Appendix C9

Bat Report

BAT REPORT

WOLFE ISLAND WIND PROJECT

TECHNICAL APPENDIX C9

File No. 160960180

Stantec

Prepared for:

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BAT REPORT

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1.0 Introduction

1.1 STUDY AREA

Canadian Hydro Developers, Inc., through its wholly owned subsidiary Canadian Renewable Energy Corporation ("CREC"), is proposing to develop a 197.8 megawatt ("MW") wind plant on Wolfe Island, Township of Frontenac Islands, Frontenac County, Province of Ontario. Eighty-six 2.3 MW wind turbine generators will be placed strategically over the western portion of Wolfe Island (the "Project").

Electricity from the Project will be gathered via a 34.5 kilovolt ("kV") collection system, converted to 230 kV at a new transformer station on Wolfe Island, and then transmitted via a new submarine cable that will run underwater through a portion of the St. Lawrence River, known locally as the "Lower Gap". Upon reaching the mainland, the transmission line will continue underground, connecting with the provincial grid at Hydro One Network Inc.'s Gardiners Transformer Station in the City of Kingston. The study area for the Project is shown in **Figure 1.1 (Appendix A)**.

As part of the Ontario Ministry of the Environment's ("MOE") Environmental Screening Process ("ESP") for electricity projects (i.e., Ontario Regulation 116/01), Stantec Consulting Ltd. ("Stantec") undertook a review of background information and conducted autumn bat surveys to assess the presence and relative abundance of bats within the study area. These surveys were carried out to help establish the environmental baseline conditions that exist prior to Project implementation.

This report, in part, also presents information relevant to item 4.4 of the MOE's environmental screening checklist, which states: *Will the project have negative effects on wildlife habitat, populations, corridors or movement?*

1.2 BACKGROUND

1.2.1 Mortality Risk for Bats

Bat mortality in relation to wind turbines varies considerably by geographic location and species (United States Government Accountability Office ["GAO"], 2005). For example, wind turbines in forested landscapes, particularly those on forested ridges such as high-profile sites in the Appalachian Mountains of West Virginia, tend to have significantly higher bat mortality rates than turbines placed in open areas.

Johnson (2004, cited in Ontario Ministry of Natural Resources ["MNR"], 2006) reported an average of 3.4 bat fatalities per turbine per year throughout the United States, which ranged from 0 to 4.3 bats per turbine per year in western states, up to 38 bats per turbine in six weeks in the Appalachians (MNR, 2006). Experts agreed that this research has not shown "alarming" numbers of bat kills at most facilities (GAO, 2005). However, habitat, and specifically forested ridges such as those present at the Appalachian facilities, appear to be an important factor in elevated bat mortality risk (Arnett et al., 2005).

Based upon a review of completed studies, most of the bat fatalities occur during their migratory season (GAO, 2005; MNR, 2006). Johnson (2004, as cited by MNR, 2006) indicated that over 90% of bat fatalities occur between mid-July and the end of September across the United States. Therefore, bat species that display migratory behaviour are at higher risk than resident species.

A review of bat mortality at wind plants in the United States found that over 80% of fatalities were of long distance migratory species, specifically silver-haired bat, hoary bat, and red bat (Johnson, 2005). Other bat species that migrate shorter distances to hibernaculae (including eastern small-footed bat, little brown bat, northern long-eared bat, and eastern pipistrelle) and the big brown bat, which may hibernate locally in buildings, had lower risk of collision.

1.2.2 Bat Activity

Natural Resources Canada, along with four independent wind plant operators[1], supported a research initiative with EchoTrack Inc. (2005) to study nighttime bird and bat activity during the autumn of 2004 at six existing wind plants in Alberta. The study also included evaluations at six control sites that were similar in topography and land-use to the plant sites, but without wind turbines. Using radar and sound recording technology, the study identified and tracked the movement of birds and bats at these sites, identifying the species of some individuals.

Three nights of monitoring were undertaken at each of the twelve sites, yielding more than one million identified flight tracks. The recorded high was nearly 375,000 bird and bat flight tracks at the most active site, and just under 15,000 flight tracks at the least active site. The most frequent flight times (primarily attributable to bird activity) were between one and two hours after dusk, gradually tapering off through the remainder of the night. At some, but not all, sites a second peak of activity (primarily attributable to bird activity) was observed at dawn.

This research indicated that bats were noted during the radar and sound monitoring mainly near ridges, especially near treed areas or buildings that would provide roosting and foraging habitat for the animals. The research also showed that most of the activity noted during the middle of the night (i.e., four and six hours after dusk) were bats and most of the activity at or just after dusk and again at dawn were birds. The number of birds or bats observed at sites did not differ between those with turbines and those without, but birds were heard to call more frequently at turbine sites compared to sites without turbines.

[1] Canadian Hydro was one of the four participating operators.

The nightly pattern indicates that birds and bats may be at greatest risk of colliding with turbines at dusk for two hours, in the middle of the night (four to six hours after dusk), and for the two hours just before dawn. However, for there to be a risk, birds and bats must fly at turbine height (i.e., within the sweep area) and many do not. Nearly 96% of recorded flights at sites with turbines and 86% of recorded flights at control sites were higher than 100 m.

The research also concluded that reduced visibility had no effect on the altitude of avian flight. No significant differences in flight speed or minimum flight height was detected between nights with good visibility and nights with poor visibility. This held true for both sites with turbines as well as control sites.

Over the study, a total of 49 collisions with the turbines were considered to have occurred, representing 0.02% of the total flights recorded. Of the 49 collisions, 45 were assumed to be bats and four appeared to be birds. The most common casualty was the little brown bat, while others included the northern long-eared bat, hoary bat, and silver-haired bat. The collisions occurred an hour after dusk, six hours after dusk, and at dawn.

A significant finding of this research was the observation that birds and bats appear to detect wind farms at night and take action to avoid the wind turbines, resulting in a very low proportion of collisions relative to the number of individuals (i.e., 0.02% collision rate). The radar studies showed many birds and bats increased their flight height and slowed their flight speed when they approached the wind turbines. Since no such behaviour was observed at the control sites, the research suggests that it was the presence of the turbines that led to this behaviour. By increasing altitude and flying well above the turbine blades, birds and bats avoided the wind turbines and effectively reduced the risk of collision.

1.2.3 Site Features Potentially Affecting Bat Activity

Under the authority of the *Fish and Wildlife Conservation Act*, the MNR is responsible for the protection of bat species, which are listed as “specially protected mammals” (MNR, 2006). The MNR has recently prepared a Developmental Working Draft entitled Guideline to Assist in the Review of Wind Power Proposals – Potential Impacts to Bats and Bat Habitat (MNR, August 2007) regarding data requirements and survey protocols for bats at proposed wind plant locations, however, the protocol was not publicly available during the 2005 and 2006 field seasons.

As discussed in Section 1.2.1 above, bats appear to have a higher risk of mortality at wind turbines in the forested Appalachian ridges, but little is known about the factors that may contribute to mortality risk in other landscapes such as the more open and agricultural spaces of southern Ontario. Site features that are expected to be related to increased bat use include significant hibernaculae, significant maternity roosts, and proximity to large linear landscape features (e.g., ridges, escarpments, and shorelines).

The MNR's Significant Wildlife Habitat Technical Guide (MNR, 2000) defines significant hibernaculae and maternity roosts relative to the species and the number of individuals present. The first two site features listed above relate to resident bats, whereas the third feature is relevant for migratory bats which research indicates may be at greater risk of mortality from wind turbines.

2.0 Methods

2.1 BACKGROUND DATA REVIEW

2.1.1 Bat Distribution in Ontario

Very little is known regarding the pathways and behaviour of migratory bats (GAO, 2005; MNR, 2007), although the EchoTrack study (2005) has provided some information in this regard. **Table 2.1 (Appendix B)** lists the eight species of bats likely to occur in southern Ontario, along with their population status, call information, and migratory behaviour and timing.

None of the species are designated as species at risk by the Committee on the Status of Wildlife in Canada ("COSEWIC") or the Committee on the Status of Species at Risk in Ontario ("COSSARO"). One species, the small-footed bat, is considered vulnerable to imperilled in Ontario (S2S3) by the Natural Heritage Information Centre ("NHIC"), and two species, northern long-eared bat and eastern pipistrelle, are considered vulnerable (S3?, where the question mark indicates uncertainty as to their ranks).

The big brown bat is sedentary and overwinters locally. The eastern small-footed bat, little brown bat, northern long-eared bat, and eastern pipistrelle are resident species that migrate, sometimes over many kilometres, to hibernaculae (MNR, 2006). Three species, the silver-haired, red, and hoary bats migrate longer distances and it is thought they leave Ontario in the winter (MNR, 2006). Autumn migration periods for these species in Canada are generally from mid- to late August through October (van Zyll de Jong, 1985), although other studies have found that the peak of migration can start as early as mid-July (Johnson, 2005, MNR, 2006).

2.1.2 Potential Bat Use on Wolfe Island

No known significant hibernaculae or roosts in the vicinity of the study area were identified in correspondence from the MNR. Most species that hibernate in Ontario rely on caves and mines, which are relatively warm and humid, for overwintering (MNR, 2006). The big brown bat also may overwinter in buildings or rock crevices (MNR, 2006). Additionally, other species may use buildings, rock slabs, tree cavities, loose bark, foliage, and snags for roosting.

The potential for bat hibernaculae in the study area was assessed in consultation with the Ontario Ministry of Northern Development and Mines ("MNDM") and by examining geological mapping (Kingston et al., 1985) to determine if karst caves or fissures in the limestone bedrock are likely to occur. Habitat types and abundance were reviewed to determine the location of potential hibernaculae and swarming sites.

2.2 SURVEY METHODOLOGY

Bat surveys were conducted in the fall of 2005 and 2006. The purpose of the surveys was to assess the presence, species, and relative abundance of bats on the western portion of Wolfe Island, which corresponds to the proposed location for the wind turbines. The timing of the surveys in September through to November was intended to capture both migratory and resident bat species, based on the migratory periods outlined by van Zyll de Jong (1985).

Surveys were conducted on the evenings of September 6 and 7, 2005, and September 5, 13, 19, and 26, October 3, 10, 17, and 24, and November 7, 20, and 28, 2006.

The 2005 surveys focused on areas of potential bat roosting habitat such as trees, buildings, and old barns, in order to gauge diversity and activity of bats leaving their roosting areas. Potential bat roosting habitat was identified during a daylight survey on September 6, 2005. Features such as woodlots, old barns, and other buildings were marked on a map and given a station number. A total of 30 stations were identified in areas on, or adjacent to, leased lands, twenty-eight of which were surveyed on both nights **(Figure 2.1, Appendix A)**. Two stations originally selected were not subsequently surveyed on September 7, 2005 due to inadequate habitat, and access denial from the landowner. A habitat description of each station is provided in **Table 2.2 (Appendix B)**.

Due to the small number of bats detected in 2005, a new set of stations were selected in 2006 to focus on areas where bats were expected to be foraging, such as wetlands, forest edges, and clearings as well as bright outdoor lights on barns or residences (which attract insect prey). Also, as recommended by MNR, the survey duration was lengthened from three minutes to ten minutes. Potential bat foraging habitat was identified during daylight hours. An effort was made to establish monitoring stations in each portion of the Island. In total, 10 stations were identified; a habitat description of each station is provided in **Table 2.3 (Appendix B)**. The locations of the 2006 monitoring stations were recorded using GPS and are illustrated in **Figure 2.2 (Appendix A)**.

The 2005 and 2006 surveys consisted of driving to each station and standing at the roadside, near the identified habitat, with a Pettersson Elektronik AB D200 ultra-sonic detector. All frequencies were scanned by slowly rolling up and then down the scale on the device (between ~10 and 115 kHz), for three minutes in 2005 and ten minutes in 2006 (as recommended by MNR). If a bat was detected, the frequency they emitted was recorded in order to help determine species. For bats that were visually observed, size and flight pattern were also used to distinguish species.

It should be noted that determining bat species using ultra-sonic detection can be imprecise, as the call frequencies of some bats closely overlap. However, ultra-sonic detection allows the surveyor to listen for and record the vocal emissions of bats, subsequently determining whether a bat is feeding or simply traveling through an area. Such detection also allows the bat group to be potentially identified.

Using ultra-sonic detection, four species/groups of bats can be distinguished with some confidence (Government of Alberta, 2005). The four identifiable groups are, each of which are common to southern Ontario:

- big brown bat (non-migratory) / silver-haired bat (migratory)
- hoary bat (migratory)
- eastern red bat (migratory)
- the *Myotis* species small-footed bat, little brown bat, and northern long-eared bat (non-migratory).

The rationale for identifying the above species/groups was to assist in determining the relative abundance of the migratory species. Recorded call frequencies were compared to the known frequency ranges of Ontario bat species (**Table 2.0, Appendix B**) and assigned to one of the species groups above.

The evening surveys began at dusk and concluded approximately three hours later, coinciding with a typical period of active feeding (EchoTrack, 2005, B. Fenton, pers. comm., January 23, 2007). Bat activity may vary throughout this three-hour window. Therefore, the order in which stations were visited differed from survey to survey, to ensure that each station was visited at a different period after dusk.

2.3 CONSULTATION WITH THE MNR

Bat surveys were conducted for the Project in the fall of 2005 and 2006. The autumn period was selected for survey due to the relevance of this time period to migrating bats. During these field seasons, the MNR did not provide any formal pre-construction monitoring protocols.

MNR comments regarding the 2005 survey work, dated April 5, 2006, were circulated to Stantec on August 28, 2006 (Appendix C). Although the preparation for survey work for 2006 was underway, the MNR comments were incorporated to the extent possible into protocols, with consideration to the time of year and guidance available.

A radar-acoustic survey is being conducted by EchoTrack in August, September and October 2007 to provide additional baseline data for bats and nocturnal migrant birds for the study area. Results will be provided under separate cover.

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3.0 Results

3.1 HABITAT

3.1.1 Hibernaculae

No known significant hibernaculae in the study area were identified in correspondence from the MNR. Although no natural caves or abandoned mines are known to occur on Wolfe Island, there is limestone bedrock underlying the study area with some potential for caves or fissures of solution origin. To better determine the potential existence of hibernaculae, Stantec examined the geology of Wolfe Island. The findings of this examination are described below.

A selective geological field investigation was undertaken in April 2004 to provide a basic understanding of the geology on Wolfe Island (Acres International, 2005). The investigation involved ten boreholes drilled to a depth of up to 7.72 m below ground level. Key findings from these investigations indicated that overburden exists over a large extent of the western half of Wolfe Island. This overburden consists mainly of firm glaciolacustrine varved clays. The maximum observed thickness of overburden was 6.26 m, but generally thickness ranged from 0.9 to 3.5 m. The investigation also indicated that the bedrock geology consists of limestone and interbedded limestone and shale. The limestone beds are consistently very strong, while the shale beds tend to be weak.

Correspondence with the MNDM indicated that on Wolfe Island there is potential to have karst caves or fissures at the juncture of the Bobcaygeon and Gull River Bedrock Formations, although no caves have been documented on the Island (F. Brunton, pers. comm., February 9, 2007). Both of these formations are of the Middle Ordovician Period. The Bobcaygeon Formation is composed of calcerenite and limestone, while the Gull River Bedrock Formation is composed of limestone and dolostone (Kingston et al., 1985).

The main contact between the Bobcaygeon Formation and the Gull River Formation runs in an east-west direction from Bayfield Bay to Boat Channel (Kingston et al., 1985) (**Figure 3.1, Appendix A**). Another contact is located on the northern tip of Simcoe Island. The greatest potential for solution-enhanced joints on Wolfe Island would be along these two contacts.

Finally, there is also potential for cave formation along a shoreline bluff on the Gull River Formation (Brunton, 2007). There is a potentially a long exposure of the Gull River Formation along the north shore of Wolfe Island, and a shorter potential for exposure along Button Bay in the south part of the Island (**Figure 3.1, Appendix A**).

Groundwater levels were also monitored on Wolfe Island during the April 2004 drilling program, using landowner water wells for livestock watering (Acres International, 2005). In all cases water was measured within 0.3 to 0.5 m of the ground surface. It was determined that the upper

1 to 2 m of bedrock is water-bearing and artesian. Due to the relatively low relief on Wolfe Island, any existing cave formations could be partly or entirely flooded, potentially reducing or eliminating their attractiveness to bats.

3.1.2 Roosting Habitat

No known significant roosts within the study area were identified in correspondence from the MNR or through field survey. Vegetation and habitat mapping of the study area is shown on **Figure 3.1 (Appendix A)**.

The vegetation communities of Wolfe Island have been significantly altered by anthropogenic activities, predominantly clearing and draining of land for agricultural purposes. Many of the fields are maintained as cropland, producing crops such as hay or winter wheat, with some areas of pasture and abandoned farmland. Small, scattered woodlots occasionally contained mature trees or large snags that may provide limited roosting or hibernating habitat. However, more habitat potential for resident bats is likely present in old barns, abandoned houses, and attics of older farmhouses. No cave or cliff habitat is known to occur on Wolfe Island.

3.1.3 Landscape-Scale Features

Wolfe Island is located at the junction of two major linear landscape features, the Lake Ontario shoreline and the St. Lawrence River. It is possible that migrating bats concentrate along shorelines or rivers in the same manner as migratory birds.

3.2 FIELD OBSERVATIONS

A total of 16 bats were recorded (7 in 2005 and 9 in 2006) during surveys conducted for the Project. The majority (11 of 16) were identified as big brown bat/silver-haired bat, the grouping that cannot be distinguished on call frequency alone. Detailed summaries of the observations are provided below.

3.2.1 2005 Results

Weather conditions during the surveys are summarized in **Table 3.1 (Appendix B)**. During the September 6, 2005 survey, two little brown bats were visually observed and detected with the ultra-sonic detector (42-49 kHz) at Station 3. At Stations 15 and 17 the detector picked up echolocations in the 30 kHz range, but no visual identification was possible. The vocalization of this bat consisted of chattering notes, rather than distinct separate notes. It can therefore be concluded that this was either a big brown bat or a silver-haired bat, but not the hoary bat, which emits a similar frequency but in distinct notes.

During the September 7, 2005 survey, a big brown bat (~31 kHz) was seen and detected at Station 17. Flight pattern and size of the mammal were indicative of the big brown bat, and not the hoary bat. At Station 24, a bat was detected at 90 kHz range. This frequency suggests either the northern long-eared or the red bat. At Station 28, a bat was detected in the 50 kHz range, which suggests the small-footed, little brown, northern long-eared, eastern pipistrelle, or red bat. No visual was obtained on this bat. The individual observations are summarized in **Table 3.2 (Appendix B)**.

3.2.2 2006 Results

Weather conditions of the surveys are summarized in **Table 3.1 (Appendix B)**. Through the season, bats were observed at only 5 of the 10 stations, including stations 2, 3, 6, 7, and 10. Station 6 a woodland edge station, had the most consistent observations (total of 3). Overall, observations appeared to be either big brown bats or silver-haired bats. The majority of the auditory observations were of very short duration, potentially of bats passing overhead. The individual observations are summarized in **Table 3.3 (Appendix B)**.

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4.0 Discussion

4.1 BAT USE OF THE STUDY AREA

The 2005 and 2006 surveys suggest a relatively small diversity of bat species are commonly found on Wolfe Island. The low diversity of species and overall low number of individual observations suggest that Wolfe Island, and more specifically the study area, does not experience high levels of bat activity. This could be partially explained by the rarity of wooded areas within the study area, as woodlands provide bats with appropriate roosting and foraging opportunities. This corresponds with Johnson (2005) who reported that the number of bat passes decrease as the distance to woodlands increased.

Several wetlands, which provide foraging habitat, are located within and adjacent to the study area. Several monitoring stations were located within these wetlands, including inlets of coastal marshes and inland marsh communities. The results of the field investigations suggest that overall, the level of bat activity in these wetland was very low. Station number 6 from the 2006 surveys had slightly higher activity than the other stations and was located within the Big Sandy Bay wetland, containing both open wetland and treed communities.

No MNR guidance documents for bat studies were available prior to the 2005 and 2006 surveys. Recently released published and unpublished information, as well as the results of this study, reveal some potential limitations of the surveys. The timing of the surveys (September-November) may have resulted in the undersampling of some species. Based on the timing of mortality at eastern US wind farms, it is possible that some species' peak migration in Ontario may occur in August or even the latter part of July. Additionally, the methods did not sample through the entire height of blade sweep, some 35-125 m above the ground. Although there is very little information as to the behaviour of bats during migration, it appears that many bats do not travel this high (EchoTrack, 2005).

4.2 POTENTIAL EFFECTS TO BATS

Although very little is known about bat populations and distribution, particularly through the migration period, studies at existing wind turbine facilities show that mortality is relatively low in the absence of forested ridges and outside of Appalachia. However, bat longevity is relatively high and reproduction rates are relatively low compared to birds. As a result, it is possible that bat populations may be more vulnerable to mortality effects (GAO, 2005; MNR, 2006).

Bat activity is not necessarily related to mortality risk. An infrared study of flight patterns and avoidance behaviour indicated that although many bats do not travel at the height of turbine blades, those bats that fly through the sweep zone of turbines can avoid moving blades. The ratio of avoidance to contact is high (Horn et al., 2004), which means that collisions are rare compared to the number of bats present (EchoTrack, 2005).

The majority of observations were in the big brown bat/silver-haired bat group. The presence of big brown bats would most likely represent a resident population, which would roost and overwinter on Wolfe Island, possibly within buildings. Turbines in the study area will generally be sited away from the buildings to address environmental noise requirements, reducing the potential for bat-turbine interaction. Studies conducted on wind plants in the United States suggest the big brown bat would be at low risk for collisions (Johnson, 2005). Very few bat fatalities occur in the spring and summer, suggesting that resident bats are unlikely to collide with wind turbines during regular foraging (MNR, 2006; B. Fenton, January 23, 2007).

The same studies suggest that silver-haired bats would be at higher risk during their fall migration (Johnson, 2005; MNR, 2006), perhaps because the migratory individuals are not familiar with the local conditions or because their migratory flight behaviour can put them at risk of collision with wind turbine blades. Although Wolfe Island is located along a major linear landscape feature, the Lake Ontario shoreline, the number of potentially migrating individual bats detected during the 2005 and 2006 surveys was very low.

4.3 CONCLUSION

Given the lack of habitat features that would be attractive to bats, coupled with the small number of bats observed during the 2005 and 2006 field surveys, bat activity in the study area is considered to be low. Based upon data collected during the field surveys and the information presented in background sources, it is unlikely that bats are present in large numbers within the study area and therefore the Project is not expected to have significant negative effects on bat habitat or populations.

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Valerie Wyatt

Valerie Wyatt, M.Sc.

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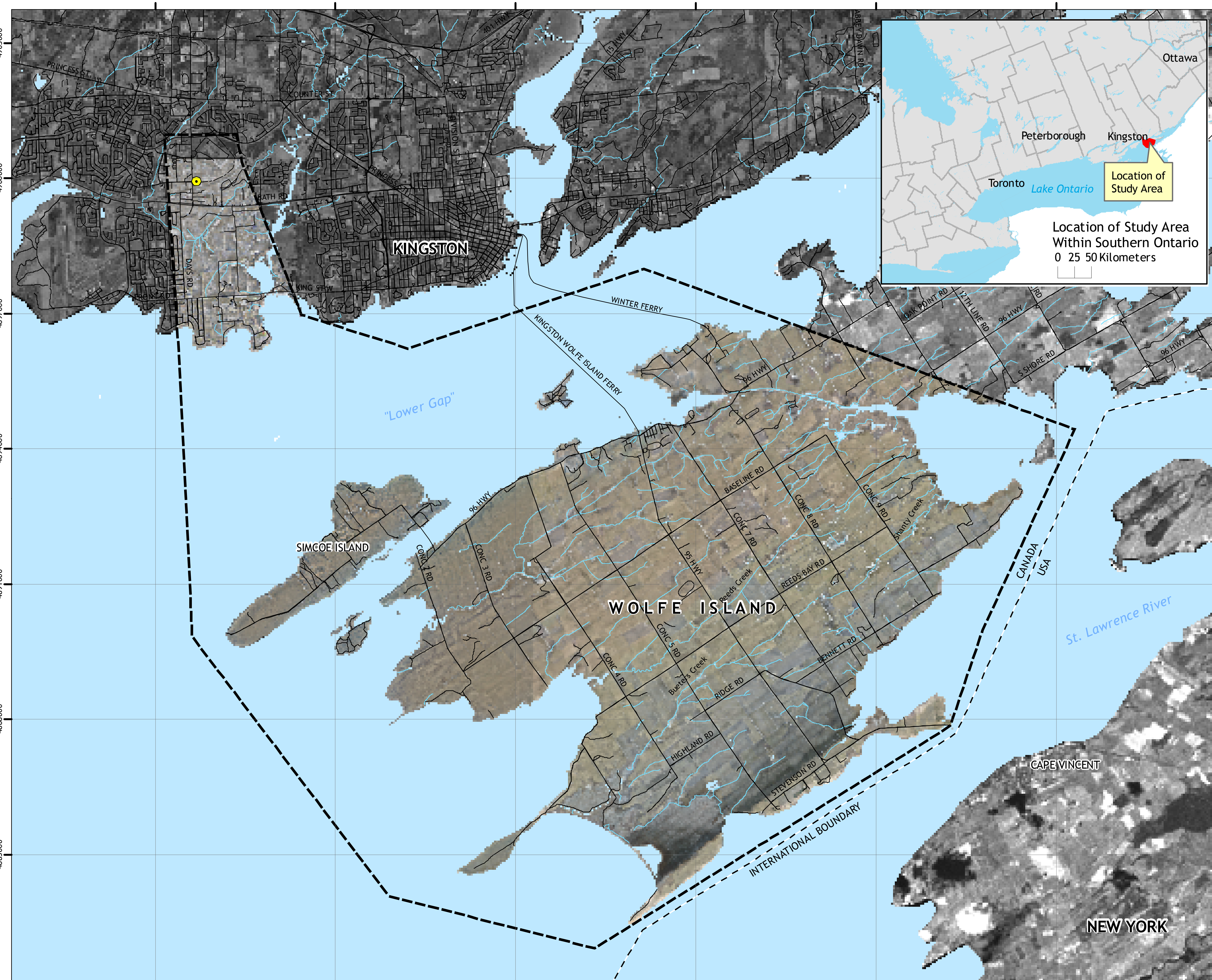
Appendix A

Figures



CANADIAN HYDRO DEVELOPERS, INC.
through its wholly owned subsidiary Canadian Renewable Energy Corporation

Stantec

0 1 2 Kilometers

Notes:
Base map layers: MNR Land Information Distribution Service (LIDS).

Air Photos: LIDAR (study area coverage), January 2006.
LANDSAT7 (U.S. coverage), 1999.
City of Kingston (city coverage), 2005.

Legend

Study Area

Gardiners Transformer Station

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FIGURE NO.

1.1

Project Location and Study Area

FILE:	PROJECT NUMBER
60960056_C9_03_project_location.mxd	60960180

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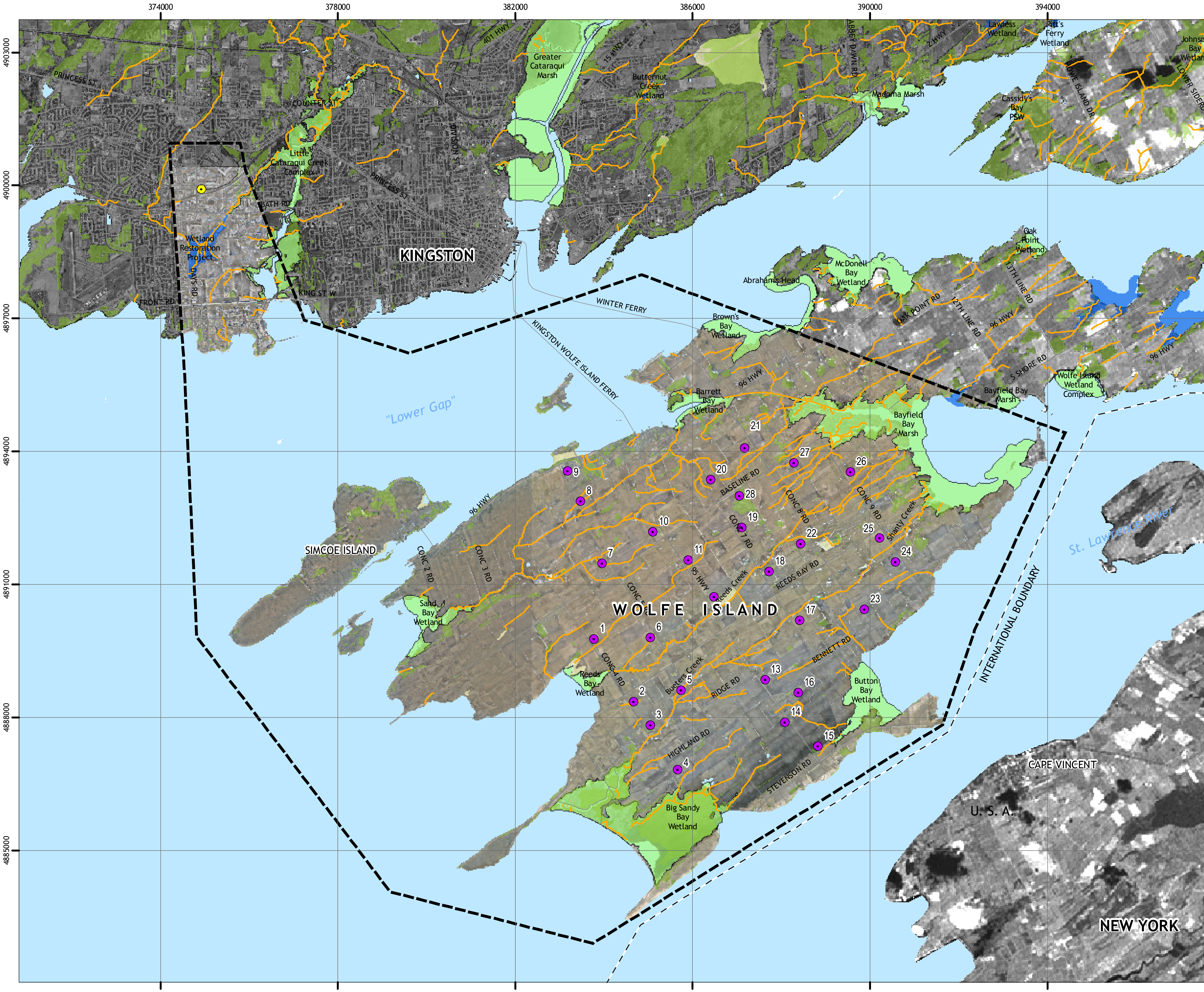
September, 2007



CANADIAN HYDRO DEVELOPERS, INC.
through its wholly owned subsidiary Canadian Renewable Energy Corporation

Stantec

0 1 2 Kilometers

Notes:
Base map layers: MNR Land Information Distribution Service (LIDS) and the Cataraqui Region Conservation Authority, 2006. Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006, and the Cataraqui Region Conservation Authority, 2006.

Legend

- Study Area
- Gardiners Transformer Station
- Bat Monitoring Autumn 2005
- Warm water streams
- Woodlot

Wetlands
- Provincially significant wetland
- Non-provincially significant wetland
- Unevaluated wetland

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FIGURE NO.
2.1

Autumn 2005 Bat Survey Locations

FILE:			PROJECT NUMBER
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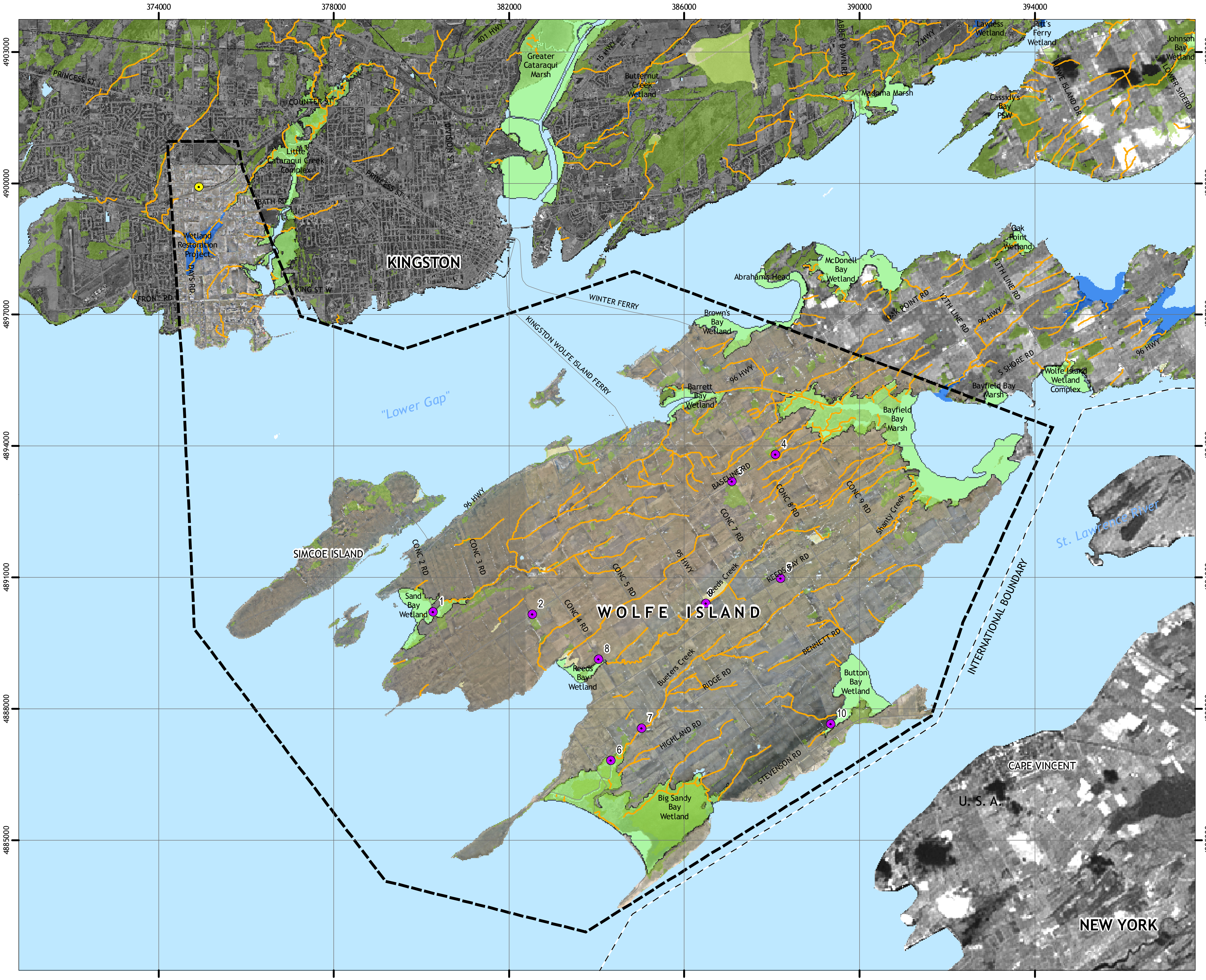
October, 2007



CANADIAN HYDRO DEVELOPERS, INC.

through its wholly owned subsidiary Canadian Renewable Energy Corporation

Stantec

0 1 2 Kilometers

Notes:
Base map layers: MNR Land Information Distribution Service (LIDS) and the Cataraqui Region Conservation Authority, 2006. Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006, and the Cataraqui Region Conservation Authority, 2006.

Legend

- Study Area
- Gardiners Transformer Station
- Bat Monitoring Autumn 2006
- Warm water streams
- Woodlot

Wetlands

- Provincially significant wetland
- Non-provincially significant wetland
- Unevaluated wetland

WOLFE ISLAND WIND PROJECT
BAT REPORT

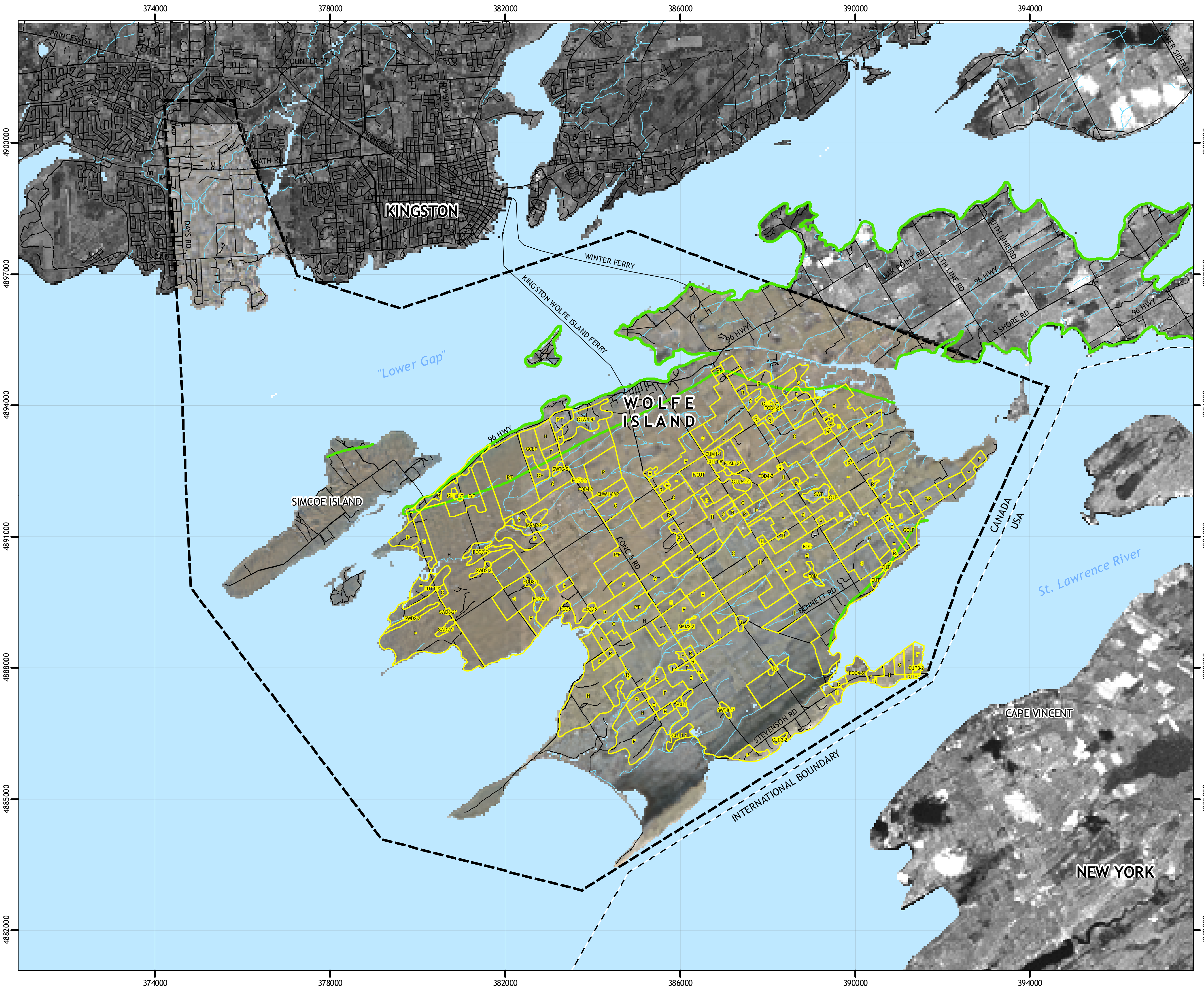
FIGURE NO.
2.2

Autumn 2006 Bat Survey Locations

FILE:	PROJECT NUMBER
60960056_C9_01_2006_bat_survey.mxd	60960056

REV. NO.	SHEET NO.	SCALE:	DRAWN BY:
0	1 OF 1	1:85,001	JLW

October, 2007



CANADIAN HYDRO DEVELOPERS, INC.
through its wholly owned subsidiary
Canadian Renewable Energy Corporation

Stantec

0 1 2 Kilometers

ELC Legend – Wolfe Island Habitat Mapping

Coniferous Forest (FOC)
FOC1-2 – White Pine Coniferous Forest

Mixed Forest (FOM)
FOM – Mixed Forest
FOM5-3* - White Ash – White Pine Mixed Forest

Deciduous Forest (FOD)
FOD – Deciduous Forest
FOD4-2 – Dry-fresh White Ash Deciduous Forest
FOD4-4* - White Ash – Hickory Deciduous Forest
FOD4-5* - White Ash – Oak Deciduous Forest
FOD5 – Dry-fresh Sugar Maple Deciduous Forrest
FOD7-7* - White Ash Deciduous Forest
FOD8-1 – Fresh-moist Poplar Deciduous Forest Type

Cultural Plantation (CUP)
CUP3-2 – White Pine Coniferous Plantation

Cultural Meadow (CUM)
CUM1-1 – Dry-moist Old Field Meadow

Cultural Thicket (CUT)
CUT – Cultural Thicket
CUT1-1 – Sumac Cultural Thicket
CUT1-7* - Hawthorn – Dogwood Cultural Thicket
CUT1-8* - Sumac – Juniper – Dogwood Cultural Thicket

Cultural Woodland (CUW)
CUW1-8* - White Elm Cultural Woodland

Deciduous Swamp (SWD)
SWD – Deciduous Swamp
SWD2-2 – Green Ash Mineral Deciduous Swamp
SWD8-1* - Poplar Mineral Deciduous Swamp
SWD8-2* – Silver Maple Mineral Deciduous Swamp

Swamp Thicket (SWT)
SWT2-5 – Red-osier Mineral Thicket Swamp

Meadow Marsh (MAM)
MAM2-2 – Reed-canary Grass Mineral Meadow Marsh

Shallow Marsh (MAS)
MAS – Shallow Marsh
MAS2-1 – Cattail Mineral Shallow Marsh

Agricultural Designations:
C – Crops (Row)
H – Hay
F – Fallow
P – Pasture

Other Designations:
R – Residential
Golf – Golf Recreational
Pit – Pit Extraction Area

Legend

Study Area

Vegetation Communities

Contact Between Bobcaygeon and Gull River Formations (Kingston et. al., 1985)

WOLFE ISLAND WIND PROJECT
BAT REPORT

FIGURE NO.

3.1

Vegetation and Habitat Mapping

FILE:			PROJECT NUMBER
60960056_C9_04_elc.mxd			60960056
REV. NO.	SHEET NO.	SCALE:	DRAWN BY:
0	1 OF 1	1:85,000	JLW

September, 2007

Appendix B

Tables

Table 2.0 Bat Species of Southern Ontario (van Zyll de Jong, 1985)

Common Name	*Scientific Name*	Ontario Status	Global Status	Highest Call Frequency in Kilohertz (kHz)	Lowest Call Frequency (kHz)	Maximum Search Call Duration in Milliseconds (ms)	Wintering	Hibernation or Migration Timing
Small-footed Bat	*Myotis leibii*	S2S3	G3	55	43	0	hibernates	late Nov
Little Brown Bat	*Myotis lucifugus*	S5	G5	88	38	2,3	hibernates	late Sep
Northern Long-eared Bat	*Myotis septentrionalis*	S3?	G4	130	42	0	hibernates	
Silver-haired Bat	*Lasionycteris noctivagans*	S4	G5	50	25		migrates	mid-Aug - early Oct
Eastern Pipistrelle	*Pipistrellus subflavus*	S3?	G5	73	45	?	hibernates	
Red Bat	*Lasiurus borealis*	S4	G5	97	40	3	migrates	late Aug – Oct
Big Brown Bat	*Eptesicus fuscus*	S5	G5	48	27	3	hibernates	
Hoary Bat	*Lasiurus cinereus*	S4	G5	50	30	15	migrates	mid-Aug – Oct

Table 2.1 Habitat at 2005 Bat Monitoring Stations

Station Number	Habitat Description
1	Station located between a residence and deciduous woodlot between fire #836-864.
2	Associated with an older barn.
3	Deciduous woodlot between fire #1342 and 1347.
4	Abandoned farmstead at fire #1517, consisting of several dilapidated buildings.
5	Located at a culvert associated with a wet fallow field (reed canary grass).
6	Located between two houses representing potential roosting habitat, at fire #847.
7	Associated with deciduous woodlots.
8	Associated with a deciduous woodlot (fire #136).
9	Deciduous woodlot.
10	Older house and barn at fire #433.
11	Located between the Corn Maze and associated farm and residential buildings (lots of outdoor lighting).
12	Abandoned house and barn at fire #907.
13	Large modern barn with extensive outdoor lighting.
14	Pyke’s Buffalo Farm (associated buildings and outdoor lighting).
15	Deciduous woodlot.
16	Small residence and two associated barns / out-buildings (outdoor lighting).
17	Deciduous woodlot at fire #1081.
18	Dilapidated barn surrounded by scrubland at fire #700.

Table 2.1 Habitat at 2005 Bat Monitoring Stations

Station Number	Habitat Description
19	Abandoned barn at fire #556.
20	Abandoned barn.
21	Older home with associated barns / outbuildings (outdoor lighting), surrounded by scrubland.
22	Barn at fire #552 (outdoor lighting).
23	Residence and barn (outdoor lighting) at fire #1150.
24	Abandoned house.
25	Residence and associated barns / outbuildings (outdoor lighting) at fire #512.
26	Residence and associated barns / outbuildings (outdoor lighting) at fire #152.
27	Abandoned houses between fire #1891 and #1850.
28	Residence with outdoor lighting at fire #1543.

Table 2.2 Habitat at 2006 Bat Monitoring Stations

Station Number	Habitat Description
1	Inlet with open water containing water lilies and pickerel weed, surrounded by a narrow margin of cattail marsh. The wetland was surrounded by woodland and thicket.
2	Located at a woodland edge. The woodland was mid-aged, containing sugar maple and white ash. Standing snags and potential roosting sites were common. The woodland, which was approximately one hectare in size, was surrounded by hay fields and pasture.
3	Mixed moist woodland of ash and white pine with portions dominated by balsam poplar. The woodland was mid-aged and approximately five hectares in size and surrounded by pasture. Snags and potential roosting

Table 2.2 Habitat at 2006 Bat Monitoring Stations

Station Number	Habitat Description
	sites were present. The roadside ditches were wet, containing cattails, red-osier dogwood, and pussy willow. Numerous small flying insects were observed during some surveys.
4	Edge of white ash – bur oak woodland. The mid-aged woodland was approximately 30 hectares in size, and was the largest wooded feature in the study area. Few snags were observed. The woodland was surrounded by pasture.
5	Located at a farm pond, next to a large outdoor light mounted on a barn. The pond was stagnant with abundant duckweed. Mature black willow and trembling aspen surrounded the pond, providing standing snags and potential roosting sites.
6	Large marsh and swamp thicket community near the edge of the Big Sandy Bay Wetland. The station was situated in an open wetland with cattail and buttonbush. It was surrounded by deciduous swamp containing some snags for potential roosting sites.
7	Red ash swamp community, surrounded by pasture. A small watercourse flowed out of the swamp. Trees in the community were relatively young with few snags. Barns were located nearby, and may provide potential roosting sites.
8	Open wetland comprised of a steam channel with cattail marsh along its margins. The wetland was surrounded by pasture.
9	Open meadow marsh community comprised of reed canary grass with meadowsweet. The community was surrounded by hay fields and crops of corn and soy bean.
10	Inlet of open water fringed with cattail marsh. White ash and Manitoba maple surrounded the wetland. A mature maple forest community was located within 200 m of the station.

Table 3.1 Weather conditions during the 2005 and 2006 bat monitoring surveys

Date	Temperature	Wind (Beaufort Scale*)	Cloud Cover	Precipitation	Notes
Sept 6, 05	~15°C	0-1	10%	Non	New moon
Sept 7, 05	~18°C	0-1	10%	Non	New moon
Sept 5, 06	~17-19°C	0-1	95-80%	Non	Full moon. Patchy rain during the day
Sept 13, 06	~16	0-1	95%	Non	3rd quarter moon
Sept 19, 06	~16	3	30%	Non	New moon
Sept 26, 06	~13	1	10%	Non	Waxing crescent moon
Oct 3, 06	~16	2-3	10%	Non	Hazy conditions Waxing Gibbous moon
Oct 10, 06	~5	2-3	10%	Non	Waning Gibbous moon
Oct 17, 06	~12	4	10%	Rain	10-15 mm of rain in past 24hr. Waning crescent moon
Oct 24, 06	~10	2-3	100%	Misty rain	New moon
Nov 7, 06	~10	1-2	100%	Light rain	Full moon
Nov 20, 06	~0	1	100%	Non	New moon
Nov 28. 06	~-2	1-2	90%	Non	1st quarter moon

Table 3.2 Results of 2005 Bat Monitoring Surveys

Date	Station - Time	Frequency Range (kHz)	Other Observations	Number of Bats and Probable Species
Sept. 6, 05	**3** - 19:56	42-49	2 bats observed.	2 - Little Brown Bat
Sept. 6, 05	**15** – 22:05	30	No visual observations.	1 - Big Brown Bat / Silver-haired Bat
Sept. 6, 05	**17** – 22:18	30	No visual observations.	1 - Big Brown Bat / Silver-haired Bat
Sept. 7, 05	**17** – 22:20	39	1 bat observed.	1 - Big Brown Bat
Sept. 7, 05	**24** – 23:05	90	No visual observations.	1 - Northern Long-eared Bat / Red Bat
Sept. 7, 05	**28** – 23:25	50	No visual observations.	1 - Small-footed Bat / Little Brown Bat / Northern Long-eared Bat / Eastern Pipistrelle / Red Bat

Table 3.3 Results of 2006 Bat Monitoring Surveys

Date	Station - Time	Frequency Range (kHz)	Other Observations	Number of Bats and Probable Species
Sept 5, 06			No bats recorded.	0
Sept 13, 06	**2** - 22:21	20 – 40	Two auditory observations of short duration (~5 sec) during the 10 minute period; very brief visual indicates medium sized.	1 - Big Brown Bat / Silver-haired Bat

Table 3.3 Results of 2006 Bat Monitoring Surveys

Date	Station - Time	Frequency Range (kHz)	Other Observations	Number of Bats and Probable Species
	6 – 21:41	28 – 32	Auditory signals faint: no visual observations.	1 - Big Brown Bat / Silver-haired Bat
Sept 19, 06	**3** – 22:28	25 – 40	Duration of auditory signal was ~5 sec. No visual observations.	1 - Big Brown Bat / Silver-haired Bat
Sept 26, 06	**6** – 21:35	25-35	Auditory signal consisted of very rapid clicks. Duration was very short (~3 sec). No visual observations.	1 - Big Brown Bat / Silver-haired Bat
	7 – 21:14	undetermined – 45	Auditory signal consisted of very rapid clicks. Duration was very short (~3 sec). No visual observations.	1 - Big Brown Bat / Silver-haired Bat
	10 – 20:51	25 – 50	Duration of auditory signal was ~3 sec. No visual observations.	1 - Big Brown Bat / Silver-haired Bat
Oct 3, 06	**2** – 19:46	30	Faint auditory signal. Short burst of rapid clicks with approximately 1 burst every minute. No visual observations.	1 - Big Brown Bat / Silver-haired Bat
	6 – 20:19	30 – 50	Auditory signal of rapid clicks. No visual observations.	1 - Big Brown Bat / Silver-haired Bat
	7 – 20:37	25-35	Auditory signal of short duration (~6 sec). No visual observations.	1 - Big Brown Bat / Silver-haired Bat
Oct 10, 06		No Bats Observed		0

Table 3.3 Results of 2006 Bat Monitoring Surveys

Date	Station - Time	Frequency Range (kHz)	Other Observations	Number of Bats and Probable Species
Oct 17, 06		No Bats Observed		0
Oct 24, 06		No Bats Observed		0
Nov 7, 06		No Bats Observed		0
Nov 20, 06		No Bats Observed		0
Nov 28, 06		No Bats Observed		0

Appendix C

MNR Correspondence

Ministry of
Natural Resources

Peterborough District Office
P.O. Box 7000, 300 Water Street
Peterborough, ON K9J 8M5
Telephone: (705) 755-2001
Fax: (705) 755-3125

Ministère des
Richesses naturelles

Le bureau du district de Peterborough
C.P. 7000, 300, rue Water
Peterborough (Ontario) K9J 8M5
Téléphone : (705) 755-2001
Télécopie : (705) 755-3125

Ontario

September 11, 2006

Rob Nadolny
Senior Project Manager
361 Southgate Drive
Guelph, ON N1G 3M5

Re: Bat Survey Protocols
Wolfe Island Wind Project

Dear Mr. Nadolny,

We have received the Bat Survey Protocols document that you forwarded to our office on August 31, 2006 and our review of the document results in the following comments.

MNR Protocols for Bat Monitoring

At this time the Ministry of Natural Resources is in the process of producing a protocol for pre-construction and post-construction monitoring of bats on lands subject to proposed wind power projects. Although these protocols are under development, we can inform you that preliminary discussions amongst MNR experts suggest that that a reasonable monitoring protocol would include a minimum of 20 to 25 nights, (dusk to dawn) per year for at lease 2 years preconstruction. The monitoring should occur within spring, summer and fall seasons, and should include combination of acoustic and RADAR monitoring equipment to assess bat activity.

In a review of the monitoring protocols of other jurisdictions, monitoring regimes have included more vigorous preconstruction monitoring. An example that may be of interest is the monitoring work that has been completed for the Maple Ridge Wind Farm (previously known as the Flat Rock Wind Power Project) in New York State. For this project, 60 nights of monitoring occurred for approximately 6.5 hours per night, using a combination of monitoring technologies. You may consider contacting the New York State Department of Environmental Conservation for more information about this project.

Comments Regarding Stantec Proposed Bat Monitoring Activities

Sampling
We recommend that monitoring stations should be designed to adequately cover the spatial distribution of the proposed wind turbine placements. The number of monitoring stations will vary depending on the size of the proposed wind power facility and the habitat composition. The proposed fifteen monitoring stations will likely provide good coverage for the area. We would recommend that equal monitoring of each of the stations occurs throughout the survey period and should be monitored from dawn to dusk so that bat activity levels can be accurately compared between each station. There should also be some "control" monitoring stations away from the proposed development area for comparison.

The Bat Survey Report Wolfe Island Wind Project (Dec. 15, 2005) involved surveying on 2 nights (Sept. 6 & 7, 2005) and the current Bat Survey Protocols (2006) proposes four survey nights in September, two nights in October, and one night in November (dusk to midnight). As mentioned previously, MNR's protocol for bat monitoring will likely recommend a minimum of 20 to 25 nights per year of monitoring, during peak bat activity within spring, summer and fall. We recommend that this approach is taken as part of the Wolfe Island study in order to accurately assess bat activity levels on the island and draw appropriate conclusions about potential impact to bats.

Representation
big brown

We suggest that a more accurate representation of bats within the context of migratory behaviour would include a) sedentary species (i.e. Eptesicus fuscus); b) species that migrate to hibernacula (i.e. Myotis, Pipistrellus subflavus); and the species thought to leave the area completely for the winter (i.e. Lasiurus, Lasionycteris). More explanation of the way in which focusing on roost areas provides information about bat activity, would be useful.

Monitoring Equipment
As mentioned above, MNR recommends a combination of acoustic and RADAR monitoring equipment for bat assessment, to ensure that migratory behaviour can be differentiated from feeding behaviour. Stantec's survey protocol suggests acoustic monitoring for 10 minute periods at each site to gauge the level of bat activity, which may be sufficient for point counts, but we recommend a more complete survey. Acoustic monitoring should occur through-the-night at each station (these can be automated detectors that begin recording when ultra-sonic sound is detected). Acoustic monitoring should cover the maximum attainable height possible to adequately sample the proposed wind turbine blade sweep area (at some sites we would recommend getting the detector up 20 or 30 metres depending on the proposed turbine height). Also, acoustic recorded data should be saved for later identification or data verification.

Data
The Stantec survey protocol should indicate how bat species will be identified and how different species of bats will be distinguished from each other. It would also be useful

to know what the qualifications are of the field crew with respect to experience identifying bat species by echolocation call.

Summary

The proposed Stantec survey protocol will consist of 9 monitoring nights from dusk to midnight (2 nights in 2005, 7 nights in 2006) over 2 years. This level of assessment (i.e. timing and effort) is below what MNR anticipates to be the recommended amount of survey time for bats for wind power projects, in order to accurately reflect the level of bat activity and potential impacts within a study area. As mentioned previously, MNR will likely be recommending a minimum of 20 to 25 nights of monitoring (dusk to midnight) per year throughout the site, over the course of spring, summer and fall periods.

We look forward to obtaining more information regarding your bat survey work, including the way in which our recommendations, as noted above, have been incorporated into your field survey work. Please note that we have provided a copy of this letter to applicable Provincial and Federal agencies for information purposes.

Yours truly,

Original signed by

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cc Vickie Mitchell, Environmental Assessment Co-ordinator, MOE, Kingston
Darla Cameron, Senior Program Officer, CEAA, Ontario Region - Toronto
Sheila Allan, Environmental Assessment Section, Environment Canada, Ontario Region
Laurie Miller, Municipal Planner, Ministry of Municipal Affairs and Housing, Kingston