881 Ontario Ltd. Property							
							WSU-1	WSU-2	WSU-3	WSU-4	WSU-5	WSU-6	WSU-7	WSU-8
Tyrannidae	**Tyrant Flycatchers**													
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC							1	1		
Empidonax traillii	Willow Flycatcher	S5B					1							
Myiarchus crinitus	Great Crested Flycatcher	S4B						1	1	1				
Vireonidae	**Vireos**													
Vireo olivaceus	Red-eyed Vireo	S5B							1		1	1		
Corvidae	**Crows & Jays**													
Cyanocitta cristata	Blue Jay	S5					1	1	1	1	1	1	1	
Corvus brachyrhynchos	American Crow	S5B					1	1	1	4	2	1	1	1
Alaudidae	**Larks**													
Eremophila alpestris	Horned Lark	S5B					1	1	1	18		2		
Hirundinidae	**Swallows**													
Tachycineta bicolor	Tree Swallow	S4B								1				1
Hirundo rustica	Barn Swallow	S4B	THR	T						4				
Paridae	**Chickadees & Titmice**													
Poecile atricapillus	Black-capped Chickadee	S5					1	1	1		1		1	
Troglodytidae	**Wrens**													
Troglodytes aedon	House Wren	S5B						1	1		1			1
Regulidae	**Kinglets**													
Regulus calendula	Ruby-crowned Kinglet	S4B				√		1						
Turdidae	**Thrushes**													
Sialia sialis	Eastern Bluebird	S5B	NAR	NAR		√				2				
Turdus migratorius	American Robin	S5B					1	1	1	2	1	1	1	1
Mimidae	**Mockingbirds, Thrashers & Allies**													
Dumetella carolinensis	Gray Catbird	S4B					1	1	2	1				
Toxostoma rufum	Brown Thrasher	S4B				√			1	1	1	1		
Sturnidae	**Starlings**													
Sturnus vulgaris	European Starling	SNA								1		1	1	
Bombycillidae	**Waxwings**													
Bombycilla cedrorum	Cedar Waxwing	S5B						2				1	1	1
Passeridae	**Old World Sparrows**													
Passer domesticus	House Sparrow	SNA											1	
Fringillidae	**Finches & Allies**													
Carpodacus mexicanus	House Finch	SNA										1	1	1

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Abundance (#) 2115881 Ontario Ltd. Property							
							WSU-1	WSU-2	WSU-3	WSU-4	WSU-5	WSU-6	WSU-7	WSU-8
Spinus tristis	American Goldfinch	S5B					1	2			1		1	1
Calcariidae	**Longspurs & Snow Buntings**													
Plectrophenax nivalis	Snow Bunting	SNA								1				
Parulidae	**Wood Warblers**													
Seiurus aurocapillus	Ovenbird	S4B				√				1				
Geothylpis trichas	Common Yellowthroat	S5B					1	1	1				1	
Emberizidae	**New World Sparrows & Allies**													
Spizella passerina	Chipping Sparrow	S5B						6	1			1	1	1
Passerculus sandwichensis	Savannah Sparrow	S4B										1		1
Melospiza melodia	Song Sparrow	S5B					1	2	1	1		2	1	1
Zonotrichia albicollis	White-throated Sparrow	S5B				√		1						
Cardinalidae	**Cardinals, Grosbeaks & Allies**													
Cardinalis cardinalis	Northern Cardinal	S5						1	1	1	1	1		2
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B					1	1	1					
Passerina cyanea	Indigo Bunting	S4B						1	2		1	1	2	1
Icteridae	**Blackbirds**													
Agelaius phoeniceus	Red-winged Blackbird	S4							1	10	1	1	1	
Quiscalus quiscula	Common Grackle	S5B												1
Molothrus ater	Brown-headed Cowbird	S4B							2	1			1	1
						Total	**17**	**30**	**27**	**25**	**19**	**20**	**19**	**18**

[1]MNRF 2019, [2]MECP 2019, [3]Government of Canada 2018, [4]Martin 1996

LEGEND
SRANK
S4 Apparently Secure
S5 Secure
SNA Unranked
COSSARO/COSEWIC
NAR Not at Risk
SC Special Concern
THR/T Threatened
SARA Schedule
Schedule 1 Officially Protected under SARA
Waterloo Region
√ Regionally Significant
√* Significant when nesting in natural circumstances

APPENDIX V

Anuran Monitoring Data from within the Subject Property (2014 – 2019)

Anuran Monitoring Data from within the Subject Property (2014-2019)

Station ANR-001		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 15	June 19	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	1 (2)	Nothing Heard (NRSI and Ecoplans)	Nothing Heard			Nothing Heard		Nothing Heard		Nothing Heard		Nothing Heard	Nothing Heard		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*	3			3	2 (2)		3							3				
Tetraploid Gray Treefrog	*Hyla versicolor*					3						1 (1)			1 (1)				
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*									1 (3)									
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*																		
	Beaufort Wind Scale	2	2	0	3	3	1-2	1	1	0	3	3	2	1	1	1	0	0	0
	% Cloud Cover	60	100	20	100	20	0	0	10	40	100	0	80	5	20	95	0	5	60
	Air temp. (°C)	17	11	16	9	14	18	14	12	15	10	18	24	10	21	22	5	12	20
	Water temp. (°C)	N/A	12.2	N/A	5.7	N/A	18.4	N/A	N/A	N/A	12.8	14.3	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	7.7	N/A	7.5	N/A	7.6	N/A	N/A	N/A	8.1	7.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None

Station ANR-002		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April 21	May 15	June 19	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Not Surveyed by NRSI, however Ecoplans did and Nothing Heard	Nothing Heard (NRSI and Ecoplans)	Nothing Heard			Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*				1 (1)														
Tetraploid Gray Treefrog	*Hyla versicolor*					2 (6)													
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*																		
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*																		
	Beaufort Wind Scale	2	1	0	3	4	2	1	1	0	3	3	2-3	1	1	2	0	0	0
	% Cloud Cover	60	100	20	100	20	0	0	10	40	100	0	90	5	20	95	5	30	60
	Air temp. (°C)	17	11	16	9	15	18	14	12	15	9	19	23	10	22	22	5	12	20
	Water temp. (°C)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None

Station ANR-003		2014			2015			2016			2017			2018			2019		
Common Name	**Scientific Name**	April	May 15	June 19	April 16	May 25	June 16	April 18	May 17	June 21	April 11	May 18	June 22	April 26	May 16	June 18	April 28	May 22	June 18
American Toad	*Bufo americanus*	Not Surveyed	Nothing Heard	Nothing Heard			Nothing Heard		Nothing Heard		Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard	Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*				2 (1)	2 (3)		3											
Tetraploid Gray Treefrog	*Hyla versicolor*					1 (2)													
Western Chorus Frog	*Pseudacris triseriata*																		
Northern Leopard Frog	*Rana pipiens*																		
Pickerel Frog	*Rana palustris*																		
Green Frog	*Rana clamitans melanota*									1 (1)									
Mink Frog	*Rana septentrionalis*																		
Bullfrog	*Rana catesbeiana*																		
Wood Frog	*Rana sylvatica*							1 (2)											
	Beaufort Wind Scale	N/A	2	0	3	4	2	0	1	0	3	2	2	1	1	1	0	0	0
	% Cloud Cover	N/A	100	20	100	20	0	0	10	40	100	0	90	5	20	95	5	30	60
	Air temp. (°C)	N/A	11	16	9	15	18	14	12	14	10	19	23	10	22	22	6	12	20
	Water temp. (°C)	N/A	13.8	N/A	N/A	N/A	15.1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Water pH	N/A	7.5	N/A	N/A	N/A	6.8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Precipitation	N/A	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None	None

LEGEND	
X	individual seen, but not calling
# (_)	call intensity and estimated number of individuals
Call Level Codes	
1	Calls can be counted; not simultaneous
2	Some simultaneous calls; yet distinguishable
3	Calls not distinguishable individually; overlapping
NA	(Not Applicable) denotes lack of water or not recorded

Beaufort Wind Scale #	**KPH**	**Description**
0	0-2	Calm; smoke rises vertically
1	3 to 5	Light air movement; smoke drifts
2	6 to 11	Slight Breeze; felt on face, leaves rustle
3	12 to 19	Gentle breeze; leaves and small twigs in constant
4*	20-30	Moderate breeze; small branches are moving, raises
5*	31-39	Fresh breeze; small trees in leaf begin to sway,
6*	40-50	Strong breeze, large branches in motion
	*	Unacceptable wind strengths for amphibian surveys

APPENDIX VI

Fish Species Known from the Study Area

Fish Species Reported from the Study Area

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	Thermal Regime	Spawn Time	Beaver Creek[4]
Cyprinidae	**Carps and Minnows**						
Chrosomus eos	Northern Redbelly Dace	S5			cool	may-july	X
Luxilus cornutus	Common Shiner	S5			cool	may-june	X
Nocomis biguttatus	Hornyhead Chub	S4	NAR	NAR (April 1988)	cool	may-july	X
Notropis heterodon	Blackchin Shiner	S4	NAR	NAR (April 1994)	cool	jun-aug	X
Pimephales promelas	Fathead Minnow	S5			warm	may-aug	X
Rhinichthys cataractae	Longnose Dace	S5			cool	may-june	X
Rihinchthys obtusus	Western Blacknose Dace	S5			cool	may-june	X
Semotilus atromaculatus	Creek Chub	S5			cool	may-june	X
Catostomidae	**Suckers**						
Catostomus commersonii	White Sucker	S5			cool	apr-june	X
Gasterosteidae	**Sticklebacks**						
Culaea inconstans	Brook Stickleback	S5			cool	may-july	X
Centrarchidae	**Sunfishes and Basses**						
Lepomis gibbosus	Pumpkinseed	S5			warm	may-aug	X
Lepomis macrochirus	Bluegill	S5			warm	jun-aug	X
Percidae	**Perches and Darters**						
Etheostoma caeruleum	Rainbow Darter	S4			cool	apr-june	X
Etheostoma nigrum	Johnny Darter	S5			cool	may-june	X
						Total	**14**

[1]MNRF 2019; [2]MECP 2019, [3]Government of Canada 2018, [4]Ecoplans et al. 2013

Legend
SRANK
S4 Apparently Secure
S5 Secure
COSSARO/COSEWIC
NAR Not at Risk

APPENDIX VII

Tree Inventory Data

2115881 Ontario Ltd., North Waterloo

Tree Inventory Data - Peninsula of Wooded Area (FOD3-1)

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Comments
1	Green Ash	*Fraxinus pennsylvanica*	Native	1	18	2.0	Improbable	Good	Grapevine entering lower crown only, minor dieback, competition for sunlight
2	Green Ash	*Fraxinus pennsylvanica*	Native	1	19	2.5	Improbable	Good	Grapevine in lower crown only, raised crown due to competition for sunlight
3	Manitoba Maple	*Acer negundo*	Native	1	11	1.5	Improbable	Fair	Slight phototrophic lean due to competition, grapevine throughout canopy
4	Manitoba Maple	*Acer negundo*	Native	3	17	3.0	Possible	Poor	3 codominant stems, grapevine throughout lower crown, phototrophic lean, major dieback in 1 stem, several branches broken under weight of grapevine
5	Trembling Aspen	*Populus tremuloides*	Native	1	26	1.0	Probable	Dead	Dead, several branches lost and few remain, conks on stem
6	Trembling Aspen	*Populus tremuloides*	Native	1	23	2.0	Improbable	Fair	Slightly reduced crown due to dieback, grapevine throughout canopy, leaf scorch
7	Trembling Aspen	*Populus tremuloides*	Native	1	33	2.5	Improbable	Fair	Grapevine around stem, slight phototrophic lean due to competition
8	Trembling Aspen	*Populus tremuloides*	Native	1	21	2.0	Improbable	Fair	Leans towards proposed area of grading due to phototrophic growth, slightly reduced crown
9	Trembling Aspen	*Populus tremuloides*	Native	1	38	3.0	Improbable	Fair	Few small branches previously lost - likely due to competition for sunlight, remaining crown relatively full, slight phototrophic lean
10	Trembling Aspen	*Populus tremuloides*	Native	1	19	3.0	Improbable	Fair	Slight phototrophic lean, minor leaf scortch, raised crown due to competition with grapevine
11	Trembling Aspen	*Populus tremuloides*	Native	1	24	3.0	Improbable	Good	Raised crown likely due to competition with grapevine, very minor dieback, grapevine dense at stem
12	Trembling Aspen	*Populus tremuloides*	Native	1	27	2.0	Improbable	Poor	Mechanical damage on stem, insect damage on bark, reduced crown due to dieback, grape in canopy
13	Trembling Aspen	*Populus tremuloides*	Native	1	22	2.0	Improbable	Poor	Reduced crown due to dieback, grapevine throughout canopy, leaf scortch
14	Trembling Aspen	*Populus tremuloides*	Native	1	23	1.0	Improbable	Poor	Reduced crown due to dieback, leaf scortch, few small branches dead
15	Trembling Aspen	*Populus tremuloides*	Native	1	29	2.0	Improbable	Poor	Fungus on stem, crown only slightly reduced due to dieback, lean at root flare self-corrects in lower stem

2115881 Ontario Ltd., North Waterloo

Tree Inventory Data - Peninsula of Wooded Area (FOD3-1)

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Comments

2115881 Ontario Ltd., North Waterloo

Tree Inventory Data - Peninsula of Wooded Area (FOD3-1)

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Comments

2115881 Ontario Ltd., North Waterloo

Tree Inventory Data - Peninsula of Wooded Area (FOD3-1)

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Comments

2115881 Ontario Ltd., North Waterloo

Tree Inventory Data - North Hedgerow (HR2)

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Comments
1601	Common Pear	*Pyrus communis*	Non-Native	4	73	3.0	Improbable	Good	Tightly upright codominant stems; dense crown, vines in lower part; patch of missing bark on 1 stem.
1602	Black Cherry	*Prunus serotina*	Native	1	61	7.0	Possible	Fair	Several branch failures; fencewire through stem; vines throughout.
1604	Common Apple	*Malus domestica*	Non-Native	3	133	6.0	Improbable	Fair	Centre rot in primary stem; large crown of twisting branches, with vines; much epicormic growth; minor included bark; history of branch failure.
1605	White Elm	*Ulmus americana*	Native	1	15	2.0	Improbable	Good	Asymmetrical crown and slight lean toward field due to neighbouring tree.
1606	White Elm	*Ulmus americana*	Native	1	20	2.5	Improbable	Good	Vigorous; tight unions at leaders.
1607	Sweet Cherry	*Prunus avium*	Non-Native	1	23	3.5	Possible	Fair	Few dead branches; potential sapwood decay; weak leader was superseded by 2 laterals; vines in crown.
1608	Black Cherry	*Prunus serotina*	Native	1	27	4.0	Possible	Fair	Dead lower branches; open stem wound; vines in crown.
1609	Sweet Cherry	*Prunus avium*	Non-Native	1	18	3.0	Improbable	Fair	Crooked stem; lower crown light pruning.
1610	Sweet Cherry	*Prunus avium*	Non-Native	1	32	3.5	Improbable	Fair	Codominant leaders with included bark; girdling root; few dead branches.
1611	Sugar Maple	*Acer saccharum ssp. saccharum*	Native	1	24	2.5	Improbable	Fair	Severe lean in lower stem, corrected; codominant leaders; healthy crown.
1612	White Ash	*Fraxinus americana*	Native	1	16	3.0	Possible	Fair	Light insectivore action; codominant leaders; few bark cracks.
1613	Common Apple	*Malus domestica*	Non-Native	1	28	4.0	Improbable	Fair	Dense, spreading crown; epicormic growth.
1614	Common Apple	*Malus domestica*	Non-Native	1	36	4.0	Improbable	Fair	Codominant leaders, included bark; bark seam; 1 scaffold branch failure; minor epicormic growth.
1616	Hawthorn species	*Crataegus sp.*	**	1	13	2.5	Improbable	Fair	Vines in crown.
1617	Sweet Cherry	*Prunus avium*	Non-Native	1	17	3.0	Improbable	Fair	Minor gummosis; tent caterpillar last year; vines in lower crown; crossing branches.
1618	White Ash	*Fraxinus americana*	Native	1	20	3.0	Improbable	Good	Decent structure; vines in crown.
1619	Sweet Cherry	*Prunus avium*	Non-Native	1	18	2.5	Improbable	Good	Once lost leader, otherwise healthy crown.
1624	White Ash	*Fraxinus americana*	Native	1	13	2.5	Improbable	Good	Light insectivore action; 1 dead, broken branch.
1625	White Ash	*Fraxinus americana*	Native	1	13	2.5	Improbable	Good	Secondary stem crosses branches of primary stem.
1626	White Ash	*Fraxinus americana*	Native	1	14	2.0	Possible	Fair	Bark cracks; bark discoloration below 1 dead branch; vines in crown.
1627	White Elm	*Ulmus americana*	Native	1	30	4.5	Improbable	Good	Codominant leaders with tight union; vines in crown.
1628	White Ash	*Fraxinus americana*	Native	1	13	2.0	Possible	Fair	Major wounds at base, some sapwood decay; vines in crown.
1629	Manitoba Maple	*Acer negundo*	Native	4	176	8.5	Possible	Fair	Massive codominant stems; history of major branch failures; 1 broken, prostrate limb has live branches now growing upward; spreading crown with many vines.
1633	American Basswood	*Tilia americana*	Native	1	15	2.0	Improbable	Good	Modest crown with decent form; vine wrapping stem.
1634	Hawthorn species	*Crataegus sp.*	**	3	94	4.0	Possible	Fair	Many broken branches and branch stubs nearly closed; 1 stem has advanced sapwood decay, fruiting bodies; vines throughout crown.
1635	Manitoba Maple	*Acer negundo*	Native	1	31	4.0	Improbable	Good	Vines heavy throughout crown; basal shoots ; lower branch pruned.

2115881 Ontario Ltd., North Waterloo

Tree Inventory Data - North Hedgerow (HR2)

Tree Number	Common Name	Scientific Name	Native/ Non-native	Stem Count	DBH (cm)	Crown Radius (m)	Potential for Structural Failure Rating	Overall Condition	Comments
1636	White Elm	*Ulmus americana*	Native	1	19	3.0	Improbable	Fair	Closed wound in lower stem; vines heavy throughout crown; 1 broken branch.
1638	Hawthorn species	*Crataegus sp.*	**	3	69	3.5	Improbable	Fair	Codominant stems, 1 failed; fencewire through 1 stem; vine in crown.
1639	Manitoba Maple	*Acer negundo*	Native	1	12	2.5	Possible	Fair	Broken top; vines throughout; crooked lower stem.
1640	Snag			1	27	2.5	Possible	Dead	No bark; basal sapwood decay; dead crown, few broken branches; cannot be identified.
1641	White Ash	*Fraxinus americana*	Native	1	11	1.5	Possible	Fair	Bark crack; insect gallery visible; vines in crown.
1642	White Ash	*Fraxinus americana*	Native	1	11	1.5	Improbable	Good	Strong taper; small open stem wound; asymmetrical crown due to neighbouring tree.
1643	White Ash	*Fraxinus americana*	Native	1	10	1.5	Improbable	Fair	Leaning north under weight of fallen limb from neighbouring tree; bark rubbing.
1644	White Ash	*Fraxinus americana*	Native	1	14	2.0	Possible	Fair	Codominant stems just above diameter; bark rubbing wound from fallen limb; bark cracks; epicormic growth.
1645	Black Cherry	*Prunus serotina*	Native	1	11	2.5	Possible	Fair	Stem is actually a lateral from a former stem that failed at base but retains some live vascular tissue.
1646	White Elm	*Ulmus americana*	Native	1	14	1.5	Improbable	Good	Healthy crown with vines.
1647	White Elm	*Ulmus americana*	Native	1	14	2.5	Possible	Fair	Strongly crooked stem; suppressed by vines.
1648	White Elm	*Ulmus americana*	Native	1	17	3.0	Improbable	Good	Crossing leaders with tight union; vines in lower crown; vigorous growth.
no tag	Common Hackberry	*Celtis occidentalis*	Native	1	13	2.5	Improbable	Fair	Vines in crown; once lost leader, lateral asserted dominance.

APPENDIX VIII

Mammal Species Observed within the Subject Property (2014 – 2019)

Mammal Species Observed within the Subject Property (2014-2019)

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Ontario Mammal Atlas[5]	NRSI Observed
Didelphimorphia	**Opossums**							
Didelphis virginiana	Virginia Opossum	S4				R	X	X
Insectivora	**Shrews and Moles**							
Blarina brevicauda	Northern Short-tailed Shrew	S5					X	
Condylura cristata	Star-nosed Mole	S5					X	
Parascalops breweri	Hairy-tailed Mole	S4				R	X	
Sorex cinereus	Masked Shrew	S5				G	X	
Sorex fumeus	Smoky Shrew	S5				R	X	
Sorex palustris	Water Shrew	S5				R	X	
Chiroptera	**Bats**							
Eptesicus fuscus	Big Brown Bat	S5					X	
Lasionycteris noctivagans	Silver-haired Bat	S4					X	
Lasiurus borealis	Red Bat	S4					X	
Lasiurus cinereus	Hoary Bat	S4					X	
Myotis lucifugus	Little Brown Myotis	S4	END	E	Schedule 1		X	
Myotis septentrionalis	Northern Myotis	S3	END	E	Schedule 1		X	
Perimyotis subflavus	Tri-colored Bat	S3?		E	Schedule 1		X	
Lagomorpha	**Rabbits and Hares**							
Lepus americanus	Snowshoe Hare	S5				S	X	
Lepus europaeus	European Hare	SNA					X	
Sylvilagus floridanus	Eastern Cottontail	S5					X	X
Rodentia	**Rodents**							
Castor canadensis	Beaver	S5				S	X	
Erethizon dorsatum	Porcupine	S5				S	X	
Glaucomys sabrinus	Northern Flying Squirrel	S5				R	X	
Marmota monax	Woodchuck	S5					X	
Microtus pennsylvanicus	Meadow Vole	S5					X	X
Mus musculus	House Mouse	SNA					X	
Napaeozapus insignis	Woodland Jumping Mouse	S5					X	
Ondatra zibethicus	Muskrat	S5					X	
Peromyscus sp.	Mouse sp.							X

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[3]	Region of Waterloo Status[4]	Ontario Mammal Atlas[5]	NRSI Observed
Peromyscus leucopus	White-footed Mouse	S5					X	
Peromyscus maniculatus	Deer Mouse	S5					X	
Rattus norvegicus	Norway Rat	SNA					X	
Sciurus carolinensis	Eastern Gray Squirrel	S5					X	X
Tamiasciurus hudsonicus	Red Squirrel	S5					X	X
Tamias striatus	Eastern Chipmunk	S5					X	X
Zapus hudsonius	Meadow Jumping Mouse	S5					X	
Carnivora	**Carnivores**							
Canis latrans	Coyote	S5				S	X	X
Mephitis mephitis	Striped Skunk	S5					X	X
Mustela erminea	Ermine	S5					X	
Mustela frenata	Long-tailed Weasel	S4				S	X	
Mustela vison	American Mink	S4				S	X	X
Procyon lotor	Northern Raccoon	S5					X	X
Vulpes vulpes	Red Fox	S5					X	
Artiodactyla	**Deer and Bison**							
Odocoileus virginianus	White-tailed Deer	S5					X	X
						Total	**40**	**12**

[1]MNRF 2019, [2]MECP 2019, [3]Government of Canada 2018, [4]Regional Municipality of Waterloo 1985, [5]Dobbyn 1994

LEGEND
SRANK
S3 Vulnerable
S4 Apparently Secure
S5 Secure
S#? Rank Uncertain
SNA Unranked
COSSARO/COSEWIC
END/E Endangered
SARA Schedule
Schedule 1 Officially protected under SARA
Region of Waterloo
G General
R Rare
S Scarce

APPENDIX IX

Blanding's Turtle Mitigation Plan

NATURAL RESOURCE SOLUTIONS INC.
Aquatic, Terrestrial and Wetland Biologists

Memo

1531B

Date: **June 8, 2020**

Re: **Blanding's Turtle Habitat Mitigation North Waterloo**

Blanding's Turtle Mitigation Plan Technical Memo

A large portion of the Beaver Creek Meadows District Plan (BCMDP) community is within the regulated habitat of Blanding's Turtle (*Emydoidea blandingii*). Blanding's Turtle is a Threatened species in Ontario and the species receives both individual and general habitat protection under the Endangered Species Act (2007). This mitigation plan is based on the original technical submission that was approved by MECP in 2019 (M. Karam and T. Copeland) and provides further detail on how the mitigation strategy is to be implemented.

NRSI is working for a number of landowners in the BCMDP area who are proposing residential development of their properties. Information Gathering Forms (IGF) have been submitted previously for 2155881 Ontario Limited, Northgate Corporation and Erbsville Kartway. NRSI is also working on an environmental study for the proposed communal stormwater management pond in the study area and has been in contact with MNRF and MECP on the implications of development in this area on Blanding's Turtle. Stantec Consultants is working for the City of Waterloo and has submitted an IGF and is working on further information as part of a municipal Class Environmental Assessment for the improvements to Conservation Drive and Beaver Creek Road. All of these projects are within the mapped habitat of Blanding's turtle, and it was determined through advice from MNRF that a collaborative approach amongst the teams would be appropriate to ensure that mitigation measures to protect the turtle and its habitat are being considered and proposed at a landscape level.

Blanding's Turtle habitat has been categorized by the MNRF, as follows:

- Category 1: Nest and area within 30m or Overwintering sites and the area within 30m.
- Category 2: The wetland complex (i.e. all suitable wetlands or waterbodies within 500m of each other) that extends up to 2 km from an occurrence, and the area within 30m around those suitable wetlands or waterbodies.
- Category 3: Area between 30m and 250m around suitable wetlands/waterbodies identified in Category 2, within 2 km of an occurrence.

The first step in managing impacts to the turtle and its habitat is to map the current extent of habitat and its existing condition. The MNRF provided baseline mapping of Category 2 and 3 habitats and this was applied to the study area. The habitat categories were edited based on knowledge of the sites in terms of barriers to turtle movement (i.e. existing chain link fencing) and areas that are not suitable (i.e. existing road surfaces). Category 1 habitat is not shown for data sensitivity reasons.

The known proposed developments in the local area are overlaid onto the categories of habitat mapping and shown on Map 1. This includes the draft plan of subdivision for Northgate South, Erbsville Kartway, 2115881 Ontario Limited and Activa. The City planned projects including the road improvements to Conservation Drive and Beaver Creek Road are shown as well as the preferred option for the communal stormwater management pond. Preliminary concepts plans for Northgate North and its connection through the Creekside Community church property are shown for context. No concepts were available for Mar-View Farms or the north central land parcel or other properties. Lands to the south and east of the BCMDP are owned by the Grand River Conservation Authority (GRCA) and will not be developed, but are used for outdoor recreation and education. Lands to the north of the BCMDP are outside of the City of Waterloo boundary and will remain in a rural state. There is potential for additional development of lands to the west and southwest of the BCMDP but this is limited due to the City of Waterloo urban boundary and the presence of provincially significant wetlands, floodplain and the Laurel Creek Headwaters Environmentally Sensitive Landscape mapped in the Region of Waterloo Official Plan.

Efforts were made in designing the proposed developments to avoid Category 2 habitats. In some cases in the study area it is not possible to avoid activities in Category 2 habitat such as road improvements, stormwater management functions and grading. Blanding's Turtles depend on these areas as movement corridors between wetlands. Knowing that the proposed developments overlap with the Category 2 and 3 habitats for Blanding's turtle, a series of maps were prepared to show a collaborative approach to mitigate impacts. Overlaps by the proposed developments with Category 2 habitat are very limited and include small encroachments along Beaver Creek Road and Conservation Drive due to widening and location of a stormwater outlet along Beaver Creek Road due to the City of Waterloo projects. Minimal encroachment (<5m) for transitional grading and location of a community trail may be necessary on Northgate and other developer properties.

Avoiding impacts to Category 2 habitat includes delineation and protection of a 30m buffer around the wetlands. Improvements to roads that are adjacent to wetlands cannot avoid encroaching into Category 2 habitat. The potential impact of such encroachments is to be addressed through design and enhanced mitigation measures. Culverts for eco-passage, construction fencing to limit the extent of the work and permanent fencing to prevent turtles from accessing the road surface will mitigate the potential for road mortality of the species. These measures are proposed by Stantec for the Conservation Drive and Beaver Creek Road project to avoid damage or destruction of Category 2 habitats.

Stormwater management facilities are proposed by individual developers as part of their developments as well as the communal stormwater management pond. The ponds themselves are generally located in Category 3 habitat, adjacent to wetlands, but outside of the Category 2 habitat. Some grading for pond slopes may encroach into the outer 15m of the Category 2 habitat. The grading will be a temporary impact during construction, following which those areas will be seeded and restored to natural vegetation. Permanent turtle barrier fencing is proposed to prevent turtles from accessing the open water portion of the ponds based on guidance from the MNRF to avoid harm to the species.

Impacts to Category 3 habitat are associated with the residential developments proposed in the agricultural fields as well as road widenings, roundabout and the communal and other stormwater management facilities.

A plan to mitigate impacts to Category 3 habitats is the main focus of this memo. Maps 1-7 show the proposed mitigation measures to ensure that safe and suitable movement corridors continue to be provided through the development of the subject properties. The mitigation plan maps are organized by Phase based on anticipated timing. Mitigation measures are described in Table 1 and shown on the maps to indicate proponent responsibility.

Table 1. Mitigation Plan Organization (see Maps 1-7)

Phase	Undertaking	Responsiblily	Anticipated Date	Mitigation Details
1a	Beaver Creek Road	City of Waterloo	2020	• Turtle barrier fencing along length of wetlands • Laurel Creek culvert improvements for ecopassage with directional fencing • Retention of existing Laurel Creek culvert with directional fencing • Turtle nesting beds on east side of Beaver Creek Road
1b	Conservation Drive East	City of Waterloo	2020	• Turtle barrier fencing along length of wetlands • Beaver Creek culvert improvements for ecopassage with directional fencing
2	BCMDP Communal SWM Facility	City of Waterloo	2022	• Turtle barrier fencing along south side of property
3	Northgate South / Erbsville Kartway, Activa, 2115881 Ontario Ltd.	Developers	2023	**Northgate South / Erbsville Kartway** • Turtle barrier fencing along outer edge of NHS buffer • Ecopassage at access road with directional fencing **2115881 Ontario Ltd.** • Turtle barrier fencing along outer edge of NHS buffer **Activa** • None
4	Conservation Drive West to Erbsville Road	City of Waterloo	2025	• Turtle barrier fencing along north and south side of road • Ecopassage at Laurel Creek tributary with directional fencing
5	Northgate North and others	Developers	2030	• Turtle barrier fencing along outer edge of NHS buffer

Map 1 is a key map showing the study area and the context of the more detailed Maps 2-7 which show the mitigation measures phase by phase, as listed in Table 1. Phases 1a and 1b are the City-planned improvements to the main roads in the study area and are anticipated to be the first development activities to proceed. The mitigation strategy for Phases 1a and 1b is shown approximately on Maps 2 and 3 based on drawings provided by Stantec. Mitigation measures for these projects are designed by Stantec on behalf of the City, as part of the detailed design process and full details are provided in their reports. Potential impacts to Blanding's turtles related to these phases are primarily due to road mortality and therefore, mitigation focuses on preventing turtles from accessing the road surface, and providing passage under Beaver Creek Road and Conservation Drive. Road improvements include ecopassage measures by maintaining and upgrading culverts at key locations for turtles to be able to travel from wetland to wetland safely. New culverts at the Laurel Creek wetlands and at Beaver Creek are shown in red on Maps 2 and 3.. Culverts have been designed according to the recommendations of the MNRF document "*Best Management Practices for Mitigating the Effects of Roads on Amphibian and Reptile Species at Risk in Ontario (2016)".* In combination with the ecopassage culverts, permanent barrier fencing is proposed along the roads to direct turtles towards the safe passage and to prevent them from entering the travelled portion of the road. Barrier fencing associated with the road improvements and Category 2 habitat is a City of Waterloo responsibility and is shown in purple on Maps 2 and 3. Turtle nesting beds are proposed to be constructed by the City of Waterloo along the eastern side of Beaver Creek Road (shown in pink on Map 2), creating new potential Category 1 habitat.

Phase 2 of the development of this study area is expected to be the construction of the BCMD Communal SWM facility, as shown on Map 4. The SWM facility has been placed outside of Category 2 habitat but will require permanent fencing to prevent turtles from entering the pond. The City typically requires SWM facilities to be fenced for public safety, but a specific wildlife type of fence is required such that turtles, including very small juveniles, cannot move through the fence. We recommend ERTEC or Animex Free Standing Wildlife Fencing, or MTO Mesh/Wood design (or similar) at a height of 26". This fencing is a permanent solid product with an overhang that provides one-way access for wildlife, such that if trapped, turtles or other animals can exit the developed side of the fence, but cannot climb over from the natural heritage side of the fence. An example of the fencing is shown on Drawing 1, attached. This fencing can be combined with standard chain link if necessary. Fencing is recommended on the south side of the facility, at the property boundary.

Map 4 in the series shows the next anticipated step in the development process; the development of the residential subdivisions, listed as Phase 3 in Table 1. This includes the applications by Northgate South, Erbsville Kartway, Activa and 2115881 Ontario Ltd. It is expected that initial construction work on these subdivisions may begin during or overlap with the City-led works described in Phases 1 and 2. In order to provide uninterrupted protection for Blanding's turtle during the time when construction projects are beginning to move forward, Map 4 shows measures needed to be implemented by the active developers. Turtle barrier fencing on the developer's properties is to be installed as shown along the outer buffer limit of natural features, encompassing Category 2 habitat as well as some Category 3. Activa does not have any natural features or Blanding's turtle habitat on their property and therefore do not need to implement any fencing or other measures. On the other developer properties, the turtle barrier fencing will be continued in a seamless fashion from the road ecopassage crossings and along the outer Natural Heritage System limits. This approach maintains habitat connectivity such that turtles may travel freely along the Beaver Creek and Laurel Creek corridors but provides protection to the species as they will not be able to wander into residential development areas, storm ponds or access the road surfaces. Additional Category 2 habitat is created on the

Erbsville Kartway lands by the removal of the existing chain link fencing, go-kart track and buildings, and restoration of the 30m wetland buffer in that location. Northgate South will install culverts for ecopassage under the access road to the internal field, to provide connection between the wooded wetlands of the ESPA in that area. The ecopassage and barrier fencing will be installed in concert with the construction of that access road.

Phase 4 will be the continued improvements by the city of Waterloo to Conservation Drive westerly from the Beaver Creek crossing to the study limits. Mitigation for this phase is the same as the easterly portion of Conservation Drive; a continuation of turtle barrier fencing along the road right of way limits adjacent to Category 2 habitat. Turtle barrier fencing is shown in purple on Map 5 as well as an additional ecopassage culvert where wetland abut the road on either side. Details of the ecopassage are designed by Stantec. Barrier fencing will have to manage a number of driveway entrances onto Conservation Drive. This phase extends beyond the boundary of the BCMDP but shows conceptually the approach to be taken.

Map 6 shows the proposed mitigation strategy for future build out of additional lands beyond the BCMDP. These lands are included in this plan to provide a comprehensive approach to the whole of the regulated habitat for Blanding's turtle. Phase 5 shows a schematic representation of this future development which includes the Creekside Church and Northgate North as well as lands west of Erbsville Road. Developers would individually be responsible for implementing turtle barrier fencing on their own properties (shown in blue). Fencing would continue to encompass the watercourses, wetlands and woodland natural features plus their buffers equivalent to the extent of Category 2 habitat. Stormwater management ponds would continue to require placement outside of Category 2 habitat and exclusion fencing would be necessary as described above. This method retains all Category 2 habitat as well as some Category 3 habitat.

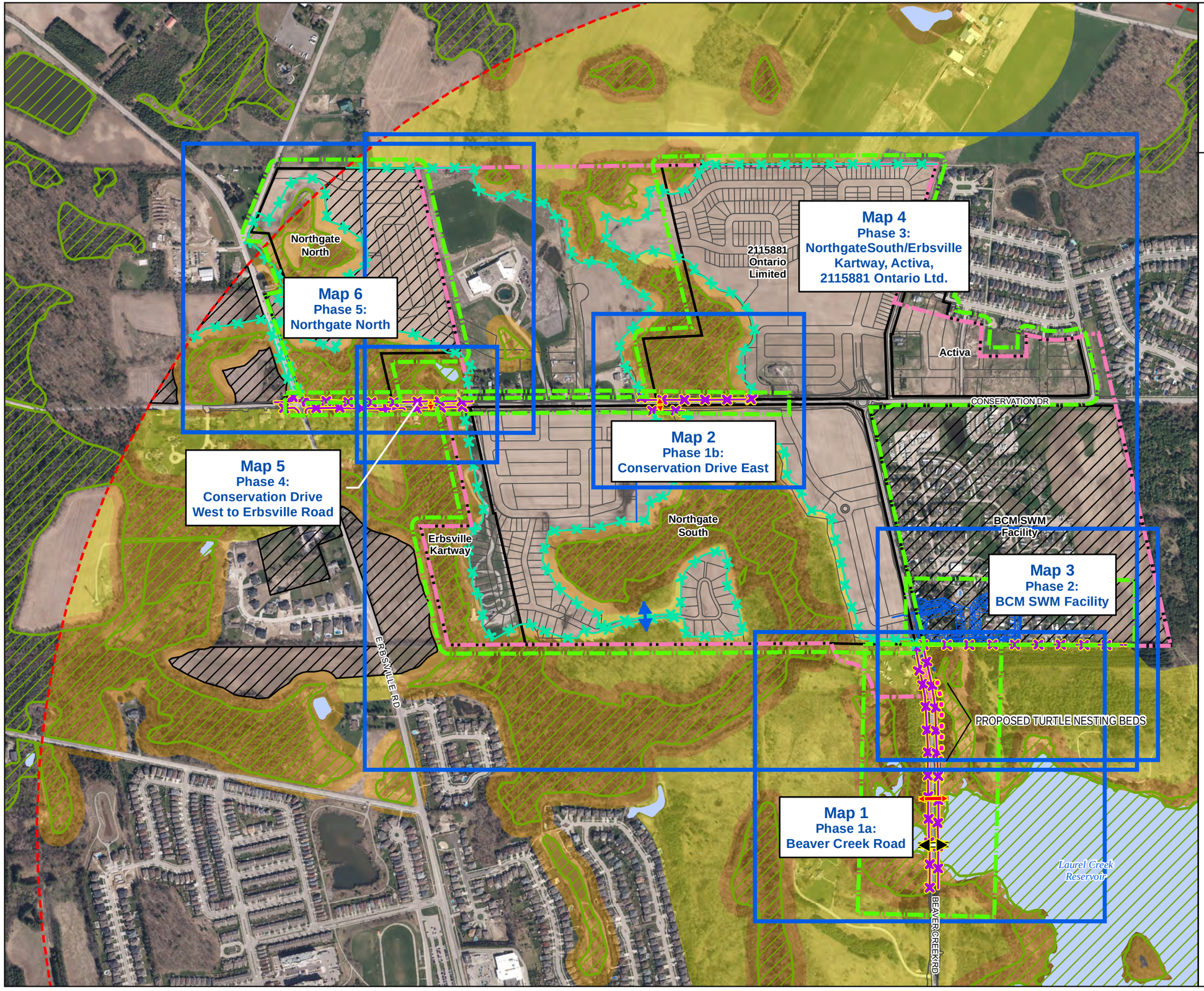
The timeframe for ultimate build-out is unknown, but this mitigation plan provides an approach for protection for turtles in the near future, while showing that the strategy can work throughout the extent of the regulated habitat in the long term. This plan allows flexibility if new information or techniques become available in the future. It is expected that this approach will create and maintain a continuous connected landscape for Blanding's Turtle and its movements through the development of the BCMDP area.

Elaine Gosnell, B.Sc., P. Biol.
Senior Terrestrial/Wetland Biologist

Map A

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan Key Map



Legend

- Subject Properties
- Map Extent
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- 2km Buffer from Blanding's Turtle Site
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Culvert for Ecopassage (City of Waterloo)
- Culvert for Ecopassage (Developer)
- Existing Culvert to be Maintained (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

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Aquatic, Terrestrial and Wetland Biologists

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Imagery: First Base Solutions (2019).

Project: 1531
Date: February 10, 2020

NAD83 - UTM Zone 17
Size: 11x17"
1:8,500

0 100 200 300 400 Metres

Path: X:\1531B_NorthGate_and_KartwayLands\NRSI_1531B_MapA_Blandings_KeyMap_8K_2020_02_10_LEH.mxd

Northgate South

BCM SWM Facility

PROPOSED TURTLE NESTING BEDS

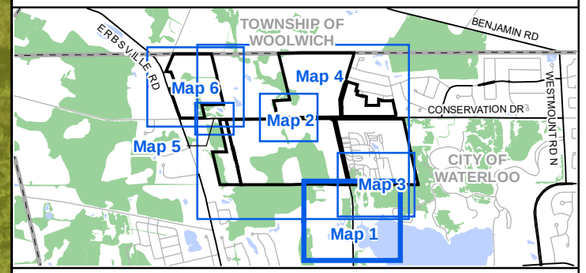
BEAVER CREEK RD

Laurel Creek Reservoir

Map 1

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 1a: Beaver Creek Road



Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Culvert for Ecopassage (City of Waterloo)
- Existing Culvert to be Maintained (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 1a: Beaver Creek Road

Responsibility: City of Waterloo

Anticipated Date: 2020

Mitigation Details:

- Turtle barrier fencing along length of wetlands
- Laurel Creek culvert improvements for ecopassage with directional fencing
- Retention of existing Laurel Creek culvert with directional fencing
- Turtle nesting beds on east side of Beaver Creek Road

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Imagery: First Base Solutions (2019).

Project: 1531
Date: February 10, 2020

NAD83 - UTM Zone 17
Size: 11x17"
1:2,500

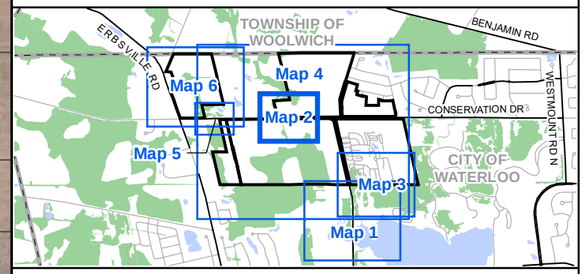
0 40 80 120 Metres

Path: X:\1531B_NorthGate_and_KartwayLands\NRSI_1531B_Map1_Blandings_Phase1a_3K_2020_02_10_LEH.mxd

Map 2

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 1b: Conservation Drive East



2115881 Ontario Limited

CONSERVATION DR

Northgate South

Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Proposed Development
- Proposed SWM Block
- Culvert for Ecopassage (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)

Phase 1b: Conservation Drive East

Responsibility: City of Waterloo

Anticipated Date: 2020

Mitigation Details:

- Turtle barrier fencing along length of wetlands
- Beaver Creek culvert improvements for ecopassage with directional fencing

*Mitigation strategy shown is conceptual and is to be refined at development stage

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Date: February 10, 2020

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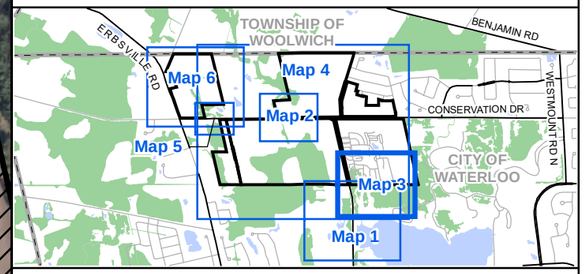
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Map 3

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 2: BCM SWM Facility



Legend

- Subject Properties
- Development Phase
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 2: BCM SWM Facility

Responsibility: City of Waterloo

Anticipated Date: 2022

Mitigation Details:

- Turtle barrier fencing along south side of property

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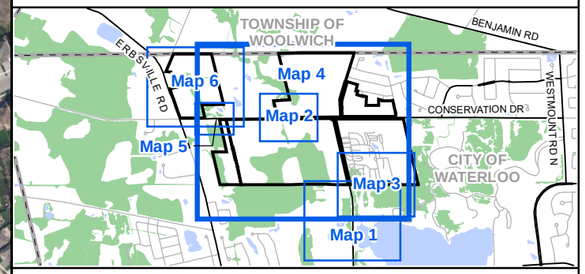
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Map 4

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan Phase 3: Northgate South/Erbsville Kartway, Activa, 2115881 Ontario Ltd.



Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Proposed Turtle Nesting Beds (City of Waterloo)
- Culvert for Ecopassage (City of Waterloo)
- Culvert for Ecopassage (Developer)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development
- Proposed SWM Block

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 3: Northgate South/Erbsville Kartway, Activa, 2115881 Ontario Ltd.

Responsibility: Developers (excluding work by City along Conservation Drive)

Anticipated Date: 2023

Northgate South/Erbsville Kartway Mitigation Details:

- Turtle barrier fencing along outer edge of NHS buffer
- Ecopassage at access road with directional fencing

Activa/2115881 Ontario Ltd. Mitigation Details:

- Turtle barrier fencing along outer edge of NHS buffer

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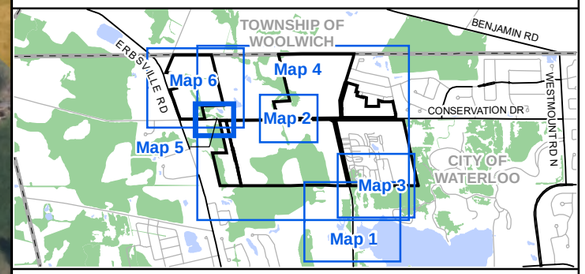
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Map 5

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 4: Conservation Drive West to Erbsville Road



Northgate North

CONSERVATION DR

Northgate South

Erbsville Kartway

Legend

- Subject Properties
- Development Phase
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Culvert for Ecopassage (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development

Phase 4: Conservation Drive West to Erbsville Road

Responsibility: City of Waterloo

Anticipated Date: 2025

Mitigation Details:

- Turtle barrier fencing along north and south side of road
- Ecopassage at Laurel Creek tributary with directional fencing

*Mitigation strategy shown is conceptual and is to be refined at development stage

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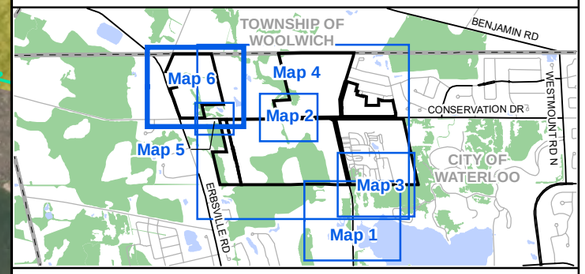
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Map 6

Northgate and Erbsville Kartway

Blanding's Turtle Mitigation Plan
Phase 5: Northgate North



Legend

- Subject Properties
- Beaver Creek Meadows District Plan Boundary
- Approximate Future Development
- 2km Buffer from Blanding's Turtle Site
- Category 2 Habitat
- Category 3 Habitat
- Wetland
- Waterbody
- Culvert for Ecopassage (City of Waterloo)
- Turtle Barrier Fencing (City of Waterloo)
- Turtle Barrier Fencing (Developer)
- Proposed Development

*Mitigation strategy shown is conceptual and is to be refined at development stage

Phase 5: Northgate North

Responsibility: Developers

Anticipated Date: 2030

Mitigation Details:

- Turtle barrier fencing along outer edge of NHS buffer

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