THE FRIENDS OF ARRAN LAKE

Arran Lake Wetlands Complex:

a study of a sensitive wildlife habitat under threat

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ARRAN LAKE WETLANDS

Executive summary

The frenzied boom in government-subsidized industrial wind power developments is sweeping across rural Ontario. It will permanently change our landscape, studding picturesque hills and pastures with thousands of incongruously tall steel wind turbine towers. It will remove many of the mature trees from our rural roads and superimpose instead hundreds of miles of electrical transmission lines.

Ostensibly, commercial wind power is intended to supply renewable energy without harming the environment. But biologists have discovered growing evidence of harm to migratory birds and long-term degrading effects on the quality of sensitive wildlife habitats. Increasing concerns include collision mortality for migratory birds (especially songbirds, and raptors, as well as bats); habitat disturbance (especially for waterfowl); and habitat fragmentation, (causing barriers to movement between feeding and breeding areas), with potentially disastrous effect upon threatened and endangered species.

There is a growing consensus that wind turbines must not be placed near migratory corridors, Important Bird Areas (IBAs), significant Areas of Natural and Scientific Interest (ANSIs), sensitive habitat systems, or areas frequented by endangered and threatened species. *Yet in Ontario, there are no provincial regulations to protect such areas from industrial wind turbine development.* Already extremely important wildlife habitats are being targeted by wind turbine development proposals and in some cases these have actually been given environmental approval.

This report examines the sensitivity and value of one typical area in Southern Ontario which is threatened by a wind farm proposal: the Arran Lake Wetlands in Bruce County. It outlines the ecological importance of the Arran Lake natural heritage system with all of its interdependent components and demonstrates how these would each be adversely affected by the planned industrial wind turbine development.

However, many other sensitive areas in the province are also in danger of being degraded by the uncontrolled siting of industrial wind power developments. This report calls upon all levels of government to exercise effective planning, *as a matter of urgency*, *by mapping out areas of particular sensitivity and habitats of endangered and threatened species to be kept out of bounds for such development*. It also urges all nature conservation organizations, conservationists and people who love the countryside to make this very real, imminent, and potentially disastrous threat to our migratory birds and sensitive wildlife habitats a priority agenda issue.

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Acknowledgements:

We are grateful to Bird Studies Canada for the use of the IBA map and to Dr. Scott Petrie for his help in tracking down additional European research.

The Ontario Ministry of Natural Resources helpfully provided information on endangered and threatened species in the Arran Lake area and extensive use was made of their website. Kathy Dodge of the Ontario Ministry of Natural Resources Owen Sound Office kindly provided documents specific to Arran Lake.

Cindy E. J. Cartwright, a member of the Ontario Field Ornithologists and an active observer of bird migrations in Bruce County, read the manuscript and provided helpful suggestions and local expertise. (Cindy is the coordinator of the Ontario Hummingbird Project and holds one of the few permits to band hummingbirds in Ontario and British Columbia issued by the Canadian Wildlife Service. She has spent many years cataloguing the birds on Chantry Island and served as the Bruce County Regional Coordinator for *The Atlas of the Breeding Birds of Ontario 2001-2005*).

Retired Professor James Strecker M. A. provided invaluable editing expertise.

ARRAN LAKE WETLANDS IN SPRING

1
Introduction

- Ontario has no provincial regulations for the siting of industrial wind turbines.
- Scientists agree they should not be placed near sensitive natural habitats or migratory bird and bat flyways.
- Currently sites that are critically important to migratory birds and bats are being considered for wind turbine development.
- Environmental screenings provided by proponents have been criticized by scientists as inadequate.

Some of Ontario's most valuable wildlife habitats—the last resort of many of our endangered species—are now facing their greatest threat since pioneer days. The giant towers and noisy sweeping blades of industrial wind turbines along with hundreds of miles of new transmission lines are planned to be built right across rural Ontario. Biologists warn that poorly situated wind turbines can have an adverse effect upon wildlife habitat. If plans go ahead, they will degrade some of our most important wetlands and intercept major migratory bird corridors. Ontario

has no provincial planning regulations to restrict the location of industrial wind turbine developments.

In the U.S.A., the National Audubon Society has cautioned the U.S. Senate Committee on Wildlife:

> **"Audubon is concerned about the potential cumulative effects of wind power on species populations** if the wind industry expands dramatically. Significant development is being considered in areas that contain large numbers of species or are believed to be major migratory flyways. **Wind energy facilities can have detrimental impacts on birds, bats, and other wildlife**."[1]

Similarly, the United States Department of the Interior, Fish and Wildlife Service has also advised planners:

> "**Wind energy facilities can adversely impact wildlife, especially birds and bats, and their habitats.** As facilities with larger turbines are built, the cumulative effects of this rapidly growing industry may initiate or contribute to the decline of some wildlife populations. The potential harm to these populations from an additional source of mortality makes careful evaluation of proposed facilities essential".[2]

In 2003 the USFWS issued *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* which included:

> "1. **Avoid placing turbines in documented locations of any species of wildlife, fish, or plant protected under the Federal Endangered Species Act.**
>
> 2. **Avoid locating turbines in known local bird migration pathways or in areas where birds are highly concentrated.** . . . Examples of high concentration areas for birds are **wetlands,** State or Federal refuges **[sanctuaries], and staging areas. . . . Avoid known daily movement flyways (e.g., between roosting and feeding areas).**
>
> 3. **Avoid placing turbines near known bat hibernation, breeding, and maternity/nursery colonies, in migration corridors,** or in flight paths between colonies and feeding areas."[3]

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[1] *Impacts of Wind Turbines on Birds and Bats.* Testimony of Mike Daulton Director of Conservation Policy National Audubon Society before the U.S. Senate Committee on Natural Resources Subcommittee on Fisheries, Wildlife and Oceans May 1, 2007.

[2] U.S. Department of the Interior Fish and Wildlife Service, *Service Interim Guidelines on Avoiding and Minimizing Wildlife Impacts from Wind Turbines.* Letter to Regional Directors, Regions 1-7, May 13, 2003.

3 Many European studies have documented habitat degradation and avian collision mortality. The USFWS guidelines were based on peer-reviewed scientific avian studies written by biologists: Orloff and Flannery 1992, Leddy et al. 1999, Woodward et al. 2001, Braun et al. 2002, Hunt 2002 as well as studies of bats: Keeley et al. 2001,Johnson et al. 2002, Johnson et al. 2003, Manes et al. 2002, and Manville 2003.

But despite the fact that such common sense advice has been acknowledged even by **national developers' organizations who admit that the only way to prevent impacts on sensitive habitats is to avoid them altogether**, industrial wind farms continue to be planned and constructed near sensitive natural areas that will suffer environmental degradation and loss of threatened species habitat as a result.

In the U.K., the Royal Society for the Protection of Birds has intervened with legal action to halt a number of inappropriately sited commercial wind projects. It has begun publishing maps of some of England's most sensitive sites-- areas that should be avoided by wind farm development. Dr Mark Avery, the RSPB's Conservation Director, says: "We have been appealing to the government for many years to publish maps like these, primarily to help developers avoid sites that are important to wildlife. "Now we have taken the initiative". Tim Youngs, an RSPB Conservation Officer, adds: "The planning system offers little protection to areas outside nature reserves where internationally important populations of birds are found. There are quite a number of wind farm proposals . . . and the maps will help developers choose the right sites for turbines. If they use the maps, they could avoid environmental objections and save themselves a considerable amount of money and significant amount of time."

In Ontario the problem is already critical. Dr. Scott Petrie, a biologist with Bird Studies Canada notes that **"the current rush for approvals and substantial competition between companies has resulted in the consideration of sites that are critically important for migratory birds and bats**, e.g., closely associated with Ramsar Sites, Important Bird Areas, Biosphere Reserves, National Wildlife Areas, Provincial Parks, etc." [4]

Many conservationists are alarmed that there is no province-wide planning law in place to restrict siting of wind turbine developments in critical natural habitat areas. The provincial government has avoided its responsibility on this issue by delegating planning decisions to local authorities—county councils and municipalities (townships). Both these bodies have been confused and inhibited by the possible use of section 24 of Bill 51 which would allow the government to exempt some "energy undertakings" from the planning act.

Dr. Petrie believes that **"there has not been a rigorous coordinated approach to the assessment of suitable sites, or to addressing concerns about existing proposals. There also do not appear to be sufficient guidelines for the placement of wind farms**; hence the proposals and possibility that wind farms will be placed on the shorelines of Lake St. Clair and Long Point, two of the most significant wetland complexes in North America."

In Ontario citizens tend to assume that protection of important natural heritage sites is being carried out by the Ministry of Natural Resources, or the Ministry of the

[4] From an email from Dr. Scott Petrie sent March 15, 2008 to Harry Verhey of the Chatham Kent Wind Action Group for presentation at the Kent Council meeting of March 25 2008. Dr. Petrie himself addressed the council on February 11, 2008.

Environment. But under the present system, **proponents of wind power developments are being allowed to conduct their own environmental screenings by commissioning their own "studies". According to Dr. Petrie, "most of the 'studies' that I have seen pertaining to bird activity are simply based on casual observations done over an insufficient number of days/seasons/weather conditions.** For example, one contractor concluded that a proposed wind farm would not impact tundra swans; however, his assessment amounted to a few days of observations prior to the fall arrival of tundra swans (early Oct) and a few days of spring observations after tundra swans had departed (mid-April). In many cases there has been an inadequate use of local expert knowledge during the planning process." Instead of local experts, consultants are hired from the city.

These contractor-prepared baseline environmental screenings are normally rubber-stamped by the Ministry of the Environment. And although technically, citizens have the right to question inadequate screenings and request elevation of the project to a full Environmental Assessment by the Ministry of the Environment, such recourse is normally denied by the Ministry. (Recently an elevation request was denied by the MOE for a wind project on Wolf Island in Lake Ontario—a well known migratory bird staging area and IBA.

Dr. Petrie notes that:

> "In most instances there has been an inadequate use of existing scientific literature pertaining to the potential impacts of turbines on wildlife (waterfowl, bats, passerines [songbirds]). There is ample European literature on the subject which has not been adequately utilized in the planning process."[5]

THE FOCUS OF THIS REPORT

- This report examines the vulnerability of Ontario's significant habitats to wind energy developments.
- It looks at an actual wetland complex which is now under threat from a wind turbine development.
- It examines the importance of holistic planning in considering the impact of wind turbine developments on the function of wildlife systems.
- It outlines concerns about habitat degradation, impacts on migratory corridors and the threat to endangered and sensitive species.
- It also looks at progressive legislation that has been passed by one local government and approved by the Ontario Ministry of Municipal Affairs and Housing. It examines provincial and local government responsibilities under existing legislation and the Provincial Policy Statement.

[5] Ibid.

- And it emphasizes the urgent need for the provincial government to restrict wind turbine development near sensitive natural habitats.

ARRAN DRUMLIN FIELDS

2
The issue: Ontario's most valuable natural habitats will soon be lost without protection against wind turbine developments

- Ontario communities have the responsibility to protect natural heritage features *and* their ecological functions.
- This requires protection of the whole functional ecological unit.
- Arran Lake is an example of a Natural Heritage System with all seven natural heritage features present.
- It is comprised of interlinking corridors and buffer zones which provide habitat for a significant wildlife population.

- It is also an area where migratory birds concentrate.

One of the advances in natural heritage planning has been the introduction of "holistic" planning. In the past, it seemed sufficient to designate the most outstanding areas as "provincially significant" or "areas of natural and scientific interest" (ANSIs). The understanding was that if we protected these isolated areas, they would remain intact for future generations.

However, our growing understanding of ecosystems has shown us that protecting an isolated wetland, for example, no matter how well intentioned, was simply *inadequate for preserving its many critical ecological functions.* This is because the wetland habitat itself and many of the life forms found in it depend on the surrounding upland meadows, the creeks and streams that drain into the wetland watershed and the upland forests that supply vital support for creatures living part of their lives beyond the immediate vicinity of the water.

For this reason, the 1996 Provincial Policy Statement under the Planning Act (*which gives Ontario municipalities the responsibility for protecting natural heritage features and areas within a land use planning context)* was amended in 2005 as follows:

> *"2.1 Natural Heritage*
>
> **"2.1.1** Natural features and areas shall be protected for the long term.
>
> **"2.1.2** The diversity and connectivity of natural features in an area, and the long-term **ecological function and biodiversity of natural heritage systems**, should be maintained, restored or, where possible, improved, **recognizing linkages between and among *natural heritage features* and *areas*,** *surface water features* and *ground water features.*
>
> **"2.1.6** Development and **site alteration shall not be permitted on adjacent lands** to the natural heritage features and areas identified in policies 2.1.3, 2.1.4 and 2.1.5 **unless the ecological function OF THE adjacent lands has been evaluated and it has been demonstrated that there will be *no* negative impacts on the natural features or on their ecological functions."**

In 1999, the Ministry of Natural Resources published its *Heritage Reference Manual* as a technical document intended to be used in assessing the "Natural Heritage Component of the Provincial Policy Statement". It focuses on identifying and prioritizing significant wildlife habitat.

To be *ecologically functional*, the best examples of all of the natural heritage features should be identified and protected. "The mosaic of natural heritage features on the landscape and the connections among them is known as a **Natural Heritage System** (OMNR 1999). The other natural heritage features (in addition to significant wildlife habitat) are significant wetlands, significant portions of the habitat

of endangered and threatened species, significant woodlands, significant valley lands, significant ANSIs, and fish habitat."

In other words, in order to preserve the ecological function of any single significant area, one must look at the *whole* picture—of both the area and those areas surrounding it and its relationship to other similar areas nearby. **Sustainability of ecosystems must be safeguarded.**

Consideration #1: Arran Lake is a precious Natural Heritage System at risk

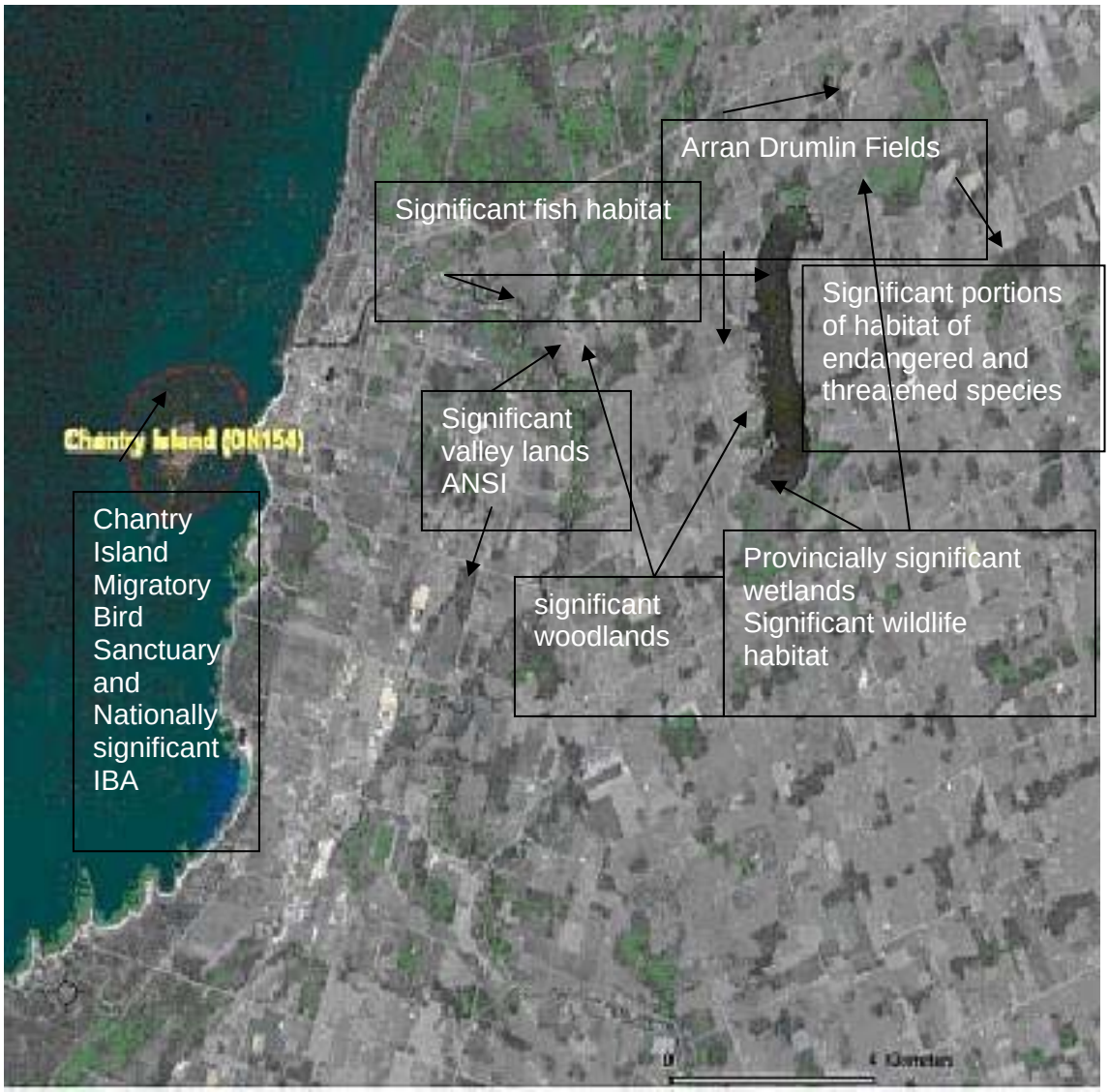
An outstanding example of the meaning of a natural heritage system can be found in the relationship between Arran Lake and its wetlands, the Arran Drumlin Field that surrounds the lake and the nearby Saugeen River valley lands. Understanding the relationships within this natural heritage system allows one to look at the whole picture and the importance of preserving all the interconnecting parts in order to maintain the ecological function of the whole.

All seven natural heritage features are present in the Arran Lake system:

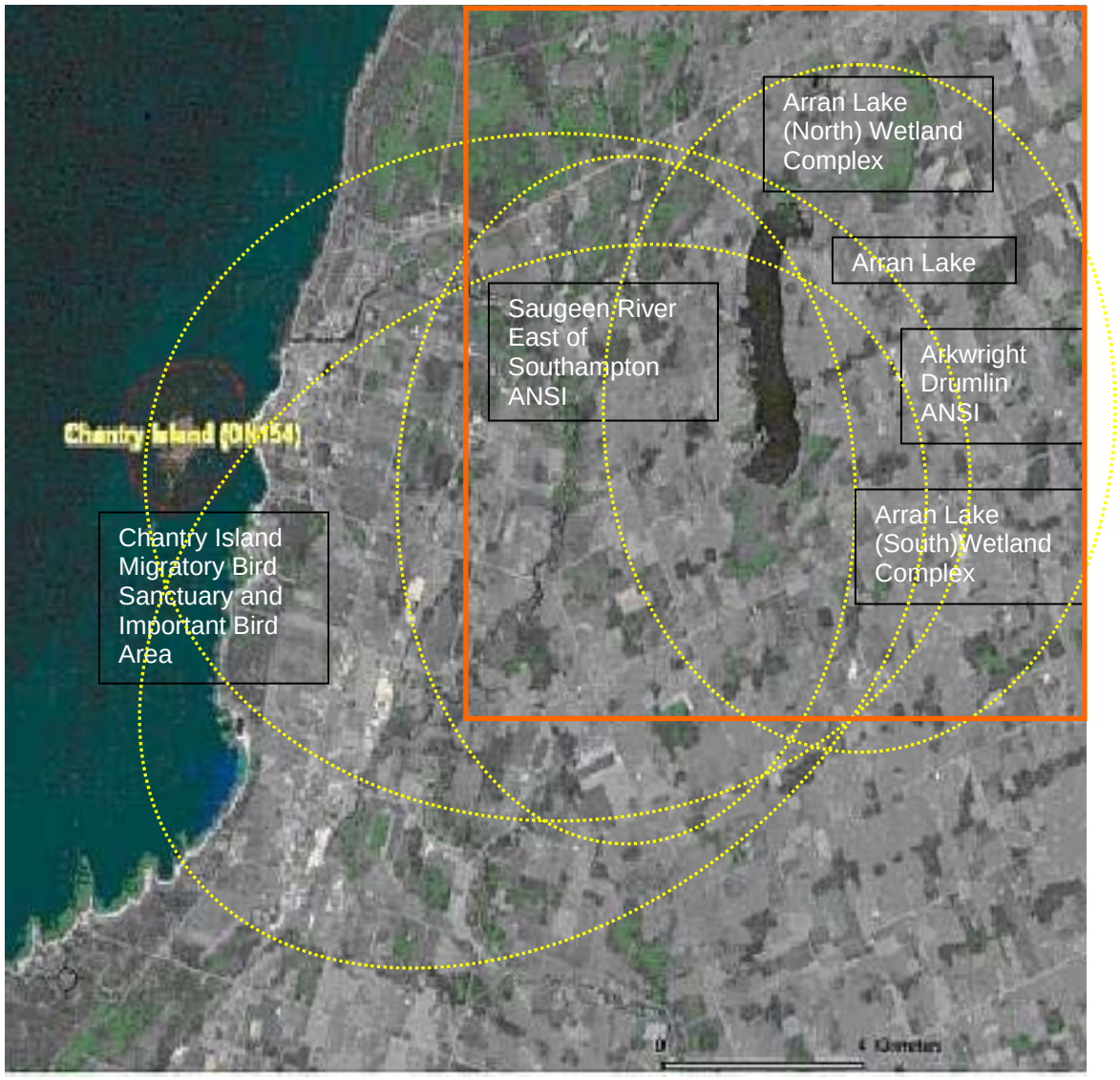
ARRAN LAKE, SURROUNDING UPLANDS, ADJACENT RIVER VALLEY LANDS	**Significant wildlife habitats**
THE ARRAN WETLANDS COMPLEX	**Provincially significant wetland Life Sciences ANSI**.
ARRAN LAKE, INTERCONNECTING UPLANDS, AND RIVER VALLEY	**Significant portions of the habitat of endangered and threatened species**
THE UPLANDS SURROUNDING THE LAKE AND THE RIVER	**Significant old growth woodlands**.

SAUGEEN RIVER	**Significant valley lands Life Sciences ANSI**
THE ARRAN DRUMLIN FIELD which surrounds the lake contains the	**Provincially significant Arkwright Drumlin Earth Sciences ANSI** just east of the wetlands
BOTH THE LAKE AND THE RIVER	**Important habitat for fish**.
CHANTRY ISLAND IBA (IMPORTANT BIRD AREA) FEDERAL MIGRATORY BIRD SANCTUARY	Connected to Arran Lake by **daily migratory corridor** for birds that roost on the island at night and forage in the fields around Arran Lake during the day.

THE SAUGEEN RIVER VALLEY MARKS THE WESTERN BORDER OF THE ARRAN LAKE NATURAL HERITAGE SYSTEM


Arran Drumlin Fields
Significant fish habitat
Significant portions of habitat of endangered and threatened species
Chantry Island (ON154)
Significant valley lands ANSI
Chantry Island Migratory Bird Sanctuary and Nationally significant IBA
significant woodlands
Provincially significant wetlands
Significant wildlife habitat

THE SEVEN NATURAL HERITAGE FEATURES PRESENT IN THE ARRAN LAKE NATURAL HERITAGE SYSTEM



INTERLINKING ECOTONES AND BUFFER AREAS AT ARRAN LAKE *The interlinked yellow circles on this map demonstrate the interdependence of interrelated natural habitats. Red square*

indicates the area of the natural heritage system. Satellite photograph (from Canadian Important Bird Areas, Bird Studies Canada) (http://www.bsc-eoc.org/iba/mapviewer.jsp)

Consideration # 2: Functional natural habitats depend on interlinking corridors and buffer areas

It is easier to understand the relationship between these specialized habitats and their interconnecting corridors, buffer zones and ecotones when one realizes that most of this ecological function takes place within a relatively small area—a little over four miles square.

Part of the reason for the continued survival of this natural high quality, quiet undisturbed habitat is the **general absence of human activity**. The roads surrounding three sides of the lake, for example, are unpaved, unfrequented and used mostly by local residents. Most human habitation is confined to a single house on the original 100 acre farmsteads. Agricultural activity is limited to pastures, haying and a few cattle feed crops, the majority of the farmers having retired. The all-pervasive quietness of the area is broken only by the calling of Loons, croaking of Sandhill Cranes, or singing of Spring Peepers.

QUIET COUNTRY ROAD BESIDE ARRAN LAKE. (NOTE ABSENCE OF TRANSMISSION LINES)

It is also important to emphasize the abundance of avian species within this natural heritage system that would be subject to disturbance and possible mortality as a result of habitat disruption, collision or noise.

The *Atlas of the Breeding Birds of Ontario* 2001-2005 indicates the presence of approximately 101-150 different avian species nesting in this area.[6]

The following list issued by Bird Studies Canada indicates those species present in the area that are a conservation priority for Bruce County.

[6] *Atlas of the Breeding Birds of Ontario 2001-2005.* Edited by Michael D. Cadman, Donald A. Sutherland, Gegor G. Beck, Denis Lepage, Andrew R. Coutourier. Toronto: co-published by Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature, 2007.

Species listed by Bird Studies Canada as Level One priority for conservation in Bruce County:[7]

Forest Birds: American Redstart, American Woodcock, Barred Owl, Black-billed Cuckoo, Black-capped Chickadee,Black-capped Chickadee, Black-throated Blue Warbler, Black-throated Green Warbler, Blackburnian Warbler, Brown Creeper, Canada Warbler, Cerulean Warbler*, Cooper's Hawk, Eastern Phoebe, Golden-winged Warbler, Gray Catbird, Least Flycatcher, Magnolia Warbler, Mourning Warbler, Nashville Warbler, Northern Goshawk, Northern Saw-whet Owl, Ovenbird, Philadelphia Vireo, Pileated Woodpecker, Purple Finch, Red-headed Woodpecker*, Red-shouldered Hawk*, Ruby-throated Hummingbird, Ruffed Grouse, Scarlet Tanager, Veery, Whip-poor-will, White-throated Sparrow, Winter Wren, Yellow-bellied Flycatcher, Yellow-bellied Sapsucker, Yellow-billed Cuckoo, Yellow-throated Vireo.

Marsh Birds: American Bittern, American Black Duck**,** American Coot**,** Black Tern*, Blue-winged Teal, Common Tern**,** Green Heron**,** Northern Harrier, Pied-billed Grebe, Rusty Blackbird, Sandhill Crane, Sedge Wren**,** Short-eared Owl*, Sora, Swamp Sparrow**,** Virginia Rail.

Open Country Birds: American Goldfinch**,** Bank Swallow, Barn Swallow, Bobolink, Brown Thrasher**,** Clay-coloured Sparrow**,** Cliff Swallow**,** Dickcissel**,** Eastern Bluebird**,** Eastern Kingbird**,** Eastern Meadowlark.

All these birds would be affected by habitat fragmentation, disturbance and disruption from wind turbines in the vicinity.

MIGRATORY BIRD FLYWAYS

A notable **feature of Arran Lake is its importance as a migratory bird stopover and staging area.** This feature extends the buffer zone required for the migratory bird corridor out 5 miles from the lake. In addition, the lake is connected to the Chantry Island Migratory Bird Sanctuary by a daily flight corridor used by birds roosting on the island and foraging in the uplands around the lake.

The holistic approach of the OMNR *Reference Manual* emphasizes **the requirement to prevent degradation of a natural heritage system by fragmentation.** It stresses that there is **a need for unobstructed corridors for the use of migratory flyways.** Therefore surrounding upland pastures must remain free from any development which could affect the foraging activities of wetland species.[8]

It is now acknowledged by scientists that these connecting areas between sensitive habitats are just as important for the biological function of the wetlands themselves.

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[7] *Conservation Priorities for the Birds of Southern Ontario*, (Technical appendicies) http://www.bsc-eoc.org/conservation/conservmain.html,
* Indicates threatened or endangered species.
[8] The manual is available online at: http://www.mnr.gov.on.ca/mnr/pubs/SWHTG.PDF

Birds, bats, reptiles, animals and amphibians do not recognize an artificial 200 metre boundary surrounding a wetland. They depend on these **wildlife corridors** as links between specialized habitats for foraging, laying eggs, hibernation, migration and flight displays. “Only when we have a full understanding of what these habitat needs and tolerances are can we effectively manage our landscapes for all marsh nesting species. This is called "holistic management. [9]"

The important links between the areas surrounding Arran Lake remain largely intact in the form of upland woodlands and small streams running in an east-west direction. These form all-important interconnecting passageways.

TRANSMISSION LINES AND TURBINES FORM A BARRIER AT BRUCE TOWNSHIP DEVELOPMENT

3
Scientists agree that wind turbines have a devastating effect

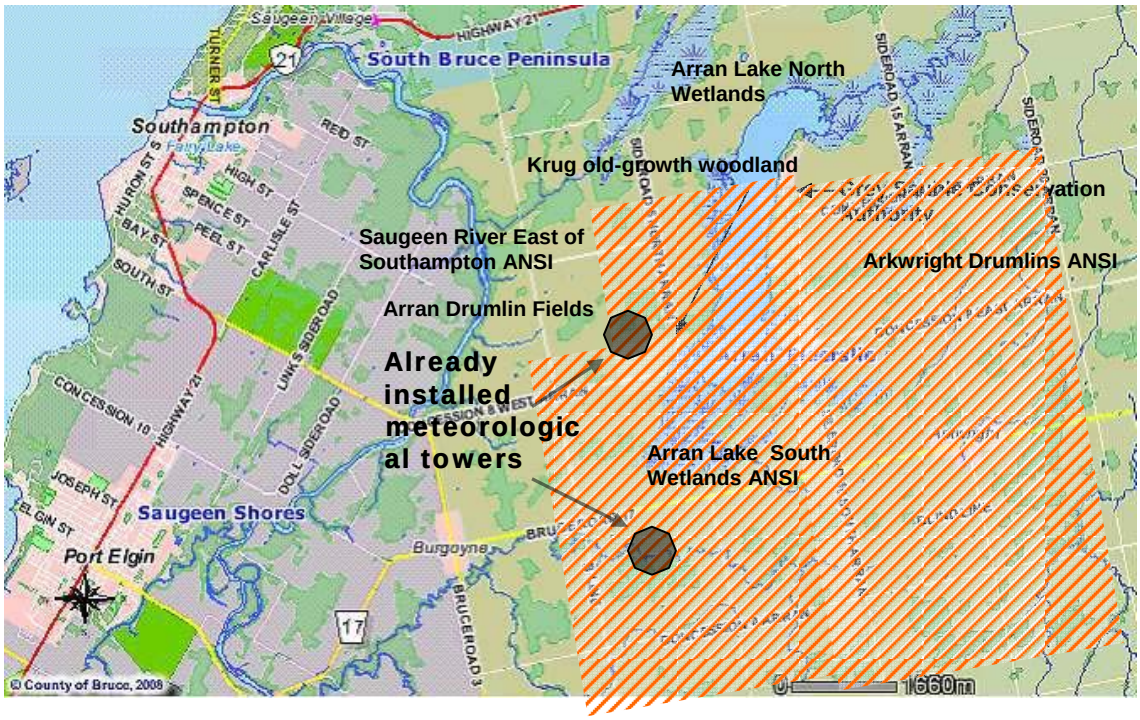
- Biologists agree that locations with high bird or bat use and migratory corridors are not suitable for wind farms.
- They are concerned about both collision mortality and long-term habitat disturbance.

[9] *Ibid*.

The guidelines issued by the Ministry of Natural Resources, make it absolutely clear that any form of industrial development in an area such as the Arran Lake Natural Heritage System would be inappropriate. But an industrial wind power proponent has, in fact, chosen the very heart of this important natural heritage system for a proposed wind turbine development.

The proposal for a wind turbine development was first made at a meeting of the Council of the Municipality of Arran-Elderslie in 2006. At that time the company proposed just 15 wind turbines but one resident has since been informed by them that more than 30 are proposed and leases are still being signed. At the same meeting (which was packed by concerned members of the public), the Friends of Arran Lake, a group of environmentally conscious local residents outlined in the presence of the developer and the councillors, why such a proposal was completely unacceptable to the community from a conservation standpoint. A report further stressing the negative environmental impact of such a development on the area was subsequently sent to the developer and to the ministries of Energy, Environment and Housing and Rural Affairs by the Friends of Arran Lake. These concerns have been disregarded by the developer.

The orange shaded area on the map below approximates the location of the wind energy development proposed at that time. It can be seen to surround three sides of the southern end of the lake and occupy part of the Arkwright Drumlin ANSI just east of the lake. It would occupy most of the area between the Saugeen River ANSI and the Arran Wetlands, effectively forming a barrier to migrating birds and fragmenting the natural heritage system.



DIAGONALLY SHADED AREA INDICATES APPROXIMATE LOCATION OF PROPOSED WIND TURBINE DEVELOPMENT.

If, as many people still assume, wind power is environmentally 'benign', why should conservationists have a problem with the siting of 'wind farms' anywhere at all?"

The proponents of commercial wind energy play down the threat to birds, bats and other animals. They have taken the position that any manmade structure poses a threat to bird life. They often refer to studies showing high avian mortality rates from collisions with communication towers, office buildings and electricity transmission lines. They insist that a wind turbine is not going to cause nearly as much destruction as the barriers already in place in cities. (But the probability that many hundreds of wind turbines situated in rural natural habitats will compound the carnage is never mentioned.)

Developers also claim post-construction studies demonstrate that a wind turbine kills fewer than one bird per year and that any studies which record massive mortality figures such as those at Altamont Pass, California or recent Spanish studies are "aberrations". However wind turbine construction is growing at an astounding pace, rotor blades are becoming ever larger, and the collective impact of thousands of turbines is certainly greater than that of one. It is estimated that over 1400 turbines are now planned for just the southern part of Bruce County.

In his 2007 testimony to the U.S. Senate Committee, Mike Daulton of the National Audubon Society outlined his conservation concerns over the impacts of largely unregulated wind turbines on birds and bats:

> "Collision mortality occurs when animals collide with the moving turbine blades, with the turbine tower, or with associated infrastructure such as overhead power lines. Impacts vary depending upon region, topography, weather, time of day, and other factors. Several recent publications have reported that collision mortality is relatively low, e.g., a 2005 Government Accountability Office report concluded, "it does not appear that wind power is responsible for a significant number of bird deaths."
>
> **"That same report, however, noted that mortality can be alarmingly high in some locations. It also pointed out that there are vast gaps in the mortality data, and that the record may be biased because most of the information collected thus far has come from the West where collision mortality appears to be lower than in other regions,** such as the Appalachians. "Currently, collision mortality is being assessed at only a small minority of the wind energy facilities in the country. In some regions, it has not been assessed at all"[10].

[10] *Impacts of Wind Turbines on Birds and Bats.* Testimony of Mike Daulton Director of Conservation Policy National Audubon Society before the U.S. Senate Committee on Natural Resources Subcommittee on Fisheries, Wildlife and Oceans May 1, 2007.

Another favourite argument used by the industry is that the domestic cat kills more birds than a wind turbine. This statement, of course, avoids the fact that the cat does not kill raptors or large waterfowl two groups that seem to be particularly vulnerable to wind turbine collision especially in adverse weather conditions. Nor does the cat remove thousands of trees along rural roads and replace them by miles of transmission lines which are often lethal to birds.

Just as the accuracy of studies commissioned by many large drug companies are now being questioned, there has also been much discussion of the methods used in various industry-sponsored post-construction studies. Some biologists have pointed out that many of these studies financed by the proponents were carried out in areas which were not densely populated by birds in the first place. Others question the validity of post-construction studies without proper multi-seasonal baseline studies for comparison. Other scientists have pointed to lack of co-operation and denial of access to sites. Tactics such as those of the Florida Power and Light Corp. in the U.S.A. certainly raise suspicion on the whole industry. When it was discovered that one of that company's installations in Florida was killing alarming numbers of bats, researchers were immediately denied entry to the property and the study had to be curtailed. Similar discrepancies have been reported from Spain where findings were not reported accurately until several years later.

Consideration # 3: Once a habitat is disturbed it becomes degraded and is abandoned by many critical species

However, despite these problems, there is gradually emerging a growing body of peer reviewed scientific literature detailing the negative effects of wind turbine developments on natural habitats. **Increasingly, biologists are concerned not only with collision mortality which seems to be critical when turbines are sited on migratory flyways (and takes a greater toll on raptors, waterfowl and songbirds), but even more with long-term habitat disturbance and degradation.**

A recent key study comes from Europe. Joris Everaert and Eckhart Kuijken of the Belgian Research Institute for Nature and Forest have undertaken a long-term project to study the impact of land-based wind turbines on birds (nature) and to act as a consultancy for proposed wind farms in Flanders. And in 2007 they published Wind turbines and birds in Flanders (Belgium): Preliminary summary of the mortality research results.

These researchers emphasize that proper site selection plays a very important role in limiting the impact of wind farms on nature.

- **"In general, current knowledge indicates that there should be precautionary avoidance of locating wind farms in regional or internationally important bird or bat areas and/or migration routes.**

Locations with high bird or bat use are not suitable for wind farms."

- **"Large modern turbines of 1500 kW or more can have as much as, or even more collision fatalities than smaller turbines.**

- **"The average number of collision fatalities in different European wind farms on land varies between a few birds up to 64 birds per turbine per year.**

- **"'Site selection' can play an important role in limiting the number of collision fatalities.**

- **"Actual observed collisions (thermal image intensifiers) was performed in The Netherlands (Winkelman 1992b). These results showed a remarkably high nocturnal collision probability of 1 on 40 passing birds (2.5%) at rotor height.**

- "An exhaustive study before the selection of future locations is a key factor to avoid deleterious impacts of wind farms on birds and bats.

- **"Cumulative negative impacts with an increasing number of wind turbines must be taken into account (Langston & Pullan 2003). This especially is developing along fixed bird migration corridors (coasts, mountain passes). More wind farms also means an extra pressure on top of the already existing sources of negative impact (powerlines, traffic etc.).**

- **"A number of environmental impact assessments (EIA) have important shortcomings because of the lack of data and time or the use of incomplete data (e.g. not covering the annual cycle).** It is very important that EIA's are made independently or are at least evaluated independently. **When important factors remain unclear and an indication exists for an important negative impact, the precautionary principle must be applied. A constructive working method is to map potential and no-go locations for wind energy in a certain country or region, based on all available information, long before concrete projects are planned.**

- "It is clear that if a wind farm could have an important negative impact on wildlife, landscape, etc., the obligation exists to look for alternatives first. In most cases there will always be less vulnerable locations or other alternatives for wind farms".[11]

Please see Appendix 4 for additional quotations from this document.

[11] More details can be seen in Appendix 3 at the end of this report.

As further research references, two comprehensive bibliographies of recent research are included at the end of this report as Appendix 1 and 3. The first gives the bibliography on bird research created by Dr. Albert Manville. The second gives one on bat research created by Dr. Michael Gannon.

Looking at the body of credible research that has accumulated to date, one can now ask “how would a natural heritage system be affected or degraded by a wind turbine development?” To find answers to this question, it is necessary to look more closely at the example of Arran Lake.

CHANTRY ISLAND GULLS FORAGING IN FIELDS BESIDE ARRAN LAKE

4
How a wind turbine development would degrade a natural heritage system

- The Arran Lake wetlands complex ANSI is provincially significant, a migratory bird and bat staging area.
- A wind turbine development would form a barrier to migratory birds and bats.
- The significant raptor population on the site is particularly vulnerable.

- Birds roosting on the Federal Migratory Bird Sanctuary at Chantry Island and foraging around Arran Lake would also be at risk.
- Wind turbine-free corridors of at least 7 miles must be kept open around migratory stopovers.

Arran Lake is the largest body of water in the southern part of Bruce County. It is situated in the Municipality of Arran-Elderslie (former Arran Township), 5 miles east of Southampton on Lake Huron.

At its southern and northern ends the lake extends into a 1235.6 hectare provincially significant wetland complex ANSI (Area Id: 7905). **The value of this feature is increased both by its size and by its diversity.** The wetlands are composed of three wetland types (0.2% fen, 68.2% swamp and 31.6% marsh).[12] This increases its suitability as wildlife habitat for a greater number of species.

ARRAN LAKE "CLASS I" WETLANDS RATE A HIGH MNR EVALUATION SCORE OF 798

The 1985 Ministry of Natural Resources evaluation of the Arran Lake Wetland listed the following scores: Biological component 194.9; Social Component 190.2; Hydrological component 163; Special features component 250.0; Total 798. Class I. A wetland that scores 600 or more points or has 200 or more points in either the biological or special features component is provincially significant.

WETLANDS ARE CRUCIAL IN SUPPORTING MARGINAL WILDLIFE

Wetlands are Ontario's most diverse and productive ecosystems. They are crucial in supporting marginal wildlife—endangered birds, plants and animals that would otherwise find it impossible to survive. Many of these have taken refuge in the last pockets of undisturbed natural habitat that remain. **We have already lost 70% of our provincial wetlands. Habitat loss today threatens more species than ever before.** For two centuries we regarded wetlands as little more than barriers to agriculture, settlement or transportation. Many were drained and filled. Others were treated so disdainfully that they became contaminated with pollutants, or were allowed to survive only in a debased form— often beside a noisy highway—and are now ecologically dysfunctional.

As a result, the great diversity of natural life they once supported has also disappeared. **That is why these vestiges of our natural heritage are now even more important as living archives. We are only just beginning to understand**

[12] (Topographic Maps: 41A/6; UTM Centroid: 17 478800 4922500; Decimal Latitude/Longitude: 44.4574919513146 -81.2663423808235;) The landform is as follows: Soils (Toth et al, 1985): 100% organic; Site Type (Toth et al, 1985): 11% palustrine (permanent or intermittent outflow), 33.5% riverine, 56.5% lacustrine (exposed to lake). http://nhic.mnr.gov.on.ca/MNR/nhic/areas/areas_report.cfm?areaid=7905

how sensitive these natural areas are and how much their ecological function depends upon the areas that surround them. We are also becoming aware for the first time that their survival is closely linked to our own. This places an even greater urgency and responsibility on us to protect our remaining wetlands from *any* form of development that could upset their subtle balance.

MIGRATORY BIRD STOPOVER

The Arran Lake wetlands are an important waterfowl habitat, a bullfrog concentration area, and a bat and reptile hibernacula. They also provide a stopover area for migrating butterflies.[13]

But the outstanding feature of this component of the natural habitat system is its value as a spring and autumn waterfowl migratory bird stopover and staging area, (designated by the Grey Sauble Conservation Authority).

The lake is also typical of "many significant land bird stopover sites [that] are located within 2 to 10 km of Great Lake shorelines because migrating birds follow these shorelines moving to narrow crossing points to continue their migration."[14]

WIND TURBINES HARM MIGRATORY BIRDS

Dr Albert Manville, Senior Wildlife Biologist with the Division of Migratory Bird Management (DMBM) of the U.S. Fish and Wildlife Service is one of the best known authorities on the topic. In a briefing dated April 4, 2008, he outlined his main concerns about wind turbines. In this document titled Current Avian Issues and Land-Based Wind Turbine Developments, he expressed concern for migratory birds and collision mortality caused by

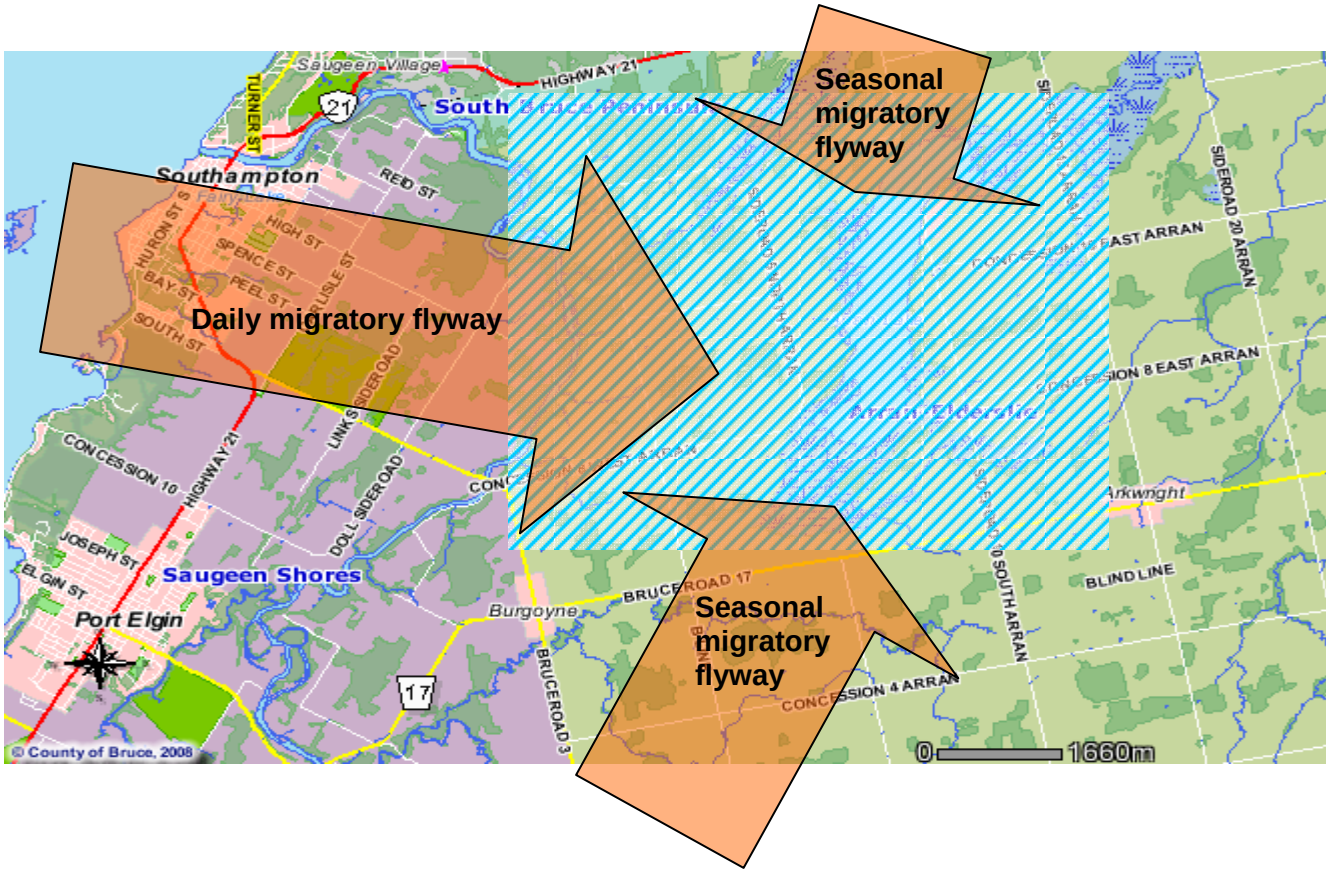
1. "the **increasing height and increasing rotor-swept area putting turbines well within the zone of risk for migrating birds, not to mention impacts to birds during take-offs and landings;** (land-based turbines now > 425-ft. above ground level); (rotor sweep currently at 3 ac but projected to approach 4 ac by 2010 [B. Ram pers. comm.]) and

[13] The great diversity of Lepidoptera species found at Arran Lake can be glimpsed in the records of the Toronto Entomologists` Association Records for this part of Bruce County for the year 2004: Northern Cloudywing, European Skipper, Canadian Tiger Swallowtail, Cabbage White, Clouded sulphur, Orange sulphur, Bronze Copper, Dorcas Copper, Acadian Hairstreak, Coral Hairstreak, Banded Hairstreak, Striped Hairstreak, Hoary Elfin, Spring Azure, Cherry Gall Azure, Great Spangled Fritillary, Aphrodite Fritillary, Atlantis Fritillary, Silver Bordered Fritillary, Meadow Fritillary, Pearl Crescent, Northern Crescent, Baltimore Checkerspot, Question Mark, Eastern Comma, Green Comma, Grey Comma, Compton Tortoiseshell, Mourning Cloak, Milbert`s Tortoiseshell, American Lady, Painted Lady, Red Admiral, White Admiral, Red Spotted Purple, Viceroy, Northern Pearly Eye, Eyed Brown, Appalachian Brown, Little Wood Stayr, Common Ringlet, Common Wood Nymph, Monarch, Northern Cloudywing, Least Skipper, European Skipper, Leonard's Skipper, Peck's Skipper, Tawny Edged Skipper, Crossline Skipper, Long Dash Skipper, Delaware Skipper, Hobomok Skipper, Dun Skipper, Common Roadside Skipper, and Black Swallowtail. From: http://www.ontarioinsects.org/Ontario%20Lepidoptera%202003-2004%20-%202004%20records.pdf

[14] *Natural Heritage Reference Manual* (OMNR 1999).

2. **"The potential for single-night, mass mortality events when mass migration and inclement weather coincide, where weather ceilings force birds down well within rotor swept areas".**

The location of the proposed wind turbine development at Arran Lake—with turbines surrounding three sides of the Arran Lake South Wetlands ANSI would certainly put migratory birds using this site at great risk during take off and landing, especially during adverse weather conditions.



Map showing seasonal and daily migration corridors. Diagonal shading indicates proposed location of wind turbine development. An additional wind turbine development is said to be planned just north of the lake.

CANWEA's website displays the Kingsley and Whittam background review: *Wind Turbines and Birds* published by the Canadian Wildlife Service in 2005:

“Staging areas
When birds migrating over land or water encounter a coastline, they often turn along that coastline and form a concentrated stream of migration along the coast. Some types of migrants (e.g. shorebirds and waterfowl) concentrate in restricted areas of suitable habitat while resting and feeding between migratory flights. These are often interior lakes or marshes, coastal estuaries, mud flats, or other areas that can provide food and/or shelter for large numbers of birds (Richardson 2000).

At staging areas, flights of large numbers of migrants are often concentrated into corridors when the birds are either taking off or approaching to land (Richardson 2000). The flight height of these migrants is often at the height of wind turbines and the distance from the stopover area within which flight altitudes will be low enough to be at risk of collisions with turbines will depend on the type of bird and other factors. Some birds, like swans, typically climb only very gradually, and may remain low for a considerable distance after takeoff from the stopover area. Other birds climb (or descend) more rapidly (Richardson 2000).”

Among the birds observed to climb very slowly around Arran Lake are the Herons, Bitterns and other waterfowl. This is a major roosting area for migrating Sandhill Cranes. Cranes forage in fields around the lake, including those in the immediate vicinity of the proposed wind power development. Flocks of Sandhill Cranes are regularly seen feeding in the area or flying over the site. It should be remembered that the staging birds associated with Arran Lake move daily from the wetlands area to the adjoining fields to feed. At other times these fields are frequented by other slow climbing birds such as Gulls, Terns, and Geese.

ARRAN LAKE’S MIGRATORY SPECIES ARE ESPECIALLY VULNERABLE

The records of the Cabot Head Research Station, the closest migratory bird monitoring station further up the Bruce Peninsula, on the same migratory flyway, are useful in estimating the diversity of migratory birds using the site. Raptors and Passerines (underlined) are considered to be particularly vulnerable to wind turbine collision, especially during migration in adverse weather conditions. Manville notes:

“Many species from raptors to passerines – and bats (in several studies, in large numbers) have been documented killed during flight by rotating turbine blades”[15].

This list is made up of the migratory species monitored during spring and autumn migrations over the years 2002-2006.

[15] Manville, *op. cit.*

ANSERIFORMES ANATIDAE
Anserinae
Snow Goose (Chen caerulescens)
Black Brant (Branta bernicla)
Canada Goose (Branta canadensis)
Mute Swan (Cygnus olor)
Anatinae
Wood Duck (Aix sponsa)
Gadwall (Anas strepera)
American Wigeon (Anas americana)
American Black Duck (Anas rubripes)
Mallard (Anas platyrhynchos)
Blue-winged Teal (Anas discors)
Northern Shoveler (Anas clypeata)
Northern Pintail (Anas acuta)
Green-winged Teal (Anas crecca)
Ring-necked Duck (Aythya collaris)
Greater Scaup (Aythya marila)
Lesser Scaup (Aythya affinis)
Common Eider (Somateria mollissima)
Surf Scoter (Melanitta perspicillata)
White-winged Scoter (Melanitta fusca)
Black Scoter (Melanitta nigra)
Long-tailed Duck (Clangula hyemalis)
Bufflehead (Bucephala albeola)
Common Goldeneye (Bucephala clangula)
Hooded Merganser (Lophodytes cucullatus)
Common Merganser (Mergus merganser)
Red-breasted Merganser (Mergus serrator)
GALLIFORMES PHASIANIDAE
Tetraoninae
Ruffed Grouse (Bonasa umbellus)
GAVIIFORMES GAVIIDAE
Red-throated Loon (Gavia stellata)
Common Loon (Gavia immer)
PODICIPEDIFORMES PODICIPEDIDAE
Pied-billed Grebe (Podilymbus podiceps)
Horned Grebe (Podiceps auritus)
Red-necked Grebe (Podiceps grisegena)
PELECANIFORMES PHALACROCORACIDAE
Double-crested Cormorant (Phalacrocorax auritus)
CICONIIFORMES ARDEIDAE
American Bittern (Botaurus lentiginosus)
Great Blue Heron (Ardea herodias)
Great Egret (Ardea alba)
Green Heron (Butorides virescens)
CATHARTIDAE
Turkey Vulture (Cathartes aura)
FALCONIFORMES ACCIPITRIDAE
Pandioninae
Osprey (Pandion haliaetus)

RAPTORS:

Accipitrinae
Bald Eagle (Haliaeetus leucocephalus)
Northern Harrier (Circus cyaneus)
Sharp-shinned Hawk (Accipiter striatus)
Cooper's Hawk (Accipiter cooperii)
Northern Goshawk (Accipiter gentilis)
Red-shouldered Hawk (Buteo lineatus)
Broad-winged Hawk (Buteo platypterus)
Red-tailed Hawk (Buteo jamaicensis)
Rough-legged Hawk (Buteo lagopus)

Golden Eagle (Aquila chrysaetos)
FALCONIDAE Falconinae
American Kestrel (Falco sparverius)
Merlin (Falco columbarius)
Peregrine Falcon (Falco peregrinus)

GRUIFORMES RALLIDAE
American Coot (Fulica americana)
GRUIDAE Gruinae
Sandhill Crane (Grus canadensis)
CHARADRIIFORMES CHARADRIIDAE Charadriinae
Black-bellied Plover (Pluvialis squatarola)
Semipalmated Plover (Charadrius semipalmatus)
Killdeer (Charadrius vociferus)
SCOLOPACIDAE Scolopacinae
Greater Yellowlegs (Tringa melanoleuca)
Lesser Yellowlegs (Tringa flavipes)
Solitary Sandpiper (Tringa solitaria)
Spotted Sandpiper (Actitis macularius)
Whimbrel (Numenius phaeopus)
Sanderling (Calidris alba)
Semipalmated Sandpiper (Calidris pusilla)
Least Sandpiper (Calidris minutilla)
Dunlin (Calidris alpina)
Short-billed Dowitcher (Limnodromus griseus)
Wilson's Snipe (Gallinago delicata)
American Woodcock (Scolopax minor)
LARIDAE Larinae
Bonaparte's Gull (Larus philadelphia)
Ring-billed Gull (Larus delawarensis)
Herring Gull (Larus argentatus)
Lesser Black-backed Gull (Larus fuscus)
Great Black-backed Gull (Larus marinus)
Sterninae
Caspian Tern (Sterna caspia)
Common Tern (Sterna hirundo)
Forster's Tern (Sterna forsteri)
Black Tern (Chlidonias niger)
COLUMBIFORMES COLUMBIDAE
Rock Pigeon (Columba livia)
Mourning Dove (Zenaida macroura)
CUCULIFORMES CUCULIDAE Coccyzinae
Black-billed Cuckoo (Coccyzus erythropthalmus)
Yellow-billed Cuckoo (Coccyzus americanus)
STRIGIFORMES STRIGIDAE
Eastern Screech-Owl (Megascops asio)
Great Horned Owl (Bubo virginianus)
Boreal Owl (Aegolius funereus)
Northern Saw-whet Owl (Aegolius acadicus)
CAPRIMULGIFORMES CAPRIMULGIDAE Chordeilinae
Common Nighthawk (Chordeiles minor)
Caprimulginae
Whip-poor-will (Caprimulgus vociferus)
APODIFORMES APODIDAE Chaeturinae
Chimney Swift (Chaetura pelagica)
TROCHILIDAE
Ruby-throated Hummingbird (Archilochus colubris)
CORACIIFORMES ALCEDINIDAE Cerylinae
Belted Kingfisher (Ceryle alcyon)
PICIFORMES PICIDAE Picinae
Red-headed Woodpecker

(Melanerpes erythrocephalus)
Red-bellied Woodpecker (Melanerpes carolinus)
Yellow-bellied Sapsucker (Sphyrapicus varius)
Downy Woodpecker (Picoides pubescens)
Hairy Woodpecker (Picoides villosus)
Black-backed Woodpecker (Picoides arcticus)
Northern Flicker (Colaptes auratus)
Pileated Woodpecker (Dryocopus pileatus)

PASSERINES

PASSERIFORMES
TYRANNIDAE Fluvicolinae
Olive-sided Flycatcher (Contopus cooperi)
Eastern Wood-Pewee (Contopus virens)
Yellow-bellied Flycatcher (Empidonax flaviventris)
Alder Flycatcher (Empidonax alnorum)
Willow Flycatcher (Empidonax traillii)
Least Flycatcher (Empidonax minimus)
Eastern Phoebe (Sayornis phoebe)
Tyranninae
Great Crested Flycatcher (Myiarchus crinitus)
Eastern Kingbird (Tyrannus tyrannus)
LANIIDAE
Northern Shrike (Lanius excubitor)
VIREONIDAE
White-eyed Vireo (Vireo griseus)
Yellow-throated Vireo (Vireo flavifrons)
Blue-headed Vireo (Vireo solitarius)
Warbling Vireo (Vireo gilvus)
Philadelphia Vireo (Vireo philadelphicus)
Red-eyed Vireo (Vireo olivaceus)
CORVIDAE
Blue Jay (Cyanocitta cristata)
American Crow (Corvus brachyrhynchos)
Common Raven (Corvus corax)
ALAUDIDAE
Horned Lark (Eremophila alpestris)
HIRUNDINIDAE Hirundininae
Purple Martin (Progne subis)
Tree Swallow (Tachycineta bicolor)
N. Rough-winged Swallow (Stelgidopteryx serripennis)
Bank Swallow (Riparia riparia)
Cliff Swallow (Petrochelidon pyrrhonota)
Barn Swallow (Hirundo rustica)
PARIDAE
Black-capped Chickadee (Poecile atricapillus)
SITTIDAE Sittinae
Red-breasted Nuthatch (Sitta canadensis)
White-breasted Nuthatch (Sitta carolinensis)
CERTHIIDAE Certhiinae
Brown Creeper (Certhia americana)
TROGLODYTIDAE
Carolina Wren (Thryothorus ludovicianus)
House Wren (Troglodytes aedon)
Winter Wren (Troglodytes troglodytes)
Marsh Wren (Cistothorus palustris)
REGULIDAE
Golden-crowned Kinglet (Regulus satrapa)
Ruby-crowned Kinglet (Regulus calendula)
SYLVIIDAE Polioptilinae
Blue-gray Gnatcatcher (Polioptila caerulea)

TURDIDAE
Eastern Bluebird (Sialia sialis)
Townsend's Solitaire (Myadestes townsendi)
Veery (Catharus fuscescens)
Gray-cheeked Thrush (Catharus minimus)
Swainson's Thrush (Catharus ustulatus)
Hermit Thrush (Catharus guttatus)
Wood Thrush (Hylocichla mustelina)
American Robin (Turdus migratorius)[16]

[16] *Bird Migration Monitoring at Cabot Head, 2002-2006 Menu, S. Bruce Peninsula Bird Observatory.*

The Ausauble Bird Observatory at Pinery Provincial Park indicates a similar bird list and the records from Haldimand Bird Observatory are also similar. Banders have noted that the species composition is almost identical as the birds migrate up the Lake Huron coast. Cindy Cartwright indicates that she has shared several recaptures (birds banded in one location and recaptured later at another site) with the Ausauble station.

Because of annual use of the Arran Lake by significant numbers of staging birds, and the importance of the adjacent fields for feeding areas, the site must be considered as "very high sensitivity".

But the wind turbines themselves would not be the only hazard for migrating birds. According to the Kingsley and Whittam background review,

> **"*disturbance* can be a factor for migrants if wind turbines are located near important staging areas, where large numbers of birds concentrate to rest or feed . . .**(e.g., stage during fall migration). **Additionally, the alteration or destruction of habitat used by birds on migration can also contribute to adverse environmental effects** (see Milko 1998a).[17]

Manville also reminds us that there are miles of transmission lines associated with wind turbine developments.

> "In addition, **birds can collide with towers, nacelles, meteorological tower guy wires, power lines, their associated structures, and "bird-unfriendly" wiring can electrocute them.…The Service has special concerns about project development on avifauna"**[18].

The Canadian Wildlife Service document also notes the danger of overhead wires to birds:

NEWLY INSTALLED TRANSMISSION LINES AT BRUCE TOWNSHIP WIND TURBINE DEVELOPMENT NEAR KINCARDINE

> "*5.5 Mortality Caused by Wires* Onshore Facilities

[17](http://www.canwea.ca/images/uploads/File/Resources/Wind_Turbines_and_Birds_a_Background_Review.pdf)

[18] Manville, *op. cit.*

Since the late 1800s, high-tension lines have been noted as a cause of avian mortality in North America. The U.S. Fish and Wildlife Service (Manville 2000) estimates that there are tens of thousands of bird fatalities a year due to collision with overhead wires. However, this estimate may be too low if a study by Koops (1987) in the Netherlands is applicable to the North American situation. Based on estimates of Koops (1987), approximately 174 million birds could be killed annually by transmission wires in the U.S.

"Several groups of birds appear to be the most susceptible to collision with wires, most notably waterfowl, shorebirds and raptors (Stout and Cornwell 1976, Curtis 1977, Anderson 1978, Enderson and Kirven 1979, NUS Corporation 1979, Olsen and Olsen 1980, Moorehead and Epstein 1985, Faanes 1987). **Raptors are frequent victims of wire collisions** (Enderson and Kirven 1979, Olsen and Olsen 1980). For example, overhead wires are believed to be one of the main causes of injury and death to Merlins[19] (*Falco columbarius*) in Great Britain (Olsen and Olsen 1980). **Waterfowl** and shorebirds may show avoidance behaviour to turbines, **but significant numbers have been known to collide with associated power lines, especially when located near wetlands (**Anderson 1978, NUS Corporation 1979, Moorehead and Epstein 1985). At a power plant in Illinois, an estimated 400 birds each autumn (0.4% of the peak number present) were killed by colliding with overhead power lines; most of the known victims were Bluewinged Teal (*Anas discors*; Anderson 1978). Powerline strikes are the cause of up to 64% of collision fatalities for certain waterfowl species, but wires also take a toll on shorebirds. At Trinidad, California, more than 150 Red-necked Phalaropes (*Phalaropus lobatus*) were killed on 6 May 1969 by striking electric wires along the coast (Gerstenberg 1972)"[20].

At Arran Lake, the raptors that spend much of their time soaring over the drumlin ridges, would be susceptible to entanglement in transmission lines as well as rotor blades. Raptors fail to perceive such hazards during concentrated hunting and the wind turbines and interconnecting wires would be spread throughout their customary hunting territory.

Clearly, migratory birds using a wetland or lake as a stopover or staging area will not be protected unless an adequate corridor of at least seven miles is kept open for their approach and departure around the lake.

Consideration # 4: Birds from Chantry Island Federal Migratory Bird Sanctuary are also threatened

At Arran Lake, however, there is a further complication. Birds using the Chantry Island Bird Sanctuary (IBA On 154) are regularly observed to spend part of their day foraging in the fields around the lake. Their presence has also been recorded in the historical documents of the OMNR specific to Arran Lake. In effect this means

[19] Merlins are known to migrate through the Arran Lake site.

[20] Kingsley and Whittam. *Wind Turbines and Birds.* Canadian Wildlife Service 2005

that **there is an additional, daily avian flight path between roosting areas on the island and foraging areas around the lake.** This corridor is used by Herring Gulls, Black Terns, Caspian Terns, Great Blue Herons, Black-crowned Night Herons, and Great Egrets among others. Many of these birds are slow to gain height on take off and their path would take them through the proposed wind turbine site.

Wind turbines if situated between Arran Lake and the Saugeen River would, effectively fragment the habitat of species roosting on Chantry Island and feeding in the wetlands and uplands surrounding the lake. **Transmission lines would be an additional hazard. This would have a direct effect on the survival of birds in the nesting colonies on the Federal Bird Sanctuary (IBA) at Chantry Island.**

INTERCONNECTING WILDLIFE CORRIDORS

It can be seen from the wildlife corridors on the map below, how closely this natural heritage system is knit together. Studies have shown the importance of wildlife corridors in maintaining diversity and resiliency in an ecosystem (Riley and Mohr 1994).

At Arran Lake, these links follow upland forested areas—a series of farmstead woodlots that were never cleared on the back forty acres of each crown land grant. Despite their gradual diminishment over the years, they still form a residual wooded section at the back of most farms, each converging onto the midpoint between two concession roads. This provides a singularly undisturbed wildlife corridor, seldom visited by humans.

The siting of wind turbines near these quality forest habitat corridors would result in habitat fragmentation.

MASSIVE HABITAT DESTRUCTION AND FRAGMENTATION AT BRUCE TOWNSHIP WIND TURBINE DEVELOPMENT SUBSTATION NEAR KINCARDINE

SIGNIFICANT WOODLAND/OLD GROWTH TREES

The Ontario Nature Reserves Program—Life Sciences Inventory Check-sheet for Arran Lake dated 2 December 1984 notes:

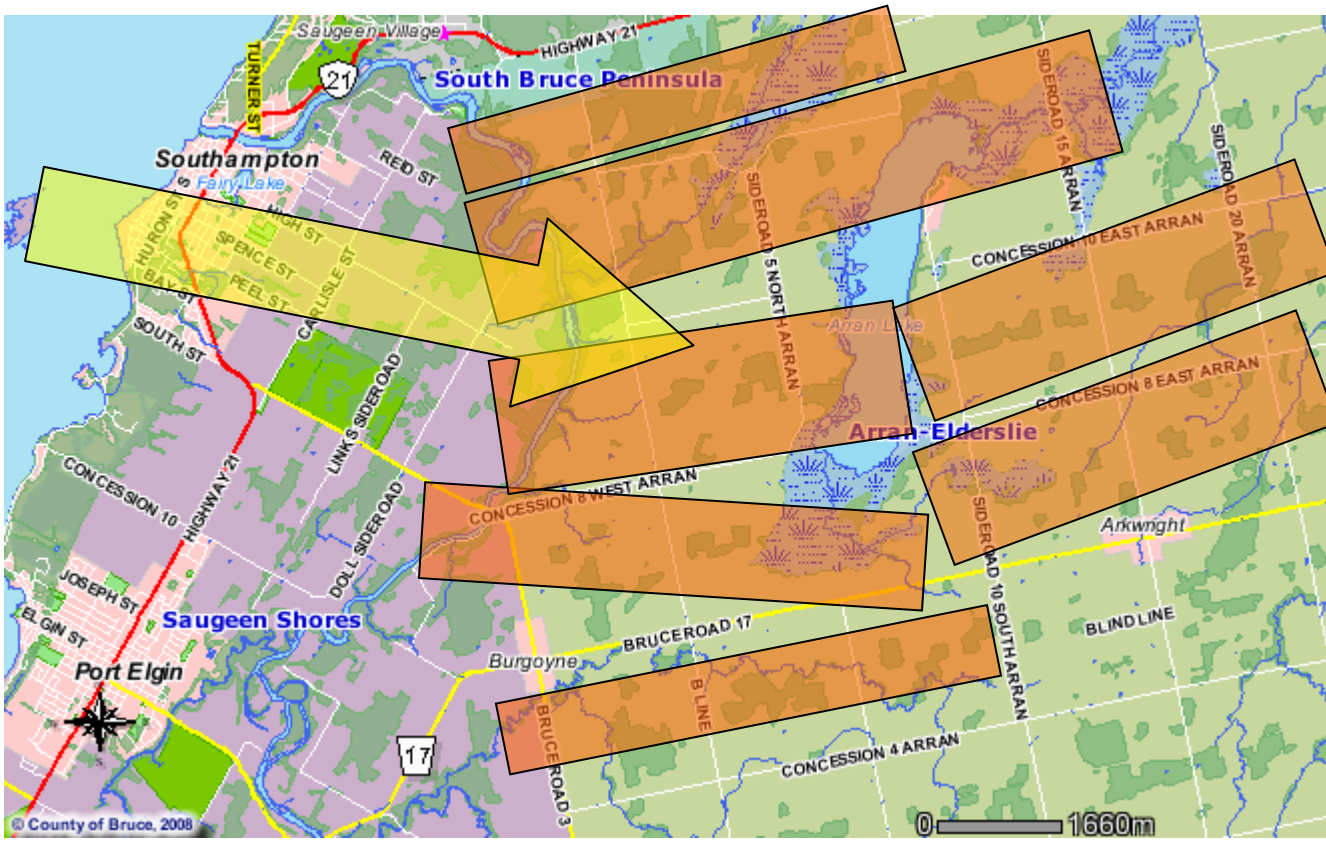
> **"A small forested drumlin is part of Arran Lake South** (41A/6 790230) and forested drumlin slopes occur in Arran Lake North (41A11 810275**). Forested drumlin and wetland complexes are scarce in this site district** [6-5 and 6-2] **and in southern Ontario as a whole. This candidate nature reserve** should be examined in field.[21]"

Several of these forest corridors are **uncommon woodland dominated by old trees and old-growth.** The Krug woodlot on Arran Side Road 5, (known locally as Billy Macintosh's Hill) for example, has remained totally undisturbed for many decades. Not even dead trees are removed from the site and these provide shelter for a range of animals and birds. Its contiguity with the lake provides an important specialized habitat for sensitive species. It contains Butternut stands (a provincially threatened tree species).

RARE FORESTED DRUMLIN WITH OLD-GROWTH TREES IN KRUG WOODLOT BESIDE ARRAN LAKE

The lands adjoining the Saugeen River are also wooded and some of the islands in the river contain a few very old examples of Eastern White Cedar (*Thuja occidentalis*) as well as Butternut stands.

[21] K. M. Lindsay*. Arran Drumlin Field—Drumlinized Till Plain.* In *Life Science Areas of Natural and Scientific Interest in Site District 6-5: A Review and Assessment of Significant Natural Areas in Site District 6-5.* September, 1984. Ministry of Natural Resources, Parks and Recreation Areas Section Central Region, Richmond Hill Southwestern Region, London, p. 79.



WILDLIFE CORRIDORS: Orange blocks represent corridors within the wildlife habitat system that follow streams and woodlands between the Saugeen River valley lands and the Arran Lake wetlands complex. The yellow arrow represents daily movement flyway between roosting and feeding areas used by birds from IBA at Federal Bird Sanctuary on Chantry Island (Southampton) (10 kilometres) regularly observed foraging in fields surrounding Arran Lake.

SIGNIFICANT EARTH SCIENCES ANSI: ARRAN DRUMLIN FIELD/ARKWRIGHT DRUMLINS ANSI

The areas east and west of the lake are made up of the Arran Drumlin Field. It includes the **provincially significant Earth Sciences ANSI (Id 7914), the Arkwright Drumlins** which covers 654 hectares (1614 acres) just east of the lake.[22] Rolling hills and ridges comprise much of the land between Arran Lake and the Saugeen River as well as the uplands on the east side of the lake. As an area of scientific research, the drumlins have the potential to provide information on ancient climate history including global warming. They were laid down by the retreat of glacial ice during the last ice age:

> "The last major glacial ice advance to cover Bruce County started about 23,000 years ago. Generally, glaciers destroy or cover landforms during an ice advance and construct landforms when the ice melts during a retreat. Intermittent pauses by the ice during retreat produced significant landforms such as drumlins and moraines. Drumlins are elongated, streamlined hills or ridges formed at the base of the ice mass. They are composed of glacial till which is sediment deposited from the melting of the glacier. The movement of the ice over the till moulds the sediment into small, short ridges or large, long hills. The long axis of the drumlin indicates the direction of flow of the glacier.
>
> "Drumlins in the ANSI, which belong to the Arran Drumlin Field, are aligned northeast-southwest indicating the ice came from the northeast. They are classic, thin, oval-shaped and were formed about 16,000 years ago. These drumlins were exposed from ice cover only after the retreat of the ice nearly 12,000 years ago."[23]

Wind turbines placed anywhere in the vicinity of an ANSI would devalue its significance.

RAPTOR HABITAT AND HUNTING TERRITORY

Notable in many of the woodlots found on the ridges of the drumlins are the raptors nesting in tall trees. Several species of Hawk, (including the Red Shouldered Hawk), vultures, owls and the Bald Eagle (protected under the *Fish and Wildlife Conservation Act)* favour this habitat. The adjacent fields (in the immediate vicinity of the proposed turbine installations) contain high densities of voles and field mice, favourite raptor prey. Even larger numbers of hawks and owls are attracted to this area during years of the peak cycles of these rodents.

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[22] **Site District:** 6E-5 **Topographic Maps:** 41A/6 **UTM Centroid:** 17 485000 4924000 **Decimal Latitude/Longitude:** 44.4711511806146 -81.1884533066782

[23] Ministry of Natural Resources Earth Science Database, http://nhic.mnr.gov.on.ca/MNR/nhic/areas/areas_report.cfm?areaid=7914

Raptors using the site during migration would include:

Northern Harrier *(Circus cyaneus)*
Sharp-shinned Hawk *(Accipiter striatus)*
Cooper's Hawk *(Accipiter cooperii)*
Northern Goshawk *(Accipiter gentilis)*
Red-shouldered Hawk *(Buteo lineatus)*
Eastern Screech-Owl *(Megascops asio)*
Broad-winged Hawk *(Buteo platypterus)*
Red-tailed Hawk *(Buteo jamaicensis)*
Rough-legged Hawk *(Buteo lagopus)*
Golden Eagle *(Aquila chrysaetos)*
Boreal Owl *(Aegolius funereus)*
Northern Saw-whet Owl (*Aegolius acadicus*)
American Kestrel *(Falco sparverius)*
Merlin *(Falco columbarius)*
Peregrine Falcon *(Falco peregrinus)*
Snowy Owl (Bubo scandiacus)

Additionally present at other times of the year are:

Bald Eagle *(Haliaeetus leucocephalus)*
Great Horned Owl *(Bubo virginianus)*

Consideration # 5: Wind farms can affect local populations of Eagles and other raptors whose breeding and recruitment rates are naturally slow

Manville and many other researchers specifically mention their apprehension over the safety of raptors nesting and hunting in close proximity to wind energy facilities.

Appendix 7 of the USFWS *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* lists the "Known and suspected impacts of wind turbines on wildlife". It is particularly concerned about the safety of raptors, waterbirds, passerines and bats:

> "However, even with a bright future for growth, and with low speed tubular-constructed wind turbine technology now being stressed, **larger and slower moving turbines still kill raptors, passerines, water birds, other avian species, and bats.** Low wind speed turbine technology requires much larger rotors, blade tips often extending more than 420 ft. above ground, and blade tips can reach speeds in excess of 200 mph under windy conditions (J. Cadogan, U.S. Department of Energy, 2002, pers. comm.). When birds approach spinning turbine blades, "motion smear" – the inability of the bird's retina to process high speed motion stimulation – occurs primarily at the tips of the blades, making the blades deceptively transparent at high velocities. This

increases the likelihood that a bird will fly through this arc, be struck by a blade, and be killed (Hodos *et al.* 2001).

"What cumulative impact these larger turbines will have on birds and bats has yet to be determined. Johnson *et al.* 2002b raised some concerns about the impacts of newer, larger turbines on birds.

"Their data indicated that higher levels of mortality might be associated with the newer and larger turbines, and they indicated that wind power related avian mortality would likely contribute to the cumulative impacts on birds.

"Howell and Noone (1992) estimated U.S. avian mortality at 0.0 to 0.117 birds/turbine/yr., while in Europe, Winkelman (1992) estimated mortality at 0.1 to 37 birds/turbine/yr. Erickson et al. (2001) reassessed U.S. turbine impact, based on more than 15,000 turbines (some 11,500 in California), and estimated mortality in the range of 10,000 to 40,000 (mean = 33,000), with an average of 2.19 avian fatalities/turbine/yr. and 0.033 raptor fatalities/turbine/yr. This may be a considerable underestimate. As with other structural impacts, only a systematic turbine review will provide a more reliable estimate of mortality. **While some have argued that turbine impacts are small (Berg 1996), especially when compared to those from communication towers and power lines, turbines can pose some unique problems, especially for birds of prey.** Mortalities must be reduced, especially as turbine numbers increase. . . . **Wind farms can affect local populations of Eagles and other raptors whose breeding and recruitment rates are naturally slow and whose populations tend to have smaller numbers of breeding adults (Davis 1995). Large raptors are also revered by Native Americans as well as by many others within the public. They are symbolic mega fauna, and provide greater emotional appeal to many than do smaller avian species. Raptors also have a lower tolerance for additive mortality (Anderson et al. 1997). As with all other human caused mortality, we have a responsibility to reverse mortality trends.**[24]

Specific literature cited by Manville can be found in Appendix 1.

Because of the Arran Lake site's importance to raptors it must be considered of "very high sensitivity". Deliberately jeopardizing the raptor population within this natural heritage system would severely upset its balanced ecological functions (including rodent control). Raptors would be at risk of being pushed into the blades by strong winds coming off Lake Huron. The slow breeding rates and lower

[24] USFWS *Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines* p. 50.


STORM APPROACHING ARRAN LAKE

tolerance for additive mortality of raptors and the fact that the wind turbines would be placed in the middle of their hunting territory would be an unacceptable formula for disaster for this group of birds. **Failing to protect the Bald Eagle from such harm would also be an offence under the Fish and Wildlife Conservation Act.**

IMPORTANCE OF THE UPLANDS AT ARRAN LAKE

It can be seen from the map below that these corridors follow creek beds running either towards the lake or to the river. Because of the surrounding elevated ridges of the drumlins, these creeks follow fairly deep, wooded valleys and swales—land that was never considered useful for agriculture and has therefore remained largely undisturbed since settlement.

Adjacent uplands are important for many wetland species at Arran Lake, and they are critical for the maintenance of its wetland functions. Waterfowl such as Mallards and Canada Geese forage in the fields around the wetlands. The abundant population of woodland frogs such as Spring Peepers rely on the spring-flooded thicket swamps and marshes for breeding, but forage and hibernate in the surrounding upland forests and plantations. Other frogs at Arran Lake such as the Bull Frog Northern Leopard Frog, Wood Frog, and Green Frog forage in fields a considerable distance from the wetlands. They also move between wetlands, hibernating in the bottom of deeper permanent ponds, and breeding in more shallow wetlands. The Lake and wetlands are abundant with fish.[25] The Snapping Turtles and Painted Turtles at Arran Lake live year-round in permanent wetlands, but lay their eggs in the surrounding uplands. These areas provide a source of prey for some of the water birds.

It is well known that amphibians are particularly sensitive to noise disturbance. It is quite likely that the noise disruption caused by wind turbines would result in abandonment by this part of the system's population. The normally referred to 40-50 db is the noise at a point of reception usually 300 to 600 metres away from the turbine—well above the normal

[25] Fish species found in Arran Lake include: largemouth bass, smallmouth bass, northern pike, yellow perch, rock bass, pumpkinseed, white sucker, brown bullhead, yellow bullhead, golden shiner, back chin shiner, emerald shiner, black nose shiner, river chub, blunt nose minnow, common shiner, Iowa darter, and Johnny darter. All of these species are typical of a warm water lake. List courtesy Kathy Dodge, OMNR Owen Sound. (From the inventory of fish in Arran Lake done in the late '80's).

background noise in this exceedingly quiet area).[26] But the "noise at source" from modern turbines is usually about 100 db. Cleary any animals in close proximity to the turbines may encounter db levels much higher than 40-50 db.

This would have potential impact on endangered grassland species. The knock on effect would be loss of prey for many of the bird species inhabiting the wetlands. It is also known that wind turbines transmit vibrations into the ground that can be measured at a distance of a mile away. Farmers with fields surrounding wind turbines have reported a disappearance of the earthworms from the soil. And it is also known that the rotor blades of the turbines dry out the soil around them. This would have an effect on surrounding spring flooded thicket swamps, ponds and swales as well as the aquifer itself. Since the Arran Lake Wetlands are supplied by water from the surrounding uplands, over time such an intrusion could result in considerable changes in the wetlands themselves.

Consideration # 6: Wind turbines cause long term habitat disturbance and degradation

Many biologists who have studied the effects of wind turbines are even more worried about long term habitat degradation and disturbance.

Manville is apprehensive about the long term effects on wildlife:

"B. Habitat fragmentation, disturbance and disruption

"Habitats can be fragmented, disturbed, and disrupted, forcing out birds and bats, preventing breeding, altering behaviours, and possibly impacting populations (evidence raised in Europe).

"Indirect effects, although frequently difficult to quantify, can include:

1) **reduced nesting/breeding densities;**

2) loss of population vigour and overall density;

3) habitat and **site abandonment**, and increased isolation between patches;

4) **loss of refugia**;

5) attraction to modified habitats;

6) behavioural effects including stress, interruption, and behavioural

[26] Traffic noise on has now been proved to reduce bird breeding density. Four Dutch ornithologists (Rien Reijnen, Ruud Foppen, Cajo ter Braak and Johan Thissen) took paired sites close to and distant from busy roads and analyzed the densities of 43 different species of breeding birds in woodland. Of these 26 species (60%) showed evidence of reduced density. The analysis clearly showed that it was the noise and not the sight of the traffic that was affecting the birds. Two other studies also published in the *Journal of Applied Ecology* - one of the scientific journals published by the British Ecological Society, (1994 31, 95-101; 31, 85-94 & 32, 187-202), confirm this finding.

modification; and

7) **disturbance and displacement** resulting in habitat unsuitability.

"As taller and larger wind turbines are installed on land nationwide, the potential for growing numbers of deaths and large-scale habitat fragmentation increases. As the industry grows, **these indirect effects will also become cumulative**. Both direct and indirect effects could become additive to normally compensatory mortality – a scenario we wish to avoid. More than 20,000 commercial turbines presently operate in the U.S., and within 10 years that number is projected to increase to > 155,000 (M. Tuttle pers. comm., AWEA data, National Renewable Energy Laboratory estimate). **This explosive growth without the availability of "tools" to address it – specifically to avoid or minimize impacts to bird, bats, and their habitats – is troubling."**[27]

In his Senate testimony Mike Daulton of National Audubon also stressed the problem of loss or degradation of habitat, disturbance and displacement as well as disruption of ecological links:

"Development of wind power facilities results in destruction of habitat from support roads, storage and maintenance yards, turbine towers, and associated infrastructure. It may involve blasting and excavation to bury power lines. Such activity **may cause contiguous blocks of habitat to become fragmented**, leading to increased abundance of predators, parasites, and invasive species. . . . It can have substantial impacts if the wind energy facilities are sited in areas of pristine or rare native habitats.

"Disturbance and subsequent displacement from habitat:
The impacts of wind energy facilities extend well beyond the footprint of the roads, power lines, and other structures. Disturbance from human activity and turbines may displace animals from the habitat. While this is seldom lethal, it may cause birds and other animals to abandon preferred habitat and seek lower-quality habitat elsewhere, where disturbance is less. **This may result in reduced survival or reduced breeding productivity, which may cause lower or declining populations.**

"In cases where the birds affected are already in decline, the turbines could push them closer to extinction.

"Disruption of ecological links:
Large wind energy facilities may interfere with the ability of birds and other wildlife to travel between feeding, wintering, and nesting sites. Alternatively, they may cause birds to make longer or higher flights between

[27] Dr Albert Manville. Current Avian Issues and Land-Based Wind Turbine Developments. U.S. Fish and Wildlife Service briefing dated April 4, 2008.

such areas. This results in higher metabolic costs, and therefore may reduce survival and reproduction.[28]

HABITAT ABANDONMENT / REDUCTION OF ABUNDANCE

Abandonment of habitat is also a finding of one of the most recent research projects at the Centre for Evidence Based Conservation, School of Biosciences, University of Birmingham in the United Kingdom. In their *SYSTEMATIC REVIEW NO. 4: Effects of wind turbines on bird abundance Review Report*, Stewart, Pullin, & Coles concluded:

- **"Available evidence suggests that windfarms reduce the abundance of many bird species at the windfarm site.**

- **"There is some evidence that Anseriformes (ducks) experience greater declines in abundance than other bird groups suggesting that a precautionary approach should be adopted to windfarm developments near aggregations of Anseriformes and to a lesser extent Charadriformes (Gulls and Terns).**

  "There is also some evidence that impact of windfarms on bird abundance becomes more pronounced with time. suggesting that short term bird abundance studies do not provide robust indicators of the potentially deleterious impacts of wind farms on bird abundance". [29]

These findings suggest that **a wind turbine development near the Arran Lake natural heritage system would have long term and permanent negative effects on bird populations and would likely lead to declines in the population of ducks, gulls and terns using the site. Two of these species, the Black Tern and the Caspian Tern are already threatened, area sensitive and in serious decline.**

The lake and surrounding wetlands are habitat for an abundance and diversity of Anseriforme species. These include Mallards, Common Mergansers, Golden-eyed Buffleheads, Wood Ducks, Redhead Ducks, Pinheads, Northern Pintails, as well as Canada Geese. Tundra Swans have also been catalogued by local ornithologists on the river and Horned Grebes on the lake. Many of these species are regularly seen foraging in the surrounding fields, the site of the proposed wind turbines. They are also often seen during flight displays and are noted for their very slow ascent

[28] *Impacts of Wind Turbines on Birds and Bats.* Testimony of Mike Daulton Director of Conservation Policy National Audubon Society before the U.S. Senate Committee on Natural Resources Subcommittee on Fisheries, Wildlife and Oceans May 1, 2007.

[29] Stewart, Pullin, & Coles. *SYSTEMATIC REVIEW NO. 4: Effects of wind turbines on bird abundance Review Report*. University of Birmingham: 2006.

on takeoff, a factor which would expose them to the rotating blades of the turbines, especially during migration.

It must therefore be assumed that if wind turbines were built adjacent to the wetlands, a major component of the natural heritage system would suffer decline.

In the light of this evidence, it would be impossible to demonstrate that there would be no negative impacts on the natural features or on their ecological functions from such development.

Consideration # 7: Wind turbines would have a negative impact on the vital tourism economy of this region.

The 1985 evaluation of Arran Lake Wetlands gives a score of **190.2 for the social component.** It indicates that "51-100% of the wetland area has mature trees, wild rice is present, fish are abundant during at least part of the year, bullfrogs snapping turtles and furbearers (muskrat, raccoons and beaver) are present. **Recreational activities include nature appreciation or study, fishing and canoeing. From an aesthetic evaluation, the landscape is clearly distinct."**

The Grey Sauble Conservation Authority operates a Conservation Area on the east side of Arran Lake. A more recent Grey Sauble Conservation Authority report indicates that Arran Lake, the Arran Lake Wetland Complex and the Saugeen River provide recreational activities including canoeing, fishing, nature study and swimming.

Drawing and painting classes are conducted by the Southampton Art School beside the lake.

CANADIAN ART INSPIRED AT ARRAN LAKE

There are three summer camps near the lake. Two local firms provide kayaking trips and rental equipment along the Saugeen River valley.

WIND TURBINES AND TOURISM

There is no evidence to indicate that wind turbine developments are an attraction to tourists, despite industry claims that such is the case.[30] **Tourism officials in Scotland, The United States and Australia have all expressed concern over declining revenues and studies that show tourists avoid wind turbine developments.**

A study in Scotland prepared for *Visit Scotland* concluded that

> **"Most of those surveyed saw wind farms as being visually intrusive.** Consequently, a common theme amongst both the trade and consumers was that **wind farms should not be sited in or near designated areas of outstanding scenery such as Areas of Outstanding Natural Beauty (**AONB), National Parks, National Scenic Areas, Sites of Special Scientific Interest etc. In addition however, there was a general consensus amongst visitors that . . . **wind turbines should not be located in or near popular 'tourist areas'. Their visual impact was generally felt to be sufficiently negative**, **that as far as possible wind farms should be sited in areas away from those popular with tourists-- ideally there was a preference to avoid having to see them at all on their visit.** . . . **As many as 26% of visitors claimed that they would be less likely to visit an area if a wind farm was developed there in future".** [31]

The entire natural heritage system around Arran Lake is an important resource for the local tourism industry, based on its outstanding scenery and because of its close proximity to summer accommodation at Southampton and Port Elgin which depend heavily on tourism.

"**Bruce County's tourism receipts reached $31,255,932 in 2006. These tourism receipts generated $21,734,000 of GDP in Bruce County, $11,539,000 in labour income and 348 jobs. A total of $14,420,000 of taxes was generated for all levels of government.**")[32]

Since over 50% of tourists visiting Bruce County ("Ontario's Natural Retreat") do so for outdoor activities, there is every probability that negative visual impact on this particularly attractive landscape and introduction of the cumulative noise of wind turbines would deter visitors from the relaxation and peace and quiet they have traditionally sought in this area. Since the

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[30] The best known wind turbine visitors' centre in England went bankrupt and was closed after two years owing to disappointing visitor numbers.

[31] *Investigation into the potential impact of wind farms on tourism in Scotland.* Final Report. Prepared for: *Visit Scotland*: http://new.wales.gov.uk/docrepos/40382/4038231141/403821124154/888061/906904/potential-impact-windfarms?lang=en

[32] Statistics published by Ontario Ministry of Tourism.

Southampton area is one of the county's prime tourist destinations, any negative influence on this important local income resource would be felt locally.

MELTING ICE, ARRAN LAKE

5

Species at Risk at Arran Lake

- The Arran Lake Natural Heritage System is an important habitat for many protected, endangered or threatened species.
- These include one significant percentage of the national population and one species in recovery program.
- The effects of habitat fragmentation and disturbance resulting in habitat avoidance raise potentially enormous issues for declining species.

- New evidence shows that the impact of wind farms on bird abundance becomes more pronounced with time.

According to Environment Canada:

> "Many bird populations in Canada and North America have been declining, especially over the past thirty years. Several species have lost half their numbers in only one human generation, and this rate of decline is of concern to scientists, naturalists and increasingly, to the general public. **These declines are due to a number of factors, including loss and degradation of breeding and wintering habitats, impacts of chemicals such as pesticides, as well as collisions with tall structures (buildings, towers, power lines, etc.) on migration or while staging, wintering, or breeding.**
>
> "Most birds that occur in Canada migrate between breeding and wintering areas. As the conservation of migratory birds is the joint responsibility of all countries they visit during the year, the Canadian government is a party to international efforts to protect migratory birds and their habitats."[33]

Environment Canada has indicated that 11 to 15 species at risk are found in the Arran Lake vicinity—the second highest category in Canada.[34]

PROTECTED, COSEWIC, SARA AND MNR ENDANGERED AND THREATENED SPECIES AT ARRAN LAKE:[35]

The Arran Wetlands Natural Habitat System is home to over a dozen avian protected, COSEWIC, SARA or MNR endangered and threatened species and Ontario Birds at Risk (OBAR) or species protected under the Fish and Wildlife Conservation Act and listed under Ontario Endangered Species Act. **The Natural Heritage component of the Provincial Policy Statement under Ontario's Planning Act provides for the protection of significant portions of the habitat of species listed in regulation under the Endangered Species Act.**

1. The Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are known to nest in the Arran Lake area. They are also regularly seen soaring over the lake and the river. **Since "wind farms can affect local populations of Eagles . . . whose breeding . . . rates are naturally slow and whose populations tend to have smaller numbers of breeding adults" (Davis 1995), it is probable that any wind turbines sited in the Arran Lake vicinity would have a detrimental effect upon this protected species** which is regulated

[33] *Wind Turbines and Birds A Guidance Document for Environmental Assessment*. April 2007; Environment Canada: Canadian Wildlife Service, p.7.
[34] http://www.sis.ec.gc.ca/ec_species/
[35] MNR Natural Heritage Information Centre Data on rare species in Ontario: http://nhic.mnr.gov.on.ca/MNR/nhic/species/listout.cfm?el=ab&sort=elcode

under the *Fish and Wildlife Conservation Act* and also Ontario's *Endangered Species Act* (E.S.A.) in southern Ontario.

2. Least Bittern *(Ixobrychus exilis)*

The presence of this **SARA and COSEWIC "threatened" species** and its use of the proposed wind turbine site as part of its habitat **makes this site one of "very high sensitivity"**. In view of the **documented destructive effect of wind turbines on low flying birds** and the fact that the least bittern is an important species found at Arran Lake and observed to fly over the proposed wind turbine site, **it would be impossible to demonstrate that this development would not effect the ecological function of the wetlands or the surrounding natural heritage system.** Its very small and declining population depends on high quality marsh habitats that are being lost and degraded across the species' range. For more details on this species please see Appendix 2.

3. Red Shouldered Hawk *(Buteo lineatus)*

The Red-shouldered Hawk is a specially protected raptor under the Fish and Wildlife Conservation Act. It is listed as **Special Concern** by the Ontario Ministry of Natural Resources. It is one of the raptor species that is particularly vulnerable from wind turbine developments. **Its hunting territory around Arran Lake corresponds to the elevated drumlin ridges-- the precise sites of the proposed wind turbines. The vulnerability of the Red-shouldered Hawk to wind turbine development at Arran Lake illustrates the importance of protecting an entire natural heritage system as a functioning ecological unit.** This is an area sensitive species and an indicator species that requires all the elements of an unfragmented, undisturbed natural heritage system consisting of wetlands, open fields, upland ridges, old growth forests and wooded wildlife corridors. **This site is therefore of "very high sensitivity" and not suitable for wind turbine development**. For more details on this species please see Appendix 2.

4. King Rail *(Rallus elegans)*

The King Rail is protected under the federal *Species at Risk Act* (SARA) and **listed by the MNR/ROM as endangered provincially and nationally**. It has a very small population in Canada which shows continued decline. Few patches of remaining habitat are large enough and of sufficient quality to support this species. "Loss of wetland habitat" and disturbance "has been the greatest single factor in the decline of the King Rail in Ontario, and is the greatest threat to their continued existence." **Most of the wetlands suitable for King Rails have been eliminated. The quality of the remaining habitat is also deteriorating.[36] In view of the sensitivity of this species to habitat disturbance and the intimate**

[36] *Ibid.*

relationship between the wetland and the ecological function of the surrounding uplands, it would be impossible to prove that the siting of wind turbines within this natural heritage system would not cause disturbance to the wetland and degrade its quality sufficiently that it could no longer support this endangered species. The presence of this bird makes the area one of very high sensitivity and it should be avoided by wind turbine developments. For more details on this species please see Appendix 2.

5. Black Tern *(Chlidonias niger)*

This bird is listed by the MNR as a **species of special concern** with the general Ontario Status as "**sensitive**".[37] The presence of the Black Tern was noted on the 1985 Field Evaluation of the Arran Lake Wetland by the Grey Sauble Conservation Authority as one of the nesting colonial waterbirds found at the lake. **The Black Tern and its nest are protected under the Migratory Birds Convention Act. Terns and Gulls are susceptible to wind turbine mortality. The presence of wind turbines intercepting its migratory landing at the lake would be an additional threat to this species of special concern, especially during adverse weather conditions during the migratory season.** For more details on this species please see Appendix 2.

TYPICAL MIGRATORY SEASON FOG AT ARRAN LAKE

6. Great Egret *(Ardea alba)*

This is **one of the birds known to use the daily movement flyway** between breeding and roosting areas at the Federal Bird Sanctuary IBA on Chantry Island and feeding areas around the Arran Lake wetlands and the Saugeen River valley lands. **The Chantry Island colony represents a significant part of the Canadian population of this species. The presence of a significant percentage of the national population of this species and the fact that it frequently flies directly over the proposed wind turbine site make this a "very sensitive area".** In

[37] http://nhic.mnr.gov.on.ca/MNR/nhic/elements/el_report.cfm?elid=180239

addition this large bird is slow to climb on take-off and slow in flight, making it more vulnerable to collision mortality from the turbine blades, especially during adverse weather conditions. **It is therefore reasonable to expect that if wind turbines were placed along the daily migratory pathway of this species, some mortality of a significant part of the national population would occur.** For more details on this species please see Appendix 2.

7. Black-crowned Night Heron (*Nycticorax nycticorax*)

The Black-crowned Night Heron is listed by COSEWIC as a "**sensitive" species** and by OBAR (Ontario Birds at Risk) as a **target species of rare breeding birds in Ontario.**[38] The 1985 MNR wetland data record confirms that the Arran Lake wetlands are a "feeding habitat for this Provincially Significant Animal Species". This links it to the protected Federal Bird Sanctuary on Chantry Island. The records of Bird Studies Canada indicate that the field surveys of Chantry Island in 1991 found 100 nests of Black-crowned Night-Herons. "This is at least 2% of the national population. In 1989 and 1990, nationally significant numbers of this species were also found, with 56 and 97 nests, respectively".[39] For more details on this species please see Appendix 2. **The presence of nationally significant numbers of this species and its documented use of the flyway between the Island and Arran Lake is another reason the Arran Wetlands Natural Habitat System must be regarded as an area of "very high sensitivity". The construction of a wind turbine development along this flyway would endanger a significant number of the population of this species.**

8. Caspian Tern (*Hydroprogne caspia*, formerly *Sterna caspia)*

The presence of this species is listed in the Ontario Ministry of Natural Resources *Wetland Data Record: Arran Lake*.[40] In Canada, breeding colonies are few, and the total numbers of birds relatively low. It was designated as **rare** by COSEWIC (1997) and considered to be a **vulnerable species in Ontario**. It is considered a target species by the Rare Breeding Birds of Ontario.[41] **The presence of a rare tern at Arran Lake makes this an area of very high sensitivity**. The recent research project at the Centre for Evidence Based Conservation, University of Birmingham referred to above, found that **wind turbines reduce the abundance of many bird species at a wind farm site, and that "Gulls and Terns (along with Ducks) experience greater declines in abundance than other bird groups suggesting that a precautionary approach should be adopted to wind farm developments near aggregations of Anseriformes (Ducks) and to a lesser extent**

[38] http://www.bsc-eoc.org/obar.html

[39] http://www.bsc-eoc.org/iba/site.jsp?siteID=ON154

[40] Toth, G, Morton, J, & Hill, A. *Wetland Data Record: Arran Lake*. Ministry of Natural Resources South Western Administrative Region and District Owen Sound: 8 August, 1985.

[41] Ontario Birds At Risk (OBAR) Site Registry. Rare breeding birds of Ontario, target species. http://www.bsc-eoc.org/obar.html Site Registry maintained by the Ministry of Natural Resources and the Ontario Rare Bird Breeding Program (Austen *et al*., 1994).

Charadriformes (Gulls and Terns)".[42] In the same report, **there is also evidence that the impact of wind farms on bird abundance becomes more pronounced with time. This, of course, is a major issue for a rare bird such as the Caspian Tern, whose numbers are already in decline.**

8. Short-eared Owl (*Asio flammeus*)

This bird has been listed by COSEWIC **(**April 2008) and by SARA as a species of **Special Concern**. It is on the MNR Bruce county priorities for conservation list of species that are **sensitive to disturbance** or that are **declining**. A functioning, unfragmented natural wildlife system is crucial to to its survival. Like the other raptors found within the proposed wind turbine development site, the Short-eared Owl would be especially endangered by the presence of rotor blades on the drumlin ridges used for hunting. The presence of the turbines and associated disturbance amid these hunting pastures and hay fields would inevitably lead to a decline in the abundance of its prey and eventual abandonment of this traditional habitat by the Short-eared Owl. For more details on this species please see Appendix 2.

9. Red Headed Woodpecker *(Melanerpes erythrocephalus)*

"This species has experienced a significant decline over the long-term associated with habitat loss and the removal of dead trees in which it nests. **There is no evidence to suggest that the population trend will be reversed**."[43] It is known to nest in old growth forests of the Arran Lake Wetlands Natural Heritage System, including the Krug woodlot immediately adjacent to the proposed wind turbine site. The COSEWIC Assessment and Update Status Report of 2007 lists it as **"threatened".** It is protected under the *Migratory Birds Convention Act, 1994.* In 1996 it was designated by COSEWIC as a species of Special Concern. (The SARA Registry indicates that it is still declining)[44]. NatureServe ranks the species as vulnerable in Ontario. In Ontario, the Ministry of Natural Resources has designated it a species of **special concern** and it appears on the provincial **species at risk** list.

SPECIES IN RECOVERY PROGRAM:

11. Loggerhead Shrike (*Lanius ludovicianus migrans)*

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[42] Stewart, Pullin, & Coles. *SYSTEMATIC REVIEW NO. 4: Effects of wind turbines on bird abundance Review Report*, (2006).

[43] COSEWIC Assessment and Update Status Report on the Red-headed Woodpecker *Melanerpes erthrocephalus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, 2007. (www.sararegistry.gc/status/status_e.cfm).

[44] http://www.sararegistry.gc.ca/virtual_sara/files/cosewic/sr_melanerpes_erythrocephalus_e.pdf (Technical Summary)

There is also the likelihood of use of this habitat by the Loggerhead Shrike (COSEWIC, SARA endangered provincially and nationally). It is now a **species in a recovery program**. The birds and their eggs are protected by the federal *Migratory Birds Convention Act, 1994*. *Rare and Endangered Species of Grey and Bruce County,* published by the Owen Sound Field Naturalists, indicates **this part of Arran Township as one of the few traditional nesting habitats for this bird. Loggerhead shrike nested successfully within 5 miles of the proposed site in 2002**. They are also historically documented nesting in the Dunblane area, a few miles away. **The Arran Lake uplands, part of the Shrike's traditional territory, still provide a perfect habitat for this bird because of the short grass pasture land, presence of mature hawthorn trees used for nesting, and abundance of split rail fences and dead trees used as perches when hunting**. **The proposed development would certainly be at odds with this important rescue program for such a shy bird near extinction.** [45]

ARRAN LAKE HAWTHORN AND SPLIT RAIL FENCE

12. **Bobolink** (*Dolichonyx oryzivorus)*

In spring, the upland fields around Arran Lake are abundant with this species notable for their aerial flight displays. The Ontario Breeding Bird Atlas indicates that Bobolinks have suffered a **28% loss of area occupancy over the last 20 years. The cause is thought to be declining quality and quantity of wet meadow habitats.** As a result, the Bobolink has been placed on the COSEWIC candidate species list "Group 1"—of the highest priority for assessment because it is **"suspected to be at high risk of extirpation from Canada**". [46] It is probable that

[45] Elaine Williams, Executive Director, Wildlife Preservation Canada, contact person for the **Eastern Loggerhead Shrike Recovery Strategy** wrote in an E-mail: "The last known nesting pair in that area was in 2002. However, last year, we had one of our 2006 release birds return to the Dyer's Bay area, and later that season a reliable birder spotted three shrikes, one was definitely an adult and the other a juvenile (he couldn't see the other one properly), so there was nesting last year on the Bruce." The Arran Lake area "is shrike nesting habitat (as long as it has the right mix of habitat features that shrikes require, i.e. short grass or active pasture land, has some snags or hydro poles from which the shrikes can perch and hunt and has hawthorns or thorny apples of the right size for a nesting tree and impaling site), and it should be preserved for the recovery program".

[46] http://www.cosewic.gc.ca/eng/sct3/sct3_1_e.cfm#p2

the presence of wind turbines would provide sufficient disturbance and quality loss to wet meadow habitats of this bird that they would further contribute to the serious population decline it has already suffered: 84% of its population over the last 37 years and an even more accelerated population decline of 53% in only the last 10 years.

Two other similar COSEWIC "candidate species" list birds found at Arran Lake are:

13. Barn Swallow (*Hirundo rustica)* of concern across Canada.

14. Field Sparrow (*Spizella pusilla)*, of concern in Ontario.

REPTILES AT RISK AT ARRAN LAKE:

15. Spotted Turtle (*Clemmys guttata)*.

In Canada, the Spotted Turtle was designated **vulnerable**, a Species of **Special Concern**) by COSEWIC in 1991. The Ontario Ministry of Natural Resources lists the species as Vulnerable (1996), and the Ontario General Status is **Sensitive** (1999). The Spotted Turtle **is listed as a Specially Protected Reptile** in Ontario. [47] Because of the habitat range of this vulnerable species and its presence during part of its annual cycle on land proposed for wind turbine construction, it is easily foreseeable that habitat fragmentation and disturbance, the building of roads to the turbine sites, increase of truck traffic during and after construction, and elimination of some of the traditional nesting environment would have an adverse effect upon this protected species. Any mortality would be all the more serious because of the low rates of reproduction of this reptile. Please see Appendix 2 for additional information on this species.

[47] (Schedule 9) in the Fish and Wildlife Conservation Act (1997; Bill 139, Chapter 41, Statutes of Ontario).

16. Eastern Milk Snake *(Lampropeltis tirangulum)*

COSEWIC Special Concern. There is increased concern over this species in Canada resulting in a designation of **Special Concern nationally** by COSEWIC in May 2002. It is **protected under the federal *Species at Risk Act*** (**SARA**). The Eastern Milk Snake is listed as a "specially protected species" in schedules of the *Fish and Wildlife Conservation Act, 1997*. It is listed by the Royal Ontario Museum as a species of special concern provincially and nationally. **This species would certainly be further threatened by the additional invasiveness of cement trucks, cranes, the vehicles of work crews and heavy transport vehicles associated with wind turbine construction. Its traditional habitat would be fragmented by the construction of new roads to the sites and the subsequent regular invasion of servicing vehicles after construction. Since this diminishing species is found throughout the entire proposed Arran Lake wind turbine development area, each of these threats would be multiplied by the number of turbines actually constructed i.e. now believed to be in excess of 30.** In addition, low frequency noise levels and earth-absorbed vibrations from operational turbines would result in habitat disturbance since snakes are extremely aware of vibrations and use this means of sensing threats rather than hearing. All of these disturbances would apply also to all snakes and reptiles found in the area—the more common ones being a source of prey for the waterfowl and other birds. Please see Appendix 2 for additional information on this species.

17. Eastern Ribbon Snake (*Thamnophis sauritus*)

COSEWIC designated this snake of **Special Concern for the Canadian Great Lakes population** in May 2002. The Royal Ontario Museum/MNR lists this species as **Special Concern provincially and nationally**. This species is included in the Greater Georgian Bay Reptile Awareness Program. Habitat stewardship projects for it are ongoing in Ontario and Quebec under RENEW (Recovery of Nationally Endangered Wildlife), the national recovery program established under the Accord for the Protection of Species at Risk. Please see Appendix 2 for more information on this species.

MAMMALS AT RISK AROUND ARRAN LAKE:

18. Grey Fox *(Urocyon cinereoargenteus)*

COSEWIC: **Threatened** (May 2002) (MNR/ROM) **Threatened nationally and provincially**. **The proposed wind turbine site is part of the traditional, preferred habitat of the Grey Fox, which has been seen on two recent occasions by local naturalists in this area. Its presence demonstrates the use by a single animal of both upland forest and marsh habitat within the Arran Wetlands natural heritage system: the grey fox prefers deciduous forests (where it climbs trees to escape enemies) and marshes;** and it may also be found in agricultural areas. **The local population is part of the south western Ontario population, the only known resident breeding population for grey fox in the province. Habitat disturbance for this animal would result from the intrusive nature of wind turbine construction, operation and maintenance.**

The effect would be cumulative since the turbines would be located amid its hunting territory.

PLANTS AT RISK AT ARRAN LAKE:

The Ministry of Natural Resources, Owen Sound Office, has indicated that at least three plant species considered by the Ministry of Natural Resources to be at risk and COSEWIC species of special concern are found at Arran Lake. These include:

19. Tuberous Indian-plantain *(Arnoglossum plantagineum)*[48]

"Status: **Special Concern**. Reason for designation: limited occurrences present within five shoreline areas of Lake Huron. **The Ontario population consists of just 5000 flowering plants**. It is probable that the known drying effect of the wind turbines would eliminate some of the wet meadows that are the habitat of this plant. Please see Appendix 2 for more information on this species.

20. Longleaf Dropseed *(Sporobolus asper)*

21. Rigid Sedge *(Carex tetanica)*

This plant is very rare in native habitats.[49] **The presence of all three rare plants further illustrates the unique quality and high sensitivity of the Arran Lake natural heritage system.**

Consideration # 8: The impact of wind turbines on declining species raises serious issues.

Manville emphasizes the **inadequacy of many of the studies that have been completed with regard to predicting the probable devastating impact wind turbines can have on declining species.**

In 1999, *Methods and Metrics for Determining or Monitoring Potential Impacts on Birds* was published (DMBM peer-reviewed), to provide the best advice

[48] COSEWIC 2002. COSEWIC assessment and update status report on the tuberous Indian-plantain Arnoglossum plantagineum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 11 pp. White, D.J. 2002. Update COSEWIC status report on the tuberous Indian-plantain Arnoglossum plantagineum in Canada, in COSEWIC assessment and update status report on the tuberous Indian-plantain Arnoglossum plantagineum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-11 pp. Previous Report: Keddy, C. 1988. COSEWIC status report on the Indian-plantain Cacalia plantaginea in Canada. Committee on the Status of Endangered Wildlife in Canada. 28 pp.

[49] 30774 Argus, G.W. and D.J. White (eds.) 1982. *Atlas of the Rare Vascular Plants of Ontario*. Part 1. National Museum of Natural Sciences, Ottawa. Argus, G.W., K.M. Pryer, D.J. White and C.J. Keddy (eds.) 1982-1987. 8438 *Atlas of the Rare Vascular Plants of Ontario*. Four parts. National Museum of Natural Sciences, Botany Division, Ottawa. Looseleaf. 79886 Flora of North America (FNA) Editorial Committee. 2002. *Flora of North America*, Volume 24, draft species accounts for Cyperaceae. Unpublished draft species accounts. 57021 Oldham, M.J., and W.J. Crins. 1998. *Atlas of the Vascular Flora of southern Ontario*. Draft 2. Natural Heritage Information Centre, Ontario Ministry of Natural Resources, Peterborough, Ontario. 378 pp.

on how to conduct research at wind sites. That document has been updated to reflect new findings. *Assessing Impacts of Wind-energy Development on Nocturnally Active Birds and Bats: a Guidance Document* was recently released (DMBM also peer-reviewed):

> "Modeling in 2001 placed nationwide annual avian mortality at an estimated 33,000 average for all birds killed (2.19 avian fatalities/turbine/year; 0.033 raptor fatalities/turbine/year), based on reviews at 14 western and midwestern wind facilities. **Unfortunately, the estimates tell us nothing about the relative risk to declining species, nor what may be happening at a site-specific location** (*e.g.,* APWRA, or Buffalo Mountain, TN). In addition, the model has some critical flaws due to comparisons drawn between studies lacking proper study design, unequal and large intervals between carcass searches (*e.g.,* once/5 wk.), and a lack of eastern and north-eastern comparison studies. **These estimates need to be updated and should be subject to peer review. More troubling, the estimates are often treated as "fact." Ideally, we need a nationwide cumulative impacts analysis – especially since the industry continues to grow exponentially.**
>
> "The newer generation of larger, slower-moving turbines may be as deadly as older, smaller turbines, especially in inclement weather and especially to some species. While RPM rates are much slower, blade tip speeds – at full operation – still may spin in excess of 170 mph. As blade length and size and rotor swept areas continue to increase, blade tip vortices and blade turbulence increase, resulting in what may be decompression impacts to bats (*e.g.,* collapsed lungs with no apparent evidence of blunt force trauma; E. Arnett pers. comm.) and perhaps to small neotropical migratory birds. More detailed research will be necessary to assess these potential impacts**. The effects of habitat fragmentation, site disturbance, and habitat avoidance raise potentially enormous issues that must be addressed.**

Consideration # 9: The huge negative effect of wind turbines on bats has economic repercussions.

Bats are one of the most important species in maintaining the balance of nature. Their economic value as a biological control agent for insects is estimated at multi billions of dollars annually in the US alone. Wind power kills bats in very large numbers. Seven species of bats are found at Arran Lake. Some of these are migratory species and therefore more vulnerable to wind turbines. The siting of wind turbines in this area would decimate this important species.

One of the first studies on bats was carried out at Pincher Creek in Alberta. **The astonishing numbers of bat fatalities there alerted biologists and the general public to the devastating effect the turbines are already having on this animal.**

Dr. Michael Gannon, Professor of Biology at Pennsylvania State University and a representative of the Pennsylvania Biological Survey on the Pennsylvania Wind and Wildlife Consortium,[50] is an acknowledged expert on bats, bat ecology, and bat population biology. He has spoken out about the adverse effect wind turbines are already having on bats. Citing the Government Accountability Office Report commissioned by congress in 2005: *Wind Power, Impacts on Wildlife and Government Responsibilities for Regulating Development and Protecting Wildlife*,[51] he emphasizes that **"wind power kills bats in large numbers. That is a fact, not in dispute. Estimates I have seen, have gone from the conservative of 5000 bats per wind site per year, to the very liberal of about 60,000 bats per site per year."**[52]

According to the congressional report:

> "Recent studies conducted in the eastern United States in the Appalachian Mountains have found large numbers of bats killed by wind power turbines. A 2004 study conducted in West Virginia estimated that slightly over 2,000 bats were killed during a 7-month study at a location with 44 turbines. More recently, **a 2005 report that examined wind resource areas both in West Virginia and Pennsylvania estimated that about 2,000 bats were killed during a much shorter 6-week study period at 64 turbines. Lastly, a study conducted of a small 3-turbine wind facility in Tennessee estimated that bat mortality was about 21 bats per turbine, per year, raising concerns about the potential impact on bats .** . . . Various species of bats have been killed at these wind power facilities and experts are concerned about impacts to

[50] A committee formed by Governor Rendell to advise on wind development and wildlife issues in Pennsylvania.

[51] GAO-05-906. Washington D. C. 64 pp. http://www.windaction.org/documents/134

[52] Letter to Mayor Kilmartin by Dr. Michael Gannon, biology professor at Penn State Altoona (*November 4, 2007) by Dr. Michael Gannon* http://www.windaction.org/documents/12514

bat populations if large numbers of deaths continue. For example, **one expert noted that 'it is alarming to see the number of bats currently being killed coupled with the proposed number of wind power developments' in these areas".**

These recently discovered statistics are acknowledged as true by the wind industry. But wind energy proponents have rather flippantly dismissed them by saying "there *is* a problem with bats, but, fortunately, bats do not have a very charismatic image with the public". But Dr. Gannon emphasizes the often forgotten economic importance of bats: **"The economic value of bats has been documented many times. Bats are the major predators of all our nocturnal insects. They consume large numbers of insect pests including many of our most troublesome crop pests".**

All the species of bats found at Arran Lake have been documented as vulnerable to the effect of wind turbines. Several are also migratory species which increases their vulnerability. **It has been observed that wind turbines situated near wetlands are more destructive of bats.**

For more information, please see Appendix 3. This research would indicate that all of the species found at Arran Lake are at risk from proposed wind turbine development.

OLD GROWTH FOREST, KRUG WOODLAND AT ARRAN LAKE

7

Summary

- A wind turbine project would have significant negative impacts on the ecological functions of a Natural Heritage System.
- Provincial siting regulations must be put into effect *with the greatest urgency*, to protect *all* our valuable habitats before they are lost to degradation

In view of the growing body of scientific literature that points to the adverse effects of wind turbines on environmentally sensitive areas, **it would be impossible to conclude, beyond any reasonable doubt, that a wind turbine project proposed for farmland within the Arran Lake natural heritage system would be without negative impacts on the natural features or on their ecological functions.**

Since the project, taking mitigation into account, is likely to lead to significant adverse long term effects, it should be abandoned. Proponents should consider other locations.

It is clear from the species found here and their dependence on the interrelating habitats within this natural heritage system that this site is highly sensitive and should be avoided by wind turbine development.

Conclusion

It is easy to see from the information on Arran Lake Natural Heritage System, why wind turbine developments near wetland habitats and natural heritage systems can have a devastating effect on the ecological functions of the systems themselves as well as the survival of many of the species found in them.

Now that the negative impact of industrial wind turbine development on sensitive habitat has been so widely recognized in the scientific community, it is incumbent upon our municipal, county, provincial and federal governments under existing legislation, to protect highly sensitive natural habitats.

Consideration # 10: "At a minimum, municipalities must protect the habitat of endangered and threatened species". *Conservation Priorities for the Birds of Southern Ontario,* Ministry of Natural Resources.

> "The presence of listed species at risk, the residences of individuals of those species or their critical habitat is an indication that special considerations are required. Proponents must comply with the requirements of the SARA."
>
> "The SARA protects plants and animals listed in Schedule 1 of the Act (the List of Wildlife Species at Risk). SARA prohibitions apply to aquatic species and migratory birds protected under the *Migratory Birds Convention Act*, 1994 wherever they are found"[53].

[53] *EA Guidance Document: Wind Turbines and Birds* Page 25 April 2007

Conservationists throughout the province should note that the **Arran Lake Wetlands Complex and its related natural heritage system is just one of the remaining highly sensitive wetland areas that will be affected by unregulated development of commercial wind power in Ontario.**

There are many other similar sites that must be kept free of this type of degradation from industrial development if we are to see the survival of the remaining fragments of Ontario's natural heritage survive functionally for the next generation. Presently threatened are the following Ontario Important Bird Areas—all of them *internationally significant* natural habitats:

> Point Pelee; Holiday Beach/Big Creek; Eastern Lake St. Clair; Greater Rondeau Area; Long Point Peninsula; Wolfe Island; Amherst Island; Chantry Island, ON; Clear Creek, ON.

Ole Odgaard, a senior advisor to the **Danish Energy Agency** was recently quoted in the *Toronto Star:* **"We made some mistakes. For example, the first land-based windmills were built without any procedure to gain public acceptance. They caused landscape pollution and now we are paying to pull them down and re-establish better more efficient ones in better locations.**"[54]

At the present time in Ontario, nothing is being done by the provincial government to protect sensitive natural habitat areas.

Local conservationists may not be aware of an industrial wind turbine development planned for their area until the planning permission process is well underway. Although proponents are required to inform the public about their proposals through public meetings, it is most often the case that land leases are taken up in great secrecy (with a clause requiring the landowners themselves to keep them secret). Companies also use this tactic to create bad feelings among neighbours, promising yearly income to farmers which they would lose if the project does not receive approval.

"The SARA also requires that every person required by federal law to ensure that an EA is conducted must (1) notify the competent minister(s) in the likelihood that a project will affect a listed wildlife species or its critical habitat; (2) identify the adverse effects of the project on the listed wildlife species and its critical habitat. For more information on listed species and environmental assessment requirements, please consult the SARA Public Registry at http://www.sararegistry.gc.ca/default_e.cfm. Guidance material on species at risk and environmental assessment is also available on the CWS Web site at http://www.cws-scf.ec.gc.ca/publications/eval/index_e.cfm.

The Migratory Birds Convention of 1916 between the USA and Canada is an international treaty implemented in Canada by the federal *Migratory Birds Convention Act, 1994* (MBCA) and accompanying regulations.

The *Migratory Birds Regulations* (MBR), in Section 6, prohibit the disturbance, destruction, and taking of a nest or egg of a migratory bird; or the possession of a live migratory bird, or its carcass, skin, nest or egg, except under authority of a permit. It is important to note that under the current MBR, no permits can be issued for the incidental take of migratory birds caused by development projects or other economic activities".

[54] The Low-Carbon Diet. Mitch Potter. *Toronto Star* September 27, 2008

When the statutory public meeting is eventually held it normally consists of an "open house" presentation on the project by the developer and most often excludes public question and answer discussion. Developers are normally unwilling to disclose the exact location of the proposed turbines "for proprietary reasons". An announcement is also required to be published in the local newspaper to let people know that the developer has actually presented his own environmental assessment to the Ministry of the Environment, and that **the public has 30 days to request the Ministry to "elevate" the project to a full environmental assessment**.

Under the existing regulations, the onus of protecting these priceless areas is thrown back to individuals and groups of concerned local citizens *who are, in the first instance, required to "negotiate" with the developers themselves!* Apart from the fact that most rural residents do not possess the resources to take up protracted "negotiations" with wealthy energy companies, others are simply too intimidated. Why is the provincial government hiding from so important a responsibility of protecting our wildlife heritage and assuming that such matters can be left to chance and inexperienced local citizens?

Consideration # 11: Commercial wind power developments must not usurp long term preservation of our natural habitat

In the past, ministers denying the case presented by citizens attempting to block a wind turbine development on conservation issues, have asserted that wind power projects are a government policy *priority* and that electricity supply security is more important for the "greater good".

But many people are beginning to question the logic of an electricity generating technology which masquerades as environmentally benign and claims to save the planet and its endangered species by "cutting carbon emissions". **The fact is that wind turbine developments are already wrecking havoc on some of our most important wildlife areas.**

The assumed carbon emission savings of wind power have, in fact now been questioned by a number of electricity experts and electricity supply authorities who warn that because of the variable nature of the wind resource there is a need to back up wind turbines with conventional fossil-fuel burning generation—a requirement that *increases* as more unstable wind power is added to the grid. This method of operating fossil fuel power stations at less than full capacity on standby mode is both expensive and increases carbon emissions considerably. A number of highly respected scientists have calculated that when the whole picture is taken into consideration, any carbon savings are close to zero.

Moreover, there is also the issue of the amount of energy needed to erect the turbines. Cement manufacturing is the third largest cause of man-made carbon dioxide emissions. Dr M J Hall, FRSC, FIBiol in his *A guide to calculating the carbon dioxide debt and payback time for wind farms* published by the Renewable Energy Foundation in the U.K.[55] estimates that a wind farm approximately the size

[55] http://www.windaction.org/documents/7753

of the one proposed for Arran Lake would emit 80,258 tonnes of CO2 during turbine fabrication, 6,696 tonnes of CO2 during concrete manufacture and 13,750 tonnes of CO2 during aggregate extraction. In the case study, when the amount of CO2 sequestering lost by vegetation removal is calculated, it would take 3.5 years before the wind turbines actually displaced any CO2 emissions from equivalent fossil-fuel electricity production.

One of the best documents on this topic was written by Jon Boone, a lifelong environmentalist, a co-founder of the North American Bluebird Society and a consultant with the Roger Tory Peterson Institute in New York. If you do not have time to read any other document on the technical capabilities and shortcomings of wind energy, make sure to have a look at this one. It is written competently, quoting the opinions of many electricity experts; at the same time, it is written simply so that even the layman can understand it. A downloadable PDF version of Jon Boone`s *Less for More* is available at http://www.windaction.org/documents/7013:

> "**Functionally, wind turbines produce little energy relative to demand and what little they do produce is incompatible with the standards of reliability and cost characteristic of our electricity system. Moreover, wind plants are unable either to mitigate the need for additional conventional power generation in the face of increased demand or to reliably augment power during times of peak demand. Ironically, as more wind installations are added, almost equal conventional power generation must also be brought on line. Crucially important, however, wind technology, because of the inherently random variations of the wind, will not reduce meaningful levels of greenhouse gases such as carbon dioxide produced from fossil-fueled generation, which is its raison d`etre".**

Boone quotes the German Electricity generating Authority E-OnNetz report of 2004:[56]

> "The massive increase in construction of new wind power plants in recent years has greatly increased the need for wind-related reserve capacity (conventional generation). This new generation would be apart from firm generation necessary to meet expectations of increased demand, and **installed at 90 percent of the nameplate capacity of aggregate wind plant, using more conventional fuels in the process, producing copious carbon emissions as much or more than if wind facilities had never existed.**(79)

Recommendations

WHAT SHOULD BE DONE?

[56] Germany is the world's largest user of wind technology, having erected over 18,000 large wind turbines in the last twenty years that produce about six percent of the nation`s total generation. E.ON Netz manages the transmission grid in Schleswig-Holstein and Lower Saxony, about a third of Germany, hosting 7,050 MW of Germany's 16,394 MW installed wind-generating capacity at the end of 2004. The total production in their system was 11.3 TW-h in 2004, representing an average feed of 1,295 MW (18.3% of capacity). It produced two brief reports in 2004 and 2005 summarizing its recent experiences with wind energy on such a vast scale.

New provincial siting regulations must be put into effect with the greatest urgency, before any more valuable habitats have been lost to degradation. Expediency is also to the benefit of the developers who can then make decisions about siting from the earliest stages without costly investment in projects that may ultimately be lost because of environmental considerations.

Constraint mapping of heritage habitat assets will indicate which areas must be completely avoided, and which ones are of less preservation merit.

EXAMPLES OF ENLIGHTENED LEGISLATION

Efforts in this direction have already been initiated by Professor Robert C. Corry, Ph.D., Associate Professor, Landscape Ecology & Design Laboratory, School of Environmental Design & Rural Development, University of Guelph, working with the Ontario Ministry of Agriculture, Food and Rural Affairs. *Landscape and Visual Assessment Guidance for Wind Energy Farm Development* was produced.[57]

This approach has been used by the Municipality of Grey Highlands in Grey County. The Grey Highlands Official Plan Amendment #10 for Renewable Energy Projects was passed by Grey Highlands and then subsequently approved by Grey County (the final approval authority). It was not appealed. It is now in effect. The MMAH did provide comments, but did not challenge the policies once they were passed. The policy can be seen at - http://www.greyhighlands.ca/files/departmentdocs/Renewable%20Energy%20OPA%2010.pdf

THE CHOICE BETWEEN GREEN ZEAL AND OLD FASHIONED CONSERVATION

Much of the popular "green" zeal that is sweeping our society is promoted by commercial interests as an excuse to consume even more resources with less guilt. A scheme that earns carbon credits allowing its promoter to be excused from other polluting activities is not green. A renewable energy project that claims to benefit wildlife by slowing planetary warming but is thoughtlessly located near a natural habitat of very high sensitivity and endangers threatened species and permanently degrades irreplaceable ecological systems, is not in the interests of conservation, no matter how many nature projects such a corporation may publicly sponsor.

[57] It is available from Professor Corry at: mailto:Robert Corry <rcorry@uoguelph.ca>

During the twentieth century, Ontarians recognized the exceptional value inherent in protecting functioning wildlife systems. Legislators acted on the public will to preserve large tracts of unspoiled nature for future generations, in good faith, believing that their efforts would be continued by their successors. Areas of Natural and Scientific Interest (ANSIs) were designated throughout the province because they were "areas of land and water containing natural landscapes or features which have been identified as having values related to protection, natural heritage appreciation, scientific study, or education". **The most significant ANSIs (provincially significant) were believed to "contribute to the achievement of the Ministry's (OMNR) protection objective".** [58]

Nature organizations, conservationists, ornithologists, local councilors, and legislators should become informed about proposed commercial wind energy projects in their areas at the earliest moment. *The threat is real. It is imminent. Once a turbine development has been constructed, long term, irreversible damage has already begun.*

Natalie Helferty, director of conservation for Ontario Nature said recently: "We've lost almost all wetlands in southern Ontario, so everything in my mind is significant to protect …. If you keep degrading the quality of wetlands, then nothing will be significant enough to protect".[59]

PROTECTION FROM DEGRADATION MUST BE PROACTIVE AND COMPREHENSIVE.

Since these are pockets on the planet that essentially remain the same as they were thousands of years ago, the task of defending them requires even more fastidious planning care. Seemingly minor disturbance on nearby lands can lead (and has led) to drastic changes in wildlife habitat resulting in degradation, abandonment and loss of ecological function. In fact, almost any development in the vicinity of a significant wildlife system likely will, in the long term, mean disaster for those species that have already reached a critical stage.

We can no longer afford the luxury of post-construction assessments, studies for mitigative measures, or superficial industry-sponsored environmental screenings that deny any negative environmental footprint. It is imperative that we make bold and courageous planning decisions based on common sense and prudent caution. If there is even the *slightest* possibility

[58] Ontario Ministry of Natural Resources, 1983. *Backgrounder: Land Use Guidelines*. Southwestern Region.

[59] *ON Nature*, Spring 2008, p.27.

of a development adversely affecting one of these *irreplaceable* natural systems, we cannot take the chance of permitting it and then realizing in ten years that the development has contributed to the degradation of one of our few remaining wetland systems.

8
What you can do

IF YOU ARE AN ORDINARY CITIZEN:

You should express your concerns about the threat of wind turbine developments to our natural heritage habitats to your member of provincial parliament. They can all be reached at the following cut and paste email address label:

saggelonitis.mpp.co@liberal.ola.org;lalbanese.mpp@liberal.ola.org ;ted.arnott@pc.ola.org ;warthurs.mpp@liberal.ola.org ;bob.bailey@pc.ola.org ;bbalkissoon.mpp.co@liberal.ola.org ; toby.barrett@pc.ola.org;rbartolucci.mpp@liberal.ola.org ;cbentley.mpp@liberal.ola.org;lberardinetti.mpp.co@liberal.ola.org;mbest.mpp@liberal.ola.org;gilles@gillesbisson.com ;jbradley.mpp@liberal.ola.org ;lbroten.mpp@liberal.ola.org;mbrown.mpp.co@liberal.ola.org;jbrownell.mpp@liberal.ola.org ;mbryant.mpp.co@liberal.ola.org;dcansfield.mpp@liberal.ola.org;dcaplan.mpp@liberal.ola.org ;acarroll.mpp@liberal.ola.org;mchan.mpp@liberal.ola.org;ted.chudleigh@pc.ola.org ;mcolle.mpp@liberal.ola.org;kcraitor.mpp.co@liberal.ola.org;bcrozier.mpp@liberal.ola.org ;bdelaney.mpp@liberal.ola.org;vdhillon.mpp@liberal.ola.org ;jdickson.mpp@liberal.ola.org;dinovocqp@ndp.on.ca;ldombrowsky.mpp@liberal.ola.org ;bduguid.mpp@liberal.ola.org ;dduncan.mpp@liberal.ola.org ;garfield.dunlopco@pc.ola.org;christine.elliott@pc.ola.org;kflynn.mpp@liberal.ola.org;pfonseca.mpp.co@liberal.ola.org;fgelinas-qp@ndp.on.ca;jgerretsen.mpp@liberal.ola.org;mgravelle.mpp@liberal.ola.org;hhampton-qp@ndp.on.ca ;ernie.hardeman@pc.ola.org ;randy.hillierco@pc.ola.org;ahorwath-qp@ndp.on.ca;phoy.mpp@liberal.ola.org;tim.hudakco@pc.ola.org;hjaczek.mpp@liberal.ola.org ;ljeffrey.mpp@liberal.ola.org;sylvia.jones@pc.ola.org ;frank.klees@pc.ola.org ;pkormos-qp.ndp.on.ca ;kkular.mpp@liberal.ola.org ;mkwinter.mpp@liberal.ola.org;jmlalonde.mpp@liberal.ola.org

;jleal.mpp.co@liberal.ola.org;dlevac.mpp@liberal.ola.org
;lisa.macleod@pc.ola.org;amangat.mpp.co@liberal.ola.org
;rmarcheseco@ndp.on.ca ;gerry.martiniuk@pc.ola.org
;dmatthews.mpp.co@liberal.ola.org;bmauro.;pp.co@liberal.ola.org
;dmcguinty.mpp.co@liberal.ola.org
;tmcmeekin.mpp.co@liberal.ola.org;pmcneely.mpp@liberal.ola.org
;mmeilleur.mpp.co@liberal.ola.org;norm.millerco@pc.ola.org;pmillerqp@ndp.on.ca;
jmilloy.mpp@liberal.ola.org;cmitchell.mpp@liberal.ola.org;rmoridi.mpp@liberal.ola.
org ;julia.munro@pc.ola.org ;bill.murdoch@pc.ola.org ;ynaqvi.mpp@liberal.ola.org
;john.otooleco@pc.ola.org;dorazietti.mpp@liberal.ola.org;jerry.ouellette@pc.ola.org
;lpendergast.mpp@liberal.ola.org ;speters.mpp@liberal.ola.org
;gphillips.mpp@liberal.ola.org ;mprueqp@ndp.on.ca
;spupatello.mpp@liberal.ola.org
;sqaadri.mpp@liberal.ola.org;kramal.mpp@liberal.ola.org
;dramsay.mpp@liberal.ola.org;lrinaldi.mpp@liberal.ola.org
;bob.runciman@pc.ola.org ;truprecht.mpp@liberal.ola.org
;lsandals.mpp@liberal.ola.org;joyce.savoline@pc.ola.org;laurie.scott@pc.ola.org
;msergio.mpp@liberal.ola.org;peter.shurman@pc.ola.org
;msmith.mpp.co@liberal.ola.org;gsmitherman.mpp@liberal.ola.org
;gsorbara.mpp.co@liberal.ola.org;csousa.mpp@liberal.ola.org
;norm.sterling@pc.ola.org ;tabunspqp@ndp.on.ca;htakhar.mpp@liberal.ola.org
;mvanbommel.mpp.co@liberal.ola.org;jwatson.mpp@liberal.ola.org
;jwilkinson.mpp.co@liberal.ola.org
;jim.wilson@pc.ola.org;elizabeth.witmer@pc.ola.org;kwynne.mpp@liberal.ola.org
;john.yakabuski@pc.ola.org ;dzimmer.mpp@liberal.ola.org

To contact your own MPP:
http://www.ontla.on.ca/web/members/member_addresses.do?AddType=QP&locale=en

You can also express your concerns to the Council of the Municipality of Arran-Elderslie: areld@bmts.com and to the Bruce County Council: warden@brucecounty.on.ca, The Minister of the Environment: The Hon. John Gerretsen http://www.ene.gov.on.ca/forms/email-form.php?replyRequested=y The Minister of Energy: The Hon. George Smitherman http://www.energy.gov.on.ca/index.cfm?fuseaction=about.contact The Minister of Natural Resources: The Hon. Donna Cansfield http://www.mnr.gov.on.ca/en/About/2ColumnSubPage/STEL02_197053.html And the Premier of the Province of Ontario, The Hon. Dalton McGuinty dmcguinty.mpp.co@liberal.ola.org

IF YOU ARE A MEMBER OF A NATURE, CONSERVATION OR WILDLIFE ORGANIZATION:

Please contact the executive of your organization and ask them what they are doing about this critical threat. Get this issue at the top of the agenda; send this report to friends and like-minded conservationists. Get them to send the message out to their friends and relatives. Together we *can* make a difference for our children and grandchildren.

INFORMATION FOR POLITICIANS

- As an elected representative of the people of Ontario, you have the responsibility under the *Migratory Birds Convention Act*, 1994, to protect the habitat of migratory bird stopovers and staging areas. It is also obligatory that you exercise due diligence to implement the Natural Heritage component of the Provincial Policy Statement and there are further responsibilities incumbent upon you under the Fish and Wildlife Conservation Act and the Endangered Species Act. This is a legal obligation to protect the environmental assets of Ontario for all of society.

- **These statutes and policies have been laid down with the prudence of previous generations in the belief that they would always be respected. It is clear from the research cited in this document that the development of the wind turbine industry in the vicinity of sensitive natural habitats in Ontario would have a detrimental effect upon the functioning of those natural heritage systems. Sustainability of ecosystems must be safeguarded.**

- Until now, an unsuspecting public has assumed that government was working to protect our natural heritage while, in fact, responsibility for preparing environmental studies for wind turbine developments has been put into the hands of the wind turbine industry which recently boasted that they had never failed an environmental assessment. This is akin to the cats making good laws for the cats but not for the mice. We in mouseland have already seen how the self-regulation of the meat industry has worked out with regard to the recent Listeria outbreak. As our elected representatives, you have been assigned the responsibility for making decisions on renewable energy that will affect future generations. It is important that you to have access to all the information, not just what is presented to you by the wind industry. Case study points out the necessity of **balancing all competing voices** and interests in land-energy development needs, **including protecting habitat integrity.**

- Already experts in Europe are questioning the economic feasibility of commercial wind energy as well as its supposed benign effect on the environment. **The question has to be asked: are you going to get out of wind energy as much as you have to spend on it, especially if thoughtless siting is going to destroy important parts of our ecosystem?** Our concern about carbon emissions has to be realistic—that is, emissions required for back-up support of wind energy also have to be calculated. This means not only the already high cost of the wind power per kW hr but also the cost of all other subsidies coming out of our taxes including tax breaks to wind power developers, the added cost of building and running back-up fossil fuel plants, the cost of new transmission lines, and above all, the long term cost of serious and irreparable damage to our

ecosystem and to our tourism industry when wind turbine developments are sited in the vicinity of natural heritage systems and migratory flyways.

- We are calling upon you to make decisions which will protect the sustainability of these ecosystems for future generations. There is an urgent need for your action on this issue. With proper planning, mistakes that have already been made in other countries can be avoided. Once the damage has been done, it cannot be reversed. Province-wide planning measures to protect these valuable assets must be put in place at once.

- If you are a member of a municipal or county council, you should make sure your council has a wind turbine policy in place and that it provides for the exclusion of industrial wind turbines from areas of ecological importance such as those surrounding wetlands and ANSIs. You can refer to the document produced by the Municipality of Grey Highlands at: http://www.greyhighlands.ca/files/departmentdocs/Renewable%20Energy%20OPA%2010.pdf

You will also want to look at the documents included in the next section, Information for the MEDIA.

INFORMATION FOR THE MEDIA

The often unforeseen negative effects of wind turbine developments have been under-reported by the media. Already in Ontario, the threat to the health of human beings is beginning to emerge. Only a few reporters have taken the time to dig more deeply into the economic implications and not much has been reported on the environmental footprint. Here is a list of web-based documents which can help you research this important topic.

Further information is also available from the provincial organization

WIND CONCERNS ONTARIO at:

Website: http://windconcernsontario.org

Email: windconcerns@gmail.com

1. *Calculating the Real Cost of Industrial Wind Power: An Information Update for Ontario Electricity Consumers.* 2007. http://www.windaction.org/documents/14007

Energy experts report **that industrial wind power is proving to be exceptionally expensive to consumers once required backup and additional infrastructure are factored in.** The high cost is caused by (a) the need to maintain backup generating

reserve to cover times when the wind does not blow. (b) The need to stabilize the grid when wind produces power that is not needed by current demand. (c) Government subsidization and tax benefits for the wind industry.

U.K energy expert David White BSc, C Eng, F I Chem E writes:

"The assessment of the national emissions benefit . . . has to be based on the extent to which wind generated power can displace conventionally generated power from the total electricity supply system *on a minute by minute basis*…. **any calculation of the CO2 emissions reduction from wind must take into account the quantity of conventional generating capacity that has to be retained in varying states of readiness while the wind-generated power is taken into the grid"**.

The German Electricity generating Authority E-OnNetz report of 2004:

"The massive increase in construction of new wind power plants in recent years has greatly increased the need for wind-related reserve capacity (conventional generation). This new generation would be apart from firm generation necessary to meet expectations of increased demand, and **installed at 90 percent of the nameplate capacity of aggregate wind plant, using more conventional fuels in the process, producing copious carbon emissions as much or more than if wind facilities had never existed."**

The Ireland Electricity Supply Board National Grid (ESB) stresses the consequential cost-effects of wind generation and their assessment in meeting the EU target will entail a 15% increase in electricity cost.

In Denmark which has one of the world's highest concentrations of wind turbines, 80% of the wind energy that is produced has to be sold to Denmark's neighbours Norway and Sweden at a price far below the cost of production in order to stabilize the grid. **Denmark has the highest consumer electricity charges in Europe. Danish households already pay 100% more for their electricity than other European consumers**.

The Tallinn report presented by the Tallinn Technical University of Estonia at the International Energy Workshop at Laxenburg, Austria in 2003 concludes:

"Participation of thermal power plants in the compensation of fluctuating production of windmills eliminates the major part of the expected positive effect of wind energy. . . . It seems reasonable to ask why wind-power is the beneficiary of such extensive support if it not only fails to achieve the CO2 reductions required, but also causes cost increases in backup, maintenance and transmission, while at the same time discouraging investment in clean, firm generation capacity".

Robert M. MacIntosh, past president of the Canadian Bankers Association said in 'Overblown Wind', in the *Financial Post* 10/21/05:

"It's time for reality to replace ideology in energy policy".

2. *Less for More: The Rube Goldberg Nature of Industrial Wind Development*. Jon Boone: December 22, 2006. http://www.windaction.org/documents/7013

"Functionally, wind turbines produce little energy relative to demand and what little they do produce is incompatible with the standards of reliability and cost characteristic of our electricity system. Moreover, wind plants are unable either to mitigate the need for additional conventional power generation in the face of increased demand or to reliably augment power during times of peak demand. Ironically, as more wind installations are added, almost equal conventional power generation must also be brought on line. ***Crucially important, however, wind technology, because of the inherently random variations of the wind, will not reduce meaningful levels of greenhouse gases such as carbon dioxide produced from fossil-fueled generation, which is its raison d`etre".***

3. *Wind Forecast Error Impacts on Efficiency*. Hok Ng. IESO (Independent Electricity System Operator): 2008. http://www.ieso.ca/imoweb/pubs/consult/windpower/wpsc 20080514-Item3.pdf

This short presentation summarizes the increasing cost to Ontario electricity consumers from the inefficiency caused by adding unpredictable wind energy to the grid. "If we assume that the forecast error percentages remain the same in 2009 we could expect the annual costs of inefficiencies to increase –Due to over forecast: $866K –Due to under forecast: $37K"

4. *The Renewables Obligation, and Climate Change Levy*. John Constable and Robert Barfoot, published by the Renewable Energy Foundation, London, England. http://www.ref.org.uk/PublicationDetails/43

The U.K. Telegram summarized this report on 14 September 2008: "Wind farms are failing to deliver value for money and distorting the development of other renewable energy sources, [the] report claims. Excessive subsidies make them an expensive and inefficient way of reducing greenhouse gas emissions, a study by the Renewable Energy Foundation (REF) think-tank says. The industry admits that for up to 30 per cent of the time, turbines are idle because wind speeds are either too low to turn the blades, or too high, risking damage to the machines. The report says that wind farms are unprofitable and rely on hefty subsidies that ultimately come from consumers in the form of rising energy prices. This cost comes on top of increases in gas and electricity prices caused by the high price of oil. They risk leaving the poorest members of society struggling to heat their homes."

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5. *False Wind Industry Claims about the Integration in Electric Grids of the Intermittent, Volatile & Unreliable Electricity from Wind Turbines*. Glenn Schleede, (former Vice President of the New England Electric System). http://www.windaction.org/documents/4710

"Wind turbines have little if any real 'capacity value,' the measure of the generating capacity that can really be counted on when needed to meet customers' demands,

particularly when electricity demand is at peak levels. . . . Wind turbines do not provide significant amounts of electricity during periods of peak electricity demand. The practical implication of this is that areas with growing peak electricity demand will need to add reliable, dispatchable generating capacity even if they already have built wind turbines. Arbitrarily high "capacity values" assigned to "wind farms" by some grid managers or regulators are, in effect, an added subsidy at the expense of electric customers."

6. ***Noise Radiation from Wind Turbines Installed Near Homes: Effects on Health.***
Barbara Frey, BA, MA, and Peter Hadden, BSc, FRICS
http://www.ecwag.org/PDF/Research/Noise/Noise%20Radiation%20from%20Wind%20Turbines%20Installed%20Near%20Homes%20-%20Effects%20on%20Health.pdf

In 2006, the French National Academy of Medicine issued a report that concludes:

"The harmful effects of sound related to wind turbines are insufficiently assessed. . . The sounds emitted by the blades being low frequency, which therefore travel easily and vary according to the wind, . . . constitute a permanent risk for the people exposed to them.. . . The Academy recommends halting wind turbine construction closer than 1.5 km from residences".

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Appendix 2: Additional information on threatened species:

Least Bittern:

been **This is a National Species of Special Concern**.[60] It is also one of the level one priority species for conservation in Bruce County. Researchers believe that this population is still in decline, because the habitats it requires are still being assaulted by developmental and agricultural interests. The

[60] Sandilands, A.P. and C.A. Campbell. 1988. Status Report on the Least Bittern, *Ixobrychus exilis*. COSEWIC. 40 pp. Austen, M.J., M.D. Cadman and R.D. James. 1994. Ontario Birds at Risk: Status and Conservation Needs. Federation of Ontario Naturalists and Long Point Bird Observatory, Ontario. 165 pp.

Natural Heritage Information Centre rates the Least Bittern as S3 (rare or uncommon). The Arran Lake Wetlands provide its preferred habitat: "Least Bitterns nest in freshwater marshes, with dense tall aquatic vegetation, interspersed with clumps of woody vegetation and open water. They are most regular in marshes that exceed 5 ha in area. Smaller marshes may be used on occasion, but do not sustain populations. In the northern part of their range they are most strongly associated with cattails (*Typha*), which is the most common tall emergent (Gibbs *et al.* 1992), but they may also nest in bulrush (*Scirpus*), reed grass (*Phragmites*), horse tail (*Equisetum*), sedges (*Carex*), grasses (*Graminaceae*), Willows (*Salix*), and dogwood (*Cornus*) (Peck and James 1983)".[61] The Arran Lake Wetlands provide all of these plants in abundance.

"Destruction of wetland habitat is the greatest single threat to Least Bitterns (Gibbs *et al.* 1992). More than 90% of the original marshes in south-western Ontario are now gone (Snell 1978).

"Because Least Bitterns tend to fly very low, collisions with cars, fences, and **transmission lines are a threat to mortality**. (Gibbs *et al.* 1992). **If development is allowed through or too close to wetlands, the habitat is obviously degraded for the bitterns.** The clear perception among field observers is that the Least Bittern population in Canada is still declining. There has an obvious loss of numbers in some Great Lakes marshes." [62]

Red Shouldered Hawk:

"This species is protected by provincial game and fish legislation. It was classified as **Special Concern by COSEWIC in 1996**. In Ontario, Red-shouldered Hawks are classified as **Special Concern** by the Ontario Ministry of Natural Resources. Active nests are also afforded protection under the Fish and Wildlife Conservation Act (1997), and **the species is a Specially Protected Raptor under the Fish and Wildlife Conservation Act."**[63]

"The Red-shouldered Hawk is considered an indicator species of sustainable forest management because it is an area sensitive species that requires mature forest habitat (McLaren *et al*. 1998). Red-shouldered Hawks are also top predators, which means that they may be potentially valuable as indicators of environmental health".[64]

"The main threat to the species is habitat loss and degradation, which is likely to be most serious in the southern parts of its Canadian range".[65]

The breeding habitat of the Red-shouldered Hawk includes "bottomland hardwood, riparian areas, flooded deciduous swamps and upland mixed deciduous/coniferous forest**. Nearby wetlands or other aquatic areas are essential. This species is area sensitive,** preferring extensive forest stands consisting **of mature to old-growth canopy trees** with variable amounts of under story. Large, contiguous forest tracts are essential to sustain breeding populations of this species".[66]

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[61] *Ibid.*

[62] *Ibid.*

[63] http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=58#habitat

[64] *Ibid*.

[65] *Ibid*.

[66] COSEWIC 2006. COSEWIC assessment and update status report on the Red-shouldered Hawk *Buteo lineatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 27 pp. http://www.sararegistry.gc.ca/status/status_e.cfm
Previous reports:
Kirk, David A. 1996. Update COSEWIC status report on the Red-Shouldered Hawk *Buteo lineatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. 1-11 pp.
Risley, Christopher J. 1983. COSEWIC status report on the Red-Shouldered Hawk *Buteo lineatus* in Canada. Committee on the Status of Endangered Wildlife in Canada. 1-71 pp.

"The most serious threats facing Red-shouldered Hawks in the southern portion of their Canadian range (i.e. south of the Canadian Shield) **include habitat loss, and fragmentation or degradation of favoured deciduous forest breeding areas and wetland feeding areas (Helferty *et al*. 2002). Loss of wetland habitats also negatively affects this species through the disappearance of preferred prey (i.e. amphibians, snakes).** Campbell (1975) suggested that Red-shouldered Hawk pairs with lower access to reptile or amphibians might have lower reproductive success".[67]

"Loss and fragmentation of habitat also have indirect effects, including reduction in prey supply and increased interspecific competition".[68]

"Many Red-shouldered Hawks will avoid areas of human use (Helferty *et al*. 2002). For example, human disturbance (from ATVs, . . . etc.) has pushed this species into the more remote wilderness areas".

The risks for this bird would be multiple: first there is the usual raptor collision mortality risk from wind turbines placed on the drumlin ridges and multiple transmission lines imposed upon the surrounding countryside. This species would also suffer from habitat fragmentation and disturbance. ATVs are regularly used in servicing wind turbine installations including the met towers already installed on this site. However, the noise disturbance and earth transmitted vibrations from the turbines themselves would certainly have a disturbing effect on its prey: vibration-sensitive species such as snakes and frogs which use the uplands during part of their life cycle. As well, the drying out of soil including upland ponds and swales, could eventually lead to loss of habitat for the reptile and amphibian prey of this bird.

King Rail:

Scattered breeding season reports come from a number of other places in southern Ontario as far north as the Bruce Peninsula.

"King Rails can occupy a variety of freshwater marshes and successional marsh shrub swamp habitats (Meanly 1992). In wetter areas **wild rice** seems to be important (Cosens 1985). What is probably most important are **large marshes with more open shallow water areas merging with shrubby areas** (McCracken and Sutherland 1987). Minimum size requirements are unknown (Brown and Dinsmore 1986), but, only where there are large expanses of marsh, not overgrown with cattails, do birds return in successive years, and persist over time in Ontario".[69]

Arran Lake provides one of the best of the only remaining 10% of the original pre-European settlement marshes left in southwestern Ontario. The presence of wild rice and open shallow water that merges with shrubby areas as well as the large extent of the wetland complex make it one of the few habitats suitable for this declining species.

Great Egret

The Chantry Island inventory states: "In 1991, surveys revealed six nests of Great Egret, which represents approximately 3% of the Canadian population".[70] However, by 2007, the number of Great

[67] *Ibid*.

[68] *Ibid*.

[69] *Ibid.*

[70] Bird Studies Canada; IBA site listing for Chantry Island On 154. http://www.bsc-eoc.org/iba/site.jsp?siteID=ON154

Egret nests on the island had increased to 54, a considerable increase in national population percentage. [71]

Black Tern

The relatively large size of the Arran Lake wetland complex makes it attractive to the Black Tern. According to the MNR data, it generally requires permanent marshes that are at least 50 ha. Black Terns have disappeared from many marshes that have been reduced much below this threshold. "Several species of **marsh birds are 'area sensitive,' requiring large tracts of habitat in order to successfully reproduce.** The Black Tern is moderately **area-sensitive**." [72]

"Recent declines have been occurring since the 1980's. **The Black Tern has seriously declined throughout its range.** A recent analysis of Breeding Bird Survey data showed that **the population has been declining by an average rate of 4.7% per year since 1966. Over the span of just 30 years, this translates to an overall loss of about 75% of the population!** This species is clearly in serious trouble.

"The decline might be more directly connected to habitat loss due to development pressures. The future of the Black Tern is quite uncertain. It is already considered endangered in New York, Pennsylvania and Ohio, threatened in Ontario, and a species of special concern in Michigan''.[73]

Black-crowned night heron:

"As its name implies, this stocky, short-legged heron is active at night. About sunset and in the gathering dusk it makes its steady way on broad wings to its feeding marshes. It feeds largely on fishes, but also eats frogs and small rodents". The Arran wetland and surrounding uplands are one of its most important feeding resources.

Short-eared Owl

This **bird prefers "extensive stretches of relatively open habitat. It is primarily a bird of marshland and deep grass fields**. It likes to hunt and roost in **abandoned pastures, fields, hay meadows, grain stubble, and marshes** in the winter. Nests are usually slight depressions in the ground. In Ontario, some nests are cups of dried weeds or flattened grasses."[74]

Spotted Turtle:

The Arran Lake Wetlands are an ideal habitat for the Spotted Turtle which occurs in high organic content wetlands including acidic bogs and alkaline fens in the Eastern Deciduous/Great Lakes forest region. The species prefers unpolluted shallow waters of ponds, bogs, fens, marshes, ditches, vernal pools, woodland streams, sedge meadows and the sheltered edges of shallow bays (Ernst et al. 1994; Haxton and Berrill 1999; Litzgus and Brooks 2000).

It also represents one of those species that moves from the wetlands area to the surrounding uplands during part of its seasonal cycle.

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[71] Cindy Cartwright, *Chantry Island Bird Survey*, June 8 2004. http://www.chantryisland.com/birds_of_chantry_island.htm

[72] Ibid.

[73] Ibid.

[74] http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=60

"Spotted Turtles use a mosaic of habitat types, display distinct seasonal shifts in habitat use (Haxton and Berrill 1999; Litzgus and Brooks 2000), and require terrestrial habitats during certain times of their seasonal activity cycle. Nesting occurs in terrestrial sites in areas exposed to full sunlight. In some populations, excursions are made to terrestrial habitats for summer dormancy (Graham 1995; Perillo 1997; Litzgus and Brooks 2000)".[75]

Habitat loss, destruction, and fragmentation have been implicated in the decline of Spotted Turtle populations throughout their range[76]. Human-altered landscapes have reduced the quantity and quality of Spotted Turtle habitats. Spotted Turtles have a relatively low reproductive output.

"The total population trend for Canada is declining; NHIC records indicate a 35% decline (see Technical Summary). This value is likely an underestimate given that most of the NHIC data were collected in the past 30-40 years, and that the average age of breeders is over 25 years, and thus 3 generations requires more than 75 years. This extended generation time exacerbates declines resulting from collection of adults for the pet trade. The species appears to remain abundant in only a few localized pockets in Ontario**, but with the increasing disappearance of wetlands in southern Ontario, further decline in Spotted Turtle populations is inevitable. (Oldham 1991)".**

Turtles in this group may be more susceptible than other turtle species to the current level of habitat modification occurring throughout eastern North America (Oldham 1991). Reasons for decline in Spotted Turtles include over collection for the pet trade, **habitat destruction and fragmentation,** and road mortality. [77]

Eastern Milk Snake

This species has been designated because of characteristics that make it particularly sensitive to human activities.[78] The snake is susceptible to the effects of human encroachment as well as habitat loss. Many Milk snakes have been killed by vehicular traffic ("road-kill") or by agricultural machinery.

Milksnakes are especially affected by habitat loss and modification.

Special significance of the species: The Eastern Milksnake is the only subspecies of Milksnake found in Canada. The snake's presence in barns and stables has proven to be **beneficial, as the snake helps to control rodent populations** (its prey).[79]

This species has been observed annually in the vicinity of the proposed wind turbine site at Arran Lake. Its preferred habitat includes farm fields, hayfields, pastures, swamp and open woodlot. Two other important features make this area ideal Milksnake habitat: the proximity to water, in this case Arran Lake and the wetlands, and suitable locations for basking and egg-laying.

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[75] ROM Litzgus 2004; Oldham 1991; Cook 1984 http://www.rom.on.ca/ontario/risk.php?doc_type=fact&id=96

[76] Lovich 1989; Burke et al. 2000.

[77] ROM *op. cit*.

[78] COSEWIC 2002. COSEWIC assessment and status report on the milksnake *Lampropeltis triangulum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 29 pp. Fischer, L. 2002. COSEWIC status report on the milksnake Lampropeltis triangulum in Canada in COSEWIC assessment and status report on the milksnake Lampropeltis triangulum in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. 1-29 pp.

[79] *Ibid*.

Easter Ribbon Snake

There is little historical data in Ontario on abundance trends, but it is likely that the **reduction of wetland habitat** through urban and agricultural development resulted in a decrease in abundance in Ontario. Today it is widespread and locally common in parts of the Bruce Peninsula, Georgian Bay and eastern Ontario.[80]

Its presence at Arran Lake is explained by the fact that it is usually found close to water, especially in marshes where it hunts for frogs and small fish. At the onset of cold weather, individuals congregate in burrows or rock crevices on land to hibernate together in what is termed a "hibernaculum." [81]

Tuberous Indian-plantain

This plant is subject to recreational development and use but with some populations in protected areas. Status history Designated Special Concern in April 1988. Status re-examined and confirmed in April 1999 and in May 2002. Last assessment based on an existing update status report. The species is found at only 13 localities consisting of shoreline fens and riparian meadows. These plants prefer open sunny areas in wet, calcareous meadows or shoreline fens".[82]

Appendix 3: Bat species found at Arran Lake:

Northern Long-eared Bat *(Myotis septentrionalis)*[83]

Little Brown Bat *(Myotis lucifugus)* "Strictly an insect-eater, it catches its food on the wing, flying about through wooded areas or over fields, lakes and streams"[84]. The presence of this species at Arran Lake illustrates the importance of the range of habitat components within this natural habitat system since it makes use of forested areas, open fields and lakes and streams. Little Brown Bats are very efficient hunters sometimes catching ten to fifteen insects per minute by means of echolocation. **(They can consume 600 mosquitoes in a single hour).**"[85]

Eastern Small-footed Bat *(Myotis Leibii).* This is an **uncommon** bat, probably as a result of low survival rate and small litter.

Silver-haired Bat *(Lacionycteris noctivagans).* This is one of the three "tree bats" (along with the Red Bat and the Hoary Bat) at Arran Lake. **The natural habitat system at Arran Lake is particularly suited to this animal which inhabits wooded country and stands of trees in open country, near ponds streams and lakes**. It roosts in trees and forages over small bodies of water—sometimes close to the ground but also at or below tree top level. This is a **migratory species** and its slow flight makes it especially susceptible to wind turbine fatality. It flies south between mid-August and early October and returns about the middle of April to early summer.

[80] Text Sources: Smith 2000; MacCulloch 2002 Royal Ontario Museum http://www.rom.on.ca/ontario/risk.php?doc_type=fact&lang=&id=295

[81] Royal Ontario Museum and the Ontario Ministry of Natural Resources

[82] *Ibid.*

[83] *Handbook of Canadian Mammals 2: Bats.* C.G.van Zyll de Jong. National Museums of Canada, 1985.

[84] *Ibid.*

[85] *The Mammals of Eastern Canada.*Randolph L. Peterson. Toronto: Oxford University Press, 1966.

Red Bat *(Lasiurus borealis)* This bat is found in forests and in more open cultivated areas where shade trees are present. The proposed wind turbine site at Arran Lake is its ideal habitat. Another **migratory species**, it is also at risk of mortality from wind turbines during migration.

Hoary Bat *(Lasiurus cinereus)* This is also a tree bat that roosts in foliage near the end of branches, usually on the edge of clearings or fields, such as beside the proposed wind turbine sites at Arran Lake. This is **a migratory species** which arrives in Canada in May or early June. The fall migration takes place from mid-August to October. These bats are thought to winter in Southern United States and Mexico.

Big Brown Bat *(Eptesicus fuscus)* Found in wooded and semi-open habitats. It hibernates in old barns, attics, and tree cavities and feeds extensively on June beetles. This bat forages among and over the tops of trees at 7 to 10 m above the ground, putting it entirely within the range of the turbine blades. "As wind turbines continue to increase in height, bats that migrate or forage at higher altitudes may be at increased risk
(Barclay *et al*. 2007)".[86]

"Relatively small numbers of bat fatalities were reported at wind energy facilities in the US before 2001 (Johnson 2005), largely because most monitoring studies were designed to assess bird fatalities (Anderson *et al*. 1999). Thus, it is quite likely that bat fatalities were underestimated in previous research. Recent monitoring studies indicate that some utility-scale wind energy facilities have killed large numbers of bats (Kerns and Kerlinger 2004; Arnett 2005; Johnson 2005)".[87]

"It has been demonstrated that this species is capable of detecting relatively low-frequency sound, such as that produced by groups of insects, over a maximum distance of 600 m. Such long distance acoustic cues could help the bat locate concentrations of flying insects and thus supplement the shorter range high frequency echolocation."[88] It is likely that this subtle natural hunting adaptation becomes confusing or dysfunctional as a result of interference from the low frequency noise projected from industrial wind turbines.

> "Of the 45 species of bats found in North America, 11 have been identified in ground searches at wind energy facilities. Of these, nearly **75% were foliage-roosting, eastern red bats (*Lasiurus borealis*), hoary bats (*Lasiurus cinereus*), and tree cavity-dwelling silver-haired bats (*Lasionycteris noctivagans*), each of which migrate long distances.** Other bat species killed by wind turbines in the US include . . . the little brown bat (*Myotis lucifugus*), . . . northern long-eared myotis (*Myotis septentrionalis*), [and] big brown bat (*Eptesicus fuscus*). **A consistent theme in most of the monitoring studies conducted to date has been the predominance of migratory, tree-roosting species among the fatalities".** [89]

The *Maple Ridge Wind Power Avian and Bat Fatality Study Year One Report (Final Report)* dated June 25, 2007 by Aaftab Jain *et al*, Curry and Kerlinger, LLC[90] also confirms that all these species are especially susceptible to wind turbine mortality. **The study also indicates that fatalities are greater when the turbines are closer to wetlands.**

> "Remains of 326 bats were found by searchers during standardized surveys, representing five species (Hoary Bat, Silver-haired Bat, Eastern Red Bat, Little Brown Bat, and Big Brown Bat). **The greatest number of bat incidents occurred during the fall migration period,** with 228 (69.9%) bat carcasses found between July 1, 2006 and August 31, 2006.

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[86] MD Tuttle, Bat Conservation International www.frontiersinecology.org The Ecological Society of America
[87] *Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses.* Thomas H Kunz *et. al.*
[88] C.G.van Zyll de Jong, *op.cit.,* p.164.

[89] *Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses* Thomas H Kunz, Edward B Arnett, Wallace P Erickson, Alexander R Hoar, Gregory D Johnson, Ronald P Larkin, M Dale Strickland, Robert W Thresher, and Merlin D Tuttle.
[90] http://www.windaction.org/documents/8533

> Bat carcasses appeared to fall closer to turbine tower bases than bird carcasses**. Bat fatalities appeared to be slightly greater at turbines close to wetland areas** than at turbines located farther from wetlands".

Scientists do not yet understand why bats are particularly vulnerable to wind turbines. But anyone who has heard the invasive noise emitted by wind turbines (equivalent to constant jet roar or freight train rumbling) will have no difficulty in understanding that an animal species capable of homing in on the subtlest of frequencies emitted by flying insects is bound to be disorientated by this thundering industrial disturbance.[91]

Two very recent research papers suggest that the impact of wind turbines on this agriculturally important keystone species is more devastating than first understood.

In Current Biology, Volume 18, Issue 16, 26 August 2008, pages R695-R696, Erin F. Baerwald, Genevieve H. D'Amours, Brandon J. Klug, and Robert M.R. Barclay of the University of Calgary report the first evidence that barotrauma is the cause of death in a high proportion of bats found at wind energy facilities. They found that 90% of bat fatalities involved internal haemorrhaging consistent with barotrauma, and that direct contact with turbine blades only accounted for about half of the fatalities. Air pressure change at turbine blades is an undetectable hazard and helps explain high bat fatality rates. They suggest that one reason why there are fewer bird than bat fatalities is that the unique respiratory anatomy of birds is less susceptible to barotrauma than that of mammals.

Another report published in the Journal of Wildlife Management 72(1):61–78; 2008 warns of the severity of impact of wind turbines on bats:

> Based on estimates of installed capacity and the limitations and assumptions with respect to fatality rates, projected annual fatalities of bats in the Mid-Atlantic Highlands in the eastern United States could range from 33,017 to 61,935 (2,158-MW installed capacity) or from 58,997 to 110,667 (3,856-MW installed capacity) bats per year by 2020 in just this one region (National Research Council 2007). These projections, although hypothetical, should be of particular concern for species of migratory tree bats that experience the highest fatalities at wind energy facilities in North America.

North American bats consume half their weight in flying insects each night. All bats in Ontario feed on insects. (At one time health risks were associated with bats but histoplasmosis has never been found in Canadian bat colonies. Bats do occasionally get rabies, but less frequently than foxes or skunks). Today, with the introduction of the West Nile Virus carried by mosquitoes, they may have an even more important role to play in the protection of human health.

Dr. Gannon continues:

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[91] In *Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses.* Thomas H Kunz *et. al.speculate that:*

> "bats may become acoustically disoriented upon encountering these structures during migration or feeding. Bats may also be attracted to the ultrasonic noise produced by turbines
> (Schmidt and Jermann 1986). Observations using thermal infrared imaging of flight activity of bats at wind energy facilities suggest that they do fly (and feed) in close proximity to wind turbines (Ahlén 2003; Horn *et al*. 2007; Figure 3). What other factors might contribute to bat fatalities?
> Wind turbines are also known to produce complex electromagnetic fields in the vicinity of nacelles. Given that some bats have receptors that are sensitive to magnetic fields (Buchler and Wasilewski 1985; Holland *et al*. 2006), interference with perception in these receptors may increase the risk of being killed by rotating turbine blades. Bats flying in the vicinity of turbines may also become trapped in blade-tip vortices (Figure 4) and experience rapid decompression due to changes in atmospheric pressure as the turbine blades rotate downward. Some bats killed at wind turbines have shown no sign of external injury, but evidence of internal tissue damage is consistent with decompression (Dürr and Bach 2004; Hensen 2004). Additionally, some flying insects are reportedly attracted to the heat produced by nacelles (Ahlén 2003; Hensen 2004). Preliminary evidence suggests that bats are not attracted to the lighting attached to wind turbines (Arnett 2005; Kerlinger *et al*. 2006; Horn *et al*. in press). Bats foraging in the vicinity of wind turbines may miscalculate rotor velocity or fail to detect the large, rapidly moving turbine blades (Ahlén 2003; Bach and Rachmel 2004; Dürr and Bach 2004). Given the speed at which the tips of turbine blades rotate, even in relatively low-wind conditions, some bats may not be able to detect blades soon enough to avoid being struck as they navigate."

"The economic value of bats as a biological control agent for insects is estimated to be in the multi billions of dollars annually in the US alone.

"As such, they are considered to be ecological keystone species**.** . . . The keystone is the stone that bears the majority of the weight in an archway. If it is disturbed or removed, the archway collapses**. Bats are keystone species in our ecosystem. They play a vital role in maintaining it, and if disturbed or reduced, the ecosystem as we know it will collapse. However, bat populations are declining worldwide, mostly due to the actions of man.**

"As bats have a very low reproduction rate, where each female produces only one offspring or pup per year, any event that causes a population decline can take many years to recover from. Any event that repeatedly kills bats, year after year, in large numbers, can be devastating to a population. **The proliferation of numerous wind sites in this part of the country, most of which have or are being documented to have such an effect on bats, could be the most serious threat to our bat populations, our biological insect control, that science has seen.** The chances that a wind facility in this area will have a negative impact on our bat populations appears to be extremely high. Government Officials, with a responsibility of protecting our valuable natural resources, have a responsibility that before they allow construction of such a facility, they insure that the sites have been evaluated for their potential impact on bats and other wildlife. Just as the power companies evaluate it for wind, and place these facilities only in areas where there is sufficient wind blowing, **they need also to be evaluated for their environmental impact and sites that have a high potential to negatively impact wildlife should be avoided".**

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Appendix 4

Research Institute for Nature and Forest, Flanders. *Wind turbines and birds in Flanders (Belgium): Preliminary summary of the mortality research results*. Joris Everaert and Eckhart Kuijken, 2007.

These researchers conclude:

"Research results of individual wind farms can not be generalised. In general, the collision mortality is mostly related to the number of (flying) birds present (at rotor height). **Large modern turbines of 1500 kW or more can have as much or even more collision fatalities than smaller** turbines. However, more data on large wind turbines (>= 1500 kW) are urgently

needed.

“The average number of collision fatalities in different European wind farms on land varies between a few birds up to 64 birds per turbine per year. Also within one wind farm, the impact can strongly differ between individual turbines (Everaert et al. 2002; Everaert & Stienen 2006), clearly showing that **‘site selection’ can play an important role in limiting the number of collision fatalities. In Nasudden, Sweden, where 49 collided birds were found after one night with poor weather conditions.**

“General recommendations

“Study results clearly show that reasonable amounts of birds and bats can collide with wind turbines. **An exhaustive study before the selection of future locations is a key factor to avoid deleterious impacts of wind farms on birds and bats.**

Cumulative negative impacts with an increasing amount of wind turbines must be taken into account (Langston & Pullan 2003). This especially is developing along fixed bird migration corridors (coasts, mountain passes). More wind farms also means an extra pressure on top of the already existing sources of negative impact (powerlines, traffic etc.). A number of environmental impact assessments (EIA) have important shortcomings because of the lack of data and time or the use of incomplete data (e.g. not covering the annual cycle). It is very important that EIA's are made independently or are at least evaluated independently. When important factors remain unclear and an indication exists for an important negative impact, the precautionary principle must be applied. A constructive working method is to map potential and no-go locations for wind energy in a certain country or region, based on all available information, long before concrete projects are planned.

“Following the article 6(4) of the European Habitats Directive, it is clear that if a wind farm could have an important negative impact on wildlife, landscape, etc., the obligation exists to look for alternatives first. In most cases there will always be less vulnerable locations or other alternatives for wind farms.”

Web link: http://www.semantise.com/~lewiswindfarms/Download%...
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everaert_kuijken_2007_preliminary_b.pdf (119.38 kB) *FROM* HTTP://WWW.WINDACTION.ORG/DOCUMENTS/11725