

2115881 Ontario Limited, North Waterloo

Environmental Impact Study

Prepared for:

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Project No. 1506 | July 2016

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2115881 Ontario Limited, North Waterloo
Environmental Impact Study

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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 development of the above noted 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, an existing residential development and 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 area as the Beaver Creek Meadows District. Natural features within and adjacent to the subject property are designated as Core Environmental Features in the Region of Waterloo's Official Plan (OP, 2015), Core 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 Laurel and Beaver Creeks 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 Ministry of Natural Resources and Forestry *Endangered Species Act* (2007), have triggered the requirement for an EIS.

Technical studies, relevant to other aspects of the project such as planning, stormwater management, engineering, etc., 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 2 years of pre-construction biological monitoring completed by NRSI (NRSI 2016) and 2 years of pre-construction surface water and groundwater monitoring by Stantec (as per the City of Waterloo's Development Monitoring Protocol (1999).

This report contains the detailed findings of the EIS, including the characterization of existing natural features based on the results of a thorough background review, as well as original field surveys from the above noted monitoring. The report identifies natural feature constraints in association with the land use policy designations, assesses potential impacts and provides mitigation measures to reduce or eliminate potential impacts from the proposed development. This EIS has been prepared in accordance with the City of Waterloo's OP (2014), Region of Waterloo's OP (2015), Greenlands Network Implementation Guidelines (2010), Section 15 – 17 of the North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013), GRCA EIS Guidelines and Submission Standards for Wetlands (2005).

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, an elementary school, stormwater management, trails and parkland as shown on Map 2. The development plan follows the land use structure of the Beaver Creek Meadows District Plan (TPP 2015, in draft).

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 report prepared by NRSI (NRSI 2016).

NRSI consulted with the MNRF with respect to SAR and SCC. A SAR/SCC screening and survey methodology memo was prepared and approved 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, GRCA, and the Ministry of Natural Resources and Forestry (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).

1.3 Relevant Policies, Legislation, and Planning Studies

For the purposes of this EIS report, information on the natural heritage features within the subject property was collected and assessed for significance. To help inform suitable land-use concepts, guide the layout of development, and identify areas to be protected, these 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 this report and Table 1 provides an overview of

the policy, legislation and planning studies that were considered and which informed the field program and analysis.

Table 1. Relevant Policies, Legislation and Planning Studies

Policy/Legislation	Description	Project Relevance
City of Waterloo Official Plan (2014)	• 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 is designated as Open Space, containing both Core Natural Feature and Supporting Natural Feature which are afforded protection under the City's OP.
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.
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,	• 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.

Policy/Legislation	Description	Project Relevance
	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."*	• 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). • 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	• Based on the background review and detailed information from the NWSSS, monitoring reports and SAR/SCC screening, several natural features afforded 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

Policy/Legislation	Description	Project Relevance
	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.	
Regional Municipality of Waterloo Tree By-Law Number 08-026	• 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. • 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.	• The Regions OP identifies the natural features within the southwest corner and south and west of the property to be 'Core Environmental Features' • 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 Natural Areas and Watercourses exist within the west portion of the subject property.

Policy/Legislation	Description	Project Relevance
	• 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.	

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 North Waterloo Subwatershed 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 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, 2 years of pre-construction surface and groundwater monitoring has also been completed by Stantec (Stantec 2016a).

Table 2. Field Survey Summary

Survey Type	Protocol	Date	
		2014	2015
Badger Survey	NWSSS (Ecoplans et al. 2013)	N/A	October 23
Barn Swallow Habitat Investigation & Descriptions Surveys	MNRF Guelph District Guidance (G. Buck, pers. comm. 2012a)	June 23	July 2
Bat Habitat Assessments (cavity trees and structures)	MNRF 2015d	October 17	N/A
Breeding Bird Surveys	OBBA 2001	June 16	June 5
		July 4	June 23
Ecological Land Classification (verification and refinement)	Lee et al. 1998	June 4	June 5
		September 25	October 1
Evening Calling Anuran Surveys	BSC 2009	April 21	April 16
		May 15	May 25
		June 10	June 16
		June 19	N/A
Nocturnal Bird Surveys	Common Nighthawk Survey Protocol (G. Buck, pers. comm. 2012b)	N/A	May 28
			June 4
			June 30
Pre-Construction Monitoring & Disturbance Data Sheet	City of Waterloo Pre-Construction Monitoring (City of Waterloo 1999)	June 4	June 5
		September 25	October 1
Snake Cover Board Surveys	N/A	June 17	N/A
		June 23	
		July 4	
		September 9	
		September 25	
Turtle Nesting and Area Surveys	MNRF Turtle Nest Survey Guidance (A. Timmerman, pers. comm. 2014)	June 4	May 25
		June 19	June 16
Vegetation Plot Monitoring	NRSI Vegetation Plot Monitoring standardized methods (GRCA approved, K. Smith, pers. comm. 2014b)	July 30	July 14
Road Crossing Mortality Surveys (MMM	NWSSS (Ecoplans et al. 2013)	May 1	N/A

Group)		May 13 May 27 June 3 June 12	

2.1 SAR and SCC Screening

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 (2012),
- 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

The SAR and SCC screening was completed by comparing the habitat requirements for significant species that are known from the vicinity of the study area against the ELC communities and habitats known to occur within and adjacent to the subject property. This comparison determined which species have potential to occur within habitats in the subject property, and identify those species with potential to be impacted by the proposed development. Those species and a methodology to survey for them was provided to the MNRF for review and approval.

2.2 Vegetation

2.2.1 Vegetation Communities

Vegetation communities within and adjacent to the subject property were characterized as per the Ecological Land Classification System 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 monitoring program conducted by NRSI in 2014 and 2015. The results of the ELC verification mapping are shown on Map 3.

2.2.2 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 (NRSI 2016) within 2 vegetation monitoring plots (Map 4). Any federally, provincially, or regionally significant vascular flora was documented during all visits to the property. A

complete list of plant species observations within the vegetation monitoring plots is appended to this report (Appendix II) while a full list of plants in the subwatershed study area can be found in the NWSSS (Ecoplans et al 2013).

2.2.3 Vegetation Surveys for Enhancement / Management Needs

Wandering transects were established within and adjacent to the natural features on the subject lands to assess enhancement and/or management needs as development proceeds. Transects surveys were conducted during spring and fall (2014 - 2015) 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 provincially and regionally significant plant species (Richardson and Martin 1999) (Map 3).

The results of the vegetation surveys for enhancement/management needs are discussed in Section 3.1.3 in this report with monitoring locations are shown on Map 4.

2.2.4 Vegetation Monitoring Plots

As requested by the GRCA, permanent plot vegetation monitoring was completed within the subject property during summer 2014 and 2015. 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, understorey trees, shrubs, and herbaceous plants.

A list of species observed within each monitoring plot is provided in Appendix II and results are discussed in Sections 3.1.2 and 3.1.4.

2.2.5 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 in 2014 and 2015 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.

2.2.6 Dripline and Wetland Boundary Flagging and Survey

Boundaries of woodlands and wetlands are largely unchanged from the NWSSS (Ecoplans et al. 2013) findings. Dripline flagging and surveying of the Core Environmental Feature boundaries was done during the NWSSS and generally was not updated during the annual Monitoring Program with one exception. The boundary of a small area of wetland in the northwest corner of the subject property was re-flagged, reviewed and approved in the field by NRSI and GRCA staff on November 17, 2015. The revised wetland boundary is integrated with and shown on Map 3.

2.3 Avifauna

2.3.1 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. Random wandering transect surveys were also completed in between point count stations. 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.

2.3.2 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 2015 according to the Guelph District MNRF Barn Swallow Survey Protocol (G. Buck, pers. comm. 2012a) which includes a third survey during the breeding bird season. A third survey visit was conducted within the cultural areas in the subject property to determine if any Barn Swallow individuals were nesting in the existing structures that may be proposed for removal within the proposed development scenario shown on Map 2. Specific Barn Swallow surveys were conducted within WSUs 6, 7 and 8 as shown on Map 4.

2.3.3 Common Nighthawk

GRCA correspondence indicated that Common Nighthawk (*Chordeiles minor*), a SCC, has been observed in the local Waterloo area (K. Smith, pers. comm. 2014a). Suitable habitat for this species is present in the subject property; therefore, surveys were conducted in 2015 according to MNRF guidance including 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.

Monitoring results from avifauna surveys, including incidental observations are provided in Appendix III and are discussed in Section 3.2.

2.4 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 and 2015), 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.

Chorus Frog (*Pseudacris triseriata* pop. 2), a provincially 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 in Appendix IV and discussed in Section 3.3.

2.5 Reptiles

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

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). Numerous targeted visual surveys for turtle SAR and SWH related to turtles (potential turtle nesting and overwintering areas) were conducted according to recent MNRF guidance for turtle nesting surveys (A. Timmerman, pers. comm. 2014). Any sightings of snakes or turtles were photographed and mapped, as well as any evidence of hibernation, nesting, or basking areas.

Blanding's Turtle

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. Category 1 habitat includes the reservoir and adjacent lands within 30m. Targeted nesting surveys were completed as part of the Monitoring Program, to determine the presence of further Category 1 habitat.

Category 2 habitat is defined as the wetland complex (i.e. all suitable wetlands or waterbodies within 500m of each other) extending up to 2km from an occurrence, and the area within 30m around those suitable wetlands or waterbodies. Category 2 habitats are present within the study area and include the wetlands plus 30m.

Category 3 habitat is defined as areas between 30m and 250m around suitable wetlands and waterbodies identified in Category 2, within 2km of an occurrence. Category 3 habitats provide movement corridors between wetlands essential for carrying out life processes within Category 1 and 2 habitats (OMNR 2013). Consultation with the MNRF is on-going to map the potential extent of Category 2 and 3 habitats within the subject property.

2.6 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 tree and existing buildings are proposed for removal under the existing development concept shown in Map 2. As such, a detailed bat habitat assessment was conducted on October 17, 2014 within the subject property. Candidate bat habitat within the subject property is shown on Map 5.

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.

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.

2.7 Road Crossing Mortality Monitoring

Road crossing mortality monitoring was completed by MMM Group during spring 2014 (Map 4). Monitoring events occurred in May and June. Methods implemented were consistent with the NWSSS (Ecoplans et al. 2013).

2.8 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 and 2015. NRSI biologists walked through the natural features within the subject property and documented 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

The components of the terrestrial feature monitoring are addressed in the vegetation related components of this report.

2.9 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, fish and benthic communities in the creek for this EIS. Fish species community list is provided in Appendix V.

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 363.1 m to Elevation 354.8 m) and from north to south (Elevation 357.6 m to Elevation 351.9 m). The site is split; with roughly half of the site going west to Beaver Creek and the remainder draining to the south-east corner of the site where it drains towards Green Acre 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 150 to 1070 mm across the site, with a thick layer of sand with some silt underlying this at all borehole locations. The sand layer ranged from 2.7 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 Consulting is preparing a hydrogeological study to accompany this application with preliminary information from their monitoring report (2016a) 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 are provided in the Stantec report.

3.3 Aquatic Habitat – Beaver Creek

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

Reach B5 flows through forest, swamp and thicket habitats, with substantial forest to the north and east (on 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. Bankful 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).

A collective total of 13 species of fish were captured in Reaches B4, and B5a during sampling in 2006 and 2009 for the North Waterloo Scoped Subwatershed Study

(Ecoplans et al. 2013). These species are listed in Appendix V. The species captured were all common and secure in Ontario, and 11 of the 13 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 North Waterloo Scoped Subwatershed Study (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' the may or may not be redds. As a result, there has been no recent confirmation of Brook Trout or Brown Trout using Beaver Creek as habitat, although suitable characteristics suggest potential use by these coldwater species.

3.4 Vegetation

3.4.1 Vegetation Communities

Existing ELC mapping was field verified by NRSI and refined during the 2014 and 2015 monitoring program. ELC in the study area is largely the same as reported in the NWSSS with 2 additional habitat inclusions found during this study. On the 2115881 Ontario Ltd. property the following habitat inclusions were delineated, as shown on Map 3: Dry-Fresh Poplar Deciduous Forest (FOD3-1), and Fresh-Moist Lowland Deciduous Forest (FOD7). 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	This 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 was identified within this vegetation community, Fresh-Moist Lowland Deciduous Forest (FOD7), and is dominated by Manitoba Maple (*Acer negundo*) and Green Ash (*Fraxinus pensylvanica*). Also Forb organic meadow marsh (MAM3-9), Fresh-Moist Poplar Deciduous Forest (FOD8-1) and Forb Mineral Meadow Marsh (MAM2-10).
SWM6-1	Birch – Conifer Organic Mixed Swamp	This 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*). Several regionally significant species were observed within this community: Meadow Horsetail (*Equisetum pratense*), Northern Beech Fern (*Phegopteris connectilis*), Virginia Creeper (*Parthenocissus quinquefolia*), Virginia Stickseed (*Hackelia virginiana*), and White Spruce (*Picea glauca*). Habitat inclusions were identified within this vegetation community, Dry-Fresh Poplar Deciduous Forest (FOD3-1), and is dominated by Trembling Aspen as well as white cedar organic coniferous swamp (SWM3-1).
SWDO3	Organic Deciduous Swamp	This 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*).

ELC Ecosite Type	ELC Description	Environmental Characteristics
SWT2/CUP3	Mineral Thicket Swamp / Coniferous Plantation	This 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 perfoliatum*), Grass-leaved Goldenrod (*Euthamia graminifolia*), and Spotted Jewelweed. Inclusions of narrow leaved sedge mineral meadow marsh (MAM2-5) and cattail mineral shallow marsh (MAS2-1). 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 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 (*Parthenocissus vitacea*), 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 42 trees inventoried within HR2, 10 are in Good condition, 19 are in Fair condition, 5 are Poor/Very Poor, and 4 are dead snags. A single regionally significant species was observed within this community, Hackberry (*Celtis occidentalis*).

3.4.2 Vascular Flora

A total of 105 vascular plant species were documented within the vegetation monitoring plots (Appendix II). Approximately 16% of the vascular plant species observed are considered 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 and 2015 (NRSI 2016). 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. Of these, Hackberry, Meadow Horsetail, and Virginia Creeper were not previously identified in the NWSSS (Ecoplans et al. 2013). White Spruce individuals are likely planted specimens given the coniferous plantation context, as reported in the NWSSS (Ecoplans et al. 2013) and confirmed by NRSI biologists.

3.4.3 Vegetation Surveys for Enhancement / Management Needs

Results of the vegetation surveys for enhancement and management needs are presented in the Pre-Construction Biological Monitoring Program report (NRSI 2016). It is noteworthy to mention that past disturbances within the natural features on the subject property are limited and include small areas of refuse dumping and minor invasive species establishment. Refer to the above-referenced report for further details and discussion.

3.4.4 Vegetation Monitoring Plots

Habitats within the subject property are comprised mainly of agricultural fields, with wetlands and small woodlands associated with Beaver Creek (tributary of Laurel Creek). A total of 2 vegetation monitoring plots were established within the subject property and surveyed in summer 2014 and 2015. The purpose of the pre-construction biological monitoring was to establish baseline conditions, for comparison with subsequent monitoring events (i.e. during and post-construction monitoring). The results were found to be generally consistent with the detailed vegetation community characterization reported in the NWSSS (Ecoplans et al. 2013).

Within Vegetation Monitoring Plot #1, a single regionally significant plant species was observed, White Spruce. No other significant plant species were observed within the monitoring plot. This monitoring plot was noted as having a moderate level of disturbance throughout, supporting several non-native and invasive species.

Within Vegetation Monitoring Plot #2, a single regionally significant plant species was observed, Meadow Horsetail. No other significant plant species were observed within

the monitoring plot. This monitoring plot was noted as having standing water, with groundwater seepage throughout the surrounding ELC polygon (SWM6-1).

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. The same analysis was completed in the NWSSS (Ecoplans et al 2013) by entire ELC community and is shown for comparison.

Table 4. Floristic Quality Index by Vegetation Plot and Community

	Veg Plot - 001	Veg Plot -002	SWT2/CUP3	SWM6-1 (FOD3-1 inclusion)	SWM4-1 (FOD7 inclusion)
Total species	60	55	54	92	127
FQI (native species)	18.76	34.75	25.96	37.53	44.83
FQI (incl. non-native)	15.88	34.11	22.32	34.51	38.42
Wetness index	0.27	-1.84	-2.41	0.84	0.51

Refer to the Pre-Construction Biological Monitoring Program report (NRSI 2016) for further details and discussion of the vegetation monitoring plots results.

3.4.5 Fixed Photo Plot Monitoring

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

3.5 Wildlife

A number of regionally, provincially and federally significant species of wildlife have been documented on the property during the current and past studies. For the purposes of this report, SAR include species listed as 'Threatened' or 'Endangered' in the *Endangered Species Act* (ESA, 2007), or on Schedule 1 of the federal *Species at Risk Act* (SARA).

In Ontario, provincial SCC includes:

- Species designated under the ESA as 'Special Concern' within Ontario,
- Species that have been assigned a conservation status (S-Rank) of S1 to S3 or SH by the Natural Heritage Information Centre,
- Species that have a high percentage of their global population in Ontario, and
- Species that are identified federally as 'Threatened' or 'Endangered' by the Committee for the Status of Endangered Wildlife in Canada (COSEWIC), but are not protected provincially by the ESA.

3.6 Avifauna

During the monitoring program conducted throughout the study area in 2014 and 2015, a total of 48 bird species were documented within the 2115881 Ontario Ltd. subject property. Of the 48 species documented, 42 exhibited signs of breeding, such as males singing, females carrying food or nest materials, and the presence of fledged young. Refer to Appendix III for a list of bird species documented during the breeding bird surveys in 2014 and 2015.

A total of 2 bird SAR, 2 bird SCC, and 8 regionally significant bird species (Martin 1996) were observed within the subject property during the breeding bird surveys conducted during the Monitoring Program and are discussed in further detail below.

Barn Swallow (*Hirundo rustica*)

Barn Swallow is a SAR and is listed as Threatened provincially, affording individuals and their habitat protection under the *Endangered Species Act*. Barn Swallow has also been listed as Threatened federally by COSEWIC; however, they are not listed under Schedule 1 of the federal *Species at Risk Act* and therefore are not afforded protection under federal legislation.

Barn Swallows 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 and WSU-6). This species was documented incidentally (i.e. no breeding evidence) as no suitable nesting habitat exists within those units. No nests were observed on or in

any of the buildings or structures on-site during the targeted Barn Swallow surveys. Therefore, suitable nesting habitat for this species may be present outside of the subject property while Barn Swallow is foraging over the subject lands.

Bank Swallow (*Riparia riparia*)

Bank Swallow, a SAR, is listed as Threatened both provincially and federally (MNRF 2015a, Government of Canada 2015). Breeding habitat 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 2 Wildlife Survey Units (WSU-4 and WSU-5). It is likely that these individuals were passing over the site, or were 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 (MNRF 2015a, Government of Canada 2015). Breeding habitat for this species includes 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 was displaying breeding evidence within 2 of the Wildlife Survey Units within the subject property; WSU-3 and WSU-5. 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 (MNRF 2015a), and Threatened federally (Government of Canada 2015). 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 displaying breeding evidence within 1 Wildlife Survey Unit in the subject property; WSU-4, with the highest breeding evidence recorded as 'T' (permanent territory), suggesting a probable breeding status. Suitable nesting

habitat for this species on-site is limited to forest edges only, with other suitable nesting habitat found off-site within the local area.

In addition to the species discussed above, a total of 8 regionally significant bird species were observed within the subject property (Appendix III). Of the 8 species observed, 6 exhibited signs of breeding: Yellow-bellied Sapsucker (*Sphyrapicus varius*), Least Flycatcher (*Empidonax minimus*), Eastern Bluebird (*Sialia sialis*), Brown Thrasher (*Toxostoma rufum*), Blue-winged Warbler (*Vermivora cyanoptera*), and Common Nighthawk.

Of the significant bird species listed above, several had previously been reported as breeding or potentially breeding on the subject lands during the background studies in support of the NWSSS (Ecoplans et al. 2013), with the following species being newly recorded; Yellow-bellied Sapsucker, Least Flycatcher, and Common Nighthawk.

3.7 Amphibians

Limited amphibian breeding evidence was documented during the call surveys conducted in 2014. ANR-001 was the only station where biologists positively identified calling amphibians. On April 21, 2014, Spring Peeper (*Pseudarcris crucifer*) was heard in full chorus (Call Code 3), and 2 American Toad (*Anaxyrus americanus*) individuals were also heard at this station. No other calling amphibians were heard during call surveys conducted in 2014.

In 2015, calling amphibians were identified at each of the 3 monitoring stations. Spring Peeper and Gray Treefrog (*Hyla versicolor*) were documented at each station during the April and May monitoring events respectively. The highest breeding evidence recorded was full choruses (Call Code 3) of Spring Peeper and Gray Treefrog at ANR-001. No calling amphibians were documented during the June survey.

Appendix IV summarizes the results of the evening amphibian call surveys by maximum calling code for stations within the subject property. Incidental amphibian observations made by NRSI biologists during all other field surveys conducted throughout the study area in during the Monitoring Program in 2014 and 2015 are listed in Table 4. No federally, provincially, or regionally significant amphibian species were documented

during the Monitoring Program. All amphibian species recorded during this study were previously documented in the NWSSS (Ecoplans et al. 2013).

Table 5. Incidental Amphibian Observations (2014 - 2015)

Scientific Name	Common Name	Location(s) Observed
Anaxyrus americanus	American Toad	WSU 2
Hyla versicolor	Gray Treefrog	WSU 1 and 2
Lithobates pipiens	Northern Leopard Frog	WSU 1
Lithobates sylvatica	Wood Frog	WSU 2

The NWSSS (Ecoplans et al 2013) reported one amphibian nationally Threatened species (COSEWIC) on the subject property; western chorus frog. This species was recorded in two locations on or in the vicinity of the subject property, including the wetland at the northern 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.

3.8 Reptiles

Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was the only reptile species observed on the property during the Monitoring Program and during the NWSSS (Ecoplans et al 2013). No federally, provincially, or regionally significant reptile species were documented during the Monitoring Program. Eastern Gartersnake was observed incidentally within the wooded edge habitats during the pre-construction ecological monitoring surveys conducted by NRSI biologists in 2014 and 2015.

Through numerous targeted visual surveys for SAR and SCC turtles, NRSI biologists did not observe or document habitat use by any turtle species within the subject property during the Monitoring Program.

Based on the extensive survey efforts in 2014 and 2015, as well as the NWSSS, the lack of any observations of any turtle species on the subject property, or during any of the roadside mortality surveys by others (Stantec, MMM Group in 2014), it has been determined that it is highly unlikely that nesting habitat is present for Snapping or Blanding's Turtle within the 2115881 Ontario Ltd. subject property. MNRF correspondence concurs with this finding (D. Marriott, pers. comm. 2015c).

3.9 Mammals and Other Wildlife

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 9 mammal species were observed during the field surveys: Virginia Opossum (*Didelphis virginiana*), Eastern Cottontail (*Sylvilagus floridanus*), Meadow Vole (*Microtus pennsylvanicus*), Eastern Gray Squirrel (*Sciurus carolinensis*), Red Squirrel (*Tamiasciurus hudsonicus*), Eastern Chipmunk (*Tamias striatus*), Coyote (*Canis latrans*), Northern Raccoon (*Procyon lotor*), and White-tailed Deer (*Odocoileus virginianus*). Appendix VI provides a complete list of mammal species reported and observed from the study area.

The detailed bat habitat assessment identified 3 suitable habitat features for these mammals within the subject property as shown on Map 5, namely residential buildings and isolated landscape trees. Recent guidance from MNRF has further recommended the buildings proposed for removal that have been identified as suitable bat habitat be surveyed visually for bats, as per standardized protocol (D. Marriott, pers. comm. 2015b). 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 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 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 lands during the Monitoring Program. This species prefers lowland to upland deciduous wooded areas, preferably near water and farmland (OMNR 2000); therefore, suitable habitat for this species is present within the habitats along the southwest corner of the property.

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 defined as 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).

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 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. 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 north and central part of the site are primarily forested with mixed swamp vegetation on organic soils, while the wetlands in the southern 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, had higher 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) of this feature. Agricultural tilling occurs right 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. This large portion of the wetland is directly connected to Beaver Creek (off-site) and provides a dense vegetated buffer, groundwater discharge, water storage and overhead canopy to enhance the aquatic habitat.

The wetland in the northwest corner of the subject property 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 contains a small inclusion of forb organic meadow marsh (MAM3-9) with an upland fringe of deciduous forest (FOD7) along the eastern edge. As a whole, this wetland community (SWM4-1) has a high diversity of species and the highest FQI in the whole subwatershed study area. The upland 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 (2016a). The NWSSS prepared a water balance for each of the catchments which are on the subject property under the existing condition. These are shown in Table 6.Table 6

Table 6. Existing Water Balance for on-Site Catchments

Catchment	Area (ha)	ET (mm)	Runoff (mm)	Infiltration (mm)
3913	12.3	553.4	68.8	222.5
3101 (in part)	21	507.2	154.2	183.4

Under the current agricultural land use, the majority of precipitation which falls on the site during the growing season is taken up by evapotranspiration (ET), with a smaller component infiltrating into the soil and very little running off.

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. It appears that the wetlands' primary hydrologic function is the storage of surface water and the storage and expression of groundwater.

4.3 Species At Risk and Significant Species

Through the field surveys and analysis in the NWSSS (Ecoplans et al 2013) and this study, no Species At Risk were found to present on the subject property, although it does contain regulated habitat for Blanding's turtle. NRSI discussed this species and its habitat with the MNRF and submitted information to them throughout the course of this study in order to make a determination of regulated habitat presence and its extent.

The most sensitive category of habitat for Blanding's turtle is Category 1, which includes the nest or overwintering sites for this turtle. This category of habitat was determined not to be present on the subject property (Marriot, D. pers. comm. 2015c).

An Information Gathering Form (IGF) was submitted to MNRF and review comments were received on July 8, 2016 (G. Buck pers comm 2016). 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 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.

MNRF response comments to the IGF included items to be addressed in the impact analysis including location and design of the stormwater management facility, wetland buffer dimensions, wetland water balance and potential for conflict with SWM pond clean out (G. Buck pers comm 2016).

A number of Species of Conservation Concern (SCC) were documented on the property and these have been used in the analysis of significant wildlife habitat (see Significant Wildlife Habitat 4.4).

4.4 Significant Wildlife Habitat

Within the NWSSS (Ecoplans et al. 2013), confirmed and candidate Significant Wildlife Habitats (SWH) 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 4 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 SWH types were confirmed for the subject property within the NWSSS (Ecoplans et al. 2013) based on the site-specific field surveys:

- seasonal concentration areas (amphibian breeding habitat (woodland)), and
- habitat for species of conservation concern (special concern and rare wildlife species).

Amphibian breeding habitat (wetlands) and turtle wintering areas were identified as candidate SWH's (Ecoplans et al. 2013).

Findings from the detailed field surveys conducted during the pre-construction monitoring in 2014 and 2015 were used to further confirm or rule out SWH within the subject property. Further confirmed SWH identified by NRSI during the Monitoring Program specific to the 2115881 Ontario Ltd. property are shown on Map 5 and include:

- seeps and springs (not previously reported in NWSSS)

In addition, turtle wintering areas, and amphibian breeding habitat (wetlands) candidate SWH was ruled out as not occurring within the subject property, while bat maternity

colonies was identified as candidate SWH within the SWM4-1 and SWM6-1 vegetation communities (Map 3).

4.4.1 Specialized Wildlife Habitat

Amphibian Breeding Habitat (Woodland)

SWH has been confirmed for Amphibian Breeding Habitat (Woodland) within the subject property during the NWSSS (Ecoplans et al. 2013). The SWM6-1 and SWT2/CUP3 vegetation communities in the southwest portion of the subject property and extending off-property provides suitable amphibian breeding habitat based on the number of species and individuals observed.

During the biological monitoring program (NRSI 2016), SWH has been confirmed for Amphibian Breeding Habitat (Woodland) 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. Survey results from the biological monitoring program (NRSI 2016) did not satisfy the criteria for amphibian breeding habitat (woodland) SWH within the SWM6-1 vegetation community.

Seeps and Springs

Seeps and Springs SWH has been confirmed within 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 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 3.2 for discussion). Given the observations of a singing male Eastern Wood-peewee in suitable wooded habitat within the subject property, this is confirmed habitat for SCC.

Common nighthawk is a SCC which was observed giving territorial displays over the subject property during the specialized field surveys for this species. Primary nesting habitat for Common Nighthawk includes coastal sand dunes and beaches, logged or slash-burned areas of forest, woodland clearings, prairies and plains, sagebrush and grassland habitat, open forests, rock outcrops, and flat gravel rooftops (Brigham et al. 2011). The subject property may provide marginal nesting habitat for Common Nighthawk along the edges of wooded features, however, preferred nesting habitat exists within the local area on the flat rooftop of the Creekside Church, approximately 450m west of the subject property. Common Nighthawk in urbanized areas of southern Ontario are readily found nesting on flat rooftops, as noted from The Atlas of Breeding Birds of Ontario (Sandilands 2007, Peck and James 1983), and The Birds of North America (Brigham et al. 2011). Habitats on this property are not considered SWH for Common Nighthawk.

4.5 Key Wildlife Habitat Functions

A summary of the findings of the wildlife surveys and wildlife use of the property is provided in Table 7, by habitat unit. This table is based on Table 4.20 presented in the NWSSS (Ecoplans et al 2013), and builds on the findings and analysis of key wildlife habitat attributes.

Table 7. Summary of Wildlife Habitat & Findings (2014 – 2015) and NWSSS Results

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. Notable wildlife habitat elements: • SWH - Amphibian breeding habitat (woodland), • SWH – seeps and springs • Groundwater seepage • Specialized habitat for Lepidoptera/Odonata (sedge meadow), • Habitat diversity and continuity/ proximity to additional natural areas.	Birds • Moderate diversity (27 species documented) • 3 Regionally Significant: Great Blue Heron, Least Flycatcher, Blue-winged Warbler • Predominantly edge or interior/edge species Amphibians • 4 common species: American Toad, Spring Peeper, Northern Leopard Frog, Gray Treefrog • 1 SCC: western chorus frog recorded here in NWSSS Plants • 1 Regionally Significant: White Spruce
2	7	Diverse mosaic of riparian and adjacent habitats – mixed swamp, thicket swamp and deciduous forest. Notable wildlife habitat elements: • SWH – seeps and springs • Amphibian breeding habitat (woodland), • Groundwater seepage • Habitat diversity and continuity/ proximity to additional natural areas.	Birds • High diversity (32 species documented) • 3 Regionally Significant: Turkey Vulture, Yellow-bellied Sapsucker, Blue-winged Warbler • Predominantly edge or interior/edge species Amphibians • 4 common species: Spring Peeper, Gray Treefrog, American Toad, Wood Frog Plants • 5 Regionally Significant: Meadow Horsetail, Northern Beech Fern, Virginia Creeper, Virginia Stickseed, White Spruce

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
3	8	Small narrow finger of deciduous swamp with a short reach of un-named intermittent watercourse. Adjacent lands are primarily agricultural, with riparian swamp extending off-site to the west. Notable wildlife habitat elements: • SWH – Special Concern and Rare Wildlife species • SWH – seeps and springs • Cavity trees and downed woody debris • Groundwater seepage	Birds • High diversity (35 species documented) • 1 SCC: Eastern Wood-pewee • 2 Regionally Significant: Brown Thrasher, Turkey Vulture • Predominantly edge or interior/edge species Amphibians • 2 common species: Spring Peeper, Gray Treefrog • 1 SCC: Western chorus frog recorded here in NWSSS
4	N/A	Agricultural field actively planted with row crops. Limited wildlife function. Notable wildlife habitat elements: • None	Birds • Moderate diversity (27 species documented) • 2 Regionally Significant: Great Blue Heron • Edge species Amphibians • No species documented
5	N/A	Isolated narrow deciduous hedgerow dominated by common edge species vegetation. Limited wildlife function. No linkage connection to other habitats. Notable wildlife habitat elements: • None	Birds • High diversity (32 species documented) • 2 Regionally Significant: Eastern Bluebird, Brown Thrasher • Edge species Amphibians • No species documented Plants • 1 Regionally Significant: Hackberry
6	N/A	Abandoned residential property; structure recently burned down in fire (2015). Notable wildlife habitat elements: • None	Birds • Moderate diversity (25 species documented) • Predominantly edge or interior/edge species

Wildlife Survey Unit (NRSI)	Wildlife Survey Unit (NWSSS)[1]	Habitat Description[1]	Species Notes
			Amphibians • No species documented
7	N/A	Occupied residential property with existing structures and landscape trees. Barn/out-building adjacent to residence recently collapsed (2015). Notable wildlife habitat elements: • None	Birds • Moderate diversity (24 species documented) • Predominantly edge or interior/edge species Amphibians • No species documented
8	N/A	Occupied residential property with existing structures and landscape trees. Notable wildlife habitat elements: • Potential bat roosting habitat (i.e. residential building)	Birds • Moderate diversity (25 species documented) • 1 Regionally Significant: Brown Thrasher • Predominantly edge or interior/edge species Amphibians • No species documented

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

4.6 Ecological Linkages

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 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 2015). 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 2015).

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 well away from this line. 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 4 and 5 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 North Waterloo Scoped Subwatershed Study (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).

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 required for natural features such as woodlands, wetlands and watercourses to protect them from impacts during development. As described above in Section 1.0, the natural features located on the subject property have a number of designations including PSW, Core Environmental Feature, 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, the Regional Official Plan, the City of Waterloo Official Plan, 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 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 (e.g. Natural Heritage Reference Manual (OMNR 2010); Greenlands Network Implementation Guideline. IV. Guideline for

Determining Buffers around Environmental Features (Region of Waterloo 2010)); How Much Habitat is Enough? (Environment Canada 2004)).

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

The NWSSS recommended the following development setbacks 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 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 policy 7.C.10, "The location, width, composition and use of buffers will be in accordance with the approved EIS, with buffers being a minimum of 10 metres…" The final setback (and buffer management recommendations) will be determined via site-specific EIS work, 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
- Enhancement opportunities (e.g. corridor widening)

Section 14.2.2.1 of the NWSSS indicates that development and site alteration within buffer areas is to be limited and is to be subject to detailed study in an EIS as follows:

- Part of SWM facilities and associated grading;
- Recreational trails and associated grading
- 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 (ie. crop lands).

These recommended buffers and site specific considerations were used to inform the limits of development as shown on Map 6 and are discussed further in the impact analysis section 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, Draft Plan of Subdivision prepared by GSP Group (2016). Further details of the proposed development, including stormwater management, preliminary grading and servicing is provided by Meritech Engineering (2016) 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 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, 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 mix of residential densities, commercial development, a school site, road network, parks, trails and stormwater management facility as shown on Map 6. 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. This infrastructure was assessed through the Class Environmental Assessment process prepared by Stantec (2015). 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 boundary 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 23.89 ha (not including open space land uses) 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 two existing residences and their outbuildings will be removed as well as the landscape plantings and ornamental trees associated with these houses. These trees and plantings are not significant and no significant species use these areas. 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 4.75 ha of the site. Other open space land uses including stormwater management, community trail and park and total 2.59 ha as shown on Map 2.

5.3.1 Vegetation Removal

Vegetation removal is limited to small areas of cultural vegetation associated with residential properties and the northern hedgerow.

The hedgerow at the rear of the property will be removed to provide allowance for a community trail. This trail location was required to provide a link in the Avon Trail which stretches from Conestoga in the north to St. Mary's in the south, passing through Waterloo Region. The placement of the trail will require the removal of a single row of trees and shrubs namely buckthorn, white ash, sweet cherry and Manitoba maple as well as some standing dead and fallen trees. This hedgerow is patchy and has large gaps. Its function as a corridor is poor, as it does not provide a connecting link to any natural feature to the east. It was identified as a Low constraint in the NWSSS.

A total of 33 trees and 4 snags (standing dead trees) will be removed, as summarized in Table 8, below. There is no impact anticipated with the removal of these areas of vegetation.

Table 8. Summary of Trees to be Removed from Northern Hedgerow

Common Name	Scientific Name	Overall Condition				Total
		Very Poor	Poor	Fair	Good	
American Basswood	*Tilia Americana*			1	1	2
Black Cherry	*Prunus serotine*		1	1		2
Common Apple*	*Malus domestica*			3		3
Common Hackberry	*Celtis occidentalis*				1	1
Common Pear*	*Pyrus communis*			1		1
Hawthorn species	*Crataegus sp.*		1	2		3
Manitoba Maple	*Acer negundo*		1	3		4
Slippery Elm	*Ulmus rubra*				1	1
Sweet cherry*	*Prunus avium*	1		2	2	5
White Ash	*Fraxinus americana*		1	3	3	7
White Elm	*Ulmus americana*			2	2	4
Total		1	4	18	10	33

* non-native species

Mitigation: Due to the presence of Common Hackberry within the hedgerow feature (HR2), it is recommended that this Regionally Significant species be integrated into the Stewardship Management Plan for the property, as described in the Enhancement of Natural Features section.

5.3.2 Bird Nest Destruction

The *Migratory Birds Convention Act* (MBCA) protects migratory birds, their eggs and nests from being harmed or destroyed. The core nesting period for migratory birds in the study area and in woodland/thicket habitat is May 1 to July 31(CWS).

Mitigation: During the time period from May 1 to July 31 it is recommended that no clearing of vegetation occur within the thicket or woodland habitats.

The Canadian Wildlife Service (CWS) advises that, nest searches, as a means of mitigating nest destruction during the core breeding period, may be undertaken in "simple" habitats such as hedgerows, bridges and other constructed features where the potential to observe all active nests is relatively high (CWS 2013).

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

There are several areas on the proposed draft plan where the recommended 30m setback from the wetland boundary is reduced. Three areas of the site where reduced buffers are proposed are:

1. SW corner, rear of Lots 284-301; buffer ranges 20-39m
2. Block 487 (Stormwater Management) and Block 480 (Park); buffer is 15m
3. NW corner, rear of Lots 64-68; buffer ranges 21-32m

The NWSSS 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 each of the reduced buffer areas, the wetland adjacent to the development is a significant and sensitive feature due to its vegetative form and the ecological functions that it provides. The wetlands are forested swamp communities for the most part (with the exception of the swamp thicket in the south west corner) and are located at low points on the property where surface water and groundwater naturally flows and collects. In all cases, the buffer lands are currently tilled right up to the edge of the wetlands, with some minor intrusions and dumping noted along the edges. The wetlands are noted to be a Moderate to High Constraint in the NWSSS and are sensitive due to being supported by groundwater and the significant wildlife habitat functions that are provided, such as breeding habitat for amphibians, seeps and springs and habitat for species of conservation concern. The wetlands and 30m surrounding them are Category 2 habitat for the Blanding's turtle. The avian community present is one that makes use of edge and interior-edge habitats. The wildlife habitat function of the wetland is directly specific to the wetland, and is not dependent on adjacent upland habitats.

The natural feature edge was found to be stable and is adapted to the annual agricultural tilling such that the surficial root zone of edge trees is not anticipated to extend beyond the dripline. The edge is rarely completely closed and light and wind is admitted directly and indirectly into the feature in the current condition.

In total an area of 0.25ha of the wetland buffer will be encroached into. This encroachment is limited to rear yards (788.5m^2) and grading associated with the berm and spreader for the SWM pond (1690m^2). These encroachments are considered minor in area and in level of disturbance and will be offset somewhat by a wider buffer at the rear of lots 287-296 (386.2m^2). The encroachment area will be disturbed temporarily and then vegetated either with lawn (in the rear yards) or naturalized with plantings (on the SWM berm) and will not have any impervious surfaces or permanent structures placed within it. The infiltration function of the buffer will remain and be enhanced while the habitat value of the buffer will be improved in the area of the SWM pond.

The proposed reduced buffers are considered adequate to protect the form and function of the wetland present based on the following factors:

- The vegetation form of the wetland will be directly protected. The buffer provided always meets or exceeds the minimum Region of Waterloo recommended buffer of 10m from dripline for Core Environmental Features,
- Buffer width overall is sufficient to increase natural cover area through the cessation of agriculture 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 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 the buffers and natural areas to focus human activity outside of the natural feature itself, and,
- Homeowner education brochure and signage will be provided.

5.4.2 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 pond itself is actually outside of the 30m buffer, but the outer berm and pipe outlet to the level spreader swale are within the outer 10-15m of the wetland buffer (see Meritech SWM report Figure 3). 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 with no direct outlet to the wetland for the frequent storms (<5 year). Based on this design, the wetland is provided with a minimum 15m no-touch buffer, followed by a zone of approximately 45+m containing the berm, spreader 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 impact due to a direct channelized SWM outlet to the wetland. 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 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.

5.4.3 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, 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 2016).

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 2016) addresses this concern and includes a water balance analysis which is summarized here. Refer to the Meritech report for more details.

The development has been designed in a manner using storm water management techniques and Low Impact Development (LID) measures such that pre-development surface and groundwater volumes and patterns will be maintained and enhanced in the post-development scenario. The proposed stormwater management plan includes two primary outlets as per the NWSSS, matching the existing drainage pattern of the site. The west side will outlet to a proposed stormwater management block on the subject property and the east side of the site will outlet to proposed infrastructure south of the intersection of Conservation Drive and Beaver Creek Road. Water quality and quantity control are required for flows directed to Beaver Creek, while drainage to Laurel Creek reservoir will receive water quality treatment downstream of the subject site.

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.

The stormwater management plan is based on the average annual infiltration volume and the directionality of the groundwater flow. A water balance on the site can be achieved through the combination of lot-level measures (lot-level soak away pits, roof water to soak away pits), conveyance (a clean water “third pipe” system) and end-of-pipe infiltration facilities (southeast corner, northeast corner, school site, and SWM facility outlet). On-site measures will enhance shallow groundwater inputs including infiltration in grass yards, small areas with infiltration galleries, “clean water collector (CWC)” system accepting roof runoff from the front halves of roofs, end of pipe infiltration facilities in the southeast corner, northeast corner and school site. Catchments 504 (rear of southwest corner lots), 505 (rear of northwest corner lots) and

506 (trail), will outlet by way of infiltration alone. Based on the measures proposed in the SWM report, the post-development infiltration will exceed the pre-development condition, as summarized in Table 1Table 9.

Table 9. Change in Annual Infiltration Volume Post-Development

Pre-development Infiltration (m^3/yr)	Post-Development Infiltration (m^3/yr)	Difference	% Difference
47,300	52,600 (with conveyance)	+5,300	+11%
	68,900 (with end-of-pipe)	+21,600	+46%

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. As shown in Table 6, much of the precipitation falling on the site is removed from the water cycle through evaporation and transpiration through the crops. By promoting infiltration of clean water in the development scenario, an increase of 11-46% in post-development infiltration is predicted, meaning groundwater recharge will be improved and therefore the groundwater discharge to wetlands and Beaver Creek may increase.

One of the items requested to be addressed in this water balance analysis is the potential to 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 pre-development monitoring is continuously recording data and therefore does capture seasonal variations and will be used as a baseline to compare to the post-development condition to indicate any changes that cannot be explained by weather, such as drought.

The NWSSS included modelling for water balance and concluded that the proposed SWM measures could/would maintain existing groundwater recharge post-development (with infiltration predicted to increase by 20% or more, due to the loss of evaporation and transpiration components). It is expected that if the assumptions of the modelling have not changed, then further modelling is not required and the outcome will not change. The water balance summary in Table 9 shows that the proposal concurs with the NWSSS predications on an annual basis. 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. Stantec will continue the groundwater monitoring program as outlined in their Terms of Reference dated July 6, 2016 (Stantec 2016b). Stantec's future hydrogeological report will include "*a review of pre- and post-development water balance to evaluate potential land use change impacts to groundwater recharge function of the Site including evaluation of proposed measure to be employed throughout the Site under the post-development condition in order to mitigate these impacts. The purpose will be to confirm that the water balance conforms to the requirements of the Subwatershed study*." In this manner, 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 groundwater monitoring program during and post-development to compare to baseline monitoring to identify any changes that may be related to the development.

5.4.4 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. Impacts to in-stream water temperature 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 (2016) including pre-treatment, treatment and enhancement. The measures prescribed include:

- Pre-treatment – downspouts and or parking lot drainage are to be directed to grass areas wherever possible grassed swales
- Treatment – the proposed stormwater management pond includes a sediment forebay to capture and settle fine sediments in runoff water

- Enhancement – the proposed stormwater management pond includes a wetland to provide extended detention to enhance water quality.
- In addition, the outflow of the constructed wetland is to a grassed level spreader located in the outer 15m of the buffer to the wetland. This spreader will convert a point source discharge to a sheet flow promoting infiltration and further improving water quality and temperature.

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

5.4.5 Erosion of Watercourses

Erosion potential of Beaver Creek is addressed in the NWSSS. Under the existing condition, runoff from agricultural fields into Beaver Creek has potential to create erosive forces detrimental to the creek channel stability. The stormwater management strategy achieves the targets for peak flows thereby eliminating the potential for creek erosion.

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

5.4.6 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 a number of recommendations regarding construction staging and site erosion and sedimentation control in their report (2016) which includes consideration of best management practices listed in the NWSSS 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. Measures such as silt ponds, silt fencing and construction staging are utilized. Elements that will form part of the E&S plan for this subdivision will include: E&S

fencing at grading limits, preventing sedimentation in adjacent natural features; temporary rock check dams in swales; timely re-vegetation of exposed soils; and regular site inspection, maintenance and reporting to ensure the controls are working properly.

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

5.4.7 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.

Mitigation: 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 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: 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.

5.6 Enhancement of Natural Features

A basis for ecological enhancements in the study area is provided in the NWSSS 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 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 7). 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.

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 (*Agrilus planipennis*) (EAB), within southern Ontario, the use of ash trees (*Fraxinus ssp.*) 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.

5.6.2 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.

5.6.3 Invasive Species Removal

Stands of White Poplar (*Populus alba*) 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 Phragmites stands through herbicide application should be considered, if possible.

Invasive species, such as Garlic Mustard (*Alliaria petiolata*) and Glossy Buckthorn (*Frangula alnus*) 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), and appear to be recently established (i.e. within past 5 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.

5.6.4 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. The draft plan shows the park block extending to the 15m buffer limit of the wetland but this land use has low potential for impacts to the surrounding natural features. Given the open “green” space associated with the park and stormwater management pond, opportunities are provided

for wildlife use of the lands as habitat and foraging, as well as for travel through to the adjacent habitats in the area.

The school block and trail are areas which will remain semi open and together with the park provide opportunities for ecological enhancements such as plantings, water retention and infiltration.

5.6.5 Ecological Linkage

As described in the EA for the improvements to Conservation Drive prepared by Stantec (2015) 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 2015). The details of these enhancements will be considered and undertaken by others.

6.0 Monitoring Plan

6.1 Pre-Construction Monitoring (Stage I)

The pre-construction monitoring program has been carried out for the past 3 years (2014, 2015 and 2016) 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) and was revised and updated based on comments received from the City of Waterloo, Grand River Conservation Authority (GRCA), and the Region of Waterloo as well as results of the Species At Risk (SAR) screening, prepared separately, which was reviewed and approved by MNRF on December 15, 2014.

The results of the first two years of pre-construction monitoring have been combined and reported by NRSI (2016), while the 2016 monitoring is ongoing. Stantec is reporting on the surface water and groundwater monitoring programs separately. 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 2017.

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 sediment and erosion control measures as well as 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 and will be prepared in accordance with the City of Waterloo's Development Monitoring Protocol (1999). NRSI will continue the biological monitoring program and Stantec will

continue the surface water and groundwater monitoring program. The details of during construction biological monitoring program will be refined following the outcome of this EIS, but are anticipated to follow the same terms of reference as the pre-construction monitoring. The pre-construction monitoring program details are provided in the *North Waterloo Subwatershed Lands Pre-Construction Biological Monitoring Program 2014-2015 Report* prepared by NRSI (2016). Stormwater management monitoring and surface and groundwater monitoring recommendations are provided by Meritech and Stantec separately in their reports. The results of the monitoring will be reported annually to the City 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.
- Ground water 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 – one benthic invertebrate sample during the year (fall), every three years;

- Terrestrial habitat - confirmation of vegetation community condition twice per year, every three years.

- Stormwater Management Facilities. Infiltration trenches/galleries and soak away pits on public property are to be inspection with 24 hours after a rainfall event to document the existence of water in the system and 72 hours after to show the water left the system. This should be done a minimum once annually and in the late spring to late fall months. Depth of the wetland and forebay cells should be recorded at the same time as the infiltration trenches, after a rainfall event plus one dry weather event to record the permanent pool level.
- 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 and the GRCA, being submitted on their own schedules which range from annually to every three years.

7.0 Summary and Recommendations

This EIS builds on the characterization of natural features presented in the NWSSS (Ecoplans et al 2013), and incorporates the findings of the two 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 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 to a lesser extent. 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 Class EA. Beaver Creek is a coolwater/warmwater stream that flows through the wetland but off-site to the west, draining to Laurel Creek, the reservoir and eventually the Grand River.

The NWSSS 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 provides a variable width buffer between the natural feature and the developed portions of the subject lands. Reduced buffers are proposed in some locations for the placement of stormwater management facilities, parks and grading/transition to residential lots, resulting in a total encroachment into the 30m buffer of 0.25ha. 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 in

areas where the width has been reduced adjacent to residential lots. Rear lot fencing, a designated trail system and homeowner education are further methods of mitigating the potential for impacts due to residents.

A stormwater management report has been prepared by Meritech that meets the design objectives for water quantity and water quality control resulting from development of the site. The storm 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 with all infrastructure and grading outside of the wetland and a minimum 15m buffer. 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 design which incorporates a mix of lot-level, conveyance and end of pipe techniques and facilities to maintain and enhance infiltration occurring on-site. Post-development infiltration is expected to exceed pre-development infiltration 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 post-construction monitoring program has been provided which includes biological, surface water and groundwater monitoring as well as 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 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 development 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 stormater 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., North Waterloo

Study Area and Natural Features

Legend

- Subject Property
- Primary Road
- Secondary Road
- Watercourse
- ESPA #80 (Laurel Creek Forest, Region of Waterloo)
- Provincially Significant Wetland (PSW)
- Other Wetland (Non-PSW)

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Aquatic, Terrestrial and Wetland Biologists

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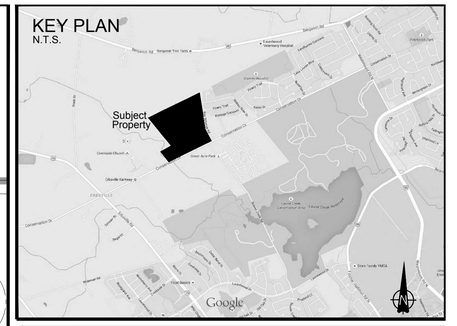
Project: 1506
Date: April 18, 2016

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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)	1-258	258	8.62
Street Townhouses	259-301, 414-478	108	2.22
Back-to-Back Townhouses	302-413	112	1.14
School	479		2.88
Park	480		1.22
Parkette	481-483		0.12
Open Space	484-486		4.75
Stormwater Management	487		1.06
Trail	488		0.31
Walkway	489-492		0.07
Road Widening	493		0.20
0.3m Reserve	494-496		0.00
Roads			6.05
Total		478	28.64

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.

OWNER _____ 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.

SURVEYOR _____ DATE _____

NOTE:

ROAD WIDENING ALONG CONSERVATION DRIVE AND BEAVER CREEK ROAD ROUNDABOUT LIMITS ARE TO BE DETERMINED

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

REVISIONS
February 1, 2016
March 3, 2016
March 30, 2016
May 2, 2016

Date: July 29, 2015 | Drawn By: S.L. | Dwg. File Name: dp09009h.dwg
Scale: 1:1250 metric | Project No.: 09009.40



Map 3

2115881 Ontario Ltd., North Waterloo

Vegetation Communities and Significant Plant Species

Legend

- Subject Property
- Flagged Wetland Boundary (MNRF and GRCA confirmed September 2015)
- NRSI Flagged Wetland Boundary (GRCA confirmed November 17, 2015)
- 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*)

- Ecological Land Classification (ELC)

(FOD7) Fresh-Moist Lowland Deciduous Forest

(FOD8-1) Fresh-Moist Poplar Deciduous Forest

(HR2) Deciduous Hedgerow

(SWDO3) Organic Deciduous Swamp Ecosite

(SWM4-1) White Cedar Organic Mixed Swamp Ecosite

(SWM6-1) Yellow Birch-Conifer Organic Mixed Swamp

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Project: 1506
Date: April 21, 2016

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

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Map 4

2115881 Ontario Ltd., North Waterloo

Biological Monitoring Locations



Legend

- Subject Property
- Photo Vegetation Plot Station Location
- Watercourse

Biological Monitoring (NRSI)

- Vegetation Station (VEG)
- Common Nighthawk Station (CNH)
- Anuran Call Station (ANR)
- Wildlife Survey Unit (Approx)
- Road Mortality Monitoring (MMM Group)

Path: X:\1506_Cook_Homes_North_Waterloo_EIS_and_Monitoring\NRSI_1506_Map4_MonitoringStations_4K_2016_04_21_AWR.mxd

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Project: 1531A
Date: April 21, 2016

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

0 50 100 150 200 Metres



Map 5

2115881 Ontario Ltd., North Waterloo

Wildlife Findings and Significant Habitats

Legend

- Subject Property
- Watercourse
- Candidate Bat Habitat

Significant Wildlife Habitat

- Amphibian Breeding Habitat - Woodland
- Seeps and Springs
- Special Concern and Rare Wildlife Species

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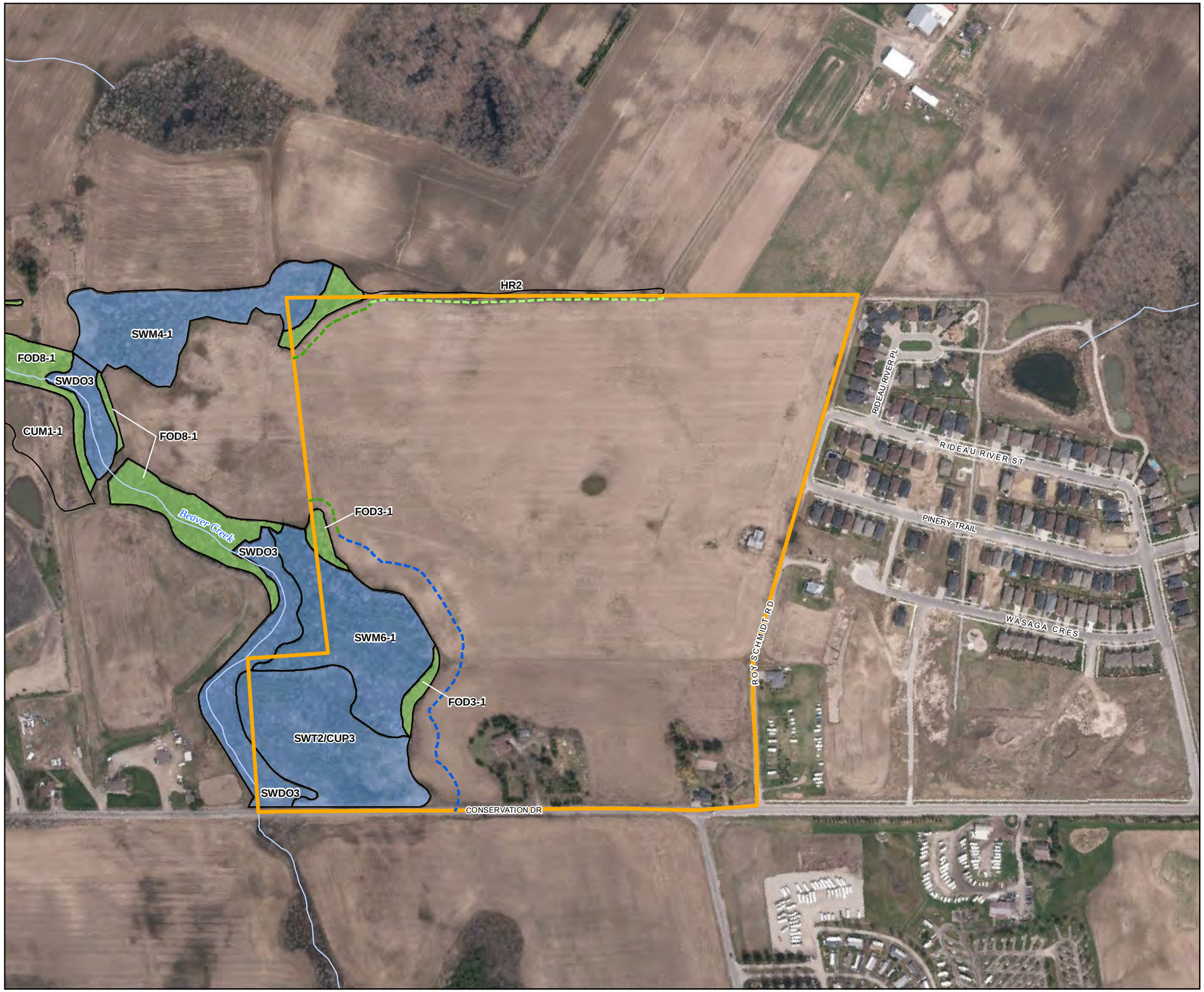
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Project: 1506
Date: April 21, 2016

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

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Map 6

2115881 Ontario Ltd., North Waterloo

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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Project: 1506
Date: April 25, 2016

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

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Map 7

2115881 Ontario Ltd., North Waterloo

Stewardship Plan

Legend

- Subject Property
- Watercourse
- Proposed Development
- Ecological Linkage
- Significant Natural Features
- Buffers to be Naturalized
- SWM to be Naturalized
- Park (Open Space)
- School & Trail (semi-open space)
- Invasive Species Management

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Project: 1506 Date: June 24, 2016	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

March 1, 2016 Project No. 1506

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: 2115881 Ontario Limited, North Waterloo
Environmental Impact Study - Terms of Reference

Natural Resource Solutions Inc. (NRSI) has been retained as part of a team by 2115881 Ontario Limited to prepare an Environmental Impact Study (EIS) for the proposed development of the above noted property located on Conservation Drive in north Waterloo, Ontario. The City of Waterloo formally refers to this area as the Beaver Creek Meadows District. An EIS is required as the lands contain woodlands, watercourses and provincially significant wetlands which are designated and protected as:

- Core Environmental Features in the Region of Waterloo's Official Plan (2015),
- Core Natural Features, and Supporting Natural Features in the City of Waterloo's Official Plan (2014),
- Wetlands and watercourses in GRCA's Policies (2013).

In addition, the lands contain known and potential habitat for Species At Risk (SAR). These species and their habitat are protected under the *Endangered Species Act* through the Ministry of Natural Resources and Forestry (MNRF).

The EIS will be prepared in collaboration with the study team which includes NRSI (biology), Meritech (engineering and stormwater management), GSP Group (planning) and Stantec (surface and groundwater monitoring). The natural features have been well studied through the North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013) and two years of pre-construction biological monitoring completed by NRSI as per the City of Waterloo's Development Monitoring Protocol (1999). Pre-construction surface water and groundwater monitoring has been completed by Stantec.

This Terms of Reference (TOR) has been prepared in accordance with the City of Waterloo Official Plan, Region of Waterloo Official Plan, Greenlands Network Implementation Guidelines, Sections 15 to 17 of the North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013), GRCA EIS Guidelines (2005) and consultation with the MNRF. The details of the TOR are attached for your review and comment. Please feel free to contact me if you have any questions or comments.

Sincerely,
Natural Resource Solutions Inc.

Elaine Gosnell

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

2115881 Ontario Limited, North Waterloo
Environmental Impact Study Terms of Reference
March 1, 2016

Introduction

The subject property is approximately 21.77ha in area and is bounded to the south by Conservation Drive, an existing residential development and Roy Schmidt Road to the east, agricultural fields and natural features to the west and north (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. Beaver Creek is identified as a Supporting Natural Feature in the City of Waterloo's Official Plan (2014).

Proposed Undertaking

The proposed development is a mixed use neighbourhood including an internal road network, a mixture of residential density types, an elementary school, stormwater management, trails and parkland as shown on Map 2. The development plan follows the land use structure of the Beaver Creek Meadows District Plan (TPP 2015, approved by City Council January 25, 2016).

Characterization of Natural Features

The natural features have been well studied through the North Waterloo Scoped Subwatershed Study (Ecoplans et al. 2013) and two years of pre-construction biological monitoring completed by NRSI as per the City of Waterloo's Development Monitoring Protocol (1999). Two years of pre-construction surface and groundwater monitoring has been completed by Stantec. For details of the pre-construction monitoring programs please refer to the Terms of Reference prepared for that study (NRSI 2015).

The natural features on the subject property will be characterized based on the background information in the NWSSS and the pre-construction monitoring reports. The EIS will refer to the data in the existing reports but will provide a summary of site conditions. The following key components will be included in the site characterization:

- Summary of and mapping of vegetation communities using the Ecological Land Classification system for southern Ontario,
- Plant and wildlife species diversity and habitats,
- There have been minimal changes to the wetland boundaries and Core Environmental Feature boundaries as identified in the NWSSS on the subject property. Wetland boundaries were reviewed and updated within the northwest corner of the subject property with GRCA staff on November 17, 2015. These updated boundaries will be shown on all EIS mapping;
- Summary of wildlife species known to use the site including birds, mammals, reptiles and amphibians,
- Description of aquatic habitat, fish and benthic communities in Beaver Creek,
- Key findings of the surface water and groundwater monitoring.

Species At Risk (SAR) and Species of Conservation Concern (SCC) Screening

A SAR and SCC screening was completed by comparing the habitat requirements for significant species that are known from the vicinity of the study area (i.e. within Waterloo Region) against the ELC communities and habitats within the subject property. This comparison allowed it to be

determined which species have potential to occur within the subject property, and identify those species with potential to be impacted by the proposed undertaking.
Species which could be present within the immediate vicinity of the proposed development and are thought to have potential to be impacted by the proposed undertaking were surveyed for including butternut, barn swallow, common nighthawk, wood thrush, Eastern wood-pewee, chorus frog, Blanding's turtle and snapping turtle as well as potential roosting sites for SAR bats. Surveys were carried out according to MNRF guidance. This screening was provided to MNRF in July 2014 and was agreed to (Buck, pers. comm. 2014). American badger (Endangered) was surveyed for in the NWSSS with no sightings or evidence found. Recently MNRF has requested targeted den surveys on-site for American badger, as time has passed since the NWSSS badger surveys (2010-2011) and this species has potential to move into the site.

Functional Analysis
The findings of the ecological, hydrological, hydrogeological studies will be compiled to provide an understanding of the interactions between the biological and physical environment. The processes contributing to the maintenance of the natural features and their functions will be discussed at the subject property scale, referring to the subwatershed study for landscape level context. This description will take 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. As provided in Section 17.0 of the NWSSS, this analysis will include the discussion of the following:

- Quality and sensitivity of terrestrial, aquatic and wetland ecosystems,
- Species at Risk and other significant species at the local, provincial and national level. The subject property includes known Category 2 and Category 3 habitats for Blanding's turtle, which are afforded protection under the *Endangered Species Act* (2007). An Information Gathering Form (IGF) for Blanding's turtle will be completed and submitted to the MNRF for review when more information on the proposed development becomes available.
- Significant wildlife habitat according to the MNRF's Significant Wildlife Habitat Technical Guide (MNRF 2000) and Ecoregion 6E criteria (MNRF 2015),
- Ecological linkage associated with the Conservation Drive crossing of Beaver Creek. Any linkage enhancements will be recommended in corroboration with the detailed design of eco-passage features in the Class Environmental Assessment for Conservation Drive (Stantec 2015; approved by City Council January 25, 2016).
- Stormwater impacts on wetland water balance will be assessed,
- Physical constraints i.e. floodplain, top of bank, etc.,
- Ecological enhancements will be recommended such as buffer management, habitat creation and linkage enhancements,
- Setbacks and buffer management. Minimum development setbacks are recommended in the subwatershed study (Section 14.2), to be confirmed or adjusted as may be appropriate through the EIS. Avoidance of the Core Natural Features and recommended setbacks is recommended wherever possible, and options to minimize encroachment into these areas will be discussed with the landowner and study team. Additional guidance for development setbacks adjacent to Core Natural Features is provided in Section 8.2.4(9) in the City of Waterloo's Official Plan (2014). Similarly, guidance for development setbacks adjacent to Supporting Natural Features is provided in Section 8.2.5 of the OP (2014). Setbacks will take into account the potential for "averaging" (minor deviations from the recommended minimum distance), specific site

conditions, the type of adjacent development, and the need for infrastructure, trails, SWM facilities and grading within the buffer. The management approach for the buffer lands will be finalized considering fencing or other barriers/boundary treatment, signage location and details, planting plans/vegetation management (i.e. invasive species control); and target habitat creation.

Assessment of Potential Impacts

The analysis of impacts will be divided into:

- Direct impacts 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.
- Induced impacts associated with impacts after the development is constructed such as subsequent demand on the resources created by habitation/use of the area and vicinity.

The EIS will make recommendations to avoid, change, minimize and mitigate potential impacts.

Direct Impacts

The identification and delineation of core natural features will be used to avoid direct impacts from the development on important natural features. No direct impacts to significant natural features are anticipated and therefore the EIS will focus on analysing and avoiding indirect and induced impacts.

Indirect Impacts

The analysis of potential indirect impacts is anticipated to include the following:

Encroachment into Buffers

It is anticipated that there may be small areas where encroachment into the NWSSS recommended buffer width occurs. These will be identified and mitigation measures including buffer management (i.e. fencing, planting) will be determined.

Changes to groundwater and surface water flow patterns

This section of the impact analysis will focus on the potential changes to the flow patterns, quality and quantity of groundwater and surface water flows that currently supply wetlands and Beaver Creek. This section will include information from the Stormwater Management Strategy and a wetland water balance analysis. The development is anticipated to be designed in a manner using storm water management and Low Impact Development (LID) measures such that pre-development surface and groundwater patterns will be maintained in the post-development scenario. The maintenance of pre-development surface water and groundwater infiltration pattern and rates will be key to maintaining the water balance in the on-site wetlands. During and post-development monitoring data will be analyzed on a monthly or seasonal basis.

Sedimentation and erosion

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 will be developed.

Indirect impacts to wildlife habitat
Indirect impacts to wildlife can occur during construction due to the increased noise, dust and human activity on the site, but are generally temporary in duration.

Induced Impacts
Induced impacts are described as those that are not directly related to the construction of the proposed development, but rather arise as a result of the use of the natural areas or pressure on them following the development. In this case, potential induced impacts could include increased use of the natural features and buffers by residents, both authorized use (i.e. trails) and unauthorized (i.e. dumping).

Recommendations for Restoration and Enhancement
A basis for ecological enhancements in the study area is provided in the NWSSS 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 will be provided using the general objectives provided in the NWSSS but tailored to the site conditions, species and habitats present and opportunities within the development plan and will be shown on a Stewardship Management Plan.

Monitoring
Pre-construction monitoring will continue until the start of construction (i.e. site grading) as per the City of Waterloo Development Monitoring Protocol (1999). Recommendations will be provided in the EIS for during- and post-construction monitoring of biological features, surface water and groundwater, mitigation measures and compliance, as per the City's protocol. The basics of the during- and post-construction monitoring plan will be prepared during the EIS and may include the installation of piezometers to assist in the monitoring of wetland water balance. During and post-construction monitoring data related to wetland water balance will be analyzed on a monthly/seasonal basis. Prior to the initiation of the during-construction phase, the pre-construction monitoring methods will be revised to incorporate the recommendations of the EIS and the new components related to stormwater management and erosion and sediment control. The study design of the pre-construction monitoring plan will be replicated to provide consistency between the pre-, during- and post-construction monitoring plan. Further details of the monitoring program will be refined at the detailed design stage and will be provided in a TOR for agency review and approval at that time.

Recommendations and Conclusions
A summary of the findings, conclusions and recommendations in the EIS will be provided.

Reporting
The EIS report will be prepared in digital and hard copy format including appropriate mapping (study area, existing conditions, monitoring locations, development plan and stewardship plan) and appendices (final TOR, species lists, pertinent agency correspondence, analysis tables, etc.).

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Region of Waterloo. 2010. Region of Waterloo Greenlands Network Implementation Guideline. January 26, 2010.

Stantec Consulting Ltd. 2015. Beaver Creek Road and Conservation Dr. Upgrades and Extension of Municipal Services Class Environmental Assessment. Prepared for the City of Waterloo. December 14, 2015.

The Planning Partnership. 2015. City of Waterloo Beaver Creek Meadows District Plan. January 8, 2015.

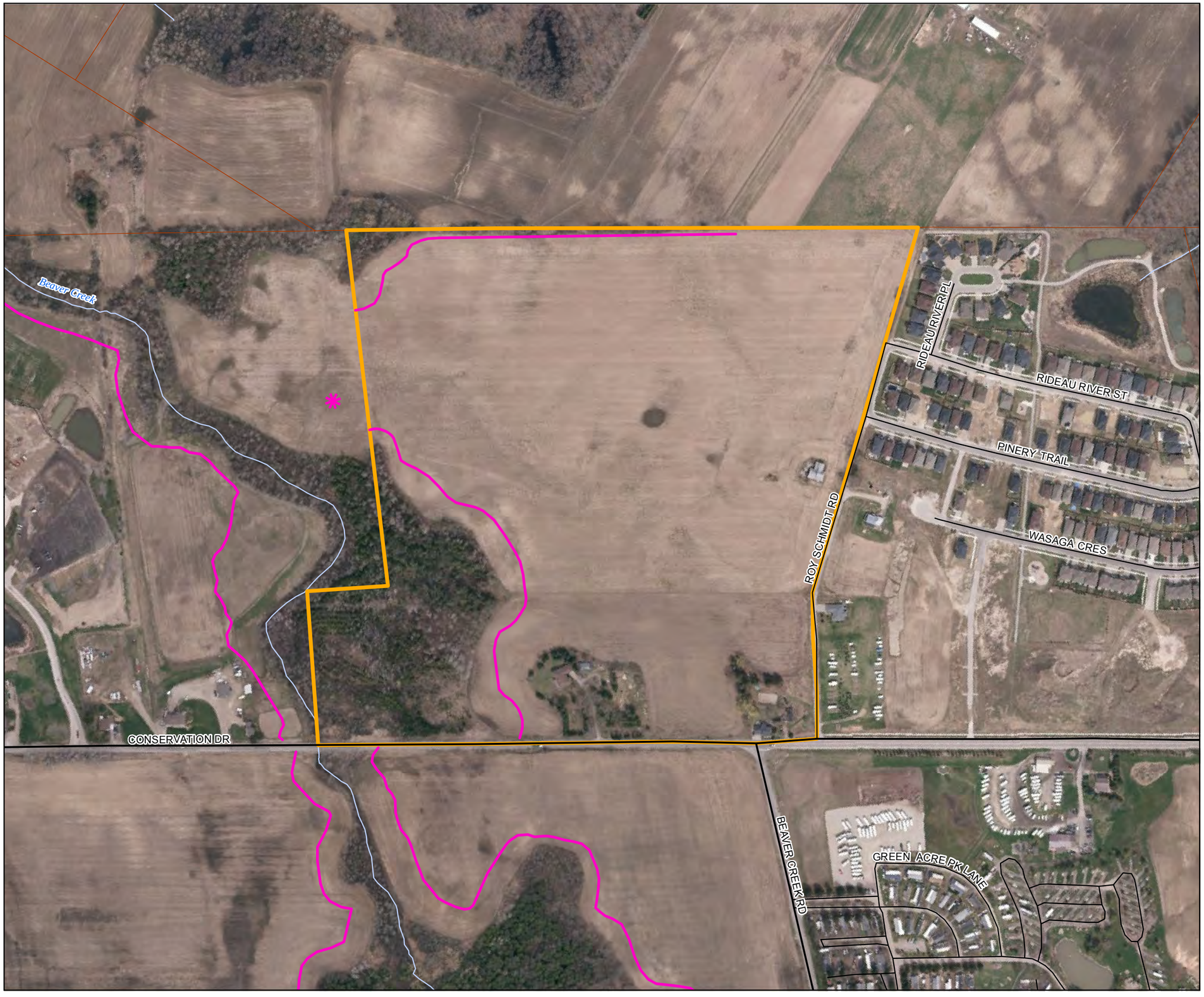
Authorities Consulted

Buck, Graham. 2014. Management Biologist, Ministry of Natural Resources and Forestry, Guelph District. Personal Communication (e-mail correspondence to Andrew Dean), December 15, 2014.

Map 1

2115881 Ontario Limited, North Waterloo, Environmental Impact Study

Study Area



Legend

- Subject Property
- Natural Heritage System (NWSSS 2013)*
- Lot Boundary (OLIW)
- Primary Road
- Secondary Road
- Watercourse
- **The NHS limits on this property are under review**

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Aquatic, Terrestrial and Wetland Biologists

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Project: 1506 Date: October 27, 2015	NAD83 - UTM Zone 17 Size: 11x17" **1:4,000**

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PART 1, PLAN 58R-- 1190
LOT 30, G.C.T.

(40 FEET WIDE) (NOT TRAVELLED) (OPENED BY BY-LAW NO. 15, DATED JUNE 13, 1851, COURT HOUSE OF GUELPH)

L O T 2 5

Township of Woolwich
City of Waterloo

N63°12'40"E 199.525 N63°55'40"E 249.428 N63°50'00"E 183.448

Township of Woolwich
City of Waterloo

Block Open Space 0.44ha.

Block Park 0.23ha.

Block Trail 0.31ha.

Block Walkway 0.02ha.

Block Walkway 0.02ha.

Wetland Limit

30m Wetland Buffer

Wetland

Beaver

Beaver Creek

Floodline

Wetland Limit

30m Wetland Buffer

Block Future Development 0.13ha.

Temporary Turning Circle

Block Future Development 0.01ha.

Block Stormwater Management 0.97ha.

Block Park 1.33ha.

Block Open Space 3.84ha.

Block 4.95m Road Widening 0.21ha.

Block School 2.85ha.

Block Future Development 0.36ha.

Street 'A'
Street 'B'
Street 'D'
Street 'E'
Street 'F'
Street 'G'
Street 'H'

Rideau River Street
Rideau River Place
Pinery Trail
Roy Schmidt Road
Kawartha Street
Conservation Drive
Beaver Creek Road

Storm Water Management

INST. NO. 1497753
EXCEPT INST. NST. 1497464
PART 1, PLAN 58R-8414

Approximate Future Roundabout

N63°33'50"E 242.4

N61°00'00"E 135.490

N38°25'30"W 184.072

N63°33'50"E 479.520

N63°51'55"E 50.380

N26°02'25"W 150.494

N07°40'00"W 238.950

N39°30'25"W 184.1

N63°40'10"W 184.1

KEY PLAN
N.T.S.

Subject Property

Google

DRAFT PLAN OF SUBDIVISION

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

Preliminary

LAND USE SCHEDULE

DESCRIPTION	LOTS/BLKS.	UNITS	AREA (ha.)
Residential (single detached)	□□	□□	□□
Street Townhouses	□□	□□	□□
Back-to-Back Townhouses	□□	□□	□□
School	□□		□□
Park	□□		□□
Open Space	□□		□□
Stormwater Management	□□		□□
Trail	□□		□□
Walkway	□□		□□
Road Widening	□□		□□
Roads			□□
Total		□□	28.64

Preliminary

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.

OWNER _____ 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.

SURVEYOR _____ DATE _____

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

REVISIONS
November 18, 2015

Date: July 29, 2015 | Drawn By: S.L. | Dwg. File Name: dp09009a.dwg
Scale: 1:1250 metric | Project No.: 09009.40

APPENDIX II

Vegetation Species Observed by Monitoring Plot (2014 – 2015)

Vascular Flora Species Reported From the Subject Property

Scientific Name	Common Name	SRANK[1]	Waterloo Region[2]	NHIC Data[3]	NRSI Observations	
					VEG-001 (SWT2/CUP3)	VEG-002 (SWM6-1)
Pteridophytes	**Ferns & Allies**					
Dryopteridaceae	**Wood Fern Family**					
Athyrium filix-femina var. angustum	Northern Lady Fern	S5				X
Dryopteris carthusiana	Spinulose Wood Fern	S5				X
Dryopteris cristata	Crested Wood Fern	S5				X
Onoclea sensibilis	Sensitive Fern	S5				X
Polystichum braunii	Braun's Holly Fern	S3	R	X		
Equisetaceae	**Horsetail Family**					
Equisetum arvense	Field Horsetail	S5			X	
Equisetum pratense	Meadow Horsetail	S5	R*			X
Osmundaceae	**Royal Fern Family**					
Osmunda cinnamomea	Cinnamon Fern	S5				X
Osmunda regalis var. spectabilis	American Royal Fern	S5				X
Thelypteridaceae	**Beech Fern Family**					
Phegopteris connectilis	Northern Long Beech Fern	S5	R			X
Thelypteris palustris var. pubescens	Marsh Fern	S5				X
Gymnosperms	**Conifers**					
Cupressaceae	**Cypress Family**					
Thuja occidentalis	White Cedar	S5			X	X
Pinaceae	**Pine Family**					
Larix laricina	Tamarack	S5				X
Picea abies	Norway Spruce	SE3			X	
Picea glauca	White Spruce	S5	R+		X	
Apiaceae	**Carrot or Parsley Family**					
Daucus carota	Wild Carrot	SE5			X	
Apocynaceae	**Dogbane Family**					
Apocynum cannabinum var. cannabinum	Indian Hemp	S5			X	

Scientific Name	Common Name	SRANK[1]	Waterloo Region[2]	NHIC Data[3]	NRSI Observations	
					VEG-001 (SWT2/CUP3)	VEG-002 (SWM6-1)
Asteraceae	**Composite or Aster Family**					
Erigeron philadelphicus ssp. philadelphicus	Philadelphia Fleabane	S5			X	
Eupatorium maculatum ssp. maculatum	Spotted Joe-pye-weed	S5			X	X
Euthamia graminifolia	Flat-topped Bushy Goldenrod	S5			X	
Hieracium caespitosum ssp. caespitosum	Field Hawkweed	SE5			X	
Rudbeckia hirta	Black-eyed Susan	S5			X	
Solidago altissima var. altissima	Tall Goldenrod	S5			X	
Solidago patula	Rough-leaved Goldenrod	S5				X
Solidago rugosa ssp. rugosa	Rough Goldenrod	S5			X	X
Symphyotrichum lanceolatum	Panicled Aster	S5			X	
Symphyotrichum lateriflorum var. lateriflorum	Calico Aster	S5			X	
Symphyotrichum novae-angliae	New England Aster	S5			X	
Symphyotrichum puniceum	Purple-stemmed Aster	S5				X
Taraxacum officinale	Common Dandelion	SE5			X	
Tussilago farfara	Coltsfoot	SE5			X	
Balsaminaceae	**Touch-me-not Family**					
Impatiens capensis	Spotted Touch-me-not	S5				X
Impatiens pallida	Pale Touch-me-not	S5				X
Betulaceae	**Birch Family**					
Betula alleghaniensis	Yellow Birch	S5				X
Boraginaceae	**Borage Family**					
Lithospermum latifolium	American Gromwell	S3	R	X		
Campanulaceae	**Bellflower Family**					
Lobelia siphilitica	Great Lobelia	S5				X
Caprifoliaceae	**Honeysuckle Family**					
Lonicera tatarica	Tartarian Honeysuckle	SE5			X	
Sambucus canadensis	Common Elderberry	S5				X
Cornaceae	**Dogwood Family**					
Cornus alternifolia	Alternate-leaved Dogwood	S5				X

Scientific Name	Common Name	SRANK[1]	Waterloo Region[2]	NHIC Data[3]	NRSI Observations	
					VEG-001 (SWT2/CUP3)	VEG-002 (SWM6-1)
Cornus amomum ssp. obliqua	Silky Dogwood	S5			X	X
Cornus stolonifera	Red-osier Dogwood	S5			X	X
Cucurbitaceae	**Gourd Family**					
Echinocystis lobata	Prickly Cucumber	S5			X	
Fabaceae	**Pea Family**					
Amphicarpaea bracteata	Hog Peanut	S5				X
Medicago lupulina	Black Medick	SE5			X	
Melilotus alba	White Sweet-clover	SE5			X	
Vicia caroliniana	Carolina Vetch	S2	R	X		
Vicia cracca	Tufted Vetch	SE5			X	
Grossulariaceae	**Currant Family**					
Ribes rubrum	Red Currant	SE5			X	
Ribes triste	Wild Red Currant	S5				X
Juglandaceae	**Walnut Family**					
Juglans nigra	Black Walnut	S4	R+*		X	
Lamiaceae	**Mint Family**					
Clinopodium vulgare	Wild Basil	S5			X	
Monarda didyma	Oswego-tea	S3	R+	X		
Prunella vulgaris ssp. lanceolata	Heal-all	S5				X
Oleaceae	**Olive Family**					
Fraxinus pennsylvanica	Green Ash	S5			X	
Onagraceae	**Evening-primrose Family**					
Circaea alpina	Smaller Enchanter's Nightshade	S5				X
Polemoniaceae	**Phlox Family**					
Phlox subulata ssp. subulata	Moss Phlox	S1?		X		
Primulaceae	**Primrose Family**					
Lysimachia ciliata	Fringed Loosestrife	S5			X	X

Scientific Name	Common Name	SRANK[1]	Waterloo Region[2]	NHIC Data[3]	NRSI Observations	
					VEG-001 (SWT2/CUP3)	VEG-002 (SWM6-1)
Ranunculaceae	**Buttercup Family**					
Actaea pachypoda	White Baneberry	S5				X
Ranunculus acris	Tall Buttercup	SE5			X	
Ranunculus hispidus var. caricetorum	Swamp Buttercup	S5				X
Ranunculus recurvatus var. recurvatus	Hooked Buttercup	S5			X	
Rhamnaceae	**Buckthorn Family**					
Rhamnus cathartica	Common Buckthorn	SE5			X	
Frangula alnus	Glossy Buckthorn	SE5			X	
Rosaceae	**Rose Family**					
Agrimonia gryposepala	Tall Hairy Agrimony	S5			X	
Amelanchier laevis	Smooth Juneberry	S5			X	
Fragaria virginiana	Wild Strawberry	S5			X	
Geum aleppicum	Yellow Avens	S5				X
Geum canadense	White Avens	S5				X
Geum rivale	Purple Avens	S5				X
Prunus serotina	Black Cherry	S5				X
Prunus virginiana ssp. virginiana	Choke Cherry	S5				X
Rubus idaeus ssp. melanolasius	Wild Red Raspberry	S5				X
Rubus pubescens	Dwarf Raspberry	S5				X
Rubiaceae	**Madder Family**					
Galium aparine	Cleavers	S5				X
Galium mollugo	White Bedstraw	SE5			X	
Galium palustre	Marsh Bedstraw	S5				X
Salicaceae	**Willow Family**					
Populus balsamifera ssp. balsamifera	Balsam Poplar	S5			X	
Populus tremuloides	Trembling Aspen	S5			X	
Salix bebbiana	Long-beaked Willow	S5			X	
Salix discolor	Pussy Willow	S5			X	
Salix eriocephala	Heart-leaved Willow	S5			X	
Saxifragaceae	**Saxifrage Family**					

Scientific Name	Common Name	SRANK[1]	Waterloo Region[2]	NHIC Data[3]	NRSI Observations	
					VEG-001 (SWT2/CUP3)	VEG-002 (SWM6-1)
Mitella nuda	Naked Mitrewort	S5				X
Tiarella cordifolia	False Mitrewort	S5				X
Scrophulariaceae	**Figwort Family**					
Chelone glabra	Turtlehead	S5				X
Solanaceae	**Nightshade Family**					
Solanum dulcamara	Bitter Nightshade	SE5				X
Ulmaceae	**Elm Family**					
Ulmus americana	White Elm	S5			X	
Vitaceae	**Grape Family**					
Parthenocissus vitacea	Woodbine	S5			X	X
Vitis riparia	Riverbank Grape	S5			X	
Dicotyledons	**Dicots**					
Araceae	**Arum Family**					
Arisaema triphyllum	Jack-in-the-pulpit	S5				X
Cyperaceae	**Sedge Family**					
Carex albicans var. albicans	Closely-covered Sedge	S3	R#	X		
Carex aurea	Golden-fruited Sedge	S5			X	
Carex bebbii	Bebb's Sedge	S5			X	
Carex flava	Yellow Sedge	S5				X
Carex gracillima	Graceful Sedge	S5			X	
Carex granularis	Meadow Sedge	S5			X	
Carex hystericina	Porcupine Sedge	S5				X
Carex lacustris	Lake-bank Sedge	S5				X
Carex rosea	Stellate Sedge	S5			X	
Carex utriculata	Beaked Sedge	S5				X
Schoenoplectus tabernaemontani	American Great Bulrush	S5				X
Scirpus atrovirens	Dark-green Bulrush	S5			X	
Juncaceae	**Rush Family**					
Juncus dudleyi	Dudley's Rush	S5			X	

Scientific Name	Common Name	SRANK[1]	Waterloo Region[2]	NHIC Data[3]	NRSI Observations	
					VEG-001 (SWT2/CUP3)	VEG-002 (SWM6-1)
Liliaceae	**Lily Family**					
Maianthemum canadense	Wild Lily-of-the-valley	S5				X
Maianthemum stellatum	Star-flowered Solomon's Seal	S5			X	X
Orchidaceae	**Orchid Family**					
Epipactis helleborine	Common Helleborine	SE5			X	
Poaceae	**Grass Family**					
Agrostis gigantea	Redtop	SE5			X	X
Dichanthelium acuminatum var. acuminatum	Acuminate Panic Grass	S5			X	
Glyceria striata	Fowl Meadow Grass	S5				X
Leersia oryzoides	Rice Cut Grass	S5				X
Poa compressa	Canada Blue Grass	S5			X	
Poa pratensis ssp. pratensis	Kentucky Bluegrass	S5			X	
[1]MNRF 2015a, [2]Richardson & Martin 1999, [3]MNRF 2016		Total	**9**	**6**	**60**	**55**

LEGEND
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
S#? Rank Uncertain
Region of Waterloo
R Native, Present, Rare
+ Significant only if demonstrably indigenous
* Significant, but additional research may prove otherwise

APPENDIX III

Avifauna Observed within the Subject Property (2014 – 2015)

Avifauna Observed within Subject Lands (2014-2015)

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[4]	Region of Waterloo Status[5]	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	
Anatidae	**Ducks, Geese & Swans**						Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#	Br.Ev.	#
Branta canadensis	Canada Goose	S5					X	2	X	2			X	6			X	2	X	1		
Anas platyrhynchos	Mallard	S5					X	1					X	1			P	4			P	2
Phasianidae	**Partridges, Grouse & Turkeys**																					
Meleagris gallopavo	Wild Turkey	S5							H	1	H	1	X	2	H	1			X	1		
Ardeidae	**Herons & Bitterns**																					
Ardea herodias	Great Blue Heron	S4B				√	X	1					X	2								
Cathartidae	**Vultures**																					
Cathartes aura	Turkey Vulture	S5B				√			X	1	X	2										
Accipitridae	**Hawks, Kites, Eagles & Allies**																					
Buteo jamaicensis	Red-tailed Hawk	S5	NAR	NAR					X	1	X	1	X	2								
Charadriidae	**Plovers**																					
Charadrius vociferus	Killdeer	S5B, S5N									H	1	S	1			P	2			H	2
Laridae	**Gulls, Terns & Skimmers**																					
Larus delawarensis	Ring-billed Gull	S5B, S4N													X	1						
Columbidae	**Pigeons & Doves**																					
Columba livia	Rock Pigeon	SNA											P	3	P	4	P	6			H	2
Zenaida macroura	Mourning Dove	S5							H	1	H	1	H	1			S	1	S	2	H	2
Caprimulgidae	**Goatsuckers**																					
Chordeiles minor	Common Nighthawk	S4B	SC	T	Schedule 1	√*							T	1								
Picidae	**Woodpeckers**																					
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B				√			H	1												
Picoides pubescens	Downy Woodpecker	S5							X	1	S	1									H	1
Picoides villosus	Hairy Woodpecker	S5									P	2										
Colaptes auratus	Northern Flicker	S4B							S	1	S	2			H	1					X	1
Tyrannidae	**Tyrant Flycathers**																					
Contopus virens	Eastern Wood-Pewee	S4B	SC	SC							S	2			X	1						
Empidonax minimus	Least Flycatcher	S4B				√	S	1														
Myiarchus crinitus	Great Crested Flycatcher	S4B					S	2	S	1	T	2	X	1	S	1						
Tyrannus tyrannus	Eastern Kingbird	S4B					T	2	S	1	S	1			P	4	S	1	CF	1		
Vireonidae	**Vireos**																					
Vireo olivaceus	Red-eyed Vireo	S5B									S	2			T	1						
Corvidae	**Crows & Jays**																					
Cyanocitta cristata	Blue Jay	S5					S	2	X	1	S	2	X	3	A	1			H	1	H	1
Corvus brachyrhynchos	American Crow	S5B					H	2	H	2	A	6	P	5	FY	1	H	1	H	4	H	2
Alaudidae	**Larks**																					
Eremophila alpestris	Horned Lark	S5B					P	4	P	4	T	2	T	22	T	2	P	4	T	2	S	4
Hirundinidae	**Swallows**																					
Tachycineta bicolor	Tree Swallow	S4B							H	1	H	2	X	1	H	1					H	1
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B							H	1			X	3					X	1		
Riparia riparia	Bank Swallow	S4B	THR	T									X	1	X	3						
Hirundo rustica	Barn Swallow	S4B	THR	T							X	1	X	2	X	5	X	1				
Paridae	**Chickadees & Titmice**																					
Poecile atricapillus	Black-capped Chickadee	S5					S	3	S	4	S	1			S	1			P	6		
Sittidae	**Nuthatches**																					
Sitta carolinensis	White-breasted Nuthatch	S5																				

Certhiidae	**Creepers**																						
Troglodytidae	**Wrens**																						
Troglodytes aedon	House Wren	S5B					S	2	T	3	T	2			S	2			S	1	T	1
Turdidae	**Thrushes**																						
Sialia sialis	Eastern Bluebird	S5B	NAR	NAR		√									H	1							
Turdus migratorius	American Robin	S5B					T	2	S	2	T	3	X	7	T	2	FY	3	FY	2	CF	2
Mimidae	**Mockingbirds, Thrashers & Allies**																						
Dumetella carolinensis	Gray Catbird	S4B					T	2	S	2	P	2	X	1	T	2			S	1		
Toxostoma rufum	Brown Thrasher	S4B				√					S	3			S	2					S	1
Sturnidae	**Starlings**																						
Sturnus vulgaris	European Starling	SNA									H	1	FY	5	H	1	FY	3			H	3
Bombycillidae	**Waxwings**																						
Bombycilla cedrorum	Cedar Waxwing	S5B					P	2	P	2	P	2			H	3	S	1	P	4	S	4
Parulidae	**Wood Warblers**																						
Vermivora cyanoptera	Blue-winged Warbler	S4B				√	S	1	S	1													
Geothylpis trichas	Common Yellowthroat	S5B					S	1	S	2	S	2			S	1	S	1	S	2		
Setophaga petechia	Yellow Warbler	S5B					X	1														
Emberizidae	**New World Sparrows & Allies**																						
Spizella passerina	Chipping Sparrow	S5B					S	2	S	2	S	1					FY	2	N	3	T	9
Passerculus sandwichensis	Savannah Sparrow	S4B									S	1	S	3	S	2					S	1
Melospiza melodia	Song Sparrow	S5B					A	1	P	2	T	3	X	2	CF	2	P	3	T	2	CF	2
Cardinalidae	**Cardinals, Grosbeaks & Allies**																						
Cardinalis cardinalis	Northern Cardinal	S5					S	2	S	1	S	1			S	1	T	2	S	2	P	3
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B					T	1	T	2	T	1			P	2			S	1		
Passerina cyanea	Indigo Bunting	S4B					T	4	T	4	T	3			T	3	S	1	A	2	T	1
Icteridae	**Blackbirds**																						
Agelaius phoeniceus	Red-winged Blackbird	S4					P	5	P	5	CF	2	X	9	P	5	S	1	S	2	S	2
Quiscalus quiscula	Common Grackle	S5B					CF	6	CF	4			X	5	H	1	CF	2	H	1	X	1
Molothrus ater	Brown-headed Cowbird	S4B					H	2	H	1	H	2	X	3	H	1			T	3	H	1
Icterus galbula	Baltimore Oriole	S4B					H	1	H	1	S	3					S	1	CF	1		
Fringillidae	**Finches & Allies**																						
Carpodacus mexicanus	House Finch	SNA																			S	1
Spinus tristis	American Goldfinch	S5B					S	2	S	1	S	2	H	5	P	3	P	3	T	3	P	3
Passeridae	**Old World Sparrows**																						
Passer domesticus	House Sparrow	SNA											X	2								
						Total	27		32		35		27		32		21		24		25	

[1,2]MNRF 2015a; [3,4]Government of Canada 2015; [5]Martin 1996

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

APPENDIX IV

Anuran Monitoring Data from within the Subject Property (2014 – 2015)

Anuran Monitoring Data from within the Subject Property (2014 - 2015)

Station ANR-001		2014			2015		
Common Name	**Scientific Name**	April 21	May 15	June 19	April 16	May 25	June 16
American Toad	*Bufo americanus*	1 (2)	Nothing Heard (NRSI and Ecoplans)	Nothing Heard			Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*	3			3	2 (2)	
Tetraploid Gray Treefrog	*Hyla versicolor*					3	
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	2	0	3	3	1-2
	%Cloud Cover	60	100	20	100	20	0
	Air temp. (^{o}C)	17	11	16	9	14	18
	Water temp. (^{o}C)	N/A	12.2	N/A	5.7	N/A	18.4
	Water pH	N/A	7.7	N/A	7.5	N/A	7.6
	Precipitation	None	None	None	None	None	None

Notes:
2014
- Gray Tree Frog, Northern Leopard Frog heard across Conservation Drive and Spring Peepers heard call code 3 off site at 310 degrees (May 15).

2015
- Background noise = 3 (traffic) (April 16)
- No Common Nighthawk observed, Gray Treefrog (calling code 2) heard beyond 100m radius (June 16)

Station ANR-002		2014			2015		
Common Name	**Scientific Name**	April 21	May 15	June 19	April 16	May 25	June 16
American Toad	*Bufo americanus*	Not Surveyed by NRSI, however Ecoplans did and Nothing Heard	Nothing Heard (NRSI and Ecoplans)	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
	%Cloud Cover	60	100	20	100	20	0
	Air temp. (^{o}C)	17	11	16	9	15	18
	Water temp. (^{o}C)	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
	Precipitation	None	None	None	None	None	None

Notes:
2014
-Spring Peepers heard calling in distance at 230 degrees (May). No water is found in these woods at the time of the May survey.
2015
- No standing water, background noise = 1, SPPE=3 heard beyond 100m radius (April 16)
- No Common Nighthawk observed, Gray Treefrog (calling code 1) and American Toad (calling code 1) heard beyond 100m radius (June 16)

Station ANR-003		2014			2015		
Common Name	**Scientific Name**	April	May 15	June 19	April 16	May 25	June 16
American Toad	*Bufo americanus*	Not Surveyed	Nothing Heard	Nothing Heard			Nothing Heard
Northern Spring Peeper	*Pseudarcris crucifer crucifer*				2 (1)	2 (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*						
Mink Frog	*Rana septentrionalis*						
Bullfrog	*Rana catesbeiana*						
Wood Frog	*Rana sylvatica*						
	Beaufort Wind Scale	N/A	2	0	3	4	2
	%Cloud Cover	N/A	100	20	100	20	0
	Air temp. (^{o}C)	N/A	11	16	9	15	18
	Water temp. (^{o}C)	N/A	13.8	N/A	N/A	N/A	15.1
	Water pH	N/A	7.5	N/A	N/A	N/A	6.8
	Precipitation	N/A	None	None	None	None	None

Notes:
2014
-many Spring Peepers heard calling in distance, call code 3 (May 15).
2015
- No standing water, background noise = 1, Spring Peeper (calling code 3) heard beyond 100m radius (April 16)
- No Common Nighthawk observed, Spring Peeper (calling code 1) and Gray Treefrog (calling code 2) heard beyond 100m radius (June 16)

APPENDIX V

Fish Species Known from the Study Area

Fish Species Reported from the Study Area

Scientific Name	Common Name	SRANK[1]	OMNR[2]	COSEWIC[3]	SARA STATUS	SARA Schedule[4]	Thermal Regime	Spawn Time	Ecoplans et al. (2013)
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 Apr 1988			cool	may-july	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	**13**

[1]OMNR 2013a; [2]OMNR 2013b; [3]COSEWIC 2012; [4]Government of Canada 2012

Legend
SRANK
S1 Critically Imperiled
S2 Imperiled
S3 Vulnerable
S4 Apparently Secure
S5 Secure
SU Unrankable
SNA Unranked
SX Presumed Extirpated
SH Possibly Extirpated (Historical)
S#? Rank Uncertain
COSSARO
NAR Not at Risk
SC Special Concern
THR Threatened
END Endangered
EXP Extirpated
DD Data Deficient
COSEWIC
Schedule 1 Protected under SARA
Schedule 2 Threatened/endangered; may be reassessed for consideration for inclusion to Schedule 1
Schedule 3 Special concern; may be reassessed for consideration for inclusion to Schedule 1

APPENDIX VI

Mammal Species Observed within the Subject Property (2014 – 2015)

Mammal Species Reported From the Study Area

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[4]	Region of Waterloo Status[5]	Ontario Mammal Atlas[6]	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	

Scientific Name	Common Name	SRANK[1]	COSSARO[2]	COSEWIC[3]	SARA Schedule[4]	Region of Waterloo Status[5]	Ontario Mammal Atlas[6]	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	
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	10

[1,2]MNRF 2015a, [3,4]Government of Canada 2015, [5]Regional Municipality of Waterloo 1985, [6]Dobbyn 1994

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