



Indian Line

Terrestrial Biological Inventory and Assessment

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1.0 Introduction

In 2014 the Toronto Region Conservation Authority (TRCA) conducted fauna and flora inventories of the Indian Line property. This inventory was undertaken primarily to update existing information for the property, information which had been collected in a previous inventory conducted in 2007; but also in order to fulfill the TRCA's commitment to maintaining up-to-date data on vegetation communities, flora and fauna species across its jurisdiction. Hence, the information can be used for both local and regional natural heritage assessment and planning.

At the larger scale, the purpose of the work conducted by the TRCA during the 2014 field season was to *characterize the terrestrial natural heritage features* of the Indian Line property. Once characterized, the site features can then be understood within the larger watershed and the regional context of the Terrestrial Natural Heritage Program, enabling a better understanding of biodiversity across the jurisdiction. Results can be used to improve the Terrestrial Natural Heritage System Strategy (TNHSS) targets. The question that the inventory addresses is "*How does the area surveyed at the Indian Line 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 17.8% 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, achieved 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 natural habitat associated with the Indian Line study area acts as an important link along the west Humber riparian corridor, helping to create a continuous corridor of natural cover from the rural upper reaches of the Humber watershed through urban Brampton and Toronto to 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

The Indian Line study area in 2014 includes the entire shoreline of the lower Claireville Reservoir, bound to the south by the housing along Finch Avenue West, to the west by the Indian Line Campground, to the east by Highway 427, and to the north by the CN railway (and the upper Claireville Reservoir)(Maps 1 and 2).

The site comprises the natural cover encompassing the 16 ha lower Claireville Reservoir. In the south-western half of the site, there are sections where this strip of natural cover is less than 30 m wide (from bank to paved surface); the most extensive natural cover is located on the east side of the reservoir, sandwiched between the reservoir and Highway 427, where, in places, natural cover extends over 250 m from the reservoir. The Indian Line property lies within the Cities of Toronto and Brampton, covering a total of 43.7 ha. It is located in the middle reaches of the West Humber sub-watershed. It is part of a larger riparian network stretching upstream and downstream on the west branch of the Humber River. The site is embedded in an entirely urban landscape (residential and industrial/commercial); however, it is also isolated from much of this landscape by various barriers: Highway 427 lies to the east, the reservoir to the north and west, and Finch Avenue to the south.

The Indian Line site is also on the Peel Clay Plain, which has undergone such intensive agricultural and then urban development that very few natural areas remain. The Claireville Conservation Area lands, which include the study area, are one of the only extensive areas of natural cover remaining on the Peel Clay Plain in the TRCA's jurisdiction.

3.0 Inventory Methodology

A biological inventory of the Indian Line 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 2013 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

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 conducted in 2014 between the months of May through September (Table 2). Botanical data also includes additional records obtained from the earlier survey in 2007 which was limited to those reaches of the site east of the reservoir.

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 2013 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) along with flora species of urban concern (ranked L4) were mapped as point data with approximate number of individuals seen. A list of all other species observed was documented for the site.

Prior to 2014, the most complete fauna survey of the study area had been conducted by the TRCA in 2007, but this earlier survey was restricted to the east side of the reservoir. Nevertheless, the most extensive natural cover is on that east side and therefore the two inventories are effectively comparable. In 2014 fauna surveys were conducted on dates in April, late May and June. The April visit 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 late May and 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 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 species of regional and urban concern (species ranked L1 to L4) were mapped as point data with each point representing a possible breeding territory.

In addition to the 2014 data, this inventory considers all incidental fauna observations mapped over the previous 10 years, primarily from the extensive inventory conducted in 2007. The fauna data management protocol imposes a 10 year threshold on use of historical data, and therefore observations made prior to 2005 are not included in the current fauna inventory.

Table 2. Schedule of TRCA biological surveys at Indian Line Study Area

Survey Item	Survey Dates	Survey Effort (hours)
Patch / Landscape	2013: ortho-photos	21 hours
Vegetation Communities and Flora Species	2014: May 6 th , July 2 nd , July 23 rd and July 31 st 2007: Jun 26 th ,	22 hours 7 hours
Frogs and Nocturnal Spring Birds	2014: April 25 th 2007: April 19 th	1 hour 1 hour
Breeding Songbirds	2014: May 28 th ; June 17 th 2007: June 4 th ; July 5 th	4.75 hours 4.5 hours

4.0 Results and Discussion

Information pertaining to the Indian Line 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 2013 ortho-photography, 26% of the land area in the TRCA jurisdiction consists of natural cover but this figure includes meadow. Although historically, the region would have consisted of up to 95% forest cover, currently (i.e. 2013) only about 17.8% is covered by forest (includes successional) and wetland. Of the non-natural cover (i.e. the remaining 74%), 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 7.7% 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. The natural cover at the Indian Line property provides continuity in an important migration and dispersal route between the more rural areas to the north (the upper reaches of the West Humber subwatershed) and significant migrant staging areas lower down the Humber, closer the Lake Ontario shoreline.

4.2 Habitat Patch Findings for Indian Line

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 2013 ortho-photos.

4.2.1 Quantity of Natural Cover

The Humber watershed covers a total of 91,078 ha. Natural cover in the watershed covers 30,270 ha (33%), including 20,100 ha as forest/successional, 8,334 ha as meadow and 1,836 ha as wetland. The Indian Line Study Area is 43.7 ha in size and contains 37.95 ha of natural habitat (Table 3; Appendix 1), which amounts to 0.13% of the total natural cover in the Humber watershed. Although this is not a large total area of natural cover, the location, lying between the rural landscape to the north and riparian habitat in the lower reaches of the watershed confers a high degree of importance to the area from a connectivity perspective. The natural cover includes 3.4 ha of forest, 12.3 ha of successional and 5.2 ha of meadow.

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 the natural cover that surrounds the smaller lower Claireville Reservoir, and as such the patches are rather restricted both in size and shape. The patches on the west bank of the reservoir are particularly narrow and linear and thus score low for both patch criteria – L4 or “poor”. On the east side of the reservoir the natural cover is somewhat more extensive and has maintained a higher score for both patch size (L3 or “fair”) and shape (L2 or “good”). The most extensive forest/successional cover on site has an area of 6.6 ha, while the most extensive open habitat covers 4.6 ha, corresponding to a “fair” and “poor” score for patch size respectively (Map 5). Accordingly, there is no habitat interior feature within the study area; this would require at least a 100 m distance in any one direction to the closest habitat edge.

Habitat Patch Matrix Influence

Analysis based on the 2013 ortho-photos shows that the matrix influence score for habitat in the study area is “poor” (Maps 6 and 7). This score is as expected given that the study area is almost completely enveloped by development: residential housing to the west and south; and commercial/industrial development beyond Highway 427 to the east. 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. This largely urban landscape exerts a negative matrix influence on the site.

Habitat Patch Total Score

The combination of “poor” matrix influence on the site, and the mix of “poor” to “fair” habitat patch size with “poor” to “good” patch shape, results in an overall “poor” to “fair” habitat patch quality (Map 8). 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 fauna representation, with no L3 fauna species reported from the lower quality patches on the west side of the reservoir. As is often the case, the same observation cannot be made for flora, but this is typical in an urban setting where sensitive flora populations persist longer than sensitive bird populations – plant populations do not have the opportunity to vacate a deteriorating habitat in the same way that bird species do. For the same reason, less mobile fauna 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 Indian Line

4.3.1 Vegetation Community Representation

Indian Line has a total of 22 different vegetation communities, 5 are found solely as an inclusion or complex within a larger community. Of the vegetation communities, forests are the most diverse (8 types). However the area they occupy is little cover when compared to aquatic, successional and meadow communities (Table 3).

Table 3. Summary of Vegetation Communities, Indian Line Study Area

Class	Number of Types	Area (hectares)
Forest	8	3.4
Successional	5	12.3
Meadow	2	5.2
Wetland	5	0.35
Aquatic	1	16.3
Dynamic (beach, bluff, barren)	1	0.4
<i>Total</i>	<i>22</i>	<i>37.95</i>

There are 3.4 ha of forest, approximately 9% of the whole Indian Line Study Area. A total of 8 forest type vegetation communities (7 plantations and 1 forest) were documented; two of which were found solely as inclusions (Appendix 1). Restoration activities in the form of plantings are noticeable throughout Indian Line. The most common community type are Restoration Deciduous Plantations (CUP1-A), Norway Maple – Conifer Mixed Plantations (CUP2-c) and Restoration Mixed Plantation (CUP2-A). The latter community collectively occupied the greatest area (0.9 ha). The deciduous plantations are usually dominated by Norway maple (*Acer platanoides*), silver maple (*Acer saccharinum*), Canada poplar (*Populus x canadensis*), cottonwood (*Populus deltoides*), red

oak (*Quercus rubra*) and/or bur oak (*Quercus macrocarpa*). White spruce (*Picea glauca*), red pine (*Pinus resinosa*) and Norway spruce (*Picea abies*) were common associates in the coniferous plantations with lesser occurrences of white pine (*Pinus strobus*). With the exception of a black locust plantation, all plantations were native in origin. Amongst them was one community of urban concern (ranked L4); a Dry- Fresh Oak – Hardwood Deciduous Forest (FOD 2-4) dominated by bur oak and ironwood (*Ostrya virginiana*). This community was found as an inclusion within a larger Deciduous Restoration Plantation (CUP1-A) was the only example of natural forest found within the site.

Successional communities are represented by 5 different vegetation types: thicket (2), savannah (1) and woodland (2). Cultural hawthorn savannah (CUS1-1) with 6.6 ha (17.4%) provided the most continuous cover throughout the site. This community was dominated by dotted hawthorn (*Crataegus punctata*) and long-spined hawthorn (*Crataegus macracantha*). Small patches of Exotic Successional Thicket (CUT1-c) occupied the second largest amount of area with 3.2 ha (8%) and was characterized by European buckthorn (*Rhamnus cathartica*), apple (*Malus pumila*), and Russian olive (*Elaeagnus angustifolia*).

Open meadow covers just 5.2 ha with the largest patch being found on the southern stretches of the site adjacent the reservoir. Two exotic meadow vegetation types were found: Exotic cool season grass graminoid meadow (CUM1-b); and Exotic Forb Meadow (CUM1-c). The former occupies 4.3 ha and is comprised of brome grass (*Bromus inermis*), Kentucky blue grass (*Poa pratensis*), and (*Festuca pratensis*). The latter community occupied 0.8 ha and supported high densities of the non-native brown knapweed (*Centaurea jacea*).

With 0.35 ha, wetlands account for less than 1% of the natural cover. They are represented by 5 vegetation types, a combination of meadow marsh and shallow marsh communities. Three occur as inclusions and/or complexes within larger vegetation communities. The main expanse of wetland occurs as a narrow strip of Narrow-leaved Cattail Shallow Mineral Marsh (MAS2-1b) along the eastern shoreline of the reservoir as well as an inland pocket on the eastern half of the site. The latter community drains west towards the reservoir and transitions into a Native Forb Mineral Shallow Marsh (MAS2-9) dominated by the native lance-leaved aster (*Symphotrichum lanceolatum ssp lanceolatum*) and the exotic purple loosestrife (*Lythrum salicaria*).

The reservoir is the single aquatic community found at Indian Line; it spans 16.3 ha and accounts for the largest proportion of natural cover at the site (43%). Being disturbed and un-vegetated it is classified as a Turbid Open Aquatic – OAO1-T.

Dynamic communities are solely represented by Mineral Open Beach (BBO1). The expanse of this community is 0.4 ha (1%). However, being subject to fluctuating water levels from dam activities, the cover provided remains in constant flux. When water levels are low the amount of exposed shoreline increases. If the shoreline remains exposed for long periods of time, the substrate, otherwise devoid of vegetation, becomes colonized by opportunistic species such as ditch stonecrop (*Penthorum sedoides*) and different rush species (*Juncus spp*). These localized colonisations are temporary and disappear when water levels revert back to higher conditions.

Disturbances to the vegetation communities are mostly from trails, encroachment (gardening), and invasive species. Trails are present in the form of paved service roads and dirt paths used to either access the dams, campground or back portions of the conservation area. The walking trails are generally informal compacted dirt trails that are most concentrated in those areas nearest the campground. Unauthorized plantings (i.e. personal garden plot) containing corn and squash were noted in the cultural thicket on the east side of the reservoir just north of the paved service road. Exotic species are widespread and occur mainly in the form of weedy cool season grasses such as brome grass and Kentucky blue grass in the meadows. Wooded areas support buckthorn and Manitoba maple (*Acer negundo*), while purple loosestrife, canary reed grass (*Phalaris arundinacea*) and narrow-leaved cattail were prolific in the wetlands. Scattered populations of varying densities of more aggressive species such as garlic mustard (*Alliaria petiolata*) and dog-strangling vine (*Cynanchum rossicum*) were seen.

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 Indian Line Study Area lies within the urban landscape and so L4 communities are 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.

Communities of regional concern (ranked L1-L3) were not present within the study area. There are two vegetation communities of urban concern (ranked L4); collectively they occupy 0.05 ha, and account for <1% of the total natural cover documented at Indian Line. The first L4 community is a Forb Mineral Shallow Marsh (MAS2-9) and the second is a Dry Fresh Oak – Hardwood Deciduous Forest (FOD4-2) which was present only as an inclusion. Both of these communities, while not rare, are somewhat vulnerable to changes in the environment. For example, the Forb Mineral Shallow Marsh is present throughout the TRCA on sites with intact hydrology and limited matrix influences. This community is sensitive to disturbances pertaining to trampling, non-native plant invasion, storm water and nutrient inputs from surface runoff, and hydrological changes due to drainage pattern alterations (e.g. loss of ground water). Some of these conditions are already present at the site and may account for the higher presence of exotic wetland communities. The impacts from urbanizations has moved what was once native communities into decline, setting the stage for succession in to weedier communities dominated by invasive species such purple loosestrife, reed canary grass and narrow-leaved cattail). A complete list of all vegetation communities with their associated ranked are provided in Appendix 1; their location and boundaries are shown on Map 9.

4.4 Flora Findings for Indian Line

4.4.1 Flora Species Representation

Biodiversity at this site is moderate given the study area size. Floristic surveys conducted by TRCA in 2007 and 2014 identified a total of 246 species of vascular plants (Table 4; Appendix 2). Of these, 221 species were naturally occurring; the remaining 25 were associated with restoration plantings. Of the non-planted species recorded, 98 are native (44%). The site is heavily disturbed and fragmented; the high proportion of exotic species (56%) reflects the negative urban influence impacting both forest and wetland species.

Table 4. Summary of Flora Species, Indian Line Study Area

Total # of species	246
Naturally-occurring species	221
Planted species	25
Native (naturally-occurring) species	98
Number of L1 to L3 species (excludes planted)	5
Number of L4 species (excludes planted)	12
Exotic species (established)	123

4.4.2 Flora Species of Concern

There are 5 vascular plant species of regional conservation concern (rank L1 to L3) in the Indian Line Study Area; an additional 12 are ranked L4 and would be considered of concern in an urban environment. With the 2014 survey area expanded to include the west and south sides of the reservoir, additional species were captured. New flora records include 3 species ranked L3 and 23 species ranked L4. In the former grouping are running strawberry bush (*Euonymus obovatus*), bladdernut (*Staphylea trifolia*), and great bur-reed (*Sparganium eurycarpum*). The first two prefer rich wooded area with fresh to moist soils while great bur-reed is a wetland forb that tends to form dense colonies once established. The majority of newly recorded L4 species are associated with the scattered wetland habitats and include porcupine sedge (*Carex hystericina*), knotted rush (*Juncus nodosus*) and square stemmed monkey flower (*Mimulus ringens*).

Introduced to the site through plantings in mainly wetland and successional habitats are 17 species of concern (6 ranked L2-L3 and 11 ranked L4). Deciduous trees and shrubs make up the largest bulk. Examples of which include: silver maple, silky dogwood (*Cornus amomum* ssp. *obliqua*), ninebark (*Physocarpus opulifolius*), winterberry (*Ilex verticillata*), and bur oak.

Appendix 2 lists plant species by ranks and locations are shown on Map 10. The ranks are based on sensitivity to human disturbance associated with development; and habitat dependence, as well as on rarity (TRCA 2010).

4.4.3 Invasive Species

Indian line supports 127 non-native species (including 4 planted species). Depending on the habitat, the majority of exotic species found are weedy perennial herbaceous plants that exhibit only mild to moderate degrees of aggressiveness. However, a select few are highly invasive in nature, possessing the ability to displace their native counterparts if conditions prove favourable.

Forest patches on the east side of the reservoir as mentioned previously are dominated by Manitoba maple and crack willow (*Salix x fragilis*). Preferring moister soils these two species are commonly associated with floodplains. The former produces copious amounts of seeds with high regeneration rates. The latter spreads via suckers and water dispersed seeds. Black locust and Norway maple are found on the west side of the reservoir. Both trees are popular ornamental trees that once escaped from cultivation spread rapidly. Originating from a plantation, a prominent black locust stand is found near the railroad tracks to the north. In addition to being highly aggressive itself it supports a thick ground layer of other exotic species namely urban avens, garlic mustard, and dog-strangling vine. All three ground species are highly invasive with strong potential to become monocultures. A present this is one of the few locations where garlic mustard and dog-strangling vine occurs in high densities and would be good location for control efforts to prevent their spread into other sections of the site.

Scattered occurrences of Norway maple have been planted in the west and south west. The more developed patches have a ground layer almost lacking in vegetation. The shade provided by Norway maples is so intense that very few species are able to grow under its canopy.

In the open savannah areas exotic shrubs prevail. High on the list of invasiveness are common buckthorn (*Rhamnus cathartica*), English hawthorn (*Crataegus monogyna*), European highbush cranberry (*Viburnum opulus ssp opulus*) and three species of honeysuckle (*Lonicera spp*). In addition to being highly prolific, they produce berries that are favoured by bird species aiding in their dispersal success. Other potentially problematic shrubs at the site include multiflora rose (*Rosa multiflora*), autumn olive (*Elaeagnus umbellata*), Russian olive (*Elaeagnus angustifolia*) and common lilac (*Syringa vulgaris*). Brown knapweed (*Centaurea jacea*) as seen in the thicket and meadow habitats has the potential to be quite invasive under the right conditions.

Wetland communities at the site have already undergone widespread invasion by exotic species. The canopy and subcanopies of most marsh and meadow marsh communities are occupied by aggressive forbes particularly purple loosestrife (*Lythrum salicaria*), reed canary grass (*Phalaris arundinacea*), hybrid cattail (*Typha x glauca*) and narrow leaved cattail (*Typha angustifolia*). Common reed (*Phragmites australis*), seen extensively throughout the GTA, is currently only seen in one small wetland pocket but will likely spread given time.

4.5 Fauna Species Findings for Indian Line

4.5.1 Fauna Species Representation

The TRCA fauna surveys at the Indian Line Study Area in 2014 documented a total of 36 bird species, 3 mammals, and 2 herpetofauna species, bringing the total number of possible breeding vertebrate fauna species identified by the TRCA to 41. Two additional bird species can be added from the 2007 inventory: brown thrasher (*Toxostoma rufum*) and northern flicker (*Colaptes auratus*). One mammal species, eastern cottontail (*Sylvilagus floridanus*), and one herp, snapping turtle (*Chelydra serpentina*), can also be added from the 2007 inventory although it is highly likely that at least the former is still present at the site. These additions bring the vertebrate fauna list to a total of 45 species.

This total is a somewhat lower than those from several other study areas in the same urban-rural interface zone. For example, the fauna list for Too Good Pond (37.4 ha) in Markham has a list of 60 vertebrate fauna species. However, it should be considered that if the open water component was removed from the calculation of site area, Indian Line would total just 27 ha. 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. Since the subject site is situated close to the urban zone this report also considers 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 Indian Line Study Area in 2014 reported two bird species of regional concern (L1 to L3: American redstart, *Setophaga ruticilla*; and American woodcock, *Scolopax minor*), and seven of urban concern (L4). In addition, there were two herpetofauna and three mammal species of regional and urban concern, including one L2 species (western chorus frog, *Pseudacris triseriata*) and one L3 species (northern leopard frog, *Lithobates pipiens*). Four species of regional and urban concern can be added from the 2007 inventory: snapping turtle (L2), brown thrasher (L3), northern flicker and eastern cottontail (both L4). The total number of L1 to L4 ranked species is 16 species. Locations of these breeding fauna are depicted on Map 12.

Table 5. Summary of Fauna Species of Regional and Urban Concern at Indian Line Study Area, 2005 – 2014.

Fauna	Number of Species	Number of Species of Regional and Urban Concern (L1 to L4 rank)
birds	38	11
herps	3	3
mammals	4	2
TOTALS	45	16



Figure 1: Snapping turtle at Indian Line in 2007, excavating nest site at the extreme northern tip of the reservoir (photo: TRCA, June 2007)

Local occurrence is one of 7 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).

Fauna surveys at the study area documented just one fauna species considered regionally rare: western chorus frog. The presence of this species at Indian Line is extremely significant. While there is still a healthy population of this federally listed Species at Risk (Threatened) at the neighbouring Claireville Conservation Area, the discovery of the species at Indian Line is the furthest down-river that the species has been recorded in the Humber Watershed since a 1994 report of a chorus heard at Humber College. A population of western chorus frogs is persisting at Wildwood Park in the neighbouring Mimico watershed, but given the dramatic population decline noted in this species every remnant population needs to be treated with caution.

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 3 or more points (out of a possible 5) for this criterion. At the study area many of the species that are ranked L1 to L4 receive this score (12 of the 16 species) and are therefore considered sensitive to one or more of the impacts associated with development (Map 7).

The surrounding landscape is almost entirely urban and thus many of the negative impacts associated with an urban or suburban matrix should be present. However, there is one potentially mitigating factor: any urban impacts emanating from the east are somewhat obstructed by the presence of Highway 427; this highway will impose its own suite of impacts onto the natural system at Indian Line but at the same time will restrict impacts associated with the urban and commercial developments to the east of the highway. No such barrier exists on the west side of the reservoir although the location of the camp-ground and associated fencing may limit urban influences somewhat. Of the nine sensitive bird species recorded in the study area, only three species are ground- or low-nesting species: American woodcock, brown thrasher, and spotted sandpiper (*Actitis macularia*). Only the latter species was reported from the west-side of the site where it was observed foraging on the shoreline of the reservoir.

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. Many of the negative influences associated with urbanization 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. 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). Similarly, clearing of forest understory to accommodate trails displaces sensitive low-nesting species. There is no evidence that such activities are occurring across the majority of the study area.

The two most locally abundant sensitive species, grey catbird (*Dumetella carolinensis*) and willow flycatcher (*Empidonax traillii*) – nine and six territories respectively – are fairly evenly distributed throughout the entire site, both on the east and west sides of the reservoir, and certainly these two species would be somewhat more resilient to the types of negative matrix influence associated with the urban development on the west side. Both species are mid-level nesters in either dense or sparse shrub habitats and as long as the shrub habitat is not removed, and as long as nests are not repeatedly and frequently disturbed by trail placement, these species are quite capable of maintaining small populations in remnant natural patches in otherwise urban landscapes. It should be noted that the TRCA fauna inventory assesses the presence of species, i.e. the number of territories of each species at the site, but does not give any indication of the success of nesting attempts. However, the fact that there are multiple territories of these two species on site suggests that local breeders are successfully returning and recruiting to maintain a viable local population.

The most significant of the fauna species which are considered sensitive to development are the three herp species: snapping turtle, western chorus frog and northern leopard frog. All three species were recorded in the north-east corner of the site, in a section of the site that is most removed from residential urban matrix influences (however, with only one report of each species, the precise location of these three records may not be a reflection of matrix impacts). It is possible, at least for the snapping turtle, the observation in 2007 simply coincided with the animal's preferred nesting substrate. The location of the northern leopard frog record may reflect a lower degree of disturbance in this north-east section of the site, but as far as the highly significant report of western chorus frog is concerned, the location of the record coincides with the presence of ephemeral wetlands which the species would require for early spring breeding activities. No doubt, excessive disturbance in this section of the site would compromise these herp species' life cycles and potentially lead to the loss of the species from the site inventory.

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).

Only 3 of the species of regional and urban concern that were identified at the study area are considered area sensitive, requiring at least 10 ha of habitat: American redstart, American woodcock, and white-tailed deer (*Odocoileus virginianus*). The total non-aquatic natural cover on the site amounts to 21.6 ha but the configuration around the edge of the reservoir is such that the shape of the habitat patches probably undermines the relatively large area. Furthermore, forest habitat amounts to just 3.4 ha and so there really is very little opportunity for area sensitive forest species to establish themselves on site. Nevertheless, with 12.3 ha of successional habitat available there is at least some potential for a forest-edge species such as American redstart to establish and maintain a small population.

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.

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.

All three herp species and one of the mammal species (eastern cottontail) of regional or urban concern are considered sensitive to patch isolation. Typically, birds are considerably less affected by this criterion. The main obstruction to movement across the landscape onto the study area is the presence of Highway 427 which no doubt creates a major barrier to east-west movement for

terrestrial species such as mammals, frogs and snakes; however, since there is no natural habitat to the east or west of the site, this barrier probably has very little impact on the site as far as dispersal and recruitment of fauna species is concerned. The more significant directions for such movements to and from the site are to the north (connection with Claireville Conservation Area) and to the south (connection to lower reaches of the West Humber River). These connections are maintained to some extent by corridors and passages beneath various roads that pass over the river to the north and south of the site.

Of the three herp species, snapping turtle and leopard frog are very likely able to disperse into and out of the site via the river running through the site. The presence of western chorus frog at the site needs to be further investigated to establish whether there is in fact any opportunities for this largely terrestrial species to move into and out of the site. Currently it seems that the small population in the north-east section of the site would have all of its life cycle needs met within the confines of the site, but this – as with any restricted population of such mobility restricted species – would leave the population vulnerable to local collapse with no opportunity for further recruitment from beyond the site.

Fauna species that score greater than three points under the **habitat dependence** criterion are considered habitat specialists (Map 13). 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. Only two fauna species that occur in the study area are considered habitat specialists: western chorus frog and northern rough-winged swallow (*Stelgidopteryx serripennis*). The chorus frog scores as highly habitat dependent primarily due to the species' requirement for two distinct habitats: wetland for breeding and upland for over-wintering and summer foraging. Northern rough-winged swallow is considered habitat dependent solely due to its exacting requirements for cavities in which to nest, either. Over all, the general lack of habitat dependent species reflects the rather low quality of the forest, wetland and meadow habitats on site.

A site's species list presents only the species' richness, i.e. it indicates only the presence or absence of species at a site but indicates neither the breeding success nor the population stability of each species at the site. A healthy functioning system will accommodate a whole suite of species that are adapted to the habitat types at the site, and will allow those particular species to thrive and breed successfully. As the quality of the habitat patch improves so will the representation of flora and fauna species associated with that habitat. In this way, representation biodiversity is an excellent measure of the health of a natural system. Thus it certainly seems that the Indian Line site is functioning at a rather low level.

Degraded habitats in urban landscapes often accommodate only generalist species with the more sensitive habitat-dependent species entirely absent. This appears to be the case at Indian Line, but the presence of a significant species such as western chorus frog indicates that the features that satisfy this species' habitat needs are at least present and perhaps just need to be enhanced and managed to strengthen this species' presence at the site.

5.0 Summary and Recommendations

The recommendations for the Indian Line 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 in the mid-reaches of the West Humber sub-watershed, north of Finch Avenue. Its natural cover fills an important function in helping to maintain a viable connection across the urban landscape between the rural and agricultural landscape to the north and important staging areas for migrant birds located in the lower reaches of the Humber River and the Lake Ontario shoreline.
2. As a Conservation Authority property, the site is secure from urban development. However, negative urban matrix influences can readily impact even protected areas if public use of such an area is not managed in a way as to maintain the local natural systems. There is a high degree of flexibility in improving natural heritage at the site thereby contributing to the local and regional terrestrial natural heritage targets.
3. Twenty-two vegetation types were observed, ranging from deciduous plantation to shallow marsh and aquatic communities. The site includes 1 aquatic, 1 dynamic, 8 forest, 5 wetland, 5 successional, and 2 meadow vegetation community types. This is a low community diversity given the size of the site (43.7 ha) and reflects historical and current land-use practices of the site and surrounding area.
4. The presence in 2014 of western chorus frog, a Species at Risk listed as Threatened at the federal level, is very significant.
5. Two hundred and twenty-one naturally occurring flora species were observed. Amongst them were 5 species of regional concern (ranked L3) and 12 species of urban concern (ranked L4). Species of concern were associated with wetland, forest and successional habitats. Total species richness is moderate for the size of the site but it is largely comprised of exotic species.
6. The 45 species of vertebrate fauna observed is a total which is probably to be expected given the urban landscape in which the site is embedded, but rather low considering the barriers to potential negative urban matrix influences that exist on and just off the site.
7. Despite the low richness and representation in the breeding bird population, the site is potentially important for migrating songbirds moving to and from migrant staging areas on the Lake Ontario shoreline.

5.2 Site Recommendations

The recommendations primarily address objectives of protecting regional biodiversity in the TRCA jurisdiction. In order to at least maintain and preferably enhance the current level of biodiversity at the Indian Line 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, connections to other natural habitat patches in the landscape need to be enhanced and maintained. Furthermore, the recommendations highlight the issues that may occur with any increased public use of the Study Area as the urban landscape continues to expand. Management needs to address this potential increase in negative matrix influence and ensure that effective mitigation is included as part of any future management plans. 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 for the habitat requirements of the small population of western chorus frogs.

- a. Investigate and monitor the status of the population of chorus frogs first encountered at Indian Line in 2014. Ensure that all elements of the species habitat requirements are maintained and enhanced as much as possible. This will include ensuring that the surface water drainage which currently creates the required spring wetland conditions is not altered by any future management on site.
- b. Pursue opportunities to expand natural cover across the site. The Indian Line property, under TRCA ownership, provides an opportunity for expanding the local and regional terrestrial natural heritage system.
- c. In choosing areas for natural restoration, focus on north-south natural cover linkages along the watercourse since any east-west linkage across the site is immediately blocked by Highway 427.
- d. In a situation such as at Indian Line, where the fauna inventory results suggest that habitat patch size is a major factor limiting use of the study area by sensitive fauna species, it may be worth concentrating efforts on maintaining the habitat available

for the one or two highly significant species (western chorus frog and snapping turtle), knowing that in doing this, several other open-habitat species will be likely to succeed. Maintaining the open habitat ephemeral wetlands for chorus frog will more than likely also maintain the sparse shrub habitat that supports a small population of willow flycatchers. This should be seen as more of a priority than, for example, establishing forest habitat on site. There is an opportunity at Indian Line to enhance and maintain a fairly large area of wet thicket habitat which will satisfy the habitat requirements of western chorus frog and maintain local populations of L3 and L4 species such as American woodcock, brown thrasher, willow flycatcher and northern leopard frog, all of which are likely to disappear if the site becomes heavily treed.

- e. Native meadow communities can provide foraging opportunities for migrating monarch butterflies (*Danaus plexippus*) and migrant songbirds in the fall (primarily sparrows). In addition, hawthorn diversity and health can be maintained by removing invasive species such as buckthorn and European highbush cranberry.
- f. Areas selected for restoration should have soil and moisture assessments conducted in order to help determine suitable lists of species for planting. If soil conditions are suitable, consideration should be given to enhancing the wetland feature on the east side of the reservoir.
- g. Surveys should be conducted to identify whether any of the east–west road infrastructure currently impacts any of the north-south connectivity along the West Humber riparian corridor. Ensure effective and adequate passage (e.g. tunnels and culverts) for frogs, snakes and mammals under the major roads which currently may be creating road-kill hotspots along the north-south axis. The existing underpasses may provide adequate opportunities for ingress and egress to and from the site, but this needs to be confirmed and monitored.

2. Manage Public Use

Visitor pressure is likely to increase in the future, and it is important that this increase in use does not impact sensitive habitat features such as the wetlands that support the most significant fauna communities.

- a. Some areas should be left without public access as pure refuges for flora and fauna. (e.g. the location of the chorus frog population). Because the land is not currently much-used by the public, it is possible to do so proactively instead of trying to manage existing uses.
- b. Hikers and dog-walkers are currently having little impact on the site. However, if there is any intention to encourage greater public use of the natural habitats within

the study area it is important to establish very definite rules on the presence of dogs. Wherever dog-walkers have access, it follows that there will be an expectation that animals will be allowed to roam off-leash – despite local by-laws to the contrary. If such a use is allowed to embed itself at the site, there is a considerable risk that the more terrestrial frog populations will suffer; furthermore, any benefits gained by increasing forest patch sizes will be off-set by the increased impact of such use on low and ground-nesting bird species.

- c. Involving the local community in any restoration efforts will enhance feelings of good stewardship, which in turn will result in more ecologically positive behaviour, e.g. provision of adequate natural cover buffers and corridors along water courses. proper disposal of yard waste; diminished use of salt on paved surfaces in close proximity to the site; responsible dog-ownership.

3. Control Invasive Species

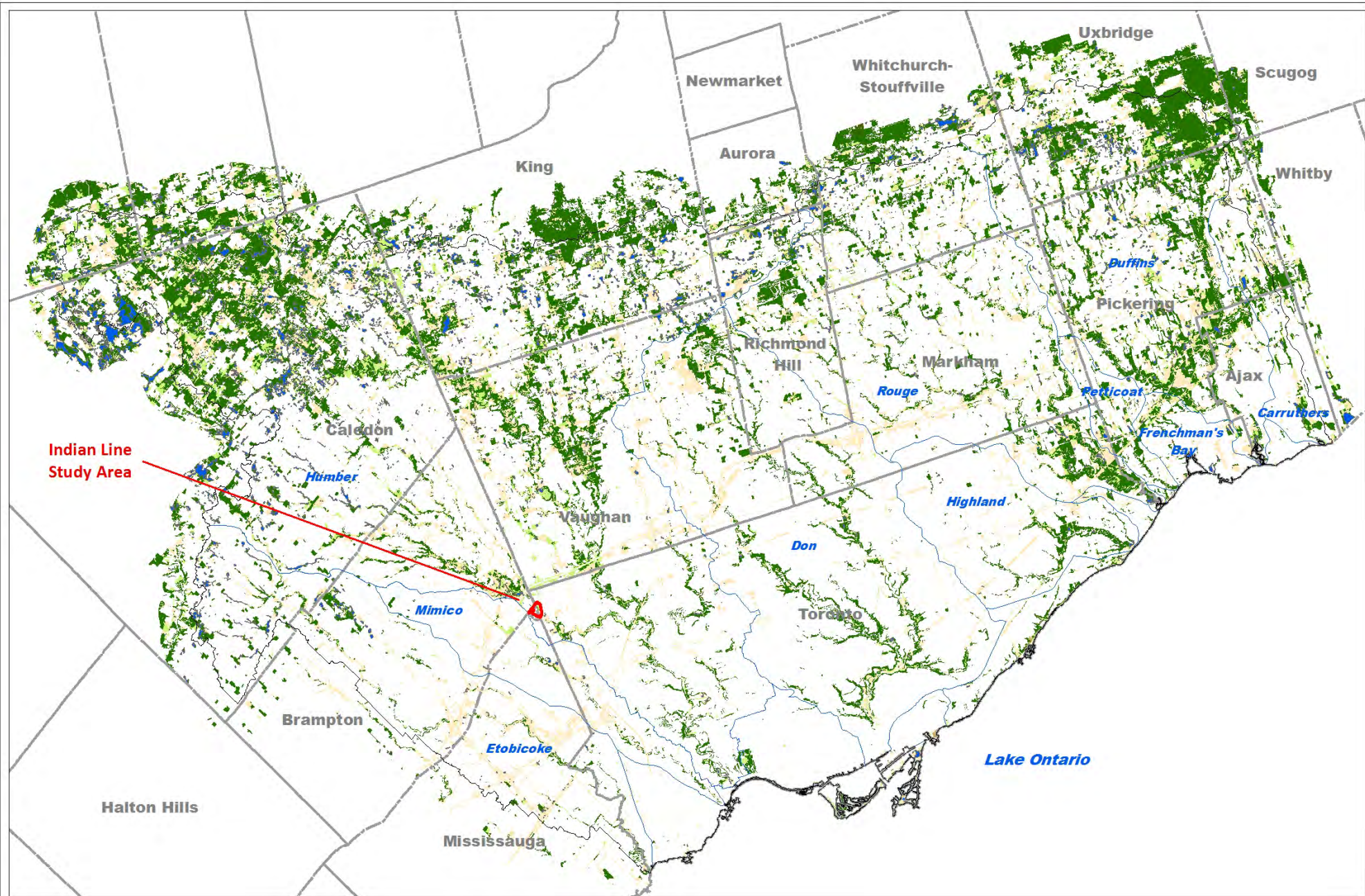
Several invasive plant species are threats to the native biodiversity in the Indian Line Study Area. ***It is essential that well-planned and realistic measures be undertaken to control invasive species.*** Management for invasive species will need to be tailored to the individual species in question,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

- a. Take a proactive management approach to invasive species control. Pre-assess areas targeted for restoration plantings or trail installation and remove existing exotic populations. This would include local removal of garlic mustard, dog-strangling vine, buckthorn, common reed, and other species that are found throughout the site.
- b. Since most of the invasive species at the site 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, discouraging dumping or encroachment through unauthorized plantings would reduce the disturbance that encourages exotics such as garlic mustard and urban avens to spread.
- c. Common reed may be a good candidate for eradication efforts as this species is currently present in discrete populations but have a high potential for spread. Their removal would thus be both feasible and have a highly protective effect on biodiversity.

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


Map 1:
**Indian Line Study Area in the
 Context of Regional Natural Cover**

Natural Cover *

-  Forest
-  Successional
-  Meadow
-  Wetland
-  Beach/Bluff

Legend

-  Indian Line Study Area Boundary
-  TRCA Jurisdiction
-  Watershed
-  Municipal Boundary



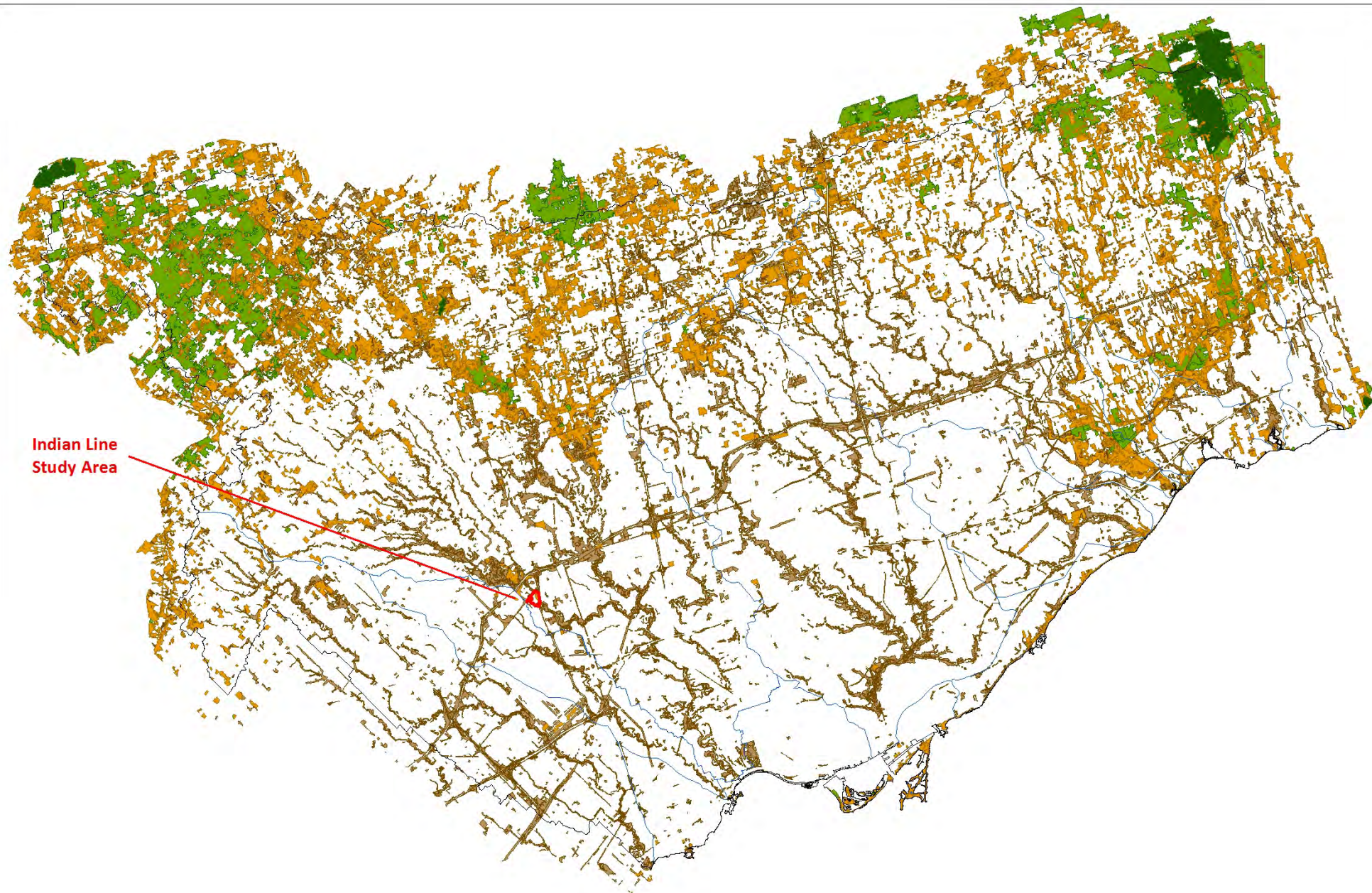
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Map 2:
Indian Line Study Area

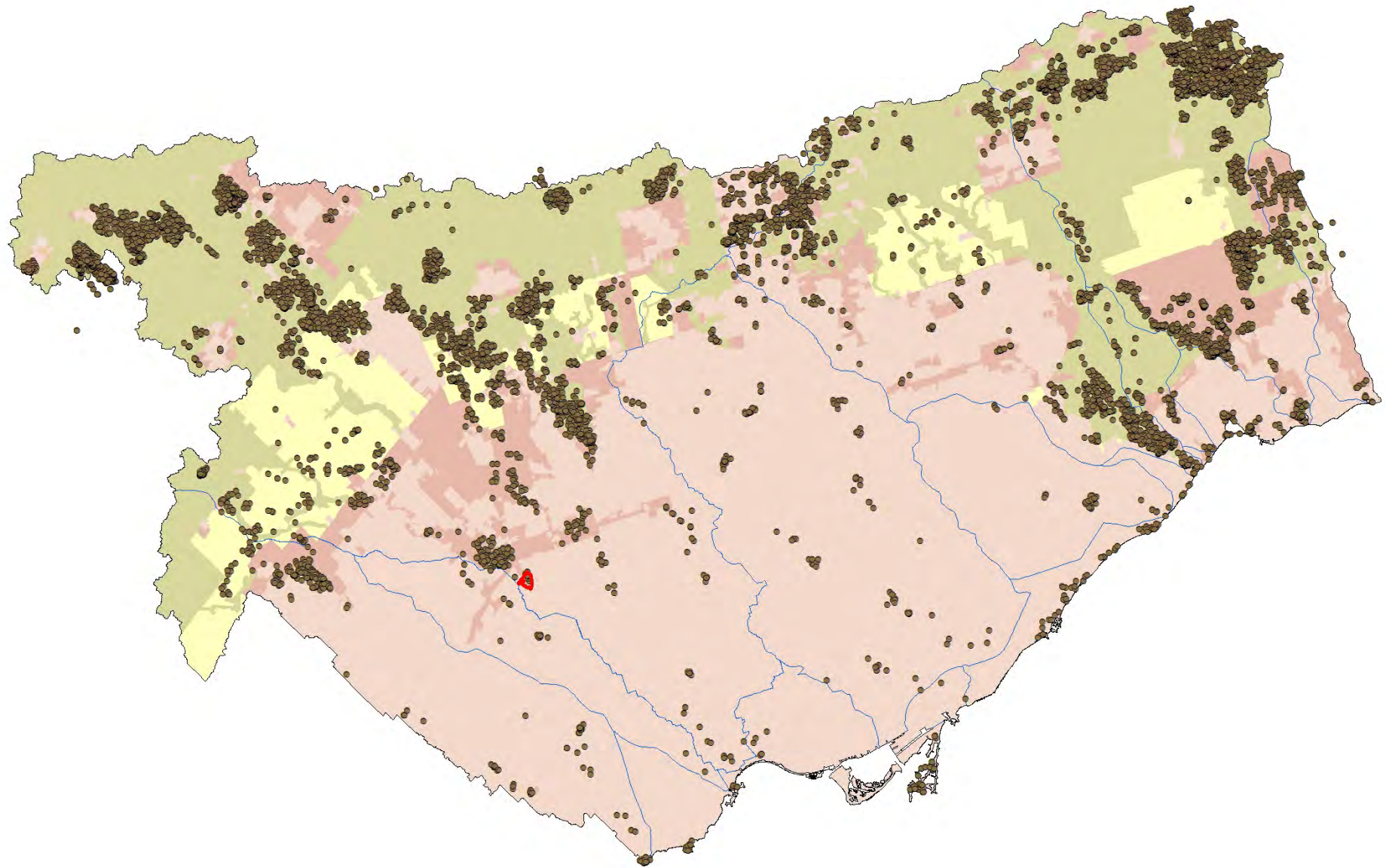
Legend

 Indian Line Study
Area Boundary











Map 3: Regional Natural System Habitat Patch Quality

Habitat Patch Quality *		Legend	
	L1 - Excellent		Indian Line Study Area Boundary
	L2 - Good		TRCA Jurisdiction
	L3 - Fair		Watershed
	L4 - Poor		
	L5 - Very Poor		



Map 4:
Distribution of Fauna
Regional Species of Concern

Legend

- | | |
|--|--|
|  Fauna Species of Concern (L1 - L3) |  Agricultural & Rural Area |
|  Indian Line Study Area Boundary |  Built-up Area |
|  TRCA Jurisdiction |  Designated Greenfield Area |
|  Watershed |  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



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

Legend

- Indian Line Study Area Boundary

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



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
- ⊕ Planted Flora Species



Map 6: 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

- Indian Line 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 25 50 100 150 200 Meters

Map 7: 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

Indian Line Study Area Boundary

Date: December 2014

Orthophoto: Spring 2013, Aero-Photo Quebec


* Landscape analysis based on 2007/2008 Orthophotography



Map 8: Habitat Patch Quality

Legend

Habitat Patch Quality *

-  L1 - Excellent
-  L2 - Good
-  L3 - Fair
-  L4 - Poor
-  L5 - Very Poor

 Indian Line Study Area Boundary



Toronto and Region
Conservation
for The Living City









0 25 50 100 150 200
Meters


Date: December 2014
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 9: Vegetation Communities with their Associated Local Ranks

Legend

Vegetation Community Ranks

	L1		L4
	L2		L5
	L3		L+

 Indian Line Study Area Boundary

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



Map 10: Location of Flora Species of Concern

Legend

Flora Species of Concern (L1-L4)

- L1 ● L3
- L2 ● L4

Planted Flora Species of Concern (L1-L4)

- L1 ● L3
- L2 ● L4

 Indian Line Study Area Boundary

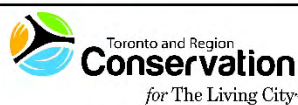


Flora Habitat Dependence Scores

- 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
- ⊕ Planted Flora Species

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



0 25 50 100 150 200 Meters

Date: December 2014
Orthophoto: Spring 2013, Aero-Photo Quebec

Map 11: Flora Species Habitat Dependence Scores


Legend

- Indian Line Study Area Boundary



Map 12: Locations of Fauna Species of Concern

Legend

Fauna Species of Concern		Frog Species of Concern	
▲ L1	▲ L3	■ L1	■ L3
▲ L2	▲ L4	■ L2	■ L4
 Indian Line 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.



Map 13: Fauna Species Habitat Dependence Scores

Legend

- Indian Line Study Area Boundary
- △ Fauna Species
- Frog Species

Appendix 1: List of TRCA Vegetation Communities found within the Indian Line Study Area (2014)

ELC Code	Vegetation Type (* indicates present as inclusion and/or complex only)	Tot. area # ha	Scores			Local Rank
			Local Occur.	Geophy. Requir.	Total Score	
	Forest					
FOD2-4	Dry-Fresh Oak - Hardwood Deciduous Forest*	-	2.5	2.0	4.5	L4
CUP1-5	Silver Maple Deciduous Plantation	0.5	3.0	0.0	3.0	L5
CUP1-A	Restoration Deciduous Plantation	0.6	2.0	0.0	2.0	L5
CUP1-b	Willow Deciduous Plantation*	-	3.0	0.0	3.0	L5
CUP1-c	Black Locust Deciduous Plantation	0.5	2.0	0.0	2.0	L+
CUP2-A	Restoration Mixed Plantation	0.9	2.5	0.0	2.5	L5
CUP2-c	Norway Maple - Conifer Mixed Plantation	0.6	3.5	0.0	3.5	L5
CUP3-A	Restoration Coniferous Plantation	0.4	2.5	0.0	2.5	L5
	Successional					
CUT1-A1	Native Deciduous Sapling Regeneration Thicket	1.4	2.0	0.0	2.0	L5
CUT1-c	Exotic Deciduous Thicket	3.2	2.0	0.0	2.0	L+
CUS1-1	Hawthorn Successional Savannah	6.6	2.0	0.0	2.0	L5
CUW1-A3	Native Deciduous Successional Woodland	0.5	1.0	0.0	1.0	L5
CUW1-b	Exotic Successional Woodland	0.7	1.5	0.0	1.5	L+
	Wetland					
MAM2-2	Reed Canary Grass Mineral Meadow Marsh*	-	1.0	1.0	2.0	L+
MAM2-b	Purple Loosestrife Mineral Meadow Marsh*	-	3.0	0.0	3.0	L+
MAS2-1b	Narrow-Leaved Cattail Mineral Shallow Marsh	0.3	2.0	0.0	2.0	L+
MAS2-9	Forb Mineral Shallow Marsh	0.05	2.5	1.0	3.5	L4
MAS2-a	Common Reed Mineral Shallow Marsh*	-	3.0	0.0	3.0	L+
	Aquatic					
OAO1-T	Turbid Open Aquatic (disturbed unvegetated)	16.3	2.0	0.0	2.0	L+
	Dynamic (Beach, Bluff, Barren, Prairie, Savannah)					
BBO1	Mineral Open Beach	0.4	3.5	2.0	5.5	L3
	Meadow					
CUM1-b	Exotic Cool-season Grass Graminoid Meadow	4.3	1.0	0.0	1.0	L+
CUM1-c	Exotic Forb Meadow	0.8	1.5	0.0	1.5	L+

Appendix 2: TRCA Flora Species found within the Indian Line Study Area (2014)												
*Plant origin(s): x = naturally occurring; p = planted, p?=likely planted; cf= identification uncertain											Survey Year	
" *Plant type(s): FO = forb; SH = shrub; TR = tree; SE = sedge; GR = grass; VI = vine; VW = woody vine; FE = fern; RU = rush											2007	2014
Scientific Name	Common Name	Local Occur.	Popn. Trend	Hab. Dep.	Sens. Dev.	Total Score	Rank (2014)	Co-efficient of Conservatism	Coefficient of Wetness	Plant Type	(152 spp)	(198 spp)
Crataegus coccinea var. fulleriana	Fuller's hawthorn	3	3	5	3	14	L3	4	5	SH	x	
Euonymus obovatus	running strawberry-bush	2	4	4	4	14	L3	6	5	SH		x
Sparganium eurycarpum	great bur-reed	2	4	5	4	15	L3	3	-5	FO		x
Staphylea trifolia	bladdernut	3	3	4	4	14	L3	7	0	SH		x
Teucrium canadense ssp. canadense	wood-sage	3	3	4	4	14	L3	6	-2	FO	p	x
Amelanchier laevis	smooth serviceberry	2	2	4	3	11	L4	5	5	SH		x
Carex hystericina	porcupine sedge	1	3	2	5	11	L4	5	-5	SE		x
Cicuta bulbifera	bulblet-bearing water-hemlock	2	3	4	3	12	L4	5	-5	FO		x
Crataegus coccinea var. coccinea	scarlet hawthorn	3	2	3	3	11	L4	4	5	TR	x	x(cf)
Crataegus macracantha	long-spined hawthorn	2	2	4	3	11	L4	4	5	SH		x
Juncus nodosus	knotted rush	2	2	5	3	12	L4	5	-5	RU		x
Juncus torreyi	Torrey's rush	2	3	4	2	11	L4	3	-3	RU		x
Mimulus ringens	square-stemmed monkey-flower	2	3	3	4	12	L4	6	-5	FO		x
Penthorum sedoides	ditch stonecrop	3	2	4	3	12	L4	4	-5	FO		x
Quercus rubra	red oak	1	4	2	4	11	L4	6	3	TR		x
Schoenoplectus tabernaemontani	soft-stemmed bulrush	1	2	5	3	11	L4	5	-5	SE		x
Typha latifolia	broad-leaved cattail	1	4	4	4	13	L4	3	-5	FO		x
Acer saccharum ssp. saccharum	sugar maple	1	3	0	2	6	L5	4	3	TR	x	x
Achillea millefolium ssp. lanulosa	woolly yarrow	1	2	0	1	4	L5	0	3	FO		x
Actaea rubra ssp. rubra	red baneberry	1	3	1	3	8	L5	5	5	FO		x
Agrimonia gryposepala	agrimony	1	2	0	2	5	L5	2	2	FO		x
Alisma plantago-aquatica	water-plantain	1	2	4	2	9	L5	3	-5	FO		x
Ambrosia artemisiifolia	common ragweed	1	1	3	0	5	L5	0	3	FO	x	x
Amphicarpaea bracteata	hog-peanut	2	2	2	2	8	L5	4	0	VI	x	x
Anemone canadensis	Canada anemone	1	2	2	2	7	L5	3	-3	FO	x	x
Anemone virginiana	common thimbleweed	1	3	0	3	7	L5	0	5	FO		x
Apocynum androsaemifolium	spreading dogbane	1	3	2	4	10	L5	3	5	FO		x
Asclepias syriaca	common milkweed	1	2	0	2	5	L5	0	5	FO	x	x
Bidens frondosa	common beggar's-ticks	1	1	4	0	6	L5	3	-3	FO	x	x
Carex cristatella	crested sedge	1	2	4	1	8	L5	3	-4	FO	x	x
Carex granularis	meadow sedge	1	2	1	3	7	L5	3	-4	SE		x
Carex rosea	curly-styled sedge	1	2	3	2	8	L5	5	5	SE		x
Carex vulpinoidea	fox sedge	1	2	4	1	8	L5	3	-5	SE	x	x
Cicuta maculata	spotted water-hemlock	1	2	2	2	7	L5	6	-5	FO		x
Circaea canadensis ssp. canadensis	enchanter's nightshade	1	1	1	1	4	L5	3	3	FO		x
Cornus stolonifera	red osier dogwood	1	2	0	3	6	L5	2	-3	SH	x	x
Crataegus punctata	dotted hawthorn	1	2	3	3	9	L5	4	5	TR	x	x
Echinocystis lobata	wild cucumber	1	2	3	1	7	L5	3	-2	VI	x	
Elymus virginicus var. virginicus	Virginia wild rye	2	2	3	2	9	L5	5	-2	GR		x
Epilobium ciliatum ssp. ciliatum	sticky willow-herb	1	2	2	2	7	L5	3	3	FO	x	
Equisetum arvense	field horsetail	1	2	1	1	5	L5	0	0	FE		x
Erigeron annuus	daisy fleabane	1	2	0	1	4	L5	0	1	FO	x	x
Erigeron canadensis	horse-weed	2	1	2	0	5	L5	0	1	FO		x
Eurybia macrophylla	big-leaved aster	1	3	2	4	10	L5	5	5	FO		x
Euthamia graminifolia	grass-leaved goldenrod	1	1	4	1	7	L5	2	-2	FO		x
Fragaria virginiana	wild strawberry (sensu lato)	1	2	0	2	5	L5	2	1	FO	x	
Fragaria virginiana ssp. virginiana	common wild strawberry	2	2	0	2	6	L5	2	1	FO		x
Fraxinus americana	white ash	1	2	0	3	6	L5	4	3	TR	x	
Fraxinus pennsylvanica	red ash	1	2	0	3	6	L5	3	-3	TR		x
Galium palustre	marsh bedstraw	1	2	3	3	9	L5	5	-5	FO	x	
Galium triflorum	sweet-scented bedstraw	2	2	2	2	8	L5	4	2	FO		x
Geum aleppicum	yellow avens	1	3	3	2	9	L5	2	-1	FO	x	x
Geum canadense	white avens	1	2	1	2	6	L5	3	0	FO	x	x
Impatiens capensis	orange touch-me-not	1	2	0	2	5	L5	4	-3	FO	x	x
Juglans nigra	black walnut	1	1	2	1	5	L5	5	3	TR	x	x
Juncus articulatus	jointed rush	1	2	4	2	9	L5	5	-5	RU		x
Juncus dudleyi	Dudley's rush	1	2	3	1	7	L5	1	0	RU	x	x
Lemna minor	common duckweed	1	2	4	2	9	L5	2	-5	FO		x
Lysimachia ciliata	fringed loosestrife	1	2	2	2	7	L5	4	-3	FO	x	
Maianthemum racemosum ssp. racemosum	false Solomon's seal	1	3	2	3	9	L5	4	3	FO		x
Mentha arvensis ssp. borealis	wild mint	1	2	3	2	8	L5	3	-3	FO	x	
Oenothera biennis	common evening-primrose	1	1	1	1	4	L5	0	3	FO	x	x
Ostrya virginiana	ironwood	1	3	2	2	8	L5	4	4	TR		x
Oxalis stricta	common yellow wood-sorrel	1	1	1	1	4	L5	0	3	FO	x	x
Parthenocissus inserta	thicket creeper	1	2	0	1	4	L5	3	3	VW	x	x
Persicaria lapathifolia	pale smartweed	2	1	4	0	7	L5	2	-4	FO	x	x
Plantago rugelii	red-stemmed plantain	1	2	0	1	4	L5	1	0	FO	x	x
Poa palustris	fowl meadow-grass	1	2	3	2	8	L5	5	-4	GR		x
Podophyllum peltatum	May-apple	1	3	3	2	9	L5	5	3	FO		x
Populus balsamifera	balsam poplar	1	2	3	2	8	L5	4	-3	TR	x	x
Potentilla anserina ssp. anserina	silverweed	2	2	3	2	9	L5	5	-4	FO		x
Prunus serotina	black cherry	1	2	0	2	5	L5	3	3	TR		x
Prunus virginiana var. virginiana	choke cherry	1	2	0	1	4	L5	2	1	SH	x	x
Ribes cynosbati	prickly gooseberry	1	3	2	2	8	L5	4	5	SH		x
Rubus idaeus ssp. strigosus	wild red raspberry	1	1	0	1	3	L5	0	-2	SH	x	x
Rubus occidentalis	wild black raspberry	1	1	0	1	3	L5	2	5	SH	x	x
Salix eriocephala	narrow heart-leaved willow	1	1	3	1	6	L5	4	-3	SH		x
Salix interior	sandbar willow	1	1	5	2	9	L5	3	-5	SH	x	x
Sambucus canadensis	common elderberry	1	3	2	2	8	L5	5	-2	SH	x	x
Sanguinaria canadensis	bloodroot	1	3	0	3	7	L5	5	4	FO		x
Scirpus atrovirens	black-fruited bulrush	1	2	4	2	9	L5	3	-5	SE	x	x
Solidago altissima	tall goldenrod	1	2	0	0	3	L5	1	3	FO	x	x
Solidago canadensis var. canadensis	Canada goldenrod	1	2	0	1	4	L5	1	3	FO		x
Solidago flexicaulis	zig-zag goldenrod	1	1	3	2	7	L5	6	3	FO		x
Solidago gigantea	late goldenrod	1	1	1	1	4	L5	4	-3	FO	x	
Solidago nemoralis ssp. nemoralis	grey goldenrod	2	2	2	2	8	L5	2	5	FO		x
Symphotrichum ericoides var. ericoides	heath aster	1	1	2	1	5	L5	4	4	FO	x	x
Symphotrichum lanceolatum var. lanceolatum	panicled aster	1	2	3	1	7	L5	3	-3	FO		x
Symphotrichum lateriflorum var. lateriflorum	calico aster	1	2	3	2	8	L5	3	-2	FO		x
Symphotrichum novae-angliae	New England aster	1	2	2	1	6	L5	2	-3	FO	x	x

Appendix 2: TRCA Flora Species found within the Indian Line Study Area (2014)																					
*Plant origin(s): x = naturally occurring; p = planted, p?=likely planted; cf= identification uncertain											Survey Year										
" *Plant type(s): FO = forb; SH = shrub; TR = tree; SE = sedge; GR = grass; VI = vine; VW = woody vine; FE = fern; RU = rush											Local Occur.	Popn. Trend	Hab. Dep.	Sens. Dev.	Total Score	Rank (2014)	Co-efficient of Conservatism	Coefficient of Wetness	Plant Type	2007 (152 spp)	2014 (198 spp)
Scientific Name		Common Name		1-5	1-5	0-5	0-5	2-20													
Tilia americana		basswood		1	3	2	3	9	L5					4	3	TR		x		x	
Toxicodendron radicans var. radicans		poison ivy (vine form)		2	2	4	2	10	L5					5	-1	VW				x	
Toxicodendron radicans var. rydbergii		poison ivy (shrub form)		1	2	0	2	5	L5					0	0	SH				x	
Ulmus americana		white elm		1	4	0	2	7	L5					3	-2	TR	x			x	
Verbena hastata		blue vervain		1	2	4	2	9	L5					4	-4	FO	x			x	
Viburnum lentago		nannyberry		1	3	1	2	7	L5					4	-1	SH				x	
Vitis riparia		riverbank grape		1	1	0	0	2	L5					0	-2	VW	x			x	
Xanthium strumarium		clotbur		2	1	4	0	7	L5					2	0	FO	x			x	
Acer negundo		Manitoba maple		1	0	0	2	3	L+?						-2	TR	x			x	
Agrostis stolonifera		creeping bent grass		2	0	0	0	2	L+?						-3	GR	x			x	
Atriplex patula		halberd-leaved orache		3	0	0	0	3	L+?						-2	FO	x				
Lepidium densiflorum		common pepper-grass		3	0	0	0	3	L+?						0	FO	x				
Phalaris arundinacea		reed canary grass		1	0	0	0	1	L+?						-4	GR	x			x	
Potentilla norvegica		rough cinquefoil		2	0	0	0	2	L+?						0	FO	x				
Abutilon theophrasti		velvet-leaf		3	0	0	2	5	L+						4	FO	x				
Acer platanoides		Norway maple		2	0	0	0	2	L+						5	TR				x	
Acer tataricum ssp. ginnala		Amur maple		3	0	0	2	5	L+						5	SH				x	
Achillea millefolium ssp. millefolium		European yarrow		3	0	0	0	3	L+						3	FO	x				
Agrostis gigantea		redtop		2	0	0	0	2	L+						0	GR	x			x	
Alliaria petiolata		garlic mustard		1	0	0	0	1	L+						0	FO	x			x	
Anthemis cotula		stinking mayweed		4	0	0	0	4	L+						3	FO	x				
Arctium lappa		great burdock		1	0	0	0	1	L+						5	FO				x	
Arctium minus		common burdock		1	0	0	0	1	L+						5	FO				x	
Artemisia biennis		biennial wormwood		3	0	0	0	3	L+						-2	FO	x				
Artemisia vulgaris		common mugwort		3	0	0	0	3	L+						5	FO	x			x	
Asparagus officinalis		asparagus		2	0	0	0	2	L+						3	FO				x	
Barbarea vulgaris		winter cress		1	0	0	0	1	L+						0	FO	x				
Bromus inermis		smooth brome grass		1	0	0	0	1	L+						5	GR	x			x	
Capsella bursa-pastoris		shepherd's purse		2	0	0	0	2	L+						1	FO	x				
Caragana arborescens		Siberian pea-shrub		3	0	0	0	3	L+						5	SH	x			x	
Carduus acanthoides		plumeless thistle		3	0	0	0	3	L+						5	FO				x	
Celtis occidentalis		hackberry		5	0	0	0	5	L+				8		1	TR				p	
Centaurea jacea		brown knapweed		3	0	0	0	3	L+						5	FO				x	
Centaureum erythraea		European centauray							L+							FO				x	
Centaureum pulchellum		branching centauray		3	0	0	0	3	L+						4	FO	x				
Cerastium fontanum		mouse-ear chickweed		2	0	0	0	2	L+						3	FO	x				
Chenopodium album		lamb's quarters		2	0	0	0	2	L+						1	FO	x			x	
Chenopodium glaucum		oak-leaved goosefoot		3	0	0	0	3	L+						-3	FO	x			x	
Cichorium intybus		chicory		1	0	0	0	1	L+						5	FO	x			x	
Cirsium arvense		creeping thistle		1	0	0	0	1	L+						3	FO	x			x	
Cirsium vulgare		bull thistle		1	0	0	0	1	L+						4	FO	x				
Convolvulus arvensis		field bindweed		2	0	0	0	2	L+						5	VI	x			x	
Cotoneaster acutifolius		Peking cotoneaster		3	0	0	0	3	L+						5	SH				x	
Crataegus monogyna		English hawthorn		1	1	4	0	6	L+						5	TR	x			x	
Cynanchum rossicum		dog-strangling vine		1	0	0	0	1	L+						5	VI	x			x	
Cynoglossum officinale		hound's tongue		2	0	0	0	2	L+						5	FO	x				
Dactylis glomerata		orchard grass		1	0	0	0	1	L+						3	GR	x			x	
Daucus carota		Queen Anne's lace		1	0	0	0	1	L+						5	FO	x			x	
Dipsacus fullonum		teasel		2	0	0	0	2	L+						5	FO	x			x	
Echium vulgare		viper's bugloss		2	0	0	0	2	L+						5	FO	x			x	
Elaeagnus angustifolia		Russian olive		2	0	0	0	2	L+						4	SH	x			x	
Elaeagnus umbellata		autumn olive		2	0	0	0	2	L+						3	SH				x	
Elymus repens		quack grass		2	0	0	0	2	L+						3	GR	x			x	
Epilobium parviflorum		small-flowered willow-herb		1	0	0	0	1	L+						3	FO	x				
Euphorbia peplus		petty spurge		4	0	0	0	4	L+						5	FO	x				
Fallopia convolvulus		black bindweed		2	0	0	0	2	L+						1	VI	x				
Galeopsis tetrahit		hemp-nettle		2	0	0	0	2	L+						5	FO	x				
Galium mollugo		white bedstraw		2	0	0	0	2	L+						5	FO	x				
Galium verum		yellow bedstraw		3	0	0	0	3	L+						5	FO				x	
Geum urbanum		urban avens		1	0	0	0	1	L+						5	FO				x	
Hordeum jubatum ssp. jubatum		squirrel-tail barley		3	0	0	0	3	L+						-1	GR	x			x	
Hypericum perforatum		common St. John's-wort		1	0	0	0	1	L+						5	FO	x			x	
Inula helenium		elecampane		2	0	0	0	2	L+						5	FO	x			x	
Iris pseudacorus		yellow flag		2	0	0	0	2	L+						-5	FO				x	
Juncus compressus		round-fruited rush		3	0	0	0	3	L+						-4	RU	x			x	
Leonurus cardiaca ssp. cardiaca		motherwort		2	0	0	0	2	L+						5	FO	x			x	
Lepidium campestre		field pepper-grass		2	0	0	0	2	L+						5	FO	x				
Leucanthemum vulgare		ox-eye daisy		1	0	0	0	1	L+						5	FO	x				
Ligustrum vulgare		privet		2	0	0	0	2	L+						1	SH				x	
Linaria vulgaris		butter-and-eggs		2	0	0	0	2	L+						5	FO	x			x	
Lolium perenne		perennial rye		2	0	0	0	2	L+						3	GR	x				
Lonicera morrowii		Morrow's honeysuckle		2	0	0	0	2	L+						5	SH				x	
Lonicera tatarica		Tartarian honeysuckle		2	0	0	0	2	L+						3	SH	x			x	
Lonicera x bella		shrub honeysuckle		1	0	0	0	1	L+						5	SH	x			x	
Lotus corniculatus		bird's foot trefoil		1	0	0	0	1	L+						1	FO	x			x	
Lycopus europaeus		European water-horehound		2	0	0	0	2	L+						-5	FO	x			x	
Lysimachia nummularia		moneywort		2	0	0	0	2	L+						-4	FO	x				
Lythrum salicaria		purple loosestrife		2	0	0	0	2	L+						-5	FO				x	
Malus pumila		apple		1	0	0	0	1	L+						5	TR	x			x	
Matricaria chamomilla		wild chamomile		3	0	0	0	3	L+						5	FO	x				
Medicago lupulina		black medick		1	0	0	0	1	L+						1	FO	x				
Medicago sativa ssp. sativa		alfalfa		2	0	0	0	2	L+						5	FO				x	
Melilotus albus		white sweet clover		1	0	0	0	1	L+						3	FO				x	
Melilotus officinalis		yellow sweet clover		2	0	0	0	2	L+						3	FO	x			x	
Myosotis scorpioides		true forget-me-not		1	0	0	0	1	L+						-5						

Appendix 2: TRCA Flora Species found within the Indian Line Study Area (2014)											Survey Year	
*Plant origin(s): x = naturally occurring; p = planted, p?=likely planted; cf= identification uncertain											2007	2014
" *Plant type(s): FO = forb; SH = shrub; TR = tree; SE = sedge; GR = grass; VI = vine; VW = woody vine; FE = fern; RU = rush											(152 spp)	(198 spp)
Scientific Name	Common Name	Local Occur.	Popn. Trend	Hab. Dep.	Sens. Dev.	Total Score	Rank (2014)	Co-efficient of Conservatism	Coefficient of Wetness	Plant Type		
<i>Pilosella flagellaris</i>	whiplash hawkweed						L+			FO		x
<i>Plantago lanceolata</i>	English plantain	1	0	0	0	1	L+		0	FO	x	x
<i>Plantago major</i>	common plantain	1	0	0	0	1	L+		-1	FO	x	x
<i>Poa compressa</i>	flat-stemmed blue grass	1	0	0	0	1	L+		2	GR	x	x
<i>Poa nemoralis</i>	woodland spear grass	2	0	0	0	2	L+		0	GR		x
<i>Poa pratensis</i> ssp. <i>pratensis</i>	Kentucky blue grass	1	0	0	0	1	L+		1	GR	x	x
<i>Polygonum aviculare</i> ssp. <i>aviculare</i>	prostrate knotweed	2	0	0	0	2	L+		1	FO	x	
<i>Populus</i> x <i>canadensis</i>	Carolina poplar	3	0	0	0	3	L+		0	TR		x
<i>Potentilla recta</i>	sulphur cinquefoil	1	0	0	0	1	L+		5	FO	x	x
<i>Prunus mahaleb</i>	Mahaleb cherry	5	ns	ns	ns	5	L+		5	SH		x
<i>Rhamnus cathartica</i>	common buckthorn	1	0	0	0	1	L+		3	SH	x	x
<i>Ribes rubrum</i>	garden red currant	1	0	0	0	1	L+		5	SH		x
<i>Robinia pseudoacacia</i>	black locust	1	0	0	0	1	L+		4	TR		x
<i>Rosa multiflora</i>	multiflora rose	1	0	0	0	1	L+		3	SH	x	x
<i>Rosa rubiginosa</i> var. <i>rubiginosa</i>	sweet brier rose	5	0	0	0	5	L+		5	SH		x
<i>Rumex crispus</i>	curly dock	1	0	0	0	1	L+		-1	FO	x	
<i>Rumex obtusifolius</i>	bitter dock	2	0	0	0	2	L+		-3	FO		x
<i>Salix</i> x <i>fragilis</i>	crack willow	1	0	0	0	1	L+		-4	TR	x	x
<i>Schedonorus arundinaceus</i>	tall fescue	3	0	0	0	3	L+		2	GR		x
<i>Schedonorus pratensis</i>	meadow fescue	1	0	0	0	1	L+		4	GR	x	x
<i>Setaria pumila</i> ssp. <i>pumila</i>	yellow foxtail	3	0	0	0	3	L+			GR		x
<i>Setaria viridis</i>	green foxtail	2	0	0	0	2	L+		5	GR	x	
<i>Silene latifolia</i>	evening lychnis	3	0	0	0	3	L+		5	FO	x	
<i>Sinapis arvensis</i>	charlock	2	0	0	0	2	L+		5	FO	x	
<i>Sisymbrium officinale</i>	hedge mustard	4	0	0	0	4	L+		5	FO	x	
<i>Solanum dulcamara</i>	bittersweet nightshade	1	0	0	0	1	L+		0	VW	x	x
<i>Sonchus arvensis</i> ssp. <i>arvensis</i>	glandular perennial sow-thistle	2	0	0	0	2	L+		1	FO	x	x
<i>Sorbus aucuparia</i>	European mountain-ash	1	0	0	0	1	L+		5	TR		x
<i>Syringa vulgaris</i>	common lilac	2	0	0	0	2	L+		5	SH	x	x
<i>Taraxacum officinale</i>	dandelion	1	0	0	0	1	L+		3	FO	x	x
<i>Tragopogon dubius</i>	lemon-yellow goat's beard	1	0	0	0	1	L+		5	FO	x	
<i>Tragopogon pratensis</i>	meadow goat's beard	2	0	0	0	2	L+		5	FO		x
<i>Trifolium pratense</i>	red clover	1	0	0	0	1	L+		2	FO	x	x
<i>Trifolium repens</i>	white clover	1	0	0	0	1	L+		2	FO	x	x
<i>Tussilago farfara</i>	coltsfoot	1	0	0	0	1	L+		3	FO	x	x
<i>Typha angustifolia</i>	narrow-leaved cattail	1	0	0	0	1	L+		-5	FO	x	x
<i>Typha</i> x <i>glauca</i>	hybrid cattail	1	0	0	0	1	L+		-5	FO		x
<i>Verbascum thapsus</i>	common mullein	2	0	0	0	2	L+		5	FO	x	x
<i>Viburnum lantana</i>	wayfaring tree	2	0	0	0	2	L+		5	SH		x
<i>Viburnum opulus</i> ssp. <i>opulus</i>	European highbush cranberry	1	0	0	0	1	L+		0	SH	x	x
<i>Vicia cracca</i>	cow vetch	1	0	0	0	1	L+		5	VI	x	x
<i>Pinus resinosa</i>	red pine	2	5	5	5	17	L2	8	3	TR		p
<i>Cornus amomum</i> ssp. <i>obliqua</i>	silky dogwood	3	3	5	3	14	L3	5	-4	SH		p
<i>Ilex verticillata</i>	winterberry	2	4	4	5	15	L3	5	-4	SH		p
<i>Physocarpus opulifolius</i>	ninebark	3	2	5	4	14	L3	5	-2	SH		p
<i>Picea glauca</i>	white spruce	1	5	4	4	14	L3	6	3	TR	p	p
<i>Salix lucida</i>	shining willow	2	4	5	3	14	L3	5	-4	SH	p	p
<i>Acer rubrum</i>	red maple	1	4	1	5	11	L4	4	0	TR		p
<i>Acer saccharinum</i>	silver maple	1	2	5	3	11	L4	5	-3	TR	p	p
<i>Acer</i> x <i>freemanii</i>	hybrid swamp maple	2	3	5	2	12	L4	5	-4	TR		p
<i>Amelanchier arborea</i>	downy serviceberry	2	2	4	3	11	L4	5	3	SH	p(cf)	
<i>Carex retrorsa</i>	retrorse sedge	1	3	3	4	11	L4	5	5	SE	p	
<i>Juniperus virginiana</i>	red cedar	2	2	4	3	11	L4	4	3	TR		p
<i>Pinus strobus</i>	white pine	1	4	3	4	12	L4	4	3	TR	p	p
<i>Quercus macrocarpa</i>	bur oak	1	4	3	3	11	L4	5	1	TR		p
<i>Salix discolor</i>	pussy willow	1	3	4	3	11	L4	3	-3	SH	p	
<i>Schoenoplectus pungens</i> var. <i>pungens</i>	three-square	3	2	5	3	13	L4	6	-5	SE		p
<i>Thuja occidentalis</i>	white cedar	1	4	1	5	11	L4	4	-3	TR	p	p
<i>Cornus foemina</i> ssp. <i>racemosa</i>	grey dogwood	2	2	3	2	9	L5	2	-2	SH		p
<i>Populus deltoides</i>	cottonwood	1	1	4	1	7	L5	4	-1	TR	p	x
<i>Populus tremuloides</i>	trembling aspen	1	3	1	3	8	L5	2	0	TR	p	x
<i>Rhus typhina</i>	staghorn sumach	1	1	2	2	6	L5	1	5	SH	p	x
<i>Prunus pumila</i> var. <i>pumila</i>	sand cherry	5	0	5	0	10	L+?	10	5	SH	p	
<i>Picea abies</i>	Norway spruce	3	0	0	0	3	L+		5	TR	p	p
<i>Salix caprea</i>	goat willow	4	0	0	0	4	L+		-3	SH	p	
Total # of species in Indian Line (2007, 2014)		246	100%									
Extant native species (including planted)		119	48%									
Exotic species (extant and planted)		127	52%									
L1 to L3 native species (including planted)		11	4%									
L4 native species (including planted)		23	9%									
L5 native species (including planted)		85	35%									

Appendix 3: List of fauna Observations for Indian Line Study Area, 2005 to 2014.

Common Name	Scientific Name	Code	count	LO	PTn	PTt	AS	PIS	StD	HD	+	TS	L-Rank
Survey Species: species for which the TRCA protocol effectively surveys.													
Birds													
American redstart	<i>Setophaga ruticilla</i>	AMRE	1	0	3	2	3	1	4	2	0	15	L3
American woodcock	<i>Scolopax minor</i>	AMWO	2	0	2	2	3	2	4	2	0	15	L3
brown thrasher	<i>Toxostoma rufum</i>	BRTH	1(2007)	0	4	3	2	2	4	1	0	16	L3
eastern kingbird	<i>Tyrannus tyrannus</i>	EAKI	2	0	4	2	2	1	3	1	0	13	L4
grey catbird	<i>Dumetella carolinensis</i>	GRCA	9	0	3	2	1	1	3	1	0	11	L4
northern flicker	<i>Colaptes auratus</i>	NOFL	1 (2007)	0	4	2	1	1	3	2	0	13	L4
northern rough-winged swallow	<i>Stelgidopteryx serripennis</i>	NRWS	2	0	3	2	1	1	2	3	0	12	L4
red-eyed vireo	<i>Vireo olivaceus</i>	REVI	1	0	1	2	2	1	3	1	0	10	L4
spotted sandpiper	<i>Actitis macularia</i>	SPSA	3	0	3	2	1	2	4	1	0	13	L4
tree swallow	<i>Tachycineta bicolor</i>	TRES	3	0	4	2	1	1	2	2	0	12	L4
willow flycatcher	<i>Empidonax traillii</i>	WIFL	6	0	4	2	1	1	3	1	0	12	L4
American goldfinch	<i>Carduelis tristis</i>	AMGO	x	0	3	2	1	1	1	0	0	8	L5
American robin	<i>Turdus migratorius</i>	AMRO	x	0	1	2	1	1	1	0	0	6	L5
Baltimore oriole	<i>Icterus galbula</i>	BAOR	x	0	4	2	1	1	1	0	0	9	L5
black-capped chickadee	<i>Parus atricapillus</i>	BCCH	x	0	1	2	1	1	1	0	0	6	L5
blue jay	<i>Cyanocitta cristata</i>	BLJA	x	0	3	2	1	1	1	0	0	8	L5
brown-headed cowbird	<i>Molothrus ater</i>	BHCO	x	0	3	2	1	1	1	0	0	8	L5
Canada goose	<i>Branta canadensis</i>	CANG	x	0	0	2	1	2	0	1	0	6	L5
cedar waxwing	<i>Bombycilla cedrorum</i>	CEDW	x	0	1	2	1	1	1	0	0	6	L5
chipping sparrow	<i>Spizella passerina</i>	CHSP	x	0	3	2	1	1	2	0	0	9	L5
cliff swallow	<i>Petrochelidon pyrrhonota</i>	CLSW	colony	1	1	2	1	1	1	2	0	9	L5
common grackle	<i>Quiscalus quiscula</i>	COGR	x	0	4	2	1	1	1	0	0	9	L5
eastern phoebe	<i>Sayornis phoebe</i>	EAPH	x	0	1	2	1	1	1	2	0	8	L5
house wren	<i>Troglodytes aedon</i>	HOWR	x	0	1	2	1	2	1	1	0	8	L5
killdeer	<i>Charadrius vociferus</i>	KILL	x	0	2	2	1	2	2	0	0	9	L5
mallard	<i>Anas platyrhynchos</i>	MALL	x	0	1	2	1	2	1	0	0	7	L5
mourning dove	<i>Zenaida macroura</i>	MODO	x	0	3	2	1	1	0	0	0	7	L5
northern cardinal	<i>Cardinalis cardinalis</i>	NOCA	x	0	1	2	1	1	2	1	0	8	L5
northern mockingbird	<i>Mimus polyglottos</i>	NOMO	2	0	3	2	1	1	1	1	0	9	L5
orchard oriole	<i>Icterus spurius</i>	OROR	3	0	3	1	1	1	1	0	0	7	L5
red-tailed hawk	<i>Buteo jamaicensis</i>	RTHA	x	0	2	2	2	1	1	1	0	9	L5
red-winged blackbird	<i>Agelaius phoeniceus</i>	RWBL	x	0	3	2	1	1	2	0	0	9	L5
song sparrow	<i>Melospiza melodia</i>	SOSP	x	0	3	2	1	1	2	0	0	9	L5

Appendix 3: List of fauna Observations for Indian Line Study Area, 2005 to 2014.

Common Name	Scientific Name	Code	count	LO	PTn	PTt	AS	PIS	StD	HD	+	TS	L-Rank
warbling vireo	<i>Vireo gilvus</i>	WAVI	x	0	1	2	1	1	2	1	0	8	L5
yellow warbler	<i>Setophaga petechia</i>	YWAR	x	0	3	2	1	1	2	0	0	9	L5
European starling	<i>Sturnus vulgaris</i>	EUST	x		4								L+
house sparrow	<i>Passer domesticus</i>	HOSP	x		4								L+
rock dove	<i>Columba livia</i>	ROPI	x		4								L+
Herpetofauna													
western chorus frog	<i>Pseudacris triseriata</i>	MICF	1	3	3	3	2	4	5	3	1	24	L2
northern leopard frog	<i>Lithobates pipiens</i>	LEFR	1	0	3	2	1	4	5	2	1	18	L3
Incidental Species: species that are reported on as incidental to the TRCA protocol.													
Mammals													
eastern cottontail	<i>Sylvilagus floridanus</i>	EACO	1(2007)	0	2	2	1	3	2	1	0	11	L4
white-tailed deer	<i>Odocoileus virginianus</i>	WTDE	2	0	2	1	3	2	1	2	0	11	L4
grey squirrel	<i>Sciurus carolinensis</i>	GRSQ	x	0	2	2	1	3	0	0	0	8	L5
striped skunk	<i>Mephitis mephitis</i>	STSK	x	1	2	2	1	3	0	0	0	9	L5
Herpetofauna													
common snapping turtle	<i>Chelydra serpentina serpentina</i>	SNTU	1(2007)	0	3	2	1	5	5	2	2	20	L2
LEGEND													
LO = local occurrence		PIS = Patch Isolation Sensitivity											
PTn = Continental population trend		STD = sensitivity to development											
PTt = TRCA population trend		+ = additional points											
HD = habitat dependence		TS = total score											
AS = area sensitivity		L-rank = TRCA Rank, October, 2008											