



Seneca College King Campus

**Terrestrial Biological Inventory
and Assessment**

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 **TORONTO AND REGION**
Conservation
for The Living City

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1.0 Introduction

In 2011 the Toronto Region Conservation Authority (TRCA) conducted flora and fauna inventories of the natural cover associated with Seneca College at the King Campus (Map 1). It was originally selected as a “baseline” inventory site; that is, rather than being surveyed because of an impending land use issue, it was chosen as an important area of natural cover to include in our regional inventory coverage. The Seneca College King Campus had not received a full systematic survey prior to 2011 and was identified as a data “gap” in the inventory coverage across the TRCA jurisdiction. Partial surveys have been conducted over the past 15 years in different sections of the property, however no survey covered the entire extent of the property or in a detailed method of capturing both flora and fauna information. Baseline inventory information can also be used for any site-specific land use or educational proposals that may arise; thus, this work also can be considered a proactive approach.

The purpose of the work conducted by the TRCA during the 2011 field season was to *characterize the terrestrial natural heritage features* of the Seneca College King Campus. Once characterized, the site features can then be understood within the larger regional context of the Terrestrial Natural Heritage Program of the TRCA. The question that the inventory addresses is “*How does the area surveyed at Seneca College 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.

A secondary but important purpose of the inventory is to help provide information for Seneca College in land-use planning for any proposals for campus expansion and ecological restoration; as well as to provide material for educational programs and initiatives.

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 extensive forest and wetland habitat at Seneca College King Campus fills an important link in the natural system along the Oak Ridges Moraine between the major forest area of the Happy Valley complex to the west and the Bloomington Wetland complex to the east. The natural cover at this site is the last sizable area of habitat heading east before the Moraine almost disappears beneath the rapidly developing residential landscape of Oak Ridges, with Aurora and Newmarket to the north. Essentially, the natural corridor that runs east-west along the Oak Ridges Moraine is severely constricted in this area and all remaining blocks of natural cover are very significant.

2.0 Study Area Description

As shown in Maps 1 and 2, the study area is located in the north-east corner of the Humber watershed, north of 15th Sideroad, and east of Keele St., in the municipality of King, York Region. It is in the upper reaches of the East Humber subwatershed. The study area covers 276 ha and lies entirely within the Great Lakes – St. Lawrence floristic region, composed of mixed coniferous-deciduous forest. At the coarse physiographic level, the site is situated on the Oak Ridges Moraine physiographic zone. Surface geology of a large proportion of the site consists primarily of

silt and clay glacial lake deposits, complexed with organic deposits of peat, muck and marl (at the centre of the site and on the west edge) and ice-supported stratified deposits of fine sands and gravel.

The site is dominated by Eaton Hall Lake, a kettle lake that is just north of the centre of the study area. Eaton Hall Lake occupies about 23 ha with a relatively deep eastern basin and a very shallow, marshy western basin. Most of the infrastructure associated with Seneca College lies just south of the east basin of the lake, while the older buildings associated with the former Eaton estate are north of the east basin of the lake.

Intensive use is mostly associated with Seneca College and its immediate environs south and east of Eaton Hall Lake. There is a day camp and other recreational activity on an island adjacent to the college buildings that partly separates the east and west basins of the lake. The old Eaton Hall is occasionally leased for social functions. Otherwise, recreation takes the form of trails that traverse the forest and plantation around the east and north sides of the lake. The Oak Ridges Moraine Trail cuts east-west across the whole study area from Dufferin to Keele Streets. The sections of trail that are distant from the campus buildings have light to moderate traffic, including some dog-walkers and cross-country skiers (as observed during the survey and from signage).

3.0 Inventory Methodology

A biological inventory of the Seneca College King Campus 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 2011 with a 10 ha area on the north side of the study area covered in 2008 (Table 2). Additional information was gleaned from Ontario Ministry of Natural Resources (OMNR) field data collected by Steve Varga for the Eaton Hall—Mary—Hackett Lakes Provincially Significant Wetland Complex (OMNR 1999). The OMNR data was collected mostly in 1997 with a small amount in 1999. These records fit within the 15-year threshold for flora data considered current for use in TRCA reports.

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 2007 digital ortho-rectified photographs (ortho-photos) to a scale of 1:2000 and then digitized in ArcView. 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 April, June and July of 2011. 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 and July 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 to be 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 bird.

In 1997 a fauna survey was concentrated in the north-east, north-west and south-west quarters of the area. A less extensive flora and fauna survey of the forest habitat in the north-east corner was conducted in April and June, 2008, and the fauna associated with the natural cover surrounding the lake was surveyed in April, June and July, 2002. Note that the fauna data management protocol imposes a ten-year threshold on use of historical data, and therefore the results of the OMNR and TRCA fauna surveys conducted in 1997 do not feature in the species list prepared for this report.

Table 2. Schedule of TRCA biological surveys at Seneca College King Campus

Survey Item	Survey Dates	Survey Effort (hours)
Patch / Landscape	2007: ortho-photos	21 hours
Vegetation Communities and Flora Species	2008: May 22 nd , July 15 th , Aug 11 th .	18 hours
	2011: May 10 th , 19 th , 30 th ; June 6 th , 14 th , 27 th ; July 18 th , 25 th ; Aug 10 th , 25 th , 31 st ; Sep 1 st , 9 th , 14 th , 15 th , 16 th .	77 hours
Frogs and Nocturnal Spring Birds	2011: April 12 th .	4 hours
Breeding Songbirds	2011: June 7 th – 9 th , 30 th ; July 4 th and 5 th .	28 hours

4.0 Results and Discussion

Information pertaining to the Seneca College King Campus 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. Seneca College occupies a pivotal place in the regional natural system along the Oak Ridges Moraine just west of the “choke point” in northern Richmond Hill along Yonge Street, where the corridor of natural area on the moraine is highly constricted by recent urban development.

4.2 Habitat Patch Findings for Seneca College King Campus

The following details the study area 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

The area of the Humber watershed is approximately 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%). Seneca College King Campus contains 0.7% of the total natural cover in the Humber watershed. This proportion may seem small, but the study area has a high strategic importance in the natural system and the Humber watershed is the largest in the TRCA jurisdiction.

The Seneca College King Campus itself covers about 276 ha of which 190.7 ha is natural cover (Appendix 1). (If one includes the sewage lagoon in the southwest part of the campus as an aquatic community, the figure is 192.9 ha). The natural cover includes 81.9 ha of forest (49.5 ha of which is plantation), 3.6 ha of successional, 52.4 ha of wetland (including 28.8 ha of treed swamp), 23.9 ha aquatic (excluding the sewage lagoon) and 28.5 ha of meadow. One 0.4 ha community is classified as “dynamic”: open or semi-open habitat maintained by unique conditions such as riparian or wind erosion (in this case a sand barren of anthropogenic origin). The campus also includes swaths of agricultural land especially in the northwest and southeast parts of the study area, and manicured areas around the campus buildings and east-side entrance (Dufferin Street).

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 consists of a rather convoluted mosaic of forest, wetland and meadow, alongside large areas of agricultural land, the latter both in-use and abandoned. The most extensive forest patch is that in the north-east corner which is part of a larger block of natural cover that has an area of 120 ha and as such scores “good” for patch size. The other forest patches are somewhat smaller achieving scores of “fair” and “poor” (Map 5). The wetland habitat patch (primarily classified as swamp) on the west side of Eaton Hall Lake covers an area of 13.5 ha which is enough to achieve a score of 4 points, or “good”. The most extensive meadow habitat patch covers only 6.2 ha (“poor”), but this is abutted by old agricultural fields which can often provide nesting opportunities for meadow associated species. The two largest forest and meadow habitat patches within the study area are scored “poor” and “very poor” for patch shape which is not surprising given the convoluted mosaic of habitats within the site.

Habitat Patch Matrix Influence

Analysis based on the 2007 ortho-photos shows that the matrix influence score for habitat in the study area is split between “good” in the north-east corner (where habitat patches are adjacent to other natural habitat patches) and “fair” in the south and west of the site (where habitat patches are influenced by the unclassified old-agricultural fields). These scores are as expected given the rural setting, with a mix of natural and agricultural land-types in the vicinity.

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/good” matrix influence on the site, and the mix of “good” to “very poor” habitat patch size and shape, results in an overall “fair” or L3 habitat patch quality (Map 9). Note that the overall “fair” patch quality is influenced by shape scores and matrix influence scores associated with large areas of unclassified old-agricultural land within the site. 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.

4.3 Vegetation Community Findings for Seneca College King Campus

4.3.1 Vegetation Community Representation

Seneca College King Campus has a very wide range of vegetation communities due to its complex kame-and-kettle topography and land use history. A total of 87 different ELC vegetation community types were described for the site (listed in Appendix 1). There are 38 forest communities (19 each of natural forest and plantation), 9 successional communities, 31 wetlands, 6 vegetated aquatic (plus 2 non-vegetated aquatic), 2 meadows, and one sand barren on gravelly fill associated with an abandoned racetrack. One plantation and one successional community were recorded solely as complexes and/or inclusions within other communities. Communities range in age and origin from native old-growth deciduous and mixed forests (identified as such with public signage but also showing old-growth characteristics such as very old trees with younger trees represented and abundant snags and logs) down to recently-abandoned agricultural land with trees planted after the year 2000. In between these extremes are mid-aged post-agricultural communities such as conifer plantations and also the wetland and aquatic communities associated with Eaton Hall Lake. Although these communities are very old, fluctuating lake levels result in periodic changes to the cover types; some marsh and shallow aquatic communities have dead trees and shrubs dating from a time of lower water levels.

Table 3. Summary of Vegetation Communities, Seneca College

Class	Number of Types	Area (hectares)
Forest	38	81.9
Successional	9	3.6
Meadow	2	28.5
Wetland	31	52.4
Aquatic	6	26.1
Dynamic (beach,bluff, barren)	1	0.4
<i>Total</i>	<i>87</i>	<i>192.9</i>

The site has 81.9 ha of forest, about 30% of the whole Seneca College King Campus land base. While over half of this (49.5 ha) is plantation, there are patches of mature and even old-growth forest focused in three places: the southeast corner of Eaton Hall Lake adjacent to the campus buildings; to the northwest of the Eaton Hall estate (north side of the lake), and in the far southwest corner of the study area (near Keele St.) The forest near the lake is contiguous with a large area of conifer plantation extending across the northeast quarter of the study area (see Section 4.2.1 for a discussion of the benefits of this large patch of forest). Deciduous forest covers 22.6 ha; while there are 8.5 ha of mixed forest and 0.5 ha of coniferous forest (the conifer component is higher in the treed swamps). Dry-Fresh Sugar Maple Deciduous Forest (FOD5-1) and Dry-Fresh Sugar Maple – Beech Forest (FOD5-2) are prevalent in the mature-to-old growth stands north and east of Eaton Hall Lake; some Dry-Fresh Hemlock – Sugar Maple Mixed Forest (FOM3-2) and Fresh-Moist Hemlock – Sugar Maple Mixed Forest (FOM6-1) are associated. The

somewhat less-mature forest near Keele St. and 15th Sideroad is mostly Fresh-Moist Sugar Maple – Hardwood Deciduous Forest (with pockets of deciduous swamp). Younger forest types occur along the edges of these larger patches, on low ridges above the lake and other wetlands, and scattered elsewhere; these range from Fresh-Moist White Cedar – Hemlock Coniferous Forest (FOC4-2) to Dry-Fresh Poplar Deciduous Forest (FOD3-1).

Plantation, which actually accounts for 60% of the total forest cover, is concentrated to the northeast of Eaton Hall Lake extending east to Dufferin Street. Most of this is conifer plantation with blended conifers (CUP3-H) along with smaller areas of single-species conifer plantations and conifer-deciduous mixed plantations. These are relatively mature plantation communities that appear to date from early-to-mid 20th century (the time of the Eaton family residence here). They have a mostly closed canopy layer. Another very different area of plantation encompasses the south-central to southwest part of the study area adjacent to 15th Sideroad. This is a younger deciduous plantation, mostly Hybrid Poplar Deciduous Plantation (CUP1-4) with some Willow Deciduous Plantation (CUP1-b). The area was planted in the late 20th century after Seneca College was established here. There has been high tree mortality and large areas of the canopy are relatively open, maintaining old-field herbs in the ground layer. This area is also sprayed with semi-treated effluent from the sewage lagoon used by the college, as indicated by Seneca staff.

Finally, there are small areas of very recent plantation close to the campus buildings and along the edges of agricultural fields further west. Some of these were undertaken through the Eaton Hall Wetland and Forest Enhancement Project beginning in 2006 as a partnership between TRCA and Seneca College (Oak Ridges Moraine Foundation 2011).

Successional semi-wooded communities cover only 3.6 ha (about 2% of the natural cover); although, arguably, the more open deciduous plantations with dieback could also be counted here instead of with the forest. There are a total of nine successional communities represented. Just two of these occupy more than one ha: Red Osier Dogwood Deciduous Thicket (CUT1-E) and Native Deciduous Successional Woodland (CUW1-A3). These are scattered across the site, occupying formerly agricultural lands and gaps in plantations where natural regeneration dominates the woody cover.

Open meadow covers 28.5 ha; most of this is Native Forb Meadow (CUM1-A) with a high proportion of tall goldenrod (*Solidago altissima*) and aster (*Symphyotrichum* spp.) The largest area of meadow is in the west-central part of the study area; this natural cover forms a linkage between the forest and wetland cover around the lake and the other patch to the west near Keele Street.

Wetlands perform a central role at Seneca College King Campus. They occupy 52.4 ha, 27% of the natural cover. The wetlands generally fit four different categories: mature conifer and mixed swamp on undisturbed headwaters and bottomlands; younger deciduous and thicket swamps in areas with more fluctuating water levels around Eaton Hall Lake and a few small streams; more mature deciduous swamps mostly in depressions associated with vernal pools, and marshes associated with the perimeter of the lake. Vegetated aquatic communities occupy an additional 15.5 ha, almost all associated with Eaton Hall Lake.

There are 18.3 ha of coniferous and mixed swamp, mostly White Cedar – Hardwood Organic Mixed Swamp (SWM4-1), White Cedar – Hardwood Mineral Mixed Swamp (SWM1-1), and Birch – Conifer Organic Mixed Swamp (SWM6-1). Organic soils are somewhat more prevalent than mineral in these headwater swamps, which attest to their age and lack of disturbance. Mature silver maple swamps: Silver Maple Mineral Deciduous Swamp (SWD3-2) and Silver Maple Organic Deciduous Swamp (SWD6-2) account for 3.0 ha. Younger deciduous swamps cover 7.5 ha (including 1.5 ha of exotic European Alder Mineral Deciduous Swamp – SWD4-b, originating from plantings); while thicket swamps cover 7.6 ha. The dominant thicket swamp type is Red-osier Mineral Thicket Swamp (SWT2-5).

Marshes (11 types) cover 16.1 ha of Seneca College King Campus. The most abundant marsh types are Reed Canary Grass Mineral Meadow Marsh (MAM2-2) along slow-moving streams and swales and Broad-leaved Cattail Organic Shallow Marsh (MAS3-1A) around the lake perimeter. In spite of biological controls introduced in the past 15 years, Purple Loosestrife Organic Shallow Marsh (MAS3-a) still occupies 2.3 ha around the lake, although its cover is not overwhelmingly dense.

Aquatic communities cover 26.1 ha. Of this total, 8.4 ha are the deep, unvegetated east basin of Eaton Hall Lake (OAO1). The disturbed, artificial sewage lagoon occupies 2.2 ha (OAO1-T). This leaves 15.5 ha of vegetated aquatic communities: six vegetation types in total. By far the largest of these is Water Lily – Bullhead Lily Mixed Shallow Aquatic (SAM1-A) occupying much of the west basin of Eaton Hall Lake as well as parts of the perimeter of the east basin and the wide, dammed-up stream flowing out from the lake to the south. The deep eastern basin is ringed by Water Milfoil Submerged Shallow Aquatic (SAS1-4).

Sands and gravels, artificially-deposited and associated with an old racetrack in the south-central part of the study area, support a 0.4 ha Dry-Fresh Flat-stemmed Bluegrass – Forb Sand Barren.

Disturbance to the vegetation communities is mostly from two sources: invasive species and trails. Exotic species are most prominent in the plantations and around the old Eaton Hall residence, where they have spread from gardens and may be facilitated by the network of trails. Some of the marshes are also heavily affected. The more mature mixed forests and swamps are relatively free of exotics, except where they are close to the former Eaton Hall gardens. The role of particular invasive exotic species at Seneca College is discussed below (Section 4.4.2). Trail use is relatively intense near Eaton Hall, which is also the area of the largest forest-plantation block. It diminishes westward and southward. Carp (*Cyprinus carpio*) are present in Eaton Hall Lake; this European fish is a source of disturbance to the aquatic communities there.

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 3.0. 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. Seneca College King Campus lies within the rural landscape and so L1 to L3 communities are identified as being of conservation concern. On the other hand, 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. This is clearly the case for the older forest communities at Seneca College, most of which have a rank of L4 or even L5 but are high-quality examples of their types. 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 17 vegetation communities at Seneca College King Campus with a rank of L1 to L3 (2 forests, 12 wetlands, 2 aquatic communities and 1 barren (communities are listed with ranks in Appendix 1; location and boundaries shown on Map 10). The communities of (regional) conservation concern (L1 to L3) occupy 34.0 ha, 18% of the total natural cover. An additional 6-8 ha (roughly) of forest might be considered old-growth.

The forest communities are of conservation concern (regardless of L-rank) because of their extent, mature age, and sometimes an intact native-dominated ground layer. The ground layer in the forest patch at the southwest end of the study area includes a good representation of sedges, ferns, and spring ephemerals. This is also true of the old-growth forest northwest of the old Eaton Hall residence, once one is away from the spreading colony of periwinkle (*Vinca minor*) that has escaped from the gardens over the past decades. Two forest communities: Dry-Fresh Hardwood – Hemlock Mixed Forest (FOM3-1) and Fresh-Moist Hemlock – Hardwood Mixed Forest (FOM6-2) have a rank of L3.

As Steve Varga noted in the 1990s, the large wetland complex that includes Eaton Hall Lake has a wide range of wetland associations that are of conservation concern (OMNR 1999). These include the following treed swamps observed in 2011: White Cedar – Conifer Mineral Coniferous Swamp (SWC1-2), White Cedar – Hardwood Organic Mixed Swamp (SWM4-1), Birch – Conifer Organic Mixed Swamp (SWM6-1), Yellow Birch Mineral Deciduous Swamp (SWD4-4), Black Ash Organic Deciduous Swamp (SWD5-1), Silver Maple Organic Deciduous Swamp (SWD6-2), and Willow Organic Deciduous Swamp (SWD7-A). The Birch – Conifer Organic Mixed Swamp west of Eaton Hall is old-growth, with some very large hemlock (*Tsuga canadensis*) and yellow birch (*Betula alleghaniensis*) and dense moss cover.

Three thicket swamps have a rank of L3: Nannyberry Mineral Thicket Swamp (SWT2-10), Alder Organic Thicket Swamp (SWT3-1), and Red-osier Organic Thicket Swamp (SWT3-5). Narrow-leaved Sedge Mineral Shallow Marsh (MAS2-3) and Broad-leaved Cattail Organic Shallow Marsh (MAS3-1A) also have a rank of L3. The cattail marsh is one of the increasingly few examples where the native broad-leaved cattail (*Typha latifolia*) is still at least co-dominant with the invasive hybrid (*Typha x glauca*) (though the latter is present in close to the same numbers).

Water Lily – Bullhead Lily Mixed Shallow Aquatic (SAM1-A) is ranked L3. Seneca College has perhaps the largest example of this community in the TRCA jurisdiction: it occupies 11.3 ha of

Eaton Hall Lake as well as the ponded channel extending south from the lake toward 15th Sideroad. The Duckweed Mixed Shallow Aquatic (SAM1-2) occupies a small pond west of Eaton Hall Lake and also has a rank of L3. The various submergent communities at Eaton Hall Lake are ranked L4 but have a number of unusual aquatic plants in them found in 2011 or 1997 (see Section 4.4.2).

The Dry-Fresh Flat-stemmed Bluegrass – Forb Sand Barren (SBO1-B), located on the old race track, has a rank of L2 but its rank does not reflect the fact that in this case the community was originally an artificial feature. It may represent a restoration opportunity for suitable species.

4.4 Flora Findings for Seneca College King Campus

4.4.1 Flora Species Representation

Floristic surveys conducted by TRCA in 2008 and 2011, combined with the relatively-recent OMNR survey in 1997 identified a total of 571 species of vascular plants (Appendix 2). These included 530 naturally-occurring species and 41 planted species. Many of the planted species are associated with the old gardens of the Eaton Hall estate; a few are from recent landscape and restoration plantings near the current Seneca College buildings. Ten of the planted species show some signs of reproducing and so could be considered *adventive*, i.e. escaped from cultivation although not necessarily established. Of the non-planted species, 355 are native (67%). The high biodiversity of this site (quite notable given the study area size) is due to the presence of so many different types of vegetation community, soil types, and age. In particular, the aquatic, marsh, treed swamp, and forest communities all have their own suite of species. The conifer plantations tend to have lower species richness. However, these plantings can create conditions favourable for certain native species, e.g. through the production of a slow-to-decay duff layer.

Table 4. Summary of Flora Species, Seneca College

Total # of species	571
Naturally-occurring species	530
Planted species	41
Native (naturally-occurring) species	355
Number of L1 - L3 species	125

4.4.2 Flora Species of Concern

There are 125 vascular plant species of regional conservation concern (rank L1 to L3) at Seneca College King Campus. 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.

Twenty-four 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. Some examples of regionally-rare plants at Seneca College include fen panicled sedge (*Carex prairea*), pale vetchling (*Lathyrus ochroleucus*), Illinois and knotty pondweeds (*Potamogeton illinoensis* and *P. nodosus*); bog goldenrod (*Solidago uliginosa*) and bog aster (*Symphotrichum boreale*), found by Steve Varga in 1997. Rare species seen in 2011 include Sartwell's sedge (*Carex sartwellii*), southern naiad (*Najas guadalupensis* ssp. *olivacea*), ribbon pondweed (*Potamogeton epihydrus*), New York fern (*Thelypteris novaboracensis*), broad-leaved panicled aster (*Symphotrichum lanceolatum* var. *latifolium*) and matted spike-rush (*Eleocharis intermedia*).

It is remarkable that three of the species of concern observed in 2011 at Seneca College King Campus were new records for the TRCA jurisdiction. Sartwell's sedge and southern naiad are thus unique to this site, while the broad-leaved panicled aster was also observed near the Scarborough Bluffs in 2011 (TRCA 2012).

A possibly less auspicious sign is the fact that fewer of the highest-ranking species (L1-L2) were observed overall in 2008-2011 than in 1997. There were 25 L1 to L2 species observed in 1997, and 18 in 2008-2011. The difference is probably not great enough nor the time period long enough to determine an actual trend. In any case, such species as pale vetchling, fen panicled sedge, and bog aster were not observed in 2011. While approximate mapped locations within the study area could be obtained for many of the 1997 species, this was not true of the pale vetchling, which was simply noted on the 1997 species list. Pale vetchling, an upland species, has not been recorded in the current round of TRCA inventories that began in 2000. It may now be extirpated from the TRCA jurisdiction. These species could have disappeared from Seneca College due to water level changes or anthropogenic impacts; or maybe were simply overlooked because they were inconspicuous at the time of the 2011 survey (e.g. not flowering, obscured by dense growth of other species, etc.).

All of the flora species of concern at Seneca College 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). A large proportion of the species of concern (notably the wetland species) are vulnerable to hydrological changes. The presence of dead trees and shrubs in the shallows of Eaton Hall Lake suggests that water levels have increased in recent decades. This may have resulted in declines of wetland species such as tamarack (*Larix laricina*) – live individuals still present but many dead ones observed; bog goldenrod (*Solidago uliginosa*), slender woolly sedge (*Carex lasiocarpa*), and eastern manna grass (*Glyceria septentrionalis*). Buttonbush (*Cephalanthus occidentalis*) – one of three known natural populations in the TRCA jurisdiction, is now restricted to several plants along the northeast shore of Eaton Hall Lake. Higher water levels may result from human or natural factors such as beaver dams or long-term wet spells. Human factors may be implicated at Eaton Hall Lake because the outlet level is controlled by several road crossings and culverts. On the other hand, matted spike-rush requires

variable water levels and was found on recently-exposed mud when water levels dropped temporarily during a hot, dry spell in the summer of 2011. Nutrient inputs from agriculture, roads, construction or fill dumping also can affect the wetland and aquatic communities; such changes have been observed in kettle lakes near Toronto (Watchorn *et al.* 2008).

Hydrological and nutrient disturbances can also encourage invasive species that displace some of the smaller and more sensitive wetland species. Purple loosestrife (*Lythrum salicaria*) and hybrid cattail are now quite abundant in the thicket swamps and marshes fringing Eaton Hall Lake. Invasive species – notably periwinkle, are also a threat to forest flora of concern at this site such as New York fern, wild columbine (*Aquilegia canadensis*), Indian tobacco (*Lobelia inflata*), and partridgeberry (*Mitchella repens*).

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. The heaviest trampling (due to pedestrian and bike trails) is in the north-eastern part of Seneca College King Campus between Eaton Hall Lake and Dufferin St. The forest patches here include sensitive species such as oak fern (*Gymnocarpium dryopteris*), broad-leaved spring beauty (*Claytonia caroliniana*), and mitrewort (*Mitella diphylla*).

Some species may be deliberately removed if they are seen: the lady's slippers (*Cypripedium* spp.) and to some extent several of the fern species are prized for gardens. Wild collection is certainly a serious conservation problem for showy native orchids.

Habitat fragmentation can lead to increased populations of herbivores such as white-tailed deer (*Odocoileus virginianus*); deer have had significant impacts in parts of the TRCA jurisdiction such as Rouge Park. Evidence of deer browse was ubiquitous at Seneca College, but seems not yet to have attained severe levels.

In addition to being sensitive to land use impacts, all of the 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. Seneca College has habitat specialists corresponding to all of its main habitat types.

Wetland species are particularly well-represented, especially those of swamps. These include species of conifer and mixed seepage swamps such as alder-leaved buckthorn (*Rhamnus alnifolia*), three-leaved false Solomon's seal (*Maianthemum trifolium*), and twinflower (*Linnaea borealis*). The rather different silver maple deciduous swamps in the southwest part of the study area have such species as tall wood reed (*Cinna arundinacea*) and Tuckerman's sedge (*Carex tuckermanii*). Buttonbush, small bedstraw (*Galium trifidum* ssp. *trifidum*), and great water dock (*Rumex britannica*) were found in thicket swamps or openings in treed swamps. The marshes are somewhat less diverse but include populations of Sartwell's sedge, water horsetail (*Equisetum fluviatile*), marsh cinquefoil (*Comarum palustre*), and blue flag (*Iris versicolor*).

The aquatic communities in Eaton Hall Lake and the associated ponds have a very large population of tuberous white water-lily (*Nymphaea odorata* ssp. *tuberosa*); and six species of pondweed (*Potamogeton* spp.) ranked L2 and L3. There are also two species of naiad, including the newly-recorded-for-TRCA southern naiad.

Upland species at Seneca College King Campus include both northern and southern associates. Hobblebush (*Viburnum lantanoides*) – not seen since 1997, is an example of the former, though many species with northern affinities are characteristic of the conifer and mixed swamps. Witch-hazel (*Hamamelis virginiana*) is an example of the latter. Pale vetchling, broad-leaved paniced aster, American bittersweet (*Celastrus scandens*), and Canada plum (*Prunus nigra*) are species of semi-open upland habitats. The Ontario aster (*Symphotrichum ontarionis*) is normally a species of deciduous swamps, but in 2011 was found in a clearing in a plantation. Spring ephemerals are not well-represented; however broad-leaved spring beauty was found. There is also the myco-heterotroph Indian pipe (*Monotropa uniflora*). (The term indicates plants that are parasitic on fungi that in turn have mycorrhizal associations with trees – hence these species have an added layer of habitat specialization. Their presence implies a robust, healthy fungal association in the forest).

Invasive Species

Although Seneca College King Campus is a floristically-rich natural area, it has two issues that result in invasive species problems. The first is the approximately 100-year history of extensive gardening at the Eaton Hall estate that introduced a large number of horticultural species to the site. While many of these garden escapes are simply harmless curiosities (for example, pink primrose – *Primula vulgaris* ssp. *sibthorpii*), the periwinkle and lily-of-the-valley (*Convallaria majalis*) have taken over swaths of plantation, mature native forest, and even some of the mixed swamp areas. Periwinkle and lily-of-the-valley are a threat to native forest ground layer species and tree regeneration and are still popular among Ontario gardeners.

The second issue is disturbance to Eaton Hall Lake and other wetlands resulting from agricultural and urban (college campus) runoff as well as a tendency toward elevated water levels. High water levels combined with silt and nutrient inputs have encouraged reed canary grass (*Phalaris arundinacea*), hybrid cattail, and purple loosestrife. Although the purple loosestrife has been subject to biological control from beetles introduced in the late 1990s, it is still present in high numbers at Eaton Hall Lake. Anecdotal observations by TRCA staff here and elsewhere suggest that these beetles seem to have undergone a population fluctuation downward over the period 2009-2011, allowing for partial recovery of purple loosestrife populations. There is also a population of common reed (*Phragmites australis* ssp. *australis*) in the wetland adjacent to Keele Street; road widening along Keele Street and 15th Sideroad observed in 2011 may further encourage its spread. The common reed population may be a long-term threat to the Sartwell's sedge population and other species of concern. Eaton Hall Lake itself has a moderate population of Eurasian water-milfoil (*Myriophyllum spicatum*), but this plant also seems to have biological control now (Newman and Biesboer 2000). Native pondweeds and naiads are present. However,

the lake also has carp (*Cyprinus carpio*), which root up aquatic vegetation during their breeding season and increase turbidity.

Unfortunately, there is a large (but local) population of dog-strangling vine (*Cynanchum rossicum*) in the plantations at the northeast end of Seneca College King Campus. This plant is a formidable threat (TRCA 2008). If it follows the trajectory it has taken in Rouge Park and the Seaton Trail / Whitevale Corridor in Durham Region, it will likely become the dominant ground layer species in most upland habitats except for mature forests. Biological control is the best long-term hope for dealing with it. It is possible that the Seneca College population is still localized enough that chemical and mechanical methods of control may be attempted.

Another strangling type of vine present is the Asiatic bittersweet (*Celastrus orbiculatus*). This woody vine is another horticultural escape. It can genetically swamp the native American bittersweet (*Celastrus scandens*), which is also present at Seneca College.

Garlic mustard appears to be occurring in those communities that are successional and/or disturbed in nature. It is likely to spread along trail systems. At present, infiltration of this species into the healthier sections of the site is minimal.

4.5 Fauna Species Findings for the Seneca College King Campus

4.5.1 Fauna Species Representation

The TRCA fauna surveys at the Seneca College King Campus in 2011 documented a total of 84 bird species, 8 mammals, and 9 herpetofauna species, bringing the total number of possible breeding vertebrate fauna species identified by the TRCA to 101. Three additional bird species (Blackburnian warbler, *Setophaga fusca*; white-throated sparrow, *Zonotrichia albicollis*; and eastern screech-owl, *Megascops asio*), can be added from the less extensive survey conducted in 2002, giving an overall total of 104 species. This total is similar to those from several other larger rural sites within the TRCA jurisdiction. For example, the 2009 report for Albion Hills Conservation Area lists 107 fauna species over the period 2001 to 2008. 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 3.0. Since the subject site is situated within the rural zone this report does not consider in detail those species ranked as L4, i.e. those species that are of concern in urban landscapes. As with flora, this is a proactive, preventive approach, identifying where conservation efforts need to be made before a species becomes rare.

Fauna surveys at the Seneca College King Campus reported 23 bird species of regional concern (L1 to L3), including two L2 bird species: ruffed grouse (*Bonasa umbellus*) and black-and-white

warbler (*Mniotilta varia*). In addition, there were 7 herpetofauna of regional concern including the L2 ranked wood frog (*Lithobates sylvatica*), spring peeper (*Pseudacris crucifer*), grey treefrog (*Hyla versicolor*), common snapping turtle (*Chelydra serpentina*), and L3 ranked eastern milksnake (*Lampropeltis triangulum*), bringing the total to 30 fauna species of regional concern (Table 5). The latter two reptile species are listed as special concern by the province under the Species at Risk legislation. Locations of these breeding fauna are depicted on Map 13.

Table 5. Summary of Fauna Species of Regional Concern, Seneca College

Fauna	Number of Species	Number of Species of Regional Concern (L1 to L3 rank)
birds	87	23
herps	9	7
mammals	8	0
TOTALS	104	30

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).

At the Seneca College King Campus there are five species that are considered regionally rare: yellow-bellied sapsucker (*Sphyrapicus varius*), hermit thrush (*Catharus guttatus*), osprey (*Pandion haliaetus*), Blackburnian warbler (documented only on the 2002 survey) and eastern milksnake. All five of these regional rarities were represented by single territories or observations. The yellow-bellied sapsucker was reported from the western forest block adjacent to Keele Street; both the hermit thrush and the Blackburnian warbler were holding territories in the more extensive mixed forest in the north-east section of the site. Ospreys have recently been making a great comeback into the region with several new nest-sites discovered over the past couple of years. However, the birds at Seneca College appear to have been on site since at least 2002 when a pair was observed nest-building on one of the lamp standards in the parking lot – the same site was occupied by a pair in 2011. Sadly, the remaining regional rarity, eastern milksnake, was documented as a road-kill found on the road running east off of Dufferin Street. Most reports of this species in the region are of road-kill specimens and it is difficult to fully understand the species' regional status. Suffice to say that eastern milksnake is listed as a Species at Risk and certainly the frequency of road-kills must be a factor in that listing.

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 30 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). Six of these species (two birds and four herp species) are ranked L2 and their presence is certainly significant, especially since two of the species (snapping turtle and eastern milksnake) are listed as Species at Risk.

The two L2 ranked birds – ruffed grouse and black-and-white warbler - are both ground-nesting species and as such are highly susceptible to ground-borne disturbance, e.g. off-leash dog-walking. A further 8 of the L3 ranked forest-bird species nest either close to or on the ground, and a few of these species are particularly well-represented throughout the forest habitat on site: 11 ovenbird (*Seiurus aurocapillus*) territories, 3 winter wren (*Troglodytes troglodytes*) territories and 8 northern waterthrush (*Prkesia noveboracensis*) territories. The latter species is possibly afforded some protection from ground-borne disturbance by its preference for nesting in areas with standing water such as swamps.

One of the ground-nesting species – white-throated sparrow (*Zonotrichia albicollis*) – was reported in 2002 and was not relocated in later surveys. However, since only one individual was mapped in 2002 the subsequent absence may not be significant; a lone record of a songbird may refer to a species that is not properly established at that site. The relatively high density of ovenbirds and northern waterthrushes indicates a forest habitat that is not currently subject to excessive disturbance. 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. These same disturbances also have considerable impact on wood frogs and spring peeper in their upland summer-foraging and over-wintering habitat.

Intensive levels of trail-related disturbance are mostly confined to the north-eastern parts of the Seneca College King Campus, but this is unfortunately the area where there is interior forest composed of original native forest combined with plantation. The Oak Ridges Moraine Trail traverses the entire study area from east to west, but it has a narrow footprint of one or at most two parallel trails and is not a network. Because the study area is not too close to residential suburban neighbourhoods, hikers prevail over dog-walkers, although dogs are present.

Higher ranked species are persisting at this site because the landscape is still entirely rural. However, it is important to understand that negative matrix influences are not solely associated with the proximity of urban and suburban developments; many of the negative influences 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 understory to accommodate trails will displace such sensitive species. It would be of considerable interest over the next few years to monitor the status of sensitive ground-nesting forest-birds and terrestrial fauna such as wood frog and common snapping turtle.

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 ≥ 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).

Twenty-two of the fauna species of regional concern that were identified at the Seneca College King Campus are considered area sensitive, including six species that require at least 20 ha of habitat. Many of these species are forest species and as such are well-accommodated by the largest patch of forest on the site which extends to the north and northwest beyond the study area boundary as far as 16th Sideroad and Keele Street (a total patch size of 120 ha). The lone area sensitive meadow-species – bobolink (*Dolichonyx oryzivorus*, a Species at Risk) – is provided with plenty of open-habitat to satisfy its nesting requirements although much of the open land on the site is not actually classed as meadow habitat.

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. Many of the forest bird species

which are well-represented on the site benefit considerably from the extent of their potential nesting habitat, ensuring that, despite some degree of disturbance from the small number of visitors and dogs, there are currently probably enough successful nestings for populations of these species to be maintained.

Three non-avian species which certainly benefit from the extensive areas of natural cover at the site are the frog species: grey tree-frog, wood frog and spring peeper. These species are considered area sensitive primarily due to their requirement for two distinct habitat elements in order to complete their life-cycles. All three species overwinter in upland forested habitat and then migrate to nearby wetlands in the early spring to breed, returning to forest habitats to forage throughout the summer and fall months. The complex mosaic of wetlands embedded in meadow and forest habitat presents excellent opportunities for these species of regional concern.

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.

Ten of the species of regional concern that occur at the Seneca College King Campus score high for patch isolation sensitivity, and as is fairly typical, all but three of these species are herpetofauna: four frog species, two turtle species and a snake species. The non-herpetofauna species are wild turkey (*Meleagris gallopavo*), Virginia rail (*Rallus limicola*) and sora (*Porzana carolina*). The former is highly mobile and susceptible to road-kill; however this species (the subject of a very successful re-introduction program in southern Ontario) appears to be faring very well across the region. The other two bird species are both wetland obligates but are highly susceptible to road-kill if their habitat is bisected by roads. Such a development scenario is unlikely actually within the study area but the situation already exists at the western border of the site. The fauna species for which patch isolation sensitivity is really an issue at Seneca College are the remaining seven species of herpetofauna: two turtles, four frogs and a snake species. All seven of the herpetofaunal species are highly mobile, moving considerable distances across the local landscape to and from breeding and wintering habitats. The network of paved and unpaved roads and trails throughout the site put these species at some risk of becoming road-kill. It is significant that the only milksnake observation was of a road-kill specimen found in the north-east quarter of the site. Milksnake and snapping turtle are important to consider in any future development of roads and trails within the study area.

On the west edge of the study area, in the southwest corner, an extensive wetland is indeed bisected by a major road – Keele Street. The aforementioned wetland species – Virginia rail, sora, wood frog, spring peeper and northern leopard frog (*Lithobates pipiens*) – all breed within this bisected wetland, on both sides of the dividing road. The potential for road-kill along this section of road is very high, particularly for the frog species. A second potential road-kill hotspot can also be envisaged on Keele Street, 750 metres to the north; again the road bisects a wetland that holds Virginia rail, spring peeper, wood frog and grey treefrog.

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. Twelve fauna species that occur in the study area are considered habitat specialists, all being forest specialists.

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 relatively high number of habitat dependent species all of which are dependent on forest indicates that the forest habitat in the study area is functioning at a particularly high level. The same cannot, however, be said of the open habitats within the site since associated species are very much under-represented despite the presence of fairly extensive open habitat patches in the southwestern half of the site.

5.0 Summary and Recommendations

The recommendations for the Seneca College King Campus 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 Seneca College King Campus within the regional context, followed by specific recommendations.

5.1 Site Summary

1. The site is located on the Oak Ridges Moraine, with complex kame-and-kettle topography, a large kettle lake (Eaton Hall Lake), and a number of other kettle and seepage wetlands.
2. Eighty-nine vegetation types were observed, ranging from old-growth forest and swamp to submerged aquatic communities: a large number considering the size of site. The site includes 38 forest, 9 successional, 31 wetland, 8 aquatic, 1 dynamic, and 2 meadow vegetation community types.

3. Old-growth forest (unusual in TRCA jurisdiction) and treed swamp communities were present on the site, totalling about 6 – 8 ha.
4. Eaton Hall Lake and associated water bodies have a good representation of vegetated aquatic communities (total of 15.5 ha), also unusual in TRCA jurisdiction.
5. There are good examples of fairly intact cattail marsh still dominated by native broad-leaved cattail instead of the hybrid; and of water-lily mixed aquatic communities.
6. Five-hundred and seventy-one flora species were observed including 125 L1 to L3 plants considered flora species of concern, many of these associated especially with the unusually wide range of wetland, aquatic, and forest habitats in the study area.
7. Of the 125 “L1 to L3” plant species identified, 24 are also considered to be regionally-rare. Several, including buttonbush, are only found at a couple of other TRCA sites, while Sartwell’s sedge, southern naiad and pale vetchling (if it still exists here) are unique to this location.
8. Three new native flora records for TRCA have been reported from the site: Sartwell’s sedge, southern naiad, and broad-leaved paniced aster.
9. A high total of 104 vertebrate fauna species were observed – a total which compares favourably to several other larger rural sites within the jurisdiction.
10. Given the rather limited size of the forest habitat patch, the area is surprisingly rich for nesting forest bird species, possibly a result of low visitor pressure within this forest block.
11. Three Species at Risk were observed on the site: bobolink, common snapping turtle and milksnake.
12. Even though the road and trail network are not heavily travelled the fauna survey in 2011 still documented a road-kill milksnake.
13. Keele Street, forming the western boundary of the study area, bisects one extensive wetland and a second smaller wetland, both of which hold good populations of wetland fauna species that are susceptible to road-kill.

5.2 Site Recommendations

In order to maintain a healthy level of biodiversity at Seneca College, the overall integrity of the natural heritage system that includes the site must be protected. Therefore, habitat patch size and shape needs 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, given the existing use and prospects for expansion of Seneca College, habitat quality and integrity must be protected from the negative matrix influences described in the body of the report. This includes strategic placement of any envisaged new facilities, 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 high-quality features on site. Thus, we recommend overall that 1) existing habitats and features be protected and enhanced; 2) that public use be managed; 3) that invasive species be controlled; and 4) that further assessment and monitoring be undertaken.

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 wetlands and aquatic communities associated with Eaton Hall Lake, areas of old-growth forest, and also the headwater swamp areas on the north side of the lake.

- a. Any future expansion of Seneca College facilities should be concentrated around the existing buildings and manicured areas in the south-eastern part of the study area rather than being distributed across the property.
- b. Management zones should be delineated for the study area in a plan that emphasizes protection of existing natural heritage features, i.e. vegetation communities, plant or animal species of high conservation rank.
- c. Natural cover should be increased through strategic plantings and restoration of agricultural fields and manicured areas. Seneca College has abundant opportunities for such expansion of natural areas. This will improve habitat patch size and shape, and help reduce negative matrix influences. Other considerations are improving habitat connectivity along the Oak Ridges Moraine corridor; buffering existing communities or species of conservation concern (maintaining conditions that allow these species to thrive and expand); increasing interior forest conditions; and reinforcing the rich avifauna, notably the particularly good numbers of ground-nesting forest species.
- d. Areas selected for restoration should have soil and moisture assessment in order to help determine suitable lists of species for planting.
- e. Control of nutrient and silt inputs into Eaton Hall Lake (and allowing for more natural water level fluctuations) would help maintain native biodiversity there and even allow it to recover. The conversion of agricultural fields and manicured areas in the lake's catchment area to natural cover should help reduce such inputs.

Runoff from paved areas should be carefully controlled through implementation of best management practices and Low Impact Development techniques. Optimally, urban-style runoff should be directed as much as possible away from the lake's catchment area to the south.

- f. The outflow from Eaton Hall Lake should be modified to allow for more water level fluctuation; for example, through replacing small culverts with larger ones or bridges when road work is being done.
- g. Ensure effective and adequate passage (e.g. tunnels) for amphibians and mammals across or under roads and trails that cross wetlands, for example when designing the trail network within the site where appropriate.

2. Manage Public Use

Although landscape metrics indicate that the matrix influence at this rural site is largely positive, this does not take into account the disturbance that occurs along the extensive network of roads and trails, not to mention the busy campus of Seneca College itself and its likely future expansion. Visitor pressure is likely to increase and ***it is important to preempt any potential increase in user pressure by designing the trail network to minimize negative impacts on sensitive forest species.***

- a. Any future trail planning needs to consider the locations of flora and fauna species of concern and to direct visitor pressure away from these areas. Likewise, restoration activities should target non-sensitive areas.
- b. Installation of board-walks as opposed to typical ground-borne trails should be considered as a means of protecting the sensitive flora and fauna species that occur throughout the various habitat patches on the site.
- c. 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.

3. Control Invasive Species

Several invasive plant species – and one fish, are threats to the native biodiversity at Seneca College. ***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. The highest-priority invasive species at Seneca are periwinkle, lily-of-the valley, dog-strangling vine, Asiatic bittersweet and common reed. These are currently

present in large but well-circumscribed populations. Some of them may be manageable through mechanical and/or chemical control (for example the small patches of Asiatic bittersweet or common reed, and satellite populations of periwinkle).

- b. Existing barriers such as roads or new barriers such as plantings or walls sunk into the soil may help impede clonally-spreading invasives that have large populations (e.g. periwinkle).
 - c. Invasive species control should be undertaken as a proactive measure prior to planting around any fields that are being targeted for restoration. This would include removal of Manitoba maple (*Acer negundo*) along with the other priority species.
 - d. Methods of addressing the carp problem at Eaton Hall Lake should be investigated with the help of aquatic and fisheries biologists.
4. Further Assessment and Monitoring

In order to address some remaining questions as well as to assess the impacts of campus expansion and efficacy of restoration work, **some monitoring projects should be initiated at Seneca College.**

- a. Long-term monitoring plots should be implemented at Seneca College, including at minimum, a forest vegetation plot, a forest bird plot, and wetland bird and frog plots, following the same protocol as is used in the TRCA's regional Long-term Monitoring Plot program.
- b. Monitoring for amphibian and reptile crossings over Keele Street where it bisects the wetlands on the western edge of the site needs to be conducted so as to fully understand the potential for road-kill hotspots. Attention should also be given to connectivity issues across 15th Sideroad and Dufferin Street.
- c. Faculty and students from Seneca College should be involved in the monitoring program.

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