Boyer Woodlot Management Plan

Photo Credit: D. Barcza, LGL Limited

Prepared for:

YORK UNIVERSITY
4700 KEELE STREET
NORTH YORK, ONTARIO
M3J1P3

Prepared by:

LGL LIMITED
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Boyer Woodlot Management Plan

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1.0 INTRODUCTION

A Management Plan has been prepared for the Boyer Woodlot in support of the York University Master Plan Update. Three season field investigations for vegetation and wildlife were conducted in the Boyer Woodlot. Data gathered was used to update the existing conditions information in the York University Secondary Plan Update Natural Heritage Report and Addendum (LGL 2008).

An ecological assessment was undertaken during 2012 to identify potential habitat restoration, enhancement and creation opportunities in the Boyer Woodlot as is documented in **Section 4.0**. A number of reports have been reviewed in order to create the Boyer Woodlot Management Plan. The following reports provide documentation from 2001 through 2011:

- Dougan & Associates. 2001. *York University South Keele Woodlot Sustainability Study.* Prepared for York University;
- LGL. 2008. *York University Secondary Plan Update: Natural Heritage Report*. Prepared for York University Development Corporation;
- LGL. 2008. *York University Secondary Plan Update Natural Heritage Report – Addendum.* Prepared for York University Development Corporation; and,
- LGL. 2011. *Natural Heritage Impact Study: Pan American Games 2015 Athletics Stadium Track and Field Facility York University.* Prepared for York University.

1.1 Study Site Location

York University is located within the City of Toronto and is bounded by Steeles Avenue West to the north, Keele Street to the east, the Finch Hydro Corridor to the south and the Black Creek Valley to the west. The Boyer Woodlot and adjacent lands, lie within the north-western portion of the York University campus. **Figure 1** presents the location of the study area in a regional context.

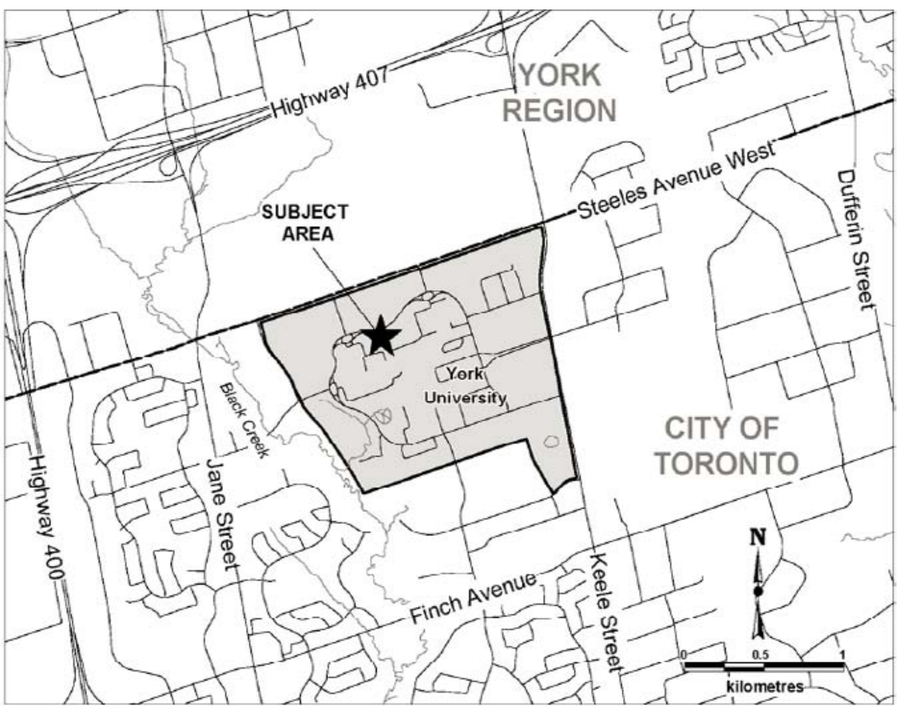

FIGURE 1. KEY PLAN OF THE BOYER WOODLOT.

1.2 Core Woodlots

The Boyer Woodlot is one of four core woodlots on the York University campus (**Figure 2**). The Boyer Woodlot covers an area of approximately of 2.28 ha. It is bounded by Ian Macdonald Blvd to the north; Ottawa Road to the east and south; there is an established pathway that has an asphalt surface to the south prior to Ottawa Road, and, East Office Building/Pan American Games Track and Field Stadium construction to the west. Further to the north and south of the roads there are manicured hedgerows.

The Boyer woodlot is the most isolated woodlot within the York University Keele Campus. The woodlot is immediately surrounded by infrastructure including sidewalks, curbs, roads, street lighting, tennis courts, areas of manicured grass and boulevard trees. There are three other woodlots on the York University campus, including Boynton, Osgoode, and Danby woodlots. Separate management plans have been prepared for each of these woodlots.

1.3 Boyer Woodlot Study Area

The Boyer Woodlot study area is composed of the Boyer Woodlot and the hedgerows to the north and south (**Figure 2**). The Boyer Woodlot Study Area is described and delineated in greater detail in **Section 3.0**.

1.4 Planning and Legislative Context

The Woodlot Management Plans have been prepared to fulfill York University's obligations related to the York University Secondary Plan, the York University Master Plan and the City of Toronto Ravine and Natural Feature Protection By-law.

The York University Secondary Plan, Amendment No. 104 to the Official Plan of the City of Toronto, was adopted by Council on December 4, 2009. The Secondary Plan includes policies related to the Natural Heritage System found on campus, including the Boyer, Boynton Danby and Osgoode Woodlots. Specifically, Policy 3.7.1.8 requires the preparation of management/stewardship plans for the woodlots at the precinct planning stage or when the University updates its 1988 Master Plan and the implementation of the plans will be a condition of development approvals. The management/stewardship plans are to include adaptive management monitoring programs to:

(a) determine and measure the ongoing health of the woodlots;
(b) determine whether the management practices implemented are effective; and,
(c) determine if modifications are required due to unacceptable impacts from adjacent development.

The York University Master Plan is being updated to inform decision-making as the University continues to grow and to guide the physical qualities of the campus by becoming a working tool used by all stakeholders, including staff, students, faculty and partners. Updates to the Master Plan were initiated in 2009 and a draft Master Plan was released for review in November 2012. The Woodlot Management Plans constitute a major component of the new Master Plan.

The City of Toronto Ravine and Natural Feature Protection By-law, Municipal Code Chapter 658, was amended by the City in May 2008 to include woodlands in addition to ravines. The purpose of the By-law is to promote the management, protection and conservation of ravines and associated natural and woodland areas and to prohibit and regulate the injury and destruction of trees, filling, grading and dumping in defined areas. The four woodlots, as well as the Hoover Creek/Black Creek Valleylands, are located within the ravine and natural heritage protection area and are thus subject to the requirements of The By-law.

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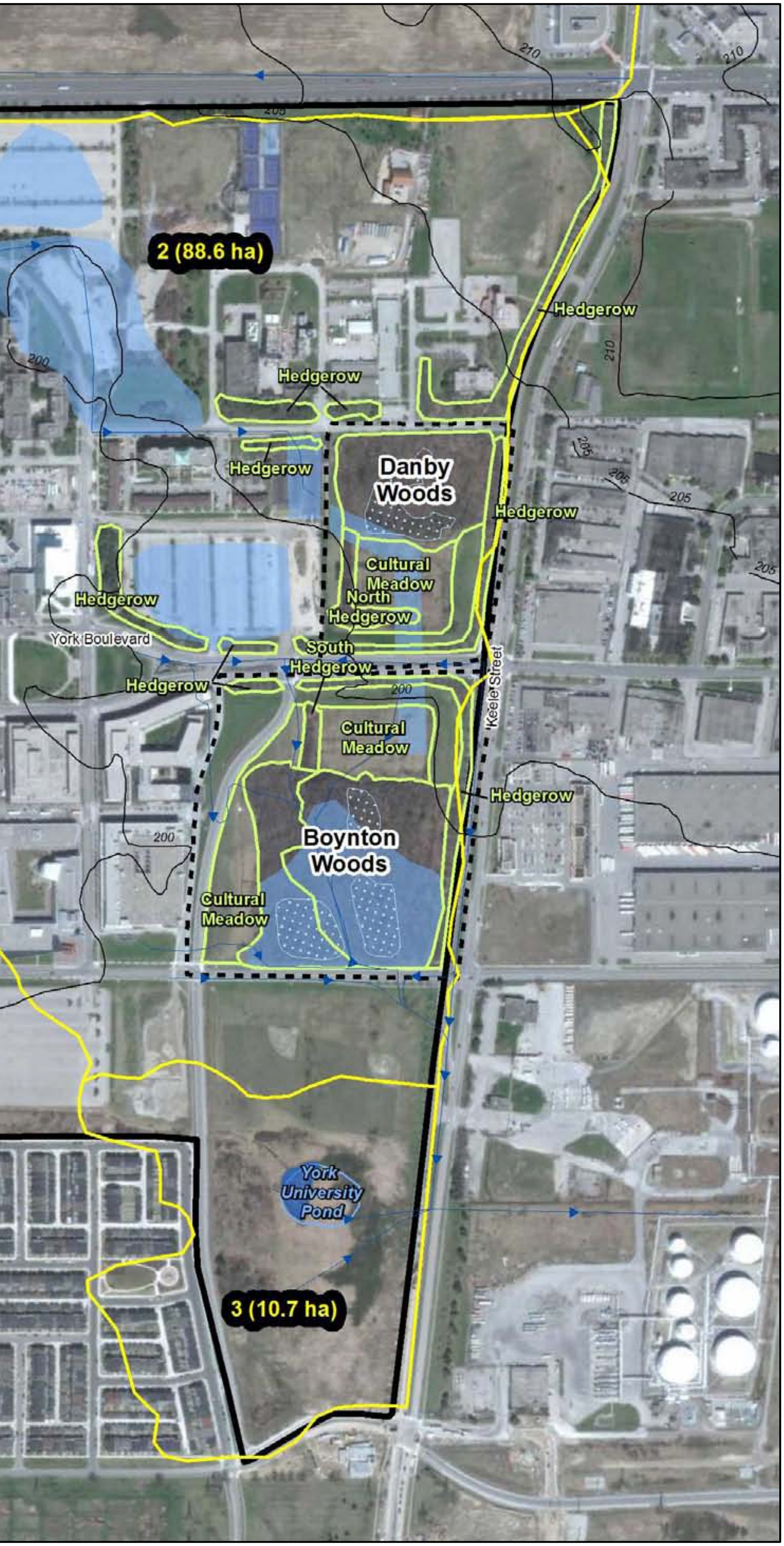

LEGEND

- York University Property Line
- Study Area
- Watercourse
- Sources of Water
- Pond
- Seasonally Wet Area
- Existing Overland Drainage Routes
- Vegetation Community Boundary
- Arboretum
- Topographic Lines
- Catchment Area
- # (## ha) Catchment Area ID (Area)

Data Source: LGL Limited Field Surveys, Dougan & Associates 2001: "York University South Keele Woodlot Sustainability Study", Conestoga-Rovers & Associates 2011: "Hydrogeological Assessment Boyer Woodlot Ponds York University Campus" and Ministry of Natural Resources.

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Woodlots on the York University Campus

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Project: TA8152	**Figure:** 2
Date: March 2013	**Prepared By:** KDR
Scale: 1 : 7000	**Checked By:** DEB

The Woodlot Management Plans have been prepared in sufficient detail to describe the site characteristics, stressors/impacts and the actions recommended to maintain and restore the woodlots as viable ecosystems. However, additional information may be required to facilitate implementation of the Woodlot Management Plans, in particular, detailed restoration plans, monitoring plans, timing and responsibilities for activities. The preparation of detailed Implementation Plans are considered beyond the scope of these Woodlot Management Plans and remain under consideration as future work by York University.

2.0 ASSESSMENT OF POTENTIAL HABITAT RESTORATION, ENHANCEMENT AND CREATION OPPORTUNITIES IN THE BOYER WOODLOT

As a part of efforts to identify areas suitable for restoration and enhancement, an assessment of the Boyer Woodlot was undertaken in 2012. Existing vegetation communities within and immediately adjacent to the Boyer Woodlot were examined to determine how the land could be restored and managed to improve the habitat. The intent of the Boyer Woodlot assessment was to identify opportunities for future strategic improvements.

2.1 Process for Boyer Woodlot Ecological Assessment

Each vegetation community within and immediately adjacent to the Boyer Woodlot was assessed to determine how it could be restored or enhanced. The vegetation communities were also reviewed to determine whether they are currently mammal and/or bird corridors or if through enhancement they could become corridors. Each site was also assessed to determine what management practices should be used to improve the vegetation communities.

The following steps have been/will be taken with respect to management of the Boyer Woodlot:

1. Current land use site assessment;
2. Examination of past disturbance regimes and current ecological stressors;
3. A Boyer Woodlot Restoration Site Plan;
4. Formation of restoration goals and objectives;
5. Creation of a management plan to improve the habitat;
6. Initiation of a monitoring program;
7. Implementation; and,
8. Adaptive management based upon monitoring.

It is the intent of the University to implement the Boyer Woodlot Management Plan once it is approved, subject to funding, staffing and University priorities.

2.2 Current Land Use Site Assessment Protocols

A reconnaissance level field investigation of natural/semi-natural vegetation communities within and immediately adjacent to the Boyer Woodlot was conducted within the study area by LGL on May 30, August 17, and September 26, 2012. Semi-natural vegetation communities are those communities that occur without regular management, maintenance or species introduction, but have been sufficiently altered in terms of species composition or vegetation structure by anthropogenic activity (Canadian National Vegetation Classification 2012). The Ecological Land Classification (ELC) for Southern Ontario (Lee et al. 1998) field sampling methods and data cards were used as a template to create more extensive restoration field sheets. Necessary data was collected to describe and classify the vegetation community type, assess the soils, the plant composition, linkages and disturbance regimes according to the ELC. Detailed field sampling techniques, analysis and mapping are described in Lee *et al*. (1998) and Apfelbaum *et al.* (2010).

Detailed site assessments included the following activities:

1) Conducting detailed analysis of the plant composition, structure and function in each vegetation community present at the site;
2) Taking soil cores for analysis of soil composition and soil moisture;
3) Identifying existing linkages;
4) Assessment of vegetation community habitat quality and corridor quality; and,
5) Identifying and analyzing past disturbance regimes for the purpose of assessing management requirements to address the ecological stressors.

2.2.1 Protocol for Vegetation Community, Structure and Function Analysis

The geographical extent, composition, structure and function of vegetation communities within the study area were first identified through aerial photo interpretation and then confirmed through field investigations. Aerial photos were interpreted to determine the limits and characteristics of vegetation communities.

Vegetation communities were classified according to the *Ecological Land Classification for Southern Ontario: First Approximation and Its Application* (Lee *et al*. 1998). The communities were sampled using a plotless method for the purpose of determining general composition and structure of the vegetation and the vegetation communities within the study area. An extensive vascular plant list was compiled, as well as the height and cover of each layer and the dominant species in each layer. Dominant flora was used to classify vegetation community types and ecosites. Plant species status was reviewed for Ontario (Oldham 1999), Toronto (Varga *et al. 2000*) and for the Toronto Region Conservation Authority (TRCA 2009a). Vascular plant nomenclature follows Newmaster *et al.* (1998), with a few exceptions that have been updated to Newmaster *et al.* (2005).

Size Class Analysis was carried out for all living woody plants, standing snags and deadfall/logs. Dichotomous keys presented in Lee *et al*. (1998) were used to determine the community age, system, site, history, substrate, cover, plant form and topographic feature. Special emphasis was placed upon surveying and recording watershed rare species and invasive species when observed in the field.

2.2.1.1 FLORISTIC QUALITY ASSESSMENT

Floristic quality assessment was used to determine the significance and amount of restoration required for each vegetation community. This assessment gives a dependable, repeatable and convenient method for evaluating the relative significance of vegetation communities in terms of their native floristic composition. It is not intended for use as a stand-alone method, but it can be applied to complement and support other methods of evaluating the natural quality of a site.

Floristic Quality Index

Floristic Quality Assessment is applied by calculating a **mean coefficient of conservatism C** (MC*C*) and a **floristic quality index** (*FQI*) from a comprehensive list of plant species obtained from a particular site. Each plant species present on the site has been assigned a Coefficient of Conservatism (C) value which ranged from 0 to 10 (Oldham et al., 1995). Species that have little or no fidelity to natural ecosystems and occur widely in a variety of altered and unaltered landscapes have a lower C value (e.g., 0-1), while species that show a very high association with unaltered natural ecosystems and do not occur in altered landscapes have a high C value (e.g., 9-10). The MCC is calculated by summing the coefficients of conservatism (*C*) of an inventory of plants and dividing by the total number of plant taxa (*n*), yielding an average or the mean coefficient of conservatism ($C = \Sigma C / n$). The *C* is then multiplied by the square root of the total number of plants (*n*) to yield the floristic quality index ($FQI = C\ n$). The square root of *n* is used as a multiplier to transform the mean coefficient of conservatism and allow for better comparison of the *FQI* between large sites with a high number of species and small sites with fewer species. Other methods used to determine the significance of each vegetation community, include number of native plants, number of exotic plants, species richness, percent exotic, sum of weediness, average coefficient of conservatism, average coefficient of wetness, number of regionally rare or uncommon species, size, soils and level of anthropogenic disturbance.

Based upon the above criteria, vegetation communities were classified as high significance areas if their floristic quality index value was (FQI > 35), moderate significance areas if (20 < FQI < 35) and low significance areas if (FQI < 20).

Coefficient of Wetness

A numerical value from -5 to +5 has been assigned to plant species based upon the tendency of that species to occur in wetland habitats (Oldham *et. Al.* 1995). The index is based upon the wetland categories, their definitions and the Wetness Index, based on Oldham *et. al.* (1995) (taken from Ecological Land Classification for Southern Ontario, First Approximation and its Application, 1998).

Wetland Category		Definition	Wetness Index	
OBL	Obligate Wetland	Occurs almost always in wetlands under natural conditions(estimated >99% probability)	OBL	-5
FACW	Facultative Wetland	Usually occurs in wetlands, but occasionally found in non-wetlands(estimated 67 -99% probability)	FACW+	-4
			FACW	-3
			FACW-	-2
FAC	Facultative	Equally likely to occur in wetlands or non-wetlands (estimated 34-66% probability)	FAC+	-1
			FAC	0
			FAC-	1
FACU	Facultative Upland	Occasionally occurs in wetlands, but usually occurs in non-wetlands(estimated 1-33% probability)	FACU+	2
			FACU	3
			FACU-	4
UPL	Upland	Occurs almost never in wetlands under natural conditions(estimated <1% probability)	UPL	5

The mean coefficient of wetness is calculated to estimate the probability that a vegetation community is a wetland or an upland area. Species assigned negative numbers are likely found in wet areas, while species assigned positive number are most often found in drier sites. The Mean Coefficient of Wetness (MCW) is calculated by summing the coefficients of wetness (*CW*) of an inventory of plants and dividing it by the total number of plant taxa (n), yielding an average or the mean coefficient of wetness ($MCW = \Sigma CW / n$).

Sum of Weediness
A numerical value from -1 to -3 has been assigned to plant species based upon how invasive the alien species are (Oldham *et. Al.* 1995). An alien species with a -3 value is a high priority invasive for removal and control, an alien species with a -2 value is a moderate priority invasive and an alien species with a -1 value is a low priority invasive plant. Sum of weediness (Weed) was calculated from pre-assigned scores of weediness for alien species to determine the proportion of high priority invasives to low priority invasives present in each vegetation community. The sum of weediness is calculated by summing the coefficient of weediness (Weed) of an inventory of plants.

2.2.2 Protocol for Soil Sampling

One auger sample was taken per vegetation community within the Boyer Woodlot and the adjacent vegetation communities to determine the soil composition and to establish if the soil profile was natural or anthropogenic. The soil texture, soil moisture, soil homogeneity or variability, depth to mottles/gleys, depth to thatch, organics and bedrock were investigated to determine the soil quality.

To determine soil texture, the following tests were carried out: feel, ribbon, taste, cast and shine test. Effective texture was used to determine the soil moisture. A metre stick and an additional 30 cm ruler were used to determine the depth to mottles, gleys, organics and bedrock. These results were analyzed to determine if any soil amendments would be required in order to restore the site. The protocol for soil sampling was the protocol used in Ecological Land Classification for Southern Ontario: First Approximation and Its Application (Lee et al. 1998) and Field Manual for Describing Soils in Ontario (Irvine et al. 2003).

2.2.3 Habitat Quality

Habitat quality was determined by looking for human disturbances (i.e. mowing, dumping, construction, logging, tracks and trails, noise, etc.), health of native vegetation (i.e. signs of Emerald Ash Borer, Dutch Elm Disease, Asian Long-horned Beetle or Gypsy Moth, etc.), later successional community age, high floristic quality index, high flora and fauna diversity, connectivity, historical hydrological conditions and high native/invasive plant ratio to come up with the habitat quality.

2.2.4 Past Disturbance Regimes and Current Ecological Stressors

2.2.4.1 Past Disturbance Regimes

Methodologies outlined in the ELC manual (Lee *et al*. 1998) were used to assess the past disturbance regimes within the Boyer Woodlot. A Management/Disturbance field sheet was filled out for each vegetation community within the Boyer Woodlot study area (**Figure 2**).

2.2.4.2 Ecological Stressors

Past disturbance regimes were analyzed to identify current ecological stressors for the purpose of assessing current management requirements. The current ecological stressors that are affecting each vegetation community or the ecosystem as a whole were examined to determine what is required to improve the area. Stressors to the area, including development, agricultural impacts (compaction, haying, erosion and sedimentation), mowing, trails, invasive plant abundance and distribution, altered hydrology, damage from hiking were described and mapped to help recognize what, how and why the landscape has changed. This was done to determine the woodlot health.

2.2.5 Mapping

Mapping requirements consisted of mapping the study area location (Boyer Woodlot), woodlots on the York University campus, vegetation communities in Boyer Woodlot, wildlife migration routes and lastly a Boyer Woodlot Restoration Site Plan. Current vegetation communities and wildlife usage was compared against the ecological stressors in order to create the Restoration Site Plan.

3.0 FINDINGS

3.1 Physical Setting

3.1.1 Physiography

The Boyer Woodlot is located within the Peel Plain Physiographic Region (Chapman and Putnam 1984), which is characterized as imperfectly drained Chingacousy clay loam, with alluvial “Bottomland” soils associated with stream courses (Hoffman and Richards, 1955). There are no significant landform features located within the study area.

3.1.2 Topography

The York University campus is primarily a terrestrial site that is not associated with the waters of a lake or river or with an active shoreline or river valley, with the exception of the west side of the campus, where Black Creek has formed a considerable valley. The site is located on unconsolidated mineral substrates. The campus is considered a Rolling Upland topographic feature, which is a site on a rolling topography with a complex pattern of ridges, slopes and hollows.

The area where the Boyer woodlot is located; is on a Tableland feature or a site that is on a more or less level plain that is not associated with any marked topographic feature. The elevation stays constant at approximately 200 m above sea level within and in the surrounding area around the woodlot. There is a rise in elevation to the northwest and northeast of the Boyer Woodlot and the slope goes down in the southeast towards York University Pond and down towards the Stong Pond, Hoover Creek and Black Creek (**Figure 2**). The only noticeable slope within the woodlot is on the western edge of the woodlot where there is a raised landscaping berm. The elevation within the woodlot decreases slightly towards the east.

3.1.3 Hydrology

Based on changes in elevation; surface water flows along Steeles Avenue and heads southwards along Founders Road into the York University campus (**Figure 2**). The surface water flows southeast first into Danby Woods and then into Boynton Woods. There does not appear to be a hydrological connection to Boyer Woodlot with this surface water flow.

There are large seasonal pools within the north-western portion of the Boyer Woodlot that are geographically isolated and also appear to be hydrologically isolated in that there is no visible surface connection either between the two pools or to any other source of water on adjacent lands. The presence of these seasonal pools could be related to former agricultural practices where ponds may have been expanded to water livestock (Dougan 2007). Water input is likely from snowmelt and precipitation, and water loss is likely due to evaporation which is slowed by the dense canopy cover over the pools. Other conditions that result in ponding include: local groundwater flow, or the presence of a clay or silt substrate or clay lenses within the substrate which impede infiltration. Much of the woodlot, especially the south-western portion, is at a higher elevation than the adjacent lands so runoff here on adjacent lands is directed away from the woodlot; however, overall runoff within the woodlot is directed east, further into the woodlot as the elevation within the woodlot decreases slightly towards the east.

3.1.4 Soil Characteristics

Boyer woodlot and adjacent habitat is located on tableland topography with mineral soils. Two soil cores were taken in the FOD6-5 vegetation community; one soil core was taken in the SWD3-2 vegetation community; and, two soil cores were taken in the centre of the two major vernal pools. The location of each soil core is delineated in **Figure 3.**

Soil Core 1 (South-eastern portion of the FOD6-5)
The A horizon silt loam goes down to a depth of 20 cm followed by a silty clay loam layer to a depth of 75 cm. The B horizon goes to a depth of 120 cm. Mottles were identified at 65 cm. The soil moisture regime was identified as very fresh (3).

Soil Core 2 (Western portion of the FOD6-5)
The A horizon loam goes down to a depth of 30 cm followed by a clay loam layer to a depth of 120 cm. The B horizon clay loam goes to a depth of 120 cm. Mottles were identified at 85 cm. The soil moisture regime was identified as very fresh (3).

Soil Core 3 (SWD3-2)
The A horizon silt loam goes down to a depth of 25 cm followed by a silty clay loam layer to a depth of 120 cm. Mottles were identified at 35 cm. The soil moisture regime was identified as moist (5).

Soil Core 4 (Wet-South Vernal Pool)
The A horizon organic layer goes down to a depth of 2 cm; followed by a clay B horizon layer to a depth of 120 cm. Mottles were identified at 3 cm. The soil moisture regime was identified as very moist (6).

Soil Core 5 (Dry-North Vernal Pool)
The A horizon organic layer goes down to a depth of 2 cm; followed by a clay B1 horizon layer to a depth of 60 cm; and, followed by a Sandy Clay B2 horizon layer to a depth of 120 cm. Mottles were identified at 3 cm. The soil moisture regime was identified as very moist (6).

3.2 Vegetation and Vegetation Communities

3.2.1 Vegetation Communities

A total of three ELC vegetation community types were identified by LGL within the study limits (**Figure 3**). These communities include: deciduous forest type (FOD6-5), deciduous swamp type (SWD3-2), and cultural plantation (CUP1). Human development has resulted in a fragmented natural landscape. The vegetation communities are considered widespread and common in Ontario and secure globally (NHIC 1997). These communities are described in **Table 1** and delineated in **Figure 3**.

There are two hedgerows to the north and one immediately to the south (**Figure 3**). There are other hedgerows to the west that are being cleared as part of the track and field facility that is being constructed immediately adjacent to the Boyer Woodlot to the west (LGL 2011).

Boyer Woodlot – Fresh- Moist Sugar Maple - Hardwood Deciduous Forest, Silver Maple Mineral Deciduous Swamp and Cultural Plantation

Boyer woodlot is located on the northwestern side of the York University campus south of Ian MacDonald Boulevard and is approximately 2.28 ha in size. The Boyer Woodlot is comprised primarily of Sugar Maple Hardwood Deciduous Forest to the west and Silver Maple Deciduous Swamp to the east with a small portion of cultural plantation in the southwestern corner. Some sections of the woodlot are dominated by large, calliper sized, latter successional and shade tolerant tree species, while other sections are dominated by smaller calliper sized and earlier successional tree species. Plant diversity within the canopy and subcanopy layers is high while plant diversity in the understorey and ground layers is low because common buckthorn is out-competing the native vegetation.


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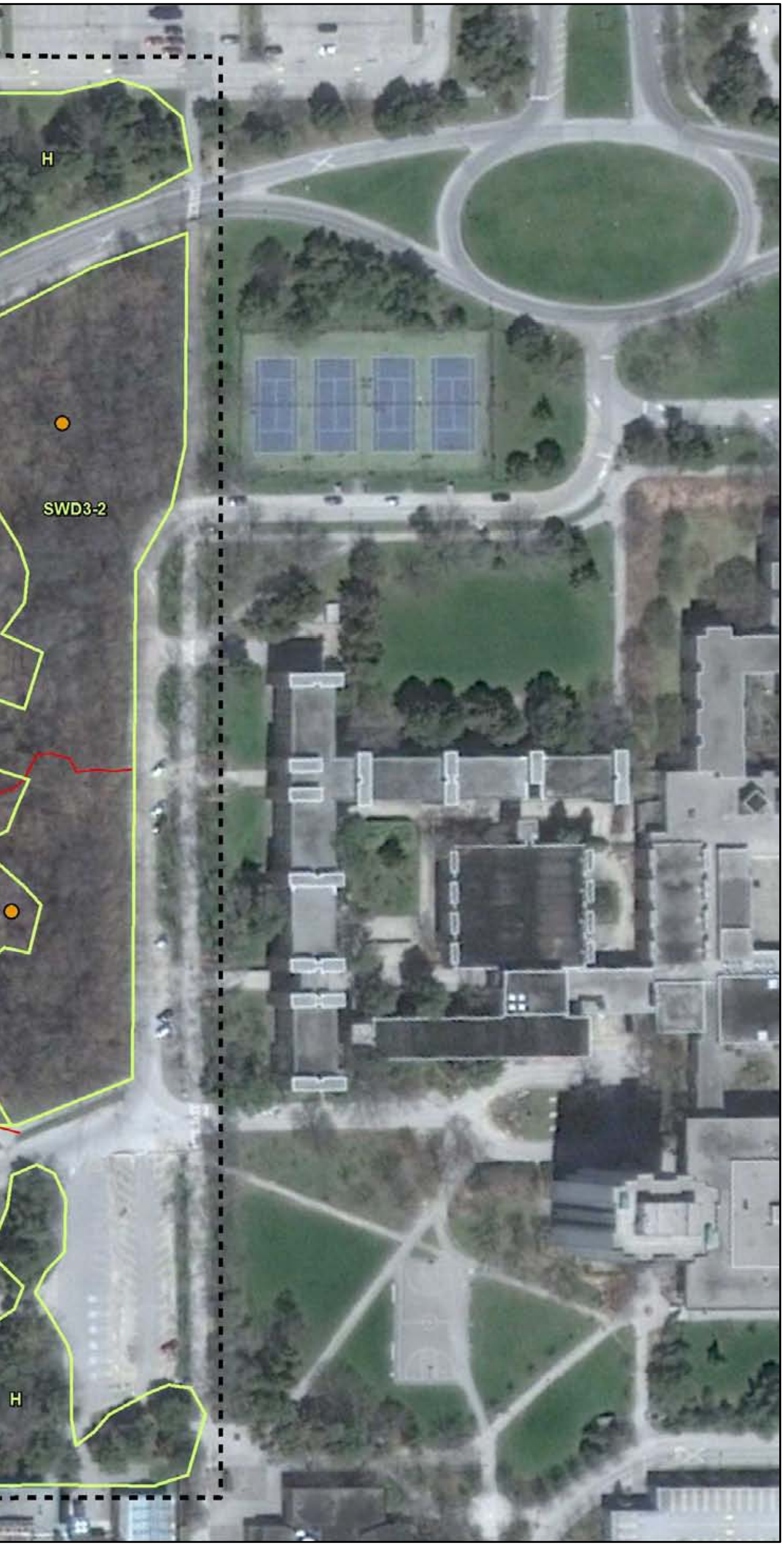
FOD6-5
H
CUP1
H
bing



LEGEND

York University Property Line
Study Area
Vernal Pools
Vegetation Community Boundary
Soil Core Location
Trail

Vegetation Community Boundary

CUP1	Deciduous Plantations
FOD6-5	Fresh-Moist Sugar Maple-Hardwood Deciduous Forest Type
SWD3-2	Silver Maple Mineral Deciduous Swamp Type
H	Hedgerow

Data Source: LGL Limited Field Surveys.

25 12.5 0 25 Metres

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VEGETATION COMMUNITIES IN BOYER WOODLOT

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Project: TA8152	**Figure:** 3
Date: March 2013	**Prepared By:** KDR
Scale: 1 : 1500	**Checked By:** DEB

TABLE 1.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES AND ASSOCIATED HEDGEROWS

ELC Code	Vegetation Type	Species Association	Comments
Terrestrial-Natural/Semi-Natural			
FOD	DECIDUOUS FOREST		
FOD6-5	Fresh-Moist Sugar Maple-Hardwood Deciduous Forest	**Canopy:** basswood (*Tilia americana*), bur oak (*Quercus macrocarpa*), sugar maple (*Acer saccharum* ssp. *saccharum*) and bitternut hickory (*Carya cordiformis*) are abundant. **Subcanopy:** bitternut hickory, sugar maple, ironwood, and basswood are abundant with occasional and red ash (*Fraxinus pennsylvanica*). **Understorey:** common buckthorn (*Rhamnus cathartica*) is dominant with abundant bitternut hickory, sugar maple, red ash, and ironwood. **Ground Cover:** Virginia water-leaf (*Hydrophyllum virginianum*) is dominant with abundant yellow enchanter's nightshade (*Circaea lutetiana* ssp. *canadensis*), white avens (*Geum canadense*), garlic mustard (*Alliaria petiolata*), and Virginia stickseed (*Hackelia virginiana*).	• Tree cover > 60% (FO). • Deciduous trees > 75% of canopy cover (D). • Sugar Maple and other Hardwoods are dominant (6-5). • Sand, loam and clay soils that are well to poorly drained, in lower slope and bottomland positions (Fresh-Moist).
Wetland			
SWD	DECIDUOUS SWAMP		
SWD3-2	Silver Maple Mineral Deciduous Swamp	**Canopy:** Silver maple (*Acer saccharinum*) is abundant with occasional bitternut hickory, eastern cottonwood (*Populus deltoides* ssp. *deltoides*) and bur oak. **Subcanopy:** Basswood and bur oak are abundant, with occasional silver maple, bitternut hickory, and red ash. **Understorey:** Common buckthorn is dominant with abundant basswood, and silver maple. **Ground Cover:** Common buckthorn, Virginia water-leaf and western poison-ivy (*Toxicodendron rydbergii*) are abundant with occasional garlic mustard, yellow enchanter's nightshade, and white avens.	• Tree or shrub cover > 25% (SW). • Deciduous trees > 75% of canopy cover (D). • Silver Maple is dominant (3-2).

TABLE 1.
SUMMARY OF ECOLOGICAL LAND CLASSIFICATION VEGETATION COMMUNITIES AND ASSOCIATED HEDGEROWS

ELC Code	Vegetation Type	Species Association	Comments
Terrestrial/Cultural			
CUP	CULTURAL PLANTATION		
CUP1	Deciduous Plantation	**Canopy:** Red ash, planted bur oak, and planted pin oak (*Quercus palustris*) are abundant with occasional planted black oak (*Quercus velutina*). **Ground Cover:** Garlic mustard, dame's rocket (*Hesperis matronalis*), common burdock (*Arctium minus*) are abundant with occasional Canada thistle (*Cirsium arvense*), and creeping bellflower (*Campanula rapunculoides*).	• Cultural communities (CU) • Tree cover and shrub cover < 25% (M) • This community can occur on a wide range of soil moisture regimes (Dry-Moist). • Pioneer community resulting from, or maintained by, anthropogenic-based influences.

This woodlot pre-dates the development of the York University campus in the early 1960s as evidenced by historical air photos and the age of some of the trees present. Maintenance of this woodlot is low to none, with minor interventions to maintain or enhance ecological function.

Vernal Pools

In addition, there are two vernal pools located within the Boyer Woodlot. There is no submerged and little floating-leaved vegetation present within the vernal pools. Rare emergent wetland plant species were visible during the September 26, 2012 field visit. The diversity and abundance of obligate and facultative wetland plant species within the vernal pools has decreased since 2004. The vernal pools were inventoried by one of the LGL botanists working for the Toronto Region Conservation Authority at that time.

Hedgerows

The three hedgerows are composed of a mixture of native and cultivated tree species. There is no native ground cover under these hedgerows, since they appear to be landscaped frequently. The northwestern hedgerow contains abundant European birch (*Betula pendula*), white ash (*Fraxinus americana*) and Austrian pine (*Pinus nigra*) trees. The northeastern hedgerow is dominated by Austrian pine with abundant white ash trees. The southern hedgerow is dominated by Austrian pine with abundant bur oak (*Quercus macrocarpa*) and white spruce (*Picea glauca*) trees. These hedgerows provide little flora and fauna habitat, due to the frequent mowing regime.

3.2.2 Flora

To date, a total of 91 vascular plant taxa have been recorded within the study area (**Figure 3**). Thirty-five taxa, or 38 percent of the recorded flora, are considered introduced and non-native to Ontario. A working vascular plant list is presented in **Appendix A**.

Significant Plant Species

No plant species that are regulated under the Ontario *Endangered Species Act* or the Canada *Species at Risk Act* were encountered during LGL's botanical investigation on the subject property (those plant species regulated as Special Concern, Endangered, Rare or Threatened).

In addition, the study area contains nine plant species that are considered rare to uncommon in Toronto and three of these species are designated L1 to L3 in the TRCA watershed. An additional three TRCA species of concern were identified within the study area. Planted pin oak trees, which are not indigenous to the TRCA watershed, were also found within the study area. **Table 2** provides a summary of regionally rare and TRCA species of concern that were identified within the Boyer Woodlot.

TABLE 2.
SUMMARY OF REGIONALLY RARE PLANT SPECIES

Scientific Name	Common Name	Status		Planted	Vegetation Community		
		TRCA	Toronto		FOD6-5	SWD3-2	CUP1
Acer nigrum	black maple		U		X		
Allium tricoccum	wild leek	L3			X		
Carex rosea	stellate sedge		U		X	X	
Euonymus obovata	running strawberry-bush	L3	R5		X	X	
Hackelia virginiana	Virginia stickweed		U		X		
Physocarpus opulifolius	ninebark	L3	R6	**X**			X
Picea glauca	white spruce	L3			X	X	
Prunus pensylvanica	pin cherry		U	**X**			X
Quercus palustris	pin oak			**X**			X
Quercus velutina	black oak	L2	R5	**X**			X
Rosa blanda	smooth rose		U		X		
Sambucus nigra ssp. *canadensis*	common elderberry		U	**X**			X
Trillium grandiflorum	white trillium	L3			X		

3.2.2.1 Floristic Quality Assessment

The FOD6-5 and SWD3-2 vegetation communities have a moderate floristic quality index value at 27.72, and 22.78 respectively, indicating that these vegetation communities have moderate significance and many specialized forest and wetland plants (**Table 3**). The CUP1 vegetation community has a low to moderate floristic quality index value at 18.11. This indicates that the vegetation community has a low significance in terms of its native floristic composition.

The CUP1 has an exotic species percentage at 37.5 and a low sum of weediness vale at -17. This is due to the low richness of 32 species within the small CUP1 vegetation community. The CUP1 is a young plantation that contains many exotic annual and biennial meadow species in the ground cover. The FOD6-5 vegetation community has an exotic species percentage of 29.85 and a sum of weediness value at -28. The SWD3-2 has a higher exotic species percentage of 42.86 and a sum of weediness value of -29.

TABLE 3.
FLORISTIC QUALITY ASSESSMENT

Vegetation Communities	CUP1	FOD6-5	SWD3-2
Number of Native Plants	17	44	28
Number of Exotic Plants	10	19	21
Species Richness	**27**	**63**	**49**
Percent Exotic	**37.04%**	**30.16%**	**42.86%**
Sum of Weediness	**-17**	**-28**	**-29**
Mean Coefficient of Conservatism	3.88	4.00	4.14
Floristic Quality Index (FQI)	**16.01**	**26.83**	**22.69**
Mean Coefficient of Wetness	0.47	1.07	0.85
# of Regionally Rare or Uncommon Species	**5**	**8**	**3**

The FOD6-5 vegetation community contains older woody canopy cover, higher species richness and greater native to exotic plant ratio than the SWD3-2 vegetation community. The FOD6-5 vegetation community also has the highest number of regionally rare to uncommon plant species at eight, while the SWD3-2 has three and the CUP1 has five. All of the regionally rare to uncommon plant species within the CUP1 vegetation community appear to have been planted in tribute to two graduate students who died while carrying out field work. There is a plaque within the CUP1 vegetation community describing the events. The SWD3-2 is dominated by common buckthorn, which has outcompeted most of the native plant species that were previously present from 2004 when the woodlot was inventoried by one of the LGL botanists. The high amount of invasive and exotic species within the three vegetation communities are indicative of the surrounding past agricultural land use and the current neighbouring institutional land use of the fragmented woodlot. Findings of the Floristic Quality Assessment are further described in **Table 3**.

3.2.2.2 Past Disturbance Regimes

The following past disturbance regimes were observed:

- Abundant alien species with broad distributions are affecting the native plant composition, structure and function of the forest, swamp, and plantation;
- There are several faint pedestrian trails and some well-marked pedestrian trails that are widespread throughout the woodlot. Faint trails run primarily along the western edge of the woodlot to the vernal pools, while a well-marked trail runs from the north-western portion of the woodlot to the northern edge of the woodlot (**Figure 3**). The trails are used for recreation and educational purposes by students and professors while carrying out lab work. Pedestrian paths around the Boyer Woodlot reduce the pedestrian use of the trails within the woodlot;
- Impact from and prevention of hikers who recreationally use the Boyer Woodland, to dump rubbish, and introduce invasive plant species;
- A picnic bench is found in the middle of the northern vernal pool and dumpings were noted within both vernal pools;
- Brush piles were concentrated within the southern edge of the woodlot;

- Noise is widespread from the adjacent roadways;
- Disease and death of trees has slightly opened up the canopy cover. There are signs of Emerald Ash Borer and Dutch elm disease within the Boyer Woodlot trees;
- There were no signs of Asian Long-horned Beetle and Gypsy Moth observed, but their presence is known to occur within the York University Keele Campus (Royle *et. al.* 2009).

3.3 Wildlife and Wildlife Habitat

The Boyer Woodlot is fragmented and isolated from other natural heritage features found within the York University Keele Campus. The Boyer Woodlot is highly disturbed due to the proximity of roads on three sides of the woodlot and the frequent pedestrian traffic both on lands adjacent to and within the woodlot. In urban settings, such as the Boyer Woodlot, wildlife have become acclimatized to urban conditions and only those fauna that are tolerant of human activities tend to persist. However, noise, roadways, artificial light, visual intrusion and pedestrian use within and adjacent to the study area may alter wildlife activities and patterns. Wildlife that elect to leave the Boyer Woodlot risk being struck by vehicles and have an increased chance of being predated (**Figure 4**).

3.3.1 Fauna in the Boyer Woodlot

Twenty-seven species of wildlife (two herpetofauna, twenty birds and five mammals) were recorded within the Boyer Woodlot (**Table 4**). Both species of herpetofauna were only observed around the southern and smaller vernal pool (**Figure 3**). Although numerous vernal pools were observed within the woodlot in the spring season, only two remained long enough to provide sustainable habitat for amphibians to use for breeding. The deeper northern vernal pool dried up sooner than the smaller and shallower southern one. On three visits to the Boyer Woodlot, May 1, May 9 and May 23, 2012, Spotted Salamander (*Ambystoma maculata*) egg masses were recorded in the smaller southern vernal pool. Juvenile Wood Frogs (*Lithobates sylvatica*) were also observed in the same vernal pool and heard calling during 2011 field observations (LGL 2011). Three days of searching around the rest of the woodlot (checking pools, flipping ground debris, listening for calls) did not reveal any other amphibian or reptile species in the woodlot.

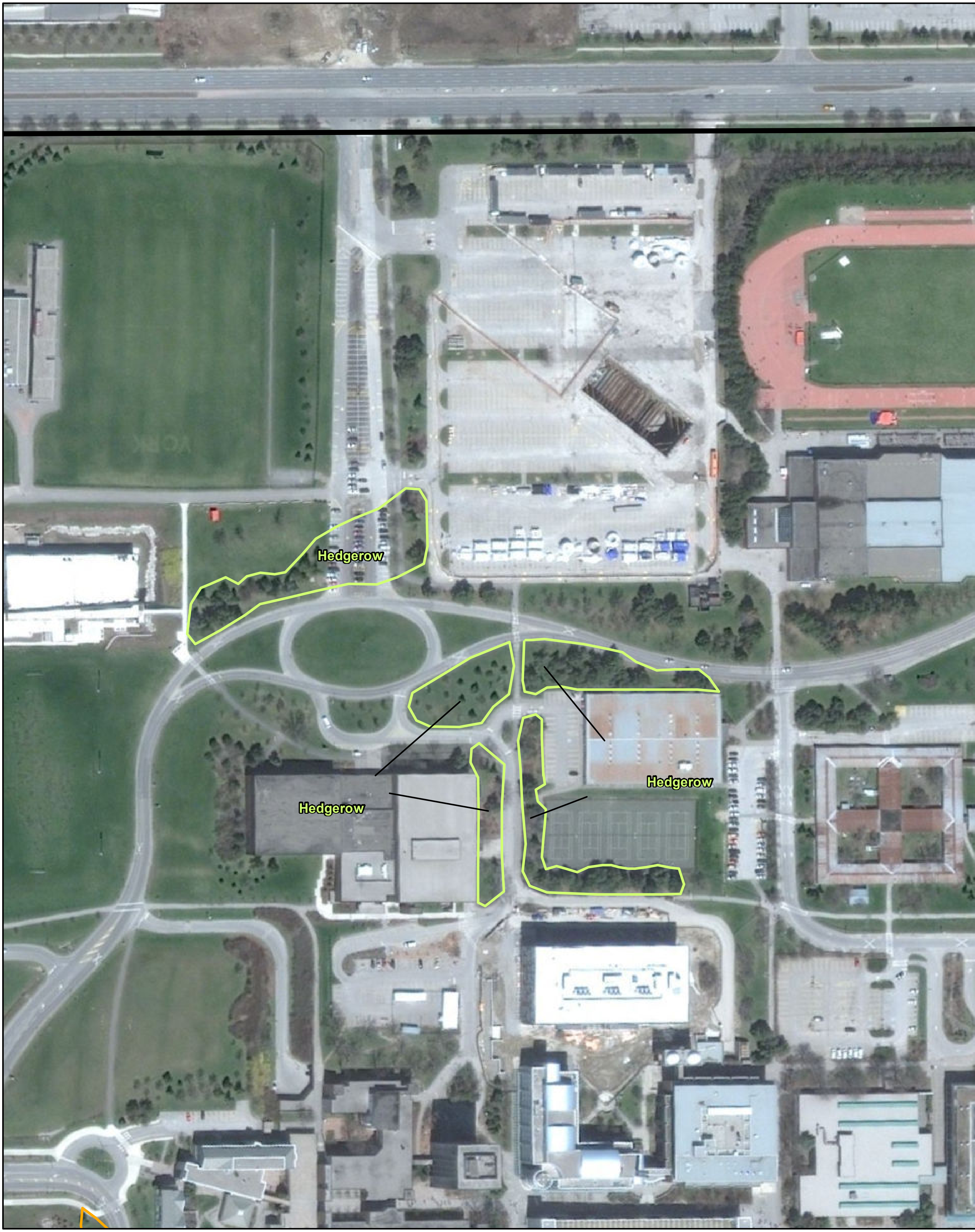
Birds, primarily migratory birds, made up the majority of the wildlife observed in the woodlot in both spring and late summer/fall seasons. Surveys were conducted as early as possible in the mornings when bird activity is the most abundant. Direct observations and bird song were the primary methods used to determine which species used the woodlot. Bird Studies Canada (BSC) Breeding Bird Atlas (BBA) criteria were used to determine whether the bird species recorded in the woodlot were local nesters or seasonal migrants. Migratory wood warblers, such as Chestnut-sided Warbler (*Dendroica pensylvanica*), Black-throated Green Warbler (*Dendroica virens*), Ovenbird (*Seiurus aurocapilla*) and others (**Table 4)** were observed feeding and singing while they migrated through the woodlot. Species such as Black-capped Chickadee (*Poecile atricapillus*), American Robin (*Turdus migratorius*) and Northern Cardinal (*Cardinalis cardinalis*), were heard in full song during each visit in the spring and early summer season and therefore recorded as local breeding bird species for the woodlot based on the BSC BBA criteria.

Five species of mammals were recorded in this woodlot (**Table 4**). Based on direct observations and sign evidence (tracks, digs, dens and trails), the woodlot appeared to be a feeding and denning area for Gray Squirrel (*Sciurus carolinensis*), Striped Skunk (*Mephitis mephitis*), Eastern Cottontail (*Sylvilagus floridanus*), Raccoon (*Procyon lotor*) and Woodchuck (*Marmota monax*).

TABLE 4.
WILDLIFE LIST

Scientific Name	Common Name	COSEWIC	(COSSARO) OMNR	LOCAL (BSC/TRCA)	LEGAL STATUS (SARA (Schedule. 1-3); FWCA (F),(G), (P); MBCA)	BREEDING STATUS
Herpetofauna						
Ambystoma maculatum	Spotted Salamander			(- / L1)	FWCA(P)	
Lithobates sylvatica	Wood Frog			(- / L2)		
Birds						
Branta canadensis	Canada Goose			(- / L5)	MBCA	Y
Picoides pubescens	Downy Woodpecker			(- / L5)	MBCA	?
Picoides villosus	Hairy Woodpecker			(- / L4)	MBCA	N
Colaptes auratus	Northern Flicker			(- /L4)	MBCA	Y
Vireo olivaceus	Red-eyed Vireo			(- / L4)	MBCA	Y
Cyanocitta cristata	Blue Jay			(- / L5)	FWCA(P)	?
Poecile atricapillus	Black-capped Chickadee			(L4 / L5)	MBCA	Y
Cathartes fuscescens	Veery			(L3 / L3)	MBCA	N
Catharus guttatus	Hermit Thrush			(L4 / L3)	MBCA	N
Turdus migratorius	American Robin			(- / L5)	MBCA	Y
Bombycilla cedrorum	Cedar Waxwing			(- / L5)	MBCA	?
Vermivora peregrina	Tennessee Warbler			(- / -)	MBCA	N
Dendroica pensylvanica	Chestnut-sided Warbler			(L1 / L3)	MBCA	N
Dendroica virens	Black-throated Green Warbler			(L2 / L3)	MBCA	N
Mniotilta varia	Black and White Warbler			(L3 / L2)	MBCA	N
Setophaga ruticilla	American Redstart			(L2 / L3)	MBCA	N
Seiurus aurocapilla	Ovenbird			(L4 / L3)	MBCA	N
Spizella passerina	Chipping Sparrow			(- / L5)	MBCA	Y
Cardinalis cardinalis	Northern Cardinal			(- / L5)	MBCA	Y
Carduelis tristis	American Goldfinch			(L3 / L5)	MBCA	Y
Mammals						
Sylvilagus floridanus	Eastern Cottontail			(- / L4)	FWCA(G)	
Sciurus carolinensis	Gray Squirrel			(- / L5)	FWCA(G)	
Mormota monax	Woodchuck			(- / L4)		
Mephitis mephitis	Striped Skunk			(- / L5)	FWCA(F)	
Procyon lotor	Raccoon			(- / L5)	FWCA(F)	

Breeding Bird Status:
- Y: Yes based on criteria used by BSC for Breeding Bird Atlas.
- N: No based on criteria used by BSC for Breeding Bird Atlas.
- ? : Unknown - bird in area however did not observe BSC criteria for breeding.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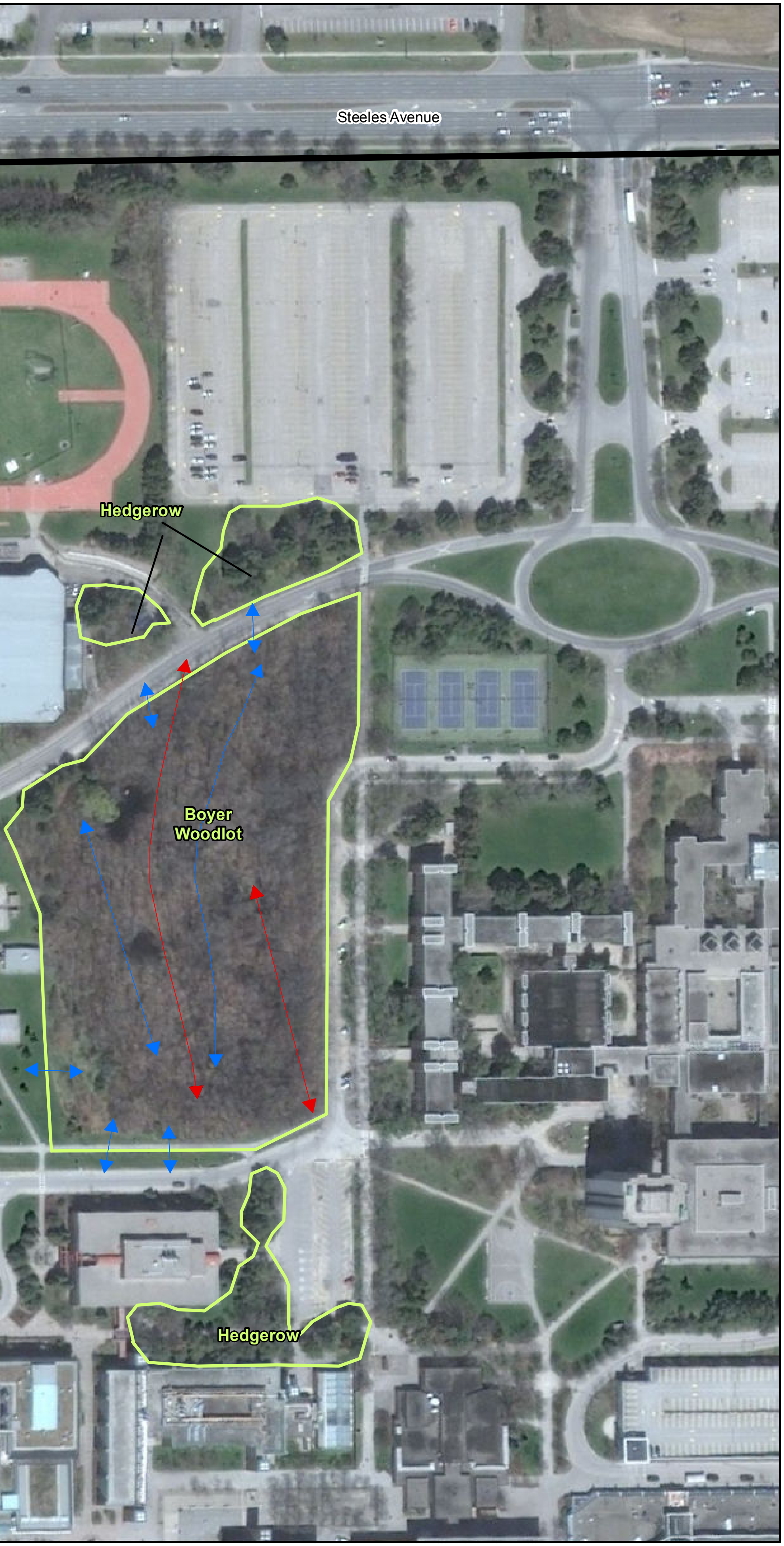


LEGEND

- York University Property Line
- Vegetation Community Boundary
- Mammal Migration Route
- Bird Migration Route

Data Source: LGL Limited Field Surveys.

50 25 0 50 Metres

N

BOYER WOODLOT WILDLIFE MIGRATION ROUTES

LGL LIMITED
environmental research associates

Project: TA8152	**Figure:** 4
Date: November 2012	**Prepared By:** KDR
Scale: 1 : 2500	**Checked By:** DEB

Birds and mammals migrated north to south through the Boyer Woodlot. They migrated from the woodlot to the two hedgerows to the north across Ian MacDonald Blvd and the one hedgerow to the south across Ottawa Road. The woodlot provides a safe travel corridor connecting the hedgerows surrounding the woodlot (**Figure 4**).

Species at Risk

A background review using the Natural Heritage Information Centre (NHIC) database indicated several historic element occurrence records for the following species.

- Blanding's Turtle (*Emdoidea blandingii*) is listed as Threatened and is regulated as such under the *Ontario Endangered Species Act* and the *Canada Species at Risk Act*. The NHIC database lists the last known occurrence record as 1986.
- The Eastern Ribbonsnake (*Thamnophis sauritus*) is listed as Special Concern and is regulated as such under the *Ontario Endangered Species Act* and the *Canada Species at Risk Act*. The NHIC database lists the last known occurrence record as 1913.
- The Jefferson X Blue-spotted Salamander (*Ambystoma* hybrid pop. 1) is provincially ranked as S2 (population is Imperiled in Ontario because of rarity due to very restricted range). The NHIC database lists the last known occurrence record as 1978.

Blanding's Turtle and Eastern Ribbonsnake occurrence records are dated and likely originate from the Black Creek Valleylands (located within 1 km of the study area), because suitable habitat for these species were not found within the study area or the Boyer Woodlot. The Jefferson X Blue-spotted Salamander occurrence record is dated but suitable habitat for this species are present within the Boyer Woodlot vernal pools. Despite being highly fragmented and disturbed, the vernal pools found within the woodlot may provide breeding habitat for this salamander. If the Jefferson X Blue-spotted Salamander is present within the Boyer Woodlot, suitable habitat for the species is restricted to within the woodlot.

None of the wildlife species recorded by LGL within the Boyer Woodlot are considered of any federal, provincial or regional significance according to the NHIC. However, 19 of the 20 species of birds recorded are protected under the *Migratory Birds Convention Act* (MBCA) and one species is protected under the *Fish and Wildlife Conservation Act* (FWCA). Nine of the bird species are also designated as a priority species of conservation concern by BSC for the Metro Toronto Region. The FWCA also protects four of the five species of mammals recorded (**Table 4**).

3.4 Pan American Games Track and Field Stadium Development

Development along the western edge of the Boyer Woodlot consists of the construction of a stadium to host track and field events for the Pan American Games in 2015. The proposed Track and Field Stadium with associated buildings will have a footprint of approximately 21,000 m^2 or 2.1 ha. For further details on how the woodlot will be protected prior to and during the proposed construction of the Pan American Games Track and Field Stadium refer to Section 5.1 of the LGL Natural Heritage Impact Study (2011).

3.5 Vernal Pools

Detailed analysis of the two vernal pools within the Boyer Woodlot was carried out by Conestoga Rovers & Associates in (2011) and by LGL in (2011) to determine if the Pan American Games Track and Field Stadium development would impact the vernal pools or not. If the vernal pools are fed by surface water flow, rather than groundwater flow, then soil amendments would be possible.

Detailed examination of the vernal pools was carried out for this report because the larger northern vernal pool dries up earlier than the smaller southern vernal pool; based upon field studies by LGL in 2010 and in 2012. Both vernal pools are at similar elevations. The only difference between the two vernal pools is that the wet, smaller and southern vernal pool has 118 cm of clay in the B1 Horizon, while the drier, larger and northern vernal pool only has 58 cm of clay in the B1 Horizon followed by a Sandy Clay to 120 cm in the B2 Horizon. The clay lens in the northern vernal pool should be impermeable enough to maintain the water depth for a sufficient amount of time for Spotted Salamanders to use it, but they don't because it drains too quickly. The southern vernal pool supports wood frog and spotted salamander populations, while the northern vernal pool does not. The objective is to improve both vernal pools so that they support a greater abundance and diversity of emergent, submergent or floating leaved macrophyte vegetation, invertebrates and amphibians.

3.5.1 Vernal Pool Topography

"The topography of the Boyer Woodlot immediately adjacent to the vernal pools is flat with a gentle slope to the southwest, towards Black Creek, which is located approximately 600 metres (m) west of the site. The woodlot has an elevation of approximately 200 m above mean sea level (AMSL), and Black Creek is at an elevation of approximately 175 to180 m AMSL. There are other smaller vernal pools within the Boyer Woodlot that are found within localized depressions" (Conestoga Rovers & Associates 2011).

3.5.2 Vernal Pool – Groundwater or Surfacewater

"The vernal pools are located in depressions within locally flat areas of low permeability till (10-4 to 10-6 cm/sec). The till and underlying silt and clay unit extend to a depth of more than 30 metres below ground surface (mBGS).

Due to the low permeability of the overburden profile, the vernal pools are likely due to locally perched water in the depressions as a result of overland flow from precipitation and spring thaw events. There is a small potential the vernal pools may be influenced by local unconfined perched groundwater within the fill, during seasonal wet periods, or possibly from very discrete local sand lenses or layers within the till.

Based on the above it is unlikely the Boyer Woodlot Vernal pools are supported by a groundwater source; due to the following site conditions:

- The Site is underlain by thick low permeability till, silt and clay unit;
- The Site is underlain by a thick **aquitard** or a bed of low permeability adjacent to an **aquifer** (underground layer of water bearing permeable rock or unconsolidated material from which water can be extracted). The **aquitard** may serve as a storage unit for groundwater and it does not yield water readily;
- It is unlikely the vernal pools are supported by a groundwater source as the water table is found within the till aquitard at a depth of approximately 5 mBGS; and,
- The water table is situated below the fill underlying the study area, but local perched groundwater conditions may exist, depending on the type of fill" (Conestoga Rovers & Associates 2011).

The western edge of the woodlot has a raised berm which provides a barrier to surfacewater flow draining out of the woodlot. If this berm is left intact or altered in a way that maintains the existing drainage, the Wood Frog and Spotted Salamander populations are expected to persist. The large vernal pools noted within the north-western portion of the Boyer Woodlot are geographically isolated and also appear to be hydrologically isolated in that there is no visible surface connection between the two vernal pools or to any other source of water on adjacent lands.

The presence of these vernal pools could be related to former agricultural practices where vernal pools may have been expanded to water livestock (Dougan 2007). Water input is likely from snowmelt and precipitation, and water loss is likely due to evaporation which is slowed by the dense canopy cover over the pools. Other conditions that result in ponding include: local groundwater flow, and the presence of clay lenses within the substrate which impede infiltration. Much of the woodlot, especially the south-western portion, is at a higher elevation than the adjacent vernal pools so runoff here on adjacent lands is directed away from the woodlot; however, overall runoff within the woodlot is directed east, further into the woodlot as the elevation within the woodlot decreases slightly towards the east (LGL 2011).

3.6 Constraints and Impact Analysis

Efforts should be taken to minimize impacts to the Boyer Woodlot mid-aged to mature forest and swamp; and associated plantations that provide a corridor for mammal movement through the remaining natural heritage system on the York University campus. Regionally rare species and their habitat should be avoided when planning future development proposals. If avoidance is not possible along the western edge, regionally rare plant species should be transplanted to suitable habitat. Displaced habitat for regionally rare wildlife species should be created or restored in other natural areas on the York University property.

3.7 Ecosystem Services

Conservation, restoration and management of the Boyer Woodlot will have positive ecosystem services for the students, faculty and workers that utilize the York University campus. For example, conserving urban forests regulates the microclimate (evapotranspiration-cooling effects, carbon dioxide sequestration, oxygen generation, removal of gaseous and particulate pollutants), prevents erosion, filters water and, the natural area is used for recreation and aesthetics. These ecosystem services play a role in enhancing environmental quality, quality of life, and, sustainable urban development. Conservation of the Boyer Woodlot will also conserve forest-dependent species (Reyers *et. al.* 2012 and Jim *et. al.* 2009).

4.0 MANAGEMENT AND RESTORATION

4.1 Goals and Guiding Principles for the Boyer Woodlot Restoration

Some guiding principles have been followed to improve the Boyer Woodlot and have been adapted from Apefelbaum *et al. (2010)*:

1. Work with, not against nature and mimic what historically occurred in the area, but be flexible and adaptable to natural succession. Restore vegetation communities based upon current site conditions and past anthropogenic disturbances rather than trying to manage the land in a way that would create habitat that is not suited to the area in the long term. The objective is to restore vegetation communities that are self-sustaining and usually what naturally occurred prior to human disturbance in that location.
2. Start restoration and management work in the most pristine ecosystems because healthier areas are refugia for species that can be reintroduced or disperse into more disturbed areas. After management has been started in the higher quality areas then the more disturbed areas should be tackled.
3. Improve the floral composition, structure and function, leading to increased faunal diversity.

4.2 Management of Ecological Stressors

The following is a list of the key ecological stressors that need to be addressed in order to restore the habitat in the Boyer Woodlot:

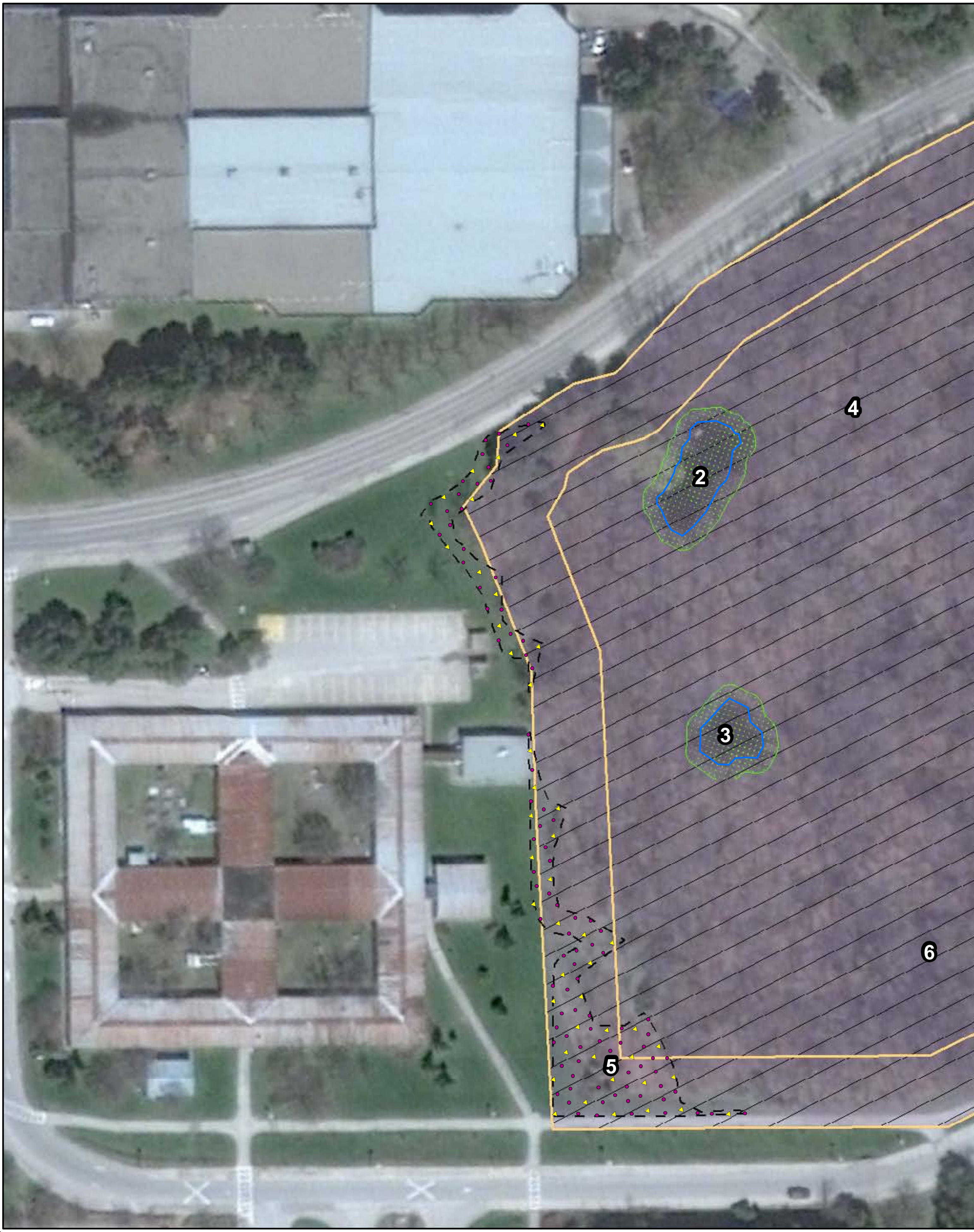
1. **Invasive species** - have spread as a result of anthropogenic influences, exotic plant and animal introductions;
2. **Edge Effect –** Development of the Pan AM Games stadium immediately to the west of the Boyer Woodlot will cause edge effects;
3. **Fragmentation** - from surrounding natural areas; and,
4. **Anthropogenic influences** – Current land use practices within and adjacent to the Boyer Woodlot have led to dumping, adverse trail systems and inappropriate landscaping immediately adjacent to natural features.
5. **Lack of Brush and Vegetation in Vernal Pools –** There is a lack of brush and hydrophytic forbs and graminoids within the vernal pools.

In order to address the current ecological stressors facing the Boyer Woodlot, the following management techniques are recommended to improve the habitat:

1. **Woody Plant Control** – To remove unwanted invasive woody vegetation, focusing on common buckthorn (*Rhamnus cathartica*) as well as control of sweet cherry (*Prunus avium*), Tartarian honeysuckle (*Lonicera tatarica*), Morrow's honeysuckle (*Lonicera tatarica*), common privet (*Ligustrum vulgare*), hybrid willow (*Salix x sepulcralis*) and common pear (*Pyrus communis*) if their abundance becomes greater;
2. **Invasive Species Control** - Herbicide application to remove invasive plant species that outcompete native plants, focusing on garlic mustard (*Alliaria petiolata*), periwinkle (*Vinca minor*) and dog strangling vine (*Cynanchum rossicum*) as well as control of dame's rocket (*Hesperis matronalis*), wood avens (*Geum urbanum*) if their abundance becomes more pronounced;
3. **Edge Management** – Planting of native trees and shrubs along the western edge of the Boyer Woodlot to help reduce the edge effects from the Pan American Games Track and Field Stadium development;
4. **Fragmentation** – There are no natural areas adjacent to the Boyer Woodlot. No corridors can be created without removing buildings (**Figures 4** and **5**); and;
5. **Lack of Brush and Vegetation in Vernal Pools –** To remedy the lack of woody brush present within the vernal pools; fallen trees and shrubs from within the woodlot should be placed into the vernal pools to provide additional amphibian egg laying sites. Additionally hydrophytic forbs and graminoid plugs and potted stock should be grown and planted within the vernal pool to increase the native plant composition; enhance the structure and function for wildlife usage.

4.2.1 Woody Plant Control

Removing common buckthorn cover is recommended to open the understorey and ground cover for native plants in the Boyer Woodlot. **Figure 5** delineates where common buckthorn should be removed from within the Boyer Woodlot and **Appendix C** describes the required equipment to carry out the task. Once the common buckthorn has been reduced through a combination of brush cutting, hand pulling and chainsaw use, Garlon needs to be applied to the cut stumps, basal bark or into a cut in the trunk. In order to allow the native seedbank to re-establish common buckthorn removal will have to occur for three to five years to kill the abundant common buckthorn root systems and deplete the common buckthorn seedbank present from previous years fruiting.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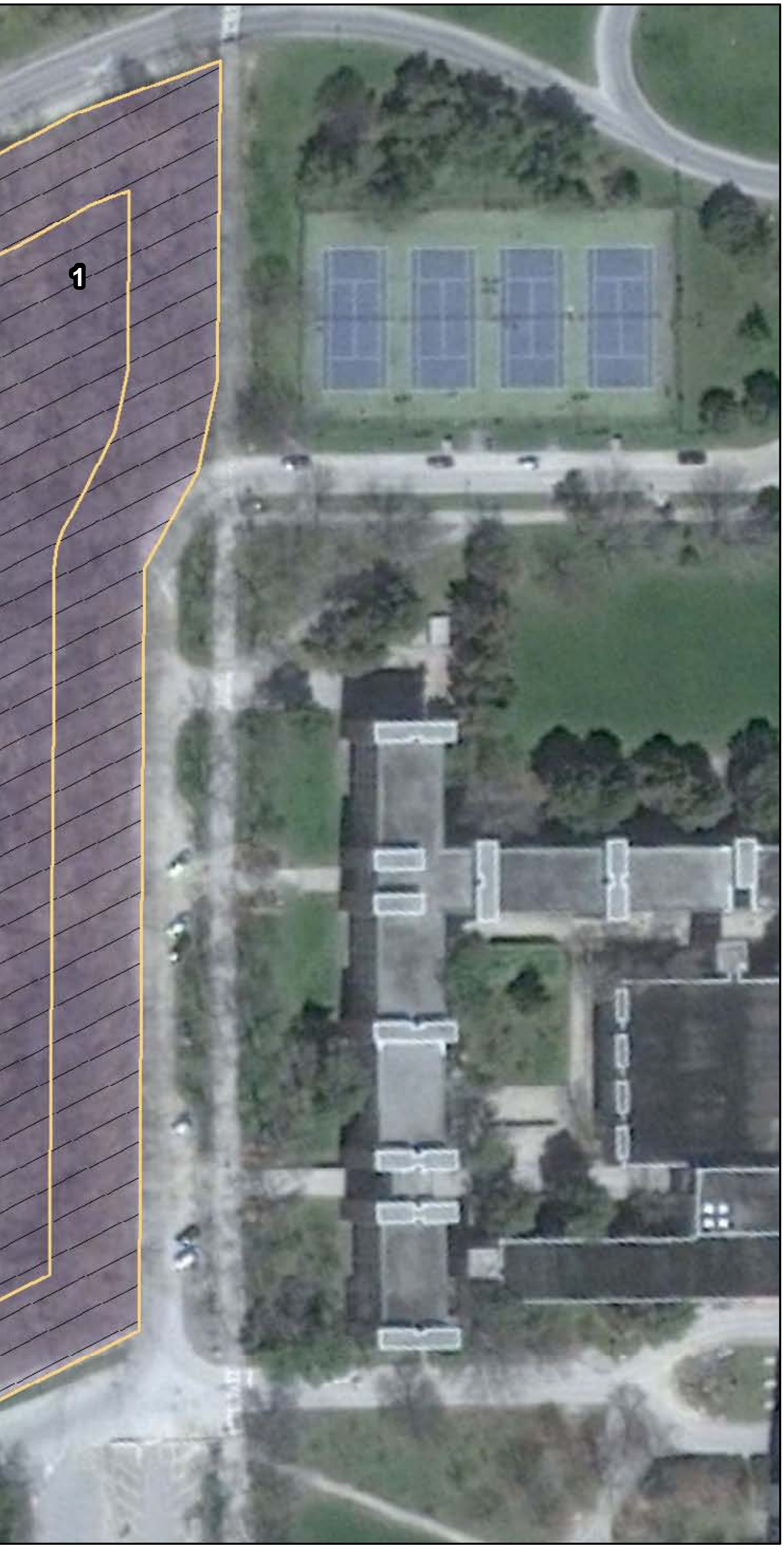

LEGEND

- Common Buckthorn (Chainsaw, Brush-cutting and Garlon herbicide application) Removal
- Garlic Mustard (Hand Removal & Roundup herbicide application
- Ash and Elm Hazard Tree Removal (15m) Zone
- Proposed Monitoring Location
- Vernal Pools
- Tree (6m spacing) & Shrub (3m spacing) Planting Area
- Wetland and Aquatic Planting (0.5m spacing)
- Tree Planting
- Shrub Planting

Data Source: LGL Limited Field Surveys.

20 10 0 20 Metres

N

BOYER WOODLOT RESTORATION SITE PLAN

LGL LIMITED
environmental research associates

Project: TA8152	**Figure:** 5
Date: November 2012	**Prepared By:** KDR
Scale: 1 : 1000	**Checked By:** DEB

Thinning of the common buckthorn cover in the understorey and ground cover will allow native shade-tolerant species to re-establish in all of the seral levels. Removing the common buckthorn increases the light availability to the ground, reduces the competition and encourages the growth of native understorey and ground layer plants. There are other woody invasives that are not quite as abundant or problematic as common buckthorn, but they should still be controlled, including sweet cherry (*Prunus avium*), Tartarian honeysuckle (*Lonicera tatarica*), Morrow's honeysuckle (*Lonicera tatarica*), common privet (*Ligustrum vulgare*), hybrid willow (*Salix x sepulcralis*) and common pear (*Pyrus communis*). Fruit from all cut woody invasives should be collected and disposed of off-site. Cut woody invasives should be cut and brush piles should be created from their remains to improve the wildlife habitat. Brush piles should be placed in openings where large quantities of common buckthorn have been removed. Further details on techniques for the removal of woody invasive species are provided in **Appendix D**.

4.2.2 Hazard Tree Management

Hazard tree management should focus on the dead standing trees located within the edges of the woodlot. All dead standing trees or hazard trees should be examined to determine if they can be retained and if required, what portions of the trees should be removed to reduce the hazard. The objective should be to retain as many dead standing trunks as possible.

In addition, the health of ash trees should be monitored and any ash trees that die as a result of Emerald Ash Borer that are within 15 metres of the woodlot edge will be examined. Branches and leaning trunks that pose a hazard should be cut down. Where possible, dead standing ash trunks should be retained for wildlife habitat. If Ash tree removal is required they should be cut down and left to decompose where they fall. The health of the elm trees should also be monitored and any elm trees that die of Dutch Elm Disease that are within 15 metres of the woodlot edge should be cut down, buried or burned to reduce the spread of Dutch Elm Disease (**Figure 5**).

No signs of either Asian Long-horned Beetle or Gypsy Moth were observed during 2012 field surveys. Both species are known to occur within the area and susceptible trees should be monitored to look for signs of infestations. York University's Keele Campus lies within the Asian long-horned beetle, Emerald Ash Borer and Gypsy Moth Regulated Area. Until the pests have been eradicated, the Canadian Food Inspection Agency recommends that known host species should not be planted (Canadian Food Inspection Agency, 2006b, 2012a and 2012b). The problem with this stipulation is that it eliminates almost all of the dominant deciduous tree species in the Toronto area for restoration purposes.

4.2.2.1 Emerald Ash Borer (Agrilus planipennis) Control

Emerald Ash Borer is an introduced insect from Asia that attacks and kills all ash (*Fraxinus*) trees. There are three species of ash present within the Boyer Woodlot, including abundant red ash (*Fraxinus pennsylvanica*) and rare European ash (*F. excelsior*) in the FOD6-5 vegetation community as well as abundant white ash (*F. americana*) in the northwestern hedgerow.

According to the City of Toronto Urban Forestry Branch (2012):

> "The Canadian Food Inspection Agency (CFIA) confirmed the presence of Emerald Ash Borer in 2007 within Toronto. All ash trees in Toronto are at risk of dying from this infestation. Mortality takes between 1 to 3 years once infestation has started" (City of Toronto 2012).
>
> New pesticide application techniques and products have provided a potential new solution to Emerald Ash Borer as is described by the City of Toronto (2012):
>
> "Pesticide injection can be used to protect trees for a certain period of time, in order to provide an extended control the injection needs to be repeated every two years. Repeated injections may

> affect the long term health of the tree given the impact of drilling holes into the main stem. However, a study of wound response conducted on City-owned trees, showed that over 90% of injection site wounds were completely healed after 2 growing seasons."

The insecticide that the City of Toronto used was created by BioForest Technologies Inc (2012):

"A pesticide called TreeAzin is the only registered product for use in Canada against Emerald Ash Borer. TreeAzin has been shown to be effective in the control of Emerald Ash Borer in keeping ash trees alive. TreeAzin is a systemic bioinsecticide containing Azadirachtin. A liquid formulation has been developed for stem injection by the Canadian Forest Service in collaboration with BioForest Technologies Inc. The pesticide has an Emergency Registration by the Pest Management Regulatory Agency (PMRA) of Health Canada for Emerald Ash Borer control in ash trees. *TreeAzin* inhibits Emerald Ash Borer larval development, prevents adult emergence, and provides preventative and remedial treatments."

4.2.2.2 Dutch Elm Disease Control

Dutch Elm Disease is the primary cause of mortality of all of the elm (*Ulmus*) trees. There is one species of elm present within the Boyer Woodlot: white elm (*Ulmus americana*). White elm trees are found rarely within the FOD6-5 vegetation community.

According to the City of Toronto Forest Health Care brochure (2010) and Myers and Bazely (2003):

> "Dutch elm disease is a wilt disease caused by ascomycete fungi: *Ophiostoma ulmi* and *O. novo-ulmi*. The fungus is spread by elm bark beetles in the genus *Scolytus.* The potential for spread is determined by the movement of infected wood and the by the flight of contaminated beetles. It attacks and blocks the water-conducting system of certain elm trees. Infection usually results in the death of the tree. The fungus spreads from infected to healthy trees. Dead elm trees, elm logs and firewood serve as breeding sites for the elm bark beetles. Connecting roots between infected and healthy trees (root grafts) may also serve as conduits for transfer of the fungus."

The following management practices to control Dutch Elm Disease are described by the City of Toronto (2010):

> "Control of Dutch Elm Disease depends mainly on denying elm bark beetles places to breed. Quick removal and disposal of seriously infected and dead trees reduces the spread of the disease to other healthy trees. The recommended method of disposal is burial or burning. Tree care specialists should debark, bury or burn all affected stems greater than 1cm in diameter, and the stump should be cut flush to the ground. Where elms grow close to each other and root grafting is suspected, a trench approx. 60 cm deep should be dug around infected trees to cut potential root grafts."

4.2.2.3 Asian Long-horned Beetle (Anoplophora glabripennis) Monitoring

According to the UFORE report completed for the York University Keele Campus by Royle *et. al.* (2009):

> "Asian long-horned beetle bores into trees and kills a wide variety of hardwood species. The Asian long-horned beetle affects both healthy and weak trees. Young shoots wither and die as a result of feeding damage *(*Canadian Food Inspection Agency, 2006a)."

A number of host tree species are present within the Boyer Woodlot study area, including **maple (*Acer*):** Manitoba maple (*Acer negundo*), black maple (*A. nigrum*), silver maple (*A. saccharinum*), sugar maple (*A. saccharum*) and Freeman's maple (*A.X freemanii*); **poplar (*Populus*):** eastern cottonwood (*Populus* *deltoides*), trembling aspen (*P. tremuloides*), and Carolina poplar (*P. X canadensis*); **willow (*Salix*):** hybrid willow (*Salix X sepulcralis*); **mountain ash (*Sorbus*):** European mountain-ash (*Sorbus aucuparia*); and, **elm (*Ulmus*):** white elm (*Ulmus americana*) (Canadian Food Inspection Agency, 2006B). If any trees with signs of Asian Long-horned Beetle are encountered during monitoring; York University faculty and the Canadian Food Inspection Agency will be notified immediately.

4.2.2.4 Gypsy Moth (Lymantria dispar) Monitoring

According to the UFORE report completed for the York University Keele Campus by Royle *et. al.* (2009):

> "Gypsy Moth is a forest pest that defoliates healthy trees and can cause death in combination with other detrimental factors (Canadian Food Inspection Agency, 2006c). --- Females lay egg masses which can be found on tree bark, branches and near other protected areas (e.g. fallen logs, lawn furniture/equipment). As larvae grow they feed on foliage – making large holes in leaves and consuming the leaf margin. Large infestations can completely defoliate a tree – whereas feeding is often barely noticeable at low populations. Tree mortality typically occurs after at least four subsequent years of infection or in combination with other insects or diseases."

A number of host tree species are present within the Boyer Woodlot study area, including **oak (*Quercus*):** abundant bur oak (*Quercus macrocarpa*), rare red oak (*Q. rubra*), planted pin oak (*Q. palustris*) and planted black oak (*Q. velutina*), which are all the Gypsy Moth's main host genus. Other host species in the Boyer Woodlot study area include: **maple (*Acer*):** Manitoba maple (*Acer negundo*), black maple (*A. nigrum*), silver maple (*A. saccharinum*), sugar maple (*A. saccharum*) and Freeman's maple (*A.X freemanii*); **hawthorn (*Crataegus*):** large-fruited thorn (*Crataegus punctata*); **beech (*Fagus*):** American beech (*Fagus grandifolia*); **apple (*Malus*):** common apple (*Malus pumila*); **poplar (*Populus*):** eastern cottonwood (*Populus deltoides*), trembling aspen (*P. tremuloides*), and Carolina poplar (*P. X canadensis*); **willow (*Salix*):** hybrid willow (*Salix X sepulcralis*); **cherry (*Prunus*):** sweet cherry (*Prunus avium*), planted pin cherry (*P. pensylvanica*), black cherry (*P. serotina*), and choke cherry (*P. virginiana*); **basswood (*Tilia*):** American basswood (*Tilia americana*) and many other tree and shrub species (Canadian Food Inspection Agency, 2006c). If any trees or shrubs with signs of Gypsy Moth are encountered during monitoring; York University faculty and the Canadian Food Inspection Agency will be notified immediately.

4.2.3 Invasive Plant Control

The following herbaceous invasive plant species should be removed: garlic mustard (*Alliaria petiolata*), dame's rocket (*Hesperis matronalis*), wood avens (*Geum urbanum*), periwinkle (*Vinca minor*) and dog-strangling vine (*Cynanchum rossicum*). **Figure 5** delineates where garlic mustard should be removed either through hand pulling and/or RoundUp herbicide application within the Boyer Woodlot and the southern hedgerow.

Native and non-native invasives should be removed when they are out-competing the native vegetation and closing the canopy cover of a vegetation community. Invasive plants should be sprayed or hand wicked with RoundUp Ultra containing Glyphosate if they are herbaceous or Garlon if it is a woody plant. Invasive woody vegetation is further described in **Section 4.2.1**. Four plants should be focused upon during invasive plant control, common buckthorn, garlic mustard, periwinkle and dog strangling vine. Other invasive plant species that require management should also be controlled where they are becoming a problem.

Many non-native and native invasive plant species have spread into the Boyer Woodlot as a result of agricultural tilling, grazing, roads and trails, cultivated plant dispersal, exotic plant and animal introduction and seeding of hay fields. The dominance of aggressive non-native plants needs to be controlled and reduced. **Table 5** describes the abundance and distribution of the priority invasive plant species within and immediately adjacent to the Boyer Woodlot. Further details on techniques for the removal of invasive species are provided in **Appendix D**.

TABLE 5.
PRIORITY INVASIVE PLANT SPECIES

Invasive Herbaceous or Woody Plants that Threaten Habitat Structure and/or Species Composition of the Boyer Woodlot		
Common Name	**Scientific Name**	**Abundance and Distribution**
Common Buckthorn	*Rhamnus cathartica*	Dominant in the understory of FOD6-5 and SWD3-2; abundant in the ground layer of the SWD3-2.
Dog Strangling Vine	*Cynanchum rossicum*	Rare in the ground layer of the FOD6-5.
Garlic Mustard	*Alliaria petiolata*	Abundant in the ground layer of FOD6-5 and CUP1, and occasional in the ground layer of SWD3-2.
Periwinkle	*Vinca minor*	Rare to occasional in the FOD6-5 and SWD3-2 vegetation communities.

4.2.4 Fragmentation

Boyer Woodlot is fragmented from the other Natural Heritage features in the York University campus. The closest woodlot is Danby Woodlot to the east or the Saywell Woods to the southwest. There is no natural heritage connection between them. Boyer Woods is surrounded by university buildings, paths, roads and planted tree rows.

4.2.5 Edge Management

Forest edge management in accordance with the TRCA *Forest Edge Management Plan Guidelines* (2004) is recommended for the western edge of the Boyer woodlot because the Pan Am Games Stadium grading limits will come right up to the edge of the dripline of the Boyer Woodlot. As part of Forest Edge Management, mitigation measures should include, but not be limited to the following:

- Planting of appropriate native trees, shrubs and ground flora which shall be undertaken as soon as possible following vegetation removals. Plantings along the disturbed forest edge will provide a protective buffer. The newly exposed forest edge becomes exposed to a greater potential for aggressive and invasive species infiltration further into the forest interior causing greater impacts. Micro-habitat conditions are also altered due to a greater incident of light penetrating further into the forest resulting in decreased soil moisture and increased windthrow. Plant species used within the buffer shall be somewhat similar to those in the adjacent habitat and be non-invasive in nature.
- Grading within areas where edges will be newly created shall be designed to meet existing grades a minimum of 3 m away from the tree drip-line.
- Compaction of soils on lands immediately adjacent to the newly exposed forest edge will be minimized to the extent possible. Construction activities can result in cut roots, and soil compaction due to re-grading and fill placement. Cut tree roots can reduce a tree's capacity to uptake and transfer water and nutrients, and soil compaction can result in a decrease in air spaces within the soil which can reduce the infiltration capacity of the soil, limit soil oxygen and limit root penetration. Decompaction efforts and methodology shall be site specific. Where decompaction is required, it shall extend to a minimum depth of approximately 25 cm.

- Drainage patterns adjacent to the newly created edge shall be maintained to avoid changes in soil moisture, this is especially important around forest communities with substrates that maintain increased moisture capacity.
- A plan must be in place to immediately mitigate the spread/invasion of aggressive plant species.
- A monitoring plan must be developed to ensure that the newly planted material survives and fulfils the intended function and to ensure that the inadvertent spread of aggressive or non-native plant species is appropriately managed.

4.2.6 Tree and Shrub Planting Plan

4.2.6.1 Edge Tree and Shrub Planting Area

Figure 5 delineates the proposed Tree and Shrub Planting area along the western boundary of the Boyer Woodlot. A stadium for the Pan AM Games is being built immediately adjacent to the woodlot. The majority of the development envelope is greater than 6 m away from the drip line along the western edge, but in some areas it is less. To mitigate the edge effects caused by construction within the 6 m buffer a Tree and Shrub planting area has been placed within the small buffer between the development and the woodlot. The Tree and Shrub Planting area is broken into two polygons: one to the north that is 0.028 ha in size; and, the other to the south that is 0.045 ha in size. There is a gap in the middle of the Tree and Shrub Planting Area where the development envelope comes right up to the tree line edge and that is why the planting area is separated into two polygons. Trees will be planted on 6 m centres while shrubs will be planted on 3 m centres.

Tree and shrub species will consist of a mixture of woody plants that are found within the FOD6-5 and SWD3-2 vegetation communities.

Tree species will consist of:

1. Bur Oak (*Quercus macrocarpa*);
2. Sugar Maple (*Acer saccharum*);
3. Trembling Aspen (*Populus tremuloides*);
4. Eastern White Pine (*Pinus strobus*);
5. Bitternut Hickory (*Carya cordiformis*);
6. American Beech (*Fagus grandifolia*);
7. Red Oak (*Quercus rubra*);
8. Ironwood (*Ostrya virginiana*);
9. Basswood (*Tilia americana*);
10. Eastern Cottonwood (*Populus deltoides*);
11. Silver Maple (*Acer saccharinum*); and,
12. Black Maple (*Acer nigrum*).

Shrub species will consist of:

1. Chokecherry (*Prunus virginiana*);
2. Staghorn Sumac (*Rhus hirta*);
3. Alternate-leaved Dogwood (*Cornus alternifolia*);
4. Red-osier Dogwood (*Cornus sericea*);
5. Wild Red Raspberry (*Rubus idaeus ssp. strigosus*);

6. Native Hawthorn species (*Crataegus sp.*);
7. Red-berried Elderberry (*Sambucus racemosa var. racemosa*);
8. Nannyberry (*Viburnum lentago*); and,
9. Common Elderberry (*Sambucus nigra* ssp. *canadensis*).

Special emphasis will be placed upon selecting native tree and shrub species that produce edible fruit for wildlife and have thorns and bristles to discourage anthropogenic disturbance of the forest edge. Tree and shrub protection barriers should be installed at the base of the trees and shrubs after planting. Trees and shrubs should be watered as required.

4.2.6.2 Planting within Openings in the Canopy Cover

In order to enhance the structural and species diversity of the woodlot, trees and shrubs should be planted within openings in the canopy cover. As ash and elm trees fall; they will open up the canopy cover. Additionally as invasive plants are removed; this will reduce competition for light, water, nutrients, space and remove some of the negative allelochemicals within the soil produced by the invasive plant species. Negative allelopathy is when plants produce chemicals that have a detrimental effect on the growth, survival and reproduction of surrounding plant species. For example garlic mustard (*Alliaria petiolata*) produces allelochemicals that suppress the growth of native mycorrhizal fungi that native forest trees require for optimum growth and establishment.

It is anticipated that the native plant seedbank will respond favourably to less competition for light, space, nutrients and water. If the native seedbank is so depleted and all that remains is an exotic seedbank, then native trees and shrubs should be planted in the new openings within the canopy cover. Trees will be planted on 6 m centres while shrubs will be planted on 3 m centres. If the native herbaceous seedbank is completely depleted, plugs and/or woodland seed mixes and plugs should also be used.

Tree and shrub species should consist of a mixture of plants that are found within the FOD6-5 and SWD3-2 vegetation communities.

Special attention should be paid to planting shade tolerant woody species in smaller gaps created by fallen trees or felled trees. The following trees should be planted in small gaps:

1. Sugar Maple;
2. American Beech;
3. Ironwood;
4. Basswood; and,
5. Black Maple.

The following shrubs should be planted in small gaps:

1. Alternate-leaved Dogwood;
2. Chokecherry;
3. Nannyberry;
4. Red-berried Elderberry; and,
5. Common Elderberry.

Semi shade-tolerant and shade intolerant woody species should be planted along the edge or in larger openings within the canopy cover; primarily where buckthorn has been removed.

The following trees should be planted in large gaps and along the edges:

1. Bur Oak;
2. Trembling Aspen;

3. Eastern White Pine;
4. Bitternut Hickory;
5. Red Oak;
6. Eastern Cottonwood; and,
7. Silver Maple.

The following shrubs should be planted in large gaps and along the edges:
1. Staghorn Sumac;
2. Red-osier Dogwood;
3. Wild Red Raspberry; and,
4. Native Hawthorn species.

Tree and shrub protection barriers should be installed at the base of the trees and shrubs after planting. Trees and shrubs should be watered as required. Further tree and shrub planting techniques are listed in **Section 4.2.6.1**.

4.2.7 Vernal Pool Mitigation

4.2.7.1 Soil Amendments
Since the Conestoga Rovers & Associates (2011) study figures that the vernal pools are fed by surface water flow, adding a fine textured impermeable clay soil should hypothetically help to maintain the water depth in the northern pond for a longer period of time. Auger samples were taken in both of the vernal pools. To hold water, the vernal pools need to be lined with clay, which they both were. The drier, larger and northern vernal pool was analyzed to determine if soil amendments would help to impede the water drainage.

Spotted Salamanders and Wood Frogs utilize the wetter, smaller, and southern vernal pool, but they have not been observed within the northern vernal pool. The hypothesis is that the northern vernal pool dries out too quickly for the amphibians to complete their reproductive cycles. It was determined that a 58 cm clay lens should be more than sufficient to impede the water drainage. There must be another factor that has not been determined by LGL that is allowing the water to drain too quickly.

A potential reason for the quicker water drainage is pockets of permeable/coarse soils within or immediately adjacent to the northern vernal pool near the surface. The coarse soils would allow the water to drain from the northern vernal pool. Further studies of the northern vernal pool are required if York University wants to slow down the water drainage and potentially create another Spotted Salamander and Wood Frog breeding habitat.

4.2.7.2 Brush Pile Creation
To remedy the lack of woody brush present within the vernal pools; fallen trees and shrubs from within the woodlot should be placed into the vernal pools to provide additional amphibian egg laying sites. Brush should also be used to create shoreline habitat features for rabbits, and other wildlife. Rocks and logs can be placed along the shore and in the water to create wildlife habitat. Submerged rocks and logs provide habitat for dragonfly and other insect larvae and contribute to a balanced ecosystem; partially submerged logs provide basking areas for turtles and frogs, and hunting posts for birds. The more structural diversity there is the more wildlife habitat and species diversity (Essex Region Conservation Authority 2012).

4.2.7.3 Emergent, Floating-leaved and Submergent Plantings
Native grasses, sedges, wildflowers and aquatic plants provide food, shelter and nesting areas for many wildlife species. To attract and sustain abundant wildlife, these native plants should be added in and

around the vernal pool (Essex Region Conservation Authority 2012). Hydrophytic plant plugs and/or potted stock will be grown in a greenhouse and planted to increase the native plant composition; enhance the structure and function for wildlife usage. The following native plants will be grown and planted on 0.5 m centres:

1. Broad-leaved Cattail (*Typha latifolia*);
2. Narrow-leaved Cattail (*Typha angustifolia*);
3. Lesser Duckweed (*Lemna minor*);
4. Greater Duckweed (*Spirodela polyrhiza*);
5. Bebb's Sedge (*Carex bebbii*);
6. Blue-flag Iris (*Iris versicolor*);
7. Thoroughwort (*Eupatorium perfoliatum*);
8. Fringed Brome (*Bromus ciliatus*);
9. Fringed Sedge (*Carex crinita*);
10. Monkey Flower (*Mimulus ringens*);
11. Riverbank Wild Rye (*Elymus riparius*);
12. Rough-leaved Goldenrod (*Solidago rugosa*);
13. Spotted Jewelweed (*Impatiens capensis*);
14. Turtlehead (*Chelone glabre*);
15. Virginia Wild Rye (*Elymus virginicus*);
16. Porcupine Sedge (*Carex hystericina*); and,
17. Giant Manna Grass (*Glyceria grandis*).

Many of these hydrophytic plants reproduce rapidly and establish quickly. These plants provide food for birds and other mammals, and provide shelter for frogs and invertebrates. A higher proportion of grasses will be planted because they help to maintain the soil moisture and they produce abundant food supplies for many species (Essex Region Conservation Authority 2012).

4.2.7.4 Other Measures
Other measures that are likely to improve the vernal pool habitat quality include the following:

- Create earth islands to lure invertebrates and herptiles;
- Dead standing snags adjacent to the vernal pools should be left because they provide habitat and nesting areas for birds such as wood ducks and woodpeckers; and,
- Bird houses for both upland and waterfowl bird species are very successful around vernal pools.

4.2.8 Garbage Removal
Light dumping is widespread and evident throughout the Boyer woodlot. Efforts should be made to remove the amount of garbage throughout the Boyer woodlot. Periodic monitoring and removal of trash from the woodlot should occur.

4.2.9 Trail Access
Efforts should be made to minimize anthropogenic disturbance throughout the Boyer woodlot. Woodlots should be monitored to determine if trail use is causing any erosion, introducing further invasive plant species, furthering the negative impacts of light dumping or damaging the remaining native plant composition that is becoming scarce.

If monitoring reveals that trail use is leading to negative impacts to the woodlot then the trails should be closed for pedestrian use. Large berms composed of clean soil, root systems and/or building debris should be placed at the entrance to each trail system, provided that these berms will not affect drainage. Woody invasive plant species brush piles should be placed behind the berms to make them less appealing for pedestrian use. Any fruit from the invasive woody plants should be disposed of outside of the woodlot. If these measures are not sufficient to discourage trail use, then native hawthorns (*Crataegus*) should be planted at 3 m on centre with Alleghany blackberry (*Rubus allegheniensis*) and thimbleberry (*Rubus occidentalis*) planted at 1 m on centre at the entrance to each trail. All three species have thorns that will discourage pedestrian use of the trails.

4.2.10 Stewardship

4.2.10.1 Labs

Annual labs should be set up in the biology department to monitor the health and level of disturbance within the Boyer Woodlot. Flora and fauna surveys should be included to monitor how the management practices have changed the species diversity. As part of the labs, students should help to pick up garbage, pull invasive plant seedlings, install tree and shrub protection barriers as well as record other forms of disturbance. Each class should adopt a section of the Boyer Woodlot for yearly maintenance. Annual labs within the Earth and Atmospheric Science and Physical Geography departments should also be set up to monitor changes in the soils, hydrology and geomorphology.

4.2.10.2 Future Stewardship

Future stewardship activities should include:

1. litter clean-ups;
2. wildlife habitat construction (brush piles, rock piles, organic matter debris piles, snake hibernacula, bird boxes, etc…);
3. environmental monitoring;
4. tree and shrub planting;
5. native forb and graminoid planting; and,
6. watering.

4.3 Measures to Improve Wildlife Habitat

Because of the maturity and uniformity of the woodlot, there is low faunal species diversity. To increase the habitat variety and species numbers, a thinning of the common buckthorn is recommended to create more plant diversity in the understory and ground cover than is present now. As American elm and red ash die this will open up the canopy and allow for new ground growth and bring in species that feed on ground vegetation.

There are vernal pools within the woodlot every spring. Two of these vernal pools hold water long enough through the spring and summer seasons for wildlife usage. Spotted Salamander and Wood Frog breed in the smaller of the two vernal pools to the south. The larger vernal pool to the north has no amphibian activity. On a June 23rd visit, the water level of this vernal pool had dropped considerably (shoreline appeared to have dropped about 2 m) and by the August 28 visit it was totally dry. The smaller vernal pool to the south of it still maintained water at this date. The number of Spotted Salamander egg masses recorded in the smaller vernal pool was low.

Spotted Salamanders depend on sturdy aquatic plants, tree branches or twigs to support their egg masses in the water while the young develop. One tree along the northwest edge of this vernal pool had a few branches extending into the vernal pool for salamanders to attach their egg masses to. More tree branches should be laid into the vernal pool to increase the number of potential egg laying sites. The branches should extend from the bottom of the vernal pool to just below the water's surface. There was no such vegetation to support salamander egg masses in the larger vernal pool. Perhaps this contributed to the absence of salamanders using it for breeding. This vernal pool should also have a number of tree branches added to it for spring breeding season. Even better, if sturdy natural vegetation could be planted within the vernal pools, it could attract salamanders for breeding purposes.

Birds appear to use the woodlot primarily for seasonal migration and as a food source. Little nesting activity was observed. Some of the non-native plants within the Boyer Woodlot could be removed to create open habitat so as to allow for some of the native vegetation to re-establish. Hopefully the creation of a better understory will encourage new bird species to use this woodlot for nesting.

Bird next boxes should be staked into the ground to encourage further nesting within the woodlot. The posts should be pound into the ground at least 60 cm deep leaving 1.6 m of the post exposed. A one metre long plastic tube should be installed just below the bird box to reduce nest predation. The bird next box should be installed at the top of the post with the plastic tube just below it. Four bird nest boxes should be installed; one at each edge of the woodland/at each cardinal direction.

Four rock piles and four organic matter debris piles should be placed at the edge of each side of the woodland. This will improve the habitat for any potential brownsnake (*Storeria dekayi*), common gartersnake (*Thamnophis sirtalis*) and red-bellied snake (*Storeria occipitomaculata*) that may potentially inhabit the area. The likelihood that there is an abundant snake population within and immediately adjacent to the Boyer Woodlot is low, but there is a small potential because of their cryptic nature. The rock piles and organic matter debris piles should be placed in openings near the edge of the woodland where large amounts of common buckthorn are removed.

Overall this woodlot is considered a highly fragmented habitat that has been virtually cut off from surrounding habitats which it depends upon for species diversity and long term survival. What remains should be maintained, if not improved, to hold on to the value that remains. There are still some significant features about this woodlot that should be protected.

5.0 MONITORING OF BOYER WOODLOT RESTORATION

The intent of the monitoring program is to determine the effectiveness of management endeavours and techniques, as well as to document the changes to vegetation structure and composition within the Boyer Woodlot and adjacent natural areas as a result of management activities, natural succession through time and further anthropogenic impacts. The amount of native seedbank that is still present should be monitored to determine if potted stock, plugs or seed mixes are required to augment the restoration efforts. In addition, monitoring should be completed on the growing progress of all planted trees and shrubs. If at any time during the monitoring program the planted trees and shrubs are found to be declining or in poor health, additional management strategies should be brought forward as part of the adaptive management strategy.

5.1 Long-term Monitoring

Annual monitoring reports should be provided for a five year monitoring time period once the Boyer Woodlot Management Plan has been approved. It is suggested that Monitoring should occur every three years after the five year monitoring time period has ended to ensure a successful long-term response to restoration initiatives. The Boyer Woodlot will never be completely restored to a point where it functions without maintenance. Stewardship activities will have to occur in perpetuity. Only in the most remote locations, where the land is still connected to the larger ecosystem processes are self-sustaining ecosystems even possible (Apfelbaum *et. al.* 2010). There are too many anthropogenic stressors, including development pressures, fragmentation, invasive species, mowing, trash and other anthropogenic impacts within the Boyer Woodlot for it to become self-sustaining. Ecosystem restoration in an urban environment is a commitment forever. As the York University campus grows in size, the impacts will become greater unless they are managed in the future.

According to Section 3.7.1.8 of the York University Secondary Plan (2009):

"Management/stewardship plans will include adaptive management monitoring programs to:

a) determine and measure the ongoing health of the woodlots;
b) determine whether the management practices implemented are effective; and
c) determine if modifications are required due to unacceptable impacts from adjacent development."

In order to ensure Section 3.7.1.8 (a) is successful, long-term monitoring and adaptive management in perpetuity are required.

5.2 Monitoring Station Site Selection

Permanent photo monitoring stations should be established at six random points in the Boyer Woodlot (**Figure 5**). Permanent monitoring stations should consist of 10.0 meter (m) by 10.0 m plots (100 m^2 plots), where qualitative and quantitative measurements of plant community structure and composition may be carried out for the five-year monitoring time period. Plots should be established in areas that when monitored, shall provide the necessary information required to assess the status of habitat restoration efforts, species diversity and invasive plant abundance on a micro scale.

5.3 Photo Monitoring Methods

Photo monitoring should be conducted three times (mid-May, mid-July and mid-September) at each permanent photo monitoring station location for a five-year monitoring time period once the Boyer Woodlot Management Plan has been approved. Two T-bars should be placed into the ground at each permanent monitoring station. The GPS co-ordinates should be recorded to ensure that the same spot is being photographed every year. A Photo Monitoring board should be placed on a piece of rebar that shall be inserted immediately adjacent to one of the T-bars, to determine plant structure and dominance.

A total of five photographic positions should be taken at each photo monitoring station, one in each cardinal direction (north, south, east and west) from the centre of the quadrat and an additional north-facing photograph from the southern end that includes the photo monitoring board. The annual photographic comparison should be complemented with quantitative measurements of vegetation height and density using the photo monitoring board. The photo monitoring board is 30 cm wide by 200 cm high and is painted with alternating, equal length bands of black and white paint. Vegetation density should be estimated by the percentage of each coloured band that is covered by vegetation. The cover values relative to vegetation density shall be described as follows: sparse (0 to 30 percent (%) cover); moderate (31 to 60% cover); dense (61 to 90% cover); and very dense (>90% cover).

5.4 Vegetation Community Surveys

All plant species within the 100 m^2 plots and their abundance within each community level (canopy, sub-canopy, understory and groundcover) should be recorded at each monitoring station. Abundance shall be estimated as a percent cover: dominant (>50% cover), abundant (35-50% cover), occasional (1-35% cover) or rare (<1% cover). All significant flora species, invasive species, wildlife use and level of disturbance (caused by humans, wildlife and/or weather) should be recorded. An annual photographic record should provide a mechanism to analyze the health status of the restored and enhanced Boyer Woodlot and adjacent natural lands. It shall provide the opportunity to eliminate invasive species from the area should they establish or require control.

5.4.1 Vegetation Community Analysis

A Floristic Quality Assessment (FQA) should be completed using the vegetation data collected from each monitoring station plot. Each native and exotic plant species present on the sites has an assigned Coefficient of Conservatism (CC) value which ranges from 0 to 10. Species that have little or no fidelity to natural ecosystems and occur widely in a variety of altered and unaltered landscapes have lower CC values (e.g., 0-1); while species that show a very high association with unaltered natural ecosystems and do not occur in altered landscapes receive a high CC value (e.g., 9-10). The CC values for each species shall be used to calculate an overall Floristic Quality Index (FQI), which represents the relative proportions of exotic/generalist species and specialist native species. Based on this criteria, the sites shall be classified as high significance sites if the floristic quality index values is (FQI > 35), moderate significance sites if (20 < FQI < 35), and low significance sites if (FQI < 20). This method should be used as one measure of restoration success (i.e. actively restored sites have higher floristic quality values, lower sum of weediness values, and greater forest species diversity than originally assessed).

5.4.2 Invasive Species Control

The distribution and abundance of invasive species within the Boyer Woodlot and adjacent natural lands should be described and delineated annually. Invasive plant species monitoring and management will be necessary for a minimum of five years to help exhaust the growth of any invasive plant species present.

5.5 Faunal Monitoring

Spring surveys for wildlife in the Boyer Woodlot should be carried out every second year to determine how the restoration initiatives have enhanced the woodlot. Early spring amphibian surveys should be conducted to see if vernal pool improvements have increased their usage or attracted new species. Amphibian call surveys and egg searches in the vernal pools are good methods to determine presence or absence of such species. Monitoring should occur throughout the spring and summer seasons to determine whether the lowering water levels and possible lack of food sources in the larger vernal pool could be factors contributing to the absence of amphibian species.

Breeding bird surveys should be conducted every second year in early summer to determine which species have adapted to the woodlot restorations and become permanent residents. Surveys should be conducted in the early mornings when the birds are most active. Breeding bird surveys involve conducting point counts in areas that represent specific habitat types to maximize the number of species that would be recorded as breeding in the study area. The point count methodology involves standing quietly for five to ten minutes in a particular location and recording any bird species seen or heard within 100 meters. This methodology should be repeated a second time, at least one week later at the same locations to determine which species are recorded again. Species recorded two weeks in a row in the same areas are considered local breeding birds according to BSC BBA criteria.

Mammals can be surveyed almost any time of the year. Reading signs, like tracks, feces, hair samples, food caches, nests and tree holes, can be used for species identification. Since most mammal species are nocturnal, visits to the woodlot, preferably at dusk, could reveal mammal species that become active at this time.

6.0 FUTURE STEPS FOR THE BOYER WOODLOT

6.1 Goals and Guiding Principles for Boyer Woodlot Restoration

Currently, the goals and guiding principles outlined in **Sections 4.1** and **4.2** should be considered as a first step. Yearly management and restoration activities should be re-assessed on an on-going basis to determine how successful the goals and guiding principles are for the restoration of the Boyer Woodlot.

6.2 Monitoring Program

The Monitoring Program should be used to evaluate the progress towards the goals and objectives. Monitoring needs to be started prior to restoration in order to come up with a starting point prior to implementation. The Restoration and Monitoring Programs should be re-evaluated yearly allowing for implementation of adaptive management techniques in order to ensure a positive restoration outcome.

6.3 Implementation

Implementation of the restoration goals should be started to help improve the Boyer Woodlot. Extensive invasive plant removal programs are recommended to ensure future native plant compositions plus higher fauna and flora diversity within the woodlots. Dead Ash and Elm trees should be felled and/or left to decompose, burned or buried to reduce the risk of them falling on any individual(s) and remove further infestations of Dutch Elm Disease. Further monitoring should be carried out to determine if Gypsy Moth and Asian Long-horned Beetle are present and what level of impact they have caused. A woody tree and shrub planting program should be started in the gaps and along the western edge of the woodlot. The vernal pools would benefit from soil amendments, brush to be added and hydrophytic plugs and/or potted stock planted. Garbage should be removed and access should be limited to reduce further anthropogenic impacts. **Table 6** describes the implementation schedule.

6.4 Adaptive Management

Documenting how, when and where habitat creation, restoration or enhancement efforts are implemented and how the vegetation community or Management Unit responded is essential. A comparison of baseline and annual monitoring data provides details on the changes that occurred. This analysis allows the restoration practitioner to view the rate of change of the vegetation communities, what plant or animal species appeared or disappeared because of a certain restoration action, what prescriptions worked best and under what weather conditions. This provides a basis for making accurate, ongoing and future restoration decisions based upon the progress of the past actions. It also allows the practitioner to adjust their methodology to reflect past monitoring results.

TABLE 6.
IMPLEMENTATION SCHEDULE

Activity	Season	Timeline (Years)				
		1	2	3	4	5
Baseline Monitoring	May, July and September	X				
Follow-up Monitoring	May, July and September		X	X	X	X
Garbage Removal	Spring, Summer and Fall	X	X	X	X	X
Common Buckthorn Control	**Fall**	**X**	**X**	**X**	**X**	**X**
Garlic Mustard Control	Mid-spring or Early Fall	X	X	X	X	X
Periwinkle Control	Spring preferably, but fall once the forest canopy is bare.	X	X	X	X	X
Dog Strangling Vine Control	Two applications from late May to early July	X	X	X	X	X
Tree and Shrub Plantings in gaps	Fall	X	X	X	X	X
Tree and Shrub Plantings along western woodland edge	Fall	X	X	X	X	X
Adding brush and planting hydrophytic plants in the vernal pools	Spring and Fall	X	X	X	X	X
Soil amendments to the northern vernal pool	Winter	X				
Tree and Shrub Maintenance (watering)	Spring, summer and fall	X	X	X	X	X
Additional Tree and Shrub Plantings	Fall		X	X	X	X
Faunal Monitoring	Spring		X		X	
Hazard Tree Monitoring and Removal	**Yearly**	**X**	**X**	**X**	**X**	**X**
Monitoring the woodlot for the presence and potential impact of Asian Long-horned Beetle and Gypsy Moth	Yearly	X	X	X	X	X
Stewardship	Yearly	X	X	X	X	X

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APPENDICES

APPENDIX A
WORKING VASCULAR PLANT CHECKLIST

Scientific Name	Common Name	Status					FQI		Vegetation Community		
		SRank	MNR	COSEWIC	Toronto	TRCA	FQI CC	FQI CW	FOD6-5	SWD3-2	CUP1
PINACEAE	**PINE FAMILY**										
* *Larix decidua*	European larch	SE2			+p	L+		5	X	X	
Picea glauca	white spruce	S5			+p	L3	6	3	X	X	
* *Pinus nigra*	Austrian pine	SE2				L+		-5		X	
Pinus strobus	eastern white pine	S5			X	L4	4	3		X	
CUPRESSACEAE	**CEDAR FAMILY**										
Thuja occidentalis	eastern white cedar	S5			X	L4	4	-3	X	X	X
RANUNCULACEAE	**BUTTERCUP FAMILY**										
Clematis virginiana	virgin's-bower	S5			X	L5	3	0			X
Ranunculus abortivus	kidney-leaf buttercup	S5			X	L5	2	-2	X		
* *Ranunculus acris*	tall buttercup	SE5			+	L+		-2		X	
Ranunculus sceleratus var. *sceleratus*	cursed buttercup	S5			X		2	-5	X		
BERBERIDACEAE	**BARBERRY FAMILY**										
Podophyllum peltatum	may-apple	S5			X	L4	5	3	X	X	
ULMACEAE	**ELM FAMILY**										
Ulmus americana	white elm	S5			X	L5	3	-2	X		
JUGLANDACEAE	**WALNUT FAMILY**										
Carya cordiformis	bitternut hickory	S5			X	L4	6	0	X	X	X
Juglans nigra	black walnut	S4			X	L5	5	3	X		
FAGACEAE	**BEECH FAMILY**										
Fagus grandifolia	American beech	S5			X	L4	6	3	X	X	
Quercus macrocarpa	bur oak	S5			X	L4	5	1	X	X	
Quercus palustris	pin oak	S4					9	-3			X

Scientific Name	Common Name	Status					FQI		Vegetation Community		
		SRank	MNR	COSEWIC	Toronto	TRCA	FQI CC	FQI CW	FOD6-5	SWD3-2	CUP1
Quercus rubra	red oak	S5			X	L4	6	3	X		
Quercus velutina	black oak	S4			U	L2	8	5			X
BETULACEAE	**BIRCH FAMILY**										
Ostrya virginiana	ironwood	S5			X	L5	4	4	X	X	
POLYGONACEAE	**SMARTWEED FAMILY**										
* *Rumex crispus*	curly-leaf dock	SE5			+	L+		-1	X		
TILIACEAE	**LINDEN FAMILY**										
Tilia americana	basswood	S5			X	L5	4	3	X	X	X
VIOLACEAE	**VIOLET FAMILY**										
Viola sororia	woolly blue violet	S5			X	L5	4	1	X		
SALICACEAE	**WILLOW FAMILY**										
Populus deltoides ssp. *deltoides*	eastern cottonwood	SU			X	L5			X	X	
Populus tremuloides	trembling aspen	S5			X	L5	2	0	X		
* *Populus* X *canadensis*	Carolina poplar	SE1			+	L+			X		
* *Salix* X *sepulcralis*	hybrid willow	SE2			+	L+			X	X	
BRASSICACEAE	**MUSTARD FAMILY**										
* *Alliaria petiolata*	garlic mustard	SE5			e	L+		0	X	X	X
* *Hesperis matronalis*	dame's rocket	SE5			+	L+		5		X	X
GROSSULARIACEAE	**GOOSEBERRY FAMILY**										
Ribes cynosbati	prickly gooseberry	S5			X	L5	4	5	X		
ROSACEAE	**ROSE FAMILY**										
Crataegus punctata	large-fruited thorn	S5			X	L5	4	5	X		
Geum canadense	white avens	S5			X	L5	3	0	X	X	X

Scientific Name	Common Name	Status					FQI		Vegetation Community		
		SRank	MNR	COSEWIC	Toronto	TRCA	FQI CC	FQI CW	FOD6-5	SWD3-2	CUP1
* *Geum urbanum*	wood avens	SE2			+	L+		5	X	X	
* *Malus pumila*	common apple	SE5			+	L+		5		X	
Physocarpus opulifolius	ninebark	S5			R	L3	5	-2			X
* *Prunus avium*	sweet cherry	SE4			+	L+		5		X	
Prunus pensylvanica	pin cherry	S5			U	L4	3	4			X
Prunus serotina	black cherry	S5			X	L5	3	3	X		
Prunus virginiana var. *virginiana*	choke cherry	S5			X	L5	2	1	X	X	X
* *Pyrus communis*	common pear	SE4			+	L+		5	X	X	
Rosa blanda	smooth rose	S5			U	L4	3	3	X		
Rubus odoratus	purple flowering raspberry	S5			X	L5	3	5			X
* *Sorbus aucuparia*	European mountain-ash	SE4			+	L+		5		X	
ONAGRACEAE	**EVENING-PRIMROSE FAMILY**										
Circaea lutetiana ssp. *canadensis*	yellowish enchanter's nightshade	S5			X	L5	3	3	X	X	
CORNACEAE	**DOGWOOD FAMILY**										
Cornus alternifolia	alternate-leaved dogwood	S5			X	L5	6	5	X	X	
Cornus sericea ssp. *sericea*	red-osier dogwood	S5			X	L5	2	-3	X		
CELASTRACEAE	**STAFF-TREE FAMILY**										
Euonymus obovata	running strawberry-bush	S5			R	L3	6	5	X	X	
RHAMNACEAE	**BUCKTHORN FAMILY**										
* *Rhamnus cathartica*	common buckthorn	SE5			+	L+		3	X	X	
VITACEAE	**GRAPE FAMILY**										
Parthenocissus vitacea	inserted Virginia-creeper	S5			X	L5	3	3	X	X	

Scientific Name	Common Name	Status					FQI		Vegetation Community		
		SRank	MNR	COSEWIC	Toronto	TRCA	FQI CC	FQI CW	FOD6-5	SWD3-2	CUP1
Vitis riparia	riverbank grape	S5			X	L5	0	-2		X	
ACERACEAE	**MAPLE FAMILY**										
Acer negundo	Manitoba maple	S5			+?	L+?	0	-2	X		
Acer nigrum	black maple	S4?			X	L4	7	3	X		
Acer saccharinum	silver maple	S5			X	L4	5	-3	X	X	
Acer saccharum var. *saccharum*	sugar maple	S5			X	L5	4	3	X	X	X
Acer X *freemanii*	freeman's maple				U?	LH				X	
ANACARDIACEAE	**SUMAC FAMILY**										
Toxicodendron rydbergii	western poison-ivy	S5			X	L5	0	0	X	X	
GERANIACEAE	**GERANIUM FAMILY**										
* *Geranium robertianum*	herb-robert	SE5			+?	L+?		5	X	X	
APOCYNACEAE	**DOGBANE FAMILY**										
* *Vinca minor*	periwinkle	SE5			+	L+		5	X		
ASCLEPIADACEAE	**MILKWEED FAMILY**										
* *Cynanchum rossicum*	swallow-wort	SE5			+	L+		5			X
SOLANACEAE	**POTATO FAMILY**										
* *Solanum dulcamara*	bitter nightshade	SE5			+	L+		0			X
HYDROPHYLLACEAE	**WATER-LEAF FAMILY**										
Hydrophyllum virginianum	Virginia water-leaf	S5			X	L5	6	-2	X	X	
BORAGINACEAE	**BORAGE FAMILY**										
* *Cynoglossum officinale*	hound's-tongue	SE5			+	L+		5			X
Hackelia virginiana	Virginia stickweed	S5			U	L5	5	1	X		
LAMIACEAE	**MINT FAMILY**										

	Scientific Name	Common Name	Status					FQI		Vegetation Community		
			SRank	MNR	COSEWIC	Toronto	TRCA	FQI CC	FQI CW	FOD6-5	SWD3-2	CUP1
*	*Ajuga reptans*	creeping bugleweed	SE2			+	L+		5	X		
*	*Nepeta cataria*	catnip	SE5			+	L+		1			X
	OLEACEAE	**OLIVE FAMILY**										
*	*Fraxinus excelsior*	European ash	SE2			+	L+				X	
	Fraxinus pennsylvanica	red ash	S5			X	L5	3	-3	X	X	X
*	*Ligustrum vulgare*	common privet	SE5			+	L+		1	X		
	CAMPANULACEAE	**BLUEBELL FAMILY**										
*	*Campanula rapunculoides*	creeping bellflower	SE5			+	L+		5			X
	CAPRIFOLIACEAE	**HONEYSUCKLE FAMILY**										
*	*Lonicera morrowii*	morrow's honeysuckle	SE3			+	L+		5	X	X	
*	*Lonicera tatarica*	Tartarian honeysuckle	SE5			+	L+		3	X	X	
	Sambucus nigra ssp. *canadensis*	common elderberry	S5			U	L5	5	-2			X
	Viburnum lentago	nannyberry	S5			X	L5	4	-1	X		
*	*Viburnum opulus*	guelder rose	SE4			+	L+		0	X	X	
	ASTERACEAE	**ASTER FAMILY**										
*	*Arctium minus*	common burdock	SE5			+	L+		5	X	X	X
	Aster lanceolatus ssp. *lanceolatus*	tall white aster	S5			X	L5	3	-3	X		X
*	*Cirsium arvense*	Canada thistle	SE5			+	L+		3			X
	Solidago canadensis	Canada goldenrod	S5			X	L5	1	3		X	X
	Solidago flexicaulis	zig-zag goldenrod	S5			X	L5	6	3		X	
*	*Taraxacum officinale*	common dandelion	SE5			+	L+		3	X		
*	*Tragopogon dubius*	doubtful goat's-beard	SE5			+	L+		5			X
	ARACEAE	**ARUM FAMILY**										

	Scientific Name	Common Name	Status					FQI		Vegetation Community		
			SRank	MNR	COSEWIC	Toronto	TRCA	FQI CC	FQI CW	FOD6-5	SWD3-2	CUP1
	Arisaema triphyllum ssp. *triphyllum*	small jack-in-the-pulpit	S5			X	L4	5	-2	X	X	
	LEMNACEAE	**DUCKWEED FAMILY**										
	Lemna minor	lesser duckweed	S5			X	L5	2	-5	X	X	
	CYPERACEAE	**SEDGE FAMILY**										
	Carex rosea	stellate sedge	S5			X	L5	5	5	X	X	
	POACEAE	**GRASS FAMILY**										
	Glyceria striata	fowl meadow grass	S5			X	L5	3	-5	X	X	
	Poa pratensis ssp. *pratensis*	Kentucky bluegrass	S5			+	L+	0	1			X
	LILIACEAE	**LILY FAMILY**										
	Allium tricoccum	wild leek	S5			X	L3	7	2	X		
	Erythronium americanum ssp. *americanum*	yellow dog's-tooth violet	S5			X	L5	5	5	X		
*	*Hemerocallis fulva*	orange day-lily	SE5			+	L+		5	X		
	Maianthemum racemosum ssp. *racemosum*	false Solomon's seal	S5			X	L5	4	3	X		
	Trillium grandiflorum	white trillium	S5			U	L3	5	5	X		
	ORCHIDACEAE	**ORCHID FAMILY**										
*	*Epipactis helleborine*	common helleborine	SE5			+	L+		5		X	

APPENDIX B
ACRONYMS AND DEFINITIONS USED IN SPECIES LISTS

Species Status

COSEWIC	**Committee On The Status Of Endangered Wildlife In Canada**

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the national status of wild species that are considered to be at risk in Canada.

Extinct (X)	A wildlife species that no longer exists.
Extirpated (XT)	A wildlife species no longer existing in the wild in Canada, but occurring elsewhere.
Endangered (E)	A wildlife species facing imminent extirpation or extinction.
Threatened (T)	A wildlife species likely to become endangered if limiting factors are not reversed.
Special Concern (SC)	A wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats.
Not at Risk (NAR)	A wildlife species that has been evaluated and found to be not at risk of extinction given the current circumstances.
Data Deficient (DD)	A category that applies when the available information is insufficient (a) to resolve a wildlife species' eligibility for assessment or (b) to permit an assessment of the wildlife species' risk of extinction.

COSSARO/MNR	**Committee On The Status Of Species At Risk In Ontario/Ontario Ministry Of Natural Resources**

The Committee on the Status of Species at Risk in Ontario (COSSARO)/Ontario Ministry of Natural Resources (MNR) assesses the provincial status of wild species that are considered to be at risk in Ontario.

Extinct (EXT)	A species that no longer exists anywhere.
Extirpated (EXP)	A species that no longer exists in the wild in Ontario but still occurs elsewhere.
Endangered (Regulated) (END–R)	A species facing imminent extinction or extirpation in Ontario which has be regulated under Ontario's *Endangered Species Act*.
Endangered (END)	A species facing imminent extinction or extirpation in Ontario which is a candidate for regulation under Ontario's *Endangered Species Act*.
Threatened (THR)	A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.
Special Concern (SC)	A species with characteristics that make it sensitive to human activities or natural events.
Not at Risk (NAR)	A species that has been evaluated and found to be not at risk.
Data Deficient (DD)	A species for which there is insufficient information for a provincial status recommendation.

Species Rank

GRANK	**Global Rank**

Global ranks are assigned by a consensus of the network of Conservation Data Centres, scientific experts, and The Nature Conservatory to designate a rarity rank based on the range-wide status of a species, subspecies or variety. The most important factors considered in assigning global ranks are the total number of known, extant sites world-wide, and the degree to which they are potentially or actively threatened with destruction. Other criteria include the number of known populations considered to be securely protected, the size of the various populations, and the ability of the taxon to persist at its known sites. The taxonomic distinctness of each taxon has also been considered. Hybrids, introduced species, and taxonomically dubious species, subspecies and varieties have not been included.

G1	**Extremely rare;** usually 5 or fewer occurrences in the overall range or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.
G2	**Very rare;** usually between 5 and 20 occurrences in the overall range or with many individuals in fewer occurrences; or because of some factor(s) making it vulnerable to extinction.
G3	**Rare to uncommon**; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.
G4	**Common**; usually more than 100 occurrences; usually not susceptible to immediate threats.
G5	**Very common**; demonstrably secure under present conditions.
GH	Historic, no records in the past 20 years.
GU	Status **uncertain**, often because of low search effort or cryptic nature of the species; more data needed.
GX	Globally extinct. No recent records despite specific searches.
?	Denotes inexact numeric rank (i.e. G4?).
G	A "G" (or "T") followed by a blank space means that the NHIC has not yet obtained the Global Rank from The Nature Conservancy.
G?	**Unranked,** or, if following a ranking, rank tentatively assigned (e.g. G3?).
Q	Denotes that the taxonomic status of the species, subspecies, or variety is **questionable**.
T	Denotes that the rank applies to a subspecies or variety.

SRANK	**Provincial Rank**

Provincial (or Sub-national) ranks are used by the Ontario Ministry of Natural Resources Natural Heritage Information Centre (NHIC) to set protection priorities for rare species and natural communities. These ranks are not legal designations. Provincial ranks are assigned in a manner similar to that described for global ranks, but consider only those factors within the political boundaries of Ontario. By comparing the global and provincial ranks, the status, rarity, and the urgency of conservation needs can be ascertained. The NHIC evaluates provincial ranks on a continual basis and produces updated lists at least annually.

S1	**Critically Imperiled** in Ontario because of extreme rarity (often 5 or fewer occurrences) or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation.
S2	**Imperiled** in Ontario because of rarity due to very restricted range, very few populations (often 20 or fewer occurrences) steep declines or other factors making it very vulnerable to extirpation.
S3	**Vulnerable** in Ontario due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors making it vulnerable to extirpation.
S4	**Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
S5	**Secure**—Common, widespread, and abundant in Ontario.
SX	**Presumed Extirpated** – Species or community is believed to be extirpated from Ontario.
SH	**Possibly Extirpated** – Species or community occurred historically in Ontario and there is some possibility that it may be rediscovered.
SE	**Exotic – Species introduced to Ontario.**
SNR	**Unranked**—Conservation status in Ontario not yet assessed
SU	**Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
SNA	**Not Applicable** —A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#	**Range Rank** —A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species or community. Ranges cannot skip more than one rank (e.g., SU is used rather than S1S4).

Regulated Species at Risk

SARA	**Species at Risk Act**

The Canada *Species at Risk Act* provides a framework for actions across Canada to ensure the survival of wildlife species and the protection of our natural heritage. It sets out how to decide which species are a priority for action and what to do to protect a species. It identifies ways governments, organizations and individuals can work together, and it establishes penalties for a failure to obey the law. Regulated species are listed in Schedules 1, 2 and 3 of the Act.

Schedule 1 SARA (1)	Species that are currently covered under the Act.
Schedule 2 SARA (2)	Species that are endangered or threatened that have not been re-assessed by COSEWIC for inclusion on Schedule 1.
Schedule 3 SARA (3)	Species that are of special concern that have not yet been re-assessed by COSEWIC for inclusion on Schedule 1.

ESA	**Endangered Species Act**

The Ontario *Endangered Species Act* provides for the conservation, protection, restoration and propagation of species of fauna and flora of the Province of Ontario that are threatened with extinction. Regulated species are listed in Ontario Regulation 338.

Schedule 1 ESA (1)	The species of fauna listed in Schedule 1 are declared to be threatened with extinction.
Schedule 2 ESA (2)	The species of flora listed in Schedule 2 are declared to be threatened with extinction.

FWCA **Fish and Wildlife Conservation Act**

The Ontario *Fish and Wildlife Conservation Act* enables to Ministry of Natural Resources to protect and manage a broad range of fish and wildlife species. Regulated fish and wildlife are listed as furbearing (F), game (G) or protected (P) in schedules to the Act.

FWCA (F)	Furbearing mammals (Schedule 1).
FWCA (G)	Game mammals (Schedule 2), birds (Schedule 3), reptiles (Schedule 4), and amphibians (Schedule 5)
FWCA (SP)	Specially protected mammals (Schedule 6), birds (raptors) (Schedule 7), birds (other than raptors) (Schedule 8), reptiles (Schedule 9), amphibians (Schedule 10) and invertebrates (Schedule 11).

MBCA **Migratory Birds Conservation Act**

The Canada *Migratory Birds Conservation Act* implements the Convention by protecting and conserving migratory birds – as populations and individual birds – and their nests. Article 1 identifies the migratory game birds, migratory insectivorous birds and other migratory non-game birds regulated by the Act.

FA **Fisheries Act**

The Canada *Fisheries Act* enables the Department of Fisheries and Oceans to protect and manage fish and fish habitat. Fish includes; parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals; and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals.

PPS **Provincial Policy Statement**

The Ontario *Provincial Policy Statement* is issued under the authority of Section 3 of the Planning Act. It provides direction on matters of provincial interest related to land use planning and development, and promotes the provincial “policy-led” planning system. The PPS enables the Province to protect significant natural heritage features and areas including the significant habitat of endangered and threatened species.

APPENDIX C
RECOMMENDED EQUIPMENT

APPENDIX C.
REQUIRED EQUIPMENT

Planting	Habitat Creation, Enhancement and Restoration	Transportation	Herbicide Application
1. Garden Hose 2. Sharp Knives 3. Transplant Spade 4. Standard Spade 5. Hand Shovel 6. Wheel Barrow 7. Garbage Bags 8. Weed Free Mulch 9. Black gardening cloth or plastic sheets 10. Mini-sledge 11. Small wood stakes 12. Camera 13. Flagging Tape 14. Ruler 15. Metre Stick 16. Hand Saw 17. Brush-cutter 18. Heavy-duty scissors or pruners 19. Watering Can 20. Chainsaw	1. Brush-cutter 2. Chainsaw	1. Pick-up Trucks	1. Back-pack Sprayer 2. Herbicide Resistant Gloves 3. Herbicide Resistant Suits 4. Herbicide Resistant Gloves for Wicking 5. 2-Stroke Oil 6. Gasoline 7. Diesel or Vegetable Oil 8. Tranxit 9. Garlon Ultra 10. RoundUp Ultra II 11. Glyfos 12. WeatherMAX 13. 2,4-D 14. Triclopyr 15. Clopyralid 16. Diacamba

APPENDIX D
INVASIVE SPECIES CONTROL STRATEGIES

APPENDIX D

Removal of Invasive Woody Species

Along with the removal of non-native plant species, additional native woody vegetation (i.e. trees and shrubs) will need to be removed and managed in the long-term. Some woody species may have to be removed through cutting and possible herbicide application.

Cutting

Trees will be cut at ground level with power or manual saws. Cutting is most effective when trees have begun to flower to prevent seed production. Because many invasive trees and shrubs spread by suckering, re-sprouts are common after treatment. Cutting is an initial control measure, and success will require either an additional herbicidal control or repeated cutting to control re-sprouts.

Girdling

This method shall be used on large trees where the use of herbicides is not practical. Using a hand axe or saw, a cut shall be made through the bark encircling the base of the tree, approximately 15 cm (6 in) above the ground while the tree is in flower and is most vulnerable. The cut shall penetrate well into the cambium layer. This method will kill the top of the tree; however, re-sprouts are common and may require follow-up treatments for several years until roots are exhausted.

Hand Pulling

Manual removal of young tree and shrub seedlings will control woody species. Plants should be pulled as soon as they are large enough to grasp, but before they produce seeds. Seedlings are best pulled after a rain when the soil is loose. The entire root must be removed since broken fragments may re-sprout. Each stalk should be pulled at ground level.

Foliar Spray Method

This method should be used for large thickets of seedlings where risk to non-target species is minimal. Air temperature should be above 18°C to ensure absorption of herbicides. An herbicide solution shall be applied to thoroughly wet all leaves. Use a low pressure and coarse spray pattern to reduce spray drift damage to non-target species.

Cut Stump Method

This control method should be considered when treating large individual trees or where the presence of desirable species precludes foliar application. Stump treatments can be used as long as the ground is not frozen. Stems shall be horizontally cut at or near ground level and an herbicide solution shall be immediately applied to the cut stump, ensuring that the outer 20 percent of the stump is covered.

Basal Bark Method

This method is effective throughout the year as long as the ground is not frozen. A herbicide solution shall be applied to the basal parts of the tree, from the ground up to a height of 30-38 cm (12-15 in). Thorough wetting is necessary for good control; spray until run-off is noticeable at the ground line.

Hack and Squirt Method

Cuts will be made at 6.5 cm (3 in) intervals around the trunk of the tree between 15 and 45 cm (6-18 in) above the ground, using a hand axe. Each cut shall be placed well into or below the cambium layer of the tree. The cut will be immediately treated with an herbicide solution.

Species Specific Control Strategies

Common Buckthorn (Rhamnus cathartica) Control

Common buckthorn is a deciduous shrub or small tree that readily invades forest edges, woodland, savannah, and prairie habitats. This plant species grows quickly and young shrubs can produce abundant fruit, and establishment often results with high densities of seedlings in very little space. Establishment can also occur through suckering of the root system (shoot which grows from the bud of a plant's roots). As a result of the dense establishment of seedlings, both the recruitment of those tree species in the canopy as well as of native herbaceous species found in the understory, can be altered, ultimately changing the vegetation composition of the forest community in which common buckthorn has invaded. In areas where common buckthorn is removed dense plantings of native shrubs and ground flora would serve to offset the subsequent regeneration of common buckthorn.

The control of buckthorn has been proven successful with the use of an herbicide application of 6% Triclopyr (480g/L) in 94% diesel fuel which is applied to the bark at the base of the stem. This solution will be applied to uncut stems with herbicide applied directly to the bark. Shrubs often show signs of decline within four days. A dye will be added to the mixture so that treated stems can be identified. This method will be applied at any time of the year but is most effective in early to mid-fall when most other species have begun to senesce and buckthorn leaves are still visible on the shrub. Application will be completed prior to leaf fall when buckthorn is moving nutrients from the leaves and twigs down into the roots for winter storage; this will also impact buckthorn's root system, and will minimize stump sprouting.

The application of the herbicide mixture of Triclopyr in diesel fuel is also effective when applied to a fresh gash in a buckthorn stem and the surrounding bark, or on freshly cut stems. Shrubs will be cut using an axe or chain saw and will be cut close to the ground. A second person can walk through the same area once the cutting is completed, to apply the herbicide treatment the gash and bark, or stem, of each targeted, nonnative stem. This method is very effective on larger buckthorn stems as compared to the bark application. The application of herbicide will occur when precipitation is not anticipated within a 2 to 3 day period following application to promote the translocation of the herbicide into the plant. As noted above, the application of an herbicide to reduce buckthorn is more effective when completed in mid to late fall, prior to leaf fall.

It is important to note that seed bearing buckthorn plants will be cut and removed prior to fruit maturation to reduce seed input into the soil, and that follow-up treatment of herbicide applications will be necessary for several years following the initial application due to stump sprouting. Broadcast seeding of native seed or transplanting seedlings in the spring, following the initial herbicide application will help to create competitive conditions that will also help to minimize the subsequent establishment of additional buckthorn stems.

Common Pear (Pyrus communis) Control

Dense and thorny thickets of common pear prevent colonization of native trees and shrubs at woodland edges. Birds and small mammals eat the fruits and disperse the seeds. Tree seedlings should be hand pulled or dug up with a shovel. Larger trees can be girdled if they are in the interior of the woodlot. If the larger trees are near the woodland edge they should be cut down and painted/sprayed with Garlon (Kaufman, 2007).

Common Privet (Ligustrum vulgare) Control

Common Privet grows along woodland edges, forests, and in meadows. It is a very adaptable species that will grow in lowland and upland conditions. It can form dense stands that out compete native understorey and ground cover for space, light and water. Birds eat the fruits and disperse the seeds to forest gaps and into meadows. Seedlings can be hand pulled or dug up with a shovel. Dense stands should be cleared using a brush cutter. The cut stumps should be sprayed with Garlon immediately after cutting (Kauffman, 2007).

Hybrid Willow (Salix X sepulcralis) Control

Glyphosate can be used during the growing season when the temperature is above 10^{0}C for foliar application or for cut-stump treatment of smaller plants. Larger trees should be cut down in the late fall to winter and the cut-stump should be painted with Garlon immediately after cutting (Czarapata 2005).

Sweet Cherry (Prunus avium) and Sour Cherry (Prunus cerasus) Control

Both exotic cherry species should only be removed when they form large stands within the forest. Cherry trees provide food for birds and mammal species. Smaller trees should be dug out or hand pulled. Larger trees can be girdled if they are in the interior of the woodlot. When the larger trees are near the edge they should be cut and painted with Glyphosate or Garlon (Kaufman, 2007).

Tartarian Honeysuckle (Lonicera tatarica) and Morrow's Honeysuckle (Lonicera morrowii) Control

Studies on the similar Tartarian Honeysuckle (*Lonicera tatarica*) by Collier *et al.* (2002); show that species richness for all species was lower in plots below honeysuckle crowns and woody cover was lower as well. Tartarian honeysuckle fruit is spread by birds and small mammals to successional thickets and woodlands filling the niche of many native shrubs. A study by Gould and Gorchov (2000) shows that removal of honeysuckle increased the fitness of three native annuals.Young shrubs can be hand pulled or dug out of the ground. Larger shrubs should be brush cut to a stump in the fall to winter and then painted with Garlon or RoundUp (Kaufman, 2007).

Removal of Invasive Herbaceous Species

Herbicide Application

Herbicide application techniques will focus on RoundUp Ultra herbicide application. The following general guidelines of herbicide application shall apply:

- All application of RoundUp Ultra herbicide shall take place a minimum of four to six hours prior to any rainfall, to ensure proper absorption of the herbicide by the invasive species and prevent runoff into surface water.
- Mowing and/or cutting of invasive species in an area shall be carried out a minimum of two weeks after the area was sprayed to ensure that the invasive species are deceased and not spread by mowing or cutting.
- All mown or cut organic matter, trimmings, clippings and other debris shall be disposed of in an approved facility.

  All equipment will be cleaned on site prior to the equipment's removal, to reduce transfer of soil or other organic matter that may contain invasive species.

Species Specific Control Strategies

Garlic Mustard (Alliaria petiolata) Control

Garlic mustard (*Alliaria petiolata*) is a biennial plant that forms a rosette in the first year which stays green through winter, and in its second year it matures into a flowering plant. It invades forests along areas of disturbance and can then spread through multiple established patches; and can ultimately form extensive monocultures within a relatively short number of years from its initial introduction (Nuzzo 1999; Czarapata 2005). Garlic mustard is not influenced by native pathogens in the soil. Native soil pathogens are less virulent against non-indigenous species (Myers *et. al.* 2003 and Kilronomos 2002). Several studies suggest that garlic mustard can inhibit arbuscular mycorrhizal fungi (AMF) activity in native plants (type of mycorrhiza in which fungus penetrates which aids in the capture of nutrients and micronutrients from the soil) (Gianinazzi-Pearson et al. 2001).

IMPORTANT NOTE: It has been shown that a single control treatment for garlic mustard (herbicide, clipping and/or pulling, etc.) with no follow up treatment can increase garlic mustard density in comparison to no treatment (Murphy et al. 2007). This means that "no management" could result with a better outcome than an unsustainable management regime that would increase soil disturbance thereby creating a more favourable competitive environment for garlic mustard. Consequently, an effective garlic mustard control plan should include multiple treatments that are regularly carried out.

A key strategy to control garlic mustard is to prevent its spread by minimizing its ability to input more seed into the seedbank. This can be carried out in a number of ways including manually pulling plants, clipping flower heads, cutting plants at the base, and herbicide application. All management regimes should include intensely planting fast growing native plants with respectively appropriate light tolerances (garlic mustard establishes within a wide range of light conditions) to use the resources that become available once garlic mustard plants have been removed.

Where large patches or colonies of garlic mustard have become established, the best approach is to begin control from the outside edges of the patch and work toward the centre of that colony (Hillmer and Liedtke 2003). This strategy will mitigate garlic mustard's ability to spread past its existing boundaries (Czarapata 2005). Nearby seed sources of garlic mustard should also be managed in order to mitigate the immigration of any seed from those nearby colonies (Slaughter et al. 2007; Myers and Bazely 2003). Any control treatments should be repeated annually until the existing, local, seed bank is depleted.

The following briefly outlines different control strategies and provides some insight as to which strategy is most practical in relation to the extent of the garlic mustard population requiring management. It is important to note that all control regimes should be carried out regularly until few to no garlic mustard individuals remain. Follow-up monitoring should continue every year for a minimum of five years.

1. Manually hand pulling garlic mustard plants can be effective and is easier to complete when the soil is damp. The root of garlic mustard is S-shaped and must be carefully broken from below the first curve to avoid re-sprouting from the root's adventitious buds (Murphy et al. 2007). Hand pulling can be labour intensive and is thus more practical when patches of garlic mustard are small, and the area to cover is relatively compact. However, this method causes much soil disturbance which can create ideal conditions for the establishment of garlic mustard. The removal of garlic mustard should be followed up with the planting of native plant species in newly available spaces. Pulling must be completed annually until such a time that few to no individuals remain; this could take five to ten years dependent on the extent of the population. Subsequent monitoring should continue every year for a minimum of five years in order to mitigate the establishment of new populations.

2. The control of garlic mustard where populations are quite large can be undertaken by cutting the plant at the base of the stem. This method is less labour intensive than manually pulling plants, and minimizes soil disturbance as compared to hand pulling. Several tools can be used to undertake this work including a scythe or weed whacker or secateurs (pruning shears) where the population of garlic mustard is small. Lawnmowers can also be used in large open patches.

3. Basal cutting is an effective removal technique (Rebek and O'Neil 2005). Cutting or weed whacking from the flowering head progressively downwards will reduce the likelihood of seeds ripening even when the stem is severed. Cutting can encourage vigorous resprouting (Czarapata 2005). If cut precisely after flowering and before seed maturation (when the stem becomes tough and fibrous), resprouting is less likely (Czarapata 2005, Murphy 2006, Nuzzo 2006). Cutting at this time can minimize resprouting, as stems are cut when most of the root reserves have been allocated to flowering/fruiting. Because flowering is often staggered within a population, two passes are required as late flowering individuals should also be cut in the same manner as note above to mitigate resprouting. Before cutting, the site should be evaluated to determine where native species should be avoided. Where garlic mustard co-occurs with native species, this strategy becomes more labour intensive. It is important to note that attempts to remove garlic mustard by just cutting the flower head has been shown to actually encourage the growth of new flower heads and repeat treatments can become excessively labour intensive (Whitman 2006).

4. Another method of garlic mustard control currently being tested by the Iowa Native Plant Society is to intensively over-plant garlic mustard infested areas with common, fast-growing, shade-tolerant native plants (Whitman 2006). A one year transplant study showed that transplanting 9 or 11 individual plants/m2 of bloodroot in areas dominated by garlic mustard significantly reduced the number of garlic mustard basal rosettes (Murphy 2005). Such research to date is limited; however, it is likely that this strategy in combination with other control methods could significantly minimize regeneration of garlic mustard.

5. Carefully applied glyphosate (commercially known as Roundup) at 1 to 3% concentrations to dormant rosettes in late fall or early spring has been shown to mitigate garlic mustard reestablishment. A fall application kills first year plants and reduces the following year's seed bearing plants. A fall application also reduces the risk of impacting early germinating co-occurring spring ephemerals. Slaughter et al. (2007) showed that after five years of fall spraying adult garlic mustard cover was reduced from 8% to 1%, however, there was no impact to rosette cover. Continued rosette cover could be due to a persistent seedbank or seed input from adjacent, unsprayed areas. A spring application, if timed to avoid spring ephemerals, could be additionally beneficial by impacting those germinated basal rosettes. Summer applications of Roundup should be avoided as spray can drift and impact other native vegetation, though a summer application could be appropriate where large patches dominated by garlic mustard exist. Glyphosate is a non-selective herbicide, however, if applied while native plant species are dormant, its documented effects appear to be restricted to the physiologically active garlic mustard and a few native evergreen species (Nuzzo 1996, Carlson and Gorchov 2004).

The use of glyphosate has several advantages over manual removal of garlic mustard because when carefully applied it greatly reduces the risks of re-sprouting, soil disturbance, impacts to native co-occurring species (when properly applied), and is less labour intensive, especially for large scale invasions. Glyphosate can be applied using a wick applicator or weed wiper which greatly reduces drift. A weed wiper, such as a Red Weeder (or a similar product), is simply swept from one side to another across the stem of individual target plants as the user walks through an affected area. The stem receives the glyphosate upon contact with the wick at the end of a handheld wand. Herbicide application should be applied during a period when rainfall is not anticipated for 2 to 3 days.

Periwinkle (Vinca minor) Control

Periwinkle spreads primarily from underground rhizomes and from the nodes along the rhizomes. It seldom reproduces from seed. Periwinkle forms dense monoculture stands in shaded and semi-shaded habitats. It completely excludes other ground cover plants, especially herbaceous species. It is an evergreen species that is able to photosynthesize in both the spring and in the fall sunlight when the forest canopy is bare. Leaves are toxic to most birds and mammals. The seeds are too small for birds. Thus, when it displaces native plants it also displaces native food sources for wildlife. RoundUp foliar herbicide application will be required to control the heavy infestations in the Boyer Woodlot. The herbicide should be applied in the mid-spring or early fall to the periwinkle stands provided the temperatures are above 10° C (Kaufman, 2007).

Dog Strangling Vine (Cynanchum rossicum) Control

Wind disburses dog strangling vine seed, which it produces in abundance at approximately 2,400 seeds / m^2. The plants also spread by rhizomes. Dense stands of dog strangling vine suppress the growth of all ground layer plants (Kaufman, 2007). Light infestations of dog strangling vine can be controlled by removing the plants, including their entire root systems. Larger infestations can be controlled by applying Roundup twice during the growing season, at the onset of flowering and 2 to 3 weeks later. Re-treatments will be required for 2-5 years to eliminate surviving plants and new seedlings.

Dame’s Rocket (Hesperis matronalis) Control

Dame’s rocket should be controlled where it produces dense stands and it displaces native plant species. Dame’s rocket produces high seed production and once it is established it may take a number of years to remove the plants from the seedbank. When the soils are moist prior to or during flowering time the plans can be hand pulled. In large infestations the plants can be sprayed in the late summer or early fall with roundup when the other plants are dormant and Dame’s Rocket still has green leaves (Kaufman, 2007).

APPENDIX E
PHOTO APPENDIX

PROJECT #TA8152
December 2012

PHOTO APPENDIX E.

LGL LIMITED
environmental research associates


View of the CUP1 facing east.


View of the west edge of Boyer Woodlot, facing north.


View of the wet, small and southern vernal pool.


View of the south edge of Boyer Woodlot, facing west.


View to the east in Boyer woodlot.


View of the dry, larger and northern vernal pool.

APPENDIX F
ELC DATA CARDS

PLANT SPECIES LIST	
SITE:	BOYER, YORK U
POLYGON:	FOD6-5
DATE:	May 30, August 17, Sept 26/12
SURVEYOR(S):	DEB, LMC

LAYERS: 1 = CANOPY TREES > 10m 2 = SUB-CANOPY 3 = SAPLINGS & SHRUBS 4 = GROUND LAYER
BRAUN BLANQUET: + PRESENT 1 = < 1-5% 2 = 5-25% 3 = 25-50% 4 = 50-75% 5 = 75-100%

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.
ACESACC	O	O	O			HEMFULV				R	
ALLPETI	A					HESMATR				R	
ACESASA	O	O	O			JUGNIGR	R	R	R		
ARCMINU				R		LONMORR			R		
ACENEGU		R	R			LONTATA			R		
ALLTRIO				R		LIGVULG			R		
ARITRIP				C		LARDECI	R				
AJUREPA	R	R				LEMMINO				R	
ACENIGR	R	R				MAIRACE				R	
CARCORD	A	A				OSTVIRG	A	A	A		
CRAPUNK			R			POPTREM		R			
CIRLUET				A		PARINSE				R	
ASTLANCE				R		PRUVIRG			O		
CARROSE				R		POOPELT				A	
CRAREDL		R				PICGLAU	R		R		
CORSTOL				R		PRUSERO			R		
CORALTE				R		POPDELT	R				
CYNROSS				R		THUOCCI		R			
ERYAMER				A		RANABOR				R	
EUOOBOV				R		RANSCEL				R	
FRAPENNS	R	O	O			ULMAMER			R		
FAGGRAN	O	R	R			QUEMACR	A	R	R		
GEUURBA				A		QUERUBR	R				
GERROBE				R		RUMCRIS				R	
GEUCANA				A		TILAMER	A	A			
GLYSTRI				R		VIOSORO				R	
HYDVIRG				D		POPXCANA	R				
HACVIRG				R		SALXSEO	R				

STAND CHARACTERISTICS		
SITE: BOYER		POLYGON: FOD6-5
SURVEYOR(S): LMC, DEB		DATE: Aug 17
UTMZ:	UTME:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPO. FEATURE	HISTORY	PLANT FORM	COMMUNITY
☒ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☒ MINERAL SOIL ☐ PARENT MATERIAL ☐ ACIDIC BEDROCK ☐ BASIC BEDROCK ☐ CARB. BEDROCK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☒ TABLELAND ☐ ROLLING UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE/CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH/BAR ☐ SAND DUNE ☐ BLUFF	☒ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☒ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☒ FOREST ☐ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WAT. ☒ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☒ TREED		

STAND DESCRIPTION

	LAYER	HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	EMERGENT			
2	CANOPY	1,2	1,2	TILAMER=QUEMACR=ACESASA=CARCORD
3	SUB-CANOPY	3	2,3	CARCORD>ACESACC>OSTVIRG=TILAMER>FRAPENN
4	UNDERSTORY	4,5	2,3	RHACATH>CARCORD=ACESASA=FRAPENN>OSTVIRG
5	GROUND LAYER	7	1	HYDVIRG>CIRLUTE=GEUCANA=ALLPETI=HACVIRG

HT CODES: 1 = > 25m 2 = >10-25m 3 = 2-10m 4 = 1-2m 5 = 0.5-1m 6 = 0.2-0.5m 7 = <0.2m
CVR CODES: 0 = NONE 1 = 1-10% 2 = >10-25% 3 = >25-35% 4 = >35-60% 5 = >60%

SIZE CLASS ANALYSIS

TREES		A	< 10cm	A	10-24cm	O	25-50cm	O	> 50cm
STANDING SNAGS		R	< 10cm	R	10-24cm	R	25-50cm	R	> 50cm
DEADFALL/LOGS	FIRM	A	< 10cm	O	10-24cm	R	25-50cm	N	> 50cm
	DECAYED	R	< 10cm	R	10-24cm	R	25-50cm	N	> 50cm

COMMUNITY MATURITY
☐ PIONEER ☐ YOUNG ☒ MID-AGE ☐ MATURE ☐ OLD-GROWTH

SOIL ASSESSMENT

	1	2	3	4
TEXTURE	SiCL			
DEPTH TO MOTTLES	g = 65	g =	g =	g =
DEPTH TO GLEY	G =	G =	G =	G =
DEPTH OF ORGANICS	Ø			
DEPTH TO BEDROCK	>120			
MOISTURE REGIME	3			

SiL
20cm
g
SiCL
75cm
CL

SOIL PROFILE

PLANT SPECIES LIST	
SITE:	BOVER, YORKU
POLYGON:	FOD6-5
DATE:	May 30
SURVEYOR(S):	DEB, LMC

LAYERS: 1 = CANOPY TREES > 10m 2 = SUB-CANOPY 3 = SAPLINGS & SHRUBS 4 = GROUND LAYER
VALUE CODES: D = DOMINANT A = ABUNDANT O = OCCASIONAL R = RARE

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.	SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.
RIBCYNO				R							
PYRCOMM		R									
ROSBLAN				R							
RHACATH		A	O	O							
TOXRYDB				A							
VINMINO				O							
VIBLENT			R								
VIBOPUL				R							
TAROFFI				R							
TRIGRAN				R							

DISTURBANCE and STAND CHARACTERISTICS	
SITE:	BOVER
POLYGON:	FOD6-5
DATE:	August 17/12
SURVEYOR(S):	DEB, LMC

MANAGEMENT / DISTURBANCE	LEVEL / EXTENT	MANAGEMENT / DISTURBANCE	LEVEL / EXTENT
SUGAR BUSH OPERATIONS	0 / 0	DUMPING (RUBBISH)	1 / 0
GAPS IN THE CANOPY	1 / 0	EARTH DISPLACEMENT	0 / 0
LIVESTOCK (GRAZING)	0 / 0	RECREATIONAL USE	0 / 0
PLANTING (PLANTATION)	0 / 0	ALIEN SPECIES	0 / 3
TRACKS AND TRAILS	0 / 3	NOISE	1 / 0
NATURAL DISTURBANCES	**LEVEL / EXTENT**	**NATURAL DISTURBANCES**	**LEVEL / EXTENT**
DISEASE / PESTS / DEATH	1 / 0	FLOODING (POOLS & PUDDLING)	0 / 0
WINDTHROW (BLOWDOWN)	0 / 0	FIRE	0 / 0
BROWSE (e.g., DEER)	0 / 0	SOIL EROSION	0 / 0
BEAVER ACTIVITY	0 / 0	OTHER	0 / 0

LEVEL: 0 = NONE 1 = LIGHT 2 = MODERATE 3 = HEAVY
EXTENT: 0 = NONE 1 = LOCAL 2 = WIDESPREAD 3 = EXTENSIVE

TREE TALLY BY SPECIES PRISM FACTOR:____

SPECIES CODE	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AV.
TOTAL							
BASAL AREA (BA)							MEAN
DEAD							

PLANT SPECIES LIST

SITE: Boyer, York U
POLYGON: SWD3-2
DATE: May 30, August 17, Sept. 26/12
SURVEYOR(S): DEB, LMC

LAYERS: 1 = CANOPY TREES > 10m 2 = SUB-CANOPY 3 = SAPLINGS & SHRUBS 4 = GROUND LAYER
BRAUN BLANQUET: + PRESENT 1 = < 1-5% 2 = 5-25% 3 = 25-50% 4 = 50-75% 5 = 75-100%

SPECIES CODE	LAYER 1	2	3	4	COLL.
LARDECI	R				
PICGLAU		R			
PINNIGR	R				
PINSTRO			R		
THUOCCI			R		
RANACRI				R	
PODPELT				R	
FAGGRAN	R	R			
QUEMACR	A	A	R		
OSTVIRG	R	R	R		
TILAMER	R	A	A		
POPDELT	O				
ALLPETI				O	
HESMATR				R	
GEUCANA				O	
GEUURBA				A	
MALPUMI		R			
PRUAVIU			R		
PRUVIRG			O	A	
PYRCOMM		R			
CIRLUET				O	
SORAUCU			R		
CORALTE			R		
EUOOBOV				R	
RHACATH	A	O	O		
PARVITA				R	
VITRIPA				R	
ACESACC	O	O	A		

SPECIES CODE	LAYER 1	2	3	4	COLL.
ACESACA	R	R			
ACEXFRE	R				
TOXRYDB				A	
GERROBE				R	
HUMVIRG				A	
FRAEXCE			R		
FRAPENS	R	O	O		
LONMORR			R		
LONTATA			R		
VIBOPUL				R	
SOLCANA				R	
SOLFLEX				R	
ARITRIP				R	
LEMMINO				R	
CARROSE				R	
GLYSTRI				R	
ERIHELE				R	
CARCORD					
SALXSEOU					
ARCMINU					
POAPRAT				R	
JUGNIGR	O				
ACENEGU		R			
CRAPRUI		R			

STAND CHARACTERISTICS

SITE: Boyer
POLYGON: SWD3-2
SURVEYOR(S): DEB, LMC
DATE: August 17
UTMZ:
UTME:
UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPO. FEATURE	HISTORY	PLANT FORM	COMMUNITY
☐ TERRESTRIAL ☒ WETLAND ☐ AQUATIC	☐ ORGANIC ☒ MINERAL SOIL ☐ PARENT MATERIAL ☐ ACIDIC BEDROCK ☐ BASIC BEDROCK ☐ CARB. BEDROCK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☒ TABLELAND ☐ ROLLING UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE/CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH/BAR ☐ SAND DUNE ☐ BLUFF	☒ NATURAL ☐ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☒ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☒ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☐ PLANTATION
SITE ☐ OPEN WATER ☐ SHALLOW WAT. ☒ SURFICIAL DEP. ☐ BEDROCK			**COVER** ☐ OPEN ☐ SHRUB ☒ TREED		

STAND DESCRIPTION

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	EMERGENT			
2	CANOPY	1,2	1,2	ACESACC > CARCORD = POPDELT = QUEMACR
3	SUB-CANOPY	3	2,3	TILAMER = QUEMACR > ACESACC = CARCORD = FRAPENN
4	UNDERSTORY	4,5	2,3	RHACATH > TILAMER = ACESACC
5	GROUND LAYER	7	1	RHACATH = HUMVIRG = TOXRYDB > ALLPETI = CIRLUTE

HT CODES: 1 = > 25m 2 = >10-25m 3 = 2-10m 4 = 1-2m 5 = 0.5-1m 6 = 0.2-0.5m 7 = <0.2m
CVR CODES: 0 = NONE 1 = 1-10% 2 = >10-25% 3 = >25-35% 4 = >35-60% 5 = >60%

SIZE CLASS ANALYSIS

TREES		A	< 10cm	A	10-24cm	O	25-50cm	O	> 50cm
STANDING SNAGS		R	< 10cm	R	10-24cm	R	25-50cm	R	> 50cm
DEADFALL/LOGS	FIRM	A	< 10cm	O	10-24cm	R	25-50cm	N	> 50cm
	DECAYED	R	< 10cm	R	10-24cm	R	25-50cm	N	> 50cm

COMMUNITY MATURITY
☐ PIONEER ☐ YOUNG ☒ MID-AGE ☐ MATURE ☐ OLD-GROWTH

SOIL ASSESSMENT

	1	2	3	4
TEXTURE	SiCL			
DEPTH TO MOTTLES	g = 35	g =	g =	g =
DEPTH TO GLEY	G =	G =	G =	G =
DEPTH OF ORGANICS	ɸ			
DEPTH TO BEDROCK	>120			
MOISTURE REGIME	5			

SiL
25
g
SiCL

SOIL PROFILE

PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY TREES > 10m 2 = SUB-CANOPY 3 = SAPLINGS & SHRUBS 4 = GROUND LAYER
VALUE CODES: D = DOMINANT A = ABUNDANT O = OCCASIONAL R = RARE

SPECIES CODE	LAYER				COLL.	SPECIES CODE	LAYER				COLL.
	1	2	3	4			1	2	3	4	

DISTURBANCE and STAND CHARACTERISTICS	
	SITE: BOYER
	POLYGON: SWD3-2
	DATE: AUGUST 17/12
	SURVEYOR(S): DEB, LMC

MANAGEMENT / DISTURBANCE	LEVEL / EXTENT	MANAGEMENT / DISTURBANCE	LEVEL / EXTENT
SUGAR BUSH OPERATIONS	0/0	DUMPING (RUBBISH)	1/2
GAPS IN THE CANOPY	1/2	EARTH DISPLACEMENT	0/0
LIVESTOCK (GRAZING)	0/0	RECREATIONAL USE	2/2
PLANTING (PLANTATION)	0/0	ALIEN SPECIES	2/3
TRACKS AND TRAILS	2/3	NOISE	1/2
NATURAL DISTURBANCES	**LEVEL / EXTENT**	**NATURAL DISTURBANCES**	**LEVEL / EXTENT**
DISEASE / PESTS / DEATH	1/2	FLOODING (POOLS & PUDDLING)	0/0
WINDTHROW (BLOWDOWN)	0/0	FIRE	0/0
BROWSE (e.g., DEER)	0/0	SOIL EROSION	0/0
BEAVER ACTIVITY	0/0	OTHER	0/0

LEVEL: 0 = NONE 1 = LIGHT 2 = MODERATE 3 = HEAVY
EXTENT: 0 = NONE 1 = LOCAL 2 = WIDESPREAD 3 = EXTENSIVE

TREE TALLY BY SPECIES

PRISM FACTOR:

SPECIES CODE	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AV.
TOTAL							
BASAL AREA (BA)							MEAN
DEAD							

PLANT SPECIES LIST	
SITE:	BOYER, YORKU
POLYGON:	CUP1
DATE:	May 30, August 17, Sept. 26/12
SURVEYOR(S):	DEB, LMC

LAYERS: 1 = CANOPY TREES > 10m 2 = SUB-CANOPY 3 = SAPLINGS & SHRUBS 4 = GROUND LAYER
BRAUN BLANQUET: + PRESENT 1 = < 1-5% 2 = 5-25% 3 = 25-50% 4 = 50-75% 5 = 75-100%

SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.	SPECIES CODE	LAYER 1	LAYER 2	LAYER 3	LAYER 4	COLL.
THUOCCI	R					POAPRAT				A	
CLEVIRG			R			RUMCRIS				R	
CARCORD			R			OSTVIRG	R				
QUEPALU	A										
QUEVELU	O										
QUEMACR	A										
QUERUBR	A										
TILAMER	A										
ALLPETI				A							
HESMATR				A							
GEUCANA				O							
PHYOPUL	R										
PRUPENS	A										
PRUVIRG			R								
RUBODOR			A								
ACESACC	R										
CYNROSS				R							
SOLULMC				R							
CYNOFFI				R							
NEPCATA				R							
FRAPENS			R								
CAMRAPU				O							
SAMCANA			R								
ARCMINU				A							
ASTLANC				R							
CIRARVE				O							
SOLCANA				R							
TRAOUPU				R							

STAND CHARACTERISTICS		
SITE: BOYER		POLYGON: CUP1
SURVEYOR(S): DEB, LMC		DATE: August 17
UTMZ:	UTME:	UTMN:

POLYGON DESCRIPTION

SYSTEM	SUBSTRATE	TOPO. FEATURE	HISTORY	PLANT FORM	COMMUNITY
☒ TERRESTRIAL ☐ WETLAND ☐ AQUATIC	☐ ORGANIC ☒ MINERAL SOIL ☐ PARENT MATERIAL ☐ ACIDIC BEDROCK ☐ BASIC BEDROCK ☐ CARB. BEDROCK	☐ LACUSTRINE ☐ RIVERINE ☐ BOTTOMLAND ☐ TERRACE ☐ VALLEY SLOPE ☒ TABLELAND ☐ ROLLING UPLAND ☐ CLIFF ☐ TALUS ☐ CREVICE/CAVE ☐ ALVAR ☐ ROCKLAND ☐ BEACH/BAR ☐ SAND DUNE ☐ BLUFF	☐ NATURAL ☒ CULTURAL	☐ PLANKTON ☐ SUBMERGED ☐ FLOATING LVD. ☐ GRAMINOID ☐ FORB ☐ LICHEN ☐ BRYOPHYTE ☒ DECIDUOUS ☐ CONIFEROUS ☐ MIXED	☐ LAKE ☐ POND ☐ RIVER ☐ STREAM ☐ MARSH ☐ SWAMP ☐ FEN ☐ BOG ☐ BARREN ☐ MEADOW ☐ PRAIRIE ☐ THICKET ☐ SAVANNAH ☐ WOODLAND ☐ FOREST ☒ PLANTATION
SITE			**COVER**		
☐ OPEN WATER ☐ SHALLOW WAT. ☒ SURFICIAL DEP. ☐ BEDROCK			☐ OPEN ☐ SHRUB ☒ TREED		

STAND DESCRIPTION

LAYER		HT	CVR	SPECIES IN ORDER OF DECREASING DOMINANCE (>> MUCH GREATER THAN; > GREATER THAN; = ABOUT EQUAL TO)
1	EMERGENT			
2	CANOPY	2,3	2,3	FRAPENN = QUEMACR = QUEPALU > QUEVELU
3	SUB-CANOPY			
4	UNDERSTORY			
5	GROUND LAYER	7	1	ALLPETI = HESMATR = ARCMINU > CIRARVE = CAMRAPU

HT CODES: 1 = > 25m 2 = >10-25m 3 = 2-10m 4 = 1-2m 5 = 0.5-1m 6 = 0.2-0.5m 7 = <0.2m
CVR CODES: 0 = NONE 1 = 1-10% 2 = >10-25% 3 = >25-35% 4 = >35-60% 5 = >60%

SIZE CLASS ANALYSIS

TREES		O	< 10cm	A	10-24cm	O	25-50cm	N	> 50cm
STANDING SNAGS		O	< 10cm	O	10-24cm	O	25-50cm	N	> 50cm
DEADFALL/LOGS	FIRM	R	< 10cm	R	10-24cm	R	25-50cm	N	> 50cm
	DECAYED	R	< 10cm	N	10-24cm	N	25-50cm	N	> 50cm

COMMUNITY MATURITY
☐ PIONEER ☐ YOUNG ☒ MID-AGE ☐ MATURE ☐ OLD-GROWTH

SOIL ASSESSMENT

	1	2	3	4
TEXTURE	CL			
DEPTH TO MOTTLES	g = 85	g =	g =	g =
DEPTH TO GLEY	G =	G =	G =	G =
DEPTH OF ORGANICS	Ø			
DEPTH TO BEDROCK	7120			
MOISTURE REGIME	3			

SiCL 30
CL
9

SOIL PROFILE

PLANT SPECIES LIST	
	SITE:
	POLYGON:
	DATE:
	SURVEYOR(S):

LAYERS: 1 = CANOPY TREES > 10m 2 = SUB-CANOPY 3 = SAPLINGS & SHRUBS 4 = GROUND LAYER
VALUE CODES: D = DOMINANT A = ABUNDANT O = OCCASIONAL R = RARE

SPECIES CODE	LAYER 1	2	3	4	COLL.	SPECIES CODE	LAYER 1	2	3	4	COLL.

DISTURBANCE and STAND CHARACTERISTICS	
	SITE: BOYER
	POLYGON: CUP1
	DATE: AUGUST 17/12
	SURVEYOR(S): DEB, LMC

MANAGEMENT / DISTURBANCE	LEVEL / EXTENT	MANAGEMENT / DISTURBANCE	LEVEL / EXTENT
SUGAR BUSH OPERATIONS	0 / 0	DUMPING (RUBBISH)	1 / 2
GAPS IN THE CANOPY	1 / 2	EARTH DISPLACEMENT	0 / 0
LIVESTOCK (GRAZING)	0 / 0	RECREATIONAL USE	2 / 2
PLANTING (PLANTATION)	0 / 0	ALIEN SPECIES	2 / 3
TRACKS AND TRAILS	2 / 3	NOISE	1 / 2
NATURAL DISTURBANCES	**LEVEL / EXTENT**	**NATURAL DISTURBANCES**	**LEVEL / EXTENT**
DISEASE / PESTS / DEATH	1 / 2	FLOODING (POOLS & PUDDLING)	0 / 0
WINDTHROW (BLOWDOWN)	0 / 0	FIRE	0 / 0
BROWSE (e.g., DEER)	0 / 0	SOIL EROSION	0 / 0
BEAVER ACTIVITY	0 / 0	OTHER	0 / 0

LEVEL: 0 = NONE 1 = LIGHT 2 = MODERATE 3 = HEAVY
EXTENT: 0 = NONE 1 = LOCAL 2 = WIDESPREAD 3 = EXTENSIVE

TREE TALLY BY SPECIES PRISM FACTOR:____

SPECIES CODE	TALLY 1	TALLY 2	TALLY 3	TALLY 4	TALLY 5	TOTAL	REL. AV.
TOTAL							
BASAL AREA (BA)							MEAN
DEAD							