Draft Management Framework for Cruickston Park

Cambridge, Ontario

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Acknowledgements

The natural value of Cruickston Park's plant and animal species, its diverse habitats of alvar, cliffs, forests, fields and wetlands is a result of a long history of management that retained natural features within the landscape. We must be thankful for the presence of this natural legacy that remains in an area otherwise dominated by human activity.

Currently there is a study team with a range of skills committed to the continued conservation and restoration of the Cruickston Park estate. The persons listed below have contributed to the preparation of Draft Management Framework of Cruickston Park.

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Front Cover: View of Cruickston Park lands
Footer: Cruickston Park Logo from an original painting by Terry Black

Executive Summary

The Draft Management Framework for Cruickston Park is a guiding document that provides a long-term vision for the conservation, restoration and appreciation of the natural features of Cruickston Park, consistent with its long history of environmental protection. The vision statement for Cruickston Park is as follows:

> *To create a self-sustaining model of preservation, conservation and enhancement techniques which stimulates a general awareness of our natural heritage.*

To achieve this the Management Framework begins by outlining the many significant environmental features present both within Cruickston Park and in the adjoining natural areas connected to Cruickston. When considering that greater than 85% of the original pre-settlement vegetation has been lost from the Region of Waterloo (Riley 1999), it immediately becomes apparent that Cruickston Park represents a unique opportunity to protect a natural area that is large in size (391 ha), ecologically linked to other natural areas and potentially without roads.

Considering the principals of Conservation Biology (see Section 2.0 Ecological Principals and Human Development), Cruickston Park possesses the key ecological attributes essential to the long-term ecological health and integrity of natural areas. The Cruickston Park Management Plan is intended to provide the vision and supporting management actions necessary to achieve a true and meaningful example of what is coined "smart growth" consistent with the Shared Management Plan for the Grand River Watershed.

A Shared Management Plan For the Grand River Watershed

Since pioneer days Grand River valley communities have grown, flourished and profited from the availability of abundant water for drinking, transportation, agricultural and industrial growth, and waste removal. Population increases and urban growth place great pressure on our water resources. It is the responsibility of all who share these resources to ensure that they can be both used and preserved for future generations of valley residents.

www.grandriver.ca/Grandstrategy/grandstrategy.cfm

The landscape in which we live constitutes part of our heritage. The current settlement patterns, industry, and economies we enjoy have developed to a large degree in response to the opportunities that were presented by the natural environment that our predecessors encountered. The vegetation and animals that are indigenous to the area, along with the climate and landform, define the place in which we live. It is our responsibility to ensure that this heritage is preserved so that future generations will also have opportunities presented in the environment we leave for them. This includes not only the protection of rare and endangered species that we value, but also the habitats that are representative or typical of the local landscape. This is particularly true of the Cruickston Park located on the Grand River, a designated Canadian Heritage River.

Cruickston Park's goal is to protect significant habitats, plants and animals within an area of substantial human development. In order to achieve this goal management concerns and appropriate management actions have been identified and prioritised. The table below summarizes this information.

An outline of the current concerns, required actions and priorities for Cruickston Park (Priority ranking: 1 - begin action within one year; 2 - begin action within two to four years)

Concerns	**Actions**	**Priorities**
Develop an increased understanding of the natural environment	Inventory and mapping of all plant communities	1
	Study of surface and ground water hydrology	1
	Study of karst topography	1
	Ecological Monitoring	2
Control of Invasive Plants	Develop Invasive Plant Management plan, including: inventory, mapping, prioritising, and methods for invasive plants to control	1
Control of unregulated use of Cruickston Park	Development of a Trail Plan, including trail closures, trail construction, signage, education, and enforcement	1
Prevent and reverse the fragmentation of Cruickston Park	Inform CARSS of the negative impacts of proposed routes.	1
	Develop a Restoration Plan, including, goals, objectives, priority areas, and methods	2
	Begin dialogue to explore options for the closure of Blair Road	2
Monitor and control the white-tailed deer population	Develop a Deer Management Plan, including, population estimates, assessment of impacts, and recommended control methods	2
Inform the public and provide stewardship opportunities	Prepare materials to inform the public and create a structure for volunteer participation/stewardship	2
Facilitate research and education opportunities	Establish formal or informal partnerships with local universities, colleges, and schools	2

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1.0 INTRODUCTION

Cruickston Park is a large estate comprised of 391 hectares (966 acres), and is primarily located in the Township of North Dumfries, but with some land in the City of Cambridge placing the estate in close proximity to the expanding urban centers of Cambridge and the City of Kitchener. A diverse range of habitats is present within the estate lands, including forests, wetlands, cliffs, alvar (limestone plain), floodplain, creeks, the Grand and Speed Rivers, as well as agricultural lands and rural estate lands. As described below, significant natural areas dominated by high quality native vegetation are present within the estate. The long-term goal for Cruickston is to pursue a science-based restoration and conservation plan aimed at creating a large, contiguous natural area that will benefit both the surrounding natural areas linked to Cruickston and the public living in the urban-rural interface.

With greater than 85% of the original pre-settlement vegetation lost from the Region of Waterloo (Riley 1999), Cruickston Park represents a unique opportunity to protect a natural area that is large in size, ecologically linked to other natural areas and potentially without roads; *i.e.*, it possesses the key ecological attributes essential to long-term ecological health and integrity as discussed below (see Section 2.0 Ecological Principals and Human Development). The Cruickston Park Management Plan is intended to provide the vision and supporting management actions necessary to achieve a true and meaningful example of what is coined “smart growth”.

Figure 1 shows the extent of the Cruickston Park lands and the main landscape units. The property is currently divided by Blair Road, which separates the lowlands, alvar and cliffs from the upland fields and forests. The confluence of the Speed River, which flows south from Guelph and the Grand River, which flows in an easterly direction are important features because of the many associated significant natural areas located along the corridors of these rivers both upstream and downstream. The City of Cambridge, an expanding urban centre, is situated in close proximity to these large natural features.

The long-term goal that has been articulated for Cruickston Park is as follows:

> *To create a self-sustaining model of preservation, conservation and enhancement techniques, which stimulates a general awareness of our natural heritage.*

The primary objectives that stem from this goal are as follows:

- develop a management plan that addresses the protection needs of the many natural features present within Cruickston Park;
- develop a restoration plan to both increase the amount of natural vegetation cover present and enhance the natural features present;
- provide multiple public benefits from Cruickston Park, ranging from the provision of a serene natural area for public appreciation, to passive recreation, active stewardship of, and education about the natural environment; and
- provide research opportunities to make Cruickston Park a model of environmental protection and restoration in near-urban environments.

Figure 1. Main landscape units of Cruickston Park (Source GRCA black and white aerial photograph, spring 2000)

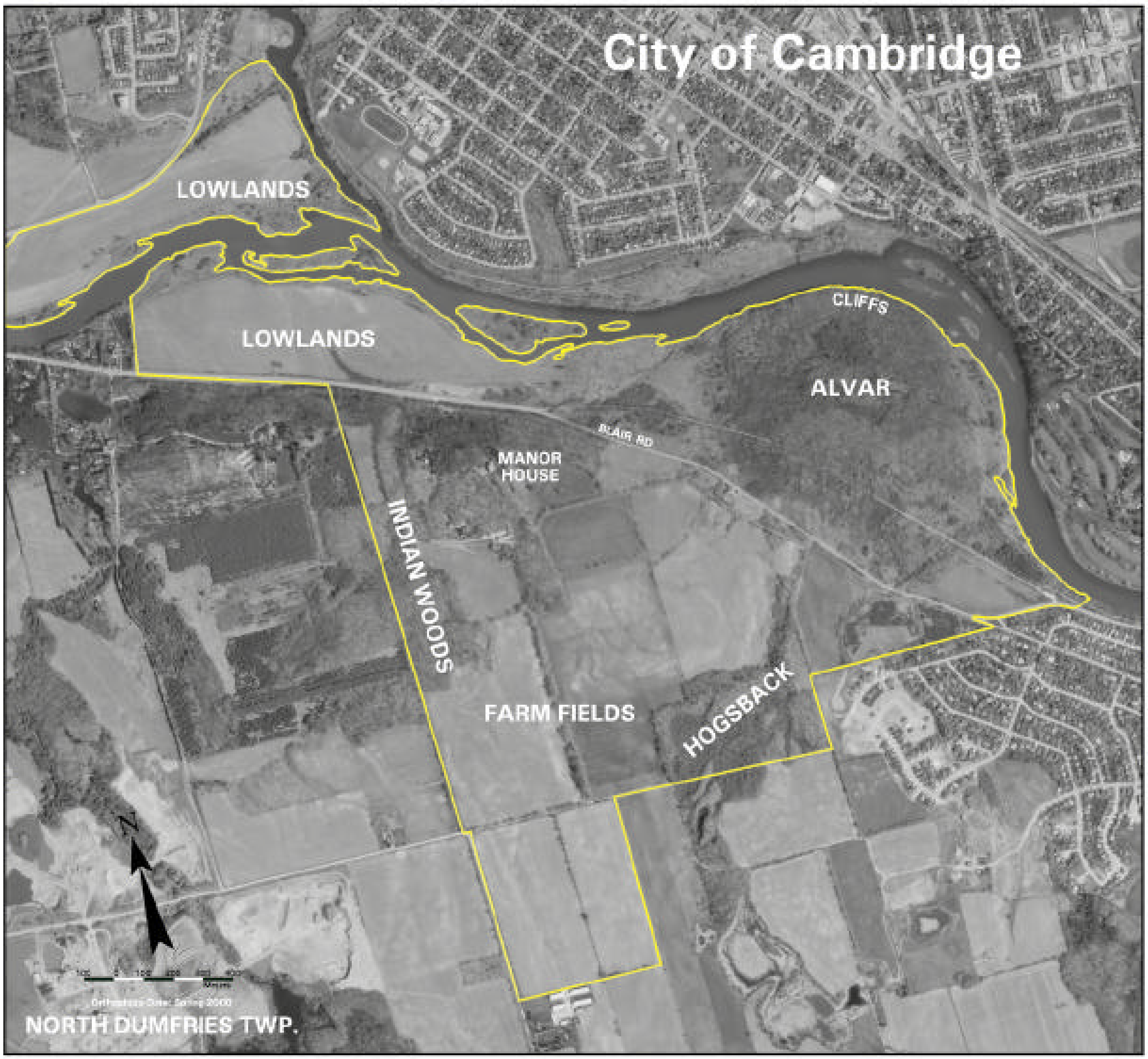


Figure 1: Main landscape units of Cruickston Park
(Source GRCA black and white aerial photograph, spring 2000)

1.1 History

The natural history of Cruickston Park goes back many thousands of years. The confluence of the Grand River and Speed River and the rich diversity of plant and animal life led aboriginal peoples to establish campsites and burial grounds on the river flats and a trail along what is now Blair Road. A large number of flint arrowheads, a tomahawk and a small oval grinding stone are some of the artifacts that have been unearthed. Early European contact occurred in the area in the late 1700s as transient fur traders moved ever further westward into unexplored areas. During this time the first settler to Cruickston was Nathaniel Dodge who purchased land and built a cabin on the property.

Cruickston Park, was established in 1858 by Matthew Wilks who acquired 81 ha (200 acres) of land and built onto a substantial residence that was already present. Additional lands were acquired during the late 1800s bringing the total area to its present 391 ha (966 acres). The farm became famous for breeding prize-winning horses while under the ownership of Katherine Langdon Wilks. After her death in 1948, her nephew Matthew Wilks Keefer modernized the farm operation and bred prize Hereford beef cattle. In 1968, Matthew gifted the estate to the University of Guelph, which took possession of it on his death in 1972. In 1996, the University sold the manor house and 21 ha (53 acres) of land to a young couple from Cambridge, Jan Chaplin and Mark Fretwurst. Jan and Mark later acquired the remaining 370 ha (913 acres) in the year 2000, with an intention to preserve the estate for future generations.

1.2 Special Environmental Designations within the Cruickston Park Area

Increasingly the science of conservation biology (see report section 2.0 Ecological Principals and Human Development) is revealing that the environmental value and health of natural areas is highest in landscapes where there are large core natural areas that are well connected by ecologically functional habitat corridors. Based on this science a review of the special environmental designations within the Cruickston Park area reveals many significant core natural areas but fewer functional habitat corridors.

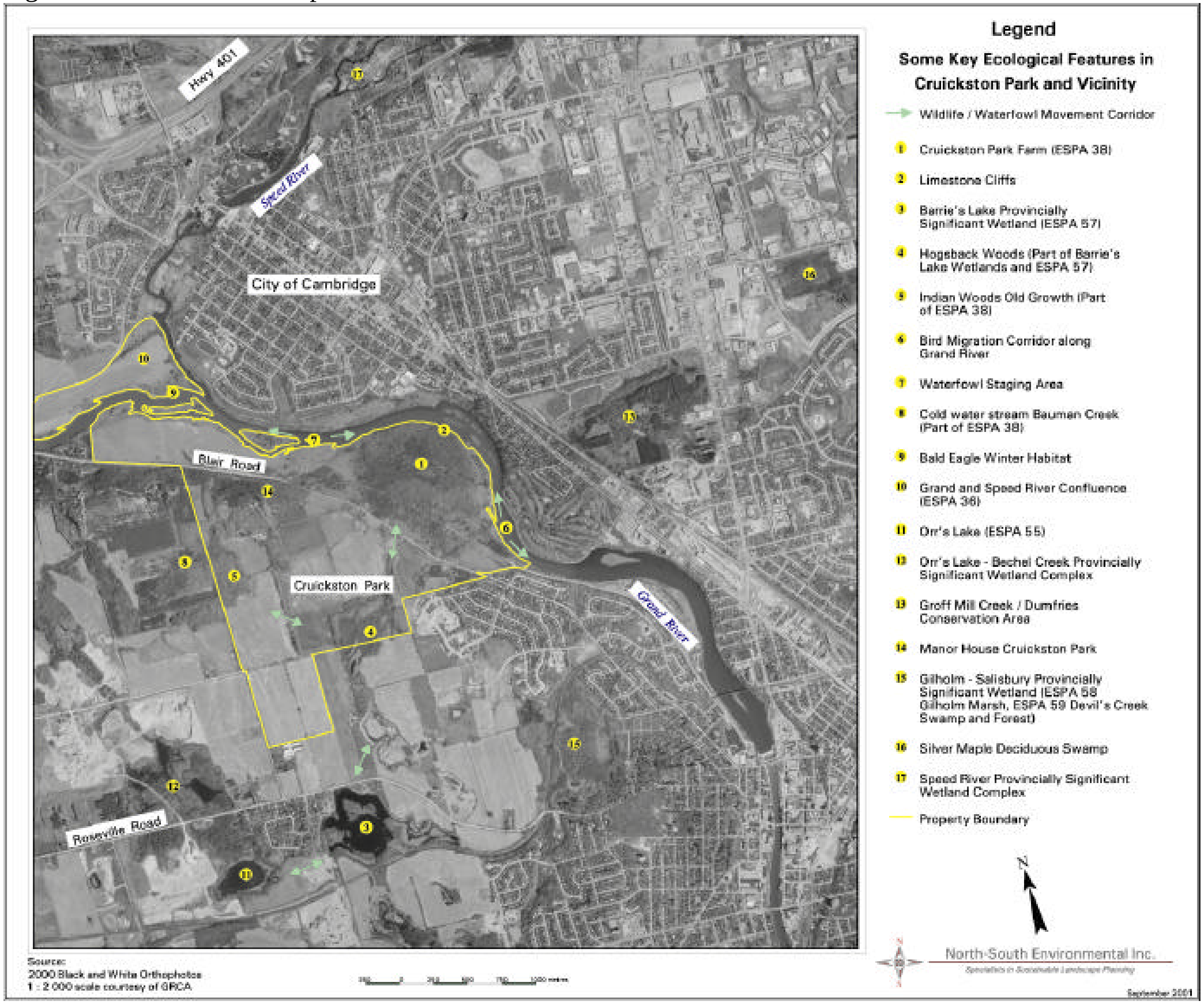
Figure 2, which is based on a 1:20,000 scale black and white aerial photograph taken in the spring of 2000, identifies fifteen natural areas with special environmental features based on provincial and/or municipal designations (Table 1). The Cruickston Park area presents numerous opportunities to both enhance core natural areas through restoration efforts aimed at increasing their overall size and integrity, and restoring functional habitat corridors to create landscape level connections between core natural areas (see report section 4.4 Restoration Plan)

In addition, to the significant areas identified in Figure 2, there are larger, regional connections and linkages that Cruickston Park contributes to. For example, east from Cruickston across the Grand River is a connection to Dumfries Conservation Area through the green space provided by the Galt Country Club. Dumfries Conservation Area, in turn, can be seen to contribute to a yet another connection through an existing green corridor that extends further eastwards to Puslinch Lake. Regional connections at this scale provide the type of environmental integrity spoken of in current literature about conservation biology (see report section 2.0).

Table 1: Provincial and municipal designations for environmental features in the Cruickston Park area (Location numbers are identified on Figure 2, * indicates feature is within Cruickston Park)

Provincial/Municipal Designation	Name of Environmental Feature	Location
Ontario Ministry of Natural Resources --		
Four Provincially Significant Wetlands	Barrie's Lake Wetland Complex*	3
	Orr's Lake - Bechtel Creek Complex	12
	Gilholm - Salisbury Wetland	15
	Speed River Wetland Complex	17
Evaluated Wetland	Bauman Creek Wetland*	8
Deer Wintering Areas	Bauman Creek, Cliffs/Alvar and Hogsback in Cruickston Park*	8,1,4
Waterfowl Staging or Wintering	Grand River Corridor*	6,7
Endangered Species	Bald Eagle wintering habitat in Grand River Corridor*	9
Locally Significant Biological Area for Animals	Cruickston Park Lands*	1,2,4,5
Regional Municipality of Waterloo --		
ESPA #36	Confluence of Speed and Grand Rivers including areas within and outside Cruickston Park*	10
ESPA #38	Cruickston Park Farm*	1,5
ESPA #55	Orr's Lake	11
ESPA #57	Barrie's Lake*	3
ESPA #58	Gilholm Marsh	15
ESPA #59	Devil's Creek Swamp and Forest	15

Figure 2. Natural areas with special environmental features in the Cruickston Park area



1.3 Cruickston Park Landscape

At a broad scale Cruickston Park is made up of six principal landscapes (see Figure 1). A brief description and long-term vision is provided for each of these landscapes below.

1.3.1 Lowlands

The Lowlands comprise a flat and open landscape at the confluence of the Grand and Speed Rivers. Bounded by Blair Road and Fountain Street to the south and west, much of this 114 ha (282 acres) area is presently farmed. The natural areas along the watercourses are an important migration stopover and wintering area for waterfowl, including the following species, Common Merganser, American Black Duck, Common Goldeneye, Mallard And Canada Goose. A total of 25 species of waterfowl have been recorded in this area within ESPA 36 (Wilson 1995, Wilson 2001b). The river also provides winter foraging habitat for Bald Eagles, an endangered species in Ontario. Magnificent hackberry and oaks are found along the remnant field edges as well as crack willow, Manitoba maple, hawthorn, elm and wild grape along the river edges.

Vision for the Lowlands:
The vision for the Lowlands is to enrich the landscape as waterfowl habitat. Agriculture will be phased out and the fields converted to open meadows, floodplain forests and wetlands indigenous to the Grand River corridor. The existing wetlands along Bauman Creek will be restored. To minimize disturbance to the waterfowl and songbird habitat, forested buffer strips along the existing road edges will be planted and will include intermittent boardwalks and viewing stations for the public. Restoration and enhancement will also improve and create habitat for fish, amphibians, reptiles and insects such as butterflies and dragonflies. Both of these insect groups are receiving considerably more attention from naturalists and subsequently are important to monitoring habitat quality and in environmental education. The result will be a vibrant floodplain landscape, both as a protected enclave and as a contiguous part of the broader Grand Valley ecosystem.

1.3.2 Cliffs and Alvar

The Cliffs and Alvar habitat is a 77 ha (191 acres) landscape of remarkable beauty and diversity. It is a smooth to deeply cavitated, dolomitic limestone plain or alvar that culminates in the rare limestone cliffs along the south edge of the Grand River, from which there are panoramic views of the valley. The limestone (dolostone) cliffs and alvar represent one of the most restricted habitats within the Region of Waterloo due the unique geology and associated rare plants. The landscape diversity includes native forests of bur oak, black maple, hackberry and American beech, with columbine and many different ferns; hawthorn savanna of elm, dogwood,

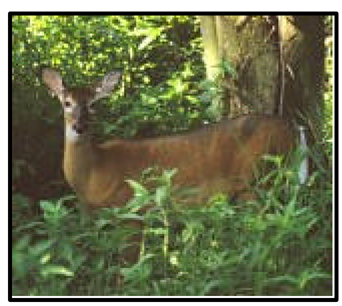
viburnums, and prickly ash; and a riparian edge landscape of white cedar and eastern hemlock. Collectively, these communities provide a rich habitat for many animals, including White-Tailed Deer, Mink, and Muskrat as well as breeding birds such as Cooper's Hawk, Eastern Wood Peewee And Scarlet Tanager. An abandoned Grand Trunk rail line, converted to the Walter Bean Trail, traverses the southern edge of this area. Open to the public, the trail is maintained by the City of Cambridge.

Vision for the Cliffs and Alvar:
The vision for the Cliffs is to enhance public access, understanding and enjoyment of the remarkable natural diversity and beauty of the landscape. This will also require vigilant restoration and protection of the fragile limestone plain ecosystem. Additional public trails will

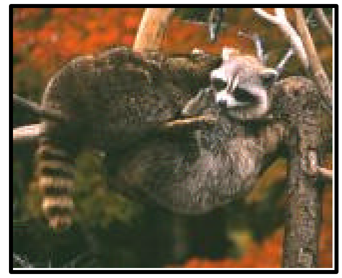
be carefully located, built and coordinated with the Walter Bean Trail. In areas adjacent to the Alvar landscape a site for an alternative elementary school for the study of nature may be established. A rare stone barn on the north side of Blair Road may be converted to an interpretive centre. The centre will feature the natural wildlife of Cruickston Park as well as the archaeological remains of the aboriginal presence that dates back over 5,000 years. It will be open to the public.

1.3.3 Hogsback

The Hogsback landscape comprises 41 ha (100 acres) on the southeast side of the estate. Its name comes from the characteristic series of ridges that form linear islands of upland similar to a bristly "hog's back" separated by wetland troughs. The Hogsback has a remarkably rich ecology from boggy wetland to mature upland woodland. Through the wetland flows the Cruickston Creek, which provides habitat for frogs, damselflies, Rose-Breasted Grosbeaks and Northern Waterthrush in a habitat of ferns, orchids, skunk cabbage and violets. In the upland



woodland, there are spectacular stands of white oak, sugar maple, American beech, bitternut and shagbark hickory. Numerous birds frequent this landscape, including the Wild Turkey, Great Horned Owl, and Pileated Woodpecker. An 8 ha (20 acres) white pine plantation has been established to the east. This plantation is broken up by a number of small meadows. Green ash and white spruce have also been planted within the white pine. The pine and ash are more or less in concentric circles with the spruce on the top of the hill.



Vision for the Hogsback:
The vision for the Hogsback is to protect and enhance the biodiversity of the wetlands, consolidate and extend the upland woods to nearby marginal farmlands and diversify the white pine plantation with native species. The result will be an intensely rich diversity of flora and fauna connected to the larger estate by other restored natural areas.

1.3.4 Indian Woods

The locally named Indian Woods is a rare and old, very selectively cut, old growth forest and remnant and mixed swamp woods adjacent to the Manor House. In this forest may be found a magnificent display of very large and very old trees, many aged at over 200 years old with one red oak dated at 232 years of age. Species include red and white oak, white ash, white pine, hop hornbeam, shagbark hickory, bitternut hickory and basswood. Shrubs include spicebush and leatherwood. The understorey consists of bloodroot, May-apple, shinleaf and red and white trilliums. This is a rich habitat for many forest birds. There are a number of breeding cavity nesters and species dependent upon dead snags and windfalls - two important components of old growth forest. Such birds would include five species of woodpecker (including Red-Bellied Woodpecker), Wood Duck, Eastern Screech-owl, Great-crested Flycatcher, Black-capped Chickadee, Brown Creeper And Winter Wren. Indian Woods also provides interior forest habitat for area-sensitive forest birds such as, Scarlet Tanager, Brown Creeper, Red-Eyed Vireo, Eastern Wood Pewee, Ovenbird And Winter Wrens. The coldwater Bauman Creek is also home to Brook Trout. To stand in the quiet of this old forest is to experience the sublime grandeur of primal nature.

Vision for Indian Woods:
The vision is to protect and preserve the old forest and to provide limited access for research and educational purposes. Preservation will include the preparation of a forest management plan that identifies the age, size, health and care of all trees. Dead, doddered and downed trees will be left to decompose naturally and build forest soils. To protect the undergrowth, a carefully located woodland trail will be built for educational visits. Interpretive signage will be located at significant locations

1.3.5 Farm Fields

The Farm Fields comprise 85 ha (210 acres) of largely open land traversed by a number of old established tree-lined lanes and hedgerows. The topography slopes down to Blair Road on the north side, producing a range of micro-climates and soils. Spectacular views of the Grand River valley and countryside beyond are experienced from the high points of the fields. Birds that are breeding along the farm field hedgerows give an indication of the potential should hedgerows be increased in number and size. These birds include the Brown Thrasher, Vesper Sparrow, And Eastern Bluebird as well as a good variety of bird species that use the hedgerows during migration and as winter habitat. Crops grown in the farm fields include corn, soybean, hay and cereals.

Vision for Farm Fields:

The vision for the Farm Fields landscape is to identify areas for restoration and to retain some areas to establish a cultivated and orchard landscape based on organic farm practices. Such practices will serve as a model of farm practices complementary to the ecological health of the area. Farm practices could include reduced tillage, nutrient management and reduced use of synthetic fertilizers and pesticides, and the establishment of field hedgerows reducing field size and providing buffers. Restoration will identify areas to serve as functional ecological corridors linking larger habitat nodes.

2.0 ECOLOGICAL PRINCIPALS AND HUMAN DEVELOPMENT

The principals of conservation biology that have emerged over the past twenty years are in direct response to efforts aimed at the long-term conservation of natural areas within landscapes containing high levels of human activity. The reason for the interest in conservation biology is the fact that many of the natural areas that have been set aside for the protection of native plants and animals are showing a decline in the presence and/or quality of the natural attributes that were originally present. The science of conservation biology has provided insights into why some of these declines occur and what efforts can be made to stop and/or reverse the trends observed.

Below is a discussion of three focus areas in conservation biology; Maintaining Biological Diversity, Habitat Fragmentation and the Role of Corridors and Linkages.

2.1 Primacy of Maintaining Biological Diversity

One of the principal aims of conservation biologists is the preservation or improvement of the biological diversity of the planet. The exponential growth of human populations has, and continues to place huge stresses on the natural environment as the demand for human livelihoods, food, transportation, and recreation increases. This is exacerbated by the affluent lifestyle of residents in the northern hemisphere, who consume a disproportionate amount of resources, with negative consequences for habitat conservation both in the northern and southern hemispheres. All of this adds up to what has been labeled the sixth great global extinction, as species are currently disappearing at up to one thousand times higher than normal on a global scale (Leakey and Lewin 1996, Primack 1998).

The loss of species is a global phenomenon. Although the loss is not evenly distributed across the globe, it is ubiquitous and results from the incremental conversion of predominantly natural habitat to human-dominated lands that support fewer species of plants and animals. Thus the loss of biodiversity is not something that is happening "somewhere else", it is an issue in our own backyards. Habitat conversion is most evident within the urban environments of southern Ontario where in many cities less than seven percent of the landscape supports any form of native ecosystem (City of Mississauga Natural Areas Report - North-South Environmental 2000).

Beyond the issue of the global loss of species, there is also an issue of local responsibility. The landscape in which we live constitutes part of our heritage. The current settlement patterns, industry,

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www.grandriver.ca/Grandstrategy/grandstrategy.cfm and economies we enjoy have developed to a large degree in response to the opportunities that were presented by the natural environment that our predecessors encountered. The vegetation and animals that are indigenous to the area, along with the climate and landform, define the place in which we live. It is our responsibility to ensure that this heritage is preserved so that future generations will also have opportunities presented in the environment we leave for them. This includes not only the protection of rare and endangered species that we value, but also the habitats that are representative or typical of the local landscape. This is particularly true of the Grand River, a designated Canadian Heritage River.

The Grand River - A Canadian Heritage River
Grand River at Kitchener (Doon) - our past and our future.
Photograph courtesy of Donald Thomas of Cambridge

With a large number of plant and animal species inhabiting a diverse range of habitats, Cruickston Park represents a unique site of high biodiversity within a region of intense human development. Within the region biodiversity continues to be threatened as the total area of available habitat declines and the remaining habitats that support biodiversity become further fragmented, isolated from one another and degraded due to onsite impacts such as trails, logging, and grazing, *etc.* and offsite impacts such as invasive plants, competition from "edge species", and the effects of pollution, *etc.* With careful management and restoration Cruickston Park can provide for the long-term protection of its plants and animals and provide an opportunity to further enhance local biodiversity.

John Riley of the Nature Conservancy of Canada states….
"We hope that communities begin to recognize that they have almost no examples of woodlands, large or small, that come close to the woodlands experienced by settlers and native peoples. This is a heritage issue and, for those of you who have visited some of the magnificent old growth upland forests elsewhere in the Great Lakes basin, it is not too much of a stretch to suggest that we should invest in some of our best woodlands now, with a goal to growing great old-growth forests for future generations."

2.2 Habitat Fragmentation

From an ecological perspective, the change in land use in southern Ontario since the beginning of European settlement can be characterized as a fragmentation of natural habitat. The large-scale conversion of the pre-settlement landscape first to agricultural, and then urban and industrial land uses has been ongoing for 200 years and continues today. Often, the current issue of land use change involves the conversion of agricultural land to urban land uses, usually for residential or employment uses. Noss and Cooperrider (1994, citing Burgess and Sharpe 1981, Noss 1983, 1987a, Harris 1984, Wilcox and Murphy 1985) notes that habitat fragmentation is the greatest threat to biodiversity worldwide.

Numerous studies, including research in the Region of Waterloo (*e.g.*, Friesen *et al.* 1995, and Friesen 1995) and several other studies in Ontario (*e.g.*, Burke and Nol 1998, Villard *et al.* 1999), or including Ontario studies (Trombulak and Frissell 2000), have documented the negative effects of fragmentation on natural areas. These impacts include:

- loss of habitat for native species;
- macro and micro climate alterations;
- hydrologic disruptions, including lower water tables;
- reduction in the size of remnant habitat patches;
- increases in the distance between remnant habitat patches;
- increase in the amount of habitat associated with "edges" and concurrent decrease in habitat associated with large unbroken patches (*e.g.*, interior forest);
- impact on the ability of vegetation and flora to migrate in response to climate change;
- decreases in the availability of breeding sites and food;
- where fragmentation is associated with new roads, increases in mortality for some species, and reduction in mobility for some species;
- the inability to re-populate sites following local extinction;
- reduced viability of animals requiring migration to move between sites to complete life cycle requirements; and
- reduction in the exchange of genetic material to prevent deleterious impacts associated with in-breeding in isolated gene pools.

Several of these impacts relate to **functional** attributes of the natural landscape (*e.g.*, species movement requirements for migration, dispersal, re-colonization, genetic mixing, *etc.*). Such impacts are often overlooked in impact assessments in favour of focusing on impacts related to **structural** attributes of the environment (*e.g.*, woodlands, wetlands, individual species). It is much easier to suggest mitigation or design that avoids particular structural elements in the landscape; however, this ignores the vital role functional attributes make to ecosystem integrity and the long-term protection of biodiversity.

It is <u>critical</u> that evaluations of proposed land use changes consider both structure and function, at a range of biological scales ranging from genetic, to species, communities and landscape, as well as a range of geographic and temporal scales to fully appreciate the qualities that characterize integral, dynamic ecosystems resilient to internal and external forces.

Bird Studies Canada (BSC) has demonstrated the impact of forest fragmentation on biodiversity within woodlots that are relatively close to each other and within the region of Cruickston Park in southern Ontario (www.bsc-eoc.org/organization/giswork.html). The figures below show a substantial (35%) reduction in the number of species of breeding birds as the total forest cover and more importantly interior forest cover declines.

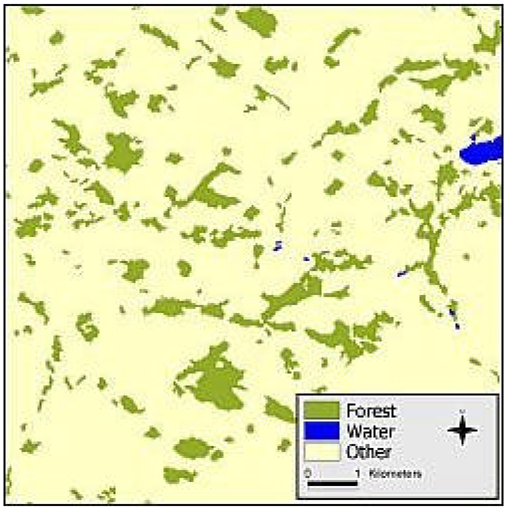

Figure 3

A landscape with a low to moderate degree of forest cover and moderate fragmentation, located near Guelph. This landscape is approximately 13% (1287 ha) forested, with 11% (142 ha) of its forests considered "forest interior" habitat. During the OBBA, a total of 77 different species of birds were identified as probable or confirmed breeders in this UTM square, with an additional 7 species classified as possible breeders.

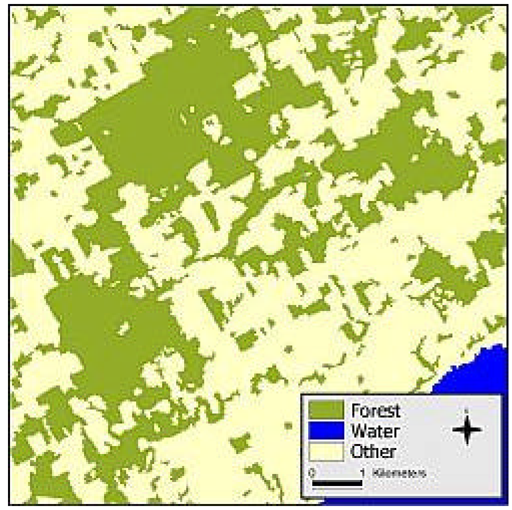

Figure 4

A landscape with a high degree of forest cover and low fragmentation, located near Long Point. This landscape is approximately 38% (3812 ha) forested, with 45% (1712 ha) of its forests considered "forest interior" habitat. During the OBBA, a total of 107 different species of birds were identified as probable or confirmed breeders in this UTM square, with an additional 23 classified as possible breeders.

Cruickston Park is located in a region characterized by low forest cover and a moderate degree of forest fragmentation as shown in Figure 3. Given the large size (391 ha) of Cruickston Park and its connection to other natural areas (see Figure 2) the protection and restoration of Cruickston Park represents an outstanding opportunity to reverse the structural and functional fragmentation that leads to species decline - provided that Cruickston it is not subjected to further urban pressures such as road expansion (*e.g.*, Blair Road) or road construction (*e.g.*, CARSS).

2.3 Role of Corridors and Linkages

The idea that connections between patches of remnant habitat be maintained as a conservation strategy, is a logical extension of the tenets of island biogeography (MacArthur and Wilson 1967), as proposed in the early seventies by Wilson and Willis (1975). The importance of connections in terrestrial landscapes is predicated on the species equilibrium theory, which is based on studies in marine environments with scattered islands. These studies have shown that species extinctions (*i.e.*, declining biodiversity) and species immigration (*i.e.*, increasing biodiversity) on each of the islands will, over time, reach equilibrium. Based on this theory, islands that are closer together experience higher immigration of new species from neighbouring islands and high biodiversity, while widely spaced islands have lower rates of immigration and low diversity. By extension this theory applies to developed landscapes such those found in southern Ontario, where habitat "islands" with good connections result in high biodiversity and habitat "islands" with poor connections result in low biodiversity.

In an island environment this species equilibrium theory proved correct. Studies in terrestrial environments though similar can be more complex. While remnant patches of natural habitat may be analogous to true islands in some ways, there can be substantial differences in the quality of the intervening landscape. In some cases the intervening terrestrial landscape may not impose the near absolute barrier to migration as would large water bodies to island residents. For example, many (but not all) animal species can move between habitat patches when the intervening landscape consists of agricultural lands. Consideration of the intervening lands, referred to as the landscape "matrix", is therefore an important factor to consider when evaluating the **functional** attributes of a landscape. Some of the issues that need attention include the following:

- the existing complement of species in a given area and a knowledge of their movement abilities and behaviour;
- the quality of the landscape matrix, is the landscape matrix acting as source for predators, parasites and disease that enter 'islands' of native habitat through corridors and edges;
- the degree to which the existing matrix imposes a complete or partial barrier, or no barrier to the resident vegetation and animals;
- the long-term viability of resident plant and animal species that will be substantially or completely isolated (confined) in a habitat 'island' due to a change in land use;
- how proposed changes to the existing land use will impact on the existing ability of animals and vegetation to disperse and/or move among remnant patches; and
- the existence and importance of linkages beyond the immediate study area to the larger landscape through regional connections (*e.g.*, south-central/southwestern Ontario).

It should be emphasized that a landscape composed of remnant patches of natural habitat in an agricultural and/or urban matrix is far from ideal and it is not a desirable conservation end point. Not only will there be numerable species for which the matrix is a barrier or partial barrier, there will also be undesirable species present in the agricultural/urban matrix whose spread and impact on natural habitat will be facilitated. Many of the non-native, invasive weeds that impact our native vegetation and reduce biodiversity evolved in the predominantly agrarian ecosystems of Europe and Asia. These species are highly adapted to the disturbance cycles associated with agricultural practice as well as the edge habitats that prevail in small remnants typical of agricultural landscapes. These species will disperse readily through these landscapes and establish in remnant natural areas, generally with negative consequences.

Corridors act to increase the frequency of immigration. Thus, in a typical southern Ontario landscape where fragmentation has resulted in small islands of remnant habitat and the movement of animals is impeded, the establishment of corridors is likely beneficial. The role of corridors as agents of re-colonization has been termed the *rescue effect* by Brown and Kodric-Brown (1977). Specifically, corridors play an indispensible role in mitigating the impacts of habitat fragmentation. Connections can facilitate the re-population of areas subject to local extinctions of particular species, they can facilitate the dispersal of young to new habitats in the post-breeding season and will provide the connections to allow certain species to fulfill lifecycle requirements such as feeding and breeding. They can also provide for the less frequent movement of individual animals among populations that is necessary for maintaining genetic health at the population level. Corridors function for vegetation as well as animals.

Survival of Fragmented Woodland Systems in Southern Ontario
By Gray Merriam in FON (1999)

Consider a ten acre farm woodlot surrounded by cultivate fields in all directions for five kilometres. Now consider some species that require woodland habitat, for example, ruffed grouse, red-backed salamanders, chipmunks, trout lily, and round-lobed hepatica trying to survive in fragmented woodlands.

How can these species survive in the woodlot that we have visualized? What are the main problems in their struggle for survival? First, in small woodlots, numbers in a population will be small. With small numbers, the chance that all the individuals will be lost at once is remarkably high. So, sometime soon, all the individuals, or all those of one sex, will die and the woodlot will have suffered a 'local extinction'. The populations in the wooded fragments can 'blink off', like little lights on a computer game. For the population to survive it must be able to 'blink on' again.

Because the woodlot is surrounded by cropland which can be threatening and hazardous to woodland species, immigration of new colonists to replace the lost species will be constrained - more so for trout lilies and red-backed salamanders than for ruffed grouse and chipmunks.

Unless individuals of the lost species can immigrate from other patches of woodlands, our one woodlot will not be re-colonized. If this process repeats itself in additional woodlots without re-colonization, the 'local extinction' will spread and become regional.

Dr. Gray Merriam, a world leader in Conservation Biology research on the effects of forest fragmentation, recently retired from the Carleton University in Ottawa.

Many plants disperse their seeds through animal vectors (*e.g.*, forest ants disperse the seeds of trilliums found in Ontario woodlands), thus linkages are needed for the animals to carry seeds to new environments. Other plants may spread by the incremental establishment of seedlings just metres away from the parent plant. For such species to spread, there needs to be an unbroken connection of suitable habitat. If the plant is one which requires interior forest to establish (*e.g.*, American beech), the connection must have continuous interior forest habitat.

Notwithstanding the intuitive appeal of establishing corridors as a conservation strategy, some researchers (Simberloff and Cox 1987, Soulé and Gilpin 1991) have noted potential negative impacts associated with corridors. Both the potential advantages and disadvantages of corridors listed below (based primarily on Noss 1987) should be considered in an overall conservation framework.

<u>Potential Advantages of Corridors</u>

- Increase in immigration rates, which could:
  a) increase or maintain species richness and diversity,
  b) increase population sizes of particular species and thus reduce probability of extinction,
  c) prevent in-breeding depression and maintain genetic variation within populations;
- Provide increased foraging area for wide-ranging species whose food requirements cannot be met within a single remnant patch;
- Provide predator escape cover for movements between patches;
- Provide a mixture of habitats and successional stages for species that require a variety of habitats for different stages or activities in their life cycles;
- Provide alternative refugia from large disturbances (*e.g.*, wind damage, fire);
- Provide greenbelts to limit urban sprawl, abate pollution, provide recreation opportunities and enhance scenery and land values;
- Trap wind-borne soil particles thus attenuating soil erosion; and
- Trap wind-borne seeds thus establishing vegetation cover.

<u>Potential Disadvantages of Corridors</u>

- Increase the immigration rates, which could:
  a) decrease the level of genetic variation among populations through genetic swamping,
  b) disrupt local adaptations and co-adapted gene complexes (outbreeding depression),
  c) promote hybridization between species with possible negative repercussions for rare species;
- Facilitate the spread of undesirable, non-native species of plants and animals to less disturbed habitats;
- the presence of 'blind alleys', *i.e.*, corridors that end abruptly;
- Facilitate the spread of diseases among core areas;
- Facilitate the spread of fire and other abiotic disturbances;
- Increase exposure to predators, including hunters and poachers; and
- Cost and conflicts with conventional land preservation strategies to preserve remnant habitats and/or rare and endangered species habitat.

While these advantages and disadvantages apply to varying degrees in Ontario, **it is widely recognized that most existing natural areas in southern Ontario are too small to maintain natural ecological processes and populations of species over the long term**. In light of this, the incorporation of corridors in conservation strategies, as a means of facilitating movement of biota among remnant areas, is considered highly desirable. While conservation strategies should be cognizant of the disadvantages of corridors reported in the literature, these are by far outweighed by the advantages that mitigate the impacts of fragmentation.

Conservation biologists throughout North America are therefore designing bioregional conservation plans that utilize corridors and linkages to restore connections among habitat fragments (*e.g.*, "Y2Y" - Yellowstone to Yukon Conservation Initiative; Crown of the Continent Ecosystem; The Wildlands Project). At the regional and local level corridors are equally important and southern Ontario has many examples such as the Richmond Hills Corridor Study (Geomatics 1998), St Clair Natural Heritage System (Geomatics 1997b), Georgian Bay Islands Greater Park Ecosystem Study (Geomatics 1999), Rouge-Duffins Natural Heritage Strategy (Geomatics 1997), Oak Ridges Moraine Natural Heritage Study (Geomatics 1993) and the Natural Environmental Systems study for the Region of Ottawa-Carleton (Geomatics 1995), *etc.*

It should be acknowledged that the functionality of corridors is directly related to their quality. Corridors based on hedgerows, (even with enhancements such as widening), will only ever accommodate species that are highly vagile (*i.e.*, able to move about freely), tolerant of disturbed conditions (*i.e.*, not interior forest species) and are not prone to easy predation. These species are generally those that are already abundant throughout the highly fragmented environment of southern Ontario. Greater emphasis should be placed, therefore, on establishing substantial connections between high quality core areas that contain interior forest species, as these are generally the species most in need of conservation attention.

The ecological dispersal requirements of plants of interior forest habitats are complex and particularly restrained by unsuitable open conditions associated with fragmentation. For example, forest insects, such as ants and beetles, disperse the seeds of many forest plants and the presence of symbiotic (mutually beneficial) fungi in the soil may be essential to a plants health. In the same manner that forest plants depend on interior forest conditions, so too do the insects that disperse these plants and the symbiotic fungi that sustain them. The fundamental requirement for the dispersal, germination and survival of forest plants is therefore, continuous interior forest conditions within core areas and along corridors intended to provide ecologically functional connections.

Conservation Priorities for Woodland Birds in Southern Ontario

Specifically, this involves protecting the largest forest tracts; maintaining woodlot shape to minimize the extent of edge and concentrating restoration efforts in areas with extensive forest in the landscape.

(Francis and Austen 1999)

To date no study in the Region of Waterloo has developed a natural heritage system aimed at conserving and restoring the remaining natural areas following the principals of conservation biology outlined above (Sections 2.1, 2.2., 2.3). It is apparent, however, that based on the information reviewed, Cruickston Park constitutes an a area of high biodiversity, it is large and so provides interior conditions that are most needed in southern Ontario, and it serves an important linkage/corridor function due to its location at the confluence of the Speed and Grand Rivers.

2.4 Cambridge Areas Route Selection Study (CARSS)

2.4.1 Brief Description of the CARSS in the vicinity of Cruickston Park

The Cambridge Area Route Selection Study (CARSS) is an evaluation of four main proposed road alignments including, an east-west arterial road through the City of Cambridge, north-south city bypass routes on both the western and eastern sides of the City and a south boundary road connecting the latter north-south routes. The proposed roads will have the capacity to carry a large volume of traffic and will be four lanes wide. It is unknown whether centre barriers will be installed on these roads. Some of the proposed routes proposed cross Cruickston Park lands; these include the proposed east-west arterial routes (EW-1, EW-2, EW-3, EW-4) and the proposed north-south routes (W-1, W-2) on the western side of Cambridge (Figure 5).

The east-west road alignment represents a new transportation corridor within the City of Cambridge and it will require the construction of a road on lands that currently have other land uses and the construction of a new bridge across the Grand River. In part, the proposed east-west corridor is based on land in the City of Cambridge that has been identified for transportation development since the 1960's, previous attempts to develop a transportation corridor have however, not been approved. Each of the four proposed roadway alignments in the CARSS east-west route corridor will result in a road crossing Cruickston Park lands and in some scenarios it will result in the construction of a bridge on Cruickston Park lands.

The two north-south routes proposed on the west side of Cambridge will also occupy lands not currently used for transportation and they will require the construction of a second new bridge across the Grand River that will also be located on Cruickston Park land (see Figure 5). The proposed W-1 route crosses the southwest corner of Cruickston Park; the W-2 route follows the existing Blair Road corridor through the centre of Cruickston Park.

Figure 5. Proposed Routes of the Cambridge Area Route Selection Study (CARSS) in the vicinity of Cruickston Park (base image 2000 aerial photograph, proposed routes taken from CARSS website, http://www.region.waterloo.on.ca/cambstudy/index.html)

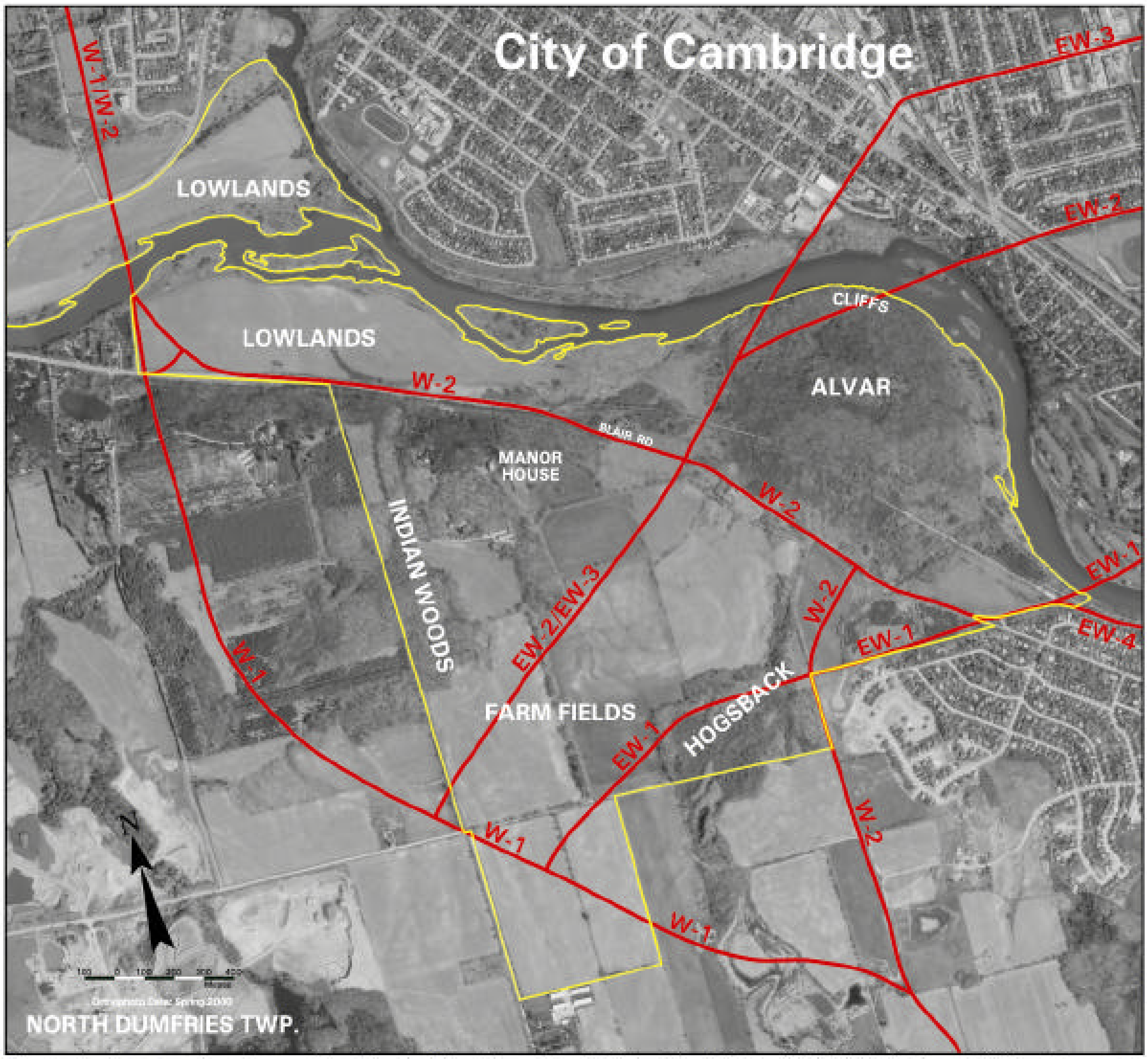

Figure 5: Proposed routes of the Cambridge Area Route Selection Study (CARSS) in the vicinity of Cruickston Park (base image 2000 aerial photograph, proposed routes taken from CARSS website, http://www.region.waterloo.on.ca/cambstudy/index.html)

2.4.2 General Discussion of the Ecological Impacts of Roads

Roads have a variety of ecological impacts on the environment related to a number of direct and indirect effects on species and habitats. The degree to which these effects occur is dependent on the characteristics of the road, such as width, surface material, number of lanes, centre and shoulder medium type and barriers, elevation relative to surrounding terrain, traffic speed and volume, lighting, de-icing practices, bridge and culvert design, *etc.*

Some of the main ecological impacts associated with roads include the following:

- roads displace habitat thus contributing to a direct reduction in natural habitat;
- roads create additional edge habitat which favours non-native and invasive plant species and increase the abundance of raccoons, opossum, blue jays, brown-headed cowbirds, American crows, species that negatively impact forest dwelling birds and mammals;
- roads are a source of mortality for mammals, amphibians, reptiles and insects;
- roads act as barriers to the movement of many species that will not cross open spaces or that are fossorial (*e.g.*, moles, shrews, and soil insects);
- roads create open habitat that increases the exposure of small and medium sized mammals to predation;
- roads result in an alteration of the local physical environment (*e.g.*, increased wind speed, noise, water runoff and light exposure, decreased humidity, more extreme temperature fluctuations, littering) with subsequent impacts on the environmental conditions adjacent natural areas;
- hydrologic disruptions, *e.g.*, 'dike effect' on sub-surface water flow if in adequate culverts are used and/or from an impermeable road base;
- roads modify the chemical environment including contributing to at least five general classes of chemicals that can be toxic to both plants and animals: heavy metals, salt, organic molecules, ozone and nutrients (see Trombulak and Frissell 2000);
- roads contribute to the spread of non-native species; and
- roads may lead to increased unregulated access with the subsequent impacts associated with this (*e.g.*, trails, hunting and fishing pressures, non-native species introductions, *etc.*);

The impacts associated with roads change with the type of road that is under consideration. Wide, paved roads are expected to have a greater impact than narrow non-paved roads. Thus road upgrades increase the impacts associated with existing roads (accepting that upgrades could include animal underpasses which may mitigate some impacts). Probably the road types associated with the highest negative impacts are those that have some form of centre barrier (*e.g.*, concrete divider or steel barriers). Animals attempting the crossing of such roads is often disoriented by the barrier and travel along it in the vain hope of finding a way around, this leads to further attempts to return across the lanes just crossed, increasing exposure to being hit by vehicles. As noted above the impact of roads extends to beyond the limits of the road edge, Trombulak and Frissell (2000) state "Even where only a small percentage of the land's surface is occupied by roads, few corners of the landscape remain untouched by their off-site ecological effects."

2.4.3 The Future of Cruickston Park

The future protection of the valued natural features within Cruickston Park can be viewed both internally in terms of the species and habitats represented and externally in terms of the contribution Cruickston makes to the maintenance of the ecological health of the surrounding lands both natural and urban. Two possible scenarios that are discussed below help illustrate both the complex interactions that occur within the natural environment and the outcome of potential responses of the environment to impacts that may result from the construction of the proposed roads.

1. Continued degradation of the environment through ongoing changes in land-use that fragment the landscape (new road construction option)

Cruickston Park exists within a region of southern Ontario strongly influenced by intensive human development that continues to result in the removal and fragmentation the natural landscape. Logging and agricultural development were the first major factors that contributed to conversion of a large proportion of the natural landscape that originally consisted of forests, woodlands, grasslands and wetlands to open agricultural fields used for crops or grazing. More recently, intensive urban developments have converted agricultural fields as well as some significant natural areas into areas dominated by human habitation.

Over-lain on the developed landscape is a grid-work of roads and bridges, that is remarkably regular in its pattern. Roads follow straight lines, they are often equally spaced and they generally cross each other at right angles. This is due to the fact that roads generally parallel socio-political boundaries formed by townships, municipalities, cities, lots and concessions. In order to achieve this regular grid-work of roads it has often been necessary to cross natural areas, thus roads have become a major factor contributing to the fragmentation of the remaining natural areas. While greater consideration is given to the impacts of human development on natural areas today, the current trend of increasing urban development in the Cruickston Park area by the Cities of Cambridge and Kitchener suggests the remaining natural areas will face continued losses and fragmentation. The negative effects of habitat loss and fragmentation on biodiversity will also increase as outlined above in sections 2.1, 2.2 and 2.3.

The plants and animals that currently inhabit the natural areas of Cruickston Park are different from the mixtures of species that once inhabited the pre-European landscape 200 to 300 years ago. While there may be similarities, the remaining natural areas have undergone changes due to the effects of selective logging, domestic animal grazing pressure and hunting, and the impacts that have occurred due to introduced plants, animals and diseases and habitat fragmentation. With adequate protection and an active resource management program, the remaining natural areas of Cruickston can, however, support habitats dominated by some of the original native plants and animals representative of southern Ontario.

The urgent need for habitat protection and active management of the remaining natural areas should not be underestimated. Field investigations conducted in June 2001 show urban development is about to encroach on the natural areas (the plantation and Hogsback) located on the eastern side of Cruickston Park (see Figure 1) and the CARSS has identified preferred transportation corridors for both east-west and north-south routes that cross Cruickston Park (Figure 5). In addition, Cruickston Park's technical advisory team has undertaken field studies in 2001 that have identified invasive/exotic plants and unregulated human recreation use activities that are having a serious negative impact on some natural areas (Lamb 2001, pers. comm., Larson 2001). Report sections 4.1 Invasive/Exotic Plant Species Management Plan and 4.2 Trail Plan are intended to address these issues.

There are also environmental impacts within Cruickston that are more difficult to manage for, such as the existing Blair Road corridor that has impacts such as those described in Section 2.4.2 Ecological Impacts of Roads. In addition, a study of animal road kills along Blair Road was undertaken from November 1993 to October 1994 that recorded the death of 68 animals, including 17 birds (Meissner 1994). There are also imperfectly known, large-scale, external environmental impacts associated with acid rain, smog, global climate warming, increased ultraviolet-B radiation, and regional changes in hydrology and hydrogeology. Ensuring protected areas have the greatest possible ecological health and therefore resiliency to cope with environmental change best mitigates the latter types of impacts.

The road development proposed in the CARSS is substantial. Within Cruickston Park the CARSS proposes two four lane arterial roads with bridges that cross the Grand River (Figure 5). Road development on this scale will have serious negative implications for the remaining natural areas of Cruickston Park. Core natural areas will be further fragmented, the barriers to species movement will be substantial and the impact of road and bridge construction on the naturally fractured limestone topography of the Alvar and Cliff landscapes will lead to unknown impacts to surface and groundwater flow and the natural habitats dependent on these. The continued protection of the many rare and significant features of Cruickston Park will be impossible if multilane roads and bridges are constructed.

2. Restoration to a condition that provides more natural habitat and improved ecological connections among remnant patches (no new roads option and active environmental management and restoration);

Cruickston Park currently has a number of valued natural features (see report sections 1.2 Special Environmental designations within Cruickston and the status of species and habitats included throughout section 3.0 Ecological Description of Cruickston Park) that could form core habitat areas to contribute towards a large-scale restoration effort aimed at the protection of an exceptional natural area. Given that "interior forest conditions" require up to a 200 m buffer on all sides, the minimum area of forest required within a regularly shaped woods (*i.e.*, roughly circular patch of forest) for one ha of interior forest is 21 ha. Within Cruickston Park the Alvar-Cliffs forest at 77 ha meets the minimum area requirement to provide interior forest conditions, Indian Woods meets the requirement if the forest on adjacent lands are included and the Hogsback because of its linear shape has a buffer of variable width of up to 150 m (see Figure 1).

Restoration of the large areas that are currently farm fields (85 ha) and lowlands (114 ha) can be seen therefore as making an important contribution to increasing the ecological integrity and resiliency of both Cruickston Park and the surrounding natural areas (see Figures 1 and 2). The proposed roads in the CARSS preclude this option by creating transportation corridors that would permanently fragment Cruickston Park (see Figure 5). Alternately a program of restoration and stewardship within Cruickston and in concert with surrounding landowners would result in large viable core natural areas providing important habitat for interior forest species and functional corridors providing important landscape scale linkages (see section 2.3 Role of Corridors and Linkages).

A vision of restoration that included the closure of Blair Road within Cruickston Park could reverse a century of landscape change leading to untold benefits for the resident plant and animal species and the possible return of native species. Conservation Biology is currently embracing "stopover ecology" as not only a scientific discipline but recognizes that this relatively new branch of ecology will be one of the keys to the survival/conservation of migrating species. The floodplains at the confluence of the Grand and Speed Rivers is a key regional stopover for several species of waterfowl and modest numbers of shorebirds. Restoration of the Cruickston Park lands could result in the river and floodplain area acting as a stopover for such magnificent birds as the Sandhill Crane, Tundra Swan and Trumpeter Swans if appropriate conditions were present.

While ecological studies can help to discriminate between the two scenarios described above, the decision of appropriate land use is a value judgment that must also consider the desires and needs of landowners and local residents today and in future generations. Cruickston Park is at a cross-roads: in one direction is further habitat fragmentation, declining biodiversity and lower quality natural areas; in the other direction is a large, contiguous natural area suitable for restoration leading to increasing biodiversity and higher ecological integrity. The former choice represents the status quo for southern Ontario, while the latter choice is radical and visionary. There will be no second chance once the decision is taken, four lane arterial roads with bridges crossing the Grand River represents permanent landscape alteration. Consequently, current and future generations can either have a special, protected natural area in Cruickston Park or not.

3.0 ECOLOGICAL DESCRIPTION OF CRUICKSTON PARK

3.1 Physiography

This section of the report is currently being developed and will inserted when available.

3.2 Vegetation and Flora

Cruickston Park is situated at the northern edge of the Carolinian vegetation zone; as such it has some examples of a more southerly flora as well as many examples of the mixed-wood vegetation zone that extends northward. To date, no study has fully characterized all of the vegetation communities and the associated fauna within Cruickston Park. Seasonal inventories of the plant and animal species, accurate mapping of the location of each community and a description of the key features and functions of each community in terms of habitat quality, management needs and rarity status are planned for the near future. The information that is available suggests Cruickston does contain highly significant, high quality, native plant communities with a number of significant species present.

Table 2 identifies 25 different community types (ecotypes), some of which are very rare in the Regional Municipality of Waterloo and many which contain significant plant species. Of particular significance are the cliff, alvar and rock barren ecotypes. Table 3 lists 48 plants that are rare in the Regional Municipality of Waterloo, of these seven are designated by the Ministry of Natural Resources, Natural Heritage Information Centre as S2 (very rare) or S3 (rare to uncommon) species and one species, ginseng (*Panax quinquefolius*) is designated as threatened by the Ministry of Natural Resources (see Appendix 1 for a description of status designations).

Table 2: Legend of nested ecological land classification units (Lee *et al*. 1998) showing all community types present reported from Cruickston (CG&S 1997, Eagles 1991, ESG 2000b, Gilbert 1981). n/d refers to ecosites for which no specific ecotype was described in the available literature, field work is required to determine ecotype.

ECOSITE	ECOTYPE	ECOTYPE DESCRIPTION
CL - Cliff	CLO1-1	Cliffbrake - Lichen Carbonate Open Cliff
	CLO1-4	Moist Open Carbonate Cliff Seepage
CLT - Carbonate Treed Cliff	CLT1-1	White Cedar Carbonate Treed Cliff
	CLT1-2	Sugar Maple-Ironwood-White Ash Treed Carbonate Treed Cliff
ALT - Treed Alvar	ALT1-2	Shagbark Hickory - Prickly Ash Treed Alvar
RBT - Treed Rock Barren	RBT1-2	Hackberry Carbonate Treed Rock Barren
	RBT2-1	Oak-Red Maple Pine Basic Treed Rock Barren
FOC - Coniferous Forest	n/d	
FOM - Mixed Forest	FOM 2-1	Dry-Fresh White Pine - Oak Mixed Forest
FOD - Deciduous Forest	FOD 5-2	Dry - Fresh Sugar Maple - Beech Deciduous Forest
	FOD 5-8	Dry - Fresh Sugar Maple - White Ash Deciduous Forest
	FOD 6-2	Fresh - Moist Sugar Maple - Black Maple Deciduous Forest
	FOD 6-3	Fresh - Moist Sugar Maple - Yellow Birch Deciduous Forest
	FOD 7-2	Fresh - Moist Ash Lowland Deciduous Forest
CUM - Cultural Meadow	CUM1-1	Dry-Moist Old Field Meadow
CUT - Cultural Thicket	n/d	
CUS - Cultural Savannah	CUS1-1	Hawthorn Cultural Savannah
CUW - Cultural Woodland	CUW2-2	Hawthorn Cultural Alvar Woodland
CUP - Cultural Plantation	n/d	
SWM - Mixed Swamp	SWM 1-1	White Cedar - Hardwood Mineral Mixed Swamp
SWD - Deciduous Swamp	SWD 5-1	Black Ash Organic Deciduous Swamp
	SWD 4-3	White Birch - Poplar Mineral Deciduous Swamp
MAM - Mineral Meadow Marsh	MAM 2-9	Jewelweed Mineral Meadow Marsh
	MAM 2-10	Forb Mineral Meadow Marsh
MAS - Shallow Marsh	n/d	

Table 3: Significant native vascular plant species documented from the Cruickston Park Lands listed in alphabetical order by scientific name. Nomenclature follows Newmaster *et al*. 1998. Rarity status as follows: RMW= rare in the Regional Municipality of Waterloo (ESG 2000b), G Rank, S Rank, COSEWIC and MNR follow NHIC (2001). A description of the various rarity status rankings is provided in Appendix 1. Source documents for plant species are listed in Reference section of this report. Location refers to occurrence on property only. Checkmarks is parenthesis (✓) have not been confirmed by the Cruickston Park technical advisory team, plants specimens and their location should be reviewed to confirm these rare species.

Scientific Name	Common Name	Rarity Status					Source				Location		
		RMW	G Rank	S Rank	COSEWIC	MNR	ESG 2000	Eagles 1991	CG&S 1997	Fieldwork 2001	Cruickston Park	Cruickston Creek	Bauman Creek
Amelanchier stolonifera	running service berry	✓	G5	S4?			✓	✓			✓		
Aplectrum hyemale	putty root	✓	G5	S2			(✓)						✓
Asplenium trichomanes-ramosum	green spleenwort	✓	G4	S4			(✓)	(✓)			✓		
Aureolaria flava	yellow false foxglove	✓	G5	S3			(✓)						✓
Carex lasiocarpa	slender sedge	✓	G5	S5			✓						✓
Celtis occidentalis	hackberry	✓	G5	S4				✓			✓	✓	✓
Conioselinum chinense	hemlock parsley	✓	G5	S3						✓		✓	
Conopholis americana	squawroot	✓	G5	S4?							✓		
Crataegus chrysocarpa	round-leaved hawthorn	✓	G5T?	S4?			✓				✓		
Cypripedium acaule	moccasin flower	✓	G5	S5				(✓)				✓	
Cypripedium calceolus var. *pubescens*	large yellow Lady-slipper	✓	G5	S5			✓	✓			✓	✓	
Dalibarda repens	dewdrop	✓	G5	S4S5				(✓)				✓	
Equisetum pratense	meadow horsetail	✓	G5	S5			✓	✓			✓		
Eupatorium purpureum	sweet-scented Joe-pye weed	✓	G5	S3			(✓)				✓		
Galearis spectabilis	showy orchis	✓	G5	S4				✓			✓		
Gentiana andrewsii	closed gentian	✓	G4	S4				✓			✓		
Helianthus decapetalus	thin-leaved sunflower	✓	G5	S5						✓	✓		
Menispermum canadense	moonseed	✓	G5	S4						✓	✓		
Panax quinquefolius	ginseng	✓	G4	S3		THR	(✓)	(✓)			✓		
Panax trifolius	dwarf ginseng	✓	G5	S4			✓	✓			✓		✓
Parthenocissus quinquefolia	Virginia creeper	✓	G5	S4?			(✓)				✓		
Parnassia glauca	grass-of-parnassus	✓	G5	S5						✓	✓		

Scientific Name	Common Name	Rarity Status					Source				Location		
		RMW	G Rank	S Rank	COSEWIC	MNR	ESG 2000	Eagles 1991	CG&S 1997	Fieldwork 2001	Cruickston Park	Cruickston Creek	Bauman Creek
Pellaea glabella ssp. *glabella*	smooth cliff-brake	✓	G5	S4			✓	✓			✓		
Penstemon hirsutus	hairy beard tongue	✓	G4	S4			✓	✓			✓		
Platanthera dilatata	tall white northern orchid	✓	G5	S5			(✓)						✓
Polygonum punctatum	dotted smartweed	✓	G5	S5			(✓)						✓
Polypodium virginianum	rock polypody fern	✓	G5	S5			✓				✓		
Prunus americana	American wild plum	✓	G5	S4						✓	✓		
Quercus bicolor	swamp white oak	✓	G5	S4			(✓)						✓
Quercus ellipsoidalis	Hill's oak	✓	G4	S3			✓				✓	✓	✓
Quercus velutina	black oak	✓	G5	S4				✓			✓	✓	
Rhus aromatica	fragrant sumac	✓	G5	S5			(✓)						✓
Rhus vernix	poison sumac	✓	G5	S4			(✓)						✓
Saururus cernuus	lizard's-tail	✓	G5	S3			✓	✓			✓		✓
Scrophularia lanceolata	hare figwort	✓	G5	S4			(✓)				✓		
Scrophularia marilandica	Carpenter's-square	✓	G5	S4			✓						✓
Sheperdia canadensis	Buffaloberry	✓	G5	S5			(✓)						✓
Sicyos angulata	bur cucumber	✓	G5	S5			(✓)	✓			✓		✓
Sisyrinchium angustifolium	pointed blue-eyed grass	✓	G5	S4			(✓)				✓		
Sorbus americana	American mountain ash	✓	G5	S5			(✓)				✓		
Spiranthes lucida	shining Ladies-tresses	✓	G5	S4			(✓)						✓
Staphylea trifolia	bladdernut	✓	G5	S4			✓	✓			✓		
Tofieldia glutinosa	sticky false asphodel	✓	G5	S4?			(✓)						✓
Verbena simplex	narrow-leaved vervain	✓	G5	S4			(✓)						✓
Verbena stricta	hoary vervain	✓	G5	S4			✓				✓		✓
Zigadenus elegans ssp. *glaucus*	white camass	✓	G5	S4			(✓)	(✓)			✓		✓
Zizia aurea	common alexanders	✓	G5	S5			✓				✓		✓
Zanthoxylum americanum	prickly ash	✓	G5	S5			✓	✓			✓	✓	✓

3.3 Animal Life

3.3.1 Fisheries

Bauman Creek is designated a coldwater watercourse. Groundwater upwelling in the creek provides brook trout spawning habitat (GRCA 1997). A resident Brook Trout population is present through the middle third of the creek (ESG 2000b).

Cruickston Creek is designated a warm-water watercourse, however, field investigations by the Cruickston technical advisory team in June/July 2001 have recorded mid-summer water temperatures of 10-12°C at the creek's source within the Hogsback and temperatures of within forested areas downstream indicating Cruickston Creek is a coldwater watercourse. The section of Cruickston Creek from the Hogsback to Blair Road has had cold (18-19°C) flowing water throughout the extended period of drought in July and August 2001. From Blair Road to the Grand River, Cruickston Creek is intermittent due to the karst topography. Field investigations undertaken on August 10, 2001 discovered cold (16°C) water flowing out from broken limestone approximately 100 m north of Blair Road. Continuing northward the water flows through an old culvert beneath the Grand Trunk Trail into an area of wet meadow. While no fisheries data are available for Cruickston Creek according to ESG (2000), the presence of coldwater flowing in midsummer, coldwater pools, areas of the creek with a cobble stone creek-bed, and the presence of caddis fly aquatic insect larvae suggest Cruickston Creek constitutes coldwater fish habitat.

The Grand River is considered a warmwater watercourse. Three freshwater mussels documented from the Grand River are designated provincially rare (ESG 2000b). These mussels are Elktoe (*Alasmidonta marginata*), slippershell mussel (*Alasmidonta viridis*) and Wavy-rayed Lampmussel (*Lampsillis fasciola*). The Wavy-rayed Lampmussel is also designated as nationally endangered (COSEWIC) and provincially endangered (COSSARO).

Two significant fish species have also been documented from the Grand River (ESG 2000b). The Greater Redhorse (*Moxostoma valenciennesi*) is considered provincially (S3) and globally rare (G3). The Silver Shiner (*Notropis photogenis*) is considered provincially rare (S2S3) and is designated nationally vulnerable (COSEWIC).

3.3.2 Reptiles and Amphibians (Herptiles)

Gilbert (1981) documented three salamander species from the Cruickston Creek Swamp and Forest (Hogsback). Dr. Bogart of the University of Guelph genetically identified the salamanders. The three salamanders are Tremblay's Salamander (*Ambystoma tremblayi*), Blue-Spotted Salamander (*Ambystoma laterale*) and Yellow Spotted Salamander (*Ambystoma maculatum*). Tremblay's salamander is a triploid hybrid with two sets of chromosomes from a blue-spotted salamander and one set from a Jefferson's Salamander (*Ambystoma jeffersonianum*) (Harding 1997). The Jefferson Salamander is considered provincially rare (S2) and nationally threatened (COSEWIC). The Cruickston technical advisory team also reports Northern Redback (*Plethodon cinereus*) is present in both normal redback and leadback (melanistic) colour phases.

Eagles (1991) documented the following significant reptiles in the vicinity of Cruickston Park. The Queen Snake (*Regina septemvittata*) considered provincially rare (S2), threatened nationally (COSEWIC) and threatened in Ontario (COSSARO) has been documented from the Grand River. The Eastern Smooth Green Snake (*Lichlorophis vernalis*) considered locally significant (rare in the Regional Municipality of Waterloo) was confirmed within Cruickston Park in June 2001 (Wilson 2001b).

3.3.3 Birds

Field studies have recorded 26 birds within Cruickston Park that are rare within the Regional Municipality of Waterloo (Table 4). Of these regionally rare birds, 17 species are considered to be 'area sensitive', meaning they require substantial areas of intact natural vegetation to be present (Cadman 1999). The Alvar-Cliffs, Hogsback and Indian Woods vegetation within Cruickston Park provides habitat for these area sensitive species. In addition to their regional rarity status one bird, the Hooded Warbler is on COSEWIC's list of Nationally Threatened Birds (NHIC 2001).

In a recent publication by Couturier (1999), birds with a high priority for conservation in southern Ontario were identified. Considering these species an additional 15 bird species have been listed for Cruickston Park in Table 5. Although these species do not have any regional rarity status, given the threat of continued habitat loss in southern Ontario the Region of Waterloo has a high responsibility for their conservation.

Two significant bird species were documented in the vicinity of Cruickston Park by Eagles (1991). The Red-Shouldered Hawk (*Buteo lineatus*) was documented as occurring on the Cruickston farm in the mid 1970s. It is considered a species of special concern (COSEWIC) and vulnerable in the province (COSARO). The Northern Bobwhite (*Colinus virginianus*) was documented as occurring on Cruickston Park in the mid 1980s (Eagles 1991). There has been no recent confirmation of this species occurring in the vicinity. The Northern Bobwhite is considered provincially rare (S1S2) and nationally endangered (COSEWIC). Wilson (2001b) observed an adult Red-headed Woodpecker (*Melanerpes erythrocephalus*) on Cruickston Park lands along Whistle Bare Road in July 1988. This species is listed nationally as a species of special concern (COSEWIC) and provincially as vulnerable.

Table 4: Significant breeding bird species in Cruickston Park observed between 1996 and 2001 (Wilson 2001a). Breeding evidence as follows: possible (PO), probable (PR), and confirmed (CO) using breeding evidence as categorized by Cadman *et al*. (1987). Rarity status is as follows: G Rank, S Rank, COSEWIC and MNR taken from NHIC (2001), RMW indicates rare in the Regional Municipality of Waterloo, Area sensitive species as identified by Cadman in FON (1999). For a complete explanation of rarity status ranking see Appendix 1.

Common Name	**Scientific Name**	**Breeding Evidence**	**Rarity Status**						**Location**							
			G Rank	**S Rank**	**COSEWIC**	**MNR**	**RMW**	**Area Sensitive**	**Lowlands**	**Cliffs**	**Indian Woods**	**Thompson Property**	**Barn Woods**	**Hogsback**	**Old Fields**	**Manor House**
Wood Duck	*Aix sponsa*	CO	G5	S5B,SZN			yes				✓	✓		✓		
Sharp-shinned Hawk	*Accipiter striatus*	PO	G5	S5B,SZN	NAR	NIAC	yes	yes			✓	✓				
Cooper's Hawk	*Accipiter cooperii*	PR	G5	S4B,SZN	NAR	NIAC	yes			✓	✓	✓				
Northern Saw-whet Owl	*Aegolius acadicus*	PR	G5	S4B,SZN			yes	yes			✓	✓				
Yellow-billed Cuckoo	*Coccyzus americanus*	CO	G5	S4B,SZN			yes		✓							
Black-billed Cuckoo	*Coccyzus erythropthalmus*	PR	G5	S4B,SZN			yes			✓						
Pileated Woodpecker	*Dryocopus pileatus*	PR	G5	S4S5			yes	yes		✓	✓			✓		
Red-bellied Woodpecker	*Melanerpes carolinus*	CO	G5	S4			yes	yes			✓		✓			
Orchard Oriole	*Icterus spurious*	PR	G5	SZB,SZN			yes			✓						
Vesper Sparrow	*Pooecetes gramineus*	CO	G5	S4B,SZN			yes								✓	
Scarlet Tanager	*Piranga olivacea*	PR	G5	S5B,SZN			yes	yes						✓		✓
Yellow-throated Vireo	*Vireo flavifrons*	PR	G5	S4B,SZN			yes									✓
Black-and-white Warbler	*Mniotilta varia*	PO	G5	S5B,SZN			yes	yes		✓						
Blue-winged Warbler	*Vermivora pinus*	PR	G5	S4B,SZN			yes	yes		✓		✓				
Magnolia Warbler	*Dendroica magnolia*	PR	G5	S5B,SZN			yes	yes		✓						
Black-throated Green Warbler	*Dendroica virens*	PR	G5	S5B,SZN			yes	yes			✓					
Pine Warbler	*Dendroica pinus*	CO	G5	S5B,SZN			yes	yes						✓		
Ovenbird	*Seiurus aurocapillus*	PR	G5	S5B,SZN			yes	yes			✓	✓				
Northern Waterthrush	*Seiurus noveboracensis*	PR	G5	S5B,SZN			yes	yes						✓		

Common Name	Scientific Name	Breeding Evidence	Rarity Status						Location							
			G Rank	S Rank	COSEWIC	MNR	RMW	Area Sensitive	Lowlands	Cliffs	Indian Woods	Thompson Property	Barn Woods	Hogsback	Old Fields	Manor House
Mourning Warbler	*Oporornis philadelphia*	PR	G5	S5B,SZN			yes	yes				✓				
American Redstart	*Setophaga ruticilla*	CO	G5	S5B,SZN			yes	yes		✓						
Hooded Warbler	*Wilsonia citrina*	PR	G5	S3B,SZN	THR		yes	yes			✓	✓				
Brown Thrasher	*Toxostoma rufum*	PR	G5	S5B,SZN			yes								✓	
Winter Wren	*Troglodytes troglodytes*	PR	G5	S5B,SZN			yes				✓			✓		
Brown Creeper	*Certhia americana*	CO	G5	S5B,SZN			yes	yes		✓						
Red-breasted Nuthatch	*Sitta canadensis*	PO	G5	S5B,SZN			yes	yes						✓		

Table 5: List of species that are not rare but for which Waterloo Region has high responsibility for conservation according to Couturier (1999), (bird observations from Wilson 2001a). Breeding evidence as follows: possible (PO), probable (PR), and confirmed (CO) using breeding evidence as categorized by Cadman *et al*. (1987).

Common Name	Scientific Name	Breeding Evidence	Location							
			Lowlands	Cliffs	Indian Woods	Thompson Property	Barn Woods	Hogsback	Old Fields	Manor House
American Woodcock	*Scolopax minor*	CO		✓					✓	
Ruffed Grouse	*Bonasa umbellus*	PR		✓	✓				✓	
Ruby-throated Hummingbird	*Archilochus colubris*	PR		✓						
Eastern Kingbird	*Tyrannus tyrannus*	CO		✓						
Eastern Phoebe	*Sayornis phoebe*	CO								✓
Horned Lark	*Eremophila alpestris*	PR							✓	
Eastern Meadowlark	*Sturnella magna*	PR	✓						✓	
American Goldfinch	*Carduelis tristis*	CO	✓	✓	✓	✓	✓	✓	✓	✓
Savannah Sparrow	*Passerculus sandwichensis*	PR	✓						✓	
Field Sparrow	*Spizella pusilla*	CO		✓						
Barn Swallow	*Hirundo rustica*	CO								✓
Gray Catbird	*Dumetella carolinensis*	CO		✓						
Black-capped Chickadee	*Poecile atricapillus*	CO		✓	✓			✓		
Wood Thrush	*Hylocichla mustelina*	PR			✓			✓		
Eastern Bluebird	*Sialia sialis*	CO							✓	

3.3.4 Mammals

Limited information is available for the mammals resident within Cruickston Park. The list of mammals shown in Table 6 is derived from small mammal trapping records and field notes from mammal sightings between the years 1992 to 2001 (Wilson 1995 and 2001b, Wilson and Meissner 1993). It is estimated that the current deer population is approximately 20 animals.

3.3.5 Insects

Little information is available for the insect fauna present within Cruickston Park. Two butterflies known from Cruickston include the Giant Swallowtail (*Papilio cresphontes*), which is considered provincially rare (S2), and the Monarch (*Danaus plexippus*) a COSEWIC species of special concern (see Appendix 1 for a description of the COSEWIC status).

Table 6. Mammals recorded within Cruickston Park (Wilson 2001b)

Common Name	**Scientific Name**
Virginia Opossum	*Didelphis virginiana*
Northern Short-tailed Shrew	*Blarina brevicauda*
Big Brown Bat	*Eptesicus fuscus*
Little Brown Bat	*Myotis lucifugus*
Eastern Cottontail	*Sylvilagus floridanus*
Woodchuck	*Marmota marmax*
Gray Squirrel	*Sciurus carolinensis*
Red Squirrel	*Tamiasciurus hudsonicus*
Beaver	*Castor canadensis*
Meadow Vole	*Microtus pennsylvanicus*
Muskrat	*Ondatra zibethicus*
White-footed Mouse	*Peromyscus leucopus*
Jumping Mouse	*Zapus* sp.
Coyote	*Canis latrans*
Red Fox	*Vulpes vulpes*
Raccoon	*Procyon lotor*
Striped Skunk	*Mephitis mephitis*
Ermine	*Mustela erminea*
Mink	*Mustela vison*
White-tailed Deer	*Odocoileus virginianus*

4.0 MANAGEMENT NEEDS AND ACTIONS

Natural areas within the highly developed landscape of southern Ontario require active management to ensure their ecological structures and functions are maintained in the best possible condition. Some of the reasons for a need to manage natural areas include, past management practices that require mitigation (*e.g.*, selective logging, species introductions, grazing within forests), adjacent land use pressures, invasive plants, hyper-abundant deer populations, and unregulated use (*e.g.*, trails, forts, dumping).

4.1 Invasive/Exotic Plant Species Management Plan

Invasive plants represent one of the most serious threats to the ecological health of natural areas in southern Ontario. An examination of the flora present at Cruickston reveals a number of invasive species are present. These are usually non-native species that have been introduced, largely from countries in Europe and Asia that are now well established in Canada.

The presence of non-native species does not always represent a threat, this is particularly true in areas where the native vegetation has been removed and the soils disturbed through agriculture, quarrying, urbanization, *etc.* In these areas non-native species generally dominate the vegetation and are therefore responsible for providing the main plant cover, limited animal habitat and they help in restoring many basic ecological functions such as nutrient cycling, soil building, photosynthetic energy flows, *etc.* to disturbed sites.

The threat from non-native and sometimes non-indigenous (*i.e.*, native plants outside their normal range) species arises from those plants that have the capacity to "invade" native plant ecosystems. Aggressive, invasive plants have the capacity to become established over large areas within natural areas, displacing diverse, native plant assemblages and animal habitat, introducing disease, and disrupting natural ecosystem functions (ecosystem integrity). Well-known examples in southern Ontario include purple loosestrife (*Lythrum salicaria*) in wetlands, garlic mustard (*Alliaria officinalis*) in the understory of forests and European buckthorn (*Rhamnus cathartica*) in thickets and forests.

Within Cruickston Park there is a need to first complete an inventory of all plants within each natural area. With good inventory information it is then possible to evaluate which plant species potentially constitute a threat to natural areas based accepted methods that rank plants based on characteristics related to their invasiveness. This information must also be supplemented by field investigations that document the location and extent of invasive plant populations.

Table 7 lists the most serious invasive plants that are currently negatively impacting natural habitats within Cruickston Park based on preliminary field investigations.

Table 7: Invasive plants (listed alphabetically by common name) currently having a negative impact on natural areas within Cruickston Park.

Common Name	Scientific Name
dame's rocket	*Hesperis matronalis*
European barberry	*Berberis vulgaris*
European buckthorn	*Rhamnus cathartica*
garlic mustard	*Alliaria officinalis*
glossy buckthorn	*Rhamnus frangula*
goutweed	*Aegopodium podagraria*
Japanese barberry	*Berberis thunbergi*
lily-of-the-valley	*Convallaria majalis*
Morrow's honeysuckle	*Lonicera morrowi*
perfumed cherry	*Prunus mahaleb*
privet	*Ligustrum vulgare*
purple loosestrife	*Lythrum salicaria*
reed canary grass	*Phalaris arundinacea*
Scot's pine	*Pinus sylvestris*
speedwell	*Veronica chamaedrys*
Tartarian honeysuckle	*Lonicera tatarica*
white bedstraw	*Galium mollugo*

4.2 Trail Plan

It is recognized that there are areas within Cruickston Park where unregulated public use has a negative impact on native plant and animal communities. Walking and biking trails and areas of overnight use within the area of the Alvar-Cliffs are expanding rapidly. With careful planning the development of a comprehensive trail plan can lead to an accommodation of limited public use without severely affecting native ecosystems.

A priority management task for Cruickston Park is the development of a comprehensive trail plan that will provide long-term protection of the natural values of Cruickston Park.

4.3 Deer Management Strategy

In southern Ontario the characteristic fragmented habitats and abundant food source available in cornfields favours the establishment of large white-tailed deer herds. Large herds can in turn have a significant negative impact on natural areas due to the grazing of herbaceous vegetation and the browsing of woody vegetation. In extreme cases plant species of the ground flora can be extirpated (*i.e.*, eliminated from an area) and the regeneration of trees placed in jeopardy. The presence of large deer herds is evident where a "browse-line" is present in the forest (*i.e.*, it is possible to see directly into a forest up to a height of about three metres due to the removal of all available forage by deer). In some areas of Cruickston a browse-line is evident, suggesting a high white-tailed deer population is present and that the native vegetation is threatened.

A priority management task for Cruickston Park is the development of a deer management strategy to limit the population of white tail deer and so provide long-term protection of the natural values of Cruickston Park.

4.4 Restoration Plan

The future vision for Cruickston Park includes the presence of large, well-connected natural areas. Section 2.0 outlines the ecological values associated with this vision, in particularly the enhancement of ecological integrity leading to natural ecosystem structures and processes. In simple terms, a large core natural area will typically have more native plants and animals and be able to provide greater protection for these species then a small natural area.

Natural area restoration is relatively new and expanding field of environmental management. A good deal of planning and effort is required to begin restoration and there is often a significant long-term commitment required to fully establish a self-sustaining natural system. Cruickston Park must establish clear goals and objectives for restoration and prioritise the sites that are most in need restoration and that will provide the most significant benefits. Restoration will proceed at a rate equal to the level of financial and/or volunteer commitments available to undertake the required tasks. Given the long-term commitment required, a level of caution in not starting too many projects is advised.

A priority management task for Cruickston Park is the development of a comprehensive restoration management plan. This will include identifying priority areas to be restored, the methods for restoration, plant species to be established, monitoring and maintenance needs of restored areas, *etc*. The restoration plan must compliment the long-term protection needs of all of the natural values within Cruickston Park.

5.0 FUTURE DIRECTIONS

5.1 Monitoring Strategy

Monitoring is an essential component of any resource management program. This is as true for management initiatives that are directed at specific targets (*e.g*., the restoration of a fish species population in a particular river), as it is for "umbrella" programs that provide general management direction (*e.g*., the maintenance of ecological health in provincial parks). In either case, monitoring provides the ability to evaluate the success of programs, and subsequently report on the program to resource managers and the public. Simply stated, monitoring facilitates accountability. Monitoring also provides information from which we learn about natural processes in the environment (*e.g.*, natural disturbance events and successional changes) and the impact of human activities on the environment, ranging from recreational pursuits (*e.g*., camping, boating, *etc*.) to resource harvesting (*e.g*., sport fishing, hunting, timber extraction, *etc*.), and the effectiveness of management and restoration initiatives.

5.2 Stewardship and Public Education

This section of the report is currently being developed and will inserted when available.

5.3 Research Opportunities and Partnerships

This section of the report is currently being developed and will inserted when available.

6.0 CONCLUSIONS

Cruickston Park is intended to protect significant habitats, plants and animals within an area of substantial human development. In order to achieve this careful management planning will be required to provide additional protection, to learn more about the environment, to undertake management actions, to restore degraded lands and to monitor ecological health. The priorities for the management planning needs discussed in this report are presented in Table 8.

Table 8. An outline of the current concerns, required actions and priorities for Cruickston Park (Priority ranking: 1 - begin to undertake action within next year; 2 - begin to undertake action within two to four years)

Concerns	Actions	Priorities
Develop an increased understanding of the natural environment	Inventory and mapping of all plant communities	1
	Study of surface and ground water hydrology	1
	Study of karst topography	1
	Ecological Monitoring	2
Control of Invasive Plants	Develop Invasive Plant Management plan, including: inventory, mapping, prioritising, and methods for invasive plants to control	1
Control of unregulated use of Cruickston Park	Development of a Trail Plan, including trail closures, trail construction, signage, education, and enforcement	1
Prevent and reverse the fragmentation of Cruickston Park	Inform CARSS of the negative impacts of proposed routes.	1
	Develop a Restoration Plan, including, goals, objectives, priority areas, and methods	2
	Begin dialogue to explore options for the closure of Blair Road	2
Monitor and control the white-tailed deer population	Develop a Deer Management Plan, including, population estimates, assessment of impacts, and recommended control methods	2
Inform the public and provide stewardship opportunities	Prepare materials to inform the public and create a structure for volunteer participation/stewardship	2
Facilitate research and education opportunities	Establish formal or informal partnerships with local universities, colleges, and schools	2

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APPENDIX 1: GLOSSARY OF TERMS FOR THE STATUS OF RARE SPECIES

Definitions provided here are taken from the Natural Heritage Information website (www.mnr.gov.on.ca/MNR/nhic/nhic.html) and from the Regional Municipality of Waterloo Planning and Culture Committee Report (1999).

COSEWIC STATUS……………………………………………………………………………

Species status assigned by the Committee on the Status of Endangered Wildlife in Canada.

EXT - Extinct A species that no longer exists.

EXP - Extirpated A species no longer existing in the wild in Canada, but occurring elsewhere in the wild.

END - Endangered A species facing imminent extirpation or extinction throughout its range.

THR - Threatened A species likely to become endangered if nothing is done to reverse the factors leading to its extirpation or extinction.

VUL/SC - Vulnerable or Special Concern. A species of special concern because of characteristics that make it particularly sensitive to human activities or natural events, but does not include an extirpated, endangered or threatened species.

IND - Indeterminate A species for which there is insufficient information to support a status designation.

NAR - Not At Risk A species that has been evaluated and found to be not at risk.

GLOBAL RANK (GRANK)…………………………………………………………………...

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

G1 - Extremely rare usually 5 or fewer occurrences in the overall range or very few remaining individuals; or because of some factor(s) making it especially vulnerable to extinction.

G2 - Very rare usually between 5 and 20 occurrences in the overall range or with many individuals in fewer occurrences; or because of some factor(s) making it vulnerable to extinction.

G3 - Rare to uncommon; usually between 20 and 100 occurrences; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances.

G4 - Common usually more than 100 occurrences; usually not susceptible to immediate threats.
G5 - Very common demonstrably secure under present conditions.
GU - Status uncertain often because of low search effort or cryptic nature of the species; more data needed.
G? - Unranked species unranked or if following a ranking, rank tentatively assigned (*e.g.*, G3?).
G A "G" (or "T") these designations if followed by a blank space means that the NHIC has not yet obtained the Global Rank from The Nature Conservancy.
Q the taxonomic status of the species, subspecies, or variety is **questionable**.
T the rank applies to a subspecies or variety.

MNR STATUS (MNR)……………………………………………………………………………

Designations made by OMNR are based on recommendations of a Ministry technical committee called the Committee on the Status of Species at Risk in Ontario (COSSARO). The Committee's purpose is to ensure a uniform, science-based, defensible approach to provincial status evaluations and recovery work for species at risk in Ontario. The Committee uses objective criteria, as defined in its *Categories and Criteria for Status Assessment*, to ensure that a consistent approach is followed in evaluating the status of candidate species. The work of COSSARO is integrated with the work of COSEWIC. Designations assigned by OMNR/ COSSARO apply at the provincial level, and those of COSEWIC apply at the national level. In a small number of cases, provincial designations and national designations may differ.
EXT - Extinct Any species formerly native to Ontario that no longer exists.
EXP - Extirpated Any native species no longer existing in the wild in Ontario, but existing elsewhere in the wild.
END - Endangered Any native species that, on the basis of the best available scientific evidence, is at risk of extinction or extirpation throughout all or a significant portion of its Ontario range if the limiting factors are not reversed. Endangered species are protected under the province's Endangered Species Act.
THR - Threatened Any native species that, on the basis of the best available scientific evidence, is at risk of becoming endangered throughout all or a significant portion of its Ontario range if the limiting factors are not reversed.
VUL - Vulnerable Any native species that, on the basis of the best available scientific evidence, is a species of special concern in Ontario, but is not a threatened or endangered species.
IND - Indeterminate Any native species for which there is insufficient scientific information on which to base a status recommendation.
NIAC - Not In Any COSSARO Category Any native species evaluated by COSSARO which does not currently meet criteria for assignment to a provincial risk category.

PROVINCIAL RANK (SRANK)……………………………………………………………...

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

S1 - Extremely rare species that are extremely rare in Ontario; usually 5 or fewer occurrences in the province or very few remaining individuals; often especially vulnerable to extirpation.

S2 - Very rare in Ontario; usually between 5 and 20 occurrences in the province or with many individuals in fewer occurrences; often susceptible to extirpation.

S3 - Rare to uncommon species that are rare to uncommon in Ontario; usually between 20 and 100 occurrences in the province; may have fewer occurrences, but with a large number of individuals in some populations; may be susceptible to large-scale disturbances. Most species with an S3 rank are assigned to the watch list, unless they have a relatively high global rank.

S4 - Common species that are common and apparently secure in Ontario; usually with more than 100 occurrences in the province.

S5 - Very common species that are very common and demonstrably secure in Ontario.

SH - Historically species known from Ontario, but not verified recently (typically not recorded in the province in the last 20 years); however suitable habitat is thought to be still present in the province and there is reasonable expectation that the species may be rediscovered.

SR - Reported species reported for Ontario, but without persuasive documentation which would provide a basis for either accepting or rejecting the report.

SRF - Reported falsely species reported falsely from Ontario.

SX - Apparently extirpated apparently extirpated from Ontario, with little likelihood of rediscovery. Typically not seen in the province for many decades, despite searches at known historic sites.

SE - Exotic not believed to be a native component of Ontario's flora.

SZ Not of practical conservation concern inasmuch as there are no clearly definable occurrences; applies to long distance migrants, winter vagrants, and eruptive species, which are too transitory and/or dispersed in their occurrence(s) to be reliably mapped; most such species are non-breeders, however, some may occasionally breed.

SZB Breeding migrants/vagrants.

SZN Non-breeding migrants/vagrants.

SA - Accidental of accidental or casual occurrence in the province; far outside its normal range; some species may occasionally breed in the province.

SAB Breeding accidental.

SAN Non-breeding accidental.

C - Captive/Cultivated existing in the province only in a cultivated state; introduced population not yet fully established and self-sustaining.

S? - Unranked species is unranked or if following a ranking, rank **uncertain** (*e.g.*, S3?). S? species are thought to be rare in Ontario, but there is insufficient information available to assign a more accurate rank.

REGIONAL MUNICIPALITY OF WATERLOO STATUS (RMW)…………………………

Significant native, vascular plant species in the Regional Municipality of Waterloo are defined as species known to occur at one to twelve extant sites in the Regional Municipality. Distinct site occurrences are considered to be not less than one kilometre apart. The most current list was prepared in 1999 by a panel of local experts and Natural Heritage Information Center (NHIC) staff with support from Regional staff.

APPENDIX 2: VEGETATION COMMUNITIES DOCUMENTED FOR CRUICKSTON PARK

Table 9. Vegetation communities documented from the available literature sources for Cruickston Park. Vegetation communities have been reclassified according to the Ecological Land Classification (ELC) community type for southern Ontario (Lee *et al*. 1998). For the location of landscape units see Figure 1. n/a indicates the landscape type was not covered in the literature source.

CRUICKSTON PARK LANDSCAPE UNIT	**LITERATURE SOURCE**			
	ESG (2000)	**Eagles (1991)**	**CG&S (1997)**	**Gilbert (1981)**
FLOODPLAIN	CUM MAM	n/a	n/a	n/a
CLIFFS and ALVAR	CL FOD6-2 FOD7-2 CUT CUM SWD SWD4-3 MAM2-10	CLO 1-1 CLO 1-4 CUW 2-2	n/a	CUS1-1
INDIAN WOODS	FOM FOD SWM	FOM 2-1 FOD 9-1 SWM 1-1	n/a	n/a
DECIDUOUS FOREST	FOD	FOD 5-2 MAM 2-9	n/a	n/a
HOGSBACK WOODS	CUT FOM FOD SWM	FOD 5-8 SWD 5-1	CUM 1-1 CUP FOD 5-2 SWD 5-1	FOD 6-3