Appendix K
Avian Monitoring Plan

Draft Avian and Bat Post-Construction Monitoring Plan: Greenwich Wind Farm, RES Canada

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Submitted to:

RES Canada

Submitted by

Dillon Consulting Limited

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1.0 INTRODUCTION

Renewable Energy Systems Canada Inc. (RES Canada) is proposing to construct and operate a 72 turbine wind farm that will generate 165.6 megawatt (MW) of electricity. The first phase of the project will consist of 43 turbines that will generate 98.9MW of electricity. The remaining 66.7 MW of electricity is scheduled to be implemented in the second phase of the project (subject to the award of a future contract). The project site is located approximately 75 kilometers northeast of Thunder Bay in northern Ontario and lies partially within the township of Dorion and partially on Ministry of Natural Resources (MNR) administered unorganized territory in the District of Thunder Bay. The project area covers approximately 17 047 hectares east of Dorion. In addition to the turbines, the project will require a 10.7 km, 230 kV power transmission line (double circuit) be constructed to the east of the study area in order to connect the Greenwich Wind Farm to the provincial grid system, approximately 10 km away.

The project components include:

- 72 Siemens SWT-2.3-101 turbines with a pad mount transformer stepping up from 600V to 34.5Kv;
- 34.5 kV collection system to link the wind turbines to the substation;
- Substation (to step up the electric output from 34.5 kV to 230 kV);
- A 10.7 km, 230 kV double circuit transmission line;
- A switching station at the point of connection with the provincial grid;
- Turbine access roads;
- Two meteorological towers (one at the western end and one at the northern end of the wind farm which are already installed and operating);
- Staging areas for assembly of wind turbines during construction.

In developing this post-construction monitoring plan, protocols outlined in several guidance documents provided by Environment Canada (EC) and the Ministry of Natural Resources (MNR) were consulted including:

- *Wind Turbines and Birds – A Guidance Document for Environmental Assessment* (EC 2007a),
- *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC 2007b)
- *Wind Turbines and Birds – A Background Review for Environmental Assessment* (EC 2007c)
- *Guidelines to Assist in the Review of Wind Power Proposals – Potential Impacts to Birds and Bird Habitats* (MNR 2006a)
- *Wind Turbines and Bats: Bat Ecology Background Information and Literature Review of Impacts* (MNR 2006b)
- *Guidelines to Assist MNR Staff in the Review of Wind Power Proposals – Potential Impacts to Bats and Bat Habitats* (MNR 2007).

This draft plan has been designed by RES Canada to evaluate the accuracy of the predicted environmental impacts on birds and bats and to meet requirements set out in both the *Canadian Environmental Assessment Act*, and the *Ontario Environmental Assessment Act* as per the requirements of Regulation 116/01. EC and MNR are being consulted with to confirm this monitoring strategy. Once their input is received, this plan will be finalized.

Kerns et al (2005), Erickson *et al* (2003) and Stantec (2008a) were also consulted in developing statistical analysis methods for searcher efficiency, carcass removal testing and calculation of corrected fatality counts.

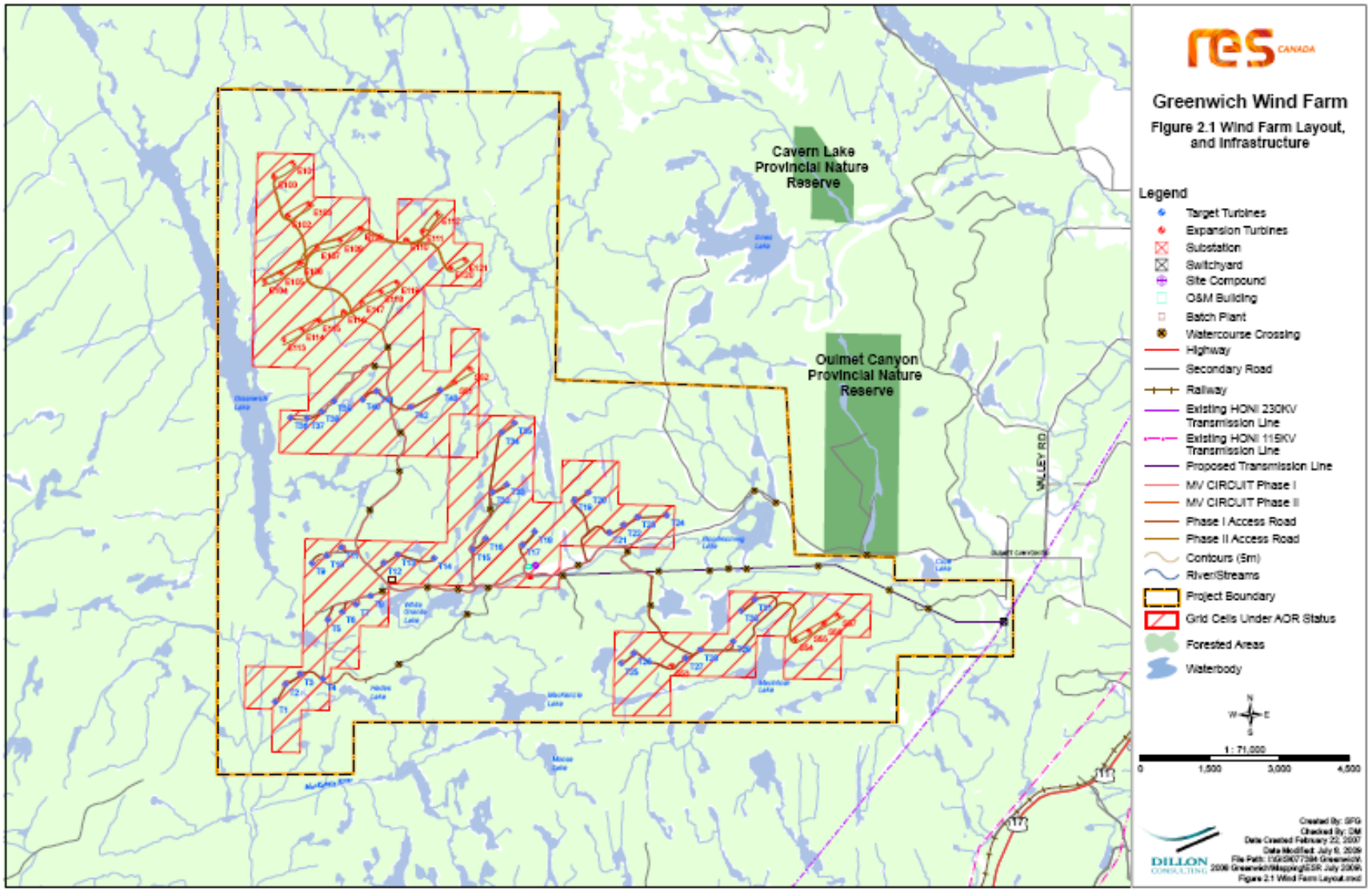

Figure 1: RES Canada–Greenwich Wind Farm Energy Centre Layout/Project Area Location

1.1 Project Area Features Relating to Birds and Bats

The project area is located near the north shore of Lake Superior (closest turbine is more than 7 km from the shore), and is in a relatively undeveloped area with no buildings located within the project boundaries. Due to the proposed size of the wind farm, the presence of species at risk, Bird Conservation Region 8 (BCR 8) priority species and the fall raptor migration corridor along the north shore of Lake Superior, the project area has been determined to have a high site sensitivity with regards to birds and has been assigned a Category 3 Level of Concern based on criteria provided by EC (EC 2007a).

The project area has been assigned a Sensitivity Rating of 2 (Medium) in relation to bats, based on criteria provided by the MNR (MNR 2007). The major concern for the project area is historical evidence of bat hibernacula and large concentrations of roosting bats located at Cavern Lake Provincial Nature Reserve. The closest turbine Cavern Lake Provincial Nature Reserve is more than 7 km away.

Details of bird and bat pre-construction surveys are provided in sections 6.6 and 6.7, and Appendices D and E, of the ESR, respectively. As stated in these sections, the expected level of impact to all guilds of birds and bats, after protection and mitigation measures have been implemented, is considered to be low.

Concerns that have been identified and will require specific monitoring include:

- Potential mortality effects to birds and bats in the project area. The main potential risk relates to the high number of BCR 8 priority species that are expected to lose a small amount of forest habitat as sites are cleared for turbines.
- The likely presence of a flyway through the study area used by high numbers of Common Loons.
- Species at Risk (listed as Threatened, Rare or Endangered, *Species at Risk Act* [SARA] and /or *Endangered Species Act, 2007* [ESA]) observed and reported to nest in or adjacent to the study area. This specifically includes the Peregrine Falcon, which are known to nest on cliffs 7 km east of the study area. Other protected species under the *Migratory Birds Act* include the Common Nighthawk, the Olive-sided Flycatcher and the Canada Warbler.

Issues that were determined to be of limited concern, and therefore not requiring specific monitoring, include:

- The number of fall migrating raptors that use the Great Lake shorelines as migration corridors.
- Species listed as Special Concern or recently listed by COSEWIC, but not yet protected, that may require specific monitoring at the study site in the near future. These include the Bald Eagle, the Short-Eared Owl, the Common Nighthawk, the Rusty Blackbird, the Olive-sided Flycatcher, the Canadian Warbler and the Northern Long-eared Bat.

Because large wind farm facilities are a relatively new addition to Ontario's infrastructure, large datasets with multiple years of study relating to environmental impacts do not exist to inform the accurate prediction of impacts. To address this uncertainty an Adaptive Monitoring and Management Plan has been developed. In the event that unexpected negative impacts occur, employment of this plan will allow for flexibility in the operation of the wind farm in an attempt to reduce these negative impacts and the likelihood of their future occurrence.

2.0 PROJECT TEAM

Table 1: Post Construction Environmental Monitoring Team

Staff	Role
Don McKinnon	Dillon Consulting Limited – Project Manager
Michael Enright	Dillon Consulting Limited – Natural Environment Coordinator

Don P. McKinnon MES, MCIP –is an Associate and Senior Environmental Planner at Dillon with over 19 years of experience. Don has worked in many parts of Canada and internationally, and has extensive experience with Environmental Assessments. Don has direct experience in the preparation of EIAs for wind power project facilities having been involved in more than ten wind farm projects.

Michael Enright, BSc. (Hons) - is a Terrestrial Biologist with fourteen years of education and professional employment in the biological sciences. During this time, Michael has acquired an in-depth knowledge of natural systems and their protection under the various levels of the legislative framework. He has been involved in numerous Environmental Assessments and developed environmental solutions for multi-disciplinary projects. Michael has been the Project Manager or Environmental Coordinator for nine wind energy projects.

All field ornithologists involved with the post-construction monitoring plan have extensive experience identifying birds and bats in Ontario by sound and sight.

3.0 POST-CONSTRUCTION MONITORING PLAN

3.1 The Need for Monitoring - Bird and Bat Mortality at Wind Farms in North America

Data available from studies of wind farms in North America indicate that the number of passerine birds killed due to blade strikes is not numerically significant in terms of population effects. Estimates of total passerine fatalities from a review of 14 studies of North American wind farms vary considerably, however on a per turbine and per MW basis, fatality rates are similar (Arnett et al 2007). Annual fatality rates ranged from 0 at a Searsburg, Vermont wind farm (Kerlinger 1997 *in* Arnett et al 2007) to 11.7 birds/MW/year at a Buffalo Mountain, Tennessee wind farm (Nicholson 2003 *in* Arnett et al 2007). Most studies indicate that passerine fatalities occur throughout the wind farm facility, with no relationship to specific features within the facility. In general, fatalities occur throughout the year but are most common from April to October (Arnett et al 2007). It appears that certain seasons pose a higher risk to birds at specific facilities; for example spring migration at Buffalo Ridge, Minnesota (Johnson et al 2002 *in* Arnett et al 2007) and fall migration at Stateline, Washington (Erickson et al 2004 *in* Arnett et al 2007).

The highest recorded raptor fatality rates relating to wind power facilities have occurred in California at a few specific sites that were designed and constructed with little thought given to impacts on avian resources. Outside of California, studies of 14 newer generation wind farm facilities in North America indicate that the mean fatality rate for raptors was 0.03 raptors per turbine and 0.04 raptors per MW. These studies occurred over at least a one-year period and included correction for scavenging and searcher efficiency (Arnett et al 2007).

Several studies on wind farms in Ontario have been performed which can provide more area specific context for the RES Canada Greenwich Wind Farm project. James (2003) reported finding 3 bird

carcasses in association with the single turbine present near the Lake Ontario shore at Pickering, with monitoring conducted throughout 2002. James and Coady (2004) reported finding 2 bird carcasses in association with the single turbine present at Exhibition Place in Toronto, over 11 weeks of monitoring during the spring and fall of 2003. James (2008) estimated a range of 0.41-2.6 native birds/turbine/year at the 66 turbine Erie Shores Wind Farm near Port Burwell, with all but 4 individual turbines having estimates of below 1 bird/turbine/year. For raptors as a group, an estimate of 0.04 raptors/turbine/year was given at Erie Shores. Natural Resource Solutions Inc. (2008) estimated an annual mortality rate for birds of 0.39 birds/turbine (0.26 birds/MW) at the 126 turbine Prince Wind Power Project (as in Stantec 2008a). Stantec Consulting Ltd (2008b) estimated an annual mortality rate for birds of 1.4 birds/turbine (0.9 birds/MW) at the Melancthon 1 Wind Plant, based on 12 weeks of post construction monitoring during the spring and fall of 2007 (as in Stantec 2008a).

Large numbers of bat fatalities have been reported at some wind energy facilities in North America. In general, bat fatalities at wind farms are higher than at other man made structures. Estimates of bat fatalities from 21 studies located at 19 wind farms in North America range from 0.9-53.3 bats/MW/year. The highest bat fatality rates have been found to occur near forested ridges. Bat fatalities appear to be higher in late summer and early fall, with migratory species like hoary bat, eastern red bat and silver haired bat being most susceptible. Bat activity and associated wind farm mortality appear to be higher on nights with low wind speeds (Arnett et al 2007).

3.2 Methods

Post-construction monitoring for birds and bats will be done concurrently to improve efficiency of fieldwork. Therefore, the methods outlined below are designed to address both faunal groups. The work being proposed will be refined through consultation with Environment Canada and the MNR. The current program as present herein is designed to monitor the most sensitive seasonal periods for each species or group of concern as identified in the ERR, including:

- Bird and bat mortality monitoring through all seasons, due to the possibility of mortality resulting from wind farm operation.
- Peregrine Falcon monitoring, due to the presence of a known breeding area/nest 7 km to the east of the project area.
- BCR 8 priority species monitoring due to the potential disturbance of limited forest habitat removal

Personnel conducting fieldwork will be skilled at identifying all species birds, both by sight and sound, and all species of bats, by sight, that are likely to occur in the project area. Detailed monitoring methods, including duration and frequency, are outlined below.

3.2.1 Bird Mortality Monitoring

As this project has been assigned a Category 3 Level of Concern in relation to birds according to EC's guidance criteria, it will be subject to the highest level of effort to assess environmental effects. Surveys will include two years of carcass searching and post-construction mortality monitoring around turbines during the spring migration period (a 6 to 8 week search period from early April to late May), the summer breeding season (a 6 week search period during June and July), fall migration period (an 8 to 10 week search period from early August to late October) and the winter season (a 4 week period from mid

January to mid February). Though mortality monitoring will occur throughout the year, the fall and spring seasons are of particular concern due to higher observed bird activity during these times.

Protocols used to perform carcass searches will follow those set out in EC's *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC 2007b). Carcass searches will be performed by trained technicians, under the guidance of an experienced biologist, within an 80m radius from the base of turbines as most birds will likely fall within this range. As this is a large project with 43 turbines in Phase 1, a subset of 14 turbines (approximately one third of all turbines) will be selected for carcass searching. A stratified random sample will be used to select turbines that are likely to represent the range of probable risk to birds and bats. Stratification will generally be based on grouping turbines based on their proximity to the study areas natural features (e.g. shoreline, forest, riparian vegetation, etc.).

Monitoring will initially be conducted twice weekly for each turbine, where mortality estimates are being conducted. Depending on the results of initial carcass searches and scavenger rate estimates, monitoring may be scaled back to once a week, where deemed appropriate through consultation with the MNR and EC. Over a three-day period all 14 turbines will be searched. Frequent searches will minimize loss to scavengers and enable a better understanding of weather conditions associated with mortality. If carcass removal trials indicate that carcasses persist for a week or more, less frequent searches may be employed. Searches will begin as soon after sunrise as possible to minimize the loss of carcasses to early morning scavengers. Carcass searches will be performed on days with weather conditions that are most suitable for successful searches, i.e. bright days, with light breeze and no recent rain. Carcass searching will also attempt to focus on substrates that are more likely to yield results such as the gravel pad at the base of the turbine, access roads and short vegetation.

For each carcass found, the following data will be recorded: date and time, state of decomposition, extent and type of injury, species if possible, distance and direction from the turbine, GPS location of carcass and substrate on which the carcass was found. Information will also be gathered for wind speeds and direction on each night preceding searches, extending to the last search event.

Scavenging Rate Trials

Scavenging rate trials will be performed to estimate the proportion of carcasses that were scavenged before the search period. Trials will be conducted twice during each season in each monitoring year, and will use native species that are freshly dead or frozen (and were freshly dead prior to being frozen). Carcasses will be laid out in a search area with their location marked by GPS in advance of a search being conducted. Technicians will wear gloves to avoid getting human scent on the test specimens, which could bias results. Carcasses can be laid out in varying time intervals before a search, or can be resurveyed multiple times to test for carcass persistence. Carcasses should be laid out for trials at each turbine that will be searched, with a small number used (1 to 2 specimens) at each site. Carcasses should be distributed on substrates in proportion to the availability of these substrates. Scavenger trials will be repeated during each survey year, as efficiency of scavengers may change among years. Presence or absence of scavenging, and degree of scavenging if present, will be recorded for trial specimens.

The rate of carcass removal by scavenging will be calculated using the following equation:

$$R_s = (n_{visit1} + n_{visit2} + n_{visit3})/ (n_{visit0} + n_{visit1} + n_{visit2})$$

Where:

R_s = Rate of scavenging

n_{visit0} = Number of carcasses originally placed
n_{visit1} - n_{visit3} = Number of carcasses remaining on visit 1 through 3

Searcher Efficiency Trials

Because individual surveyors will have different search success rates, searcher efficiency trials will be conducted once per year as required by EC's guidelines. Each searcher will be tested and if survey personnel changes, searcher efficiency trials will be repeated as needed. Testing can occur continuously. Carcasses will be laid out in random locations at a search location on the night before a search period and will have their location marked by GPS. A small number will be used (1 to 2 specimens) for a test at each site; however overall at least twenty carcasses should be used. Testing will occur continuously over multiple nights. Native species will be used in searcher efficiency tests so that searchers are not aware that they are trial specimens. The date, time and location that test specimens were planted will be recorded, as will the date it was searched for and whether or not it was retrieved. The condition of the carcass when it was retrieved will also be recorded.

The following equation will be used to calculate searcher efficiency:

$E_s = C_f/C_p$

Where:

E_s = Searcher efficiency
C_f = Carcasses found
C_p = Carcasses placed

Calculating corrected number of bird and bat fatalities will then be done using the following formula:

$C = c/[(E_s)(R_s)(P_s)]$

Where:

C = Corrected number of carcasses
c = Number of carcasses found
E_s = Searcher efficiency
R_s = Rate of scavenging
P_s = Percentage of area searched

3.2.2 Bat Mortality Monitoring

As the project area has been assigned a Sensitivity Rating of 2 (Medium) according to the MNR's *Guidelines to Assist in the Review of Wind Power Proposals – Potential Impacts to Bats and Bat Habitats* (MNR 2007), at least two years of post-construction monitoring will be required from May to September to assess impacts to bats. The major associated risk for the project area is the proximity to the Cavern Lake Provincial Nature Reserve, which may support large concentrations of roosting bats and has historical evidence of bat hibernacula.

Bat mortality monitoring will be conducted, as is recommended in the MNR's *Guidelines to Assist in the Review of Wind Power Proposals – Potential Impacts to Bats and Bat Habitats* (MNR 2007) and using the same protocol as listed above for bird mortality monitoring. Bat mortality data will be collected along with bird mortality data using the same methods, to improve efficiency.

Any bats encountered outside of the sensitive seasons of late summer and early fall (i.e. spring, early summer) will also be collected and recorded. Monitoring will occur approximately twice per week but the frequency of searches can be increased if it is believed to be necessary, based on results of scavenger trials. Searcher efficiency trials will be conducted once per month during the season of highest bat sensitivity (late summer and early fall) (MNR 2007).

During carcass searches, technicians will use protective gear (gloves, tools, etc.) and ensure that they have updated rabies pre-exposure vaccination. Biological waste will be disposed of in a way that will not pose a risk to public or environmental health, and that will comply with appropriate legislation. Mortality monitoring can be focused on turbines that are in close proximity to landscape features that are likely to concentrate bats (e.g. riparian areas, lakeshores, larger woodlots and buildings). For example, pre-construction monitoring found the highest number of bat passes near site E2 in the eastern portion of the project area, which is located closest to Lake Superior (Echo Track 2008).

3.2.3 Species at Risk Monitoring - Peregrine Falcon

No Peregrine Falcons were observed in the study area during pre-construction bird surveys. However, they are known to nest on cliffs approximately 7 km to the east of the study area. Peregrine Falcons have been observed hunting over the fields east of Ouimet Canyon and at Hurkett in May 2008 and are thought to be associated with the known nest site. Most foraging takes place between 2 and 6 km from the nest site. Good foraging habitat has been identified over the open farmlands south of Ouimet Canyon and at Black Bay on Lake Superior, outside of the study area. The OMNR Peregrine Falcon Guidelines (1987) recommends observing a 3 km buffer zone from nest sites. The closest turbine to the known nesting area is more than double this distance.

In addition to the existing nest site, three other potential Peregrine Falcon nesting habitat cliffs have been confirmed along the eastern boundary of the study area. Both Nolan Lake and Crow Lake have sites that are confirmed "Marginal" nesting habitat and the site at Good Morning Lake has been confirmed as "Good". A 1 km buffer has been placed around the Good Morning Lake potential nest site. No buffer has been provided for the marginal habitat sites. Most foraging takes place between 2 and 6 km from the nest site.

Better foraging habitat is present over the open farmlands south of Ouimet Canyon and at Black Bay on Lake Superior. Figure 2 identifies the location of proposed turbines and the identified potential Peregrine Falcon nesting habitat.

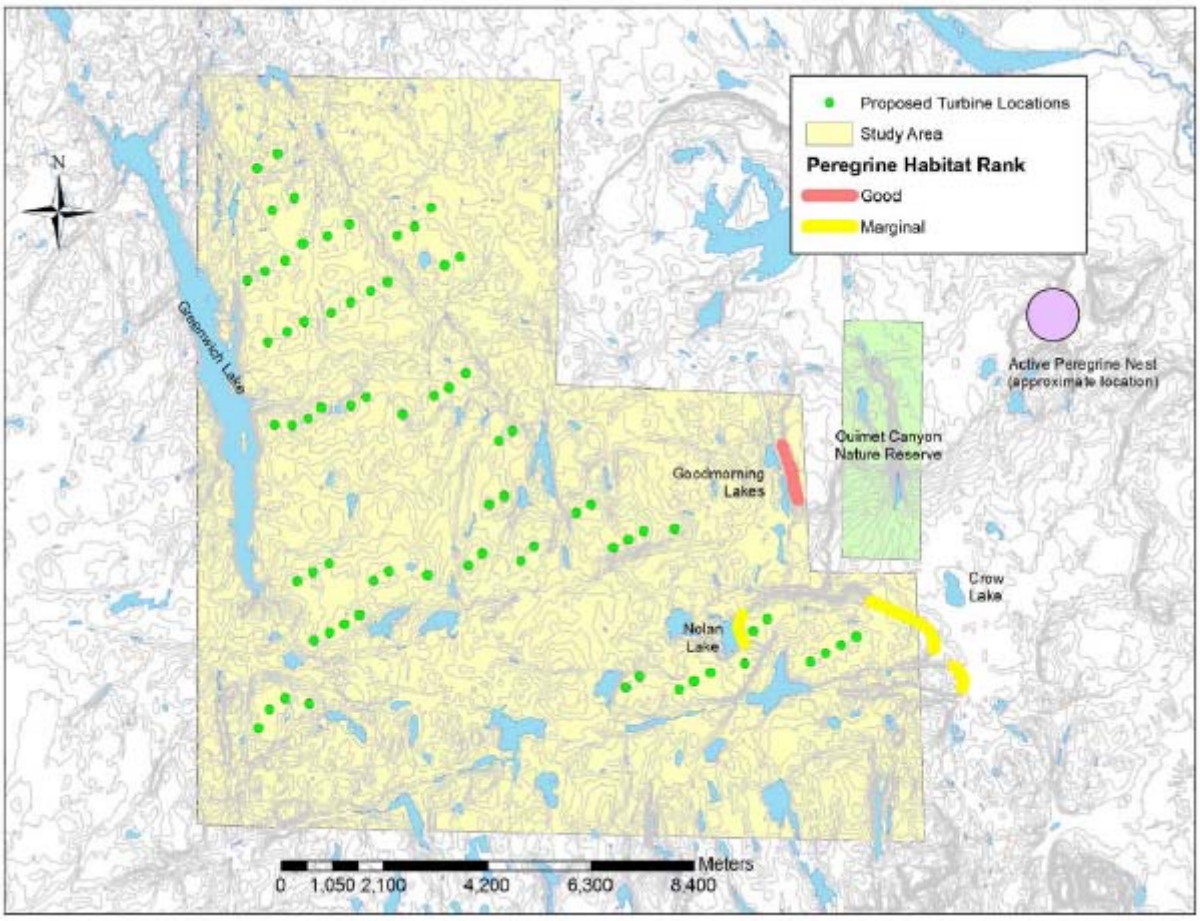

Figure 2: Locations of proposed turbines in relation to identified potential Peregrine Falcon nesting habitat

In addition to the aerial survey of all cliff sites within the study area prior to construction to assess the presence or absence of nesting Peregrine Falcons, post-construction monitoring will include surveying all potential nesting habitat during breeding season (March 15 to August 15). If Peregrine Falcons are observed in the study area, behavioural studies will be conducted to monitor activity and behaviour in or directly adjacent to the eastern boundary of the project area during the breeding season. Surveys will be conducted twice weekly throughout the breeding season for approximately 6 hours each visit. Surveys will consist of watches conducted from a vantage point having a clear view of areas with potential nesting habitat. Flight paths in relation to turbines, flight heights in relation to turbine blade sweep, habitats used and number of times the falcons enter the wind farm will be recorded. If access allows, determination of breeding will be documented.

3.2.4 Species at Risk Monitoring - Other Species at Risk

Protected under the *Migratory Birds Act*, the Common Nighthawk, Olive-sided Flycatcher and Canada Warbler were all observed within or near the project site during pre-construction monitoring. Suitable nesting habitat has been identified within the study area for all three species. Where construction has occurred and may have resulted in potential displacement of breeding birds or disruption of nests,

monitoring efforts will target those species/areas by use of area searches. Flight paths of displaced birds, any interaction with turbine locations and determinations of breeding will be recorded wherever possible.

Besides Peregrine Falcons and the species listed above, no other specific monitoring is planned for Species at Risk in the project area; however surveyors will be made aware of the potential Species at Risk present, and any occurrence during surveys will be noted and investigated. Species of Special Concern to be aware of include the Bald Eagle, the Short-eared Owl and the Rusty Blackbird as well as the Northern Long-eared bat. During post-construction monitoring the status of federally and provincially listed species at risk will be regularly reviewed and monitoring efforts will be evaluated based on current assessments available.

3.2.5 BCR 8 Priority Species Monitoring

It was identified that 25 of 30 BCR 8 priority species located within the study area are birds that use forested habitats. It is likely that some habitat will be lost as forest is cleared for turbines and there is the possibility that some species may experience a negative effect depending on the proximity of their habitat to the turbines. Overlap between turbine locations and previous BCR 8 bird observations will be identified and those turbines will be subject to routine inclusion in the mortality monitoring. In addition to carcass searches at these identified turbines, during the breeding season point counts will be conducted for BCR 8 species.

Point counts will consist of ten-minute non-fixed radius counts recording all bird species observed or heard. If BCR 8 species are recorded in the area, area searches will be conducted to search for potential habitat of the species and record information on the number of birds and breeding evidence.

3.2.6 Common Loons and Waterfowl Monitoring

Significant numbers of migrating loons were observed on several dates during pre-construction monitoring. It is believed that the project site may act as a flyway for birds staging on Black Bay and Thunder Bay on Lake Superior. No individuals were observed to land in the study area. As migrating loons tend to gain elevation as they fly inland, the majority of the loons were observed at elevations exceeding the heights of turbines.

Although there is an expectation for low net effects to common loons and other waterfowl in the area, due to the high numbers that have the potential to be impacted by the study area a monitoring program will be implemented to track any negative effects. In addition to the bird mortality monitoring, behavioural studies will determine how often and how many birds flew through the project site, whether they are adopting turbine avoidance behaviour while flying through the study area and if they are using any portion of the project site as a landing zone. These studies will take place during times when loons are more likely to migrate and may be undertaken on multiple consecutive days to assess the day-to-day variation in activity.

Table 2: Post Construction Monitoring Summary for Birds and Bats

Monitoring	Timing	Sampling Protocol	Sampling Frequency
Spring Migration: Bird and Bat	Early April to late May	Sunrise carcass searching/Mortality monitoring	Twice weekly
Summer Breeding: Bird and Bat	June/July	Sunrise carcass searching/Mortality monitoring	Twice weekly
Fall Migration: Bird and Bat	Early August to late October	Sunrise carcass searching/Mortality monitoring	Twice weekly
Migration: Loons and Waterfowl	Early April to late May; Early August to late October	Behavioural studies	Approximately weekly; variable depending on conditions and observations
Winter Survey: Bird and Bat	Mid-January to mid-February	Sunrise carcass searching/Mortality monitoring	Twice weekly
Species at Risk: Peregrine Falcon	March 15 to August 15	6 hour behavioural watches	Twice weekly
Species at Risk: Common Nighthawk, Olive-sided Flycatcher, Canada Warbler	June/July	Targeted area searches; Behavioural studies	Approximately Weekly; Study frequency to be determined if necessary
BCR 8 Monitoring	June/July	Point counts and area searches at locations where potential displacement from turbines has been identified	Twice weekly

4.0 REPORTING

Reporting of fieldwork results will be submitted annually, and results will be expressed both in terms of fatalities/turbine/year and fatalities/MW/year, to enable comparison between studies. Reports will include comparisons between projected annual avian mortality rates for the Greenwich Wind Farm Project and rates reported at other projects throughout North America (e.g. as summarized in Arnett et al 2007). If these projected annual mortality rates fall within the low or middle ranges of reported rates, no immediate mitigation is needed. However, if mortality rates approach the higher end of the reported scale, RES Canada will consult with the relevant agencies as needed to adjust monitoring and reporting described below to determine the reasons for the high mortality rates and to develop possible mitigation measures.

If a potentially serious negative effect is observed during monitoring, RES Canada will notify the relevant agencies during the survey period. If needed, RES Canada may take action prior to contacting the relevant agencies. Specific thresholds that will trigger the need for notification are outlined in **Table 3** below.

Table 3: Observed Mortality Thresholds Triggering Notification of Relevant Authorities

Species group	Single Mortality Event	Observed Mortality Rate	Number of Mortalities Observed During Surveys (sampling 18 turbines)
General Birds	33 or more observed[a]	11.7 fatalities/MW/year[b]	18 fatalities observed over 3 weeks
Raptors	1 or more observed	0.09 fatalities/MW/year[c]	1 fatality observed over 3 weeks
Bats		20 fatalities/turbine/year[d]	20 fatalities observed over 3 weeks
Species at Risk	Any mortality	Any mortality	Any mortality

[a] - the largest single mortality event observed at a wind farm in North America, at the Mountaineer site (Kerlinger and Kerlinger 2004).
[b] - the highest recorded rate in North America observed at the Buffalo Mountain Facility in Tennessee (Arnett et al 2007).
[c] - the highest recorded in North America, outside of California, from the Stateline Facility in Oregon (Arnett et al 2007).
[d] - the highest documented bat mortality in Ontario (Stantec 2008a).

5.0 ADAPTIVE MONITORING AND MANAGEMENT

In general, if observed mortality impacts for any group of birds, bats and/or species at risk are found to exceed thresholds noted in **Table 3** above, EC and the MNR will be consulted to establish the appropriate mitigative response, which could include: conducting research with the goal of identifying the factors leading to the observed mortality rate; conducting more frequent surveys; increasing reporting frequency; and operational modifications.

If bats are experiencing disproportionate mortality, and rates are near the higher reported levels, RES Canada may consider installation of ultrasonic deterrent devices. However, as of yet this technology has limited ability to effectively deter bats from areas as large as a turbines blade-sweep radius (Szewczak and Arnett 2008). Increasing the wind speed required to start a turbine on specific turbines having a high associated mortality could occur, as bats tend to be active at lower wind speeds (Arnett et al 2007).

If a review of environmental conditions unrelated to the wind farms operation is unable to shed light on increased mortality rates, then further action will be required. This could include blade feathering, and if necessary, shutting down specific problem turbines.

Blade feathering involves adjusting the pitch of the turbine blade such that reduced aerodynamics precludes efficient turbine operation. Blade rotation would be slowed and energy output reduced. This approach would be used to manage the turbine operation during specific time periods or weather conditions considered a high risk for bats or birds.

Turbine shut down would include the temporary removal of a turbine from service and stopping production of power. This action would be taken during a set period, such as a core seasonal migration window, and turbine operation would resume after the period of high risk has passed (EC 2007a).

These actions will be considered on a turbine by turbine basis, based on areas of concern identified through the monitoring program and as deemed economically feasible. Actions taken in response to mortality events will depend on species involved, behaviour implicated (migration, foraging etc.) and geographical extent of the observed mortality, as agreed upon by the relevant agencies.

6.0 SUMMARY

The project area for RES Canada's Greenwich Wind Farm has been designated as having high site sensitivity, Category 3 Level of Concern with respect to birds, and a Sensitivity Rating of 2 (Medium) with respect to bats. These sensitivity ratings trigger the need for this post construction monitoring plans as stipulated in EC and MNR guideline documents. The potential for bird and bat mortality, particularly during the spring and fall migration seasons, and the presence of Peregrine Falcons and other species at risk directly in and adjacent to the project area boundary are the main concerns that will require post-construction monitoring. Post-construction monitoring is planned for two years after the wind farm is in operation. EC and the MNR will be kept up to date on monitoring results through annual reporting and will be notified of unexpected negative environmental effects. Mitigation measures have also been outlined in the case that unexpected negative environmental effects occur that cannot be explained by factors unrelated to the wind farms operation.

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