



# Bolton Camp

## Terrestrial Biological Inventory and Assessment

February, 2013



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This report may be referenced as:

Toronto and Region Conservation Authority (TRCA). 2013. Bolton  
Camp Terrestrial Biological Inventory and Assessment.

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## 1.0 Introduction

In 2012 the Toronto Region Conservation Authority (TRCA) conducted a fauna survey at the recently acquired property at Bolton Camp (Maps 1 and 2). This data was combined with flora and fauna data from previous surveys to help provide background information in order to inform the development of management zones for the property. The inventory will also aid in designing a trail network that best protects sensitive features or mitigates any impacts that may arise. In addition, the resulting species lists and maps will be used by the TRCA in any future management of the area, and in any review of the trail design or of any proposed new facilities.

The study area was acquired by the TRCA in 2011. For much of the twentieth century the property had been run as a field-camp for disadvantaged youth and low-income families from Toronto; this use has required the installation of a large number of buildings on the property, peaking at 169 structures. In 2000, the land was sold to Toronto Montessori Schools, who then sold to Hi-Lands of Bolton in 2006. From this point on the land and buildings have been left unused and there has been a considerable degree of vandalism on site. Some of these facilities may be refurbished for renewed field camp use while others will be removed. In addition, the site has been investigated for its suitability for a high ropes course.

Bolton Camp has had three surveys over the past 15 years: in 1998 (fauna and a partial flora survey involving a species list but no mapping); 2001-02 (flora and vegetation community survey with partial fauna survey); and 2012 (full fauna survey, no flora). A study for Bolton Arterial Roads in 1995 overlapped with Bolton Camp but included a much larger area (Ecoplans 1995). The survey conducted in 2012 constitutes the first formal inventory of the site for the past decade. As such, given the 10 year threshold for all fauna records, the 1998 and 2001 fauna data is referred to in this current document as historic or archival data. The flora data has a 15 year threshold, and so all records from 1998 are included; however, there are no flora records more recent than 2002. See Section 3.2 and Table 2 for details on surveys.

At the larger scale, the purpose of the work conducted by the TRCA was to *characterize the terrestrial natural heritage features* of the Bolton Camp Study Area. Once characterized, the site features can then be understood within the larger East Humber and regional contexts of the Terrestrial Natural Heritage Program, enabling a better understanding of biodiversity across the jurisdiction, thereby helping to improve the Terrestrial Natural Heritage System Strategy (TNHSS) targets. The question that the inventory addresses is “*How does the area surveyed at Bolton Camp Study Area fit within the regional and watershed natural system, and how should its contribution to this system be protected and maximized?*” The important underlying message offered by this question is that the health of the natural system is measured at the regional scale and specific sites must be considered together for their benefits at all scales, from the site to the larger system.

## 1.1 TRCA's Terrestrial Natural Heritage Program

Rapid urban expansion in the TRCA jurisdiction has led to continuous and incremental loss of natural cover and species. In a landscape that probably supported 95% forest cover prior to European settlement, current mapping shows that only 17% forest and wetland cover remains. Agricultural and natural lands are increasingly being urbanized while species continue to disappear from a landscape that is less able to support them. This represents a substantial loss of ecological integrity and ecosystem function that will be exacerbated in the future according to current urbanization trends. With the loss of natural cover, diminishing proportions of various natural vegetation communities and reduced populations of native species remain. Unforeseen stresses are then exerted on the remaining flora and fauna in the natural heritage system. They become even rarer and may eventually be lost. This trend lowers the ability of the land to support biodiversity and to maintain or enhance human society (e.g. through increased pollution and decreased space for recreation). **The important issue is the cumulative loss of natural cover in the TRCA region that has resulted from innumerable site-specific decisions.**

In the late 1990s the TRCA initiated the Terrestrial Natural Heritage Program to address the loss of terrestrial biodiversity within the jurisdiction's nine watersheds. This work is based on two landscape-level indicators: the quality distribution of natural cover and the quantity of natural cover. The aim of the program is to create a conservation strategy that both protects elements of the natural system (vegetation communities, flora and fauna species) *before* they become rare and promotes greater ecological function of the natural system as a whole. This preventive approach is needed because by the time a community or species has become rare, irreversible damage has often already occurred. A healthy natural system capable of supporting regional biodiversity in the long term is the goal of the Terrestrial Natural Heritage Systems Strategy by setting targets – both short- and long-term (100 years) – for the two landscape indicators in order to provide direction in planning at all scales (TRCA 2007a, TRCA 2007b).

A target system that identifies a land base where natural cover should be restored is a key component of the Strategy. Although the objectives of the Strategy are based on making positive changes at all scales, the evaluation models were developed at the landscape scale using a combination of digital land cover mapping and field-collected data. Field-collected data also provides ground-level information in the application of the landscape models at the site scale. The two indicators and the targets that have been set for them are explained in Section 3.1. It is important to understand that habitat quality and distribution are interdependent. For example, neither well-distributed poor-quality natural cover nor poorly-distributed good-quality natural cover achieves the desired condition of sustainable biodiversity and social benefits across the watershed.

The forest habitat at the Bolton Camp Study Area acts as an important natural link through an urbanizing landscape, between the extensive natural cover in the Cold Creek subwatershed to the north, and the natural corridor of the Humber River flowing south through Nashville Tract towards the Lake Ontario shoreline. The persistence of natural cover at sites such as this is extremely

important in maintaining effective migration and dispersal routes across the rapidly expanding urban landscape.

## 2.0 Study Area Description

As shown in Maps 1 and 2, the study area is located on property recently acquired by the TRCA in the northern reaches of the Humber River watershed, on the east side of the town of Bolton. The study area is bound to the east by the Caledon-King Townline and to the west by the town of Bolton, and is situated between Columbia Way (to the north) and King Street (to the south). The site is within the Municipality of Caledon, Peel Region and covers a total of about 144 ha. It lies entirely within the Great Lakes – St. Lawrence floristic region which is composed of mixed coniferous-deciduous forest. At the coarse physiographic level, the site is situated on the South Slope physiographic zone. Surface geology of the site is primarily glacial (till) deposits of clay silt to silt, with mainly gravel-sand river deposits associated with the water course of Cold Creek, its west branch and other Humber River tributaries. There is a small area of ice-supported stratified deposits of fine sand and gravel in the northern corner of the site.

The site is dominated by complex hilly topography and small areas of floodplain associated with the several watercourses meandering through the study area. There is an extensive network of trails remaining from the field-camp which used to operate on site, and likewise there are several unused buildings scattered throughout the area; the site is also crossed by a number of paved roads and trails.

## 3.0 Inventory Methodology

A biological inventory of the Bolton Camp Study Area was conducted at the levels of habitat patch (landscape analysis), vegetation community, and species (flora and fauna) according to the TRCA methodologies for landscape evaluation (TRCA 2007c) and field data collection (TRCA 2007d). Habitat patch mapping was taken from the regional 2007/08 mapping of broadly-defined patch categories (forest, wetland, meadow and coastal) and digitized using ArcView GIS software.

A key component of the field data collection is the scoring and ranking of vegetation communities and flora and fauna species to generate local “L” ranks (L1 to L5); this process was undertaken in 1996-2000 and ranks are reviewed regularly (TRCA 2010). Vegetation community scores and ranks are based on two criteria: *local occurrence* and the number of *geophysical requirements* or factors on which they depend. Flora species are scored using four criteria: *local occurrence*, *population trend*, *habitat dependence*, and *sensitivity to impacts associated with development*. Fauna species are scored based on seven criteria: *local occurrence*, *local population trend*, *continent-wide population trend*, *habitat dependence*, *sensitivity to development*, *area-sensitivity*, and *patch isolation sensitivity*. With the use of this ranking system, communities or species of *regional concern*, ranked L1 to L3, now replace the idea of *rare* communities or species. Rarity

(*local occurrence*) is still considered as one of many criteria that make up the L-ranks, making it possible to recognize communities or species of regional concern before they have become rare.

In addition to the L1 to L3 ranked species, a large number of currently common or secure species at the regional level are considered of concern in the urban context. These are the species identified with an L-rank of L4. Although L4 species are widespread and frequently occur in relatively intact urban sites, they are vulnerable to long-term declines.

### 3.1 Landscape Analysis

The quality, distribution and quantity of natural cover in a region are important determinants of the species distribution, vegetation community health and the provision of “ecosystem services” (e.g. air and water quality, recreation, aesthetics) in that region.

#### Base Mapping

The first step in evaluating a natural system or an individual *habitat patch* is to interpret and map land cover using aerial photographs. The basic unit for the evaluation at all scales is the habitat patch in the region, which are then combined and evaluated as a system at any scale. A *habitat patch* is a continuous piece of habitat, as determined from aerial photo interpretation. The TRCA maps habitat according to four broad categories: *forest*, *wetland*, *meadow*, and *coastal* (beach, dune, or bluff). At the regional level, the TRCA jurisdiction is made up of thousands of habitat patches. This mapping of habitat patches in broad categories is conducted through remote-sensing and is used in the evaluation of quality, distribution and quantity of natural cover. It should not be confused with the more detailed mapping of vegetation communities obtained through field surveys and that is used to ground-truth the evaluation (see Section 3.2).

#### Quality Distribution of Natural Cover

The quality of each habitat patch is evaluated according to three criteria: *size* (the number of ha occupied by the patch), *shape* (edge-to-area ratio), and *matrix influence* (measure of the positive and negative impacts from surrounding land use) (TRCA 2007c). A total score for each patch is obtained through a weighted average of the scores for the three criteria. This total score is used as a measure of the ‘quality’ of a habitat patch and is translated into a local rank (L-rank) ranging from L1 to L5 based on the range of possible total scores from 3 to 15 points. Of these L-ranks, L1 represents the highest quality habitat and L5 the poorest.

Species presence or absence correlates to habitat patch quality (size, shape and matrix influence) (Kilgour 2003). The quality target is based on attaining a quality of habitat patch throughout the natural system that would support in the very long term a broad range of biodiversity, specifically a quality that would support the region’s fauna Species of Conservation Concern (Table 1).

**Table 1: Habitat patch quality, rank and species response**

Size, Shape and Matrix Influence	Patch Rank	Fauna Species of Conservation Concern
Excellent	L1	Generally found
Good	L2	Generally found
Fair	L3	Generally found
Poor	L4	Generally not found
Very Poor	L5	Generally not found

In addition to the three criteria that make up the total habitat patch score, another important measure to consider in assessing habitat patch quality is forest interior, i.e. the amount of forest habitat that is greater than 100 m from the edge of the forest patch, using 100 m increments. A recognized distance for deep interior conditions occurs at 400 m from the patch edge. Such conditions are a habitat requirement for several sensitive fauna species.

### Quantity

The amount of natural cover needed in the landscape is based on the quantity required to accommodate and achieve the quality distribution targets described above. The two targets are therefore linked to each other: it will be impossible to achieve the required distribution of natural heritage quality without the appropriate quantity of natural cover. The proportion of the region that needs to be maintained as natural cover in order to achieve the desired quality has been identified as 30%.

### 3.2 Vegetation Communities, Flora and Fauna Species

Vegetation community and flora and fauna species data were collected through field surveys. These surveys were done during the appropriate times of year to capture breeding status in the case of amphibians and birds, and during the optimal growing period of the various plant species and communities. Vegetation communities and flora species were surveyed concurrently.

Botanical field-work was mostly conducted in the spring and early summer of 2002 (Table 2). The 6 ha area south of the terminus of Mount Hope Road was done in 2001. In 1998, there was no ELC survey or flora mapping, but a checklist of flora was recorded.

Vegetation community designations were based on the Ecological Land Classification (ELC) and determined to the level of vegetation type (Lee *et al.* 1998). Community boundaries were outlined onto printouts of 2002 digital ortho-rectified air photos to a scale of 1:2000 and then digitized in ArcView (air photos were later updated to 2007 for report). Flora regional species of concern (species ranked L1 to L3) were mapped as point data with approximate number of individuals seen. A list of all other species observed was documented for the site.

The most complete fauna survey of the site was conducted by the TRCA in March and June of

2012. The spring surveys searched primarily for frog species of regional concern but recorded incidentally the presence of any early-spring nocturnal bird species (owls and American woodcocks). Surveys in June were concerned primarily with the mapping of breeding bird species of regional concern. As per the TRCA data collection protocol, breeding bird surveys were carried out by visiting all parts of the site at least twice during the breeding season (last week of May to mid-July) to determine the breeding status of each mapped point. The methodology for identifying confirmed and possible breeding birds follows Cadman *et al.* (2007). All initial visits were completed by the end of the third week of June. The field-season is organized so that by late June only repeat visits are being conducted. It is imperative that any visit made in the first half of June is subsequently validated by a second visit later in the season. Fauna regional species of concern (species ranked L1 to L3) were mapped as point data with each point representing a possible breeding territory.

In addition to the 2012 data, a single species point has been mapped from an incidental observation made in the summer of 2004.

**Table 2. Schedule of TRCA biological surveys at Bolton Camp Study Area**

Survey Item	Survey Dates	Survey Effort (hours)
Patch / Landscape	2007/08: ortho-photos	21 hours
Vegetation Communities and Flora Species	1998: May 12 <sup>th</sup> ; June 9 <sup>th</sup> , 15 <sup>th</sup> ; Aug 27 <sup>th</sup> . 2001: May 24 <sup>th</sup> 2002: May 8 <sup>th</sup> , 24 <sup>th</sup> , 27 <sup>th</sup> , 29 <sup>th</sup> , 30 <sup>th</sup> ; June 4 <sup>th</sup> , 7 <sup>th</sup> , 10 <sup>th</sup> , 11 <sup>th</sup> , 12 <sup>th</sup> , 13 <sup>th</sup> .	69 hours (1998-2002)
Frogs and Nocturnal Spring Birds	2012: March 19 <sup>th</sup>	2.25 hours (2012)
Breeding Songbirds	2012: June 7 <sup>th</sup> , 8 <sup>th</sup> , 25 <sup>th</sup> and 27 <sup>th</sup>	16.75 hours (2012)

## 4.0 Results and Discussion

Information pertaining to the Bolton Camp Study Area was collected through both remote-sensing and ground-truthing surveys. This information contains three levels of detail: habitat patch, vegetation community, and species (flora and fauna). This section provides the information collected and its analysis in the context of the TNHS Strategy.

### 4.1 Regional Context

Based on 2007/08 ortho-photography, 25% of the land area in the TRCA jurisdiction consists of natural cover but this figure includes meadow and old field. Although historically, the region would have consisted of up to 95% forest cover, currently (i.e. 2007/08) only about 17% is covered by forest and wetland. Of the non-natural cover (i.e. the remaining 75%), 48% is urban and 27% is rural / agricultural.

The regional level analysis of habitat patches shows that the present average patch quality across the TRCA jurisdiction is “fair” (L3); forest and wetland cover is contained largely in the northern half of the TRCA jurisdiction, especially on the Oak Ridges Moraine; and the quantity is 16.7% of the surface area of the jurisdiction (Map 3). In addition, meadow cover stands at 8.1% of the region. Thus the existing natural system stands below the quantity target that has been set for the region (30%) and also has an unbalanced distribution. The distribution of fauna species of concern is also largely restricted to the northern part of the jurisdiction; fauna species of regional concern are generally absent from the urban matrix (Map 4). The regional picture, being the result of a long history of land use changes, confirms that **all** site-based decisions contribute to the condition of a region.

## 4.2 Habitat Patch Findings for Bolton Camp Study Area

The following details the site according to the two natural system indicators used in designing the Terrestrial Natural Heritage System Strategy: the *quality distribution* and *quantity* of natural cover. Analysis was based on 2007/08 ortho-photos.

### 4.2.1 Quantity of Natural Cover

Bolton Camp is a critical link in the Humber Watershed, the largest of the TRCA watersheds. The Humber watershed covers about 91,077 ha containing 32.0% natural cover (2007/08), including 15,803 ha as forest (17.4%), 8,169 ha as meadow (9.0%) and 2078 ha as wetland (2.3%). The Bolton Camp Study Area contains 0.5% of the total natural cover in the Humber watershed. It has a strategic importance in the corridor of natural cover associated with the Humber River as it flows south from the Oak Ridges Moraine, maintaining a natural corridor from the rural area to the north, through the highly urbanized area to the south. In particular, it provides a link in the natural cover that bypasses the local urban node of Bolton immediately to the west.

The Bolton Camp Study Area has 132.3 ha of natural cover (Table 3; Appendix 1). The natural cover includes 62.0 ha of forest, 40.5 ha of successional, 1.0 ha aquatic (almost all of it unvegetated riverine along Cold Creek), 4.0 ha of meadow and just 1.6 ha of wetland. The site also includes 0.1 ha of “dynamic” communities: open or semi-open habitat maintained by unique conditions such as riparian or wind erosion (in this case clay barren resulting from post-agricultural erosion and difficult soil conditions).

### 4.2.2 Quality Distribution of Natural Cover

The results for quality distribution are reported below under the headings of habitat patch size and shape, matrix influence and total score.

## Habitat Patch Size and Shape

The study area is almost entirely upland forest and successional woody cover perched on higher ground between the several creek ravines which traverse the site. Open habitats are generally associated with the numerous buildings, remnants of the site's function as a field camp in decades past. The southern forest patch on the site (south of the largest driveway) scores "good" for patch size, while the patch to the north scores "fair" (Map 5). Thus, the largest extents of forest interior habitat are also located in the southern half of the site, the most extensive being an arc of habitat within the western block which is less disrupted by the former camp's infrastructure (Map 6). The small meadow and wetland patches at the east side of the site have "poor" or "very poor" size scores. Most of the natural cover at Bolton Camp scores "poor" for patch shape, owing to the patches' convoluted form broken up by camp buildings and grounds.

## Habitat Patch Matrix Influence

Analysis based on the 2007/08 ortho-photos shows that the matrix influence score for habitat in the study area is split between "good" to the north of the main driveway, and "fair" to the south (Maps 7 and 8). These scores are as expected given the urban matrix to the west and natural matrix to the east and north.

The TRCA measures matrix influence at the landscape level by assigning set values; positive, neutral and negative, to the type of landscape use occurring within 2 km of the subject site. It is important, however, to also understand and consider the matrix influence that occurs at the site and patch level. Such influences include those transferred to an otherwise remote natural habitat patch from a distant urban or suburban development, for example via a trail system.

## Habitat Patch Total Score

The combination of "fair" to "good" matrix influence on the site, and the mix of "fair" to "good" habitat patch size with "poor / very poor" patch shape, results in an overall "fair" or L3 habitat patch quality (Map 9). Landscape scores are intended to be applied at the broader landscape level and therefore caution needs to be exercised when referring to such measures at the more refined site level. However, in this particular case, it appears that the landscape scores are in keeping with the ground-truthed flora and fauna representation, with a moderate number of L3 species reported. Considerably more L3 flora points were mapped but this is typical in areas that have at least some urban influence where sensitive flora populations persist longer than sensitive fauna populations – plant populations do not have the opportunity to vacate a deteriorating habitat in the same way that many fauna species do (for the same reason, less mobile taxa such as herpetofauna lag behind highly mobile birds in the exodus of sensitive fauna that occurs as urbanization encroaches).

## 4.3 Vegetation Community Findings for Bolton Camp Study Area

### 4.3.1 Vegetation Community Representation

Bolton Camp has a relatively high proportion of forest and successional communities due to its sloping ravine topography (Table 3). The presence of Cold Creek and past and present land-use disturbances also results in a number of open and wetland communities that cover a small portion of the total area. A total of 77 different ELC vegetation community types were described for the site (Map 10; listed in Appendix 1). There are 33 forest communities (including 7 occurring only as inclusions or complexes within larger polygons), 8 successional communities, 8 wetland, 1 vegetated aquatic, 1 unvegetated aquatic (Cold Creek), 3 meadows, and 2 dynamic communities (barrens). Communities range in age and origin from native mature deciduous and mixed forests down to recently-abandoned areas; probably released from disturbance as recently as 2005-2010 when the camp was decommissioned (the newer areas were not surveyed in 2002 as they would have then been manicured). In between these extremes are mid-aged successional and disturbed forest communities.

**Table 3. Summary of Vegetation Communities, Bolton Camp Study Area**

Class	Number of Types	Area (hectares)
Forest	33	62.0
Successional	8	40.5
Meadow	3	4.0
Wetland	8	1.6
Aquatic (vegetated or not)	2	1.0
Dynamic (beach, bluff, barren)	2	0.1
<i>Total</i>	<i>56</i>	<i>132.3</i>

The site has 62.0 ha of forest, just under half of the whole study area. Not quite half of the forest (30.0 ha) is composed of various types of more mature late-successional forest (dominated by sugar maple, *Acer saccharum* ssp. *saccharum*; black maple, *Acer saccharum* ssp. *nigrum*; white cedar, *Thuja occidentalis*; hemlock, *Tsuga canadensis* alone or in varying mixes). The remaining 32.0 ha consists of plantations and younger deciduous forest (with ash, *Fraxinus* spp; Manitoba maple, *Acer negundo*; trembling aspen, *Populus tremuloides*; apple, *Malus pumila*; and hawthorn, *Crataegus* spp). These younger forest types grade into the successional habitats, distinguished mostly by their denser canopy cover. Deciduous forest of whatever age class or type covers 29.4 ha; while there are 7.3 ha of mixed forest and 8.1 ha of coniferous forest. Finally, there are 17.1 ha of plantation.

The ravine slopes toward the southern and eastern parts of the study area include Dry-Fresh White Cedar Coniferous Forest (FOC2-2), Fresh-Moist Hemlock Coniferous Forest (FOC3-1), Fresh-Moist White Cedar Coniferous Forest (FOC4-1), Dry-Fresh Sugar Maple – Hemlock Mixed Forest (FOM3-2), Fresh-Moist Sugar Maple – Hemlock Mixed Forest (FOM6-1), and several types

of Dry-Fresh Sugar Maple Deciduous Forest (FOD5). Small areas of Fresh-Moist Sugar Maple – Black Maple Deciduous Forest (FOD6-2) and Fresh-Moist Black Maple Lowland Deciduous Forest (FOD7-5) occur on lower slopes and terraces.

The younger to mid-aged forests and plantations are widespread across Bolton Camp and grow up the ravines, on the tablelands, and in the floodplain of Cold Creek. Dry-Fresh Apple – Hawthorn Deciduous Forest (FOD4-H) is the most extensive, covering over 8 ha. White Pine Coniferous Plantation (CUP3-2) covers 6.1 ha and Black Locust Deciduous Plantation (CUP1-c) covers 4.3 ha. There are also small areas of Fresh-Moist Manitoba Maple Lowland Deciduous Forest (FOD7-a) along the floodplain and patches of Fresh-Moist Ash Deciduous Forest (FOD7-2) and Dry-Fresh Poplar Deciduous Forest (FOD3-1). These younger forests tend to have less forest ground species and more of the invasive buckthorn (*Rhamnus cathartica*).

Successional semi-wooded communities at Bolton Camp are similar to the younger forests but distinguished by having less tree canopy (less than 60% cover). There are 40.5 ha of such communities. Taken together, the combination of young forest, plantation, and successional habitat dominates Bolton Camp overall (total about 80 ha). The largest share of successional cover is Hawthorn Successional Woodland (CUW1-D) at 26.2 ha. The semi-open character results from past agricultural land use (probably mostly cow pasture pre-dating the camp). Possibly Dutch elm disease and other tree pathogens play a role. Soil compaction from cattle trampling followed by slope erosion has probably slowed the rate of tree colonization and canopy closure (given the long tenure of the camp facilities, it has likely been many decades since cattle were on site). Although the tree cover has some preponderance of native species, European buckthorn and sometimes shrub honeysuckle (*Lonicera x bella*) are prominent members of the shrub and seedling layers.

Open meadow covers just 4.0 ha; most of this is Native Forb Meadow (CUM1-A) with a high proportion of tall goldenrod (*Solidago altissima*) and aster (*Symphyotrichum* spp.) It occurs mostly on more-recently farmed tableland and terrace in the north end of the study area.

Wetlands are diverse but very small in coverage. They are mostly associated with groundwater seepage near Cold Creek (Figure 1). Such places have Alder Mineral Thicket Swamp (STW2-1), Red-osier Mineral Thicket Swamp (SWT2-5), and several mineral and shallow marsh types (Appendix 1). A very small Duckweed Floating-leaved Shallow Aquatic (SAF1-3) community is found in a pothole or mini-kettle in the north part of the site.

In a couple of places, the soil has remained bare due to surface compaction and erosion persisting long after pasturage. These areas of patchy vegetation are kept dynamically open and include White Cedar Low Treed Clay Barren (CBT1-A) and an inclusion of Shrub Clay Barren (CBS1).

Disturbance to the vegetation communities is mostly from two sources: invasive species and trail use. Exotic species are most prominent in the young forests and successional areas. The more mature forests are relatively free of exotics. Although it has not yet arrived at Bolton Camp,

emerald ash borer (*Agrilus planipennis*) is an imminent threat to ash-dominated communities. The role of particular invasive exotic species is discussed below (Section 4.4.2). Trail use was originally associated with the camp facilities, and persists through informal use of the site. There is also vandalism.



**Figure 1. Seepage wetland (Alder Mineral Thicket Swamp with white cedar clump)**

#### **4.3.2 Vegetation Communities of Concern**

The vegetation communities that occur in the TRCA jurisdiction are scored and given a local rank from L1 to L5 based on the two criteria mentioned in Section 3.2. Vegetation communities with a rank of L1 to L3 are considered of concern across the entire jurisdiction while L4 communities are considered of concern in the urban portion of the jurisdiction. The Bolton Camp Study Area lies along the border of the urban landscape and so L4 communities can be considered along with L1 to L3 communities as being of conservation concern. In addition, community ranks do not take into account the intactness or quality of individual examples of communities; thus, a common type of vegetation community may be of conservation concern at a particular site because of its age,

intact native ground layer, or other considerations aside from rank. For example, an old-growth sugar maple forest may belong to a relatively common and adaptable vegetation type but should still be considered of high conservation concern.

There are four vegetation communities at Bolton Camp with a rank of L1 to L3 plus an additional 17 that are ranked L4 (communities are listed with ranks in Appendix 1; location and boundaries shown on Map 10). The L1 to L3 communities occupy just 0.9 ha, 0.7% of the total natural cover; but the L4 communities cover 22.0 ha, 16.7% of the natural cover.

The White Cedar Low Treed Clay Barren (CBT1-A) and Shrub Clay Barren (CBS1) are ranked L2. These communities depend on ongoing erosion and otherwise harsh soil conditions to maintain their character.

Two wetlands have a rank of L3: Narrow-leaved Sedge Mineral Meadow Marsh (MAM2-5) and Broad-leaved Cattail Organic Shallow Marsh (MAS3-1A) (present as an inclusion). Five other wetland (or aquatic) communities, including Alder Mineral Thicket Swamp (SWT2-1), Red-osier Mineral Thicket Swamp (SWT2-5), Broad-leaved Cattail Mineral Shallow Marsh (MAS2-1A), Forb Mineral Meadow Marsh (MAM2-10) and Duckweed Floating-leaved Shallow Aquatic (SAF1-3) have a rank of L4. All of these depend on high-quality water inputs and are noteworthy for having low invasive cover.

Most of the L4 communities are forests. These include all six coniferous and mixed forest types (Appendix 1). They also include the Fresh-Moist Sugar Maple – Black Maple Deciduous Forest (FOD6-2), Fresh-Moist Black Maple Lowland Deciduous Forest (FOD7-5), Dry-Fresh Poplar Deciduous Forest (FOD3-1), Fresh-Moist White Elm Lowland Deciduous Forest (FOD7-1), and Fresh-Moist Ash Deciduous Forest (FOD7-2). The ground layer of the more mature forest communities (e.g. Fresh-Moist Hemlock – Sugar Maple Mixed Forest [FOM6-1], and Fresh-Moist Black Maple Lowland Deciduous Forest [FOD7-5] includes a good representation of sedges, ferns, and spring ephemerals. Ground vegetation is less dense on the steeper slopes. One successional community, White Pine Successional Savannah (CUS1-A2) is ranked L4.

## **4.4 Flora Findings for Bolton Camp Study Area**

### **4.4.1 Flora Species Representation**

Surveys conducted by TRCA in 1998, 2001 and 2002 identified a total of 271 species of vascular plants (Table 4; Appendix 2). These included 267 naturally-occurring species and 4 planted species (four species of conifer associated with plantations). Of the non-planted species, 195 are native (70%). Biodiversity of this site is in the moderate range given the study area size, and reflects the presence of mature forest and successional communities, as well as a few wetlands and barrens. Each of these has own suite of species.

**Table 4. Summary of Flora Species, Bolton Camp Study Area**

Total # of species	271
Naturally-occurring species	267
Planted species	4
Native (naturally-occurring) species	186
Number of L1 - L3 species	22
Number of L4 species	64
Exotic species (established)	81

#### 4.4.2 Flora Species of Concern

There are 22 vascular plant species of regional conservation concern (rank L1 to L3) at Bolton Camp; of these, 20 are ranked L3 and 2 are ranked L2. An additional 64 have a rank of L4, and are of conservation concern in natural areas that have surrounding urban land-uses associated with higher levels of disturbance. Appendix 2 lists plant species by ranks and locations are shown on Map 11. The ranks are based on sensitivity to human disturbance associated with development; and habitat dependence, as well as on rarity (TRCA 2010). In most cases, the species are not currently rare but are at risk of long-term decline due to the other criteria.

Three of these L1 to L3 plants are regionally rare (found in six or fewer of the forty-four 10x10 km UTM grid squares that cover the TRCA jurisdiction. They are Robin's plantain (*Erigeron pulchellus*), wild blue phlox (*Phlox divaricata*), and prickly-ash (*Zanthoxylum americanum*). Outside of Rouge Park, Robin's plantain is found only in a few locations in Caledon, one of which is Bolton Camp (Figure 2). Wild blue phlox is scattered in deciduous woodlots in the middle and upper reaches of the Humber, with a couple of locations further east in the jurisdiction. The prickly-ash was observed in 2002 but its location and population were not recorded. All of the TRCA records for this species are in the area between Albion Hills, Woodbridge, and Thornhill.

All of the flora species of regional concern at Bolton Camp are sensitive to development, being vulnerable to at least one kind of disturbance that is associated with land use changes (see Map 7 for sensitivity to development scores). Some of these are vulnerable to hydrological changes. Ferns such as oak fern (*Gymnocarpium dryopteris*) and some sedges such as fen star sedge (*Carex interior*) require cool, moist, sheltered conditions, often with groundwater close to the surface. Increasing warmth and dryness will cause these species to decline. The same is true of many of the L4 species such as hemlock (*Tsuga canadensis*), one of the keystone species of the mixed and coniferous forest communities at the study area.

Hydrological and nutrient disturbances can also encourage invasive species that displace some of the smaller and more sensitive forest species. Garlic mustard (*Alliaria petiolata*) and dame's rocket (*Hesperis matronalis*) are present at Bolton Camp, although they were not recorded as dominant species in 2002. Invasive plants at this site could affect such less-competitive species as wild blue

phlox, running strawberry-bush (*Euonymus obovatus*), and Robin's plantain. Butternut (*Juglans cinerea*) is threatened by butternut canker disease.



**Figure 2. Robin's plantain (regionally-rare)**

Increased human traffic into a natural area results in disturbance caused by trampling and also facilitates incursion of invasive species that compete with the existing native flora. Bolton Camp has had a history of outdoor recreation; as the property becomes more heavily used by the public

in an official way, trampling disturbance will need to be controlled. The forest here includes sensitive species such as MacKay's fern (*Cystopteris tenuis*) and other ferns; rose twisted stalk (*Streptopus lanceolatus* var. *lanceolatus*), and Dutchman's breeches (*Dicentra cucullaria*).

Some species may be deliberately removed if they are seen: small yellow lady's slipper (*Cypripedium parviflorum* var. *makasin*) and to some extent several of the fern species are prized for gardens. Wild edibles collection could also have a detrimental effect on the currently-L4 species wild leek (*Allium tricoccum*) and the L5 species ostrich fern (*Matteucia struthiopteris*) (fiddleheads).

In addition to being sensitive to land use impacts, the 22 species of concern can be considered habitat specialists, scoring relatively high in *habitat dependence*. Habitat dependence scores are shown on Map 12. Roughly, they are found in seven or fewer vegetation cohorts (groupings of vegetation types with similar floristic characteristics) (TRCA 2010). They will not readily recover when these habitats are lost or altered. Bolton Camp has habitat specialists corresponding to its forest, riparian, and dynamic barren or successional habitats.

Forest species are particularly well-represented, especially those of more mature mixed and deciduous forests. There are spring ephemerals among the species of concern, notably cut-leaved toothwort (*Cardamine concatenata*) present in large populations; along with squirrel-corn (*Dicentra canadensis*), Dutchman's breeches, wild leek, and narrow-leaved spring beauty (*Claytonia virginica*). The site has several forest sedge species (counting all ranks). Few-nerved wood sedge (*Carex leptonevia*) has a rank of L3. Also of interest is the southern species running strawberry-bush.

Wetland specialists at Bolton Camp include tamarack (*Larix laricina*), speckled alder (*Alnus incana* ssp. *rugosa*) and swamp red currant (*Ribes triste*).

Species of concern requiring more open, successional or dynamically-active sites include common juniper (*Juniperus communis* var. *depressa*), Robin's plantain, and Canada plum (*Prunus nigra*). The common juniper is found in the clay barren community. Robin's plantain is found on an open slope in the hawthorn woodland community, although it might be expected to grow in clay barren environments where it is less subject to competition and more tolerant of microclimate extremes such as drought. The Canada plum is a typical associate of semi-open treed and shrub communities such as the hawthorn woodland.

### **Invasive Species**

The most prevalent invasive species by far at Bolton Camp is buckthorn. It is abundant in most of the younger forest, plantation, and successional communities where it can shade out and suppress more light-loving vegetation. Shrub honeysuckle is also locally abundant in such places.

There are a number of other potentially-severely invasive species at Bolton Camp; they were found in low numbers in 1998-2002 and their locations and habitats were not noted. These include

dog-strangling vine (*Cynanchum rossicum*), garlic mustard yellow bedstraw (*Galium verum*), dame's rocket, hedge parsley (*Torilis* sp. most likely *T. japonica*) and multiflora rose (*Rosa multiflora*). Dog-strangling vine is particularly problematic in the TRCA jurisdiction and other parts of the Lower Great Lakes (TRCA 2008). Garlic mustard and dog-strangling vine are currently the subject of research on biological control (Bouchier and Smith 2008).

While the non-native hawkweed species found at this site (*Pilosella caespitosa* and *P. piloselloides*) are not normally considered to be serious invasives, they are abundant and do share a similar ecological niche to Robin's plantain. In this context, they could be a competitor with this rare and sensitive species. There were over 50 rosettes of Robin's plantain observed in 2002 but it is quite possible that the population could have declined due to increased shade and competition in the past 10 growing seasons since the survey was done.

Emerald ash borer is an additional consideration. It is now present in the TRCA jurisdiction and is likely to decimate ash trees in the next several years. Not only will ash decline in numbers, but also ash-dominated communities will be rapidly opened up to increased light. Invasive plants, especially buckthorn are likely to take advantage of the openings. Preventive management and re-planting is indicated for such areas.

The best approach to reducing the spread of invasive plant species at Bolton Camp is to control sources of disturbance. Specific control efforts at this site would require further identification of particular populations and locations of problem plants (please refer to Section 5.2 Recommendations for further details).

## **4.5 Fauna Species Findings for Bolton Camp Study Area**

### **4.5.1 Fauna Species Representation**

The TRCA fauna surveys at the Bolton Camp Study Area in 2012 documented a total of 46 bird species, 8 mammals, and 5 herpetofauna species, bringing the total number of possible breeding vertebrate fauna species identified by the TRCA to 59. One additional bird species (pileated woodpecker, *Drycopus pileatus*) can be added from an incidental record reported in 2004, giving an overall total of 60 species. This total is similar to those from several other study areas of equal size in the same urban-rural interface zone but does not compare quite so well with similar sized rural sites. For example, the fauna inventory for the 145 ha rural-urban interface study area South of Rutherford Road, East of Islington (also known as the Pine Valley site) reported 78 species including 54 bird species, while the inventory for the somewhat more extensive and more rural Cold Creek Conservation Area reported 89 fauna species. Further reference to the 1998 survey and 2001 partial survey indicate an additional nine species, including two L2 ranked songbirds: black-and-white warbler (*Mniotilta varia*) and blue-winged warbler (*Vermivora pinus*). Refer to Appendix 3 for a list of the fauna species and their corresponding L-ranks.

#### 4.5.2 Fauna Species of Concern

Fauna species, like vegetation communities and flora species are considered of regional conservation concern if they rank L1 to L3 based on their scores for the seven criteria mentioned in Section 3.2. As with flora, this is a proactive, preventive approach, identifying where conservation efforts need to be made before a species becomes rare. Since the subject site is situated within the rural zone this report does not consider those species ranked as L4, i.e. those species that are of concern in urban landscapes.

Fauna surveys at the Bolton Camp Study Area in 2012 reported six bird species of regional concern (L1 to L3), including one L2 bird species: ruffed grouse (*Bonasa umbellus*). In addition, there were two herpetofauna and one mammal species of regional concern (spring peeper, *Pseudacris crucifer*; wood frog, *Lithobates sylvatica*; and northern short-tailed shrew, *Blarina brevicauda*). A further L3 ranked bird species can be added from the incidental record mapped at the north end of the area in 2004 (pileated woodpecker) bringing the total to 10 fauna species of regional concern (Table 5). Locations of these breeding fauna are depicted on Map 13.

**Table 5. Summary of Fauna Species of Regional at Bolton Camp**

Fauna	Number of Species	Number of Species of Regional Concern (L1 to L3 rank)
birds	47	7
herps	5	2
mammals	8	1
<b>TOTALS</b>	60	10

**Local occurrence** is one of seven scoring criteria for fauna species and is based on TRCA data and information from the Natural Heritage Information Centre (NHIC) of the Ontario Ministry of Natural Resources (OMNR) (NHIC 2008). Using local occurrence as a measure of regional rarity, any species that is reported as a probable or confirmed breeder in fewer than 10 of the forty-four 10x10 km UTM grid squares in the TRCA jurisdiction is considered regionally rare (i.e. scores three to five points for this criterion) (TRCA, 2010). The fauna surveys at the Bolton Camp Study Area documented two fauna species that are considered regionally rare: blue-headed vireo (*Vireo solitarius*) and northern short-tailed shrew. The latter species is probably considerably more widespread than the TRCA database suggests but TRCA inventories are not geared toward effective appraisal of small mammal populations and so the species' presence at Bolton Camp is not necessarily particularly significant. On the other hand, the presence of blue-headed vireo, found in just 6 of the 44 regional grid squares, is quite surprising, although the fact that only one territory was mapped needs to be considered - a lone record of a songbird may refer to a species that is not properly established at that site.

**Sensitivity to development** is another criterion used to determine the L-rank of fauna species. A large number of impacts that result from local land use, both urban and agricultural, can affect the local fauna. These impacts – considered separately from the issue of actual habitat loss – can be divided into two distinct categories. The first category involves changes that arise from local urbanization that directly affect the breeding habitat of the species in question. These changes

alter the composition and structure of the vegetation communities; for example, the clearing and manicuring of the habitat (e.g. by removal of dead wood and clearance of shrub understorey). The second category of impacts involves changes that directly affect individuals of the species in question. Examples include increased predation from an increase in the local population of predator species that thrive alongside human developments (e.g. blue jays, *Cyanocitta cristata*; American crows, *Corvus brachyrhynchos*; squirrels, *Sciuridae*; raccoons, *Procyon lotor*; and house cats, *Felis catus*); parasitism (from facilitating the access of brown-headed cowbirds, *Molothrus ater*, a species which prefers more open, edge-type habitat); competition (for nest-cavities with bird species such as house sparrows, *Passer domesticus*; and European starlings, *Sturnus vulgaris*); flushing (causing disturbance and abandonment of nest) and, sensitivity to pesticides.

Fauna species are considered to have a high sensitivity to development if they score three or more points (out of a possible five) for this criterion. At the study area all ten of the species that are ranked L1 to L3 receive this score and are therefore considered sensitive to one or more of the impacts associated with development (Map 8).

The one L2 ranked bird (ruffed grouse) and two of the L3 ranked species (mourning warbler, *Geothlypis philadelphia*; and ovenbird, *Seiurus aurocapillus*) are species that habitually nest on or near to the ground and as such are highly susceptible to ground-borne disturbance, e.g. off-leash dog-walking. Interestingly, both of the L3 species were reported in higher numbers (a combined total of 12 territories) in the 2012 inventory than had been reported in the previous inventory conducted in 1998 (seven territories).

Ground-nesting birds are highly susceptible both to increased predation from ground-foraging predators that are subsidized by local residences (house cats, raccoons) and to repeated flushing from the nest (by pedestrians, off-trail bikers and dogs) resulting in abandonment and failed breeding attempts. Currently the public use of the site is entirely informal and although there are many trails throughout the study area it is likely that actual public use of the site is somewhat sparser than in the previous decade, prior to closure of the field-camp. This would certainly be a reasonable explanation for the increase in numbers of territories of low/ground-nesting bird species in 2012.

Many of the negative influences associated with an urban landscape can be transferred deep within an otherwise intact natural matrix by extensive trail networks used by large numbers of people originating from quite distant urban and suburban centres. Extensive public use of a natural habitat can have substantial negative impact through the cumulative effects of hiking, dog-walking and biking on the site. Similarly, clearing of forest understorey to accommodate trails will displace such sensitive species.

Various studies have shown that many bird species react negatively to human intrusion (i.e. the mere presence of people) to the extent that nest-abandonment and decreased nest-attentiveness lead to reduced reproduction and survival. One example of such a study showed that abundance was 48% lower for hermit thrushes (a ground-nesting/foraging species) in intruded sites than in the control sites (Gutzwiller and Anderson 1999). Elsewhere, a recent study reported that dog-

walking in natural habitats caused a 35% reduction in bird diversity and a 41% reduction in abundance, with even higher impacts on ground-nesting species (Banks and Bryant 2007).

**Area sensitivity** is a scoring criterion that can be closely related to the issue of a species' need for isolation. Fauna species are scored for area sensitivity based on their requirement for a certain minimum size of preferred habitat. Species that require large tracts of habitat (>100 ha in total) score the maximum five points, while species that either show no minimum habitat requirement, or require <1 ha in total, score one point. Species scoring three points or more (require  $\geq 5$  ha in total) are deemed area sensitive species. Researchers have shown that for some species of birds, area sensitivity is a rather fluid factor, dependent and varying inversely with the overall percentage forest cover within the landscape surrounding the site where those species are found (Rosenburg *et al.* 1999).

Eight of the fauna species of regional concern that were identified at the Bolton Camp Study Area are considered area sensitive, including two L3 species (ovenbird and scarlet tanager, *Piranga olivacea*) that require at least 20 ha of habitat. All of the area sensitive species are forest species and as such are well-accommodated by the largest patch (66.4 ha) of continuous forest in the western half of the site. Much of the rest of the site is also forest habitat but is somewhat fragmented into smaller patches by the network of paved roads and trails and is interspersed with areas of successional habitat (Map 5). This network leaves four areas of forest interior over 100 m from the edge, mostly focused in the west-central part of the site (Map 6); such patches are important for many forest fauna species since the interior conditions satisfy very specific habitat preferences, e.g. moisture, temperature and light.

Species' patch-size constraints are due to a variety of factors including foraging requirements and the need for isolation within a habitat block during nesting. In the latter case, regardless of the provision of a habitat patch of sufficient size, if that block is seriously and frequently disturbed by human intrusion, such species will be liable to abandon the site. Such a variety of habitat needs are more likely satisfied within a larger extent of natural cover. Currently, the quantity of forest cover at the study area accommodates multiple territories of three of the classic area sensitive forest species (scarlet tanager, ovenbird and wood thrush, *Hylocichla mustelina*) and this density suggests that the forest habitat is extensive enough to allow these species to nest successfully.

The most extensive forest habitat is also managing to provide adequate habitat for the two non-avian area-sensitive fauna species: wood frog and spring peeper. Both of these species, together with grey treefrog (*Hyla versicolor*, reported historically but not in the more recent inventory), require two distinct habitat elements - wetlands for breeding and upland forest for foraging and overwintering - in which to complete their annual life cycle.

**Patch isolation sensitivity** in fauna measures the overall response of fauna species to fragmentation and isolation of habitat patches. One of the two main aspects of this scoring criterion is the physical ability or the predisposition of a species to move about within the landscape and is related to the connectivity of habitat within a landscape. The second main aspect is the potential impact that roads have on fauna species that are known to be mobile. Thus

most bird species score fairly low for this criterion (although they prefer to forage and move along connecting corridors) whereas many herpetofauna score very high (since their life cycle requires them to move between different habitat types which may increase likelihood of road-kill). One example of how this criterion affects species populations is the need for adult birds to forage for food during the nestling and fledgling stage of the breeding season. By maintaining and improving the connectivity of natural cover within the landscape (e.g. by reforestation of intervening lands) we are able to positively influence the populations of such species, improving their foraging and dispersal potential.

The two L2 frog species reported from the study area are the only fauna species of regional concern reported from the site that are considered sensitive to patch isolation. The potential incidence of road-kill would be compounded by their sensitivities to other matrix influences, especially since in other parts of the Toronto region it has become clear that road-kill applies to paved and un-paved trails frequented by bicycles. As such, road-kill has the potential to gradually diminish local populations of these species and therefore, if the species are to persist at the site, measures need to be taken to enable safe passage for these fauna elements throughout the site, but in particular in the vicinity of the three known breeding ponds (locations identified by the three frog points on Maps 5, 8, 13 and 14). It is important to note that there are four additional frog breeding ponds located beyond the western boundary of the study area (not shown on the maps); animals breeding in these ponds no doubt depend on the upland forest habitat within the study area for their summer-foraging and over-wintering needs, and therefore regularly migrate and disperse across this western boundary.

Fauna species that score greater than three points under the **habitat dependence** criterion are considered habitat specialists (Map 14). These species exhibit a combination of very specific habitat requirements that range from the microhabitat (e.g. decaying logs, aquatic vegetation) and requirements for particular moisture conditions, vegetation structure or spatial landscape structures, to preferences for certain community series and macro-habitat types. Four fauna species that occur in the study area are considered habitat specialists, two (ovenbird and scarlet tanager) being forest specialists and the other two – the two L2 frog species – requiring a combination of two habitat types, wetland and forest.

Richness is essentially the presence or absence of species at a site. Beyond mere presence of single species is the idea that a natural system can be considered as a healthy functioning system if there is an association of several species thriving within that system. Each habitat type supports particular species associations. As the quality of the habitat patch improves so will the representation of flora and fauna species within that habitat. In this way representation biodiversity is an excellent measure of the health of a natural system. The presence of a rather low number of forest habitat dependent species indicates that the forest habitat in the study area is not functioning at a particularly high level. To some extent, this is to be expected given the proximity to the urban landscape on the west side of the site. Just 2 km east of the current study area the forest habitat at Cold Creek Conservation Area accommodates a much higher number of forest specialists (at least 12 species), due in part to the higher quality of the forest habitat.

## 5.0 Summary and Recommendations

The recommendations for the Bolton Camp Study Area are given in relation to the regional targets for natural heritage in the TRCA jurisdiction. To reach the regional targets for quality distribution and quantity of natural cover, every site will require its own individualized plan of action. Following is a short summary of the study area within the regional context, followed by specific recommendations.

### 5.1 Site Summary

1. The site is located on the upper reaches of the Humber River, and is an important link in the chain of natural cover that constitutes the migration and dispersal corridor along the Humber.
2. Fifty-six vegetation types were observed, ranging from mature mixed and deciduous forest to clay barren and thicket swamp. The site includes 33 forest, 8 successional, 8 wetland, 2 aquatic, 2 dynamic, and 3 meadow vegetation community types. This reveals a high level of vegetation community diversity particularly regarding forest types.
3. Forest and successional vegetation cover most of the site, forming an extensive patch of natural cover buffering the east side of the Bolton urban area and connecting Cold Creek to the Humber Valley. The site has 62.0 ha of forest and 40.5 ha of successional vegetation communities in total.
4. Although wetlands are a minor component here, the eight wetland community types are mostly dominated by native species and mostly associated with small areas near Cold Creek.
5. The presence of clay barren communities is a notable feature because they are associated with two flora species of regional conservation concern that can grow under the harsh physical conditions but benefit from lack of competition.
6. Two hundred and seventy-one flora species were observed including 22 plants ranked L1 to L3 considered flora species of regional concern, plus an additional 64 species of concern in urban areas (L4). Most of these species are associated with the forests but there are some in the wetland and dynamic vegetation communities. Total biodiversity and representation of sensitive species is in the moderate range but the site has not been surveyed in ten years and more species would likely be found.
7. There are three regionally-rare species: Robin's plantain, wild blue phlox, and prickly-ash. Robin's plantain is associated with semi-open dry areas, while wild blue phlox is a species of deciduous forests; these species have a rank of L2. Prickly-ash is usually found in semi-open lowland areas and has a rank of L3.

8. Bolton Camp has a good representation of spring ephemerals where forest cover is sufficiently mature (six species in total). Ground cover is diverse and native-dominated in the mature forests.
9. The 60 species of vertebrate fauna observed is a total which is in keeping with the site's location between the dense urbanisation of Bolton to the west and the extensive natural cover extending to Cold Creek Conservation Area in the east.
10. Three significant forest dependent bird species (ovenbird, wood thrush and scarlet tanager) were better represented by number of territories in the 2012 survey than in the 1998 survey (16 versus 7 territories). This is possibly in response to a decrease in the amount of disturbance on the site after the closure of the field-camp. Of particular note is the recruitment of four pairs of scarlet tanagers in the more recent survey – a species not reported in 1998.
11. Six bird species of regional concern reported in the 1998 survey were not reported in 2012; however, there were three such species reported in the latter survey that were not reported in 1998. Most of this changeover involves single territory representations and therefore is of little significance compared to the larger changes noted for ovenbird, wood thrush and scarlet tanager.
12. At least three frog breeding-ponds are located on site, with an additional four situated just beyond the western boundary. The upland forest habitat at Bolton Camp therefore provides vital foraging and overwintering habitat not just for frogs restricted to the site but for animals that move into the surrounding urban landscape in the spring.

## **5.2 Site Recommendations**

The recommendations primarily address objectives of protecting regional biodiversity in the TRCA jurisdiction. In order to maintain or enhance the current level of biodiversity at the Bolton Camp Study Area, the overall integrity of the natural heritage system that includes the site must be protected. Therefore, at the landscape scale, in keeping with the TNHSS, habitat patch size and shape need to be optimized so as to provide large enough habitat patches with interior habitat to support sensitive flora and fauna sustainably. In addition, connectivity between natural habitats within and beyond the study area must be improved.

Furthermore, the recommendations identify the issues that will occur with the increased public use of the study area as a result of the formalization of the trail system and the re-establishment of the field-camp, including the installation of a high ropes course. The trail plan needs to address this potential increase in negative matrix influence and ensure that effective mitigation is included as part of the plan. This includes strategic placement of any interpretive signage, managing public use, allowing healthy dynamic natural processes to proceed, and controlling invasive species.

The following recommendations address the above natural heritage concerns, with an emphasis upon bolstering the existing natural features on site. Thus, we recommend overall that 1) existing

habitats and features be protected and enhanced; 2) that public use be managed; and 3) that invasive species be controlled.

#### 1. Protect and Enhance Existing Features

The first priority should be to focus on ***maintaining conditions that allow existing communities or species of conservation concern to thrive***. This is especially true of the relatively high nesting density of certain forest-dependent nesting birds, and the apparently thriving populations of spring peeper and wood frog, species which are most likely to be affected by trail routing.

- a. If and when the field camp facilities are restored, they should be consolidated so as to minimize their footprint on the landscape. Existing buildings should be used where possible for both natural and cultural heritage reasons. New structures should be located in existing cleared areas associated with where buildings currently exist. Access trails should also be consolidated.
- b. Any future trail alignment should minimize removal of vegetation and leave the forest canopy intact. Given the extensive network of trails and roads throughout the site it is suggested that many of these can be decommissioned, allowing for either natural regeneration or restoration using selective plantings. The latter is preferred since this should pre-empt any invasion by non-native species.
- c. Forest cover should be increased through strategic plantings and through restoration of gaps in the forest canopy and of those neglected open spaces associated with the numerous buildings on site. Any gap restoration will improve habitat patch size and shape, and help reduce negative matrix influences. Other effects from such restoration are the enhancement of habitat connectivity along the Humber River corridor; the buffering of existing communities or flora species of conservation concern (maintaining conditions that allow these species to thrive and expand); the increase in interior habitat conditions; and reinforcement of the avifaunal population. It should be noted that although there is no expectation that sensitive low-nesting species (e.g. ovenbird) will persist once the field-camp is re-established, negative impacts will be somewhat mitigated by providing extra nesting and foraging opportunities in restored forest habitat, and by ensuring that facilities and activities associated with the field-camp are consolidated rather than being spread throughout the entire property.
- d. Flora species of concern that require more open habitats should have those habitats maintained in open condition: for example, Robin's plantain, common juniper, and Canada plum. These species should also be propagated and planted out in suitable locations to augment their populations.

- e. Areas selected for restoration should have soil and moisture assessment in order to help determine suitable lists of species for planting. Where soil conditions are suitable, consideration should be given to adding additional vernal pool features. The vernal pools would need to be hydrologically separated from Cold Creek.
  - f. Ensure effective and adequate passage (e.g. tunnels and culverts) for snakes and mammals across or under roads and trails, for example when designing the trail network within the site where appropriate. A network of raised boardwalks will reduce the degree of soil compaction arising from high human traffic, and reduce the impacts on spring peepers and wood frogs during the terrestrial portion of their life cycle. In addition, if opportunities present themselves for the installation of amphibian passages under Columbia Way, Caledon-King Townline or King Road (e.g. in the context of road work) such opportunities should be investigated by studying the existing amphibian movements across these roads. This would better link Bolton Camp to natural areas to the north, east and south.
  - g. In the event that hazard trees will be removed (at least in proximity to the trail network), thereby removing the viable opportunities for cavity-nesting birds, it is recommended that properly constructed and fully-monitored nest-boxes be installed to enhance opportunities for species such as great-crested flycatcher (*Myiarchus crinitus*), and increase the likelihood of recruitment of other cavity-nesters such as eastern screech-owl (*Megascops asio*).
  - h. The neglected and derelict buildings throughout the site will need to be fully assessed for the presence of sensitive fauna species before any management of such buildings is conducted. Several of these buildings have the potential to provide hibernacula opportunities for milksnake (a Federal and Provincial Species at Risk, and a species that is often associated with old buildings in both rural and urban landscapes), and nursery opportunities for bat species during the summer months.
2. Manage Public Use

Landscape metrics indicate that the existing matrix influence at this urban-edge site is largely fair. The impact of these urban influences will be compounded by the effects of the re-establishment of the field-camp and measures to mitigate these impacts should be initiated as soon as possible. Visitor pressure will certainly increase and ***it is important to pre-empt any potential increase in such pressure by designing the trail network to minimize negative impacts on sensitive forest habitat and species.***

- a. Any future trail planning (including the option to decommission existing trails) needs to consider the locations of flora and fauna species of concern and should direct visitor pressure away from these areas. Likewise, restoration activities should target non-sensitive areas. Particular attention should be paid to the dispersal and migration routes used by local amphibian populations, especially those using the off-site ponds at the western boundary.
  - b. Dogs should be either excluded from the site or, at the very least, the leash-by-law should be properly enforced, bolstered by effective interpretive signs.
  - c. Backyard dumping and runoff should be controlled, possibly through the application of a Sustainable Neighbourhood Action Plan (SNAP).
  - d. The footprints of both the field-camp and the proposed ropes course should be as restricted as possible, setting aside areas within the study area that are essentially sanctuaries for sensitive fauna.
3. Control Invasive Species

Several invasive plant species are threats to the native biodiversity at Bolton Camp. ***It is essential that well-planned and realistic measures be undertaken to control invasive species.*** Management for invasive species will need to be tailored to the individual species in question, depending on how wide-spread and established they are.

- a. Since most of the invasive species at Bolton Camp have large and/or diffuse populations, the best approach is to control disturbance that would aid their further spread rather than eradication efforts. For example, trailside plantings of competitive native ground covers such as bloodroot (*Sanguinaria canadensis*) and eliminating backyard dumping along the western boundary of the site would reduce the disturbance that encourages garlic mustard.
- b. Given the age of the flora data, and the lack of information regarding population and location of most of the invasive species, there should be an assessment of the status of dog-strangling vine, garlic mustard, hedge parsley, and multiflora rose prior to any management plan.
- c. Removal of buckthorn and shrub honeysuckle from successional and younger forest habitats would help restore them either by facilitating further native tree establishment or by restoring a more open woodland habitat; depending upon what is desired at the particular location.

- d. Control efforts should be focused on where there are existing populations of species of concern such as Robin's plantain. In this case it might involve careful thinning of hawkweeds as well if that seems to be required.
- e. Invasive species control should be undertaken as a proactive measure along the trail corridor prior to construction as well as to any other areas targeted for restoration planting. This would include local removal of shrub honeysuckles, buckthorn, and other species that are widespread across the site as a whole.
- f. Emerald ash borer is a particular concern. This insect is likely to arrive soon at Bolton Camp and will kill many ash trees. Dead trees near trails will become hazards and expensive to remove. Trail alignments should avoid dense populations of ash. At the same time, areas with ash should be targeted for control of other invasive species that are likely to take advantage of increased light in the gaps created by tree mortality as per recommendation "e" above.

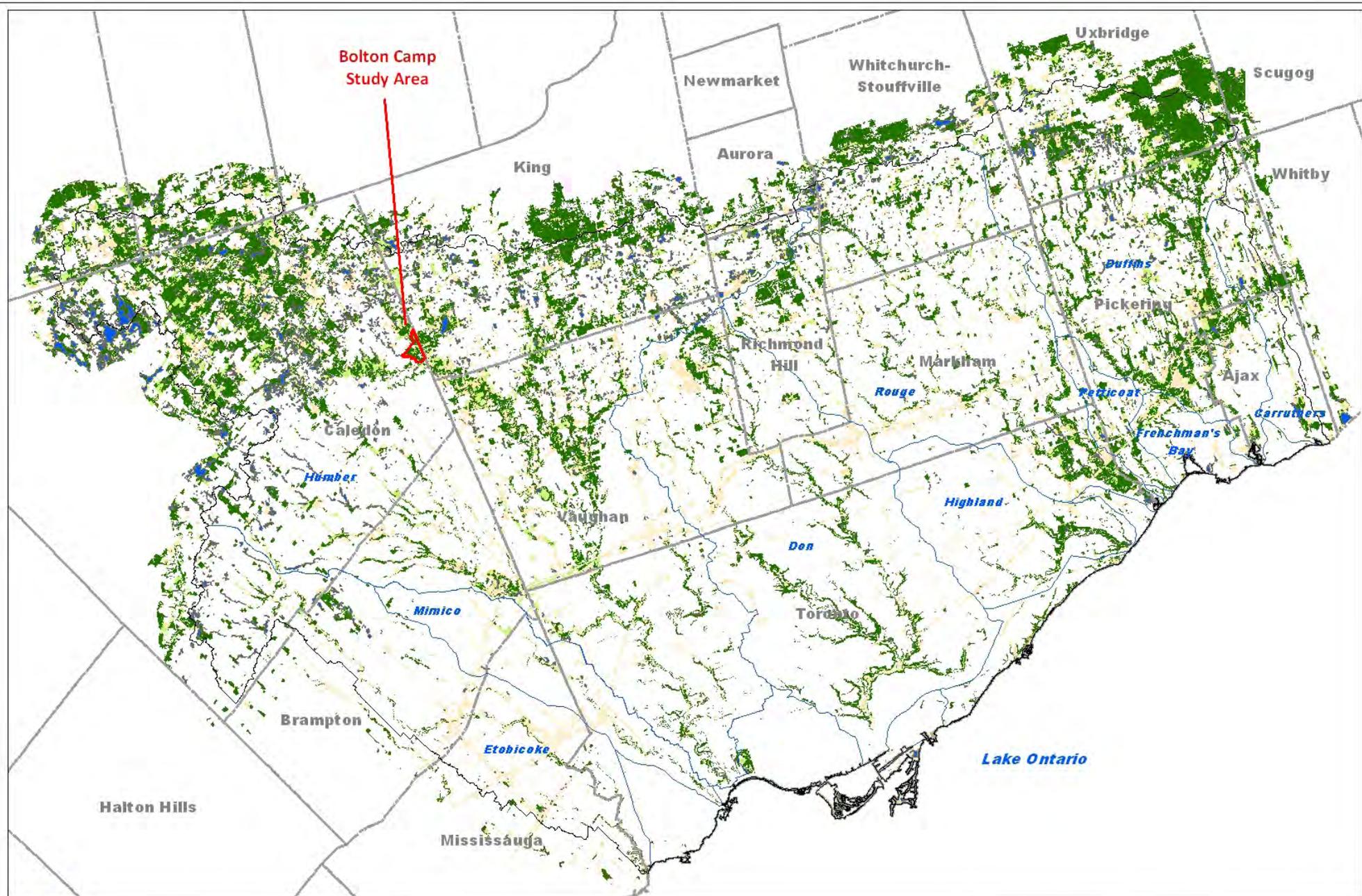
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Date: January 2013

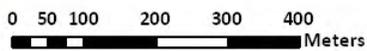
\* Landscape analysis based on 2007/2008 Orthophotography

**Map 1:**  
**Bolton Camp in the Context**  
**of Regional Natural Cover**

Natural Cover *		Legend	
	Forest		Bolton Tract Study Area Boundary
	Successional		TRCA Jurisdiction
	Meadow		Watershed
	Wetland		Municipal Boundary
	Beach/Bluff		



Toronto and Region  
**Conservation**  
 for The Living City

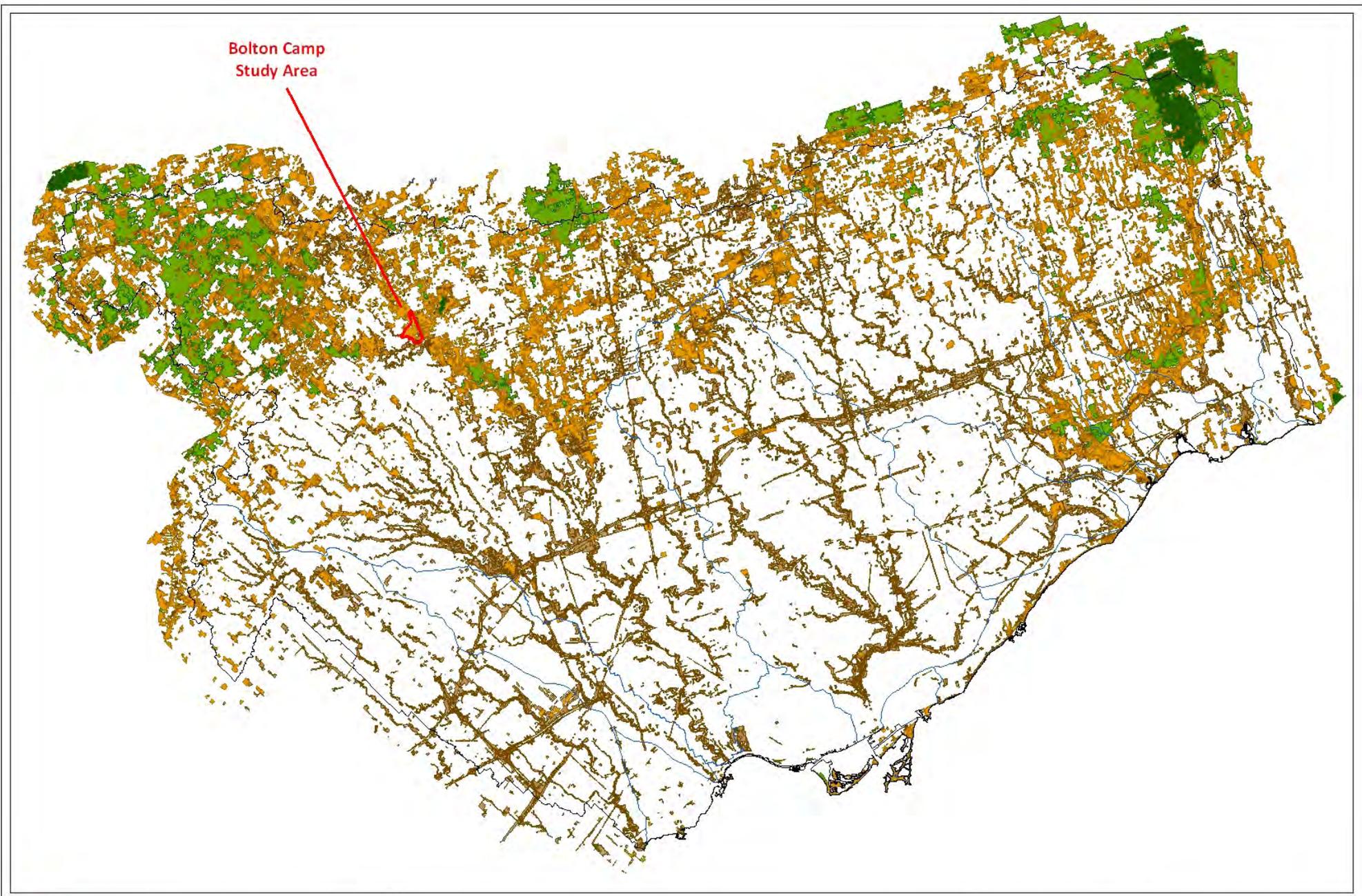


Date: January 2013  
 Orthophoto: Spring 2009, First Base  
 Solutions Inc.

## Map 2: Bolton Camp Study Area

### Legend

 Bolton Camp Study Area Boundary



Bolton Camp Study Area



Toronto and Region  
**Conservation**  
for 'The Living City'



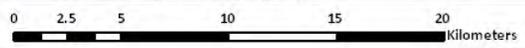
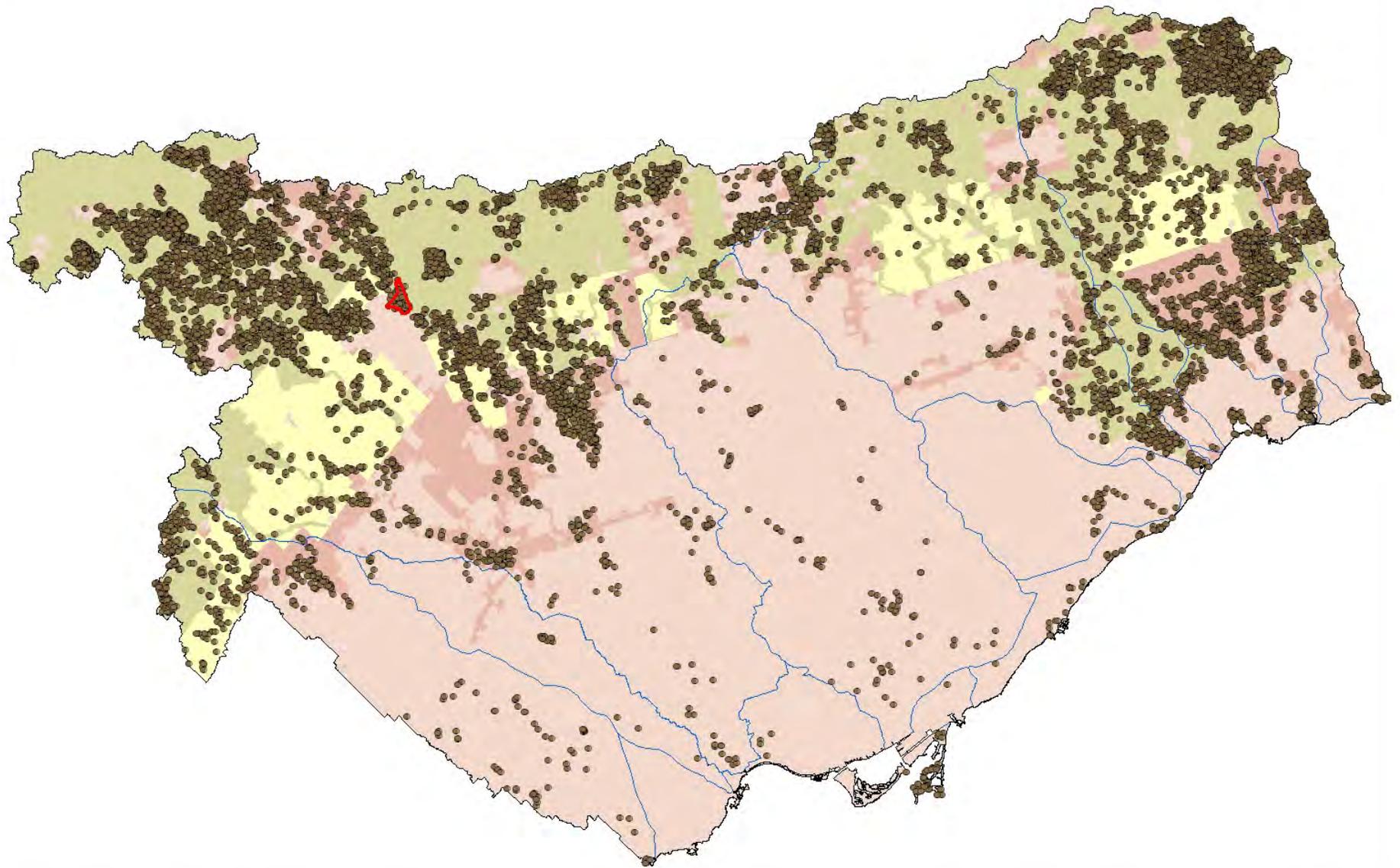
0 2.5 5 10 15 20 Kilometers

Date: January 2013  
\* Landscape analysis based on 2007/2008 Orthophotography

**Map 3:**  
**Regional Natural System**  
**Habitat Patch Quality**

**Habitat Patch Quality \***

	L1 - Excellent	<b>Legend</b>		Bolton Camp Study Area Boundary
	L2 - Good			TRCA Jurisdiction
	L3 - Fair			Watershed
	L4 - Poor			
	L5 - Very Poor			

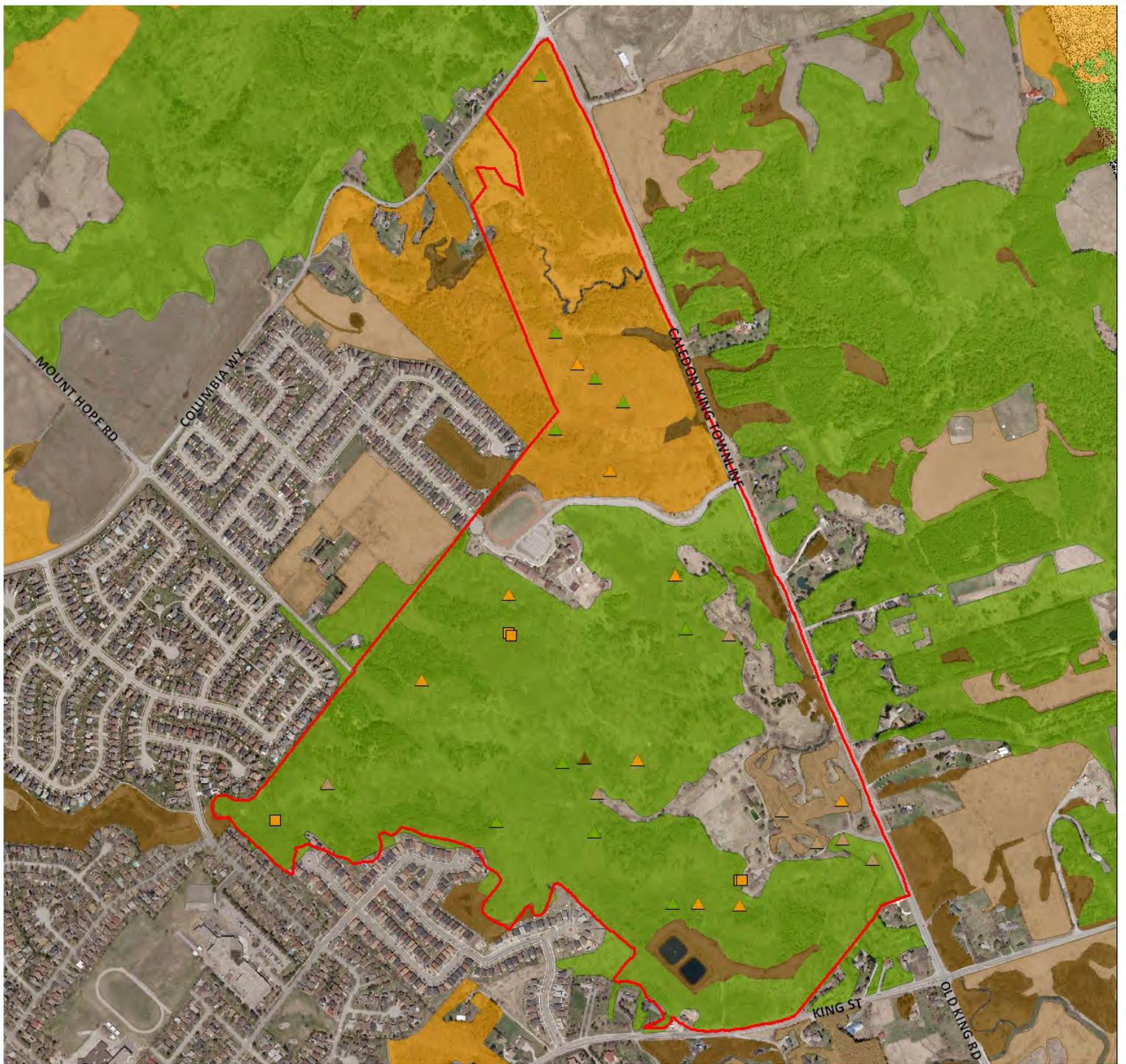


Date: January 2013

### Map 4: Distribution of Fauna Regional Species of Concern

**Legend**

-  Fauna Species of Concern (L1 - L3)
-  Bolton Camp Study Area Boundary
-  TRCA Jurisdiction
-  Watershed
-  Agricultural & Rural Area
-  Built-up Area
-  Designated Greenfield Area
-  Greenbelt Area



**Fauna Area Sensitivity Scores**

- ▲ 5 - >100ha
- ▲ 4 - >20ha
- ▲ 3 - > 5ha
- ▲ 2 - > 1ha
- ▲ 1 - < 1ha

- △ Fauna Species
- Frog Species

**Habitat Patch Size Scores \***

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor



0 50 100 200 300 400 Meters

Date: January 2013

Orthophoto: Spring 2009, First Base Solutions Inc.

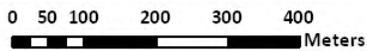
\* Landscape analysis based on 2007/2008 Orthophotography

**Map 5:  
Habitat Patch Size  
Scores with Fauna Area  
Sensitivity Scores**

**Legend**

- Bolton Camp Study Area Boundary

NOTE: All fauna species with their associated scores for area sensitivity can be found in Appendix #3.

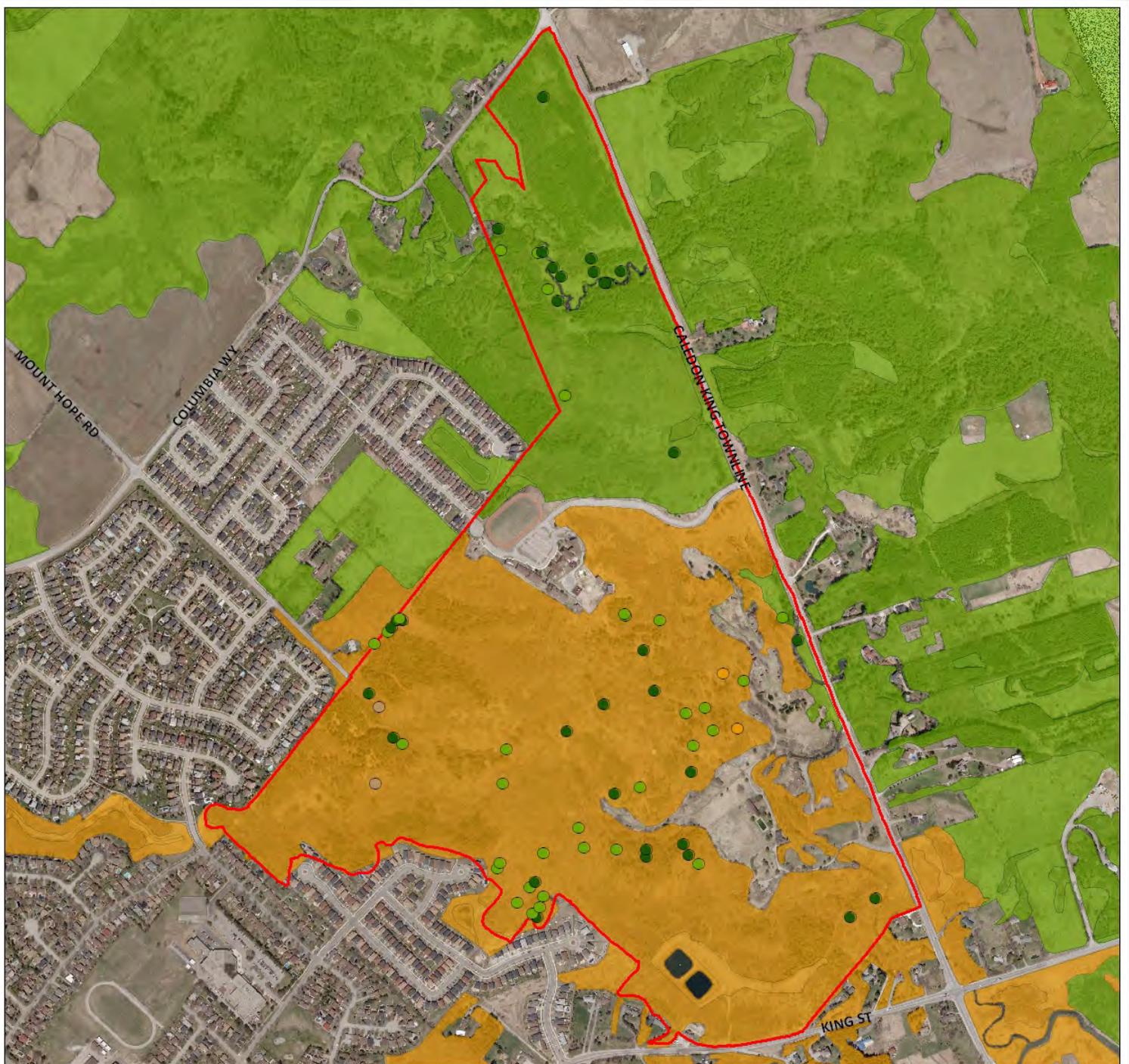


**Map 6:**  
**Interior Forest**  
**at Bolton Camp**

**Legend**

-  Bolton Camp Study Area Boundary
-  Forest
- Forest Interior**
-  100m-200m
-  400m-500m
-  200m-300m
-  500m-600m
-  300m-400m
-  600m-700m

Date: January 2013  
 Orthophoto: Spring 2009, First Base Solutions Inc.  
 \* Landscape analysis based on 2007/2008  
 Orthophotography

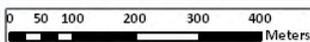


### Flora Sensitivity to Development Scores

- 5 - Species receives severe negative impact from development-related disturbances
- 4 - Species receives moderately severe negative impact from development-related disturbances
- 3 - Species receives significant negative impact from development-related disturbances
- 2 - Species receives slight negative impact from development-related disturbances
- 1 - Species experiences no overall benefit or detriment from development-related disturbances (neutral)
- 0 - Species benefits significantly from development-related disturbances

NOTE: All flora species with their associated scores for sensitivity to development can be found in Appendix #2.

○ Flora Species



Date: January 2013

Orthophoto: Spring 2011, First Base Solutions Inc.

\* Landscape analysis based on 2007/2008 Orthophotography

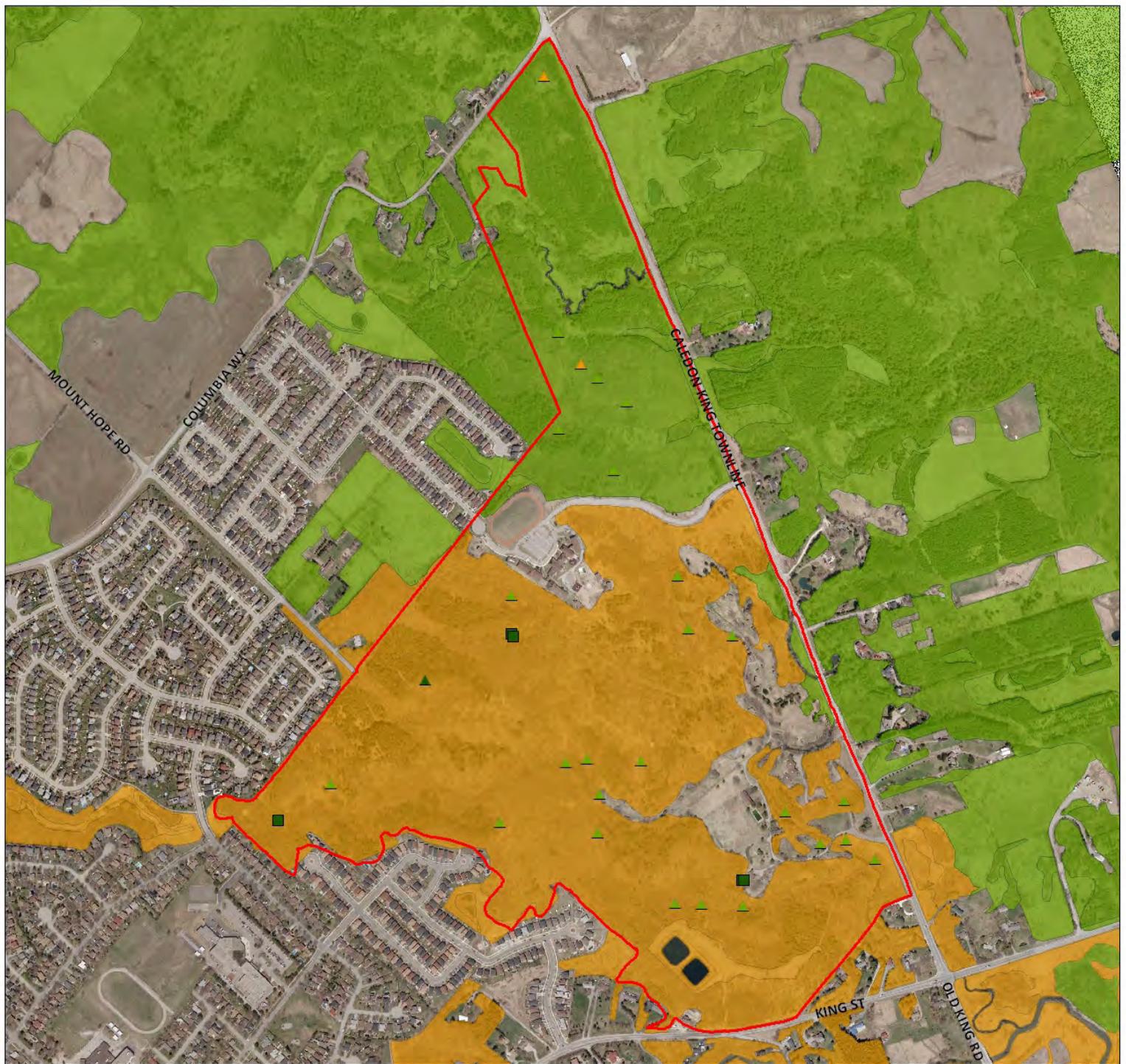
## Map 7: Scores for Matrix Influence and Flora Sensitivity to Development

### Legend

Habitat Matrix  
Influence Scores \*

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor

□ Bolton Camp Study Area Boundary



**Fauna Sensitivity to Development Scores**

- ▲ ■ 5 - Species receives severe negative impact from development-related disturbances
- ▲ ■ 4 - Species receives moderately severe negative impact from development-related disturbances
- ▲ ■ 3 - Species receives significant negative impact from development-related disturbances
- ▲ ■ 2 - Species receives slight negative impact from development-related disturbances
- ▲ ■ 1 - Species experiences no overall benefit or detriment from development-related disturbances (neutral)
- ▲ ■ 0 - Species benefits significantly from development-related disturbances

NOTE: All fauna species with their associated scores for sensitivity to development can be found in Appendix #3.

- △ Fauna Species
- Frog Species



0 50 100 200 300 400 Meters

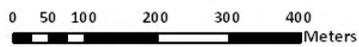
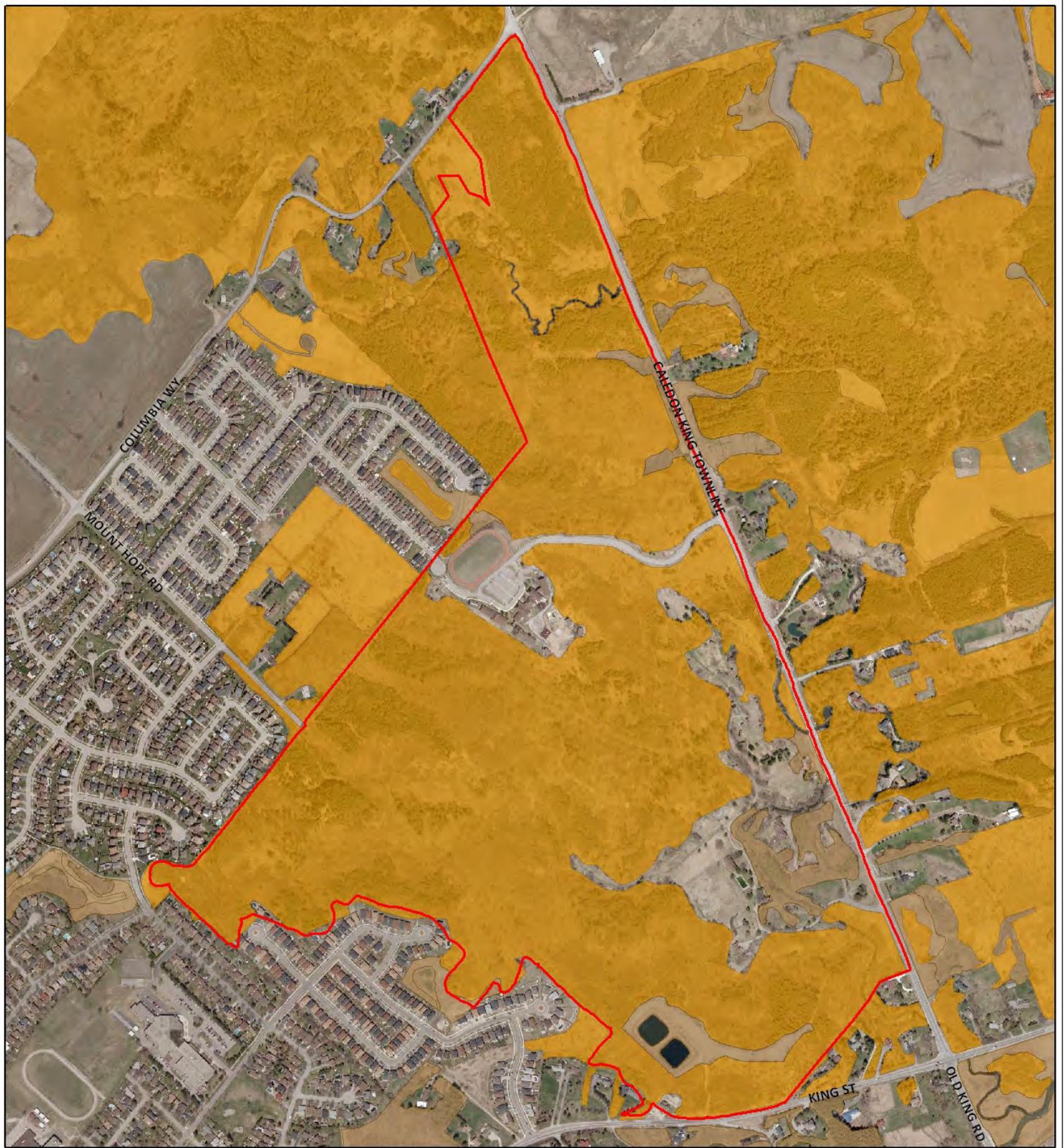
Date: January 2013  
 Orthophoto: Spring 2009, First Base Solutions Inc.  
 \* Landscape analysis based on 2007-2008 Orthophotography

**Map 8:  
 Scores for Matrix Influence  
 and Fauna Sensitivity to  
 Development**

**Legend**

Habitat Matrix Influence Scores \*

- 5 - Excellent
- 4 - Good
- 3 - Fair
- 2 - Poor
- 1 - Very Poor
- Bolton Camp Study Area Boundary



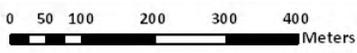
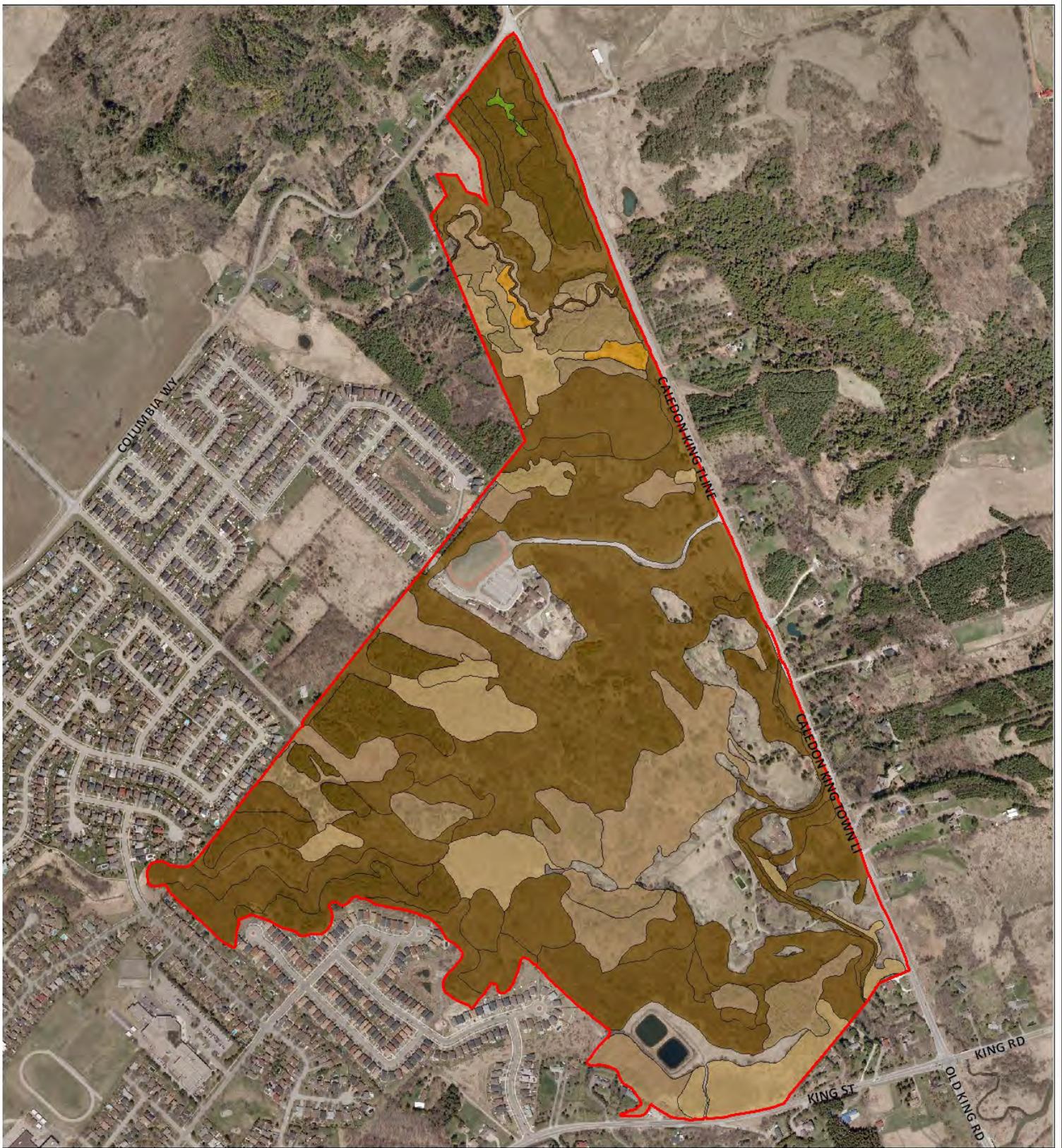
Date: January 2013  
 Orthophoto: Spring 2009, First Base Solutions Inc.  
 \* Landscape analysis based on 2007/2008  
 Orthophotography

## Map 9: Habitat Patch Quality

### Legend

#### Habitat Patch Quality \*

- L1 - Excellent
  - L2 - Good
  - L3 - Fair
  - L4 - Poor
  - L5 - Very Poor
- Bolton Camp Study Area Boundary



Date: January 2013  
 Orthophoto: Spring 2009, First Base Solutions Inc.

### Map 10: Vegetation Communities with their Associated Local Ranks

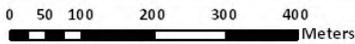
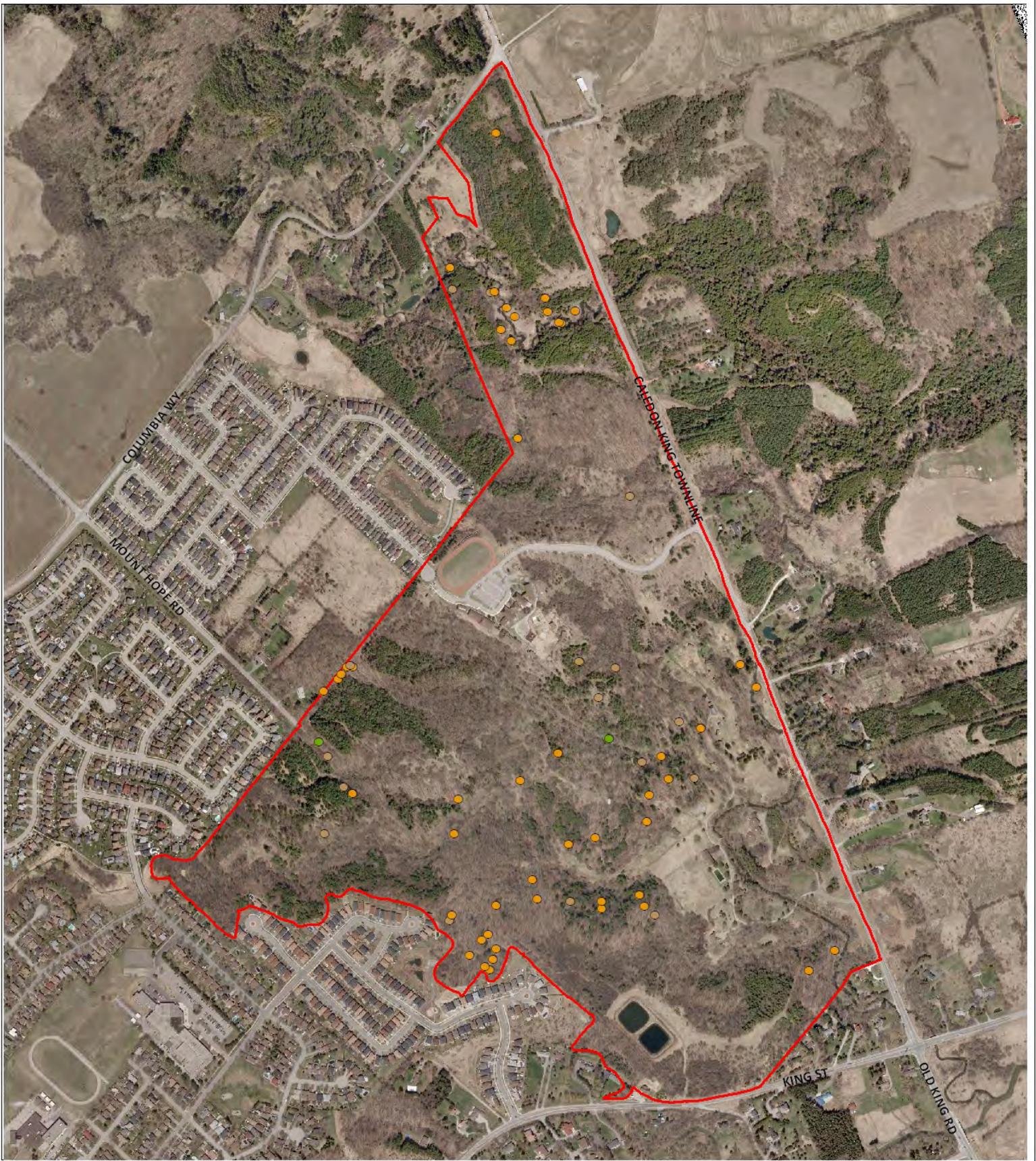
**Legend**

**Vegetation Community Ranks**

	L1		L4
	L2		L5
	L3		L+

 Bolton Camp Study Area Boundary

NOTE: All vegetation communities with their associated scores and ranks can be found in Appendix #1.



Date: January 2013  
 Orthophoto: Spring 2009, First Base  
 Solutions Inc.

### Map 11: Locations of Flora Species of Concern

#### Legend

Flora Species of Concern

- L1    ● L3
- L2

Bolton Camp Study Area Boundary

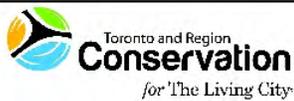


**Flora Habitat Dependence Scores**

- 5 - Extreme habitat specialist
- 4 - Strong habitat specialist
- 3 - Moderate habitat specialist
- 2 - Moderate habitat generalist
- 1 - Strong habitat generalist
- 0 - Extreme habitat generalist

○ Flora Species

NOTE: All flora species with their associated scores for habitat dependence can be found in Appendix #2.



0 50 100 200 300 400 Meters

Date: January 2013  
 Orthophoto: Spring 2009, First Base Solutions Inc.

**Map 12:  
 Flora Species Habitat  
 Dependence Scores**

Legend

Bolton Camp Study Area Boundary



0 50 100 200 300 400 Meters

Date: January 2013  
 Orthophoto: Spring 2009, First Base  
 Solutions Inc.

### Map 13: Locations of Fauna Species of Concern

#### Legend

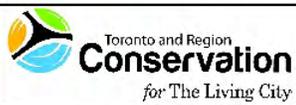
Fauna Species of Concern		Frog Species of Concern	
 L1	 L3	 L1	 L3
 L2		 L2	
 Bolton Camp Study Area Boundary			



**Fauna Habitat Dependence Scores**

- ▲ ■ 5 - Extreme habitat specialist
- ▲ ■ 4 - Strong habitat specialist
- ▲ ■ 3 - Moderate habitat specialist
- ▲ ■ 2 - Moderate habitat generalist
- ▲ ■ 1 - Strong habitat generalist
- ▲ ■ 0 - Extreme habitat generalist

NOTE: All fauna species with their associated scores for habitat dependence can be found in Appendix #3.



0 50 100 200 300 400 Meters

Date: January 2013  
 Orthophoto: Spring 2010, First Base Solutions Inc.

**Map 14:  
 Fauna Species  
 Habitat Dependence  
 Scores**

**Legend**

- Bolton Camp Study Area Boundary
- △ Fauna Species
- Frog Species

**Appendix 1: Bolton Camp Vegetation Communities (2001-2002)**

ELC Code	Vegetation Type (* indicates present as inclusion and/or complex only)	Tot. area # ha	Scores			Local Rank (2012-08)
			Local Occur.	Geophy. Requir.	Total Score	
<b>Forest</b>						
FOC2-2	Dry-Fresh White Cedar Coniferous Forest	4.2	2.5	2.0	4.5	L4
FOC3-1	Fresh-Moist Hemlock Coniferous Forest	3.7	2.5	2.0	4.5	L4
FOC4-1	Fresh-Moist White Cedar Coniferous Forest	0.3	2.0	2.0	4.0	L4
FOM3-2	Dry-Fresh Hemlock - Sugar Maple Mixed Forest	1.6	2.5	2.0	4.5	L4
FOM6-1	Fresh-Moist Sugar Maple - Hemlock Mixed Forest	5.7	2.0	2.0	4.0	L4
*FOM7-2	*Fresh-Moist White Cedar - Hardwood Mixed Forest		1.5	2.0	3.5	L4
FOD3-1	Dry-Fresh Poplar Deciduous Forest	1.5	2.0	2.0	4.0	L4
*FOD4-b	*Dry-Fresh Manitoba Maple Deciduous Forest		2.5	0.0	2.5	L+
FOD4-H	Dry-Fresh Hawthorn - Apple Deciduous Forest	8.3	2.5	0.0	2.5	L5
FOD5-1	Dry-Fresh Sugar Maple Deciduous Forest	1.2	1.5	0.0	1.5	L5
FOD5-2	Dry-Fresh Sugar Maple - Beech Deciduous Forest	3.9	1.5	0.0	1.5	L5
*FOD5-4	*Dry-Fresh Sugar Maple - Ironwood Deciduous Forest		2.5	0.0	2.5	L5
FOD5-6	Dry-Fresh Sugar Maple - Basswood Deciduous Forest	1.5	2.5	0.0	2.5	L5
FOD5-7	Dry-Fresh Sugar Maple - Black Cherry Deciduous Forest	1.5	2.0	0.0	2.0	L5
FOD5-8	Dry-Fresh Sugar Maple - White Ash Deciduous Forest	1.6	1.5	0.0	1.5	L5
FOD6-1	Fresh-Moist Sugar Maple - Ash Deciduous Forest	2.1	2.0	0.0	2.0	L5
FOD6-2	Fresh-Moist Sugar Maple - Black Maple Deciduous Forest	0.5	2.5	1.0	3.5	L4
FOD6-5	Fresh-Moist Sugar Maple - Hardwood Deciduous Forest	1.2	1.5	0.0	1.5	L5
*FOD7-1	*Fresh-Moist White Elm Lowland Deciduous Forest		2.0	1.0	3.0	L4
FOD7-2	Fresh-Moist Ash Deciduous Forest	1.6	2.0	1.0	3.0	L4
FOD7-3	Fresh-Moist Willow Lowland Deciduous Forest		2.0	0.0	2.0	L5
FOD7-5	Fresh-Moist Black Maple Lowland Deciduous Forest	1.1	3.5	1.0	4.5	L4
FOD7-a	Fresh-Moist Manitoba Maple Lowland Deciduous Forest	3.4	1.5	0.0	1.5	L5
*FOD8-1	*Fresh-Moist Poplar Deciduous Forest		1.0	0.0	1.0	L5
CUP1-7	Red (Green) Ash Deciduous Plantation	0.5	3.0	0.0	3.0	L5
CUP1-c	Black Locust Deciduous Plantation	4.3	2.0	0.0	2.0	L+
CUP2-D	Apple - Conifer Mixed Plantation	1.1	3.5	0.0	3.5	L5
CUP3-1	Red Pine Coniferous Plantation	2.6	1.5	0.0	1.5	L5
CUP3-2	White Pine Coniferous Plantation	6.1	1.5	0.0	1.5	L5
CUP3-3	Scotch Pine Coniferous Plantation	1.8	2.0	0.0	2.0	L+
CUP3-C	White Spruce Coniferous Plantation	0.02	2.0	0.0	2.0	L5
*CUP3-G	*White Cedar Coniferous Plantation		2.5	0.0	2.5	L5
CUP3-H	Mixed Conifer Coniferous Plantation	0.6	1.5	0.0	1.5	L5

Appendix 1: Bolton Camp Vegetation Communities (2001-2002)						
ELC Code	Vegetation Type (* indicates present as inclusion and/or complex only)	Tot. area # ha	Scores			Local Rank (2012-08)
			Local Occur.	Geophy. Requir.	Total Score	
<b>Successional</b>						
CUT1-A1	Native Deciduous Sapling Regeneration Thicket	4.0	2.0	0.0	2.0	L5
CUT1-A2	Native Mixed Sapling Regeneration Thicket	3.4	2.5	0.0	2.5	L5
CUT1-b	Buckthorn Deciduous Thicket	2.4	2.5	0.0	2.5	L+
CUT1-c	Exotic Deciduous Thicket	2.8	2.0	0.0	2.0	L+
CUH1-A	Treed Hedgerow	0.2	1.5	0.0	1.5	L5
CUS1-A2	White Pine Successional Savannah	1.0	2.5	1.0	3.5	L4
CUW1-A3	Native Deciduous Successional Woodland	0.5	1.0	0.0	1.0	L5
CUW1-D	Hawthorn Successional Woodland	26.2	2.5	0.0	2.5	L5
<b>Wetland</b>						
SWT2-1	Alder Mineral Thicket Swamp	0.6	3.0	1.0	4.0	L4
SWT2-5	Red-osier Mineral Thicket Swamp	0.1	2.0	2.0	4.0	L4
*MAM2-2	*Reed Canary Grass Mineral Meadow Marsh		1.0	1.0	2.0	L+
MAM2-5	Narrow-leaved Sedge Mineral Meadow Marsh	0.7	3.0	2.0	5.0	L3
MAM2-10	Forb Mineral Meadow Marsh	0.1	2.0	1.0	3.0	L4
MAS2-1A	Broad-leaved Cattail Mineral Shallow Marsh	0.1	2.0	1.0	3.0	L4
MAS2-1b	Narrow-Leaved Cattail Mineral Shallow Marsh	0.1	2.0	0.0	2.0	L+
*MAS3-1A	*Broad-leaved Cattail Organic Shallow Marsh		2.5	3.0	5.5	L3
<b>Aquatic</b>						
SAF1-3	Duckweed Floating-leaved Shallow Aquatic	0.02	2.5	1.0	3.5	L4
OAO1	Open Aquatic (deep or riverine unvegetated)	1.0	2.0	0.0	2.0	L5
<b>Dynamic (Beach, Bluff, Barren, Prairie, Savannah)</b>						
*CBS1	*Shrub Clay Barren		4.0	4.0	8.0	L2
CBT1-A	White Cedar Low Treed Clay Barren	0.1	5.0	3.0	8.0	L2
<b>Meadow</b>						
CUM1-A	Native Forb Meadow	4.0	1.5	0.0	1.5	L5
*CUM1-b	*Exotic Cool-season Grass Graminoid Meadow		1.0	0.0	1.0	L+
*CUM1-c	*Exotic Forb Meadow		1.5	0.0	1.5	L+

Appendix 2: Bolton Camp Flora (1998-2002)		Local	Popn.	Hab.	Sens.	Total	Rank
Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Erigeron pulchellus</i>	Robin's plantain	4	5	4	5	18	L2
<i>Phlox divaricata</i>	wild blue phlox	4	4	4	5	17	L2
<i>Alnus incana</i> ssp. <i>rugosa</i>	speckled alder	1	4	4	5	14	L3
<i>Cardamine concatenata</i>	cut-leaved toothwort	2	3	5	4	14	L3
<i>Carex interior</i>	fen star sedge	2	4	4	4	14	L3
<i>Carex leptonevia</i>	few-nerved wood sedge	2	4	4	4	14	L3
<i>Claytonia virginica</i>	narrow-leaved spring beauty	2	4	4	5	15	L3
<i>Cypripedium parviflorum</i> var. <i>makasin</i>	smaller yellow lady's slipper	2	4	4	5	15	L3
<i>Cystopteris tenuis</i>	Mackay's fragile fern	2	4	5	5	16	L3
<i>Dicentra canadensis</i>	squirrel-corn	2	4	5	4	15	L3
<i>Dicentra cucullaria</i>	Dutchman's breeches	2	4	4	5	15	L3
<i>Euonymus obovatus</i>	running strawberry-bush	2	4	4	4	14	L3
<i>Gymnocarpium dryopteris</i>	oak fern	1	3	5	5	14	L3
<i>Juglans cinerea</i>	butternut	1	5	4	4	14	L3
<i>Juniperus communis</i> var. <i>depressa</i>	common juniper	2	3	4	5	14	L3
<i>Larix laricina</i>	tamarack	2	4	4	4	14	L3
<i>Prunus nigra</i>	Canada plum	2	4	4	4	14	L3
<i>Ribes triste</i>	swamp red currant	2	4	4	5	15	L3
<i>Sisyrinchium montanum</i>	blue-eyed grass	2	3	4	5	14	L3
<i>Streptopus lanceolatus</i> var. <i>lanceolatus</i>	rose twisted-stalk	2	4	4	5	15	L3
<i>Uvularia grandiflora</i>	large-flowered bellwort	1	4	5	5	15	L3
<i>Zanthoxylum americanum</i>	prickly-ash	4	4	4	3	15	L3
<i>Acer saccharinum</i>	silver maple	1	2	5	3	11	L4
<i>Acer saccharum</i> ssp. <i>nigrum</i>	black maple	2	3	4	2	11	L4
<i>Acer spicatum</i>	mountain maple	2	3	4	4	13	L4
<i>Acer x freemanii</i>	hybrid swamp maple	3	3	5	2	13	L4
<i>Actaea pachypoda</i>	white baneberry	2	3	4	3	12	L4
<i>Allium tricoccum</i>	wild leek	1	3	4	4	12	L4
<i>Antennaria</i> cf. <i>howellii</i> ssp. <i>howellii</i>	Howell's pussytoes	3	2	3	3	11	L4
<i>Aquilegia canadensis</i>	wild columbine	1	4	3	5	13	L4
<i>Asarum canadense</i>	wild ginger	2	3	4	3	12	L4
<i>Betula alleghaniensis</i>	yellow birch	1	4	3	5	13	L4
<i>Caltha palustris</i>	marsh marigold	2	4	3	4	13	L4
<i>Cardamine diphylla</i>	broad-leaved toothwort	2	3	4	4	13	L4

Appendix 2: Bolton Camp Flora (1998-2002)		Local	Popn.	Hab.	Sens.	Total	Rank
Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Carex arctata</i>	nodding wood sedge	2	4	2	3	11	L4
<i>Carex cephaloidea</i>	thin-leaved sedge	2	3	5	3	13	L4
<i>Carex communis</i>	fibrous-rooted sedge	2	4	3	3	12	L4
<i>Carex deweyana</i>	Dewey's sedge	2	4	3	3	12	L4
<i>Carex gracillima</i>	graceful sedge	2	3	4	2	11	L4
<i>Carex hirtifolia</i>	hairy wood sedge	2	3	4	3	12	L4
<i>Carex hystericina</i>	porcupine sedge	2	3	2	5	12	L4
<i>Carex intumescens</i>	bladder sedge	2	4	4	2	12	L4
<i>Carex lacustris</i>	lake-bank sedge	2	3	3	4	12	L4
<i>Carex peckii</i>	Peck's sedge	2	3	4	3	12	L4
<i>Carex scabrata</i>	rough sedge	2	3	4	3	12	L4
<i>Carex spengelii</i>	long-beaked sedge	2	4	4	2	12	L4
<i>Carex tenera</i>	straw sedge (sensu lato)	2	3	2	3	10	L4
<i>Carpinus caroliniana</i> ssp. <i>virginiana</i>	blue beech	1	3	4	3	11	L4
<i>Carya cordiformis</i>	bitternut hickory	1	4	4	2	11	L4
<i>Caulophyllum giganteum</i>	long-styled blue cohosh	1	3	4	4	12	L4
<i>Corylus cornuta</i>	beaked hazel	2	4	3	4	13	L4
<i>Cystopteris bulbifera</i>	bulblet fern	1	3	4	4	12	L4
<i>Dryopteris cristata</i>	crested wood fern	1	4	4	4	13	L4
<i>Dryopteris intermedia</i>	evergreen wood fern	2	4	4	3	13	L4
<i>Dryopteris marginalis</i>	marginal wood fern	1	3	3	4	11	L4
<i>Eupatorium perfoliatum</i>	boneset	1	3	4	3	11	L4
<i>Eurybia macrophylla</i>	big-leaved aster	2	3	2	4	11	L4
<i>Fagus grandifolia</i>	American beech	1	4	3	4	12	L4
<i>Fraxinus nigra</i>	black ash	1	4	4	3	12	L4
<i>Geum fragarioides</i>	barren strawberry	2	4	4	3	13	L4
<i>Glyceria grandis</i>	tall manna grass	2	3	4	2	11	L4
<i>Impatiens pallida</i>	yellow touch-me-not	3	2	4	2	11	L4
<i>Lilium michiganense</i>	Michigan lily	1	4	3	5	13	L4
<i>Lycopus uniflorus</i>	northern water-horehound	2	3	3	3	11	L4
<i>Maianthemum canadense</i>	Canada May-flower	1	4	1	5	11	L4
<i>Myosotis laxa</i>	smaller forget-me-not	2	4	3	4	13	L4
<i>Oryzopsis asperifolia</i>	white-fruited mountain-rice	2	4	3	4	13	L4
<i>Pinus strobus</i>	white pine	1	4	3	4	12	L4

Appendix 2: Bolton Camp Flora (1998-2002)		Local	Popn.	Hab.	Sens.	Total	Rank
Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Populus grandidentata</i>	large-toothed aspen	1	3	4	3	11	L4
<i>Prunella vulgaris</i> ssp. <i>lanceolata</i>	heal-all (native)	4	2	3	2	11	L4
<i>Quercus macrocarpa</i>	bur oak	2	4	3	3	12	L4
<i>Quercus rubra</i>	red oak	1	4	2	4	11	L4
<i>Ranunculus hispidus</i> var. <i>caricetorum</i>	swamp buttercup	2	4	4	3	13	L4
<i>Ranunculus recurvatus</i> var. <i>recurvatus</i>	hooked buttercup	3	3	2	3	11	L4
<i>Rudbeckia hirta</i>	black-eyed Susan	1	4	4	3	12	L4
<i>Sagittaria latifolia</i>	common arrowhead	2	2	5	4	13	L4
<i>Salix discolor</i>	pussy willow	2	3	4	3	12	L4
<i>Schoenoplectus tabernaemontani</i>	soft-stemmed bulrush	1	2	5	3	11	L4
<i>Sium suave</i>	water-parsnip	2	2	4	4	12	L4
<i>Solidago rugosa</i> ssp. <i>rugosa</i>	rough-stemmed goldenrod	3	3	2	3	11	L4
<i>Thuja occidentalis</i>	white cedar	1	4	1	5	11	L4
<i>Tiarella cordifolia</i>	foam-flower	1	3	3	4	11	L4
<i>Trillium erectum</i>	red trillium	1	4	3	5	13	L4
<i>Trillium grandiflorum</i>	white trillium	1	3	4	5	13	L4
<i>Tsuga canadensis</i>	eastern hemlock	1	4	3	5	13	L4
<i>Typha latifolia</i>	broad-leaved cattail	1	4	4	4	13	L4
<i>Acer saccharum</i>	sugar maple	2	3	0	2	7	L5
<i>Achillea millefolium</i> ssp. <i>lanulosa</i>	woolly yarrow	3	2	0	1	6	L5
<i>Actaea rubra</i> ssp. <i>rubra</i>	red baneberry	2	3	1	3	9	L5
<i>Ageratina altissima</i> var. <i>altissima</i>	white snakeroot	2	2	2	1	7	L5
<i>Agrimonia gryposepala</i>	agrimony	2	2	0	2	6	L5
<i>Alisma plantago-aquatica</i>	water-plantain	2	2	4	2	10	L5
<i>Amphicarpaea bracteata</i>	hog-peanut	2	2	2	2	8	L5
<i>Anemone canadensis</i>	Canada anemone	2	2	2	2	8	L5
<i>Anemone virginiana</i>	common thimbleweed	3	3	0	3	9	L5
<i>Aralia nudicaulis</i>	wild sarsaparilla	2	3	1	4	10	L5
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	1	3	2	3	9	L5
<i>Asclepias syriaca</i>	common milkweed	2	2	0	2	6	L5
<i>Athyrium filix-femina</i> var. <i>angustum</i>	northeastern lady fern	2	3	1	3	9	L5
<i>Bidens cernua</i>	nodding bur-marigold	2	2	3	3	10	L5
<i>Bidens frondosa</i>	common beggar's-ticks	2	1	4	0	7	L5
<i>Carex bebbii</i>	Bebb's sedge	2	2	3	3	10	L5

Appendix 2: Bolton Camp Flora (1998-2002)		Local	Popn.	Hab.	Sens.	Total	Rank
Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Carex blanda</i>	common wood sedge	2	2	1	2	7	L5
<i>Carex granularis</i>	meadow sedge	3	2	1	3	9	L5
<i>Carex radiata</i>	straight-styled sedge	2	2	2	2	8	L5
<i>Carex rosea</i>	curly-styled sedge	2	2	3	2	9	L5
<i>Carex stipata</i>	awl-fruited sedge	2	3	2	3	10	L5
<i>Carex vulpinoidea</i>	fox sedge	2	2	4	1	9	L5
<i>Circaea canadensis</i> ssp. <i>canadensis</i>	enchanter's nightshade	2	1	1	1	5	L5
<i>Clematis virginiana</i>	virgin's bower	2	2	2	3	9	L5
<i>Cornus alternifolia</i>	alternate-leaved dogwood	2	2	1	2	7	L5
<i>Cornus stolonifera</i>	red osier dogwood	2	2	0	3	7	L5
<i>Crataegus punctata</i>	dotted hawthorn	2	2	3	3	10	L5
<i>Dryopteris carthusiana</i>	spinulose wood fern	2	3	2	2	9	L5
<i>Echinocystis lobata</i>	wild cucumber	2	2	3	1	8	L5
<i>Equisetum arvense</i>	field horsetail	2	2	1	1	6	L5
<i>Equisetum hyemale</i> ssp. <i>affine</i>	scouring-rush	2	2	2	2	8	L5
<i>Erigeron philadelphicus</i> var. <i>philadelphicus</i>	Philadelphia fleabane	3	2	0	1	6	L5
<i>Erythronium americanum</i> ssp. <i>americanum</i>	yellow trout-lily	2	3	3	2	10	L5
<i>Euthamia graminifolia</i>	grass-leaved goldenrod	2	1	4	1	8	L5
<i>Eutrochium maculatum</i> var. <i>maculatum</i>	spotted Joe-Pye weed	2	2	3	3	10	L5
<i>Fragaria vesca</i> ssp. <i>americana</i>	woodland strawberry	3	2	2	2	9	L5
<i>Fragaria virginiana</i>	wild strawberry	2	2	0	2	6	L5
<i>Fraxinus americana</i>	white ash	2	2	0	3	7	L5
<i>Fraxinus pennsylvanica</i>	red ash	1	2	0	3	6	L5
<i>Galium triflorum</i>	sweet-scented bedstraw	2	2	2	2	8	L5
<i>Geum</i> cf. <i>canadense</i>	white avens	2	2	1	2	7	L5
<i>Hydrophyllum virginianum</i>	Virginia waterleaf	2	2	1	2	7	L5
<i>Impatiens capensis</i>	orange touch-me-not	2	2	0	2	6	L5
<i>Juglans nigra</i>	black walnut	2	1	2	1	6	L5
<i>Juncus dudleyi</i>	Dudley's rush	2	2	3	1	8	L5
<i>Juniperus virginiana</i>	red cedar	2	2	4	2	10	L5
<i>Laportea canadensis</i>	wood nettle	2	3	2	2	9	L5
<i>Lemna minor</i>	common duckweed	2	2	4	2	10	L5
<i>Lysimachia ciliata</i>	fringed loosestrife	2	2	2	2	8	L5
<i>Maianthemum racemosum</i> ssp. <i>racemosum</i>	false Solomon's seal	2	3	2	3	10	L5

Appendix 2: Bolton Camp Flora (1998-2002)		Local	Popn.	Hab.	Sens.	Total	Rank
Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Maianthemum stellatum</i>	starry false Solomon's seal	2	2	1	3	8	L5
<i>Matteuccia struthiopteris</i> var. <i>pensylvanica</i>	ostrich fern	2	2	2	2	8	L5
<i>Mentha arvensis</i> ssp. <i>borealis</i>	wild mint	2	2	3	2	9	L5
<i>Oenothera biennis</i>	common evening-primrose	2	1	1	1	5	L5
<i>Onoclea sensibilis</i>	sensitive fern	2	3	1	3	9	L5
<i>Ostrya virginiana</i>	ironwood	2	3	2	2	9	L5
<i>Parthenocissus inserta</i>	thicket creeper	2	2	0	1	5	L5
<i>Plantago rugelii</i>	red-stemmed plantain	3	2	0	1	6	L5
<i>Podophyllum peltatum</i>	May-apple	2	3	3	2	10	L5
<i>Populus balsamifera</i>	balsam poplar	2	2	3	2	9	L5
<i>Populus tremuloides</i>	trembling aspen	2	3	1	3	9	L5
<i>Prunus serotina</i>	black cherry	2	2	0	2	6	L5
<i>Prunus virginiana</i> var. <i>virginiana</i>	choke cherry	2	2	0	1	5	L5
<i>Ranunculus abortivus</i>	kidney-leaved buttercup	2	3	1	2	8	L5
<i>Ranunculus sceleratus</i>	cursed crowfoot	3	2	3	2	10	L5
<i>Rhus typhina</i>	staghorn sumach	2	1	2	2	7	L5
<i>Ribes americanum</i>	wild black currant	2	3	2	2	9	L5
<i>Ribes cynosbati</i>	prickly gooseberry	2	3	2	2	9	L5
<i>Rubus idaeus</i> ssp. <i>strigosus</i>	wild red raspberry	1	1	0	1	3	L5
<i>Rubus occidentalis</i>	wild black raspberry	2	1	0	1	4	L5
<i>Salix eriocephala</i>	narrow heart-leaved willow	2	1	3	1	7	L5
<i>Salix interior</i>	sandbar willow	2	1	5	2	10	L5
<i>Sambucus canadensis</i>	common elderberry	2	3	2	2	9	L5
<i>Sambucus racemosa</i> ssp. <i>pubens</i>	red-berried elder	2	3	2	2	9	L5
<i>Sanguinaria canadensis</i>	bloodroot	2	3	0	3	8	L5
<i>Scirpus atrovirens</i>	black-fruited bulrush	2	2	4	2	10	L5
<i>Scirpus microcarpus</i>	barber-pole bulrush	1	2	4	3	10	L5
<i>Solidago altissima</i>	tall goldenrod	2	2	0	0	4	L5
<i>Solidago caesia</i>	blue-stemmed goldenrod	2	2	4	2	10	L5
<i>Solidago canadensis</i> var. <i>canadensis</i>	Canada goldenrod	2	2	0	1	5	L5
<i>Solidago flexicaulis</i>	zig-zag goldenrod	2	1	3	2	8	L5
<i>Solidago gigantea</i>	late goldenrod	3	1	1	1	6	L5
<i>Solidago nemoralis</i> ssp. <i>nemoralis</i>	grey goldenrod	3	2	2	2	9	L5
<i>Symphotrichum cordifolium</i>	heart-leaved aster	2	1	0	2	5	L5

Appendix 2: Bolton Camp Flora (1998-2002)		Local	Popn.	Hab.	Sens.	Total	Rank
Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Symphotrichum lanceolatum</i> var. <i>lanceolatum</i>	panicked aster	2	2	3	1	8	L5
<i>Symphotrichum lateriflorum</i> var. <i>lateriflorum</i>	calico aster	2	2	3	2	9	L5
<i>Symphotrichum novae-angliae</i>	New England aster	2	2	2	1	7	L5
<i>Symphotrichum puniceum</i> var. <i>puniceum</i>	swamp aster	2	2	2	2	8	L5
<i>Thalictrum dioicum</i>	early meadow rue	2	3	3	2	10	L5
<i>Thalictrum pubescens</i>	tall meadow rue	2	3	2	2	9	L5
<i>Tilia americana</i>	basswood	2	3	2	3	10	L5
<i>Ulmus americana</i>	white elm	2	4	0	2	8	L5
<i>Urtica dioica</i> ssp. <i>gracilis</i>	American stinging nettle	2	3	2	2	9	L5
<i>Verbena hastata</i>	blue vervain	2	2	4	2	10	L5
<i>Verbena urticifolia</i>	white vervain	2	2	2	2	8	L5
<i>Viburnum lentago</i>	nannyberry	2	3	1	2	8	L5
<i>Viola labradorica</i>	dog violet	3	2	0	2	7	L5
<i>Viola pubescens</i>	stemmed yellow violet (sensu lato)	2	3	1	2	8	L5
<i>Viola sororia</i>	common blue violet	2	2	0	2	6	L5
<i>Vitis riparia</i>	riverbank grape	2	1	0	0	3	L5
<i>Alliaria petiolata</i>	garlic mustard	4				4	L+
<i>Arctium lappa</i>	great burdock	4				4	L+
<i>Asparagus officinalis</i>	asparagus	5				5	L+
<i>Barbarea vulgaris</i>	winter cress	4				4	L+
<i>Berberis thunbergii</i>	Japanese barberry	4				4	L+
<i>Berberis vulgaris</i>	common barberry	5				5	L+
<i>Bromus inermis</i>	smooth brome grass	4				4	L+
<i>Cerastium arvense</i> ssp. <i>arvense</i>	field chickweed	5				5	L+
<i>Cerastium fontanum</i>	mouse-ear chickweed	3				3	L+
<i>Chelidonium majus</i>	celandine	5				5	L+
<i>Cichorium intybus</i>	chicory	5	0	0	0	5	L+
<i>Cirsium arvense</i>	creeping thistle	4				4	L+
<i>Convallaria majalis</i>	lily-of-the-valley	5				5	L+
<i>Crataegus monogyna</i>	English hawthorn	4	1	4	0	9	L+
<i>Cynanchum rossicum</i>	dog-strangling vine	4				4	L+
<i>Cynoglossum officinale</i>	hound's tongue	5				5	L+
<i>Dactylis glomerata</i>	orchard grass	4				4	L+
<i>Daucus carota</i>	Queen Anne's lace	4				4	L+

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Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Dicentra spectabilis</i>	bleeding hearts	5				5	L+
<i>Dipsacus fullonum</i>	teasel	5				5	L+
<i>Elaeagnus angustifolia</i>	Russian olive	4				4	L+
<i>Epipactis helleborine</i>	helleborine	5	0	0	0	5	L+
<i>Galium verum</i>	yellow bedstraw	5				5	L+
<i>Glechoma hederacea</i>	creeping Charlie	4				4	L+
<i>Hemerocallis fulva</i>	orange day-lily	5				5	L+
<i>Hesperis matronalis</i>	dame's rocket	4				4	L+
<i>Hypericum perforatum</i>	common St. John's-wort	4	0	0	0	4	L+
<i>Inula helenium</i>	elecampane	4				4	L+
<i>Lepidium campestre</i>	field pepper-grass	5				5	L+
<i>Leucanthemum vulgare</i>	ox-eye daisy	2				2	L+
<i>Linaria vulgaris</i>	butter-and-eggs	5	0	0	0	5	L+
<i>Lonicera x bella</i>	shrub honeysuckle	4				4	L+
<i>Lysimachia nummularia</i>	moneywort	4				4	L+
<i>Malus pumila</i>	apple	4				4	L+
<i>Medicago lupulina</i>	black medick	5				5	L+
<i>Melilotus albus</i>	white sweet clover	4	0	0	0	4	L+
<i>Myosotis scorpioides</i>	true forget-me-not	4				4	L+
<i>Pastinaca sativa</i>	wild parsnip	5				5	L+
<i>Persicaria maculosa</i>	lady's thumb	5	0	0	0	5	L+
<i>Phleum pratense</i>	Timothy grass	4	0	0	0	4	L+
<i>Phlox paniculata</i>	garden phlox	5				5	L+
<i>Pilosella caespitosa</i>	yellow hawkweed	5				5	L+
<i>Pilosella piloselloides</i>	smooth yellow hawkweed	3				3	L+
<i>Pinus sylvestris</i>	Scots pine	4				4	L+
<i>Plantago lanceolata</i>	English plantain	5	0	0	0	5	L+
<i>Plantago major</i>	common plantain	2	0	0	0	2	L+
<i>Poa compressa</i>	flat-stemmed blue grass	4				4	L+
<i>Poa pratensis</i> ssp. <i>pratensis</i>	Kentucky blue grass	4				4	L+
<i>Populus alba</i>	white poplar	5				5	L+
<i>Populus nigra</i>	black poplar	5				5	L+
<i>Pyrus communis</i>	pear	3				3	L+
<i>Ranunculus acris</i>	tall buttercup	4				4	L+

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Scientific Name	Common Name	Occur.	Trend	Dep.	Dev.	Score	TRCA
		1-5	1-5	0-5	0-5	2-20	(08/2012)
<i>Rhamnus cathartica</i>	common buckthorn	4				4	L+
<i>Rheum rhabarbarum</i>	rhubarb	5				5	L+
<i>Ribes rubrum</i>	garden red currant	4				4	L+
<i>Robinia pseudoacacia</i>	black locust	3				3	L+
<i>Rosa multiflora</i>	multiflora rose	4				4	L+
<i>Salix alba</i>	white willow	5				5	L+
<i>Salix x fragilis</i>	crack willow	3				3	L+
<i>Saponaria officinalis</i>	bouncing Bet	5	0	0	0	5	L+
<i>Securigera varia</i>	crown vetch	5				5	L+
<i>Solanum dulcamara</i>	bittersweet nightshade	4	0	0	0	4	L+
<i>Sorbus aucuparia</i>	European mountain-ash	5				5	L+
<i>Syringa vulgaris</i>	common lilac	4				4	L+
<i>Taraxacum officinale</i>	dandelion	4				4	L+
<i>Torilis cf. japonica</i>	hedge-parsley	5				5	L+
<i>Tragopogon pratensis</i>	meadow goat's beard	3				3	L+
<i>Trifolium pratense</i>	red clover	5				5	L+
<i>Tussilago farfara</i>	coltsfoot	4				4	L+
<i>Typha angustifolia</i>	narrow-leaved cattail	3				3	L+
<i>Typha x glauca</i>	hybrid cattail	3				3	L+
<i>Urtica dioica</i> ssp. <i>dioica</i>	European stinging nettle	4				4	L+
<i>Verbascum thapsus</i>	common mullein	4	0	0	0	4	L+
<i>Veronica serpyllifolia</i> ssp. <i>serpyllifolia</i>	thyme-leaved speedwell	5				5	L+
<i>Viburnum lantana</i>	wayfaring tree	3				3	L+
<i>Viburnum opulus</i>	European highbush cranberry	4				4	L+
<i>Vicia cracca</i>	cow vetch	4				4	L+
<i>Acer negundo</i>	Manitoba maple	4	0	0	2	6	L+?
<i>Geranium robertianum</i>	herb Robert	4				4	L+?
<i>Phalaris arundinacea</i>	reed canary grass	3				3	L+?
<i>Potentilla norvegica</i>	rough cinquefoil	3				3	L+?
<i>Pinus resinosa</i>	red pine	2	5	5	5	17	pL2
<i>Picea glauca</i>	white spruce	1	5	4	4	14	prL3
<i>Larix decidua</i>	European larch	4				4	pL+
<i>Picea abies</i>	Norway spruce	5				5	prL+

Appendix 3: Fauna List for Bolton Camp Study Area.

Common Name	Code	Scientific Name	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
<b>Survey Species:</b> species for which the TRCA protocol effectively surveys.													
<b>Birds</b>													
black and white warbler	BAWW	<i>Mniotilta varia</i>	historic	1	3	2	4	2	2	5	1	20	L2
blue-winged warbler	BWWA	<i>Vermivora pinus</i>	historic	3	3	2	3	1	2	5	1	20	L2
ruffed grouse	RUGR	<i>Bonasa umbellus</i>	1	1	3	3	3	2	2	5	1	20	L2
American woodcock	AMWO	<i>Scolopax minor</i>	historic	0	2	3	3	2	2	4	0	16	L3
blue-headed vireo	BHVI	<i>Vireo solitarius</i>	1	3	2	2	3	1	2	3	0	16	L3
brown creeper	BRCR	<i>Certhia americana</i>	historic	1	2	2	3	2	2	4	0	16	L3
eastern towhee	EATO	<i>Pipilo erythrophthalmus</i>	historic	2	3	2	2	2	1	4	0	16	L3
mourning warbler	MOWA	<i>Geothlypis philadelphia</i>	7	0	3	2	2	2	2	4	0	15	L3
Nashville warbler	NAWA	<i>Oreothlypis ruficapilla</i>	historic	2	1	2	2	1	2	5	1	16	L3
ovenbird	OVEN	<i>Seiurus aurocapillus</i>	5	0	2	3	4	2	4	4	0	19	L3
pileated woodpecker	PIWO	<i>Dryocopus pileatus</i>	1(2004)	0	2	2	4	1	3	3	0	15	L3
scarlet tanager	SCTA	<i>Piranga olivacea</i>	4	0	2	2	4	1	3	4	0	16	L3
wood thrush	WOTH	<i>Hylocichla mustelina</i>	7	0	3	2	3	2	2	4	0	16	L3
common yellowthroat	COYE	<i>Geothlypis trichas</i>	x	0	2	2	1	2	1	4	0	12	L4
eastern kingbird	EAKI	<i>Tyrannus tyrannus</i>	x	0	4	2	2	1	1	3	0	13	L4
eastern screech-owl	EASO	<i>Megascops asio</i>	historic	0	2	2	1	2	3	3	0	13	L4
eastern wood-pewee	EAWP	<i>Contopus virens</i>	x	0	4	2	2	1	1	3	0	13	L4
field sparrow	FISP	<i>Spizella pusilla</i>	4	0	3	2	2	1	1	4	0	13	L4
great-crested flycatcher	GCFL	<i>Myiarchus crinitus</i>	x	0	2	2	3	1	2	2	0	12	L4
grey catbird	GRCA	<i>Dumetella carolinensis</i>	x	0	2	2	1	1	1	3	0	10	L4
hairy woodpecker	HAWO	<i>Picoides villosus</i>	x	0	2	2	3	1	2	2	0	12	L4
indigo bunting	INBU	<i>Passerina cyanea</i>	x	0	2	2	1	1	2	4	0	12	L4
least flycatcher	LEFL	<i>Empidonax minimus</i>	historic	0	4	2	2	1	1	3	0	13	L4
northern flicker	NOFL	<i>Colaptes auratus</i>	x	0	3	2	1	1	2	3	0	12	L4
red-breasted nuthatch	RBNU	<i>Sitta canadensis</i>	x	0	1	2	3	1	1	2	0	10	L4
red-eyed vireo	REVI	<i>Vireo olivaceus</i>	x	0	2	2	2	1	1	3	0	11	L4
rose-breasted grosbeak	RBGR	<i>Pheucticus ludovicianus</i>	x	0	2	2	3	1	2	3	0	13	L4
ruby-throated hummingbird	RTHU	<i>Archilochus colubris</i>	x	0	2	2	1	1	2	2	0	10	L4
tree swallow	TRES	<i>Tachycineta bicolor</i>	x	0	2	2	1	1	2	2	0	10	L4
white-breasted nuthatch	WBNU	<i>Sitta carolinensis</i>	x	0	2	2	3	1	2	2	0	12	L4
wood duck	WODU	<i>Aix sponsa</i>	1	0	2	1	3	2	2	4	0	14	L4
American Crow	AMCR	<i>Corvus brachyrhynchos</i>	x	0	1	2	1	1	0	0	0	5	L5
American goldfinch	AMGO	<i>Carduelis tristis</i>	x	0	2	2	1	1	0	1	0	7	L5

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Common Name	Code	Scientific Name	count	LO	PTn	PTt	AS	PIS	HD	StD	+	TS	L-Rank
American robin	AMRO	<i>Turdus migratorius</i>	x	0	1	2	1	1	0	1	0	6	L5
Baltimore oriole	BAOR	<i>Icterus galbula</i>	x	0	2	2	1	1	0	1	0	7	L5
black-capped chickadee	BCCH	<i>Parus atricapillus</i>	x	0	1	2	1	1	0	1	0	6	L5
blue jay	BLJA	<i>Cyanocitta cristata</i>	x	0	4	2	1	1	0	1	0	9	L5
brown-headed cowbird	BHCO	<i>Molothrus ater</i>	x	0	2	2	1	1	0	1	0	7	L5
Canada goose	CANG	<i>Branta canadensis</i>	x	0	1	1	1	2	1	0	0	6	L5
cedar waxwing	CEDW	<i>Bombycilla cedrorum</i>	x	0	1	2	1	1	0	1	0	6	L5
chipping sparrow	CHSP	<i>Spizella passerina</i>	x	0	2	2	1	1	0	2	0	8	L5
common grackle	COGR	<i>Quiscalus quiscula</i>	x	0	3	2	1	1	0	1	0	8	L5
downy woodpecker	DOWO	<i>Picoides pubescens</i>	x	0	3	2	1	1	1	1	0	9	L5
eastern phoebe	EAPH	<i>Sayornis phoebe</i>	2	0	2	2	1	1	2	1	0	9	L5
house wren	HOWR	<i>Troglodytes aedon</i>	x	0	2	2	1	2	1	1	0	9	L5
killdeer	KILL	<i>Charadrius vociferus</i>	x	0	2	2	1	2	0	2	0	9	L5
mallard	MALL	<i>Anas platyrhynchos</i>	x	0	2	2	1	2	0	1	0	8	L5
mourning dove	MODO	<i>Zenaidura macroura</i>	x	0	2	2	1	1	0	0	0	6	L5
northern cardinal	NOCA	<i>Cardinalis cardinalis</i>	x	0	2	2	1	1	1	2	0	9	L5
red-tailed hawk	RTHA	<i>Buteo jamaicensis</i>	x	0	2	2	2	1	1	1	0	9	L5
red-winged blackbird	RWBL	<i>Agelaius phoeniceus</i>	x	0	2	2	1	1	0	2	0	8	L5
song sparrow	SOSP	<i>Melospiza melodia</i>	x	0	2	2	1	2	0	2	0	9	L5
yellow warbler	YWAR	<i>Setophaga petechia</i>	x	0	1	2	1	1	1	3	0	9	L5
European starling	EUST	<i>Sturnus vulgaris</i>	x										L+
house finch	HOFI	<i>Carpodacus mexicanus</i>	x										L+
<b>Herpetofauna</b>													
bullfrog	BUFR	<i>Lithobates catesbeiana</i>	historic	3	3	2	2	4	2	5	1	22	L2
grey treefrog	TGTF	<i>Hyla versicolor</i>	historic	0	3	3	3	4	2	5	1	21	L2
northern spring peeper	SPPE	<i>Pseudacris crucifer crucifer</i>	3	0	2	3	3	4	3	5	1	21	L2
wood frog	WOFR	<i>Lithobates sylvatica</i>	2	0	2	3	3	4	3	5	1	21	L2
American toad	AMTO	<i>Anaxyrus americanus</i>	x	0	3	2	1	4	0	4	0	14	L4
green frog	GRFR	<i>Lithobates clamitans</i>	x	0	2	2	1	3	1	4	0	13	L4
<b>Incidental Species: species that are reported on as incidental to the TRCA protocol.</b>													
<b>Mammals</b>													
northern short-tailed shrew	NSTS	<i>Blarina brevicauda</i>	1	3	2	2	1	2	2	4	0	16	L3

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beaver	BEAV	<i>Castor canadensis</i>	x	1	2	1	2	3	1	3	0	13	L4
eastern chipmunk	EACH	<i>Tamias striatus</i>	x	0	2	2	2	3	1	3	0	13	L4
eastern cottontail	EACO	<i>Sylvilagus floridanus</i>	x	0	2	2	1	3	1	2	0	11	L4
red squirrel	RESQ	<i>Tamiasciurus hudsonicus</i>	x	0	2	2	1	3	1	2	0	11	L4
white-tailed deer	WTDE	<i>Odocoileus virginianus</i>	x	0	2	1	3	2	2	1	0	11	L4
grey squirrel	GRSQ	<i>Sciurus carolinensis</i>	x	0	2	2	1	3	0	0	0	8	L5
raccoon	RACC	<i>Procyon lotor</i>	x	0	2	2	1	3	1	0	0	9	L5
<b>Herpetofauna</b>													
eastern gartersnake	EAGA	<i>Thamnophis sirtalis sirtalis</i>	x	0	2	2	1	3	0	3	0	11	L4
<b>LEGEND</b>													
LO = local occurrence		PIS = Patch Isolation Sensitivity						LX = extirpated					
PTn = population trend, continent-wide		STD = sensitivity to development						L+ = non-native/introduced					
PTt = population trend, TRCA		+ = additional points											
HD = habitat dependence		TS = total score											
AS = area sensitivity		L-rank = TRCA Rank, October, 2008											