

CRUICKSTON PARK

INTO THE FUTURE



THE ENVIRONMENTAL MANAGEMENT PLAN FOR CRUICKSTON CHARITABLE RESEARCH RESERVE

February 2002

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“... the dreams of Mennonites and Mohawks, Germans and Ontario Scotch coalesced where the Speed meets the Grand...” John Moss *Enduring Dreams* (1994)

1.0 INTRODUCTION..... Douglas W. Larson and William G. Wilson

Cruickston Park is a unitary property unlike most others in southern Ontario. It has been under private ownership primarily by one family since the clearing of the land in the 1840s and has retained the traditional uses of land that started at that time and continued into the 1960s. A variety of threats to the land is current including local real estate development and highway expansion. Of the 391 hectares (966 acres) of land at Cruickston Park, 370 hectares (913 acres) have been transferred to Cruickston Charitable Research Reserve by Jan Chaplin and Mark Fretwurst to be preserved in perpetuity for a variety of purposes including:

- education (both within and outside of the publicly funded educational system, and continuing education for the public at large)
- public interpretive trails along the cliffs and portions of the floodplain explaining the geology, biology and cultural history of the property
- stewardship (by professional scientists, land managers, ecologists, foresters, naturalists and others)
- research that is conducted under peer support and review and adds to the knowledge base of conservation biology and restoration ecology
- conservation that includes activities to preserve natural features that are present and to restore natural features that have been lost.

In January 2001, Nicholas Hill, Heritage Architect Planner, prepared the *Vision Statement: Cruickston Park, a vision for conservation and education*, which presented the Goals and Vision of the owners, Jan Chaplin and Mark Fretwurst, for Cruickston Park. During the early winter of 2001, Bill Wilson was approached by Jan Chaplin and Mark Fretwurst to form an advisory group that would formulate recommendations and priorities for the ecological restoration and the environmental management of the property. The Cruickston Park Ecological Advisory Team (CPEAT) was established to undertake an all-seasons' biophysical inventory of Cruickston Park and to prepare an environmental management plan. Members of CPEAT include:

Kenneth W. Dance, aquatic biologist, Dance Environmental Inc., Kitchener;

Lawrence E. Lamb, manager of Environmental Studies Ecology Lab and adjunct lecturer, University of Waterloo;

Douglas W. Larson, professor of Botany and director of The Cliff Ecology Research Group, University of Guelph;

William G. Wilson – naturalist, CPEAT co-ordinator; editor, Environmental Management Plan; Cambridge.

CPEAT also served as the Technical Advisory Team for the *Draft Management Framework for Cruickston Park*, August 2001, prepared by Brent Tegler, North-South Environmental Inc. As a result of on-going fieldwork, CPEAT provided their findings and advice regarding current environmental concerns for Cruickston Park.

2.0 ACKNOWLEDGEMENTS

This environmental plan is the result of the belief in the Goals and Vision of Cruickston Park and the recognition of the opportunities in environmental education, conservation biology and restoration ecology that this property presents to the citizens of Waterloo Region by a number of individuals who generously donated their time and expertise. They include members of CPEAT who visited the property numerous times, spent many hours collecting and analysing data and promoting the Goals and Vision to the public; members of the Kitchener-Waterloo Field Naturalists (KWFN) who participated in outings to learn more about the property so they could promote its ecological importance to others; the KWFN Plant Study Group who assisted with vegetation surveys; Graham Buck, The Nature Conservancy of Canada and President of KWFN, who participated in vegetation reconnaissance and assisted with identification of sedges (*Carex* spp.); Wynfield Y. Watson, Professor Emeritus, Biology, Wilfrid Laurier University, for his survey of mosses and liverworts on the property; Chris Gosselin and Virgil Martin, Department of Planning, Housing and Community Services, the Regional Municipality of Waterloo, who assisted with the vegetation survey of the Cliffs along the Grand River and identification of ferns; Bob McMullen, Cambridge Riverbank Trail Advisory Committee, who offered helpful advice concerning trail proposals and management; Professors Anne and Allan Morgan, Biology and Earth Sciences respectively, University of Waterloo, who visited the Cliffs and Alvars and noted their biological and geological features; Jerry Guenther and Bill Wilson, who, because of their interest in natural history and their familiarity with the property, were present for the majority of the vegetation investigations.

Additional sightings of reptiles and amphibians were made by Kevin Dance, Bill and Heather Wilson, Jerry Guenther, Larry Lamb, Graham Buck and other members of the KWFN during a club outing and Plant Study Group outings to Cruickston Park. A number of people contributed bird sightings and observations of bird activities including breeding behaviour. Jerry Guenther accompanied Bill Wilson on area searches of the property on many occasions since 1995, making numerous and significant contributions. His keen sense of observation and birding skills contributed greatly to the bird findings presented in this plan. Also included are Ken and Kevin Dance and Larry Lamb who contributed significant bird sightings during their own fieldwork; Larry and Shirley Allen, Marilyn Armstrong, Ken and Janet Dance, Ruth Kroft, Klaus Mohn, Dave and Rosemary Stafford, Don Thomas, Art Timmerman, Wynn Watson and others who contributed observations of Bald Eagle. The Bird Records of the KWFN provided some historical observations, particularly of riparian birds.

Mathew Dance assisted with the preparation of the maps. Heather Wilson assisted with fieldwork including setting up of the bird monitoring stations, mapping, searching for nests and other signs of breeding activity as well as preparation and editing of this plan.

3.0 SIGNIFICANCE OF CLIFFS AND ALVARS..... Douglas W. Larson

The Cliffs and Alvares is a heterogeneous unit that includes not only the true river escarpments along the south east portion of the river, but also the plateau forested lands set back from the cliff edges (Map 1). The Cliffs and Alvares unit is separated from the rest of the property by Blair Road. The lack of commercial agriculture and the proximity to the river have led to an expansion of trails throughout this area so that overuse and inappropriate use of the property are evident.

3.1 Cliffs proper

Limestone cliffs facing the Grand River occur in two areas of Cruickston Park (Map 1). Both of these areas are within the habitat type called "Cliffs" in the Vision Statement Presentation prepared by Nicholas Hill (Chaplin and Fretwurst 2001). The cliffs nearest the eastern margin of the property bordering the City of Cambridge are fully exposed and heavily disturbed by people. Here, the cliffs span a distance of roughly 150 m. The plateau lands and talus slopes in this area are also severely disturbed. The cliffs along the northern perimeter of the property are much more extensive and much more protected from human disturbance. They span about 250 m. The forest cover is nearly complete for this long section of cliff, but the Grand River passes directly at the foot of the rock outcrop and hence there is no talus formation.

The cliffs support a flora that is similar to that found in the ancient cedar forests that occur along the full length of the Niagara Escarpment. The cliff flora includes Eastern White Cedar, Maidenhair Spleenwort, Bulbet Bladder Fern, and Smooth Cliff-brake (Larson et al. 1989). A variety of algae, lichens, mosses and liverworts also occurs on the cliffs. The Eastern White Cedar trees that occur on the cliffs are deformed and evidently slow growing, but they mostly show signs of historical human disturbance. The trees have not been sampled for their age, but the distribution patterns and axial morphology of the trees are identical to trees that occur in the ancient forests. The conclusion from these observations is that the cliff edge and cliff face habitats within Cruickston Park represent a habitat type that is identical to that of the Niagara Escarpment, and therefore that it should be managed as though it were part of the Escarpment.

The Niagara Escarpment's ancient forests represent the most ancient and least disturbed woodland in eastern North America. The Niagara Escarpment Planning and Development Act, as well as the UNESCO World Biosphere Reserve designation, both give an indication of the importance of these habitat types in the global context. Even though the cliffs in Cruickston Park have been disturbed in the past, the habitat type is rare enough so that any sections of limestone cliff – even if historically disturbed – are valuable sites for the species that are restricted to them. A wide variety of invertebrates and vertebrates have a close habitat dependence on cliffs, and thus the protection of the cliffs within the confines of Cruickston Park should be given the highest priority.

The plant species that occur on cliff faces are dependent on a continuous supply of water that percolates through the limestone (Larson et al. 2000). Any surface clearing or disruption of the

water table in the areas adjacent to the cliffs has the potential to limit these species. The sparse cover of Eastern White Cedar trees near the eastern limit of the property, and the general sparseness of the fern cover on these cliffs, is possibly due to forest clearing or road construction. As part of the management plan for the property, efforts should be made to insure the integrity of water supply to the cliff biota.

3.2 Alvars

The alvars have been sampled by Larry Lamb, and the habitats have been visited by the other members of CPEAT (Map 1). Alvars are considered a globally rare habitat type (Schaefer and Larson 1997), and hence the open limestone plain that occurs near the cliff edges, represents an important biophysical unit that could be used to expand the range of alvar species whose range is severely restricted in Ontario. The only undisturbed alvars in Ontario are in the Bruce Peninsula, but there is active research underway whose goal is to evaluate the possibility of transplanting some native alvar species to suitable habitats in other parts of Ontario. Cruickston Park has outstanding alvar habitat that should also be given the highest degree of protection possible.

3.3 Recommendations

- The lowlands between the Grand River and Blair Road should be used for experimental work in restoration and revegetation of riparian zones. The experimental work could attract sponsors and researchers from local universities and will lead to the publication of research papers and books available internationally. The *scientific* aspects of restoration ecology are just beginning to develop, and setting aside this area that is presently cropland, would benefit all parties enormously. Sponsorship for this restoration work could be obtained from a variety of public and private sector agencies and foundations. The goal should be to return monies raised from the sponsors directly into the research activities. A trail passing through the area to be used in the experimental restoration, with appropriate signage, would serve to inform the public about restoration ecology and provide a walking experience within this riparian zone (Map 6). Trail location would be restricted to prevent disturbance of waterfowl that congregate along the Grand River during migration and during winter. As well, trail location should respect areas designated by the OMNR as wintering habitat for Bald Eagle (OMNR 2001a).
- Any trail within the Cliffs and Alvars area should be posted with clearly marked signs to indicate trail location, appropriate and inappropriate uses of the area, and to indicate that persons are required to stay on the trail. Persons with dogs or other pets should be required to stay on the Grand Trunk Trail and not permitted on trails in Cruickston Park. Any removal work of alien vegetation (especially trees) should be done within the context of planned research activities. The wanton removal of plants and animals that are deemed “unwanted” can end up doing as much damage as leaving the plants or animals in place.
- Some of the croplands present a good opportunity to demonstrate and experiment with different types of agricultural practices. Experimental sites could be established to

demonstrate the costs/benefits of different types of agriculture: archaic (pre-European), colonial, pre-industrial and industrial. Water quality and soil quality monitoring could be done on replicated plots of land to demonstrate the impact on the environment of each of these types of agricultural practices. Some of the croplands could also be used in the study of experimental forest restoration.

- The best management plan for the Hogsback is to leave it alone forever. Hiking trails on a boardwalk may one day be considered for this area, but, for the present, the Hogsback should simply be secured against public encroachment.
- Absolutely nothing should be done with Indian Woods for a long time. If Indian Woods is effectively protected, it will become an item of intense and permanent appeal to persons interested in conservation and natural history. At some future date, a series of viewing platforms could be constructed within the forest to allow people to appreciate the wonder of Indian Woods. Some opportunities to encourage research in forest ecology may exist but only under tightly controlled conditions to prevent any deterioration of the land.
- The forests along the Bauman Creek drainage system include a spectacular watershed valley system that accepts runoff water from Indian Woods, Manor House Woods, Barn Woods and the western portion of Blair Road Slope Woods (Map 2). These forests should therefore be considered wherever possible as contiguous with Indian Woods and managed in the same manner. Some wonderful hickory, ash, and oak trees occur in the valley as well as hard maples to 200 years of age.
- Portions of Blair Road Slope Woods to the north and east of the Manor House have seen some disturbance. Still, some individual trees to 165 years of age are present and, accordingly, these properties should also simply be left alone.

4.0 VEGETATION.....Lawrence E. Lamb

4.1 Prior Studies

A number of vegetation studies including both qualitative and quantitative assessments have been undertaken on Cruickston Park since the mid-1970s; however, no comprehensive vegetation study has been completed for the entire property to this date. These prior studies include: Lothian (1976); Gilbert [(1981) in P.F.J. Eagles Planning Ltd.1991]; P.F.J. Eagles Planning Ltd. (1991); Ecologistics Limited (1996); ESG International Inc. (2000). As well, an inventory and a vegetation management plan were undertaken for the City of Cambridge along the Grand Trunk Trail that runs through a portion of Cruickston Park (Thompson 1996; Thompson & Associates 1996). Most recently, North-South Environmental Inc. (2001) summarized preliminary findings of CPEAT.

4.2 Methods

The main objective of this vegetation survey was to survey the vegetation of Cruickston Park in order to become familiar with the composition and distribution of all of its plant communities. Based on this familiarity, recommendations on how to manage the vegetation could then be formulated. In the first phase of this environmental plan, initiated by Nicholas Hill, landscape units were described in both geographical and cultural terms. Working within these units, CPEAT has refined his terminology and identified and delineated where possible, vegetation units as ecosites based upon both on-foot surveys and analysis of aerial photograph mosaics, 1:5000 (Regional Municipality of Waterloo 2000) (Maps 1 to 4). These vegetation units are named according to their location and the dominant vegetation or feature of the site (e.g. Indian Woods Mixed Swamp). Some boundaries between ecosites intergrade and are so indicated. North-South Environmental Inc. (2001) reviewed all vegetation community types delineated on portions of Cruickston Park lands in prior studies.

Between February 25, 2001, and January 18, 2002, 23 on-foot surveys were undertaken in which a comprehensive search was made of each habitat. The searches were carefully staged to take advantage of the best seasonal development at each site, that is, the times when various plant communities were at their best or when a species of particular interest would be most evident. Several key habitats were visited on more than one occasion to observe seasonal variation at the sites. Particular emphasis was placed on locating and evaluating plant associations and species with characteristics important enough to protect them from development or intrusion. These characteristics included: rare species presence, regional or provincial extent, ecological representation and integrity, ecological functioning and physical sensitivity. Particular emphasis was also placed on searching ecotonal habitats, especially the interface between drier, upland habitats and wetter, lowlands due to their propensity to be more species rich. All hedgerows, lanes and woodlot edges were also checked.

In consideration of future landscape restoration efforts, searches were made for, and sites documented of, habitats that are particularly disturbed or are strategically important for aesthetics, buffers, linkage strategies and trail development. Locations of significant populations of problematic – aggressive and invasive – alien plant species and plantations were also noted. Large specimen trees were also searched for and GPS plotted.

Written notations of findings were made and sites of interest were mapped and/or GPS plotted and flagged. Blue vinyl flagging tape was used consistently to mark significant vegetation. A comprehensive and systematic effort was made to photograph all of the habitats and significant species on the property. Approximately 20 rolls of 36-exposure slide film were used. A collection was made of plant species requiring identification in the lab or of selected, significant species to be deposited as vouchers in the Biology Herbarium, University of Waterloo.

Throughout the course of the survey a bibliographic search and review was made of the extensive documentation related to the vegetation at Cruickston Park (see 4.1 Prior Studies). Comments related to vegetation from the document review and details of any significant findings

during the course of the field surveys have been forwarded to the owners, their planning consultants and the environmental planning staff of the Regional Municipality of Waterloo. Any discoveries related to other aspects of the field investigations were forwarded to other members of CPEAT. Species status was determined using Newmaster et al. (1998) and Regional Municipality of Waterloo (1999).

A concerted effort during the year was made to invite other individuals or agencies to assist with the vegetation surveys (see 2.0 Acknowledgements). This facilitated more frequent and more thorough coverage of sites within Cruickston Park.

During 2001, Wynn Watson undertook a survey of mosses and liverworts throughout Cruickston Park and prepared a preliminary list (APPENDIX A). A large number of species previously undocumented for Waterloo Region was discovered at Cruickston Park during this season's survey.

4.3 Findings

The significant discoveries related to the vegetation survey are highlighted in tables below. The geographic locations and vegetation units, in which these discoveries are located, are presented on Maps 1 to 4.

Table 3 in the *Draft Management Framework for Cruickston Park* (North-South Environmental Inc. 2001) lists native vascular plant species documented in Cruickston Park. Regrettably, only the new species discovered for Cruickston Park up until August 2001 were listed; significant species previously discovered by others and rediscovered during CPEAT's surveys are not listed. Nevertheless, this table portrays the quality and importance of the floristic resources on the property.

Tables 1a to 1d below highlight findings of significant plant species and those not previously listed in the *Draft Management Framework for Cruickston Park* (ibid.).

Table 1a: Significant plant species newly discovered, Cruickston Park.

Nomenclature follows Newmaster et al. (1998). For explanation of terms for the status of rare species (i.e. RMW, G Rank, S Rank) see APPENDIX C;

Species	RMW	G Rank	S Rank	Geographic Location and Vegetation Unit
<i>Cinna arundinacea</i> Sweet Reed Grass	✓	G5	S4	<ul style="list-style-type: none"> Cliffs and Alvars Mixed Swamp
<i>Conioselinum chinense</i> Hemlock-parsley	✓	G5	S3	<ul style="list-style-type: none"> Hogsback Mixed Swamp
<i>Conopholis americana</i> Squawroot	✓	G5	S4	<ul style="list-style-type: none"> Indian Woods Deciduous Forest Manor House Woods Deciduous Forest
<i>Elymus riparius</i> Streambank Wild Rye	✓	G5	S4	<ul style="list-style-type: none"> Grand River (north bank) Floodplain Meadow with scattered trees and shrubs
<i>Euonymus atropurpurea</i> Burning Bush	✓	G5T	S3	<ul style="list-style-type: none"> Cliffs and Alvars Deciduous Forest on fractured, solution-cavities, dolomitic limestone
<i>Gentiana andrewsii</i> Closed Gentian	✓	G4	S4	<ul style="list-style-type: none"> Cliffs and Alvars Wet Meadow
<i>Gentianopsis virgata</i> Smaller Fringed Gentian	✓	?	S4	<ul style="list-style-type: none"> Cliffs and Alvars Wet Meadow
<i>Helianthus decapetalus</i> Thin-leaved Sunflower	✓	G5	S5	<ul style="list-style-type: none"> Manor House Woods Deciduous Forest
<i>Maianthemum trifolium</i> Three-leaved Solomon's Seal	✓	G5	S5	<ul style="list-style-type: none"> Hogsback Mixed Swamp
<i>Menispermum canadense</i> Moonseed	✓	G5	S4	<ul style="list-style-type: none"> Cliffs and Alvars Deciduous Forest on fractured, solution-cavities, dolomitic limestone Grand River (north bank) Floodplain Meadow with scattered trees and shrubs
<i>Osmunda claytoniana</i> Interrupted Fern	✓	G5	S5	<ul style="list-style-type: none"> Blair Road Slope Woods Deciduous Forest Indian Woods Mixed Swamp
<i>Parnassia glauca</i> American Grass-of-parnassus	✓	G5	S5	<ul style="list-style-type: none"> Cliffs and Alvars Wet Meadow

<i>Populus deltoides</i> Eastern Cottonwood (some indigens)	✓	G5T?	SU	<ul style="list-style-type: none"> • General distribution
<i>Prunus americana</i> Wild Yellow Plum	✓	G5	S4	<ul style="list-style-type: none"> • Cliffs and Alvars Hawthorn Savanna/Old Field on Alvar
<i>Quercus velutina</i> Black Oak	✓	G5	S4	<ul style="list-style-type: none"> • Hedgerows and Lanes • Hogsback Deciduous Forest
<i>Stachys hispida</i> Rough Hedge-nettle	✓	G4Q	S4S5	<ul style="list-style-type: none"> • Grand River (north bank) Floodplain Meadow with scattered trees and shrubs
<i>Teucrium canadense</i> Wood Germander	✓	G5T	S5?	<ul style="list-style-type: none"> • Grand River (north bank) Floodplain Meadow with scattered trees and shrubs

Table 1b: Species found in new locations, Cruickston Park

<i>Amelanchier spicata</i>	Low Juneberry
<i>Celtis occidentalis</i>	Common Hackberry
<i>Galearis spectabilis</i> *	Showy Orchis
<i>Quercus ellipsoidalis</i>	Hill's Oak
<i>Staphylea trifolia</i>	Bladder-nut
<i>Zanthoxylum americanum</i>	American Prickly-ash
<i>Zizia aurea</i>	Golden Alexanders

*not listed in ESG (2000) but listed in P.F.J. Eagles Planning Ltd. (1991)

Table 1c: New species of interest, but not significant, Cruickston Park

<i>Asclepias exaltata</i>	Poke Milkweed	found in Hogsback Mixed Swamp
<i>Hydrophyllum canadense</i>	Canada Waterleaf	found in Blair Road Slope Woods Deciduous Forest
<i>Phragmites communis</i>	Common Reed (likely non-indigens)	found on downstream end of large island below the confluence
<i>Physostegia virginiana</i>	Obedient Plant (non - indigens)	found along Grand River (north bank) Floodplain Meadow with scattered trees and shrubs

Table 1d: New alien species, Cruickston Park

<i>Butomus umbellatus</i>	Flowering Rush	found along the Grand River (south bank) at the base of the cliffs
<i>Impatiens glandulifera</i>	Himalayan Balsam	found along the Grand River (north bank) Floodplain Meadow with scattered trees and shrubs

4.4 Interpretations

4.4.1 Noteworthy additions to the flora of Cruickston Park

The findings from the vegetation surveys have been substantial. Notable highlights include the discovery of 17 new, significant species and the rediscovery of the majority of species listed in

recent reports (P.F.J. Eagles Planning Ltd. 1991; ESG 2000; North-South Environmental Inc. 2001) as well as the discovery of additional locations for these significant species. Fifty to ninety percent of the known number of individuals of five regionally significant plant species occurs here. These include: Bladder-nut, Smooth Cliff-brake, Lizard's-tail, Maidenhair Spleenwort and Rock Polypody Fern.

Searches for invasive species confirmed the widespread presence of the majority listed for the property (North-South Environmental Inc. 2001). Especially large populations of the following invasive species were found: Common Periwinkle in Manor House Woods and along the middle reach of Bauman Creek; Goutweed and Lily-of-the-valley in the middle reaches of Bauman and Cruickston Creeks.

Flowering Rush and Himalayan Balsam, two, new, alien species found within Cruickston Park, are highly aggressive invaders as their seed spreads easily via water transport. In certain jurisdictions in eastern Canada and the northeastern United States, these species have become serious invaders, jeopardizing native floodplain species, many of which are rare. Both of these species should be eradicated immediately during their next growing season (summer 2002) before they become further established.

4.4.2 Questionable plant species records within Cruickston Park

Several plants listed as occurring on Cruickston Park in earlier reports, have not been found by CPEAT. It is questionable that they occur on Cruickston Park lands. Two species* likely do not occur on surrounding lands or in the rest of Waterloo Region.

- *Asplenium trichomanes-ramosum** – Green Spleenwort
- *Eupatorium purpureum* – Purple Joe-pye-weed
- *Parthenocissus quinquefolia* – Five-leaved Virginia-creeper
- *Quercus bicolor** – Swamp White Oak
- *Shepherdia canadensis* – Buffalo Berry

4.4.3 Significant vegetation features of Cruickston Park

The vegetation at Cruickston Park is special for its diverse array of both common and unusual, more spatially restricted habitats.

Typical habitats of southwestern Ontario are well-represented in Cruickston Park: old-field systems, including flood plain meadows, upland and lowland forests in various stages of ecological succession and hedgerows (Maps 1 to 4). More unusual habitats include the regionally and provincially significant, fern-dominated plant community and an associated rim flora on dolomitic limestone cliffs; carr and forests on sizeable, dissected and solution-cavitated, dolostone outcropping and extensive old-field and meadow systems on alvar. Three relatively intact subwatersheds – Bauman Creek, Cruickston Creek and Newman Creek – exist totally, from source to mouth, or for the majority of their lengths, within the property boundaries (Maps

1 to 3). A number of small, regionally significant, though highly restricted, marsh and pond habitats also occur.

A provincially significant highlight of the vegetation at Cruickston Park that warrants special mention is Indian Woods, which due to its distant and minimal logging history, approximates an “old-growth forest” condition, dominated by “honour roll sized” specimen trees. Doug Larson describes Indian Woods as follows: “This heavily wooded part of the landscape is either old-growth deciduous forest or is very selectively cut old-growth remnant. Very few deciduous forests in southern Ontario are in as good and natural condition as this. Encroachment of wind and light along the western boundary has taken place, but no damaging effects on Indian Woods have been detected.” As well, Indian Woods is more or less contiguous with Manor House Woods and the forests along the reach of Bauman Creek that extends to Blair Road. Together, these woods contain sizeable American Beech, Sugar Maple, Red Oak, White Ash and Shagbark Hickory. Beneath this canopy, the middle reach of Bauman Creek forms a spectacular forested, watershed, valley system.

The 1817 survey notes of land surveyor, Adrian Marlet who surveyed North and South Dumfries townships, describes the forest that would have included Indian Woods and Manor House Woods (Map 2) as consisting of Sugar Maple, American Beech and elm (likely White Elm) (Marlet 1817). Dutch Elm Disease has eliminated all of the large elms; however, these woods are still dominated by sizeable Sugar Maple and American Beech, demonstrating the long-term ecological stability of these two forest remnants. Indian Woods and Manor House Woods are still likely representative of their first historical documentation.

Speculation is that the sizeable trees exist because sensitive land management spared them in the past. This perceived sensitivity might be deemed plausible due to the secure financial circumstances of the former property owners during the 19th and early 20th centuries, the size of the property and the resources available to sustain it. The owners could afford to save a number of large trees. For example, the largest Bur Oak listed in an Honour Roll of trees for Waterloo Region (KWFN 1991) is found in Cruickston Park. As well, a Black Maple on the property (measured in 2001) is a candidate for the Region of Waterloo Honour Roll as well as the Ontario Honour Roll. P.F.J. Eagles Planning Ltd. (1991) compared diameters at breast height of a number of trees found on the property and noted that five trees exceeded the size of Honour Roll Trees, including a Bitternut Hickory, Sugar Maple, Red Maple and two American Basswoods. In a tree-coring study, Ecologistics Limited (1996) determined that trees of the following species were greater than 175 years old: Red Oak, American Beech, Sugar Maple and White Ash. The oldest tree in this sample, a Red Oak, is now 232-years old. The oldest Shagbark Hickory is 164 years old.

Another significant feature is the regionally unique and provincially significant forest on the dissected, solution-cavities, dolomitic limestone area between Blair Road and the Grand River. There are hints, from the presence of large, open-grown Bur Oaks, that portions of this forested area may once have been savanna-like. However, the site is now dominated by Black Maple, Sugar Maple, American Beech, White Ash, Bitternut Hickory, Common Hackberry and Bur Oak

forest. There is an abundance of Bladder-nut, a regionally rare shrub, in the understory as well as smaller numbers of the equally rare shrubs, Moonseed and Burning Bush. The spring ephemeral wildflower display in these woods is exceptional for its diversity and aesthetics. This area is as fine as it is, likely due to the rough, coarsely pitted dolostone that prevented easy access for cattle to graze. Unfortunately, grazing activities were not regulated elsewhere between Blair Road and the Grand River. The alvar communities in particular are significantly degraded due to cattle grazing in the past, as are sizeable-forested areas.

4.4.4 Significance of restoration and rehabilitation opportunities in Cruickston Park

The floodplain along the Grand River is extensive and has been intensively used for pasture and, more recently, for cropland for a very long time. The agricultural practices have been devastating to the natural flora and fauna that once occurred in this riparian floodplain. An important attribute of Cruickston Park is the potential to restore such large acreages of land, currently under cultivation, back to a near-natural condition. This unprecedented restoration effort would create one of the larger, single landowner units of contiguous habitat in southwestern Ontario. Such large-scale reserves are the only hope for the long-term protection of organisms requiring an undisturbed sanctuary such as forest-interior habitat, or for those that require extensive ranges for food supply or shelter. There is also an immense advantage in having the property under one ownership since planning, development and management of the property could be highly simplified.

4.5 Recommendations

- Continue the search for significant plant species and undertake a detailed inventory and mapping of the vegetation on an individual community basis for the entire property. Lands adjacent to Cruickston Park should also be visited, and assessed for potential impacts (beneficial or detrimental) on the property. Their worth for future land assembly strategies should be determined.
- Restrict access to physically sensitive habitats including the fern-rich areas along the cliffs, the vertical face and base of the limestone cliffs along the Grand River, the deciduous forest and mixed swamp of Indian Woods, the mixed swamp of the Hogsback along the upper reach of Cruickston Creek as well as the marsh and wet meadows along this creek north of Blair Road.
- Research the history of land management of Cruickston Park related to agriculture including crop production and livestock grazing, forest use including logging and reforestation, quarrying and the operation of mills, dairies, breweries, fisheries or other such enterprises. This information should be catalogued and made available for future land management decision-making and as an educational resource.
- Complete the documentation of major, aggressive, alien plant species and a detailed mapping of their locations so that a strategy for alien species removal can be formulated.

The small populations of Flowering Rush and Himalayan Balsam should be eradicated during the next growing season (summer 2002).

- The boundaries of the alvar and the dissected, solution-cavities, dolomitic limestone zones should be defined and mapped. These areas should be the first consideration for restoration.
- Request that the Ontario Ministry of Natural Resources: define the boundary of the Provincially Significant Wetland (PSW) along the entire length of Cruickston Creek and update their database on the Barrie's Lake Wetland Complex; re-evaluate Bauman Creek, an Evaluated Wetland.
- Alterations to habitats on adjacent lands may negatively impact the water quality of the drainage systems within Cruickston Park and harm associated wildlife on the property. In some cases, immediate remediation efforts may be essential. The hydrology of the property is important to many of its vegetation units. The hydrology of Cruickston and Newman Creeks is little understood, especially related to the karst topography and the movement of either surface or groundwater. The negative impacts on hydrology by the railway bed, now the Grand Trunk Trail, and Blair Road have been severe. The historic configurations of the lower reaches of Bauman, Cruickston and Newman Creeks should be modelled and eventually recreated.
- Consider extending the eastern boundary of ESPA 38, Cruickston Park, from its present limit adjacent to Newman Creek along the cliffs proper to the City of Cambridge boundary so that the entire vegetation unit, Hawthorn Alvar/Old Field Complex on Alvar, is included as well as the Conifer plantation, this latter site offering an opportunity for alvar restoration (Map 5).
- Complete a detailed Environmental Impact Statement to determine the impact of the closure of Blair Road.
- Formulate a configuration of cropland that can be taken out of agricultural use for ecological restoration to create corridors, linkages, buffers or augmented habitat (see the *Draft Management Framework for Cruickston Park*, North-South Environmental Inc. 2001 for discussion of the value of corridors and linkages as a conservation strategy).
- Develop a plan for identifying and designating strategic habitats within Cruickston Park in order for Cruickston Charitable Research Reserve to participate as an Ecological Science Co-operative (ESC) site within the Ecological Monitoring and Assessment Network (EMAN) and as a monitoring site using the Smithsonian Institute Man and Biosphere (SI/MAB) protocols.

- Examine the feasibility of establishing a nursery operation for growing plants for ecosystem restoration and, if possible, using the existing greenhouse and gardens. There are several, local, native plant growing businesses that could “partner” such an enterprise.
- Establish an educational, demonstration garden that will contain simplified examples of plant communities that will be restored or re-created within Cruickston Park. This garden should be accessible to the public.
- Develop a population management strategy to reduce the negative impact of White-tailed Deer on plant communities in Cruickston Park.
- Continue to measure and compare the size of large specimen trees on Cruickston Park to determine which qualify for inclusion in either regional or provincial Honour Roll lists of trees.
- Establish a library facility to house information and reference materials related to Cruickston Park, the Cruickston Charitable Research Reserve and all activities, both research-oriented and educational, associated with the property.

5.0 AQUATIC HABITAT AND FISH.....Kemeth W. Dance

5.1 Prior Studies

Aquatic habitat and fish species and communities present in the Grand and Speed Rivers and Bauman Creek have been recently documented in one or more of the following reports: CH₂ M Gore & Storrie Limited (1997), OMNR and GRCA (1998), ESG International Inc. (2000), OMNR file data October (2000), and OMNR (2001a).

5.2 Methods

No formal sampling of fish or aquatic invertebrates occurred during the present study. Observations on habitat conditions were made on various dates between April and October 2001, in various locations, particularly along the Grand River, Bauman Creek and Cruickston Creek.

On June 28, 2001, during a canoe trip down the Grand River, mapping of Smallmouth Bass nest concentrations was undertaken. Observations of juvenile fish and adult Smallmouth Bass concentrations were also recorded.

5.3 Findings

Where noteworthy observations have been made, these are described under the appropriate study area heading. See APPENDIX C for definitions of at-risk status.

5.3.1 Hogsback

5.3.1.1 Upper Reach Cruickston Creek

On August 6, 2001, Bill Wilson and Ken Dance walked the upper reach of Cruickston Creek channel from Blair Road to the headwater spring source within the Hogsback (Map 3). At 9:30 a.m. the water temperature in Cruickston Creek in the first treed area upstream of Blair Road was 19°C. Just downstream of the large block of forest, predominantly mixed swamp, water temperature was 17.5°C at 10:00 a.m. Within this mixed swamp and approximately 125 m downstream of the groundwater source of Cruickston Creek, water temperature was 12.5°C. At the spring source of the creek at 10:35 a.m., the water temperature was 10.5°C and air temperature was 21°C. These readings indicate that even during the very dry summer of 2001, there was a coldwater reach within Cruickston Creek. July was the driest month in Waterloo Region in 30 years when measurements were first recorded in the region and driest in more than half a century in southern Ontario (The Record September 1, 2001; The Toronto Star September 9, 2001). By the time Cruickston Creek reaches the farm lane a few metres upstream of Blair Road, the flow present in the nearby forest disappears underground. Here, a wet meadow, herbaceous plant community exists in the Cruickston Creek channel between two lobes of cornfield.

On August 10, 2001, Bill and Heather Wilson traced the Cruickston Creek channel north of Blair Road. The channel becomes braided and difficult to follow in places; however, at approximately 350 m northwest of the culvert where Cruickston Creek continues under Blair Road, water seeps out of broken limestone within the creekbed, forming a shallow pool. Water temperature in the pool was 16°C at 11:10 a.m. This reach of Cruickston Creek continues for approximately 140 m, passing under the Grand Trunk Trail and disappears underground within a wet meadow (Map 1). Further study is needed to determine the extent of braided channels of Cruickston Creek, north of Blair Road.

5.3.2 Indian Woods

5.3.2.1 Bauman Creek

On October 10, 2001, Brook Trout were observed in Bauman Creek between the impoundment and the bridge crossing on the old carriage road to Langdon Hall (Map 2). In one location, Brook Trout appeared to be beginning to spawn. This reach of Bauman Creek provides excellent trout habitat with extensive seepage on both banks throughout this reach and much in-stream cover. The stream bottom has both fine and coarse gravel substrates suitable for trout spawning. Stream depth is generally less than 25 cm, but the large volume of seepage ensures that trout have areas suitable for overwintering.

CH₂M Gore and Storrie (1997) indicate that approximately 50% of the Bauman Creek drainage basin is wooded and that the highest water temperature recorded in Bauman Creek during this subwatershed study was 13.2°C, at Blair Road, in July 1994. This subwatershed study also reported both young-of-the-year and adult Brook Trout at four locations downstream of the

impoundment. Fifty-three Brook Trout were captured downstream of Blair Road, including young-of-the-year fish.

5.3.3 River

5.3.3.1 Open Water

Four freshwater mussels (clams) of significance have been documented from the Grand River (ESG 2000). Three mussel species are provincially rare: the Elktoe, Slippershell Mussel and Wavy-rayed Lampmussel. The Wavy-rayed Lampmussel is also designated as nationally Endangered (OMNR 2001b).

Two rare fish species have been recorded from the Grand River (ESG International Inc., 2000; Baldwin, 1988). These fish are the Greater Redhorse, considered provincially and globally rare, and the Silver Shiner, designated a species of Special Concern nationally (OMNR 2001b).

Dozens of Smallmouth Bass nests were found along the northern margin of the Grand River opposite the vicinity of the mouth of Bechtel Creek and downstream on June 14, 2001 (Map 4). Adult bass were observed guarding some of the nests. Common Carp were also spawning near the northern shore approximately half way between the mouth of Bechtel Creek and the confluence of the Grand and Speed Rivers.

Another important habitat for Smallmouth Bass that occurs in the Cruickston Park study area is the deep water off the cliffs along the southern half of the Grand River at the eastern edge of Cruickston Park (Map 1). Here water depths of 1 to 1.6 m were measured on June 28, 2001 and numerous, large adult Smallmouth Bass were observed. This deep-water habitat is important to these fish in both summer and winter. The most significant limiting factor for Smallmouth Bass in the Grand River is the availability of deep-water pools in winter (Art Timmerman pers. comm.).

5.4 Interpretations

There are two significant points to raise about the river and stream habitats present within and adjacent to Cruickston Park. These are:

- (1) the confluence of the Grand River and one of its major tributaries, the Speed River, is situated on the northern margin of Cruickston Park (Map 4); and
- (2) there is a concentration of streams (many having coldwater fish communities) that discharge along the southern bank of the Grand River – three of these streams, Bauman, Cruickston and Newman creeks, flow through Cruickston Park (Maps 1 to 3).

Regarding the confluence of the Grand and Speed Rivers, the same physical, chemical, and biological features that make this area attractive to bird life (overwintering Bald Eagle and

waterfowl, migrating songbirds, shorebirds and waterfowl) also provide conditions suitable for a large variety and density of fish and aquatic invertebrate life. The confluence of rivers has long been known as locations where First Nation peoples settled, since concentrations of fish and wildlife were present.

The energy inputs from the Speed River benefit the Grand. As well, certain fish species often migrate from larger rivers into smaller rivers to spawn and to colonize available habitat. The pools scoured by flows from tributary streams and the deposition bars and islands which form in these locations provide shallow, sheltered areas for growth of aquatic and wetland vegetation, and provide nursery habitat for fish as well as rearing habitat for waterfowl. During site visits, thousands of small fish and many broods of ducks and geese were observed in the area of the confluence and its islands.

In a south easterly direction along Blair Road starting at Fountain Street, there are six named streams: Blair Creek, Bechtel Creek, Bauman Creek, Cruickston Creek, Newman Creek and Devil's Creek, which drain to the southern bank of the Grand River along an approximate five-kilometre length of Blair Road. There are additional groundwater seepages along this bank. Reaches of many of these streams have coldwater habitat.

This concentration of good quality aquatic habitat is a precious resource. Inputs of good quality water from these streams must also be beneficial to the quality of the Grand River.

ESG (2000) indicates that groundwater seepage areas may be considered significant wildlife habitat. Seepage occurs out of the base of the cliffs within Cruickston Park on the south bank of the Grand River at several locations over a distance of more than 120 m. Groundwater seepage is also present within the mixed swamp of the Hogsback where it feeds the headwater of Cruickston Creek (Map 3), along both banks of Bauman Creek within the mixed swamp of Indian Woods (Map 2), and within the Blair Road Slope deciduous forest.

6.0 REPTILES AND AMPHIBIANS..... Kenneth W. Dance

6.1 Prior Studies

To our knowledge no detailed studies of reptiles and amphibians (herptiles) have been previously completed on Cruickston Park. Observations of herptiles from lands surrounding and or including Cruickston Park have been recorded in P.F.J. Eagles Planning Ltd. (1991), CH₂ M Gore & Storrie Limited (1997), and ESG International Inc. (2000). The larger area of some of these study zones has included Orr's Lake, Altrieve Lake and the Upper Blair Creek Subwatershed.

6.2 Methods

Area searches for breeding frogs and salamanders began on March 22, 2001. During site visits throughout the spring season and into late October 2001, salamander, frog and toad breeding sites and reptile sightings were recorded. In addition to listening for frog and toad choruses, searches of pools for amphibian eggs were conducted. Searches for herptiles occurred beneath logs, leaves, stones and debris. Turtles were inventoried by spotting them at sunning locations and searching for nesting sites.

A canoe trip was undertaken to study the Grand River and mouth of the Speed River on June 28, 2001. Observations of herptiles and fish habitat were made during this inventory along the entire length of the Grand River within Cruickston Park.

Ken Dance and various assistants searched for herptiles on the following dates in 2001: March 3, 22, 25, April 8, 11, 14, 23, May 16, June 1, 3, 14, 28, August 6, September 30, October 10, and 12.

Extensive and valuable observations of herptiles from the Cruickston Park study area were recorded during several dozen visits by Bill and Heather Wilson from incidental observations during the bird studies.

6.3 Findings

Table 2 summarizes the Year 2001 observations of reptiles and amphibians by study area, which correspond to geographic locations and vegetation units identified and delineated on Maps 1 to 4, e.g. Hogsback Mixed Swamp. Fifteen species were found during 2001. See APPENDIX C for definitions of at-risk status.

The text comments on concentrations of herptiles, occurrence of breeding habitat, or historical observations of less common species. If a study area is not discussed there are likely no historical records of importance and/or only common or no species were observed during the 2001 fieldwork.

6.3.1 Cliffs and Alvars

6.3.1.1 Hawthorn Savanna/Old Field on Alvar

A single Smooth Green Snake was observed on two dates during 2001 in this vegetation unit (Map 1). This snake is considered rare in the Regional Municipality of Waterloo. On June 13, 2001, Heather and Bill Wilson saw this species near bird monitoring station C-4. On October 12, 2001, Ken Dance found and photographed a 40-cm long specimen in a stone pile located 4 m north of the Grand Trunk Trail. A Brown Snake and a Redbelly Snake were less than 1 m away in the same stone pile.

6.3.2 Hogsback

6.3.2.1 Mixed Swamp

Two specimens of Spotted Salamander were discovered by Kevin Dance and confirmed by Ken Dance on April 14, 2001. One was 62 mm long and the other was 77 mm. Searches for larger Spotted Salamanders and eggs revealed none.

Along with numerous adult Red-backed Salamanders, a specimen only 25 mm long was found. This indicates that a range of age classes of Red-backed Salamanders is present in the Hogsback.

Seven species of herptiles were found in this vegetation unit in 2001, the highest diversity of any area in Cruickston Park.

Ponds within the Hogsback Mixed Swamp, at and just south of the Cruickston Park boundary, are used by large numbers of breeding frogs and toads.

6.3.2.2 Deciduous Forest

A single Spotted Salamander was observed by Jerry Guenther, Larry Lamb (photo) and Bill Wilson on June 16, 2001.

6.3.3 Indian Woods

6.3.3.1 Bauman Creek

Although habitat for Pickerel Frog appears to be suitable upstream of the impoundment on Bauman Creek (Map 2), none was found during 2001. Only Green and Leopard Frogs were found.

On October 10, 2001, a concentration of Red-backed Salamanders was observed around the dam of the impoundment. The dam structure and the fill around the base of the dam may be used as a hibernation site for Red-backed Salamanders.

6.3.4 River

6.3.4.1 Open Water

The shoreline and rocky bottom of the Grand River could provide habitat for the Queen Snake which has been found here in the past. This snake is provincially rare (S2), Threatened nationally and Threatened in Ontario. Francis and Campbell (1983) report that the snake has been found at three locations along the Grand River. One station was adjacent to the Galt Country Club across the river from Cruickston Park. This snake is aquatic and feeds on crayfish, small fish and amphibians. In 2001, habitat was suitable and food was abundant. The expectation is that an intensive search would reveal that this snake still occurs along the Grand River at Cruickston Park.

6.3.4.2 Shoreline

American Toad, Northern Leopard Frog, Green Frog and Bullfrog are reported, and have been for many years, along the shoreline of both the Speed and Grand Rivers by Bill Wilson. Ken Dance heard or observed breeding American Toads and thousands of toad tadpoles at several locations along the Grand River between Fountain Street and the George Street extension. Juvenile toads were common along the Grand River margins in late June 2001.

Bill Wilson reports the occurrence of both the Common Snapping Turtle and Midland Painted Turtle along the shoreline of both the Grand and Speed Rivers over several years including 2001. Kevin and Ken Dance observed the Midland Painted Turtle along the Grand River on June 28, 2001.

6.4 Interpretations

A variety of common frogs, toads, snakes and turtles was found to be widely distributed across Cruickston Park.

The two regionally rare species found in 2001, Spotted Salamander and Smooth Green Snake, were present in small numbers and were very localized in distribution. The Queen Snake, Threatened nationally and provincially and reported historically from the Grand River at the Galt Country Club, was not observed during 2001, but more thorough searches might encounter this species because suitable habitat is present.

Water quality and quantity in woodland ponds, floodplain pools, river backwaters and groundwater seepage, stream and river habitat, along with uncultivated vegetation cover are critical to sustaining flourishing herptile populations. Amphibian populations are frequently used to monitor environmental quality since these organisms have very specific habitat requirements and they have been found to be sensitive to land use practices and pollution.

Cruickston Park and other natural habitats that are connected to it or are within a few kilometres of it, provide habitat for one of the greatest varieties of herptiles in Waterloo Region. Certainly Cruickston Park and adjacent lands must have one of the greatest herptile diversities in a habitat complex that is becoming surrounded by the urban mass of Kitchener and Cambridge.

Management of lands in the Roseville Swamp, Altrieve Lake, Orr's Lake, Barrie's Lake, Cruickston Park and adjacent wetlands along the western boundary in a manner that would benefit herptiles would also benefit fish and other wildlife populations. This would ensure the perpetuation of what must be a regionally significant herptile community, given records of Spotted Salamander, Blue-spotted Salamander, Tremblay's Salamander, Pickerel Frog, Blanding's Turtle, Queen Snake, Northern Ribbon Snake, and Smooth Green Snake, from the greater area surrounding Cruickston Park (ESG International Inc. 2000).

Table 2: Year 2001 occurrence of reptiles and amphibians by study area, Cruickston Park.

SPECIES	STUDY AREA												
	A1	A2	A3	A4	A6	A8	H1	CC	G1	G2	BC	C1	C2
AMPHIBIANS													
Spotted Salamander									+	+			
Red-backed Salamander		+							+	+		+	
American Toad			+			+			+				
Spring Peeper						+			+	+		+	+
Striped Chorus Frog									+				+
Bullfrog												+	
Green Frog											+	+	+
Wood Frog									+				+
Northern Leopard Frog		+				+			+		+	+	
REPTILES													
Common Snapping Turtle		+											
Midland Painted Turtle													
Brown Snake		+											
Eastern Garter Snake			+							+			
Eastern Smooth Green Snake		+											
Red Belly Snake		+											
Number of Taxa Observed in Area	0	6	2	0	0	3	0	0	7	4	2	5	4

+ species was observed during 2001.

LEGEND					
Study Area Number	Area Name	Specific Area Type	Study Area Number	Area Name	Specific Area Type
A	Cliffs & Alvars		G	Hogsback	
A1		Cliffs	CC		Cruickston Creek
A2		Hawthorn savanna/old field complex	G1		Mixed swamp
A3		Deciduous forest on fractured, solution-cavities, dolomitic limestone	G2		Deciduous-mixed forest
A4		Deciduous swamp	C	Indian Woods	
A6		Pioneer deciduous forest-carr	BC		Bauman Creek
A8		Wet meadow	C1		Mature deciduous forest
H1		Meadow with scattered trees and shrubs	C2		Deciduous-mixed swamp

Table 2 cont'd Year 2001 occurrence of reptiles and amphibians by study area, Cruickston Park.

SPECIES	STUDY AREA													
	F1	F2	BMR	D1	D2	J	K	J2	H1	A2 west	BLR	P	OW	S
Spotted Salamander														
Red-backed Salamander	+													
American Toad									+		+		+	+
Spring Peeper	+										+			
Striped Chorus Frog														
Bullfrog									+					+
Green Frog				+		+			+			+		+
Wood Frog														
Northern Leopard Frog						+	+		+			+		+
REPTILES														
Common Snapping Turtle													+	+
Midland Painted Turtle									+			+	+	+
Brown Snake						+								
Eastern Garter Snake							+		+					
Eastern Smooth Green Snake														
Red Belly Snake														
Number of Taxa Observed in Area	2	0	0	1	0	3	2	0	6	0	2	3	3	6

+ species was observed during 2001.

LEGEND					
Study Area Number	Area Name	Specific Area Type	Study Area Number	Area Name	Specific Area Type
F	Blair Road Slope Woods		H	Floodplain	
F1		Deciduous forest	J2		Riparian forest
F2		Mixed plantation	H1		Riparian meadow
BMR		Bauman Creek (Middle Reach)	A2 west		Old field in hawthorn savanna/old field complex
D	Barn Woods		BLR		Bauman Creek (Lower Reach)
D1		Deciduous forest	P		Pond
D2		Deciduous swamp		River	
J		Hedgerows & lanes	OW		Open water
K		Cropland	S		Shoreline

6.5 Recommendations

- Determine the flow path of Cruickston Creek from the edge of the Hogsback to the Grand River.
- Select cropland to be taken out of row crop production to initiate ecological restoration and to preserve the topsoil, a key natural resource. Implement such changes initially along steep slopes adjacent to Cruickston Creek and those to the south of Indian Woods.
- Organize a planting scheme along the middle reach of Cruickston Creek immediately south of Blair Road that would widen the treed corridor along Cruickston Creek to a minimum width of 125 m and reconnect the deciduous woodland patch adjacent to Blair Road to form a woodland valley extending from Blair Road to the core area of the Hogsback.
- Cease the application of sludge on tilled lands.
- Undertake quantitative assessment of the quality of sediment in Bauman and Cruickston Creeks prior to, and after, cessation of sludge application on cropland.
- In cooperation with adjacent landowner's, develop a watershed management strategy for lands upstream of Cruickston Park including those with kettle lakes and those on the Waterloo Moraine.
- In cooperation with the Grand River Conservation Authority, determine what is required to rehabilitate the lower reach of Bauman Creek between Blair Road and the outflow of the creek into the Grand River.
- Implement a more intensive White-tailed Deer hunt to prevent further severe browse damage to vegetation.

7.0 BIRDS.....William G. Wilson

7.1 Prior Studies

In 1981, Gilbert undertook an environmental assessment of Cruickston Park including breeding bird censusing of the “extreme southeast portion of the alvar” (P.F.J.Eagles Planning Ltd. 1991). Eagles (ibid.), in his terrestrial biology study of Cruickston Park, included a qualitative assessment of bird species encountered from May to September, 1991. Wilson (1995) documented bird species of riparian habitat of Cruickston Park, in particular, waterfowl, along the Grand and Speed Rivers based upon a 24-year period of observation. Bird records within a two-kilometre radius of the confluence of the Grand and Speed Rivers – seasonally since 1971 and weekly since 1994 – have been summarized in a seasonal checklist, *Birds along the Cambridge Riverbank Trail System*:

Linear Trail and environs (Wilson 2000; see also *Grand Actions Registry* 1999). Cruickston Park lies within this two-kilometre radius of the confluence although bird study on the property was confined to riparian habitat, hedgerows and Indian Woods until 1995. From 1996 to 2001, bird study was extended throughout the property (Wilson field notes). In 1999, an environmental assessment of lands for the Cambridge Area Route Selection Study (CARSS) included a large portion of Cruickston Park. In this assessment, breeding bird surveys were undertaken only in major vegetation patches within the CARSS study area from late May to early July 1999 (ESG International Inc. 2000)

Further documentation of bird sightings in Cruickston Park, primarily during migration and early winter, exist in the Bird Records of the KWFN (1977-1998). Technical Data Reports are on file for two Environmentally Sensitive Policy Areas (ESPA), 36 and 38, which are located within Cruickston Park (Regional Municipality of Waterloo 1984). Portions of Cruickston Park lie within the boundaries of both the Kitchener and Cambridge Audubon Christmas Bird Counts conducted by members of KWFN.

7.2 Methods

Point-count monitoring and area searches were used to determine the species composition and the species-habitat associations of the breeding birds of Cruickston Park.

7.2.1 Surveying birds during the non-breeding season

To identify winter resident birds as well as early migrants, area searches for birds and bird activity were undertaken throughout the property from early January until mid-April 2001. Waterfowl counts during late winter and early spring were undertaken along the Grand and Speed Rivers within Cruickston Park. Area searches for spring migrants continued throughout the latter half of May; fall migration was monitored from mid-August to mid-December 2001.

7.2.2 Surveying birds during the breeding season

Area searches referred to above also served to identify early nesting birds. Thirty-six point count monitoring stations were established in Cruickston Park and procedures followed were those prescribed by the Forest Bird Monitoring Program in Ontario (1997). The locations of these monitoring stations have been plotted by GPS. In areas where monitoring stations were not established (i.e. along the river, in croplands, hedgerows and lanes), area searches were conducted. As well, area searches for nesting species continued throughout the breeding season until early August to gather and document breeding evidence following the Ontario Breeding Bird Atlas (2001a) *Guide for Participants*.

7.3 Findings

A total of 187 species of birds has been recorded in Cruickston Park. Most bird species discussed in this section are breeding birds of regional significance¹ (Regional Municipality of Waterloo 1996) and/or breeding birds of conservation priority for the Regional Municipality of Waterloo² (Couturier 1999), e.g. Scarlet Tanager^{1,2}. See APPENDIX C for definitions of at-risk status.

Bird findings are discussed in terms of the vegetation units described for the property (Maps 1 to 4).

7.3.1 Cliffs and Alvars

7.3.1.1 Cliffs proper

The cliffs of Cruickston Park provide natural nesting opportunities for Northern Rough-winged Swallow² and Eastern Phoebe², the former selecting natural crevices in the rock while the latter selects a flat projecting surface to attach its nest, usually sheltered under an overhang.

Bald Eagle, an Endangered species in Ontario, has established winter residency along reaches of the Grand River above and below the confluence of the Grand and Speed Rivers (OMNR 2001a) (See Section 7.3.9 River). Single eagles have been observed perched in trees along the cliffs during the winter of 2001 and 2002. On one occasion, in March 2001, a pair of adult eagles was observed perched there (Map 1). Other raptors used both snags and large limbed trees as perches during other seasons. Cooper's Hawk^{1, 2} has been observed in trees along the edge of the cliffs during the breeding season. Osprey^{1, 2} regularly perches in trees along the cliffs during both spring and fall migration. Occasionally, Turkey Vulture^{1, 2}, Black-crowned Night-Heron^{1, 2} and Great Blue Heron¹ perch in such trees along the cliffs.

7.3.1.2 Deciduous Forest

The Deciduous Forest in the Cliffs and Alvars section provides hunting territory for avian predators such as Cooper's Hawk^{1, 2} and Great Horned Owl. Both Eastern Screech-Owl and Northern Saw-whet Owl^{1, 2} have been recorded here in autumn and early winter. Sightings and signs of Wild Turkey and Ruffed Grouse² are apparent throughout the year. Five species of woodpeckers inhabit this forest including a Carolinian species, Red-bellied Woodpecker^{1, 2} and an area-sensitive species, Pileated Woodpecker^{1, 2}. Forest-interior species such as Ovenbird^{1, 2} and Scarlet Tanager^{1, 2} establish breeding territories here, as do area-sensitive birds, Brown Creeper^{1,2} and Wood Thrush². At least three bands of Black-capped Chickadees² roam the Cliffs and Alvars during the winter.

7.3.1.3 Deciduous Swamp and other wetlands

Seven species of conservation priority in Waterloo Region nest within the Deciduous Swamp of the Cliffs and Alvars sections of Cruickston Park including area-sensitive forest species, American Redstart^{1, 2} and Brown Creeper^{1, 2}. In 1997, Blue-gray Gnatcatcher^{1, 2} may have nested here. Gray Catbird² breed in the Pioneer Deciduous

Forest-Carr and Swamp Sparrow², observed in this habitat and in the nearby Wet Meadow, probably breeds in the latter.

7.3.1.4 Hawthorn Savanna/Old Field on Alvar

During the evenings of early spring, the twitters of the courtship display of American Woodcock² are audible at the western end of the Cliffs and Alvars section along either side of the Grand Trunk Trail. Breeding of this species was confirmed with the sighting of fledged young. Sightings of Orchard Oriole^{1, 2}, a Carolinian species, have been made in five of the last six years in this habitat in Cruickston Park and, immediately across the river along Linear Trail, where in 1997, Orchard Oriole successfully fledged four young. Adults would forage on both sides of the river. Sightings of this oriole in the same vicinity on both sides of the river suggested a possible breeder in 1998 and probable in 2001.

Five members of the guild of old-field birds are found at the west end of the Cliffs and Alvars section including American Kestrel², Eastern Kingbird², Eastern Meadowlark², Bobolink² and Savannah Sparrow². Bobolink is annually observed during its stopover on migration but so far has not remained to nest. The kestrel hunted in the field while the others nested there.

Hawthorn Savanna/Old Field on Alvar habitat also is found toward the eastern end of the Cliffs and Alvars section. Several species breed here including Black-billed Cuckoo^{1, 2}, Black-capped Chickadee² and American Goldfinch² and Field Sparrow², which raised at least one brood successfully, possibly two. In 1980, nesting Orchard Oriole was located in hawthorn savanna at the eastern end of the Cliffs and Alvars section (P.F.J.Eagles Planning Ltd. 1991).

During spring migration, more warblers as well as other songbirds are observed along the interface between the Hawthorn Savanna/Old Field on Alvar and the Mixed Swamp than in any other habitat in the Cliffs and Alvars section (Map 1). A few species remain to nest: American Redstart^{1, 2} and Yellow Warbler were confirmed breeding during 2001. Magnolia Warbler^{1, 2} established a breeding territory and is considered a probable breeder. Sightings in June of Black-and-white Warbler^{1, 2}, and an agitated female Canada Warbler^{1, 2}, suggest that these species, too, may have initiated breeding territories.

7.3.2 Hogsback

7.3.2.1 Mixed Swamp

In spring and fall, the foliage of the Hogsback provides stopover habitat for numbers of sparrows, thrushes, vireos and warblers. Subject to very little human disturbance, the Mixed Swamp of the Hogsback offers a home to a variety of bird species ranging from the tiny Golden-crowned Kinglet^{1, 2} to the largest breeding bird on the property, Wild Turkey. In winter, more Wild Turkey tracks and droppings are noted here than elsewhere in Cruickston Park. Winter residents of the Mixed Swamp include Brown Creeper^{1, 2}, Pileated Woodpecker^{1, 2} and Red-breasted Nuthatch^{1, 2}. Brown Creeper^{1, 2} is a probable breeder and Red-breasted Nuthatch^{1, 2} a possible one. Further field study may reveal

whether Golden-crowned Kinglet^{1, 2} breeds here as well. Vertical rows of drill holes in an old sapwell tree located within the Mixed Swamp suggest that Yellow-bellied Sapsucker^{1,2} resided here in the recent past. By 22 February 2001, Great Horned Owl was on nest in the Hogsback. In early spring, pairs of Wood Duck^{1, 2} were observed in ponds created by melt water and ground seeps in the Mixed Swamp. This duck, a successful breeder in nest boxes, is considered rare in Waterloo Region as a natural-cavity nester. Wood Duck^{1, 2} nests in natural cavities in Cruickston Park. By late spring, Northern Waterthrush^{1, 2} arrived to set-up a breeding territory.

7.3.2.2 Deciduous Forest

Breeding birds of note in the Deciduous Forest include Scarlet Tanager^{1, 2}, Pine Warbler^{1,2} and Wood Thrush².

7.3.3 Indian Woods

7.3.3.1 Mixed Swamp

A total of six avian raptors indicates that Indian Woods and the adjacent forested lands to the west, support a significant diversity of top carnivores and hence a significant number of prey species of small mammals and birds. In the Mixed Swamp, breeding birds that are rare in Waterloo Region but found here include Winter Wren^{1, 2} and Black-throated Green Warbler^{1, 2}. This swamp provides both roosting sites and hunting territory for Great Horned Owl and Eastern Screech-Owl. On the adjacent property to the west of Indian Woods, evidence obtained during the spring of 2001 indicated that Northern Saw-whet Owl^{1, 2} had established a breeding territory.

7.3.3.2 Deciduous Forest

This remnant of old-growth forest with its large mature trees, numerous snags and decaying trees, both standing and windfalls, provides feeding and nesting habitat for almost a dozen tree bark feeders and tree cavity nesters. These birds include Black-capped Chickadee², Brown Creeper^{1, 2}, Eastern Screech-Owl, Great-crested Flycatcher, House Wren, White-breasted Nuthatch, Wood Duck^{1, 2} and five woodpecker species.

Breeding evidence was found in this forest for Brown Creeper^{1, 2}, Eastern Screech-Owl, Red-bellied Woodpecker^{1, 2}, Scarlet Tanager^{1, 2}, Wood Duck^{1, 2} and Wood Thrush². Great Horned Owl nested here in previous years. In 1997, Hooded Warbler^{1, 2}, a nationally Threatened species, was a probable breeder along the western boundary of Indian Woods. During early spring and during the breeding season, Sharp-shinned Hawk^{1, 2} and Cooper's Hawk^{1, 2} have been observed hunting within the canopy of Indian Woods and adjacent forests.

Although not within the boundaries of Cruickston Park, the adjacent properties immediately to the west consist of deciduous forest contiguous with Indian Woods, the headwaters of Bauman Creek, as well as old fields undergoing successional growth and a mixed plantation. These adjacent properties provide habitat for a variety of regionally significant birds (Table 3) some of which are found on Cruickston Park lands as well.

Table 3: Significant bird species in Waterloo Region found on lands along the western boundary of Cruickston Park (All sightings, except Grasshopper Sparrow, recorded since 1996)

Species	Breeding Status	Migration Stopover
Black-and-white Warbler ^{1,2}	PO	
Blue-winged Warbler ^{1,2}	PR	
Chestnut-sided Warbler ^{1,2}	PR	
Grasshopper Sparrow ^{1,2}	PO	
Hooded Warbler ^{1,2 T, C}	PR	
Long-eared Owl ^{1,2}		✓
Mourning Warbler ^{1,2}	PR	
Northern Saw-whet Owl ^{1,2}	PR	
Pine Warbler ^{1,2}	PR	
Whip-poor-will ^{1,2}		✓

T, C = designated Threatened in Canada

1 = breeding birds of regional significance (Regional Municipality of Waterloo 1996)

2 = breeding birds of conservation priority for the Regional Municipality of Waterloo (Couturier 1999)

7.3.3.3 Bauman Creek

The forest canopy above and beside Bauman Creek provides breeding habitat annually for Scarlet Tanager^{1,2} and, in some years, for Yellow-throated Vireo¹, both area-sensitive forest birds. This forest canopy forms a more or less continuous closed canopy with the Mixed Swamp to the south and with Manor House Woods and Blair Road Slope Woods to the east

7.3.4 Blair Road Slope Woods

7.3.4.1 Deciduous Forest

For several years, Red-tailed Hawk has nested in these woods. Although a north-facing slope, these woods attract good numbers of migrating passerines in spring.

7.3.4.2 Mixed Plantation

Brown Creeper^{1,2}, an area-sensitive forest bird, is a possible breeder in this plantation.

7.3.5 Barn Woods

7.3.5.1 Deciduous Forest

Area searches of this two-hectare forest in spring and fall indicate that several species of warbler stop over during migration.

7.3.5.2 Deciduous Swamp

Red-bellied Woodpecker^{1,2} was active within this small area of Barn Woods; a possible nest cavity was located.

7.3.6 Floodplain

7.3.6.1 Meadow with scattered trees and shrubs – north and south banks of Grand River
The meadow between cropland and the north bank of the Grand River above the confluence provides nesting habitat for Yellow-billed Cuckoo^{1, 2}, a Carolinian species, Eastern Kingbird², Savannah Sparrow² and Spotted Sandpiper². The cuckoo and kingbird nest in hawthorns within the meadow and the sparrow and sandpiper nest on the ground under a canopy of grasses and herbaceous vegetation. Nine species including Eastern Kingbird², Savannah Sparrow² and Spotted Sandpiper² nest along the south bank.

7.3.6.2 Fountain Street Old Field and Pond

Upstream from the confluence, along the banks of the Speed River, groves of Manitoba Maple and dense growth of vines and shrubs provide excellent stopover habitat for migrants, particularly in autumn (Map 4). This secluded section of the floodplain provides roosts at night and in inclement weather for many overwintering passerines including Black-capped Chickadee², House Finch, Mourning Dove, Northern Cardinal, Song Sparrow and White-breasted Nuthatch. Bald Eagle, Great Horned Owl and Red-tailed Hawk have been observed during early morning hours perched in oaks and White Pines that tower above the second-growth canopy. The pond provides feeding habitat for both Great Blue Heron¹ and Belted Kingfisher.

7.3.7 Hedgerows and Lanes

There are almost seven kilometres of hedgerows and lanes within the upland farmland of Cruickston Park providing habitat for 27 bird species. Although the Eastern Bluebird² is no longer listed as a Species at Risk in Canada, its recovery in large measure is the result of the successful efforts of volunteers establishing bluebird nest box trails. Three, possibly four, pairs of Eastern Bluebird² nested in Cruickston Park during the 2001-breeding season in natural cavities such as those provided by mature Sugar Maples along the farm lanes. Of the half dozen species of conservation priority breeding in Cruickston Park hedgerows or lanes, Brown Thrasher^{1, 2} and Vesper Sparrow^{1, 2} are also regionally significant. The regionally rare Carolinian species Red-bellied Woodpecker^{1, 2} utilizes the trees of the hedgerows and lanes throughout winter and early spring, retreating to the forests and deciduous swamps of the property during the breeding season.

In July 1988, an adult Red-headed Woodpecker^{1, 2} was observed along a Cruickston Park laneway. No follow-up on this species' status in Cruickston Park was possible in 1988 or in the years immediately following. No sightings have been made since 1994. This woodpecker has recently been designated a species of Special Concern in Canada and Vulnerable in Ontario.

7.3.8 Cropland

Horned Lark² is one of the few species to nest within Cruickston Park Cropland. After the harvest of corn, soybean or wheat, waterfowl – including Canada Geese, Mallards and small numbers of other dabbling ducks – forage the Cropland in both the lowlands and

uplands. By mid-October, as many as 900 Canada Geese and 270 Mallards forage in these fields (Wilson 1995). From late autumn to early winter, numbers build so that as many as 1500 Canada Geese and as many as 2200 Mallards congregate along the reaches and confluence of the Grand and Speed Rivers and their adjacent croplands (Audubon Christmas Bird Counts 1995, 1996). Within Cruickston Park, numbers of Ring-billed Gulls (200+) and American Crows (70+) have been recorded on the Cropland. During September 1999, three Sandhill Cranes¹ visited the Cropland along the Grand River; the previous September, 1998, one was observed at the confluence.

7.3.9 River

7.3.9.1 Open water

In winter, open reaches of the Grand River between Kitchener and Paris provide wintering habitat for Bald Eagle, a species designated Endangered in Ontario and protected under the Endangered Species Act. Bald Eagle sightings have been documented in the Grand River Valley between Kitchener-Waterloo and Paris during 17 of the past 23 years (since 1980), primarily during winter months (KWFN bird records 1977-98; Wilson 1995; Wilson 1998; OMNR 2001a; Wilson field notes). In each of those 17 years, sightings have also been made in the vicinity of the confluence of the Speed and Grand Rivers. Since 1994, Bald Eagles have been sighted within Cruickston Park most frequently during January and February (Table 4).

Table 4: Months during which sightings were made of Bald Eagle, Cruickston Park.

Month	Aug	Nov	Dec	Jan	Feb	Mar	Apr
# of years in which sightings were made in a particular month between Feb. 1994-Feb. 2002	1	2	3	6	6	4	1

OMNR (2001a) has documented the locations of perch trees along the Grand River between the Highway 401 bridge, the confluence of the Grand and Speed Rivers and the Galt Country Club since 1994 including sites in Cruickston Park. Eagles perched in trees on Cruickston Park have been observed during each of the following years: 1995, 1996, 2000-2002 (Cruickston sightings during each of the other years since 1994, were of eagles in flight over, or along the river through, Cruickston Park.). Locations of known perch trees are shown on Maps 1 and 4. The most frequently used perch is in a Crack Willow grove approximately 600 m above the confluence along the Grand River. For example, at least one Bald Eagle, and often two, was observed here on at least 16 days in February 2001 (ibid.).

As many as four Bald Eagles were observed along the river on Cruickston Park property in winter 2001 (J. Guenther pers. comm., Wilson field notes). During the winter of 2002, as many as three Bald Eagles have been observed at one time as of mid-January (W. Wilson and m.obs.). In February 2000, four eagles were observed along the shoreline of an island north of the Fountain Street bridge (Wilson field notes).

Bald Eagles have been observed on hunting forays along the length of the river through Cruickston Park. Here, they have been observed with prey on five occasions, dates

ranging from late autumn to early spring (Maps 1 and 4) between December 2000 and January 2002 (J. Guenther, fide K. Mohn, D. Stafford, A. Timmerman pers. comm.). On two of these occasions, Bald Eagles were observed taking live fish. In March 2001, an eagle was observed feeding along the shoreline of an island just down river of Cruickston Park (W. Watson pers. comm.). Bill Wilson first observed Bald Eagle feeding activity in the vicinity of the confluence on 17 February 1994 on ice at the edge of an island upriver of the Fountain Street bridge (Wilson field notes).

The confluence of the Grand and Speed Rivers has been acknowledged for many years as the premier wintering waterfowl location in Waterloo Region (Wake 1997) (Map 4). Of the twenty-five species of waterfowl recorded here, five species congregate in significant number*: Canada Goose (650+), Mallard (1700), Common Goldeneye (450), Common Merganser (180+) and American Black Duck (75). Wintering waterfowl are the main criterion for the confluence being designated ESPA 36 (Map 5) in Waterloo Region (Regional Municipality of Waterloo 1984). The Canadian Wildlife Service also recognizes this site as a major waterfowl concentration area in winter (OMNR 2001a). During late winter-early spring, as many as 450-500 waterfowl gather nightly in the waters of the baylet immediately above the confluence of the Grand and Speed Rivers (Map 4). This section of the river, as well as others along the shorelines above and below the confluence, provides loafing and preening sites with minimal human intrusion (Maps 1, 2 and 4). Six species of waterfowl observed here are priority species in Waterloo Region: American Black Duck^{1,2}, Blue-winged Teal², Common Merganser^{1,2}, Gadwall^{1,2}, Hooded Merganser^{1,2} and Wood Duck^{1,2}.

* Maximum number observed immediately above the confluence at one time since 1995

7.3.9.2 Shoreline

Breeding waterfowl along the shorelines and islands within and adjacent to Cruickston Park include Canada Goose and Mallard. During the breeding season, 2001, a pair of Green-winged Teal¹ and Common Merganser^{1,2} were observed. From mid-June into July, Peter Lord (pers. comm) observed a female merganser sp. with nine ducklings. Wading birds, including Black-crowned Night-Heron,^{1,2} Great Blue Heron¹, Great Egret and Green Heron^{1,2} frequent the shoreline habitat of Cruickston Park particularly from mid-summer to early autumn. Great Blue Heron¹ is observed throughout the year though rarely in January and February. With the exception of the Green Heron^{1,2}, none of these herons breeds in the vicinity of Cruickston Park; nevertheless, both adults and young-of-the-year show up annually to forage along the shoreline during the post-breeding season.

Regionally rare breeding marsh birds that are occasionally found along the shoreline in mid-summer – Virginia Rail^{1,2} and Sora^{1,2} – may be birds dispersing from local marshes where they breed, including Barrie's Lake and the wetlands that lie south of the Hogsback.

Modest numbers of as many as 13 species of shorebirds can be found foraging in the exposed mud, between cobblestones and on algae mats along the shoreline of the Grand and Speed Rivers during periods of low water levels in mid and late summer, the southern migration period for shorebirds (Maps 2 and 4).

7.3.9.3 Confluence

The confluence of the Speed and Grand Rivers is a migrant corridor for nighthawk, shorebirds, swallows, swifts, thrushes, vireos, warblers, and waterfowl. For example, during migration, 27 species of warblers have been recorded since 1971 (Wilson 2000).

In winter, as many as eight species of gulls have been observed resting and preening in the shallows about the confluence, a significant loafing area for these birds (ibid.). In mid-summer, the gulls are joined by Caspian Tern, which until recently was designated Rare provincially. Occasionally Common Tern and Black Tern (a species designated Vulnerable in Ontario) are observed during migration.

The confluence not only provides a refuge for migrants and summer and winter residents but also offers safe haven for infrequent visitors forced down during migration by heavy rains and vagrants blown off course by storms. American Bittern, Common Loon, Pied-billed Grebe and Snow Goose are some of the infrequent visitors recorded here. Vagrants observed include Little Blue Heron and Swainson's Warbler (Dobos 1995; Burr et al.1996).

7.4 Interpretations

7.4.1 Why Cruickston Park is important for birds

Birds serve as an effective barometer of the health of the environment and are not only used to monitor and track changes in environmental quality, but also to provide opportunity for research and public education in conservation biology (Cheskey 1995; Kenney and Rusak 2001). Cruickston Park currently provides significant habitat for breeding forest birds, wintering waterfowl and wintering Bald Eagle as well as stopover sites for migratory songbirds, waterfowl and shorebirds (Maps 1, 2 and 4). The Goals and Vision for Cruickston Park offer opportunities to protect its natural areas and, through restoration ecology, to expand and improve the habitat of forest, wetland and meadow for birds of Waterloo Region. In terms of size and bird species diversity, Cruickston Park, 391 ha, ranks with recognized large core natural areas in Waterloo Region such as Grand Valley Forest, Roseville Swamp, Waterloo Forest and the Wrigley-Bannister Lakes and Sudden Tract complex (Regional Official Policies Plan 1994).

Since 1966, Breeding Bird Surveys have been undertaken throughout North America along more than 2500 survey routes designed to detect and measure both long-term and short-term changes in breeding bird populations. These surveys indicate that breeding bird populations of many bird species are undergoing measurable declines. A total of 28 species known to breed within Cruickston Park are exhibiting long-term/short-term decline in eastern North America (DeGraaf and Rappole 1995).

7.4.2 Significant birds

In Cruickston Park, with its diverse vegetation communities, a total of 187 bird species has been recorded, which represents 67% of the 283 birds recorded in all of Waterloo

Region (Burr et al. 1996). In Waterloo Region, 142 bird species are known to breed; in Cruickston Park, breeding evidence has been recorded for 87 species since 1996 (Wilson field notes) and, of these, 32 are designated as rare in Waterloo Region (Regional Municipality of Waterloo 1996) (Table 5). Forty-seven species considered priority species of conservation concern in Waterloo Region (Couturier 1999) are known to breed in Cruickston Park. Thirty species or 34% of the breeding birds documented in Cruickston Park are both regionally rare and priority species of conservation concern in Waterloo Region.

Table 5: Significant breeding bird species observed between 1996 and 2001, Cruickston Park. Breeding Evidence: possible (PO), probable (PR), confirmed (CO) using breeding evidence as categorized by Ontario Breeding Bird Atlas (2001a).

Common Name	Breeding Evidence	Common Name	Breeding Evidence
American Redstart ^{1,2}	PR	Nashville Warbler ^{1,2}	PR
Black-and-white Warbler ^{1,2}	PO	Northern Saw-whet Owl ^{1,2}	PR
Black-billed Cuckoo ^{1,2}	PR	Northern Waterthrush ^{1,2}	PR
Black-throated Green Warbler ^{1,2}	PR	Orchard Oriole ^{1,2}	PR
Blue-gray Gnatcatcher ^{1,2}	PR	Ovenbird ^{1,2}	PR
Blue-winged Warbler ^{1,2}	PR	Pileated Woodpecker ^{1,2}	PR
Brown Creeper ^{1,2}	PR	Pine Warbler ^{1,2}	CO
Brown Thrasher ^{1,2}	PR	Red-bellied Woodpecker ^{1,2}	CO
Chestnut-sided Warbler ^{1,2}	PR	Red-breasted Nuthatch ^{1,2}	PO
Common Merganser ²	PR	Scarlet Tanager ^{1,2}	PR
Cooper's Hawk ^{1,2}	PR	Sharp-shinned Hawk ^{1,2}	PO
Eastern Bluebird* ^{1,2}	CO	Vesper Sparrow ^{1,2}	CO
Green-winged Teal ¹	PO	Winter Wren ^{1,2}	PR
Hooded Warbler ^{1,2; T,C}	PR	Wood Duck* ^{1,2}	CO
Magnolia Warbler ^{1,2}	PR	Yellow-billed Cuckoo ^{1,2}	CO
Mourning Warbler ^{1,2}	PR	Yellow-throated Vireo ¹	PR

*= nesting in natural circumstances; T,C = designated Threatened in Canada

¹ = breeding birds of regional significance (Regional Municipality of Waterloo 1996)

² = breeding birds of conservation priority for the Regional Municipality of Waterloo (Couturier 1999)

A number of bird Species at Risk (OMNR 2001b) have been recorded in Cruickston Park. Bald Eagle winters along reaches of the Grand River that flows through Cruickston Park (OMNR 2001a). This species, designated Endangered in Ontario, is protected under the Endangered Species Act of Ontario. In 1997, Hooded Warbler, a Threatened species in Canada, established a breeding territory along the western boundary of Indian Woods (Wilson field notes). Three other notable species recorded in Cruickston Park include: Northern Bobwhite, an Endangered Species in Canada whose presence in this region until the mid-1980s was maintained by release from captive stock ((Lumsden 1987; Curry 2001); Red-headed Woodpecker, recently designated as a species of Special Concern nationally and Vulnerable provincially, was observed in mid-July (Kitchener-Waterloo Field Naturalists Bird Records 1988); and, Red-shouldered Hawk, designated as a species of Special Concern nationally and Vulnerable provincially, has been documented on two occasions, 1973 and July 1975 (P.F.J. Eagles Planning Ltd.1991).

7.4.3 Key Locations for Birds in Cruickston Park

7.4.3.1 Riparian zone and river

The riparian zone and rivers through Cruickston Park provide habitat for ninety-eight bird species, the largest number observed in any of the landscape units of Cruickston Park. Of these, only 15 species are known to breed, including two regionally significant birds, Yellow-billed Cuckoo^{1,2} and Orchard Oriole^{1,2}. At present, in Cruickston Park, the presence of the narrow strips of riparian habitat and the predominance of non-native vegetation between the rivers and cropland likely limit the number of breeding pairs of existing species and the diversity of breeding birds.

The water quality, favourable winter conditions such as open water and lack of human disturbance along the reaches of the Grand and Speed Rivers about the confluence provide excellent habitat for wintering waterfowl. The rivers and their shoreline extend more than five kilometres through Cruickston Park and constitute over 80% of ESPA 36, which is recognized as the premier waterfowl wintering habitat in Waterloo Region. A half-dozen sites along the reach of the river through Cruickston Park are key locations for feeding, preening feathers and resting during autumn and winter (Maps 1, 2 and 4). The presence of diving ducks such as Common Merganser and Common Goldeneye reflects the quality of this habitat. Common Merganser feed primarily on small fish and crayfish and Common Goldeneye feed on aquatic insects, fish, crustaceans and molluscs. Eadie et al. (1995) recommend Common Goldeneye as a bio-indicator of habitat quality.

The baylet in the Grand River above the confluence of the Grand and Speed Rivers has little or no human intrusion. Consequently, this location has for many years been a preferred night time roost site for many waterfowl and other water birds (Map 4). As many as 450 Common Goldeneye and 180+ Common Mergansers have been observed in early morning hours and at dusk during the winter months at this location. The shallow waters of the Grand River above the confluence also provide a year-round, undisturbed daytime loafing area for waterfowl, gulls and shorebirds. Preening feathers and resting are key life activities for all birds and this reach of the river permits such daytime activity free from human disturbance. Linear Trail, the closest walking trail, lies opposite Cruickston Park along the Grand and Speed Rivers in Cambridge, 300-400 metres at its closest point from both the baylet and upstream shallows, thus permitting excellent viewing and study opportunity without disturbance. Sandhill Crane¹, a species known to select nocturnal roost sites in shallow water free from human disturbance (Tacha et al 1992) spent one night in the river's shallows during September 1998 (Wilson field notes). Three Sandhill Cranes were observed in mid-day feeding in nearby cropland in September 1999 (ibid.). Restricting human activity and intrusion about the confluence on Cruickston Park lands, will allow waterfowl and other waterbirds to continue to utilize this location.

Reaches of the Grand River above and within Cruickston Park have recently been part of a report concerning the protection of wintering Bald Eagles in the Grand River Valley (OMNR 2001a). The report lists the specific features of these reaches that provide excellent wintering habitat for Bald Eagle. Specific to Cruickston Park lands are these habitat features: a Crack Willow grove 600 m above the confluence that permits undisturbed perch sitting throughout the day; snags and mature trees along the sheltered Cliffs area for perching; large trees for potential roosting in the undisturbed extensive forest atop the Cliffs; and islands upon which to safely feed (Maps 1 to 4). OMNR has designated sites above and within Cruickston Park as high risk zones for Bald Eagles – where human intrusion is undesirable during the months of the winter when eagles are present. These zones have a radius of 300 m; the high risk zone for Reach 2 of the OMNR study lies within Cruickston Park lands (Map 6). Reach 3 is currently under study. The presence of Bald Eagle along these reaches of the river since the late 1980s attests to the high quality of this section of the Grand River. In fact, Bald Eagle is recognized as an excellent indicator of the environmental health of the Lower Great Lakes basin (Bird Studies Canada 2000).

7.4.3.2 Forests along Bauman Creek Drainage System

The forests of Blair Road Slope Woods, Manor House Woods, Barn Woods, and Indian Woods along Bauman Creek and of adjacent properties to the west of Cruickston Park, form a closed canopy of 52 ha interrupted by only a few laneways (Map 2). Because of its highly irregular, amoeboid shape, only a small area of forest within Indian Woods can be considered forest interior, i.e. greater than 100 m from the forest's edge at any point. Nevertheless, these existing forests form the core of mature deciduous forest whose interiors would increase in size should cropland that presently surrounds them, fill in with trees. Of the 14 regionally significant species of birds for which there is breeding evidence in these forests, seven are species that have an affinity for forest interior.

The “Umbrella Species” of Riparian Ecosystems

Reaches of the Grand River within and about Cruickston are providing wintering habitat for Bald Eagle. An Endangered Species in Ontario, the Bald Eagle is undergoing significant recovery in the province. Particularly encouraging is its breeding success in the lower Great Lakes basin. This recovery is cause for optimism about the environmental quality of this region because the Bald Eagle is an “umbrella species” within the riparian ecosystem. Protecting the habitat requirements of this species for breeding and for wintering ensures the protection of other riparian species and of the water quality of this ecosystem. The goal of every species recovery program is to establish a thriving, self-sustaining population. For such to happen requires the recognition that if a species is to survive, appropriate habitat must be available to it. Bald Eagles along the Grand River have “declared” this valley their winter home. When the Bald Eagle becomes delisted in Ontario – as it surely will if people continue to respect its space – we will have reason to celebrate its future in southern Ontario. The environmental quality of our own future will also be more secure.

7.4.3.3 Hogsback

The deciduous forest and mixed swamp along the upper reach of Cruickston Creek forms a 23-hectare forest, 17 ha of which are within Cruickston Park (Map 3). This forested area, known as the Hogsback, provides breeding habitat for six regionally significant species. As well, it provides stopover habitat for a variety of songbirds on migration including sparrows, thrushes, vireos and wood warblers. Its relative isolation and lack of human intrusion contribute to its use as nesting habitat for Great Horned Owl and wintering habitat for several species including Eastern Screech-Owl, Ruffed Grouse² and Wild Turkey. Numerous turkey tracks in and about groundwater seeps within the Hogsback suggest this mixed swamp provides important winter habitat for this species.

7.4.3.4 Cliffs and Alvars

The nine vegetation units recognized in this landscape unit attract 83 species of birds – second only to the riparian community extending along the Grand and Speed Rivers. Twelve regionally significant species breed here. The hawthorn alvar offers habitat to species such as Field Sparrow², found nowhere else in Cruickston Park and a species that is undergoing both short-term and long-term decline across the continent (DeGraaf and Rappole 1995). Shrub thickets along the edge of the alvar provide stopover sites for songbirds on migration. The forest within this landscape unit is the largest contiguous one within Cruickston Park (67 ha) and provides breeding opportunity for nine forest area-sensitive species.

7.4.4 Threats to birds in Cruickston Park

7.4.4.1 Forest fragmentation

In southern Ontario, forest fragmentation is more pronounced than in any other region of comparable size in the entire Great Lakes basin (Larson et al. 1999). In general, fragmented landscapes contain more species such as American Robin, Blue Jay, European Starling, Gray Catbird², House Sparrow, Northern Cardinal and Song Sparrow and have fewer Ovenbird^{1,2}, Red-eyed Vireo, Scarlet Tanager^{1,2} and Wood Thrush² (Riley and Mohr 1994). Also, fragmented forests of small size are known to harbour more males than females (ibid.) raising the question about the breeding potential of such sites. A 1989 study in Waterloo Region, demonstrated that woodlots ranging in size from 0.3 ha to 73.6 ha had significantly fewer breeding bird species compared with expected numbers in equivalent sizes of contiguous forest (ibid.).

When forest fragments are smaller than 50 ha, no forest interior remains (Larson et al. 1999). The vulnerability of forest-interior species may be partially attributed to their reproductive habits for such birds have evolved strategies to survive deep within the forest and well removed from the forest-edge (Riley and Mohr 1994). As influence from the forest edge increases, these forest-interior species tend to decline in reproductive success. Predation by common forest-edge species such as Common Grackle, Raccoon and Opossum has significant negative impact on these breeding birds (Larson et al. 1999; Terborgh 1989).

Larson et al. (1999) consider 41 breeding bird species as good indicators of upland woodland habitats in southern Ontario. These include area-sensitive and forest-interior species as well as those simply associated with large tracts of forest. Of these forest birds, nine have achieved breeding status in Cruickston Park at some point during the past five years (Table 6). Of seventeen forest bird species that have declined more than 50% in Ontario (Riley and Mohr 1994), ten of these species breed in Cruickston Park; however, five of these declining species that formerly bred in Cruickston Park no longer do so.

A forest fragment that can be increased in size and/or connected with other forests of similar sizes so that the amount of forest interior increases, can only increase habitat availability for forest birds and improve the ecological integrity of this environment. The *Draft Management Framework for Cruickston Park*, (North-South Environmental Inc. 2001) lists the negative impacts of forest fragmentation on forest species and comments on the lack of consideration given to functional attributes of the environment during environmental impact assessments in favour of the more easily identified structural attributes.

7.4.4.2 Loss of riparian habitat

The riparian zone of a river is an area of transition between the river and the uplands. It may be a narrow corridor of vegetation hugging the river or an extensive network of wetlands that extend well into the floodplain. Riparian vegetation includes meadow, shrub thicket and forest that provide critical habitat for amphibians and invertebrates and significant habitat for a large number of different bird species at some point throughout the year, e.g. breeding, feeding, over-wintering, roosting and migration stopover habitat. Studies have demonstrated that some species of birds will not breed in riparian habitat unless the riparian vegetation is in good ecological condition, particularly the understory, while other species are greatly reduced in number and are unlikely to persist in the long-term (Bureau of Land Management 1998).

7.4.4.3 Alien vegetation

Aggressive alien plants may replace native vegetation upon which birds depend for food, shelter and nesting. Concern exists that the vegetative structure of alien species is not equivalent to native species and thus makes birds more susceptible to nest predation (Rich 2001). For example, alien buckthorn and honeysuckle that are increasingly dominating forest understories in the American mid-west and elsewhere provide nest sites that are more susceptible to predation than those in native shrubs. All bird habitats within Cruickston Park have been impacted by alien species to some extent (North-South Environmental Inc. 2001). Throughout southern Ontario, alien species now make up between 14% and 22% of the plants (Larson et al. 1999).

7.4.4.4 Forest structure and composition: effects of White-tailed Deer

The ground vegetation and forest understory of Cruickston Park show considerable signs of deer browsing and grazing. Sheltered areas within the Cliffs and Alvars, Hogsback and Indian Woods show signs of much deer activity during winter months. The feeding on the understory by White-tailed Deer may account for the low numbers of ground nesting birds (e.g. Ovenbird^{1,2}) within the forests of Cruickston Park.

7.4.5 Possible restoration and rehabilitation opportunities for birds

7.4.5.1 Riparian habitat

Rehabilitation and restoration of riparian forest, shrub thicket and meadow along the banks of the Grand River may well increase the number of breeding pairs of existing species and attract more breeding species to this habitat in Cruickston Park. Studies have shown that the width of riparian vegetation determines the number and diversity of birds found within it. For example, in central Pennsylvania, a 125 m strip of riparian vegetation, including forest, shrub thicket and meadow, supports the full complement of riparian bird species in that area (Klapproth and Johnson 2000).

In southern Ontario, almost 70% of wetland has been lost to agriculture, urban growth and industrialization (Natural Resources Canada 2001). An opportunity to restore and rehabilitate wetland habitat for birds exists in the riparian zone of Cruickston Park (Maps 4 and 6). The lower reach of Bauman Creek, for example, could provide breeding habitat for species of waterfowl and rails, including Sora^{1,2} and Virginia Rail^{1,2}, both regionally rare. Rehabilitating wetland near the Grand River could create stopover habitat for migrating wetland species including Tundra Swan, Trumpeter Swan, Sandhill Crane¹, rails, shorebirds and marsh songbirds. The Trumpeter Swan re-introduction program is currently underway in Ontario (Lumsden 1999); this species bred for the first time in Waterloo Region in 2001 (Ontario Breeding Bird Atlas 2001b).

7.4.5.2 Meadows

The Goals and Vision of Cruickston Park include taking cropland out of production to restore native vegetation through natural succession and restoration ecology. With over 150 ha of cropland in Cruickston Park, the potential for establishing meadows for grassland songbirds is outstanding.

The loss of native grasslands in North America has been described as apocalyptic (Weidensaul 1999). Such loss has created a crisis for grassland songbirds, which have declined faster for a longer period of time and over a wider area than any other group of birds in North America. Although southern Ontario is within the northern hardwood and Carolinian forest zones, portions of it were tallgrass prairie and oak savanna, both of which now occur in a much reduced extent in parts of southern Waterloo Region and northern Brant County. During the past 200 years, these naturally occurring habitats of forest and grassland became agricultural lands. Although hedgerows and hayfields once provided breeding habitat for several grassland and early succession species, since the 1960s, improvements in agricultural production have eliminated hedgerows to create

larger fields. Hayfields, once subject to only one cut in a season, are often cut more than once, the first cut coinciding with the peak of nesting season.

Non-native grasses, such as Reed Canary Grass, planted in hayfields and pastures, do not provide favourable breeding habitat for a number of grassland songbirds (Rich 2001) and provide little food value in their seed (U. S. Department of Agriculture 1999). The agricultural landscape has changed in many parts of southern Ontario as corn and soybeans have replaced hayfields. These crops are inhospitable to many species as nesting habitat. A restoration program designed to increase meadows and hedgerows could benefit many breeding species including Bobolink and Eastern Meadowlark, both of which have demonstrated significant short-term and long-term declines throughout North America (DeGraaf and Rappole 1995). Species such as Brown Thrasher^{1,2}, Eastern Towhee², Vesper Sparrow^{1,2}, and Grasshopper Sparrow^{1,2} – all rare in Waterloo Region – could benefit from habitat restoration in Cruickston Park. The increase and widening of hedgerow habitat may facilitate the reintroduction of Northern Bobwhite, a nationally Endangered species.

7.4.5.3 Forests

Cruickston Park offers an opportunity to increase forest size thus improving two special habitat conditions for forest birds – forest interior and old growth – conditions that are absent in many southern Ontario forests. Presently, in Cruickston Park the estimated number of breeding pairs for many of the species with an affinity for these conditions is low (Table 6). Nudds (Larson et al. 1999) has determined that a minimum forest size of 75 ha would be required in southern Ontario before the number of breeding birds found within it would equal the number of birds found in a similarly sized area where contiguous forest exists. Increasing the forest cover of any of the existing forests in Cruickston Park to this size or larger is desirable (for current size of forests in Cruickston Park, see Section 7.4.3).

Table 6: Estimated number of breeding pairs of regionally significant forest birds that would benefit from forest restoration, Cruickston Park (based upon area searches, 1996-2001 and bird monitoring, 2001).

Species	Estimated # pairs
Black-and-white Warbler ^{1,2}	1
Black-throated Green Warbler ^{1,2}	1
Brown Creeper ^{1,2}	3
Hooded Warbler ^{1,2, T,C}	*½
Ovenbird ^{1,2}	2
Pileated Woodpecker ^{1,2}	1
Scarlet Tanager ^{1,2}	3
Wood Thrush ²	2 ½
Yellow-throated Vireo ¹	1

*½ indicates that the breeding territory is partially within Cruickston Park

T,C = designated Threatened in Canada

¹ = breeding birds of regional significance (Regional Municipality of Waterloo 1996)

² = breeding birds of conservation priority for the Regional Municipality of Waterloo (Couturier 1999)

Fourteen species of birds observed during the breeding season in the old-growth remnant of Indian Woods are dependent for some aspect of their life history on conditions that are made possible within old-growth woods. Since almost no original old-growth woodland remains in southern Ontario (ibid.), remnants of old growth such as Indian Woods should be preserved and enhanced by establishing a forested buffer around the existing forest.

7.5 Recommendations

- Ensure no disturbance of migrating or wintering waterfowl, wintering Bald Eagle and breeding birds that are regionally (or provincially) significant. For example, ensure sections of the river and associated shoreline (Maps 1, 2 and 4) utilized by waterfowl for preening, loafing and feeding remain free from human intrusion. The sensitivity of sites varies seasonally; critical seasons are autumn and winter.
- Explore ways of mitigating the impact of mammalian predators on breeding birds, e.g. ground-dwelling species and cavity nesters. Of particular concern are raccoons and feral cats. Initiatives could include the endorsement of Cat Indoors Program in residential areas adjacent to Cruickston Park.
- Consult the Grand River Conservation Authority and Bird Studies Canada concerning forest management decisions that will increase and improve habitat for woodland birds. Include strategies that maintain the White-tailed Deer population at low numbers to allow understory regeneration, convert plantations to mixed forests in order to increase biodiversity and promote connectivity between forest habitat within Cruickston Park and forested properties adjacent to it.
- Increase the amount of forest cover and connectivity between existing forests to create canopied forested areas larger than 75 ha in a manner that increases the amount of forest interior. Initially this action should include the forests within the Bauman Creek watershed, viz. Barn Woods, Blair Road Slope Woods, Indian Woods and Manor House Woods.
- Enhance connectivity between existing forests through expanded hedgerows and vegetation corridors within Cruickston Park. Manage both hedgerows and laneways to permit cavity-dwelling birds such as Eastern Bluebird and woodpeckers to continue to occupy natural nesting and/or roosting sites. Enhance scrubland or thicket ecosystems to create corridors wider than hedgerows along edges of some existing cropland. Increase the width of the riparian zone along the Grand River to a minimum of 125 m to increase the number of breeding pairs of existing species and to attract other riparian species
- Restore and enhance a viable and healthy wetland system in the lower reach of Bauman Creek and Cruickston Creek that addresses the ecological needs of wetland species. Establish along the lower reach of Bauman Creek, a boardwalk system that accommodates on-site environmental education opportunities and

connects to an interpretive trail system linked to the proposed Cruickston Park Interpretive Centre (Map 6).

- Contribute to Cruickston Park's long-term monitoring opportunities by continuing to monitor bird species composition and abundance using monitoring sites established on the property in 2001.
- Develop a protocol for reporting, documenting and cataloguing sightings of significant species of flora and fauna.
- Establish walking trails that permit nature study while at the same time avoid sensitive and fragile habitats. This can be achieved by restricting walkers to designated trails and closing inappropriate trails. Disturbance of such habitats and of the animals that live within them should be prevented. Pets should be leashed and restricted to the Grand Trunk Trail (Map 6).

8.0 OTHER FAUNA.....William G. Wilson

During fieldwork, members of CPEAT and visitors to the property reported sightings of other fauna including butterflies and mammals. No formal monitoring of butterflies or mammals has been undertaken on the property. See APPENDIX C for definitions of at-risk species.

8.1 Butterflies

The only species of conservation significance found in Cruickston Park during 2001 was the Monarch, which is nationally considered a species of Special Concern. The Monarch continues to be threatened by the eradication of nectar sources and milkweeds that serve as larval food through the use of herbicides over much of their ranges (Layberry et al. 1998).

The largest butterfly in Canada, Giant Swallowtail, is rarely observed anywhere in the country outside of extreme southwestern Ontario where it is common (ibid.). Lamb (1967) considered the Giant Swallowtail extirpated in Waterloo Region by 1967. Sightings of Giant Swallowtail were made in 1999 and 2000 by several observers, both in Cruickston Park and sites immediately across the Grand River; however, these sightings may have been the result of a local release program discontinued in 2000 (Jerry Guenther pers. comm.). On August 29 2001, a Giant Swallowtail was observed in Manor House Woods by Larry Lamb, Heather and Bill Wilson. Many patches of American Prickly-ash, a significant larval food plant for Giant Swallowtail, are found in large patches throughout Cruickston Park.

Common Hackberry trees of varying size are found within Cruickston Park and along the banks of the Grand River, particularly along the Preston-Cambridge side. Their presence here is acknowledged by the inclusion of this local distribution within ESPA 36 (Regional Municipality of Waterloo 1984) (Map 5). Common Hackberry is the larval

food plant of the Tawny Emperor, a butterfly that has a limited range in Canada, specifically extreme southwestern Ontario. This butterfly has been found infrequently in the vicinity of Cruickston Park. Tawny Emperor was collected in Preston during the mid-60s (Lamb 1967) and is observed annually there in small number (Jerry Guenther, pers. comm.; Wilson field notes).

Managing habitat for butterflies at Cruickston Park may establish populations of these species in this region. A number of other butterfly species would also benefit from planned habitat management and release programs. Habitat management should include increase and expansion of hedgerows and creation of meadows.

8.2 Mammals

In 1993, Erwin Meissner and Bill Wilson undertook mammal atlassing that included small mammal trapping, in a number of sites in North Dumfries Township including Cruickston Park. Meissner (1993) monitored road kills along Blair Road through Cruickston Park for a one-year period. ESG (2000) cites the *Atlas of the Mammals of Ontario* (Dobbyn 1994) to document 21 species of mammals found within their Cambridge study area, which includes a portion of Cruickston Park. During 2001, CPEAT recorded sightings including road kills and mammal activities in and around Cruickston Park, which is home to at least 20 species of mammals (North-South Environmental 2001). No mammal species recorded to date are regionally rare.

Raccoons are likely very common in Cruickston Park for signs of their presence – tracks, scats, young and adults, daytime roosts – are everywhere. Three dead Opossums – two of which were road kills – were found in 2001 on or adjacent to the property. Both Raccoon and Opossum are opportunistic bird nest predators.

An estimated 20 White-tailed Deer inhabited Cruickston Park during winter 2001 (Mark Fretwurst pers. comm. and L. Lapierre pers. comm). A local bow-hunter estimates that twice that number lives here and on adjacent lands. Browsing and grazing by White-tailed Deer is quite evident throughout Cruickston Park (see Section 7.4.4.4) and can have a major impact on both the structure and the composition of plant communities. White-tailed Deer have increased dramatically in number throughout eastern North America including southern Ontario during recent decades. Where deer occur in large number, their foraging can damage trees, eliminate tree seedlings and young saplings and reduce some ground vegetation while increasing others because some plant species are more palatable to deer than others. Long-term studies by Watt et al. (1996) in Rondeau Provincial Park demonstrated that ground vegetation characteristic of Carolinian forests increased in study plots ungrazed by deer while study plots grazed by deer had more invasive alien plant species.

Cattle grazed throughout much of Cruickston Park in both pasture and some forested areas until the late 1960s (Bob Gravell pers. comm.). Vegetation recovery from foraging by either deer or cattle is slow (Larson et al. 1990). Controlled studies following the

culling of White-tailed Deer in the Long Point area show that vegetation recovery is possible (Bradstreet and Bowles 2001).

8.3 Recommendations

- Develop a population management strategy to reduce the negative impact of White-tailed Deer on plant communities.

9.0 PRIORITIES.....Cruickston Park Ecological Advisory Team

9.1 A rationale for priorities

The Vision Statement for Cruickston Park – a vision for conservation and education: *“To create a self-sustaining model of preservation, conservation and enhancement techniques which stimulates a general awareness of our natural heritage.”* Jan Chaplin and Mark Fretwurst

The recommendations and priorities of CPEAT serve to stimulate the Goals and Vision of Cruickston Park to be promoted, undertaken and achieved within the management framework of the Cruickston Charitable Research Reserve. Each member of CPEAT acknowledges that conservation biology and restoration ecology will underpin conservation and stimulate environmental education within the Cruickston Charitable Reserve Research:

“...the cliff edge and cliff face habitats within Cruickston Park represent a habitat type that is identical to that of the Niagara Escarpment, and therefore... should be managed as though it were part of the Escarpment.” Doug Larson

“An important attribute of Cruickston Park is the potential to restore large acreages of land currently under cultivation back to a near natural condition. This unprecedented restoration effort would create one of the larger, single landowner units of contiguous habitat in southwestern Ontario. Such large-scale reserves are the only hope for the long-term protection of organisms requiring an undisturbed sanctuary...” Larry Lamb

“Certainly Cruickston Park and adjacent lands must have one of the greatest herptile diversities in a habitat complex that is becoming surrounded by the urban mass of Kitchener and Cambridge. Management of lands ... in a manner that would benefit herptiles would also benefit fish and other wildlife populations. This concentration of good quality aquatic habitat is a precious resource. Inputs of good quality water from these streams must also be beneficial to the quality of the Grand River.” Ken Dance

“Perhaps Cruickston Park is best viewed from across the river at Settlers’ Fork Park. From here, one has an outstanding panoramic view of the floodplain and its surrounding forested slopes. Imagine the results of a restorative management plan that added to this

vista: a complex of riparian meadows, wetlands and forests and what these could represent to future generations.” Bill Wilson

9.2 Contributing to conservation biology: a priority for the Cruickston Charitable Research Reserve.....Douglas W. Larson

9.2.1 What is research?

Research is any investigative activity that is carried out by a person or a group, with the goal of discovering something new, at least to them. Research can be conducted on existing published information, or can be conducted by making new observations. Research is not the same as training or education. These latter two activities involve the learning of information already obtained by someone else. Research cannot be learned – it must be conducted.

Research has not been completed (i.e. it does not exist) until and unless it has been published. If someone says, “I’ve done some research on...”, the listener is permitted to ask for the proof of the existence of this research. Such proof only exists in peer-reviewed published documents. Research that is not published is considered “in progress” but is not considered to be completed.

Peer reviewed publications include a large collection of international journals, books, government reports (sometimes peer-reviewed), CD-ROMs, web-sites, films, drawings, maps.

Those who receive the products of research must be convinced that the work was done under no conflict of interest. That is, the audience must believe that the research worker did not try to obtain a particular result that benefits them or their workplace. Hence, research conducted by the profit-oriented private sector is rejected universally as being fundamentally biased. It must be considered biased because the sponsor of the research wishes to make a profit from its execution.

Accordingly, there are very few agencies or groups who can be considered independent enough to conduct unbiased research. The list includes government laboratories, privately and philanthropically-endowed research institutions, and universities. Government laboratories do not regularly encourage their research workers to try to publish their results in the peer-reviewed press. Also, government laboratories can easily be controlled by politicians. Hence, only endowed research institutions and universities are well-positioned in the western world, to conduct research.

The fundamental difference between high schools and universities, is that universities are knowledge factories whose business is to make new discoveries in every field of inquiry, and without fear of dismissal for those discoveries (hence the function of tenure). Teaching students about this process of gaining new knowledge or interpretations of the

way the world works, is also an important function of universities, but the teaching itself is little-different from that conducted at other teaching institutions.

9.2.2 Why is research important?

Research permits the process of natural selection to apply to ideas. It allows ideas to be tested in a critical and unbiased fashion, and allows the bad (or less fit) ideas to die while permitting the good ideas to flourish. Research has grown explosively since the invention of the printing press, because that invention permitted the manufacturing of text that could be guaranteed to be identical to different readers. Up until the year 1495, each copy of each work could (and was) edited by scribes on an individual basis.

Since 1900, research has been a major activity of universities because these institutions give the greatest freedom possible to investigators. Research is the foundation of everything that we currently value in society. Everything.

9.2.3 Why is conservation and restoration ecology important?

Research workers for 50 years have noted the rapid rate of global extinction of species, and the loss of habitat supporting those species that survive. David Quammen (1996) concludes that the human impact on the biodiversity of the planet will represent (when it is finished) the single largest episode of mass-extinction that the planet has ever seen. Other workers have noted that the earth's ecosystems interact with each other in a way that is not in steady-state. There is no balance of nature; instead, there is constant warfare among taxa. The instability of the atmosphere, of soils, of climate, etc. is an example of the kinds of fluctuations that occur normally except that the magnitude of the changes, and their period (duration), are truly exceptional. Humans have redirected almost 60% of the sun's output to activities that directly or indirectly support us. No other species in history has changed so fully the very environment that it depends upon.

Put the argument another way: humans have been able to adapt to and therefore avoid all constraints on their individual health and population size except one: their own success. We may well be (as a species) at the beginning of "the big crumble" wherein the entire planet's functional infrastructure begins to slowly decay to the point where our own species suffers irreversible increases in morbidity and mortality. We may be unable to avoid our own success as a species, and may suffer from it.

Conservation biology and restoration ecology are disciplines rooted in this knowledge, and whose goals are to discover the structural and functional features of the planet, to try to maintain all components of structure and function as they are now (conservation) or to try to repair them to an earlier condition (restoration) as best we can. Conservation biology and restoration ecology both advocate the view that humans should minimize their functional "footprint" on the planet so that an "earth" can exist that is beautiful, productive, and self-maintaining.

Conservation biology and restoration ecology represent the bulk of the hope for a future world that people will want to live in. Both disciplines must be based in science, and in scientific research, because otherwise, practitioners of conservation and restoration will simply protect "what they want" and rebuild "what they can".

9.2.4 Why should research be conducted at Cruickston Park?

Cruickston Park is ideally suited to conduct research in conservation and restoration. First, the property is large and has been under the control of a small number of owners since land clearing. Second, the property sits within the northern limit of the Carolinian forest zone of North America, and therefore is within the biological zone with the greatest biodiversity in Canada. This biodiversity is currently threatened by urban, agricultural, and industrial expansion. Third, the property includes a wide variety of habitat types and at least one parcel of old-growth deciduous forest. Fourth, the croplands at Cruickston offer themselves as sites that could be used to develop a scientific basis for restoration ecology for streams, shorelines, alvars, cliffs and forests. Fifth, and most importantly, the current owners of the property want all this to happen while also using the property to explain these activities to the public at large.

9.2.5 Why should one sponsor research at Cruickston Park?

There are no other properties such as Cruickston Park in southern Ontario. In fact, I am not aware of a single private landowner in the entire province who has set aside a piece of valuable land specifically for the purpose of supporting research and education in conservation biology and restoration ecology. Any donor to the Cruickston Charitable Research Reserve will be making a contribution to:

- research results that can be made available internationally.
- education at all levels from elementary schools to post-secondary. Such education adds value to the knowledge-based economy. Cruickston can help to reverse the brain drain, which is a real phenomenon in the field of ecology and environmental science.
- actual conservation. Quite aside from the issue of the research, the activities at Cruickston can be used to increase the public discussion of the need (and mechanisms) to achieve conservation and effective restoration of habitats and species.
- the economy. Research workers traditionally have small salaries, but they are large consumers of field and laboratory equipment. The building up of research infrastructure will permit local companies to benefit from the local activities.
- their own marketing, and/or tax write-offs. Any involvement by sponsors can be used by them to advance their corporate image, or to save tax dollars.

- the aesthetic value of the property as an example of what southern Ontario once looked like.

9.3 Priorities for Cruickston Charitable Research Reserve

1. The promotion of understanding and respect for natural ecosystems through research, education and passive recreation will be both an on-going and long-term priority for those who embrace the goals and vision of Cruickston Charitable Research Reserve. **Four initiatives should be undertaken beginning in 2002 for the purpose of establishing strategies and protocols that will guide both the immediate and long-term planning.**
 - Consult with established interpretive centres and their personnel in order to prepare a management plan for Cruickston Charitable Research Reserve to become a nature interpretive resource and to establish a nature interpretive centre (Map 6). This centre located on the boundary between the Carolinian and northern hardwood forests of Ontario would serve the families, students, educators and community leaders of Waterloo Region as well as visitors to the region.
 - Establish walking trails to facilitate passive recreation and nature study within Cruickston that, while avoiding sensitive habitat, are designed (a) to provide opportunities to view sites of natural and cultural interest, (b) to view, where feasible, experimental restoration plots that would serve to inform the public about restoration ecology, and (c) establish connecting links with the Cambridge Riverbank Trail system (Map 6). To further enhance passive recreational opportunities within the City of Cambridge, exploratory discussions should continue between Cruickston Charitable Research Reserve and Cambridge Riverbank Trail Advisory Committee to facilitate the completion of a Cambridge trail link between Preston and Blair.
 - Investigate the feasibility of entering into cooperative ventures between the Outdoor Education Departments of regional school boards, the Grand River Conservation Authority and Cruickston Charitable Research Reserve.
 - Invite and work with researchers in biology conservation, restoration ecology and environmental planning to establish both undergraduate course projects and graduate research studies.
2. In order to develop Cruickston Charitable Research Reserve's full capacity for long-term monitoring, research and natural history interpretation, **biophysical inventories and monitoring should be continued on a systematic basis.** The search for significant species should continue and a detailed inventory and mapping of the vegetation should be completed on an individual community basis for the entire property. Priority should be given to the vegetation units within the Cliffs and Alvars. Equally important is the development of a protocol for reporting,

documenting, storing and retrieving the data gathered through inventories and monitoring.

3. **Selectively identify croplands to be restored using ecological restoration techniques and allowing natural succession to occur.** Recognizing that the scientific aspects of restoration ecology are just beginning to develop, much of the restoration should be done in the context of planned research activities. In co-operation with researchers at local universities, establish vegetation linkages and corridors between existing habitats. Create buffers where cropland abuts core conservation areas (see #4) and plant vegetation screens along selected fringes of the property (Map 6). To foster public awareness about restoration ecology within Cruickston, initial efforts should occur within and along the floodplain between Blair Road and the Grand River. Particular attention should be given to the rehabilitation of the lower reach of Bauman Creek, including the creation of wetlands adjacent to this reach.

4. **Designate a number of habitat sites within Cruickston Park to be core conservation areas, including areas of significant vegetation for conservation (Map 6), that are effectively protected from human intrusion and encroachment.** These core conservation areas will become sites of intense and permanent interest to persons interested in conservation and natural history and are wonderful examples of our natural legacy within Waterloo Region. These core conservation areas should include woodlands, wetlands, limestone cliff formations and the confluence of the Grand and Speed Rivers. Specifically, the woodlands include those of Blair Road Slope Woods, Hogsback, Indian Woods and Manor House Woods. Wetlands include the upper reaches of Bauman Creek and its associated Deciduous-Mixed Swamp and the reaches of Cruickston Creek that extend through the Hogsback and into the Mixed Swamp, Marsh and Wet Meadows south of Blair Road. The fern-rich cliffs along the Grand River are physically sensitive to intrusion and access should be restricted. Reaches of the rivers, particularly in and about the confluence, where migratory waterfowl congregate during migration and winter, should remain undisturbed. Reaches of the river and floodplain within Cruickston that have been designated by OMNR as wintering habitat for Bald Eagle should have restricted access according to recommendations by OMNR (2001a).

5. **Undertake immediately the following remedial actions :**
 - Fragile and sensitive habitats within the landscape unit Cliffs and Alvars should be posted with clearly marked signs to indicate appropriate and inappropriate uses of the area. Where trails are permitted, signs should indicate that persons are required to stay on the trails. Persons with pets are requested to stay on Grand Trunk Trail (Map 6).

 - Contact the OMNR and, in light of new data gathered by CPEAT, request that an evaluation of the wetlands north of Blair Road within the Cruickston Creek drainage basin be undertaken; that the database of the Provincially Significant

Wetland south of Blair Road, known as the Barrie's Lake Wetland Complex (Map 5) that includes the upper reaches of Cruickston Creek, be updated; and, that a re-evaluation of Bauman Creek, an Evaluated Wetland, take place.

- Initiate discussion with the Regional Municipality of Waterloo and EEAC to extend the eastern boundary of ESPA 38, Cruickston Park, from its present limit adjacent to Newman Creek along the cliffs proper to the City of Cambridge boundary so that the entire vegetation unit, Hawthorn Alvar/Old Field Complex on Alvar, is included as well as the Conifer Plantation, this latter site offering an opportunity for alvar restoration (Map 5).
 - Cease the application of sludge across tilled lands.
 - Begin restoration on cropland with steep slopes to conserve soil. Included should be the cropland immediately adjacent to the southern edge of Indian Woods and the steep slopes along the north side of Cruickston Creek (Map 6).
 - White-tailed Deer have, and continue to have, a noticeable detrimental impact on some plant communities in Cruickston. While maintaining the population at low numbers to allow understory regeneration is desirable, deer browse and predation studies should be undertaken to facilitate the development of a comprehensive management strategy.
 - A detailed Environmental Impact Study should be completed to determine the impact of closing Blair Road.
6. Seek permission to visit lands adjacent to Cruickston in order to **assess potential impacts, both beneficial and detrimental, to the objects of Cruickston Charitable Research Reserve**. Where possible, determine the landowners' intent for these properties. In co-operation with adjacent landowners, develop a watershed management strategy for the lands upstream of Cruickston including the Waterloo Moraine and the upstream kettle lakes to ensure water quality of both surface and ground water flowing into Cruickston. In co-operation with the Grand River Conservation Authority and landowners throughout the watershed, participate in the initiative, the *Watershed Forest Plan for the Grand River* (2001).

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Personal Communications

Mark Fretwurst 2001
Bob Gravell 2001
L. Lapierre 2001
Peter Lord 2001

APPENDIX AMosses and Liverworts of Cruickston Park.....Wynnfield Y. Watson

Cruickston has a large and varied moss and liverwort flora. It is apparent, even after preliminary collecting that the most recent list of mosses of Ontario (Ireland and Cain 1975) does not begin to represent the mosses that are found in this area. Considering all the counties and districts of the province, the list averages out to 87 species per area, ranging from 271 in Thunder Bay district to 1 in Prescott Township; 27 species are listed from Waterloo Region. In Cruickston, one season's collecting has yielded more than 50 species of mosses. Some collecting locations remain to be explored and all (see below) must be explored in more detail and during different seasons; likely there are still many species that remain to be found. Not only are the common mosses such as *Anomodon* and *Plagiomnium* present but some southern elements (e.g. *Climacium americanum*) are here as well. There is little doubt that when Cruickston is fully explored and the identification of some species clarified, the moss flora of Cruickston will be an excellent example of the mosses of southern Ontario.

The liverworts found in Cruickston, although not representing as many species as the mosses, are varied and abundant. So far, at least five species have been found. *Conocephalum conicum*, a stemless liverwort, is abundant wherever there is the least bit of moisture. *Radula complanata* and *Lophocolea heterophylla*, both stemmed liverworts, are frequently found mixed with the mosses. Undoubtedly further collecting will yield other species. Fortunately there is a new publication by Ley and Coates (1999) that will help to sort out the liverworts of this area.

Collecting Locations in Cruickston Park

1. Hogsback
 - Mixed swamp with considerable Eastern White Cedar; normally damp with groundwater seeps forming Cruickston Creek.
 - Pine plantation south of Blair Road.
2. Indian Woods
 - Deciduous, well-drained old-growth forest, largely open growth with a couple of catch-basin ponds.
 - Mixed swamp bordering Bauman Creek.
3. Blair Road Slope Woods
 - Deciduous forest along Bauman Creek on moderate, north-east slope and well-drained glacial bed.
4. Cliffs and Alvars
 - Deciduous forest growing in shallow soil over limestone.
 - Hawthorn savanna/old field complex on alvar including top of cliffs.
5. Barn Woods
 - Open deciduous forest.
6. Shoreline
 - Along the river's edge in open area between west end of cliffs and Blair-Cambridge.
7. Grand Trunk Trail
 - Along old rail line through several vegetation units within the Cliffs and Alvars including the Scotch Pine grove near lookout.
8. Farm Fields
 - With or without crops, on upland or on river flats.
9. Cruickston Creek
 - Narrow vegetated strip along the middle reach of the creek south of Blair Road.

Preliminary List of Mosses and Liverworts of Cruickston Park

Mosses

<i>Amblystegium serpens</i>	<i>Grimmia apocarpa</i>
<i>Amblystegium varium</i>	<i>Hedwigia ciliata</i>
<i>Anomodon attenuatus</i>	<i>Homomallium adnatum</i>
<i>Anomodon rostratus</i>	<i>Hygroamblystegium fluviatile</i>
<i>Atrichum angustatum</i>	<i>Hygroamblystegium tenax</i>
<i>Atrichum undulatum</i>	<i>Hymenostylium recurvirostre</i>
<i>Barbula convoluta</i>	<i>Hypnum curvifolium</i>
<i>Barbula unguiculata</i>	<i>Hypnum imponens</i>
<i>Brachythecium</i> spp.	<i>Hypnum lindbergii</i>
<i>Bryum argenteum</i>	<i>Hypnum</i> sp.
<i>Bryum caespiticium</i>	<i>Isopterygiopsis muelleriana</i>
<i>Callicladium haldanianum</i>	<i>Leptobryum pyriforme</i>
<i>Campylium chrysophyllum</i>	<i>Leptodictyum riparium</i>
<i>Campylium hispidulum</i>	<i>Leucobryum glaucum</i>
<i>Campylium</i> sp.	<i>Leskea polycarpa</i>
<i>Ceratodon purpureus</i>	<i>Leskeella nervosa</i>
<i>Cirriphyllum piliferum</i>	<i>Mnium marginatum</i>
<i>Climacium americanum</i>	<i>Orthotrichum anomalum</i>
<i>Climacium dendroides</i>	<i>Plagiomnium cuspidatum</i>
<i>Desmatodon obtusifolius</i>	<i>Platydictya subtilis</i>
<i>Dicranum flagellare</i>	<i>Polytrichum</i> sp.
<i>Dicranum montanum</i>	<i>Rhytidiadelphus triquetrus</i>
<i>Ditrichum</i> sp.	<i>Schistidium rivulare</i>
<i>Drepanocladus aduncus</i>	<i>Sphagnum</i> sp.
<i>Encalypta procera</i>	<i>Taxiphyllum deplanatum</i>
<i>Entodon seductrix</i>	<i>Tetraphis pellucida</i>
<i>Eurhynchium hians</i>	<i>Thuidium delicatulum</i>
<i>Eurhynchium pulchellum</i>	<i>Thuidium recognitum</i>
<i>Fissidens adianthoides</i>	<i>Tortella tortuosa</i>
<i>Fissidens taxifolius</i>	<i>Tortula ruralis</i>
<i>Fissidens</i> sp.	<i>Weissia</i> sp.
<i>Fontinalis hypnoides</i>	

Liverworts

<i>Aneura pinguis</i>	<i>Marchantia polymorpha</i>
<i>Conocephalum conicum</i>	<i>Porella platyphylla</i>
<i>Frullania eboracensis</i>	<i>Radula complanata</i>
<i>Lophocolea heterophylla</i>	<i>Reboulia hemisphaerica</i>

APPENDIX B

Common and scientific names of flora and fauna found in this report. This is not a complete listing of species occurring in Cruickston Park.

American Basswood	<i>Tilia americana</i>
American Beech	<i>Fagus grandifolia</i>
American Grass-of-parnassus	<i>Parnassia glauca</i>
American Prickly-ash	<i>Zanthoxylum americanum</i>
Bitternut Hickory	<i>Carya cordiformis</i>
Black Maple	<i>Acer nigrum</i>
Black Oak	<i>Quercus velutina</i>
Bladder-nut	<i>Staphylea trifolia</i>
Buffalo Berry (Canada Soapberry)	<i>Shepherdia canadensis</i>
Bulbet Bladder Fern	<i>Cystopteris bulbifera</i>
Bur Oak	<i>Quercus macrocarpa</i>
Burning Bush	<i>Euonymus atropurpurea</i>
Canada Water-leaf	<i>Hydrophyllum canadense</i>
Closed Gentian	<i>Gentiana andrewsii</i>
Common Hackberry	<i>Celtis occidentalis</i>
Common Periwinkle	<i>Vinca minor</i>
Common Reed	<i>Phragmites communis</i>
Crack Willow	<i>Salix fragilis</i>
Eastern Cottonwood	<i>Populus deltoides</i>
Eastern White Cedar	<i>Thuja occidentalis</i>
Five-leaved Virginia-creeper	<i>Parthenocissus quinquefolia</i>
Flowering Rush (Indian Balsam)	<i>Impatiens glandulifera</i>
Golden Alexanders	<i>Zizia aurea</i>
Goutweed	<i>Aegopodium podagraria</i>
Green Spleenwort	<i>Asplenium trichomanes-ramosum</i>
Hemlock-parsley	<i>Conioselinum chinense</i>
Hill's Oak	<i>Quercus ellipsoidalis</i>
Interrupted Fern	<i>Osmunda claytoniana</i>
Lily-of-the-valley	<i>Convallaria majalis</i>
Lizard's-tail	<i>Saururus cernuus</i>
Low Juneberry	<i>Amelanchier spicata</i>
Maidenhair Spleenwort	<i>Asplenium trichomanes</i>
Moonseed	<i>Menispermum canadense</i>
Obedient Plant	<i>Physostegia virginiana</i>
Poke Milkweed	<i>Asclepias exaltata</i>
Purple Joe-pye-weed	<i>Eupatorium purpureum</i>
Red Maple	<i>Acer rubrum</i>
Red Oak	<i>Quercus rubra</i>
Reed Canary Grass	<i>Phalaris arundinacea</i>
Rock Polypody	<i>Polypodium virginianum</i>
Rough Hedge-nettle	<i>Stachys hispida</i>
Scotch Pine	<i>Pinus sylvestris</i>
Shagbark Hickory	<i>Carya ovata</i>
Showy Orchis	<i>Galearis spectabilis</i>
Smaller Fringed Gentian	<i>Gentianopsis virgata</i>
Smooth Cliff-brake	<i>Pellaea glabella</i>
Squawroot	<i>Conopholis americana</i>
Streambank Wild Rye	<i>Elymus riparius</i>

Sugar Maple	<i>Acer saccharum</i>
Swamp White Oak	<i>Quercus bicolor</i>
Sweet Reed Grass	<i>Cinna arundinacea</i>
Thin-leaved Sunflower	<i>Helianthus decapetalus</i>
Three-leaved Solomon's Seal	<i>Maianthemum trifolium</i>
White Ash	<i>Fraxinus americana</i>
White Elm	<i>Ulmus americana</i>
Wild Yellow Plum	<i>Prunus americana</i>
Wood Germander	<i>Teucrium canadense</i>
BUTTERFLIES	
Giant Swallowtail	<i>Papilio cresphontes</i>
Monarch	<i>Danaus plexippus</i>
Tawny Emperor	<i>Asterocampa clyton</i>
MOLLUSCS	
Elktoe	<i>Alasmidonta marginata</i>
Slippershell Mussel	<i>Alasmidonta viridis</i>
Wavy-rayed Lampmussel	<i>Lampsilis fasciola</i>
FISH	
Brook Trout	<i>Salvelinus fontinalis</i>
Common Carp	<i>Cyprinus carpio</i>
Greater Redhorse	<i>Moxostoma valenciennesi</i>
Silver Shiner	<i>Notropis photogenis</i>
Smallmouth Bass	<i>Micropterus dolomieu</i>
AMPHIBIANS	
American Toad	<i>Bufo americanus</i>
Blanding's Turtle	<i>Emydoidea blandingi</i>
Blue-spotted Salamander	<i>Ambystoma laterale</i>
Bullfrog	<i>Rana catesbeiana</i>
Common Snapping Turtle	<i>Chelydra serpentina</i>
Green Frog	<i>Rana clamitans</i>
Midland Painted Turtle	<i>Chrysemys picta marginata</i>
Northern Leopard Frog	<i>Rana pipiens</i>
Pickerel Frog	<i>Rana palustris</i>
Red-backed Salamander	<i>Plethodon cinereus</i>
Spotted Salamander	<i>Ambystoma maculatum</i>
Tremblay's Salamander	<i>Ambystoma tremblayi</i>
REPTILES	
Brown Snake	<i>Storeria dekayi</i>
Northern Ribbon Snake	<i>Thamnophis sauritus</i>
Queen Snake	<i>Regina septemvittata</i>
Redbelly Snake	<i>Storeria occipitomaculata</i>
Smooth Green Snake	<i>Opheodrys vernalis</i>
BIRDS	
American Bittern	<i>Botaurus lentiginosus</i>
American Black Duck	<i>Anas rubripes</i>
American Crow	<i>Corvus brachyrhynchos</i>
American Goldfinch	<i>Carduelis tristis</i>

American Kestrel	<i>Falco sparverius</i>
American Redstart	<i>Setophaga ruticilla</i>
American Robin	<i>Turdus migratorius</i>
American Woodcock	<i>Scolopax minor</i>
Bald Eagle	<i>Haliaeetus leucocephalus</i>
Belted Kingfisher	<i>Ceryle alcyon</i>
Black Tern	<i>Chlidonias niger</i>
Black-and-white Warbler	<i>Mniotilta varia</i>
Black-billed Cuckoo	<i>Coccyzus erythrophthalmus</i>
Black-capped Chickadee	<i>Poecile atricapilla</i>
Black-crowned Night-Heron	<i>Nycticorax nycticorax</i>
Black-throated Green Warbler	<i>Dendroica virens</i>
Blue Jay	<i>Cyanocitta cristata</i>
Blue-gray Gnatcatcher	<i>Poliophtila caerulea</i>
Blue-winged Teal	<i>Anas discors</i>
Blue-winged Warbler	<i>Vermivora pinus</i>
Bobolink	<i>Dolichonyx oryzivorus</i>
Brown Creeper	<i>Certhia americana</i>
Brown Thrasher	<i>Toxostoma rufum</i>
Canada Goose	<i>Branta canadensis</i>
Canada Warbler	<i>Wilsonia canadensis</i>
Caspian Tern	<i>Sterna caspia</i>
Chestnut-sided Warbler	<i>Dendroica pensylvanica</i>
Common Goldeneye	<i>Bucephala clangula</i>
Common Grackle	<i>Quiscalus quiscula</i>
Common Loon	<i>Gavia immer</i>
Common Merganser	<i>Mergus merganser</i>
Common Tern	<i>Sterna hirundo</i>
Cooper's Hawk	<i>Accipiter cooperii</i>
Eastern Bluebird	<i>Sialia sialis</i>
Eastern Kingbird	<i>Tyrannus tyrannus</i>
Eastern Meadowlark	<i>Sturnella magna</i>
Eastern Phoebe	<i>Sayornis phoebe</i>
Eastern Screech-Owl	<i>Otus asio</i>
Eastern Towhee	<i>Pipilo erythrophthalmus</i>
European Starling	<i>Sturnus vulgaris</i>
Field Sparrow	<i>Spizella pusilla</i>
Gadwall	<i>Anas strepera</i>
Golden-crowned Kinglet	<i>Regulus satrapa</i>
Grasshopper Sparrow	<i>Ammodramus savannarum</i>
Gray Catbird	<i>Dumetella carolinensis</i>
Great Blue Heron	<i>Ardea herodias</i>
Great Egret	<i>Ardea alba</i>
Great Horned Owl	<i>Bubo virginianus</i>
Great-crested Flycatcher	<i>Myiarchus crinitus</i>
Green Heron	<i>Butorides virescens</i>
Hooded Merganser	<i>Lophodytes cucullatus</i>
Hooded Warbler	<i>Wilsonia citrina</i>
Horned Lark	<i>Eremophila alpestris</i>
House Finch	<i>Carpodacus mexicanus</i>
House Sparrow	<i>Passer domesticus</i>
House Wren	<i>Troglodytes aedon</i>
Little Blue Heron	<i>Egretta caerulea</i>

Magnolia Warbler	<i>Dendroica magnolia</i>
Mallard	<i>Anas platyrhynchos</i>
Mourning Dove	<i>Zenaida macroura</i>
Mourning Warbler	<i>Oporornis philadelphia</i>
Northern Bobwhite	<i>Colinus virginianus</i>
Northern Cardinal	<i>Cardinalis cardinalis</i>
Northern Rough-winged Swallow	<i>Stelgidopteryx serripennis</i>
Northern Saw-whet Owl	<i>Aegolius acadicus</i>
Northern Waterthrush	<i>Seiurus noveboracensis</i>
Orchard Oriole	<i>Icterus spurius</i>
Osprey	<i>Pandion haliaetus</i>
Ovenbird	<i>Seiurus aurocapillus</i>
Pied-billed Grebe	<i>Podilymbus podiceps</i>
Pileated Woodpecker	<i>Dryocopus pileatus</i>
Pine Warbler	<i>Dendroica pinus</i>
Red-bellied Woodpecker	<i>Melanerpes carolinus</i>
Red-breasted Nuthatch	<i>Sitta canadensis</i>
Red-eyed Vireo	<i>Vireo olivaceus</i>
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>
Red-shouldered Hawk	<i>Buteo lineatus</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Ring-billed Gull	<i>Larus delawarensis</i>
Ruffed Grouse	<i>Bonasa umbellus</i>
Sandhill Crane	<i>Grus canadensis</i>
Savannah Sparrow	<i>Passerculus sandwichensis</i>
Scarlet Tanager	<i>Piranga olivacea</i>
Sharp-shinned Hawk	<i>Accipiter striatus</i>
Snow Goose	<i>Chen caerulescens</i>
Sora	<i>Porzana carolina</i>
Spotted Sandpiper	<i>Actitis macularia</i>
Swainson's Warbler	<i>Limnithlypis swainsonii</i>
Swamp Sparrow	<i>Melospiza georgiana</i>
Trumpeter Swan	<i>Cygnus buccinator</i>
Tundra Swan	<i>Cygnus columbianus</i>
Turkey Vulture	<i>Cathartes aura</i>
Vesper Sparrow	<i>Pooecetes gramineus</i>
Virginia Rail	<i>Rallus limicola</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
White-breasted Nuthatch	<i>Sitta carolinensis</i>
Wild Turkey	<i>Meleagris gallopavo</i>
Winter Wren	<i>Troglodytes troglodytes</i>
Wood Duck	<i>Aix sponsa</i>
Wood Thrush	<i>Hylocichla mustelina</i>
Yellow Warbler	<i>Dendroica petechia</i>
Yellow-bellied Sapsucker	<i>Sphyrapicus varius</i>
Yellow-billed Cuckoo	<i>Coccyzus americanus</i>
Yellow-throated Vireo	<i>Vireo flavifrons</i>
MAMMALS	
Raccoon	<i>Procyon lotor</i>
Opossum	<i>Didelphis virginiana</i>
White-tailed Deer	<i>Odocoileus virginianus</i>

APPENDIX C

Definitions of At-Risk Status

COSEWIC (Committee on the Status of Endangered Wildlife in Canada)
http://www.cosewic.gc.ca/cosewic/eng/sct0/terms_e.htm

Extinct – species that no longer exists anywhere in the world.

Extirpated – indigenous species that no longer exists in the wild in Canada, but still in occurs elsewhere.

Endangered – any indigenous species at risk of immediate extirpation or extinction.

Special Concern – any indigenous species at risk because of characteristics that make it particularly sensitive to human activities or natural events

Threatened Species – any indigenous species at risk of becoming endangered in Canada if limiting factors are not reversed.

Nature Conservancy of Canada (NCC)
<http://www.natureconservancy.ca>

The Nature Conservancy assigns a number on a scale of one to five to a rank – the more likely the risk, the lower the number. A number of factors are considered when a rank is assigned: abundance, range, protection, threats, and the number of all known sightings or occurrences.

Global Ranks

G1 - Extremely Rare - usually 5 or fewer occurrences in its range or very few surviving individuals; or, some factor(s) are making the species vulnerable to extinction.

G2 - Very Rare - usually between 5 and 20 occurrences in its range or many individuals in fewer occurrences; or, some factor(s) are making the species vulnerable to extinction.

G3 - Rare to Uncommon - usually between 20 and 100 occurrences in its range; there may be fewer occurrences, but in such cases there would be a large number of individuals in some populations; may be susceptible to large-scale disturbances.

G4 - Common - usually more than 100 occurrences in its range and not susceptible to immediate threats.

G5 - Very Common - secure under current conditions.

GQ – Questionable - taxonomic status of the species, subspecies, or variety is under question.

GT - "T" means that the assigned rank (on a scale of one to five) applies to a certain subspecies or variety.

GU - Uncertain - status is uncertain. More data is needed.

G? – Unranked - species not yet ranked. If a “?” follows a rank (G2?), the rank has tentatively been assigned.

G_ - Unassigned - "G" followed by a blank space means that a global rank has not been assigned yet to the species by NCC.

<p>Natural Heritage Information Centre (NHIC) http://www.mnr.gov.on.ca/MNR/nhic/about.html</p>
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Provincial Ranks

S1 - Extremely Rare – usually 5 or fewer occurrences in the entire Ontario range or very few surviving individuals and especially vulnerable to extirpation in the province.

S2 - Very Rare – usually between 5 and 20 occurrences in the entire Ontario range or many individuals in fewer occurrences and often susceptible to extirpation in the province.

S3 - Rare to Uncommon – usually between 20 and 100 occurrences in the entire Ontario range; there may be fewer occurrences, but in such cases there would be a large number of individuals in some populations and these species may be susceptible to large-scale disturbances.

S4 – Common -- apparently secure in Ontario; usually more than 100 occurrences in the province.

S5 - Very Common – secure in Ontario under current conditions.

SE - Exotic – not considered native to Ontario.

SH – Historical – known to have existed in Ontario, but not verified recently and likely not recorded in Ontario in the last 20 years; suitable habitat may still occur in the province and thus the species may be rediscovered.

SR – Reported – reported for Ontario, but inadequate documentation for the report to be accepted or rejected.

SRF - Reported Falsely – false report about the species from Ontario.

SX – Extirpated – extirpated in Ontario.

S? - Unranked – no ranking of the species in Ontario. Where the “?” follows a rank, the rank for Ontario has only been tentatively assigned. S? species are likely rare in Ontario, but insufficient information is available for a more certain rank.

<p>COSSARO (committee on the Status of Species at Risk in Ontario) http://www.mnr.gov.on.ca/MNR/nhic/queries/definitions/mnr.html</p>

Status designations assigned to native Ontario species by the Ontario Ministry of Natural Resources (OMNR) and the national Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The list is updated and revised at least once a year.

END-R – Regulated under provincial Endangered Species Act.

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.

EXP – Extirpated – any native species no longer existing in the wild in Ontario, but existing elsewhere in the wild.

EXT – Extinct – any species formerly native to Ontario that no longer exists.

SC – Special Concern – any indigenous species at risk because of characteristics that make it particularly sensitive to human activities or natural events

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.

<p>Regional Municipality of Waterloo (RMW) http://www.region.waterloo.on.ca</p>

Significant native, vascular plant species – usually one to twelve occurrences in the Regional Municipality and distinct sites are not less than one kilometre apart. (Significant Species List – native vascular plants component, RMW 1999)

Bird Studies Canada

<http://www.bsc-eoc.org/conservation/priorlists>

Conservation Priorities for the Birds of Southern Ontario (Couturier 1999)

Bird species of conservation priority are those breeding birds and their associated habitats that are significant within a municipality/region. These species of conservation priority have been evaluated on the basis of three different components:

- i.) **Jurisdictional responsibility** – species that are characteristic of the region and their inclusion reflects the importance of the region to its Ontario, or possibly, its global, breeding range.
- ii.) **Preservation responsibility** – species are uncommon in the region and/or possess biological characteristics that render them susceptible to catastrophe.
- iii.) **Area sensitivity** – species are sensitive to the amount of suitable breeding habitat available with a region.