WOLFE ISLAND WIND PLANT
POST-CONSTRUCTION FOLLOW-UP PLAN
BIRD AND BAT RESOURCES

MONITORING REPORT NO. 7
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Executive Summary

This report, the seventh in a series, contains the results of the post-construction monitoring program for bird and bat resources at the Wolfe Island Wind Plant for the period between January 1 and June 30, 2012 (the Reporting Period). The Wolfe Island Wind Plant is a 197.8 megawatt (MW) wind power plant on Wolfe Island, Township of Frontenac Islands, Frontenac County, Ontario. Eighty-six 2.3 MW wind turbine generators (WTGs) and ancillary facilities (i.e., substation, transmission lines) have been placed over the western portion of Wolfe Island with additional supporting electrical infrastructure on the Kingston mainland, near the city of Kingston, Ontario.

Consistent with the schedule for post-construction monitoring outlined in Section 5.1 of the Post-Construction Follow-Up Plan for Bird and Bat Resources for the Wolfe Island Wind Plant (revised February 2010) (the Follow-up Plan), field surveys conducted during the Reporting Period included:

- bird and bat mortality monitoring;
- disturbance effects monitoring – wintering raptors; and
- disturbance effects monitoring – breeding grassland birds.

Mortality monitoring was carried out by employees of Wolfe Island Wind Monitoring, an independent consulting firm, according to a schedule and methods prepared by Stantec Consulting Ltd. (Stantec) that were based on the Follow-up Plan. In addition to carcass searches, trials to determine various corrective factors for searcher efficiency and scavenging rates were conducted during the Reporting Period.

A total of 20 carcasses of 13 bird species were collected during the Reporting Period. Bird fatalities were more commonly found later in the spring period (May and June), with no carcasses recorded in January or February. During the Reporting Period all species had provincial S-Ranks of S5 (i.e., Secure – common, widespread and abundant in Ontario), S4 (i.e., Apparently Secure – uncommon but not rare) or SNA (i.e., Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities).

Three Bobolink fatalities were observed during the Reporting Period. This species is listed as Threatened on the Species at Risk in Ontario list of the provincial Endangered Species Act (2007). Bobolink has also been identified by the Committee on Status of Endangered Wildlife in Canada (COSEWIC) as threatened, but has not been added to a schedule of the Species at Risk Act (2002).

After applying correction factors for searcher efficiency, scavenger removal and percent area searched, the three carcasses found represent an estimated 23.0 Bobolink fatalities over the Reporting Period. The number of fatalities is small relative to the estimated 1,000 to1,500 that were observed in the Study Area during pre-construction surveys (approximately 1,050 counted during area searches, plus others observed during point counts; Stantec, 2008) and the estimated Ontario population of 800,000 (Cadman et al., 2007).

Three species have been identified as species of conservation priority by Ontario Partners in Flight (2008); Black-billed Cuckoo, Eastern Kingbird, and Bobolink. Bobolink is discussed above as a Threatened Species at Risk in Ontario. Three fatalities were recorded for the Eastern Kingbird during the Reporting Period, and a single Black-billed Cuckoo fatality was recorded. This level of mortality is not considered to result in a measureable impact to the local, regional or provincial populations of these species.

The annual bird mortality rate of 0.77 birds/MW for the Reporting Period is lower than that observed at the nearby Maple Ridge facility, located in New York, approximately 75 km south of the Wolfe Island Wind Plant. Estimated mortality rates at Maple Ridge was 5.81 birds/MW in 2006 (Jain et al., 2007) and 3.82 birds/MW in 2007 (Jain et al., 2009). Also, estimated mortality rates at the Wolfe Island Wind Plant mortality rates are within the mortality range of 0 to approximately 14 birds/MW reported by The National Wind Coordinating Collaborative (NWCC), Strickland et al., 2011) in their review of fatality rates at 63 North American wind facilities. When comparing mortality estimates from the Wolfe Island Wind Plant with other facilities, it is important to note that most, if not all of the studies at Maple Ridge and those summarized in the NWCC report did not include winter mortality monitoring; therefore any fatalities occurring over the winter months were not included in annual mortality rates of these sites. The data for the Wolfe Island Wind Plant includes winter fatalities.

Ten raptor fatalities were recorded over the course of this Reporting Period: two unidentified hawk species, one Northern Harrier, two Ospreys, two Red-tailed Hawks, two Rough-legged Hawks and one Turkey Vulture. Based on the dates of recovery during the Reporting Period, the Rough-legged Hawk fatalities (March 27 and April 13), unidentified raptor (March 23), and one of the Red-tailed Hawk fatalities (April 3) represent wintering and migratory birds, whereas the remaining Red-tailed Hawk fatality (May 17), unidentified raptor (April 17), Northern Harrier (May 17), Osprey (May 3 and May 14), and Turkey Vulture (May 17) fatalities would likely represent resident birds. One hawk was observed outside of the mapped search area, on February 21, 2012. This fatality was not included in the mortality correction factors.

The ten raptor carcasses recovered within the mapped search area, when corrected for scavenger removal, searcher efficiency, and percent area searched, represent an estimated total raptor mortality rate of 0.36 raptors/turbine (0.16 raptors/MW) during the Reporting Period. The estimated mortality rate for all birds is 2.12 birds/turbine (0.93 birds/MW) during the Reporting Period. This mortality rate is well below the adaptive management threshold of 11.7 birds/MW identified in the Follow-up Plan.

When combined with the results of the July to December 2011 monitoring period, the annual raptor mortality rate is estimated to be 0.44 raptors /turbine (0.19 raptors/MW). The annual raptor mortality rate of 0.19 raptors/MW is within the annual mortality range observed at other facilities in North America outside California (0 to 0.49 raptors/MW; Strickland et al., 2011). This estimated mortality rate would place the Wolfe Island Wind Plant tied for seventh if the 34 wind farms summarized outside of California were ranked from lowest to highest estimated raptor and vulture mortality rates.. It is also less than the rate observed at Maple Ridge in 2007, (0.25 raptors/MW; Strickland et al., 2011). However, the annual raptor mortality rate is higher than the notification threshold of 0.09 raptor /MW identified in the Follow-up Plan.

A total of eight carcasses of five bat species were collected during the Reporting Period. Individual fatalities were recorded for the Big Brown Bat, Tri-coloured Bat *(*formerly known as the Eastern Pipestrelle), Hoary Bat , Red Bat , and Silver-haired Bat. Three bat fatalities were not identifiable given the advanced state of decomposition. All species identified are ranked either S5 (i.e., Secure – common, widespread and abundant in Ontario) or S4 (i.e., Apparently Secure – uncommon but not rare) in Ontario. One species, the Tri-coloured Bat was assessed in February of 2012 by COSEWIC as an endangered species. However, it has not yet been added to any Schedule under the *Species at Risk Act (2002)*.

Correcting for searcher efficiency, scavenger removal rates, and percent area searched, the eight recovered carcasses represent an estimated total bat mortality rate for the Reporting Period of 0.73 bats/turbine (0.32 bats/MW).

When the results of the Reporting Period (January to June) are combined with the estimated mortality rate for the period July to December 2011 (3.19 bats/MW), the resultant estimated annual mortality rate of 3.51 bats/ MW is within the low end of the range of mortality reported by NWCC (Strickland et al., 2011) (0 to 39.7 bats/MW). The annual bat mortality rate is well below the adaptive management threshold of 12.5 bats/MW as identified in the Follow-Up Plan.

Winter raptor surveys were completed in November and December 2011, the results of which were presented in Monitoring Report No. 6. This report addresses the entire winter raptor season (i.e. November 2011 to March 2012) which allowed for a full comparison to the preconstruction surveys conducted in 2006-2007, and the post-construction surveys conducted in 2009/2010 and 2010/2011. Maximum numbers of observations during any one survey in the 2011/2012 winter raptor surveys include 32 Rough-legged Hawks (March 6), 24 Northern Harriers (March 6), 20 Snowy Owls (January 18), 14 Red-tailed Hawks (January 18), and 6 American Kestrels (January 9). The largest number of Bald Eagles (3 observations) occurred on February 21, 2012. Peak numbers of Short-eared Owls were observed in March 2012, with up to 67 individuals observed on a single survey (March 6). This high count coincided with the discovery of numerous Short-eared Owls (28) leaving an unknown roost on Wolfe Island and travelling over open water to nearby Simcoe Island, roughly 500 meters (m) away. One possible explanation for this behaviour is these birds showed roost site fidelity on Wolfe Island, yet higher prey densities on Simcoe encouraged the crossing to hunt.

The abundance of Short-eared Owl observations suggests Wolfe Island remains an important and productive wintering area for this species.

The results of the multi-year studies demonstrate the annual variability of raptor abundance, with different species peaking in different years. Overall, the 2006/2007 season (0.72 raptors/kilometer (km)) appeared to have particularly high raptor abundance with very high numbers of Northern Harriers observed. Raptor numbers observed in 2009/2010 were significantly lower (0.25 raptors/km); however, some species such as Snowy Owl and Bald Eagle appeared to peak in abundance that year. The results from the 2010/2011 surveys (0.54 raptors/km) demonstrates that raptor abundance had increased from the 2009/2010 season, but numbers were lower than those observed in 2006/2007. For the current Reporting Period, raptor densities were the highest recorded in post-construction surveys (0.60 raptors/km). Northern Harrier, Red-tailed and Rough-legged Hawks were all well represented with high counts indicating a productive winter season for these species. Short-eared Owl numbers were their highest to date for any pre- or post-construction evening survey (205 recorded observations over 10 survey dates). Snowy Owl numbers observed in 2011/2012 more than doubled any previous pre- or post-construction tally with 76 observations, indicating a large irruption had occurred. Differences in raptor density observed within the Study Area between 2006/2007, 2009/2010, 2010/2011 and 2011/2012 seasons are reflective of observations throughout the Kingston area and across southern Ontario. Differences observed between the pre- and post-construction monitoring are attributed to natural variability and not avoidance of the wind plant.

The grassland bird surveys indicated that, overall, grassland breeding birds remained common throughout the Wolfe Island Wind Plant area. The grassland point counts, repeated during pre- and post-construction monitoring, recorded an apparent decrease in breeding density in some grassland species; implying that the presence of the Wolfe Island Wind Plant has resulted in lower densities, potentially due to avoidance of the WTG. However, decreases were not observed for the same species through paired point count surveys, designed to capture WTG avoidance effects by comparing densities near to and far from individual WTGs, and grassland area searches; implying that the WTGs are not the cause of this decrease in breeding densities. One potential explanation for this decrease observed at grassland point counts (and not during paired point counts) is roadside avoidance. Results of the grassland area searches, which surveyed large portions of grassland habitat in the Study Area during both pre- and post-construction, did not demonstrate a decrease in grassland bird density.

Species-specific results indicated that densities of Bobolink recorded in suitable breeding habitat (hay or pasture) in the Northwest Area of the Wolfe Island Wind Plant have shown a slight increase in post-construction monitoring in 2011 and 2012, when compared to 2007 and 2010. Bobolink in the Southeast Area experienced a notable increase in density in 2012 when compared to all previous years of monitoring. Interestingly, Savannah Sparrow showed a slight increase in the Southeast Area in 2012 compared to 2011 surveys, yet showed decline in the Northwest Area for the same years.

Potential explanations for these fluctuations include seasonally variable weather, habitat suitability (e.g., Bobolink abundance is linked to taller and denser spring hayfields while Savannah Sparrows are associated with shorter and sparser vegetation; Nocera et al., 2007) and local population variability. A WTG avoidance effect was not observed for grassland species through paired point count data, as densities for most species were similar at 0-100m and 100-200m from WTG bases. Northern Harrier, Eastern Kingbird, Savannah Sparrow, Bobolink and Eastern Meadowlark all showed densities slightly higher in the 0 to100m survey sector than the 100 to 200m sector.

Disturbance effects monitoring surveys detailing raptor behaviour, staging and foraging migratory waterfowl, breeding waterfowl, as well as breeding woodland and marsh birds densities were not conducted in 2012. These surveys were discontinued based on the results from earlier in the Monitoring Program and through consultation with agencies that disturbance impact to these groups of birds were not a significant concern. Results of these surveys are provided in previous reports.

Overall, the Wolfe Island Wind Plant Post-Construction Follow-up Plan for Bird and Bat Resources, represents the most extensive post-construction monitoring program in Ontario to date. Results of this multi-year study indicate that the project area continues to support a healthy and vibrant bird community throughout the year, with levels of bird, raptor and bat mortality that are unlikely to have an impact at the local, regional or provincial population level.

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1.0 Introduction

1.1 PROJECT OVERVIEW

TransAlta Corporation, through its wholly owned subsidiary Canadian Renewable Energy Corporation (CREC), has developed a 197.8 MW wind plant on Wolfe Island, Township of Frontenac Islands, Frontenac County, Province of Ontario. Eighty-six 2.3 MW wind turbine generators (WTGs) and ancillary facilities (i.e., substation, transmission lines) have been placed over the western portion of Wolfe Island (**Figure 1.0, Appendix A**) with additional supporting electrical infrastructure on the Kingston mainland, near the city of Kingston, Ontario.

BirdLife International, in cooperation with Bird Studies Canada and Nature Canada, has identified Wolfe Island as an Important Bird Area (IBA) due to the presence of globally and continentally significant numbers of "congregatory" waterfowl species that gather offshore during the spring migration (information is available at www.bsc-eoc.org/iba/site.jsp?siteID=ON037). In addition, Wolfe Island supports notable landbird populations (albeit not in numbers of global or continental importance) including wintering raptors and Tree Swallows.

The high quality grassland habitat that attracts wintering raptors also supports a high abundance and diversity of grassland breeding bird species of conservation priority (Cadman et al., 2007; Ontario Partners in Flight, 2008). As discussed in Section 7.9.1 of the Environmental Review Report (ERR; Stantec 2008), Wolfe Island is a Category 4 Level of Concern Project from the perspective of bird use, based on criteria provided in Environment Canada's *Wind Turbines and Birds: A Guidance Document for Environmental Assessment* (April, 2007a).

Wolfe Island would be a Sensitivity Rating 3 (High) Project for bats based on the criteria provided in the Ontario Ministry of Natural Resources *Guideline to Assist in the Review of Wind Power Proposals: Potential Impacts to Bats and Bat Habitats* (August 2007). Potential concerns with bats are generally associated with the Project's proximity to the shoreline of Lake Ontario, which could potentially act as a corridor or channeling feature for migrating bats.

Recognizing the IBA designation related to waterfowl, as documented in the Project's ERR, and the importance of the area to wintering raptors and breeding grassland birds, extensive primary pre-construction data were collected through multiple-year bird and bat baseline studies on Wolfe Island. These data were further augmented with secondary data from published and unpublished sources to generate a robust data set from which to assess the potential effects of the Project during its operation phase.

The potential bird and bat effects and associated mitigation measures, based upon this dataset, ornithological advice, and professional opinion, among other factors, are provided in ERR Section 7.9. Additionally, bird and bat post-construction monitoring commitments are provided in ERR Section 9.4. These commitments provide the first step of confirming the ERR predictions of potential effects and provide the basis from which the need for mitigative actions, if any, may be determined.

1.2 POST-CONSTRUCTION FOLLOW-UP PLAN

A formal Post-Construction Follow-up Plan for Bird and Bat Resources ("Follow-up Plan") was developed among CREC, Environment Canada / Canadian Wildlife Service, the Ontario Ministry of Natural Resources, Natural Resources Canada, and Ducks Unlimited Canada (collectively the "parties") in consideration of the unique features of Wolfe Island. The final Follow-up Plan was posted to the Wolfe Island Project website in May, 2009 following a period of public comment on a draft Follow-up Plan.

The Follow-up Plan was subsequently revised to reflect site-specific findings available from the 2009 studies on Wolfe Island, and revised guidance materials available from the regulatory agencies. The revised Follow-up Plan (February, 2010) has been posted on TransAlta's Wolfe Island Wind Plant website at www.transalta.com/wolfeisland for stakeholder information. The previous version of the Plan (May, 2009), a summary of stakeholder comments received on the draft Follow-up Plan, and written notification of the revised Follow-up Plan are also available on the Project website.

The objective of the Follow-up Plan was to set out the methods used to assess the direct and indirect effects of the 86 WTGs on the birds and bats of Wolfe Island and, if necessary, to implement appropriate measures to mitigate adverse environmental effects so they do not become significant. The Follow-up Plan was designed by the parties to achieve all of the provincial and federal commitments and requirements.

The Follow-up Plan was fully implemented upon commencement of commercial operations to test the predictions of the ERR prepared in accordance with the Ontario *Environmental Assessment Act* and the Canadian *Environmental Assessment Act*. Should any unanticipated adverse environmental effects be identified, it is the goal of the Follow-up Plan to mitigate those effects such that they do not become significant.

1.3 MONITORING REPORT OVERVIEW

The Follow-up Plan specifies bi-annual post-construction monitoring reporting for periods ending June 30 and December 31. This report, the seventh in a series, contains the results of the post-construction monitoring program for the period between January and June 2012 (Reporting Period).

Consistent with the schedule for post-construction monitoring outlined in Section 5.1 of the Follow-up Plan, field surveys conducted during the Reporting Period included:

- bird and bat mortality monitoring;
- disturbance effects monitoring – wintering raptors; and
- disturbance effects monitoring – breeding grassland birds.

Pre- and post-construction monitoring to date has shown stable numbers of geese and dabbling ducks foraging inland and unchanged movement patterns between foraging areas and offshore staging areas. Breeding pairs in each of the major wetlands that are in proximity to WTG were comparable between 2010 and 2011, although the overall species diversity was lower. Avoidance by geese and ducks nesting, staging, and moving through the Project Area does not appear to be occurring. As such, in consultation with the review agencies, surveys for disturbance effects monitoring for inland movement and foraging migratory waterfowl were discontinued in the fall of 2011. Nesting surveys were discontinued after the 2011 summer breeding season.

Densities of breeding woodland and wetland birds, as measured by point counts and area searches, remained relatively similar between pre- and post-construction surveys as well as between 2010 and 2011. These results are presented in Monitoring Reports 3 (January – June 2010) and 5 (January – June 2011). As such, in consultation with the review agencies, these surveys were discontinued after the 2011 summer breeding bird season.

This report presents the results of the mortality monitoring for birds, raptors and bats from January 1-June 30, 2012 as well as the results of the winter raptor surveys (November 2011-March 2012) and grassland breeding bird surveys (point counts, area searches, and paired point counts) for summer (June) 2012.

2.0 Methods

2.1 MORTALITY MONITORING

2.1.1 Field Surveys

Mortality monitoring was carried out by employees of Wolfe Island Wind Monitoring, an independent, third party consulting firm based in Kingston Ontario. The firm and individual employees conducting the carcass searches have remained consistent since the start of the monitoring program in the spring of 2009. Their activities were carried out according to methods prepared by Stantec Consulting Ltd. (Stantec) that were based on the Follow-up Plan.

The Follow-up Plan specifies that carcass searches are to be conducted at half the WTGs twice per week and at the other half once per week; the two groups shall be rotated so that one week the subset of WTGs receives the less intensive treatment, and the next week the more intensive treatment. To reduce some imprecision arising from the alternating carcass search schedule, one recommendation of Monitoring Report No. 2 (Stantec, May 2010) was to change to a search schedule in which one half the WTGs are searched twice weekly (3.5 day search interval) and the other half are searched once weekly (7 day search interval) without rotation. With agreement from the agencies, the latter approach was adopted starting at the beginning of May 2010. Mortality estimates were calculated separately for each treatment.

Due to the very low levels of scavenger removal and mortality observed over the winter months, one recommendation of Monitoring Report No. 3 was to reduce the frequency of the winter carcass searches in December, January and February. With agreement from the agencies, in the Reporting Period, all WTGs were searched once weekly (7 day search interval) from January 1-March 30, 2012 (**Appendix B**).

Carcass searches for birds and bats were conducted at operating WTGs on weekdays during the Reporting Period, consistent with the Follow-Up Plan. Carcass searches were not conducted under hazardous weather conditions (e.g., thunder and lightning), or when maintenance or reclamation activities prevented access or presented a safety concern.

The carcass searches consisted of one surveyor searching clear or minimally-vegetated portions (as recommended by Environment Canada [2007b]) of a 50 m radius area under each WTG, walking concentric transects spaced at approximately 7 m intervals starting at 2 m from the WTG base. The search area radius and the locations of the transects at each WTG were determined using laser rangefinders with an accuracy of ±1 m.

If a bird or bat carcass was discovered, the following information was recorded:

- date and time it was found;
- state of decomposition;
- estimated number of days since death;
- injury sustained (or best estimate if the carcass was in poor condition);
- species (or best estimate if the carcass was in poor condition);
- distance and direction from the nearest WTG; and
- substrate in which the carcass was found.

Carcasses were photographed, collected, and transported to an on-site freezer by Wolfe Island Wind Monitoring for confirmation of species by Stantec, if necessary. Those that were found in reasonable condition were kept for later use in searcher efficiency or scavenger trials.

2.1.2 Correction Factors and Data Analysis

Information to calculate various corrective factors for searcher efficiency and scavenging rates was also collected during the Reporting Period. Correction factors were calculated to account for carcasses that fell in areas that were not searched as a result of dense vegetation or other obstacles, for carcasses that were overlooked, and for carcasses that were removed by scavengers prior to the search.

There are numerous published and unpublished approaches to incorporating these corrective factors into an overall assessment of total bird and bat mortality. Currently, as documented in the Follow-up Plan, Environment Canada, Canadian Wildlife Service and Ministry of Natural Resources recommend the following correction formula:

C = c / (Se x Sc x Ps), where

C is the corrected number of bird or bat fatalities

c is the number of carcasses found

Se is the proportion of carcasses expected to be found by searchers (searcher efficiency)

Sc is the proportion of carcasses not removed by scavengers over the search period

Ps is the percent of the area searched.

Correction factors for raptors and vultures are expected to be significantly different than those for small birds and bats, for the following reasons:

- searcher efficiency rates are higher than average for larger birds;
- larger and heavier birds are more likely to land closer to the WTG; and
- scavenger rates are lower for larger birds as they are harder for scavengers to carry off and take longer to decompose. There is also some evidence from western North America that scavengers may have an aversion to the carcasses of large hawks (Strickland and Morrison, 2008).

As a result, Se was estimated to be 1.0 for raptors and vultures. An estimate of Sc for raptors and vultures was determined through January and March 2012 scavenger trials using 1 and 3 raptor carcasses, respectively. These trials were combined to increase sample size and applied throughout the Reporting Period. Additionally, to account for the greater visibility of large birds such as raptors or vultures, separate estimation of Ps was undertaken (Section 2.1.2.3). Therefore, in calculating the total number of bird fatalities, raptor and vulture fatalities were corrected separately. The corrected number of raptor and vulture fatalities was added to the corrected number of other bird fatalities to obtain the total estimated number of bird fatalities:

$$\mathbf{C = (c_1 / (Se_1 \times Sc_1 \times Ps_1)) + (c_2 / (Se_2 \times Sc_2 \times Ps_2))},$$ where

C is the corrected number of bird fatalities

$\mathbf{c_1}$ is the number of raptor or vulture carcasses found

$\mathbf{c_2}$ is the number of other carcasses found

Se is the proportion of raptor/vulture carcasses ($\mathbf{Se_1}$) or other carcasses ($\mathbf{Se_2}$) expected to be found by searchers (searcher efficiency)

Sc is the proportion of raptor/vulture carcasses ($\mathbf{Sc_1}$) or other carcasses ($\mathbf{Sc_2}$) not removed by scavengers over the search period

Ps is the percent of the area searched for raptors/vultures ($\mathbf{Ps_1}$) or other carcasses ($\mathbf{Ps_2}$).

The total number of bird or bat fatalities was divided by the number of WTGs (i.e., 86) and the number of MW (i.e., 197.8) to obtain the estimated mortality rates by turbine and by MW for the Reporting Period. The mortality rate at the two MET towers would have been calculated separately, however no fatalities were observed at either MET tower throughout the Reporting Period.

2.1.2.1 Searcher Efficiency

Searcher efficiency trials are designed to correct for carcasses that may be overlooked by searchers during the survey periods. Environment Canada (2007b) provides detailed recommendations on determining searcher efficiency, expressed as a proportion of carcasses expected to be found by individual searchers.

During the Reporting Period, searcher efficiency trials involved "testers" that placed carcasses under WTGs prior to the standard carcass searches over the period May 1 –June 30, 2012 to test each searcher's detection rate. The trials involved 20 test bird and bat carcasses for each of the two full-time searchers that participated in the Reporting Period and between 13 to 15 test bird and bat carcasses for each of the two part-time searchers that participated in the Reporting Period.

Searcher efficiency is expressed as a proportion of unscavenged carcasses found by individual searchers. Searcher efficiency (Se) was calculated for each searcher as follows:

$$Se = \frac{\text{number of test carcasses found}}{\text{number of test carcasses placed} - \text{number of test carcasses removed by scavengers}}$$

Because searchers surveyed varying numbers of WTGs over the course of the mortality monitoring, it was necessary to find a weighted average which reflected the proportion of WTGs each searcher surveyed. This weighted average, or overall Se, was calculated as follows:

$$Se_o = Se_1(n_1/T) + Se_2(n_2/T) + Se_3(n_3/T) + Se_4(n_4/T)$$

where:

Se_o	is the overall searcher efficiency;
Se_1 –Se_4	are individual searcher efficiency ratings;
n_1 – n_4	is quantity of search days completed by each searcher; and
T	is the total number of search days completed by all searchers.

2.1.2.2 Scavenger Trials

Scavenger trials are designed to correct for carcasses that are removed by scavenging animals before the search period. These trials involve the distribution of carcasses in known locations at each WTG, followed by periodic checking to determine the rate of removal.

During the Reporting Period, three two-week scavenger trials were conducted during the months of January, May and June. Two dead, native bird carcasses were placed in two locations within the 50 m search radius at 20 WTGs in January (1 of which was a raptor carcass, details outlined below), May and June. UTM coordinates were taken at each trial carcass location and the distance and direction from the WTG were measured.

Trial carcasses were placed on January 29, May 27, and June 17, 2012, with their presence or absence recorded during regularly-scheduled carcass searches over the subsequent two weeks. Proportions of carcasses remaining after each search interval were pooled to calculate the overall scavenger correction (Sc) factors as follows:

$$Sc = \frac{n_{visit1} + n_{visit2} + n_{visit3} + n_{visit4,}}{n_{visit0} + n_{visit1} + n_{visit2} + n_{visit3}}$$ where

Sc is the proportion of carcasses not removed by scavengers over the search period

$\mathbf{n_{visit0}}$ is the total number of carcasses placed

$\mathbf{n_{visit1} - n_{visit4}}$ are the numbers of carcasses remaining on visits 1 through 4

Sc is expected to vary with the length of the search interval, i.e., the proportion of carcasses not removed by scavengers over the search period is expected to be higher for shorter search intervals and lower for longer search intervals. Accordingly, Sc was calculated separately for the WTGs that were searched weekly (7 day interval) and for those when turbines were searched twice a week (3.5 day interval). All turbines were searched once a week during the month of January.

Additional scavenger trials were conducted in January and March, with 1 raptor carcass included in the January scavenger trials (outlined above) as well as three raptor carcasses, placed at three different WTGs on March 11, 2012. Their presence or absence was recorded during regularly-scheduled carcass searches over the subsequent two weeks, and Sc for raptors and vultures was calculated by summing across trials and then calculating in the manner as described above.

2.1.2.3 Percent Area Searched

Environment Canada has indicated that 85% to 88% of carcasses fall within 50 m of a WTG base (C. Francis, pers. comm., January 2008; MNR, 2011). Environment Canada (2007b) also specifies that for a WTG of the size as those on Wolfe Island, most bat carcasses fall within 50 m. Accordingly, and to be comparable to the results of post-construction monitoring reported for other Ontario wind power facilities, and in accordance with the Follow-Up Plan, the percent area searched was calculated based on a 50 m radius circle.

In each season (i.e., winter: November, 2011-March 30, 2012; fall: September-October, 2011 and summer: May1-June 30, 2012), searchers filled out a 50 m radius circle diagram with 5 m x 5 m grid cells for each WTG, sketching areas searched and identifying areas that could not be searched due to vegetation cover or other factors. In June 2012, searchers also identified areas that were not clear enough to be searched for small carcasses, but in which large carcasses (such as those of raptors and vultures) would be detectable during regular searches. The area searched was determined for each WTG or MET tower by counting the number of searched grid cells within 50 m, and dividing the summed area of those cells by the total area within a 50 m radius circle to determine the percent area searched for that WTG (Ps_x, where x is the WTG number or the MET tower).

$$Ps_x = \frac{\text{area searched within 50 m radius circle}}{\pi (50)^2}$$

The overall Ps for the facility during the search period was calculated as the average of Ps_1 through Ps_{86}, with Ps for MET towers calculated separately:

$$Ps = \frac{Ps_1 + Ps_2 + Ps_3 + \ldots + Ps_{86}}{86}$$

During periods in January and February, occasionally some turbines were inaccessible due to deep snow covering the access roads, despite snow removal efforts. As a result some turbines were not searched in every search round. No correction for missed turbines was necessary as no fatalities were recorded in January or February.

2.2 DISTURBANCE EFFECTS

Disturbance studies completed during the Reporting Period include winter raptor surveys and grassland breeding bird surveys. Breeding bird surveys included point counts and area searches of grassland habitat, in which a total of 27 point counts were conducted in the same locations as the pre-construction surveys, using the same standard protocols. In addition to the standard point counts, paired point counts were conducted at 20 turbine locations, in which each count located at the WTG base was paired with a second (i.e., paired) point count station located 200 m from the base of the WTG. The purpose of the paired point counts is to record bird densities in 100 m bands to document the effective distance of any observed disturbance effects on grassland breeding birds.

2.2.1 Winter Raptor Surveys

Pre-construction baseline winter raptor surveys were conducted to establish areas of raptor use and general behaviour in the Study Area. The purpose of the post-construction winter raptor use surveys is to assess potential displacement or disturbance effects (i.e., distribution and abundance) to these species compared to pre-construction conditions.

The post-construction winter raptor surveys were carried out using the same survey protocols as the pre-construction baseline surveys conducted in 2006-2007. On each date, a late afternoon survey was conducted for raptors and an early evening survey (from sunset to dusk) was conducted for Short-eared Owls. Two vehicles were used on each survey, with an experienced surveyor and a driver in each vehicle. The use of two vehicles allowed the Study Area to be more thoroughly covered during the early evening period.

All north-south roads and most of the east-west roads in the Study Area were driven at slow speeds (i.e., 30-40 km/h). The fields and woodlots were scanned using binoculars to detect any raptors, and a spotting scope was used for closer inspection of stationary birds. All raptors and owls were recorded and their locations mapped.

On each visit, weather conditions, the route taken and the number of kilometers driven were recorded. Density estimates were calculated as the number of raptors or owls per km traveled. Visibility during each of the surveys was good or excellent.

Winter raptor surveys were completed once every two weeks in November 2011 through March 2012. Monitoring Report No. 6 outlined the details for surveys conducted between November and December, 2011. This report will address the entire winter raptor season (i.e., November 2011 to March 2012) to allow for a full comparison to 2006-2007 (pre-construction) and 2011-2012 (post-construction) results.

2.2.2 Grassland Breeding Bird Point Counts, Paired Point Counts and Area Searches

The post-construction grassland breeding bird surveys gathered extensive data on species presence and breeding density, to be compared to pre-construction conditions. Two types of point count surveys were conducted: pre/post construction point counts and paired point counts.

In addition to the point counts, area searches were repeated using the same areas and protocols as the pre-construction baseline surveys in 2007 (**Figure 3.0, Appendix A**). Each area search covered two large tracts containing areas of high quality grassland habitat in areas surrounded by WTGs, one in the northwestern portion of the Study Area (199 ha) and the other in the southeastern portion (195 ha). Both area searches were conducted twice in June, 2012.

Point Counts

Each of the 27 point counts in grassland habitat established during pre-construction surveys was resurveyed in 2012, using the same protocols. Due to changes in crop types, some point count locations were adjusted to ensure all 27 were in suitable grassland habitat. Point count locations are shown in **Figure 2.0, Appendix A**.

Paired Point Counts

Paired point counts were conducted at 20 WTGs that were in high quality grassland habitat (**Figure 2.0, Appendix A**). Paired point counts consisted of two 10-minute point counts; one half circle, 100 m-radius point count at the WTG base and one full circle, 100 m-radius point count located 200 m from the base of the WTG. During both point counts, birds were recorded at 100 m intervals allowing bird occurrences to be mapped in 100 m circular bands from 0 to 100, 100 to 200, and 200 to 300 m from the WTG' s base.

All point counts were conducted twice in June, once during an early June visit and once during a late June visit. Point counts were conducted in the mornings between dawn and 10:00. For each point count, a record was made of the start time and a hand-held global positioning system (GPS) unit was used to georeference its location. A brief description of the habitat was recorded for each point count. Each standard point count was conducted for 10 minutes, during which time all breeding pairs were recorded within 100 m of the observer.

Southeast Area Search

The "Southeast Area" was located between Concession 9 and Concession 8, and between Reeds Bay Road and Bennett Road. Landowner permission determined which fields were surveyed. The area was broken into eleven sub-areas, or "sectors", based on land use. Separate lists of breeding birds were recorded for each sector. The Southeast Area contained several open country habitats including 71 ha (36%) of hay, 101 ha (52%) of pasture and 23 ha (12%) of crop. Total grassland habitat (i.e. hay and pasture) in the Southeast Area increased during the three year monitoring period, encompassing 141 ha in 2007, 165 ha in 2010, 172 ha in 2011 and 172 ha in 2012.

Northwest Area Search

The "Northwest Area" was located between Concession 2 and Concession 3 for approximately 500 m north of and 1200 m south of Baseline Road. This area was broken into eight sub-areas, or "sectors" based on land use. Separate lists of breeding birds were recorded for each sector. The Northwest Area encompassed 96 ha (48%) of hay, 101 ha (51%)of crop and 2.5 ha (1%) of woodland. Total grassland habitat (i.e. hay) decreased during the three year monitoring period, encompassing 199 ha in 2007, 147 ha in 2010, 110 ha in 2011 and 96 ha in 2012.

Each area search consisted of walking predetermined transects through the designated area. Transects ran parallel through each area at 200 m intervals. While in the field, aerial photography was used to navigate along the routes, while a GPS unit assisted in spacing the transects. Tallies of all breeding pairs were recorded by species while for grassland birds, separate tallies were made for each parcel.

A conservative approach to breeding status was taken. The presence of a male bird (singing, displaying, perched or flying) in appropriate breeding habitat was considered to represent a breeding pair. Of the grassland species present, Bobolink required additional consideration to record accurate numbers of breeding pairs, due to their colonial nesting habits. Therefore, Bobolinks were counted on a landscape scale, recording the number of flying and/or displaying males in each colony as they were encountered.

Some species, such as the Northern Harrier or Upland Sandpiper, frequently travel some distance while hunting or displaying. A single individual of these species could likely be encountered on two or more of the transects. In the case of Northern Harrier, a single individual could be encountered multiple times throughout an area search. However, the relatively large size and conspicuous flight of these species made it relatively easy to track individuals and avoid double counting.

To standardize the data, all breeding bird point count and area search results were expressed in pair densities per 10 ha. To address changes in the amount of grassland habitat (i.e. hay and pasture) within the area searches between pre and post construction, the density was also calculated within just the grassland sectors. For paired point counts, an Analysis of Variation (ANOVA) was performed to determine whether the differences in the most commonly observed species' densities were significant among of the distance regimes.

3.0 Results

3.1 MORTALITY MONITORING

Results of the mortality monitoring for the Reporting Period are summarized in Tables 3.1-3.11, **Appendix C** with all survey dates, personnel, and weather conditions found in **Appendix D**. Raw mortality data is presented in **Appendix E**.

3.1.1 Correction Factors

3.1.1.1 Searcher Efficiency

Individual searcher efficiency during the Reporting Period ranged from 76.9% to 95.0% (**Table 3.1, Appendix C**). The overall searcher efficiency was subsequently calculated by weighting the individual searcher efficiencies, according to the proportion of search days surveyed in each month over the Reporting Period. The weighted searcher efficiency values for each month are shown in **Table 3.2, Appendix C** and ranged from 0.918 in April to 0.938 in January. These values were applied to assess bat and small bird mortality rates. Searcher efficiency for raptors and vultures was assumed to 100% in searchable areas where raptors and vultures were readily visible. In non-searchable areas, searcher efficiency was assumed to be 0%. Unsearched areas within the 50 m search radius were accounted for in the percent area searched correction factor when calculating the estimate of total mortality.

3.1.1.2 Scavenger Removal

Analysis of the scavenger trial data indicates that in the winter, on average, 73.5% of trial carcasses were not removed by scavengers over the average search interval (**Table 3.3, Appendix C**). The January results were applied to February which is on the same winter search schedule. In spring, the May scavenger trial indicated that, on average, 48.5% of carcasses for the turbines checked once a week (7 day interval) and 53.7% of carcasses for those checked twice a week (3.5 day interval) were not removed by scavengers (**Table 3.3, Appendix C**). The May results were applied to other spring months (i.e., March and April). Results of the June scavenger trials indicated that, on average, 39.1% (7 day interval) and 55.8% (3.5 day interval) of carcasses were not removed by scavengers over the search interval (**Table 3.3, Appendix C**).All these values were applied to assess bat and small bird (i.e., non-raptor) mortality rates.

The scavenger removal rate of raptor and vulture carcasses is expected to be less than for that of bats and smaller birds. A total of four (4) raptor carcasses were used during the 2012 scavenger trials, conducted in January and March (**Table 3.4, Appendix C*).*** The overall scavenger rate (Sc) was calculated by pooling carcasses across trials to increase sample size, resulting in a Sc of 0.86.

3.1.1.3 Percent Area Searched

The average proportion of the 50 m radius search area that was physically searched during January, February, March, and April was 28.0%. In May and June, 26.1% and 27.0% of the 50 m radius was searched for WTGs searched weekly and bi-weekly, respectively. These values were applied to assess bat and bird mortality rates (see below).).

Specific information was collected related to the visibility to large carcasses (i.e. raptors and vultures). The average proportion of the 50 m radius in which large carcasses were visible was 49.4% in January, February, March, and April. Searchable area did not change between May and June, the average proportion of the 50 m radius was 25.0% and 35.8% for those searched weekly and bi-weekly, respectively. These results were applied to assess raptor and vulture mortality rates (see below) Direct Effects - Birds

Raw mortality data for the Reporting Period is provided in **Appendix E**.

An Avian and Bat Observation Form is available on the Project website to receive comments from the public regarding bird and bat observations related to wind plant operations. No comments were received from the public during the Reporting Period.

A total of 20 carcasses of 13 identifiable bird species were collected during the Reporting Period (**Table 3.5, Appendix C)**. During the Reporting Period all species had provincial S-Ranks of S5 (i.e., Secure – common, widespread and abundant in Ontario), S4 (i.e., Apparently Secure – uncommon but not rare) or SNA (i.e., Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities).

Three Bobolink (S4) fatalities were observed during the Reporting Period. This species is listed as Threatened on the Species at Risk in Ontario list of the provincial *Endangered Species Act (2007).* Bobolink has also been identified by the Committee on the Statue of Endangered Wildlife in Canada (COSEWIC) as threatened, but has not been added to a schedule of the *Species at Risk Act (200*2). After applying correction factors for searcher efficiency, scavenger removal and percent area searched, the three carcasses found represent an estimated 23.0 Bobolink fatalities over the Reporting Period. The number of fatalities is small relative to the estimated 1,000-1,500 breeding individuals that were observed in the Study Area during pre-construction surveys (approximately 1,050 counted during area searches, plus others observed during point counts; Stantec, 2008a) and the estimated Ontario population of 800,000 (Cadman et al., 2007).

Three species have been identified as species of conservation priority by Ontario Partners in Flight (2008); Black-billed Cuckoo, Eastern Kingbird, and Bobolink. Bobolink is discussed above as a Threatened Species at Risk in Ontario.

Three fatalities were recorded for the Eastern Kingbird during the Reporting Period, with a single Black-billed Cuckoo fatality. This level of mortality is not considered to result in a measureable impact to the local, regional or provincial populations of these species

These bird fatalities (excluding raptors), when corrected seasonally for searcher efficiency, scavenger, and percent area searched, represents an estimated total bird mortality rate of 1.76 birds/turbine (0.77 birds/MW) (**Table 3.6, Appendix C**).

Ten raptor fatalities were recorded over the course of this Reporting Period: two unidentified hawk species, one Northern Harrier, two Ospreys, two Red-tailed Hawks, two Rough-legged Hawks and one Turkey Vulture (**Table 3.7, Appendix C)**. Based on the dates of recovery, the Rough-legged Hawk fatalities (March 27 and April 13), unidentified raptors (March 23 and April 17), and one of the Red-tailed Hawk fatalities (April 3) represent wintering and migratory birds, whereas the remaining Red-tailed Hawk fatality (May 17), Northern Harrier (May 17), Osprey (May 3 and May 14), and Turkey Vulture (May 17) fatalities would likely represent resident birds. One individual unidentified raptor was observed outside of the mapped search area on February 21, 2012.. This fatality was not included in the mortality correction factors.

The ten raptor carcasses recovered within the mapped search area, when corrected seasonally for searcher efficiency, scavenger, and the percent area searched, represent an estimated total raptor mortality rate of 0.36 raptors /turbine (0.16 raptors /MW) for the Reporting Period (**Table 3.7, Appendix C**). The 20 other bird carcasses recovered after corrections represent an estimated bird mortality rate (excluding raptors) for the Reporting Period of 1.76 birds/turbine (0.77 birds/MW) (**Table 3.6, Appendix C**). Combined, the estimated total bird mortality rate is 2.12 birds/turbine (0.93 birds/MW) for the Reporting Period.

The majority of bird fatalities (bird and raptor combined) occurred later in the Reporting Period, in May and June 2012. Fewer fatalities were observed in March and April with no fatalities observed in January or February (**Figure 4.0, Appendix A**). Bird fatalities (bird and raptor combined) were distributed relatively uniformly across the wind plant area, with 63 of the 86 monitored turbine not experiencing any bird mortality. The remaining 23 turbines experienced no more than 3 mortalities at any individual turbine (**Figure 5.0, Appendix A**).

3.1.2 Direct Effects - Bats

Raw mortality data for the Reporting Period is provided in **Appendix E**.

An Incidental Avian and Bat Observation Form is available on the Project website to receive comments from the public regarding bird and bat observations related to wind plant operations. No comments were received from the public during the Reporting Period.

A total of eight carcasses of five bat species were collected during the Reporting Period. Individual fatalities were recorded for the Big Brown Bat, Tri-coloured Bat *(*formerly known as the Eastern Pipestrelle), Hoary Bat, Red Bat , and Silver-haired Bat. Three bat fatalities were not identifiable given the advanced state of decomposition (**Table 3.9, Appendix C)**. All species identified are ranked either S5 (i.e., Secure – common, widespread and abundant in Ontario) or S4 (i.e., Apparently Secure – uncommon but not rare) in Ontario.

One of the species found as a mortality, the Tri-coloured Bat was assessed in February of 2012 by COSEWIC as an endangered species. However, it has not yet been added to any Schedule under the *Species at Risk Act (2002)*. It is currently under assessment by the Committee on the Status of Species at Risk in Ontario (COSSARO). The recent assessment was the result of current population impacts this species is experiencing from a fungal pathogen known as White-nose Syndrome. A single fatality of the Tri-Coloured Bat occurred on May 11, 2012 at Turbine 39.

Bat fatalities occurred primarily in May, with one fatality in June 2012, and no fatalities observed earlier in the Reporting Period (**Figure 4.0, Appendix A**). Bat fatalities were distributed relatively uniformly across the wind plant area, with no more than 1 bat recovered from any individual turbine (**Figure 5.0, Appendix A**).

Correcting seasonally for searcher efficiency, scavenger removal, and percent area searched, the 8 recovered carcasses represent an estimated total bat mortality rate for the Reporting Period of 0.73 bats/turbine (0.32 bats/MW) (**Table 3.10 Appendix C**).

3.1.3 Direct Effects – Annual Summary

Table 3.11 (Appendix C) summarizes the corrected mortality rates for all birds, raptors and bats during each of the 7 Reporting Periods. January to June bird mortality (excluding raptors) rates ranged from 1.53 birds/turbine in 2011 to 6.27 birds/turbine in 2010. July to December bird mortality (excluding raptors) rates ranged from 3.62 birds/turbine in 2011 to 8.18 birds/turbine in 2010.

January to June raptor mortality ranged from 0.12 raptors /turbine in 2010 to 0.36 raptors/turbine during the current Reporting Period (2012). July to December mortality rates ranged from 0.09 raptors/turbine in 2010 and 2011 to 0.15 in 2009.

Bat mortality rates showed a relative distinctive pattern, with higher fatality rates during the fall July to December Reporting Periods (range: 5.73 bats/turbine in 2011 to 14.77 bats/turbine in 2009), when compared to the spring January to June Reporting Periods (range: 0.48 bats/turbine in 2011 to 5.22 bats/turbine in 2010).

3.2 DISTURBANCE EFFECTS MONITORING

3.2.1 Winter Raptor Surveys

A summary of raptors and owls recorded during each survey throughout the winter season (November 2011 to March 2012) is provided in **Table 3.12 (Appendix C).** Although not within the Reporting Period, November and December 2011 were included to provide a full season of results, allowing for a complete comparison to pre-construction surveys.

Within the 2011/2012 winter season, Rough-legged Hawk (134 observations) was the most common raptor observed during the afternoon surveys. Other common species included Northern Harrier (123 observations), Red-tailed Hawk (79 observations), Snowy Owl (76 observations) and American Kestrel (33 observations). Other raptor species had 10 or fewer observations over the course of the winter raptor season.

Maximum numbers of observations during any one survey include 32 Rough-legged Hawks (March 6), 14 Red-tailed Hawks (January 18), 24 Northern Harriers (March 6), 20 Snowy Owls (January 18) and 6 American Kestrels (January 9). The largest number of Bald Eagles (3 observations) was observed on February 21, 2012.

During the evening surveys, Short-eared Owls were common with a total of 205 observations throughout the season. The maximum number of Short-eared Owls observed in a single survey was 67 on March 6, 2012. **Table 3.13 (Appendix C)** compares the maximum number of Short-eared Owls observed in a single survey during the pre-construction 2006/2007 surveys and the three years of post-construction surveys in 2009/2010, 2010/2011 and 2011/2012.

Movements of Short-eared Owls flying toward Simcoe Island, in the northwest corner of the Study Area, were observed in March of 2012. During the dusk survey on March 6 a total of 28 Short-eared Owls were observed in a steady, direct flight, at an approximately height of 100m, moving from Wolfe Island to Simcoe Island (roughly 500m overwater flight). The owls were moving in small groups of 2 to 3 birds. A similar movement of 19 Short-eared Owls was observed on the following survey on March 19. Further discussion is provided in **Section 4.2.1**.

Table 3.14 (Appendix C), provides a comparison of 2006/2007 pre-construction, 2009/2010, 2010/2011 and 2011/2012 post-construction survey results by species. Results of the afternoon survey show annual variability between the years. The winter of 2009/2010 had particularly low raptor abundance, however the post-construction monitoring in 2010/2011 and 2011/2012 showed similar numbers to the pre-construction surveys in 2006/2007.

Several species show particular variability in observed abundance. Northern Harrier, which peaked in 2006/2007 at 159 individuals dropped to a low of 19 in 2009/2010 and as high as 123 in the current reporting period (2011/2012). Rough-legged Hawk peaked in 2010/2011 at 184 (55% higher than during the pre-construction monitoring). Snowy Owls also showed

considerable variability, with the highest numbers recorded during the current reporting period of the winter of 2011/2012. Results from the evening surveys suggest the current year of monitoring in 2011/2012 was a peak year for Short-eared Owls on Wolfe Island, with a 146% increase in abundance when compared to pre-construction monitoring.

Numbers of wintering raptors and owls are known to vary significantly from year to year, based on prey conditions in their northern breeding and southern wintering areas. **Table 3.15, Appendix C** summarizes the results of the Kingston Christmas Bird Count (CBC) from 2000 to 2011, and demonstrates annual fluctuations in wintering raptor numbers in the Kingston area, which includes Wolfe Island and other areas surrounding Kingston, The results are presented as number of birds observed per party hour. The CBC data suggests that 2006 was a peak year for many raptor species with high numbers of Northern Harriers and Red-tailed Hawks. The 2011 CBC data generally corresponds to the 2011/2012 post-construction monitoring results, and especially shows a similar high peak in Snowy Owl abundance. Similar trends were observed in 2009 and 2011 across southern Ontario, as recorded by other CBC counts around the province that helped recorded the irruption of Snowy Owls in 2011/2012.

As with the results of the pre-construction raptor surveys, areas of particularly high raptor and Short-eared Owl density (defined as more than 5 raptors/kilometer (km) or more than 3 owls/km) were mapped. Areas of high raptor and high owl density, as defined above, are shown in **Figure 6.0** and **Figure 7.0, Appendix A**, respectively. Results of the multi-year study suggest areas of winter raptor concentration shifted locations between years. Most areas of raptor concentration in 2011/2012 occurred in a band originating from the Northwest corner of the Study Area stretching easterly across the island to north of Button Bay. When compared to pre-construction results, the 2011/2012 season had more winter raptor concentrations in this centre of the Study Area, whereas 2006/2007 had more concentrations around the edges of the area surveyed.

3.2.2 Grassland Breeding Bird Point Counts, Paired Point Counts and Area Searches

Point Counts

Table 3.16, Appendix C compares grassland breeding bird densities, as measured through the 2006 and 2007 pre-construction and 2010, 2011 and 2012 post-construction grassland breeding bird point counts. Results of the 2012 monitoring found the Red-winged Blackbird to be the most abundant species observed, followed by Bobolink and Savannah Sparrow.

Results of the 2012 grassland point counts demonstrated an increase, relative to 2011, of breeding Bobolink, Eastern Meadowlark, and Barn Swallow, densities. Slight declines were demonstrated by Savannah Sparrow and Eastern Kingbird (**Table 3.16, Appendix C**).

Overall, the density of most breeding birds, as measured through the grassland point counts, displayed a decreasing trend from pre-construction to post-construction. However, a similar declining trend was not observed between the pre- and post-construction grassland area searches (results presented below). Further discussion is provided in **Section 4.2.2**.

Paired Point Counts

Table 3.17, Appendix C provides the results of the grassland paired point count surveys, comparing average breeding bird densities (pairs/10 ha) at three distance regimes; within 100 m of the WTG bases, 100 to200 m and 200 to 300 m from the bases. Detailed results are provided in **Appendix F**.

Bobolink, Savannah Sparrow and Red-winged Blackbird were the most commonly encountered species, which is consistent with the grassland point counts.

When comparing the three distance regimes, very little difference in density was observed between 0 to 100 m, 100 to200 m and 200 to 300 m from the WTG base with variations in densities between species not showing any particular trend. Summary statistics are provided in **Appendix F**. The single factor ANOVA analysis of the results indicated significant difference in the three distance regimes for all species and the six most common grassland species combined (i.e., Upland Sandpiper, Eastern Kingbird, Savannah Sparrow, Grasshopper Sparrow, Bobolink and Eastern Meadowlark) ($p<0.05$, **Appendix F**). Looking at individual species, the ANOVA analysis found a significant differences between distance regimes for Savannah Sparrow and Eastern Meadowlark, but not for Bobolink ($p>0.05$, **Appendix F**).

Southeast Area Search

In total, 32 species were observed breeding within the Southeast Area. Detailed observations are provided in **Appendix F**. **Table 3.18, Appendix C** compares the densities of grassland breeding birds in the 2007 pre-construction to the 2010, 2011 and 2012 post-construction surveys. **Table 3.19, Appendix C** compares the densities within grassland sectors alone, to account for change in the amount of hay and pasture between years.

Over the entire Southeastern search area (**Table 3.18, Appendix C**), Bobolink was the most abundant species (14.3 pairs/10ha), followed by Savannah Sparrow (8.9 pairs/10ha). A pair of Northern Harriers was observed and likely bred within the Southeast Area during both pre and post-construction surveys.

The amount of suitable grassland habitat in the southeast search area remained unchanged in 2012 from 2011. When correcting for this change in availability of suitable habitat (**Table 3.19, Appendix C**), Bobolink had the largest change in density with an increase in 2012 compared to previous years of pre and post-construction monitoring. Savannah Sparrow had a relatively consistent abundance over the 4 years of monitoring. Eastern Meadowlark appeared to be

more abundant in the Southeast search area in 2012, compared to 2011. However, Eastern Meadowlark number remained below those observed during pre-construction surveys in 2007.

One species in decline in the southeast area, Grasshopper Sparrow, continued the trend in 2012 with no individuals recorded; down from 0.4 pairs/10 ha (2007), 0.2 pairs/10 ha (2010) and 0.1 pairs/10 ha (2011).

Northwest Area Search

In total, 30 species were observed breeding within the Northwest Area. Detailed observations are provided in **Appendix F**. **Table 3.18, Appendix C** compares the densities of grassland breeding birds between 2007 pre-construction and 2010, 2011 and 2012 post-construction surveys. **Table 3.19, Appendix C** compares the densities within grassland sectors alone, to account for change in the amount of hay and pasture between years.

Over the entire Northwest Area (**Table 3.18, Appendix C**), Bobolink had the highest observed density (10.7 pairs/10ha), followed by Savannah Sparrow (6.1 pairs/10ha). A pair of Northern Harriers was observed during both pre- and post-construction surveys and were likely breeding within the Northwest Area.

The area of suitable grassland habitat (hay) has experienced a large decline since pre-construction surveys were conducted, as a result of crop rotation. In 2007, 199.6 ha of hay was present in the Northwest Area, 146.5 ha in 2010, 106.7 ha in 2011 and 96.0 ha in 2012. This difference in suitable grassland habitat reflects a 10% decrease in 2012 compared to 2011. Overall, a 52% decrease in high-quality grassland habitat has occurred from 2007 to 2012. When correcting for this change in availability of suitable habitat (**Table 3.19, Appendix C**), Bobolink density within the Northwest Area was slightly lower in suitable grassland habitat in 2012, compared to 2011, however they remain similar to 2007 pre-construction and 2010 post-construction numbers. Savannah Sparrows appeared to be in lower abundance in 2012, when compared to the previous pre- and post-construction monitoring. As observed during pre-construction surveys, Upland Sandpiper was a common species within the Northwest Area during the 2012 post-construction monitoring. As a species that will nest on disturbed soils, it did not appear to be as affected by the loss of hayfield as other grassland species (**Table 3.18, Appendix C**).

An observed decline in Grasshopper Sparrows was recorded between the 2007 pre-construction and 2010 post-construction survey. In 2012, the species was not recorded in northwest area searches. Slightly fewer Eastern Meadowlarks were observed during the 2012 post-construction monitoring, when compared to 2007 and 2010, but similar to 2011 numbers.

3.3 NOTIFICATIONS

Section 3.2 of the Follow-up Plan outlines mortality and disturbance thresholds which trigger contact with EC / CWS, the MNR, and NRCan. There were six notifications filed during the Reporting Period (**Table 3.21, Appendix C**), related to mortality of raptors and vultures or species at risk.

Notifications and the agency responses are provided in **Appendix G**.

3.3.1 High Annual Mortality Rates – Raptors and Vultures

The notification threshold for high annual mortality rates – raptors as outlined in the Follow-up Plan is two raptor or vulture fatalities over a six-week period. Four of the six notifications were related to raptor and vulture fatalities, and were submitted on March 30, May 3, May 15, and May 22, 2012 (**Table 3.21, Appendix C**). Each notification involved two raptor or vulture fatalities over periods of varying length, but less than six weeks (**Table 3.21, Appendix C**).

3.3.2 Mortality of Species at Risk

The Follow-up Plan requires that any mortality of species at risk must be immediately reported to NRCan, MNR and EC. Two of the six notifications were related to Bobolink fatalities, and were submitted on June 6 and June 19 (**Table 3.21, Appendix C**). The first notification represented two female fatalities and the second represented a single female fatality. Bobolink is listed as Threatened on the Species at Risk in Ontario List of the provincial *Endangered Species Act*. Bobolink has also been evaluated as Threatened by COSEWIC but is currently not on a Schedule of the federal *Species at Risk Act*.

4.0 Discussion and Recommendations

4.1 DIRECT EFFECTS – MORTALITY

During the current Reporting Period of January 1 to June 30 2012, 30 bird carcasses and 9 bat carcasses were recorded at WTG's. Over the Reporting Period, no fatalities were observed at either of the two MET towers, suggesting mortality rates at the towers were very low to nil. The very low mortality rate can possibly be attributed to the absence of guy wires on the MET towers, which can be associated with bird mortality at other similar structures (e.g. communication towers).

4.1.1 Birds

The estimated bird mortality rate (excluding raptors) of 0.77 birds/MW for the Reporting Period is lower than that observed at the nearby Maple Ridge facility, located in New York, approximately 75 km south of the Wolfe Island Wind Plant. Estimated mortality rates at Maple Ridge was 5.81 birds/MW in 2006 (Jain et al., 2007) and 3.82 birds/MW in 2007 (Jain et al., 2009). Also, estimated mortality rates at the Wolfe Island Wind Plant are within the range of 0 to 14 birds/MW reported by NWCC, (Strickland et al., 2011) in their review of fatality rates at 63 North American wind facilities. When comparing mortality estimates from the Wolfe Island Wind Plant with other facilities, it is important to note that most, if not all of the studies at Maple Ridge and those summarized in the NWCC report did not include winter mortality monitoring; therefore any fatalities occurring over the winter months were not included in annual mortality rates of these sites. The data for the Wolfe Island Wind Plant includes winter fatalities.

The estimated total bird mortality rate for the six-month Reporting Period at the Wolfe Island Wind Plant, at 0.93 birds/MW (2.12 birds/turbine), was slightly above that observed during the same period in 2011 (0.66 birds/MW or 1.53 birds/turbine). Although the actual number of carcasses were similar (31 total avian mortalities in 2011, 20 in 2012) differences in the corrected mortality rates have resulted from slightly decreased percent area searched and increased scavenging rates in 2012.

Annual estimated mortality rates were calculated by combining the results of the Reporting Period (January-June) with the estimated mortality rate for the previous six month period July to December 2011 (1.69 birds/MW), resulting in an estimated mortality rate of 2.62 birds/MW/year. This estimated annual mortality rate is well below the adaptive management threshold of 11.7 birds/MW/year identified in the Follow-Up Plan.

Excluding Reporting Period No. 1 (which was only 2 months in duration), the mortality rates for all birds ranged from 1.53 to 8.18 birds/turbine (0.67 to 3.56 birds/MW) which put the annual mortality rates consistently well below the adaptive management thresholds outlined in the Follow-up Plan of 11.7 birds/MW/year. Considering that this level of mortality was spread over 69 species, over the three years of monitoring, it is unlikely to have an impact at the local, regional or provincial population level.

Bobolinks have been identified as a species of conservation priority by Ontario Partners in Flight (2008). This species was listed as Threatened on the Species at Risk in Ontario list of the provincial *Endangered Species Act (2007),* in September of 2010*.* Bobolink has also been identified by COSEWIC as Threatened, but has not been added to a schedule of the *Species at Risk Act (200*2). Three Bobolink fatalities recorded within the Reporting Period, all of which were female. This is contrary to previous years (2009, 2010 and 2011), when only male Bobolink mortalities were recorded during the early breeding season in May and June.

Seven Bobolink fatalities were recorded over the most recent one year period from July 2011 to June 2012. When applying correction factors to the seven Bobolink fatalities, the estimated mortality rate is 26.0 Bobolinks for the July to December 2011 period and 23.0 Bobolinks for the January to June 2012 period. The total annual Bobolink mortality rate for 2011/2012 is therefore estimated at 49.0 fatalities. This level of mortality is small relative to the estimated 1,000 to 1,500 breeding individuals (i.e. approx. 3 to4% of the population) that were observed in the Study Area during pre-construction surveys (approximately 1,050 breeding individuals counted during area searches, plus others observed during point counts; Stantec, 2008a) and the estimated Ontario population of 800,000 individuals (i.e. approx. 0.005% of the population) (Cadman et al., 2007). The population estimate for the Study Area is likely a conservative one, because it was based on surveys of territorial birds in spring, and would not account for young birds fledged later in summer. It is therefore likely that the percentage of the local population affected (i.e., 3 to 4%) would be lower if these additions of young were accounted for.

Two other species of conservation priority were found as fatalities during the Reporting Period; specifically, one Black-billed Cuckoo and two Eastern Kingbirds. This level of mortality is not considered to be a concern at the population level for either species, with Ontario populations of each species estimated at 40,000 and 300, 000 breeding individuals, respectively (Cadman et al., 2007).

The estimated raptor mortality rate over the Reporting Period of 0.32 raptors /turbine (0.16 raptors /MW) is higher than that observed during previous Reporting Periods. The number of raptor fatalities observed during the January to June period has been similar in each Reporting Period (10 in 2010, 7 in 2011 and 10 in 2012). The variability in corrected morality rates between years (**Table 3.11, Appendix C**) can be attributed to variability in corrector factors.

When combined with the results of the July to December 2011 monitoring period, the annual raptor mortality rate is estimated, to be 0.44 raptors /turbine (0.19 raptors /MW). The annual raptor mortality rate of 0.19 raptors/MW is within the annual mortality range observed at other facilities in North America outside California (0 to 0.49 raptors /MW; Strickland et al., 2011). This estimated mortality rate would place the Wolfe Island Wind Plant tied for seventh if the 34 wind farms summarized outside of California were ranked from lowest to highest estimated raptor and vulture mortality rates. It is also less than the rate observed at Maple Ridge in 2007, (0.25 raptors /MW; Strickland et al., 2011).

When comparing mortality rates, it is important to note that most, if not all of the studies at Maple Ridge and those included in the NWCC summary did not involve mortality monitoring during the winter months. Four (31%) of the 13 raptor fatalities recorded between July 2011 and June 2012 were found between mid-November and the end of March; fatalities that may not have been recorded using search schedules in other studies.

The annual raptor mortality rate (0.16/MW) is higher than the notification threshold of 0.09 raptors/MW identified in the Follow-up Plan. In accordance with the Follow-up Plan, TransAlta, in consultation with MNR, has developed and implemented raptor behavioural studies to determine potential risk factor to raptor mortality. These surveys were conducted in fall of 2010 and spring of 2011, the results of which were presented in Monitoring Report No. 6 (July-December, 2011). In addition, TransAlta is continuing discussions with the MNR regarding raptor mortalities and potential studies/partnerships to determine risk factors.

4.1.2 Bats

Arnett et al. (2007) summarized the bat mortality rates from 22 wind facilities in North America where recent standardized mortality monitoring was conducted using a systematic survey process for a minimum of one year and incorporating scavenging and searcher efficiency corrections. The bat mortality rates ranged from 0.3 to 53.3 bats/MW/year (Arnett et al, 2007). Of the seven sites located in the eastern U.S., the bat mortality rates ranged from 14.9 to 53.3 bats/MW (Arnett et al, 2007). A recent summary of available mortality rates for birds, raptors and bats has been prepared byNWCC (Strickland et al., 2011), who reports bat mortality rates of between less than one and approximately 40 bats/MW/ year.

The estimated bat mortality rate for the Reporting Period at the Wolfe Island Wind Plant at 0.32 bats per MW (0.73 bats/turbine), which is significantly lower than the same period in 2011 (2.27 bats/MW or 5.22 bats/turbine). When the results of the Reporting Period (January to June) are combined with the estimated mortality rate for the period July to December 2011 (0.91 bats per MW), the resultant estimated mortality rate of 1.23 bats per MW is well within the range of rates reported by NWCC (Strickland et al., 2011) and Arnett et al. (2007).

When compared to previous years, the corrected bat mortality during the current Reporting Period, is very similar to the rates observed in the spring of 2011**(Table 3.11, Appendix C**).

The spring of 2010 had particularly high rates of bat mortality, attributed to a higher numbers of Silver-haired Bat fatalities observed across the project over a relatively short time period; possibly attributed to a mass migration event during inclement weather.

Generally, high bat mortality rates have been observed during the July to December Reporting Periods (**Table 3.11, Appendix C**), which is consistent with other studies. Johnson (2004, as cited by Ontario Ministry of Natural Resources, 2006) indicated that over 90% of bat fatalities at wind plants occur between mid-July and the end of September. Over the three years of post-construction monitoring at the Wolfe Island Wind Plant, bat mortality rates during the July to December period have been variable, ranging from 5.73 bats/turbine in 2011 to 21.84 bats/turbine in 2010.

The annual bat mortality rate during the most recent one year period (1.23 bats/MW) or during any of the previous years, has been well below the adaptive management threshold of 12.5 bats/MW as identified in the Follow-Up Plan. Although the bat mortality rate is below the threshold, TransAlta has proactively developed and implemented a research program to mitigate and reduce bat mortality. The research was implemented during the fall bat migration season when the majority of fatalities occur. The research includes operational control of selected turbines during night time hours under low wind conditions. Results from this research were presented Monitoring Report No. 6 (June-December, 2011).

4.2 INDIRECT EFFECTS – DISTURBANCE

4.2.1 Wintering Raptors

Wolfe Island has been identified as a significant wintering area for a variety of species of raptors and owls. Results of the pre-construction winter raptor monitoring, which was conducted from November 2006 to March 2007, confirmed that some species can become abundant during winter months, including one species at risk, the Short-eared Owl.

The results of the multi-year study demonstrate the annual variability of raptor abundance, with different species peaking in different years. Overall, the 2006/2007 season (0.72 raptors/kilometer) appeared to have particularly high raptor abundance with very high numbers of Northern Harriers observed. Raptor numbers observed in 2009/2010 were significantly lower (0.25 raptors/kilometer); however, some species such as Snowy Owl and Bald Eagle reported higher numbers than 2006/2007. The results for the 2010/2011 Reporting Period (0.54 raptors/kilometer) demonstrate that raptor abundance had increased significantly from the 2009/2010 season. The current reporting period of 2011/2012 has again shown an increase in abundance (0.60 raptors/kilometer), sitting slightly below pre-construction numbers. Snowy Owls were particularly abundant, with counts doubling any previous year of monitoring. This is attributable to a large Snowy Owl irruption year across Ontario documented by CBCs across the province in 2011 (Audubon 2011). The Short-eared Owl also had a new high count of 205

recorded observations, compared to past years 2010/2011 (142), 2009/2010 (52) and 2006/2007 (83).

Annual numbers of most overwintering raptors are dependent upon the number of meadow voles, the populations of which vary in a cyclical fashion. As such, the low density of raptors on Wolfe Island in the winter of 2009/2010 is likely a direct result of low prey abundance. Likewise, high raptor densities in 2006/2007 may be the results of high prey abundance. The same annual variability observed during the pre and post-construction monitoring on Wolfe Island generally correspond with observations at other sites (Stantec, unpublished; Environment Canada, pers. comm.) and studies such as the Christmas Bird Count (CBC).

The Kingston area CBC results (Audubon, 2011), which include Wolfe Island and other areas surrounding Kingston, generally correlate with the differences observed between the 2006/2007 pre-construction, 2009/2010, 2010/2011 and 2011/2012 post-construction monitoring on Wolfe Island. Between 2006/2007 and 2009/2010, both the CBC and the post-construction monitoring found Rough-legged Hawks and Northern Harriers experienced a large decrease in abundance. However, during the 2010/2011 winter season, both studies recorded peak numbers of Rough-legged Hawks, a significant increase over the 2009/2010 numbers. In 2011/2012, both the CBC and post-construction monitoring observed peaks in Snowy Owls. Overall, similar fluctuations in raptor abundance between years were observed throughout the Kingston area (and across southern Ontario) which can likely be attributed to variable prey abundance. Variable raptor densities on Wolfe Island are likely not a result of WTG avoidance behaviour. Observations of peak numbers of Short-eared Owls in 2011/2012, suggest Wolfe Island remains an important and productive wintering area for this species.

The number of observed raptor and owl concentration areas varied between the three years of monitoring, as shown in **Figures 6.0** and **7.0**, **Appendix A**. Differences in the number of concentration areas observed correlates with the observed raptor abundance each year. For example, during low raptor abundance in 2009/2010, few concentration areas were observed.

It was noted that raptor and owl concentration areas appear to shift from year to year. Possible explanations for the shifting concentration areas might include changes in land use (i.e. crop type), survey variability (i.e. where raptors happen to be at the time of the survey relative to the roads driven by observers) or behavioural modification due to wind plant operation. In all years, during both pre and post-construction monitoring, Short-eared Owls could consistently be observed in proximity to two suspected roosts sites located near WTGs within the Study Area. Post-construction monitoring also consistently observed both raptors and owls hunting in close proximity to single WTGs or groups of WTG's, suggesting raptors and owls do not avoid utilizing habitat adjacent to WTG's.

Peak numbers of Short-eared Owls were observed in March 2012, with up to 67 individuals observed on a single survey (March 6). This high count coincided with the discovery of numerous Short-eared Owls (28) leaving an unknown roost on Wolfe Island and travelling over open water to nearby Simcoe Island, roughly 500 m away. One possible explanation for this behavior is these birds showed roost site fidelity on Wolfe Island, yet higher prey densities on Simcoe encouraged the crossing to hunt. The abundance of Short-eared Owl observations suggests Wolfe Island remains an important and productive wintering area for this species. In the northwest corner of the Study Area, an area of relatively high WTG density, raptor concentrations were recorded during the current Reporting Period, although in lower numbers than pre-construction surveys of 2006/2007. As the monitoring program did not attempt to measure various factors that may affect raptor abundance (e.g. track changes in land use), reasons for the apparent decrease in raptor density in the northwest end of the Study Area cannot be conclusively determined. It is worth noting however, there is no evidence to suggest avoidance of wintering raptors to the greater wind plant area, as the post-construction monitoring has demonstrated that raptors have remained abundant in the wind plant area and Wolfe Island continues to experience seasonal irruptions of species such as Short-eared Owl and Rough-legged Hawk.

4.2.2 Grassland Breeding Bird Point Counts, Paired Point Counts and Area Searches

The grassland surveys indicated that grassland breeding birds remained common throughout the Wolfe Island Wind Plant. Crop rotation in some fields has resulted in a loss of grassland habitat (i.e., hay and pasture), while grassland habitat in other fields was gained. Overall, grassland habitat decreased in 2012 within the Study Area, particularly the Northwest Search Area. By shifting three of the pre-construction grassland point count locations to adjacent fields, to account for crop rotation, and by correcting the grassland area searches for changes in percent grassland habitat, the composition of grassland habitat surveyed during pre- and post-construction were generally consistent.

The grassland point counts, repeated during pre- and post-construction monitoring, recorded an apparent decrease in breeding density in several grassland species. Given the relatively short timeframe between pre- and post-construction surveys, and because decreases were not observed for the same species in the Study Area through paired point count surveys and grassland area searches (discussed below), it is likely that some other factors, unrelated to the operation of the Wolfe Island Wind Plant, have contributed to the decrease. It is possible that the observed decrease in grassland species could, in part, be attributed to the general declining population trend in grassland birds, which has been reported throughout Ontario (McCracken, 2009). Overall, although the post-construction monitoring have recorded a evident decline of breeding birds at the roadside point counts, the monitoring results do not provide a clear understanding of causation, other than to conclude similar trends were not observed in grassland habitats away from roads.

Results of the grassland area searches, which surveyed large portions of the Study Area with high grassland bird densities both pre- and post-construction, did not demonstrate the same decrease in grassland bird density. Additionally, many species of common and widespread non-grassland birds, such as American Robin, Mourning Dove and Yellow Warbler, were also observed to decrease between pre and post-construction conditions, further suggesting that the observed decreases are not related to greater population trends.

A WTG avoidance effect was not observed for grassland species through paired point count data, as densities for most species were similar at 0 to 100 m and 100 to 200 m from WTG bases. For some species, such as Bobolink and Savannah Sparrow, a slight increase in density was noted at the 0 to 100 m distance, when compared to 100 to 200 m distance from the WTG bases. At some WTG's, portions of the 0 to 100 m sector consisted of disturbed areas in a state of succession, where the gravel pads used during construction had been removed. These successional areas, may be reaching a suitable state for nesting Bobolink, owing for an apparent increase in the 0 to 100 m sectors over recent years. Some species that are more likely to nest within the early successional areas, such as Upland Sandpiper, did not show any noticeable change in density within the 0 to 100 m sectors to 100 to 200 m sectors.

No obvious pattern was noted among other species from the 0 to 100 m, 100 to 200 m and 200 to 300 m sectors. The ANOVA analysis showed significant difference between the three distance regimes for all species and the six most common grassland species combine, as well as Savannah Sparrow and Eastern Meadowlark. However, in each case above, the highest breeding densities were recorded in the distance regime closest to the WTG. As such, the significant difference can likely be attributed to other habitat or environmental factors, not WTG avoidance.

For most species, the results of the grassland area searches showed little change in breeding density between pre- and post-construction surveys. After correcting for the amount of grassland habitat, Bobolinks were significantly (Anova F=1.91, p=0.16) more abundant in the Southeast Area search during the 2012 post-construction monitoring than in the 2007 pre-construction monitoring or 2010 and 2011 post-construction monitoring. Savannah Sparrow density was relatively similar in the Southeast Area Search, compared to pre-construction surveys.

During the Northwest Search Area, Bobolink numbers remained high in 2012 post-construction monitoring, falling slightly below 2011 post-construction, yet above numbers recorded in 2010 post-construction and 2007 pre-construction monitoring. Savannah Sparrows in the northwest area search showed a decline in 2012 post-construction monitoring when compared to 2011 and 2010 post-construction and 2007 pre-construction surveys. Explanations for the dramatic increase in Bobolink in the southeast area, or declines in Savannah Sparrows in the Northwest Search Area are not readily apparent.

One possible explanation is slight changes in year to year farming practices, such as rotation of cattle herds to various plots of pasture in the early spring of 2012 or late season haying practices in the fall of 2011. Another explanation could be changes in weather conditions; starting in March 2012 when one of the most significant heat waves in recorded North American history gave an abnormal boost to the start of the growing season, potentially resulting in an earlier (and more successful) breeding season. Overall, after three years of post-construction monitoring, these annual changes do not appear to reflect avoidance to the Wolfe Island Wind Plant.

Upland Sandpipers are an area sensitive grassland breeding species, with numbers observed remaining very constant in the Northwest Area between 2007, 2010, 2011 and 2012. Many Upland Sandpiper pairs were nesting in disturbed fields, adjacent to grassland habitat. As such, their density appears artificially low after correcting for the amount of grassland habitat between years (**Table 3.24, Appendix C**).

Grasshopper Sparrow densities were lower in 2012 surveys compared to pre-construction surveys in 2007. The decrease in post construction surveys (2012, 2011, 2010) was likely not attributable to WTG avoidance, given that Grasshopper Sparrows observed during pre-construction surveys were located in areas that were greater than 500m from eventual WTG locations.

Eastern Meadowlarks appear to have experienced a slight decline from 2007 pre-construction densities in the Northwest Area. However, this decrease results from small differences in the number of observed individuals between surveys.

Overall, the results of the grassland breeding bird surveys suggest populations of grassland species remain common within the Study Area with no evidence of WTG avoidance.

4.3 CLOSING

This Report provides the results of the 7th and final Reporting Period in the three years of post-construction monitoring as outlined in the Post-construction Follow-up Plan. With the completion of this Reporting Period, 38 consecutive months of mortality monitoring have been completed at each of the 86 WTG's. Over the course of the three year post-construction monitoring program, a total of 17,200 individual turbines searches have been conducted, accounting for seasonal variability of search schedules. This level of effort far exceeds other post-construction monitoring programs in Ontario and the current guidelines for post-construction monitoring at wind power projects in Ontario (MNR, 2011). As a comparison, Kerlinger et al. (2010), in their summary of mortality data from wind farms across North America, estimated that approximately 25,000 individual turbine searches had been conducted at the 30 different facilities they summarized. At the Wolfe Island Wind Plant, more than half this number of individual turbine searchers was conducted at a single facility.

Some fluctuation in overall avian mortality rate has been observed over the three years of monitoring; however the mortality rate, which has averaged 4.1 birds/MW/year, has consistently remained below the adaptive management thresholds outlined in the Follow-up Plan of 11.7 birds/MW/year. The total avian mortality rate observed at the Wolfe Island Wind Plant has in some years been higher than other wind farms in Ontario and higher than average compared to wind farms across North America (Strickland et al., 2011). However, the mortality rate of 4.1 birds/MW/year has been spread over at least 69 species during the three year program. When looking at any one species individually, the observed mortality is unlikely to impact the species at the local, regional or provincial population level. It is also noted that while the avian mortality rates may be high compared to other wind farms, it is very low compared to estimates of other sources of avian mortality (Arnett et al. 2007; Kingsley and Whittam 2007; National Academy of Sciences 2007; Kerlinger et al. 2011) and likely small compared other local sources of anthropogenic avian mortality on the island (i.e. window strikes, cats, farming practices).

Raptor mortality rates over the three years of mortality monitoring have averaged 0.15 raptors/MW/year, which is over the adaptive management threshold in the Follow-up Plan of 0.09 raptors/MW/year. The raptor mortality has been spread over seven species, with Red-tailed Hawks and Turkey Vultures experiencing higher mortality. Most of the raptor mortality appears to occur during migration, with lesser mortality of wintering and breeding individuals. Raptor behavioral studies presented in Monitoring Report No. 5 found that raptors, in particular Red-tailed Hawks and Ospreys, continue to breed within the project area. The level of raptor mortality observed at the Wolfe Island Wind Plant is in the middle of the mortality range in North America (Strickland et al., 2011), although the highest rate observed in Ontario of reported studies to date. The higher raptor mortality rate, in comparison to other Ontario wind farms, was not unexpected given the number of wintering and staging raptors on Wolfe Island, as identified in the Environmental Review Report (Stantec 2008a). Regardless, the post-construction monitoring has observed levels of raptor mortality that represents a very small fraction of the Ontario species population. It is unlikely this level of mortality will have an impact at the local, regional or provincial population level.

Bat mortality rates, which have averaged 7.1 bats/MW/year, have remained well below the adaptive management threshold in the Follow-up Plan of 12.5 bats/MW/year. The bat mortality rate at the Wolfe Island Wind Plant is in the middle of the range of North American (Strickland et al. 2011) and Ontario wind farms.

Three years of post-construction monitoring for winter raptors densities have demonstrated that raptors continue to winter in the project area in large numbers. Short-eared Owls have been found to be particularly abundant in the project area during the winters of 2010/2011 and 2011/2012, with no recorded fatalities.

Raptor behavioral studies completed in the fall of 2010 and spring of 2011 (Monitoring Report No. 5) provided insight into potential risk factors to raptor mortality, specifically that raptors are

likely to be at higher risk during high wind conditions and at reduced risk at low temperatures and during precipitation.

The disturbance studies of waterfowl from the fall of 2009 to spring of 2011 (4 seasons) (Monitoring Reports No. 2 to No. 5) provided two full years of post-construction monitoring and found stable numbers of geese and dabbling ducks foraging inland (Appendix H1) and unchanged movement patterns between foraging areas and offshore staging areas (Appendix H2). Waterfowl mortalities were negligible over the full four years of monitoring, including three Mallard mortalities reported in Monitoring Report No. 3, two Mallard and one Canada Goose mortalities reported during Monitoring Period No. 4 and one Mallard mortality reported during Monitoring Report No. 5. Overall, no evident impacts to inland staging waterfowl were observed.

The Aerial waterfowl studies of offshore staging birds between spring of 2008 and fall of 2011, providing four full years (8 seasons) of data (Monitoring Reports No.2 to No.6). Analysis of the data demonstrates the waterfowl abundance has been relatively uniform over the 4 year study period, with no indication of avoidance or impacts of the Wolfe Island Wind Plant (Appendix H3).

Breeding waterfowl studies completed in the spring of 2010 and 2011 found that waterfowl continued to breed in the large coastal wetlands in proximity to WTG (Monitoring Reports No. 3 and No. 5; Appendix H4). Likewise, no evidence of WTG avoidance was observed to marsh birds during breeding bird area searches and point counts in 2010 and 2011 (Monitoring Reports No. 3 and No. 5), which found species diversity and abundance remained relatively constant (Appendix H5). During the 2010 monitoring, Least Bittern, a relatively sensitive to disturbance marsh bird, was observed breeding in one of the marshes adjacent to WTG's.

Area searches and point counts in woodland habitat in 2010 and 2011 found high diversity of species will little change in breeding density from pre-condition surveys (Monitoring Reports No. 3 and No. 5; Appendix H6). The resulted suggested there was no avoidance of WTG's.

The post-construction monitoring included very extensive surveys of grassland breeding birds. The program included 27 grassland points repeated from pre-construction and paired point counts at 20 WTG's. In total, over 200 grassland point counts have been completed over the three years of post-construction monitoring. In addition, two large grassland areas searches, covering a total of 394ha, were surveyed during pre-construction and repeated during each of the three years of post-construction monitoring. While the post-construction surveys did find some variability in some species from year to year and field to field, overall, grassland birding birds remain abundant within the project area and within field containing WTG's. With specific regard to Bobolink, the breeding bird surveys have found this species to remain very abundant, with evidence of them commonly using habitat in close proximity (within 100 m) of WTG.

5.0 Closing

Overall, the Wolfe Island Wind Plant Post-Construction Follow-up Plan for Bird and Bat Resources, represents the most extensive post-construction monitoring program in Ontario to date. Results of this multi-year study indicate that the project area continues to support a healthy and vibrant bird community throughout the year, with levels of bird, raptor and bat mortality that are unlikely to have an impact at the local, regional or provincial population level.

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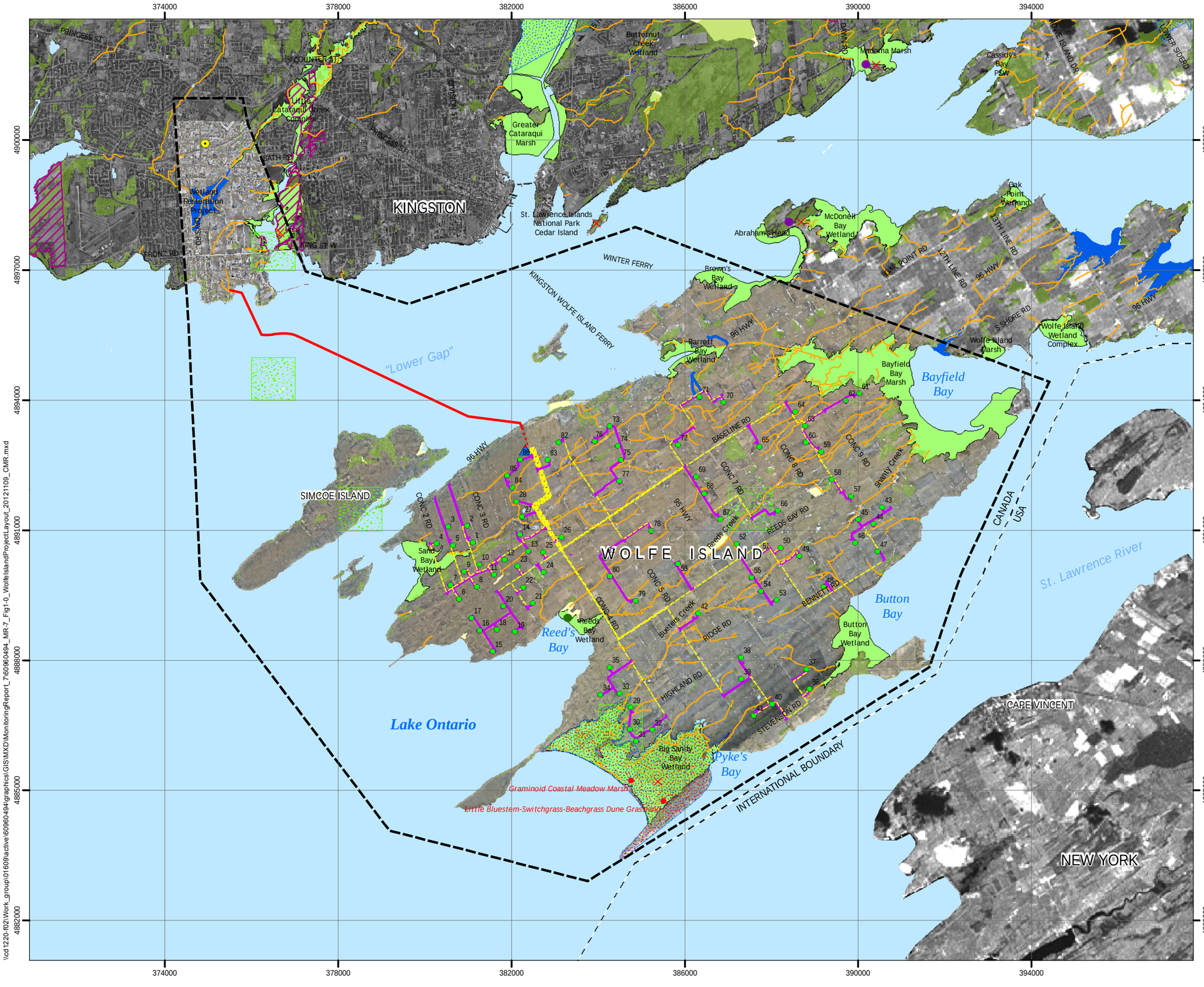
Appendix A

Figures



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Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road

Area of Natural or Scientific Interest (ANSI)

- Earth
- Life

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

Other Natural Areas

- Earth Science Site
- International Biological Program Site
- Life Science Site
- Vegetation Communities
- Warm Water Streams
- Cataraqui Region Conservation Authority Lands
- Rare Species Occurence (NHIC)
- Woodlot

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

   Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006 and the Cataraqui Region Conservation Authority, 2006.

November, 2012
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Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 7

Figure No.

1.0

Title

Wolfe Island Project Layout

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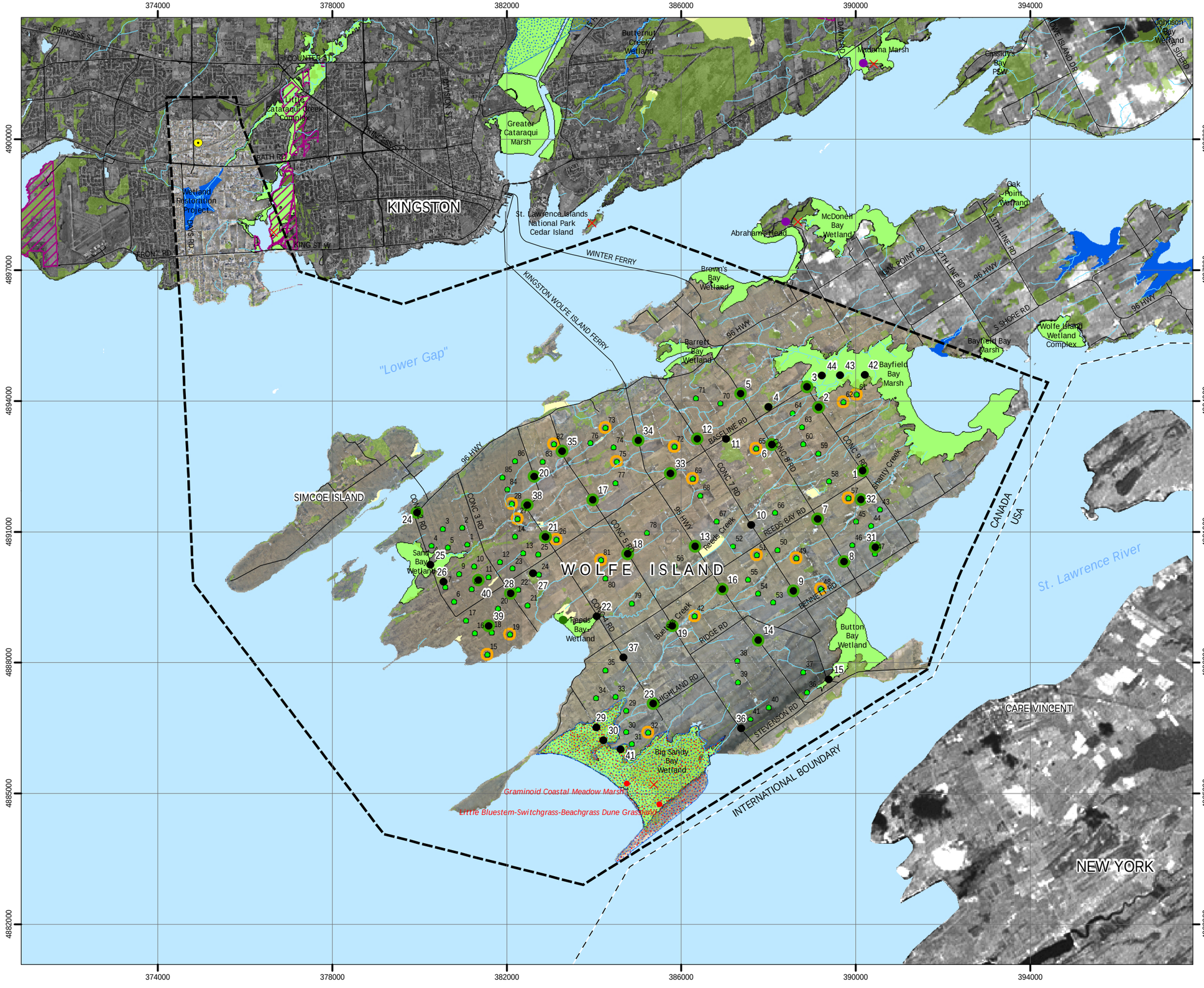

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Legend

- Study Area
- Turbine Layout
- Gardiners Transformer Station
- Location of Preconstruction Breeding Bird Point Count
- Paired Point Count Location Post Consstruction
- Grassland Point Count Resurveyed Post-Construction
- roads

Area of Natural or Scientific Interest (ANSI)
- Earth
- Life

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

Other Natural Areas
- Earth Science Site
- International Biological Program Site
- Life Science Site
- Vegetation Communities
- Woodlot
- Cataraqui Region Conservation Authority Lands

Notes

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Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
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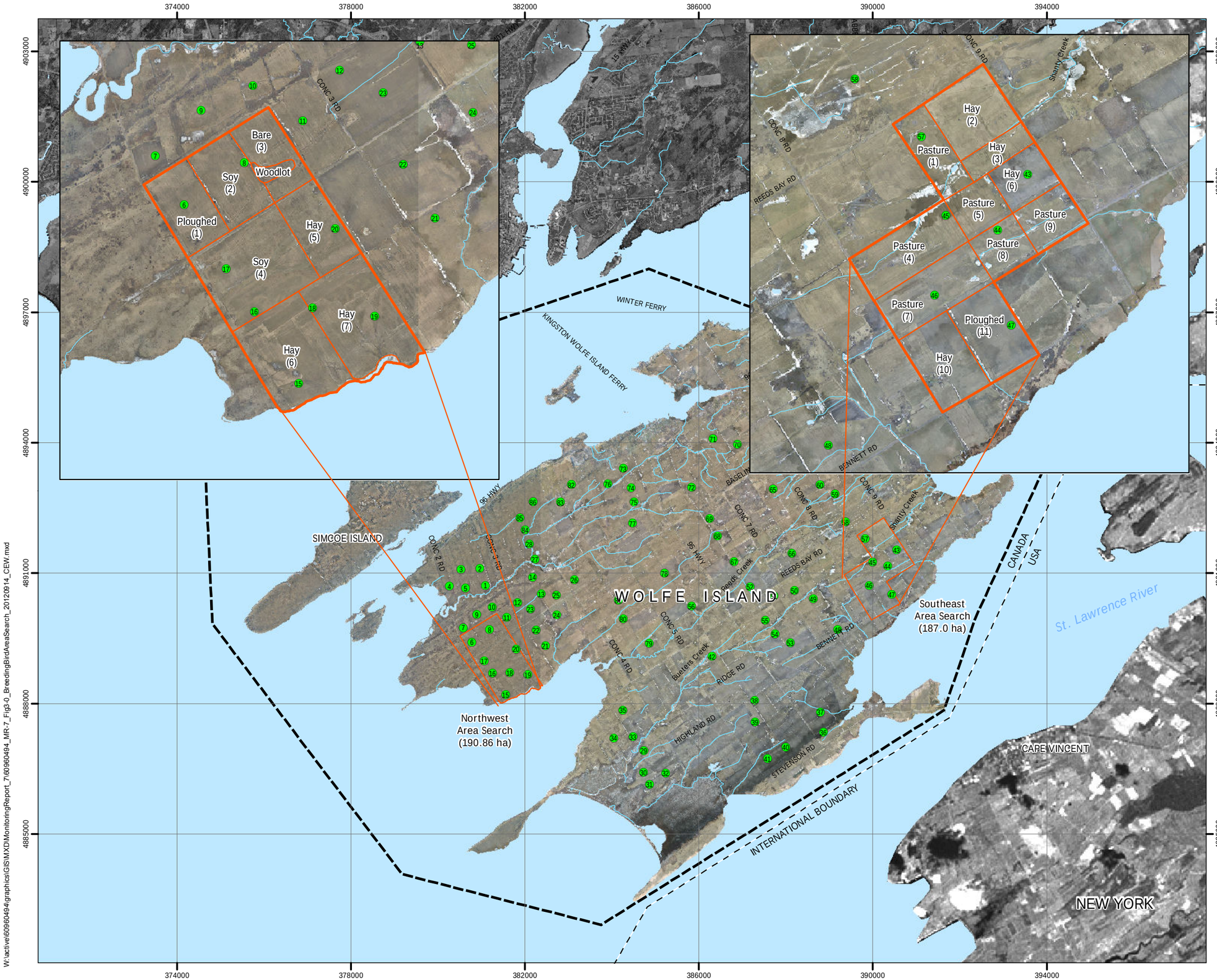
Client/Project
WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 7

Figure No.
2.0

Title
Location of Grassland and Marsh Breeding Bird Point Counts



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N W E S

Legend

- Study Area
- Turbine Layout
- (1) Sector Number

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

September, 2012
160960494

Client/Project
WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 7

Figure No.
3.0

Title
Post-Consturction Breeding Bird Area Search Locations

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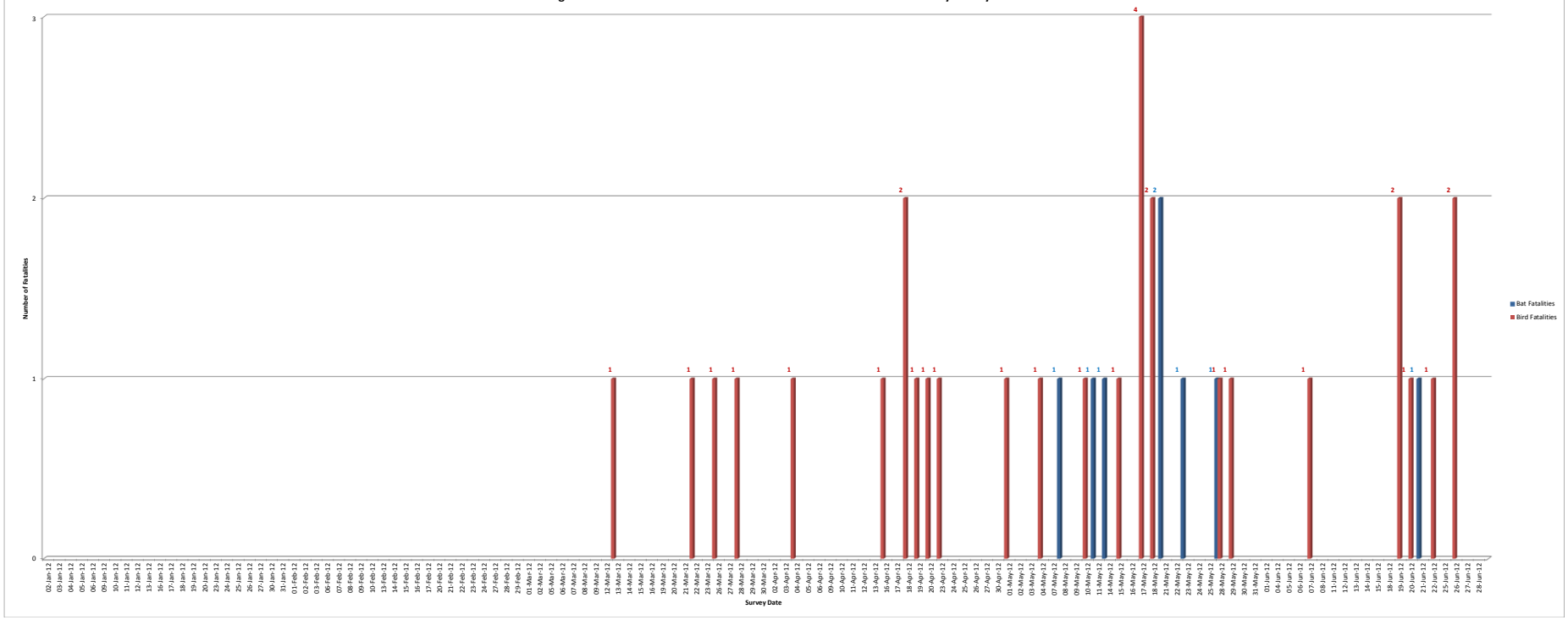
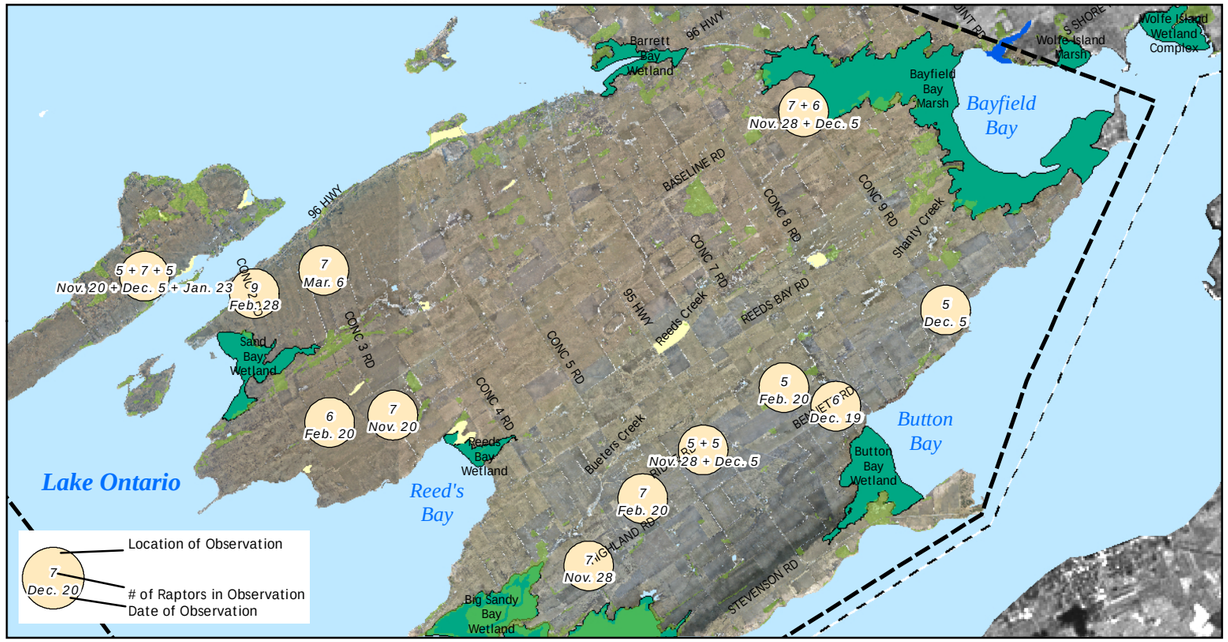
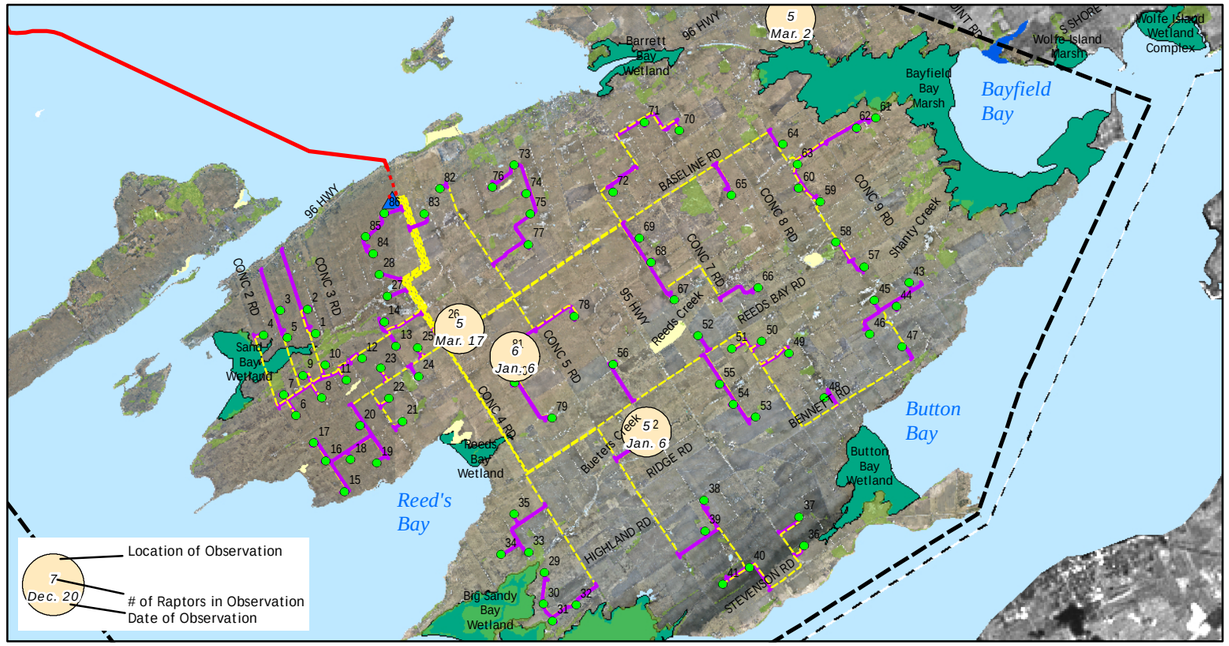
Figure 4.0. Wolfe Island Wind Farm: Numbers of Bird and Bat Fatalities by Survey Date



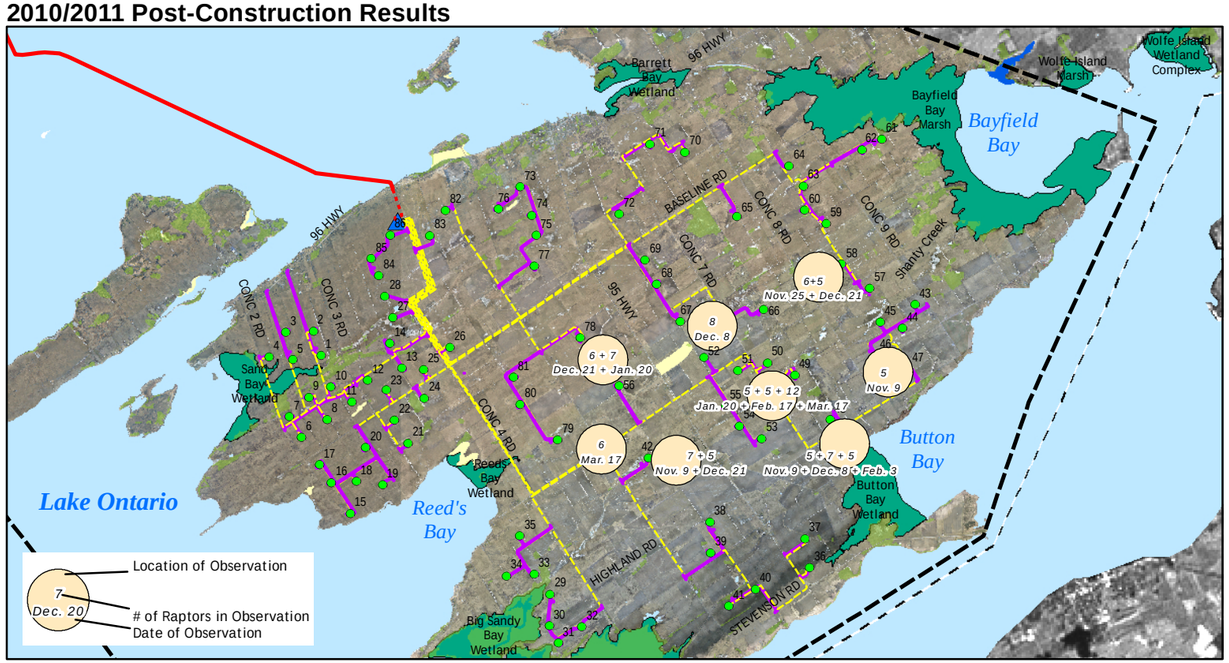
2006/2007 Pre-Construction Results



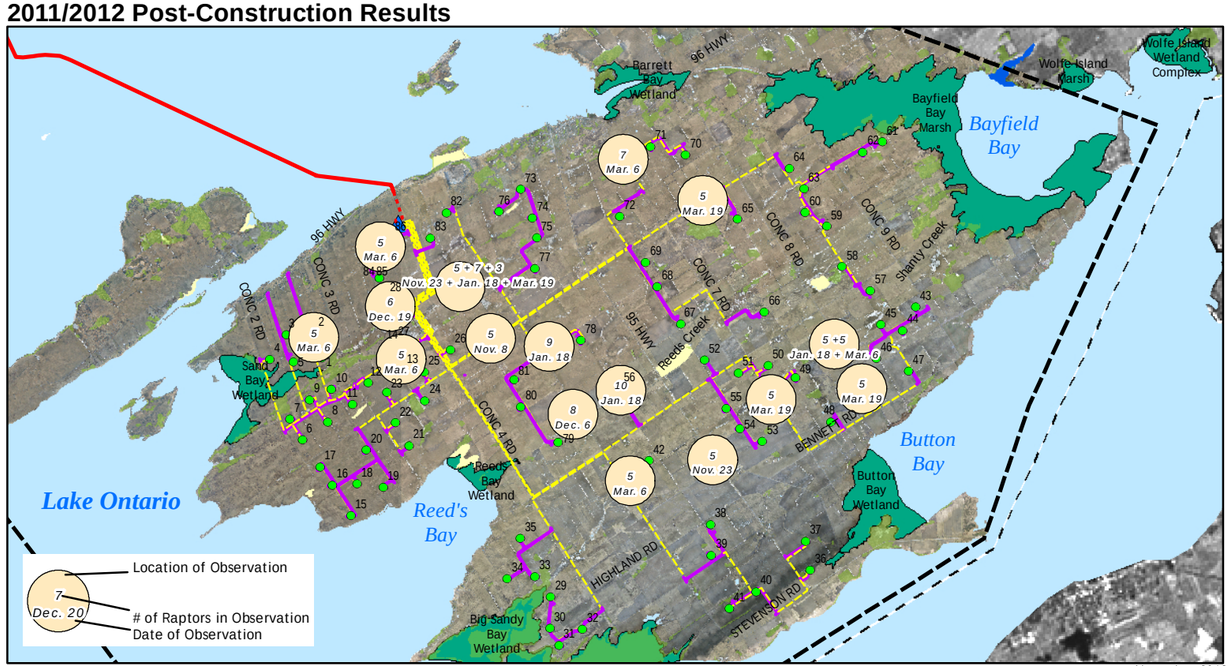
2009/2010 Post-Construction Results



2010/2011 Post-Construction Results



2011/2012 Post-Construction Results



Legend

- Study Area
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

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November, 2012
160960494

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006 and the Cataraqui Region Conservation Authority, 2006.

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WOLFE ISLAND ECOPOWER CENTRE MONITORING REPORT NO. 7

Figure No.

6.0

Title

Comparison of Wintering Raptor Concentrations Pre-Construction (2006/07); Post-Construction (2009/10, 2010/11 and 2011/12)

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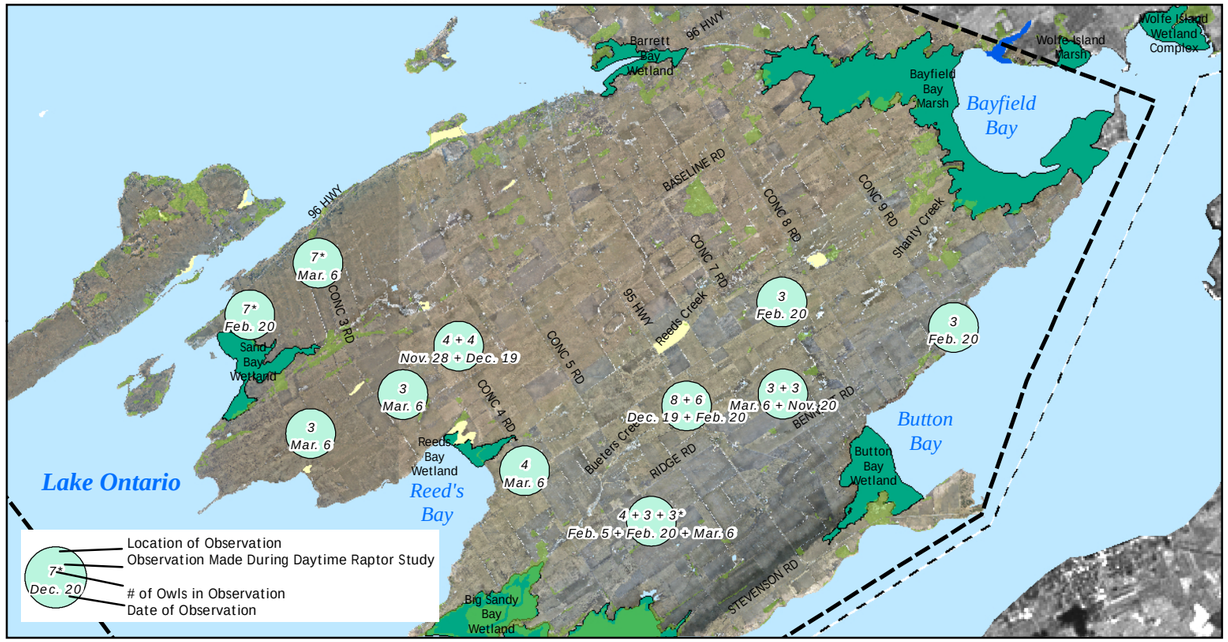
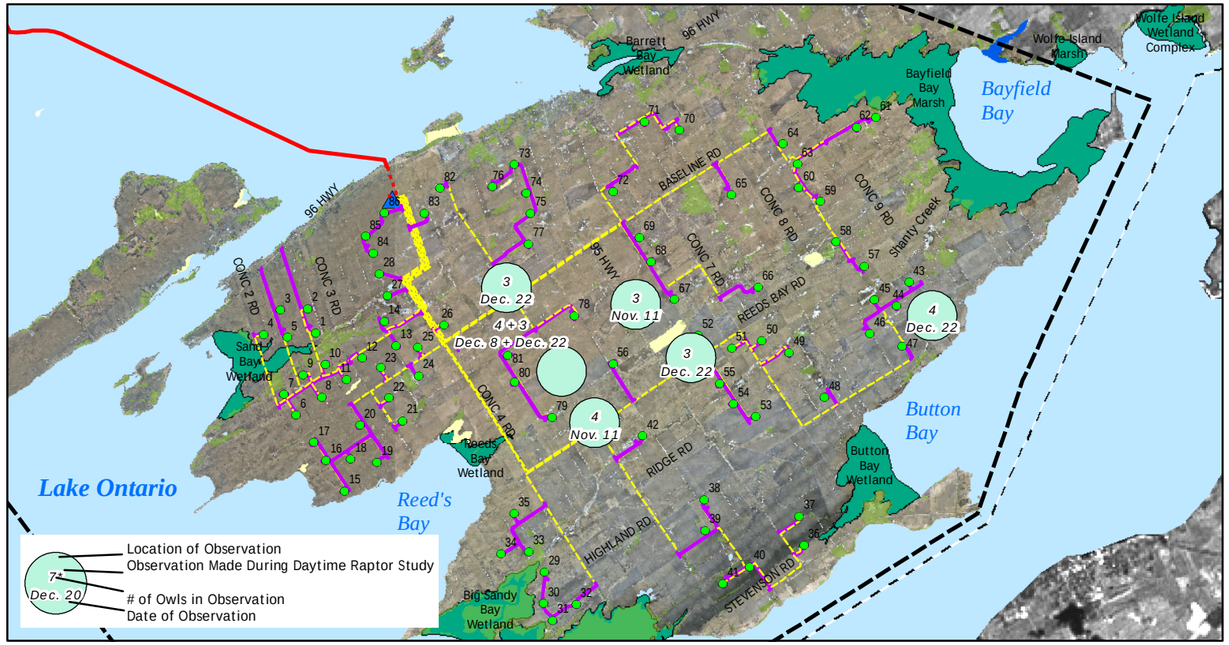
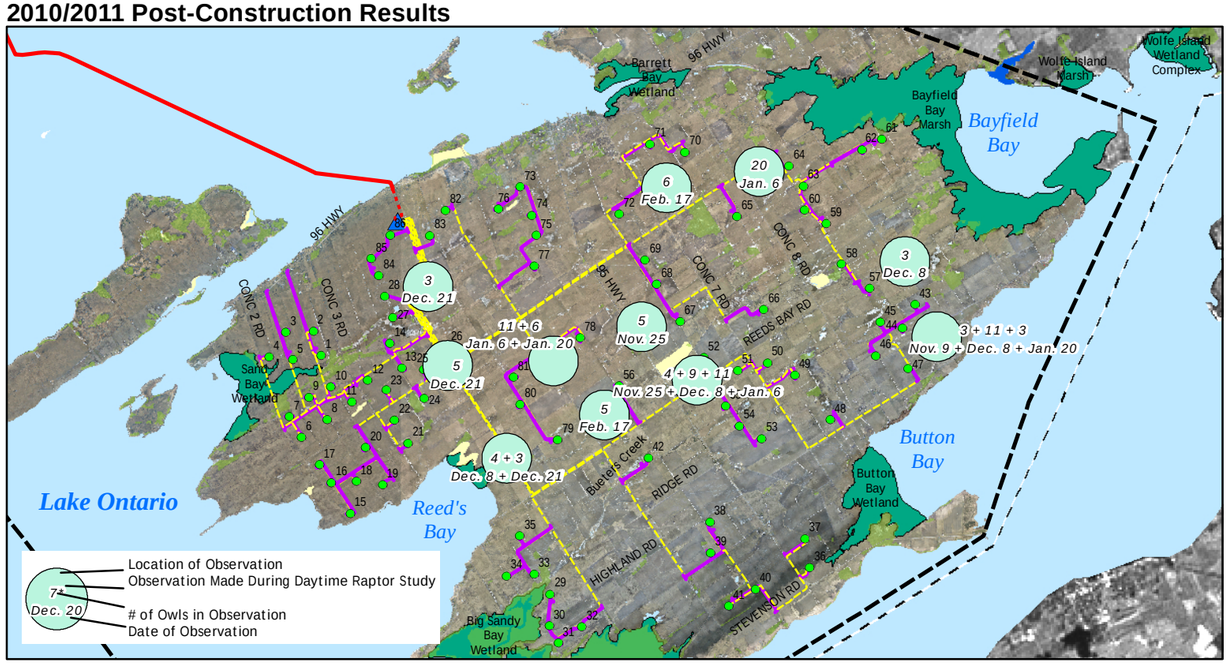
2006/2007 Pre-Construction Results



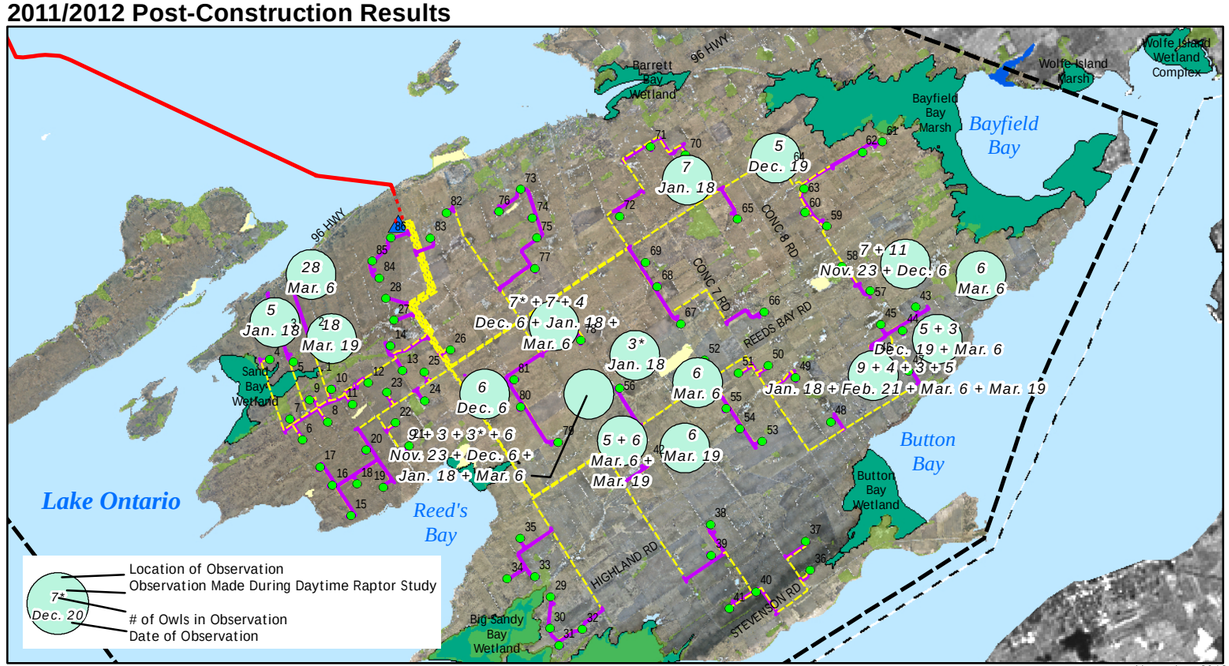
2009/2010 Post-Construction Results



2010/2011 Post-Construction Results



2011/2012 Post-Construction Results



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Legend

- Study Area
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

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November, 2012
160960494

Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 7

Figure No.

7.0

Title

Comparison of Wintering Short-eared Owl Concentrations Pre- Construction (2006/07); Post-Constuction (2009/10, 2010/11 and 2011/12)

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006 and the Cataraqui Region Conservation Authority, 2006.

Appendix B

Mortality Monitoring Schedule

SUBSET	Monday	Tuesday	Wednesday	Thursday	Friday
Subset A – Turbine searched once weekly		4, (6, 7, 8, 9, 10, 11), 12, 66	(3, 5), (13, 14), 21, 22, 26, (29, 30, 31, 32), (40, 41), 47, 48, 52, 56, 58, (59, 60, 63), 72, (79, 80, 81), 83, MET 1	(53, 54, 55), (73, 74, 75, 76, 77)	
Subset B – Turbines searched twice weekly	(1, 2), 23, 24, 27, 28, (33, 34, 35), 36, 37, (38, 39), 42, (43, 44, 45, 46), 50, 64, 65, 78, 82, (84, 85, 86), MET 2	(15, 16, 17, 18, 19, 20), 25, 49, 51, 57, (61, 62), (67, 68, 69), (70, 71)		(1, 2), 23, 24, 27, 28, (33, 34, 35), 36, 37, (43, 44, 45, 46), (84, 85, 86)	(15, 16, 17, 18, 19, 20), 25, (38, 39), 42, 49, 50, 51, 57, (61, 62), 64, 65, (67, 68, 69), (70, 71), 78, 82, MET 2

Appendix C

Tables

Table 3.1: Results of Searcher Efficiency Trials May – June 2012

Surveyor	Number of Carcasses Placed	Number of Carcasses Scavenged	Number of Carcasses Found	Individual Se
1	23	3	19	0.950
2	15	2	10	0.769
3	15	2	11	0.846
4	24	4	19	0.950

Table 3.2: Weighted Searcher Efficiency by Month

Surveyor	Individual Se	January: Proportion of Searching (Weighted Se)	February: Proportion of Searching (Weighted Se)	March: Proportion of Searching (Weighted Se)	April: Proportion of Searching (Weighted Se)	May: Proportion of Searching (Weighted Se)	June: Proportion of Searching (Weighted Se)
1	0.950	45.8% (0.435)	47.4% (0.451)	45.2% (0.429)	38.4% (0.364)	51.0% (0.485)	48.4% (0.460)
2	0.769	1.3% (0.010)	3.0% (0.023)	13.9% (0.107)	13.5% (0.104)	6.6% (0.050)	1.3% (0.010)
3	0.846	8.9% (0.075)	17.8% (0.151)	4.8% (0.040)	7.6% (0.065)	8.2% (0.070)	14.4% (0.122)
4	0.950	43.9% (0.417)	31.8% (0.302)	36.2% (0.344)	40.5% (0.385)	34.2% (0.325)	35.9% (0.341)
		100% (0.938)	**100% (0.926)**	**100% (0.920)**	**100% (0.918)**	**100% (0.930)**	**100% (0.933)**

Table 3.3: Results of Scavenger Trials by Month; Non-raptors and Bats

	Number of Test Carcasses Placed	Number Remaining - Visit 1	Number Remaining - Visit 2	Number Remaining - Visit 3	Number Remaining - Visit 4	Sc
January - 7d interval	19	15	10	-	-	0.735
May – 7d interval	20	13	3	-	-	0.485
May – 3.5d interval	20	13	6	2	1	0.537
June – 7d interval	16	7	2	-	-	0.391
June – 3.5d interval	24	17	8	3	1	0.558

Table 3.4: Results of Raptor Scavenger Trials

	Number of Test Carcasses Placed	Number Remaining - Visit 1	Number Remaining - Visit 2	Number Remaining - Visit 3	Number Remaining - Visit 4	Sc
January – 7d interval	1	n/a	1	n/a	1	1.000
March – 3.5d interval	3	3	2	2	1	0.800
Overall	4	4	3	3	2	0.857

Note: n/a – Carcasses were not checked during visit

Table 3.5: Summary of Bird Fatalities (excluding raptors and vultures), Reporting Period

Species	Dates Observed	Turbine Number
Bird sp.	17-Apr-12	20
	9-May-12	22
	25-Jun-12	82
Black-billed Cuckoo	6-Jun-12	60
Bobolink (Female)	16-May-12	80
	28-May-12	43
	18-Jun-12	86
Brown-headed Cowbird	18-Apr-12	30
Double-crested Cormorant	30-Apr-12	23
Eastern Kingbird	21-Jun-12	28
	21-Jun-12	28
European Starling	12-Mar-12	33
Golden-crowned Kinglet	19-Apr-12	54
	20-Apr-12	51
Common Grackle	25-Jun-12	86
Horned Lark	25-May-12	25
Killdeer	21-Mar-12	5
Eastern Kingbird	16-May-12	5
American Redstart	16-May-12	31
Wilson's Snipe	18-Jun-12	27

Table 3.6: Calculation of Bird Mortality Rates (excluding raptors and vultures), Reporting Period

Month (Search Interval)	c -birds	Ps	Sc	Se	C -birds
January (1x weekly)	0	0.280	0.735	0.938	0.000
February (1x weekly)	0	0.280	0.735	0.926	0.000

Table 3.6: Calculation of Bird Mortality Rates (excluding raptors and vultures), Reporting Period

Month (Search Interval)	c -birds	Ps	Sc	Se	C -birds
March (1x weekly)	2	0.280	0.735	0.920	10.563
April (1x weekly)	2	0.280	0.485	0.918	16.043
April (2x weekly)	3	0.280	0.537	0.918	21.734
May (1x weekly)	5	0.261	0.485	0.930	42.472
May (2x weekly)	2	0.270	0.537	0.930	14.832
June (1x weekly)	1	0.261	0.391	0.933	10.503
July (2x weekly)	5	0.270	0.558	0.933	35.571
Total	**20**				151.718
Per Turbine					1.764
Per MW					0.767

Sc: Scavenger Impact Trial Results

Se: Searcher Efficiency Trial Results

Ps: Percent Area Searched

C: Corrected Number of Fatalities

Per Turbine: C Divided by Total Number of Turbines

Per MW: C Divided by Total Number of MW

Table 3.7: Summary of Raptor Fatalities, Reporting Period

Species	Dates Observed	Turbine Number
Hawk sp.	23-Mar-12	71
	17-Apr-12	61
Northern Harrier	17-Mar-12	23
Osprey	3-May-12	86
	14-May-12	
Red-tailed Hawk	3-Apr-12	71
	17-May-12	76
Rough-legged Hawk	27-Mar-12	17
	13-Apr-12	78
Turkey Vulture	19-Jun-12	10

Table 3.8: Calculation of Raptor and Vulture Mortality Rates

Month (Search Interval)	c (raptors)	Ps	Sc	Se	C (raptors)
January (1x weekly)	0	0.494	0.857	1	0.000
February (1x weekly)	0	0.494	0.857	1	0.000
March (1x weekly)	2	0.494	0.857	1	4.724
April (1x weekly)	0	0.494	0.857	1	0.000
April (2x weekly)	3	0.494	0.857	1	7.086
May (1x weekly)	1	0.25	0.857	1	4.667
May (2x weekly)	3	0.358	0.857	1	9.778
June (1x weekly)	1	0.250	0.857	1	4.667
June (2x weekly)	0	0.358	0.857	1	0.000
Total	**10**				30.923
per Turbine					0.360
per MW					0.156

Sc: Scavenger Impact Trial Results

Se: Searcher Efficiency Trial Results

Ps: Percent Area Searched

C: Corrected Number of Fatalities

Per Turbine: C Divided by Total Number of Turbines

Per MW: C Divided by Total Number of MW

Table 3.9: Summary of Bat Fatalities, Reporting Period

Species	Dates Observed	Turbine Number
Bat sp.	7-May-12	85, 61, 63
	25-May-12	
	20-Jun-12	
Big Brown Bat	22-May-12	71
Eastern Red Bat	18-May-12	62
Hoary Bat	10-May-12	28
Silver-haired Bat	18-May-12	16
Tri-coloured Bat[(a)]	11-May-12	39

[(a)] Formerly known as Eastern Pipistrelle

Table 3.10: Calculation of Bat Mortality Rates

Month (Search Interval)	c – bats	Ps	Sc	Se	C -bats
January (1x weekly)	0	0.280	0.735	0.938	0.000
February (1x weekly)	0	0.280	0.735	0.926	0.000
March (1x weekly)	0	0.280	0.735	0.920	0.000
April (1x weekly)	0	0.280	0.485	0.918	0.000
April (2x weekly)	0	0.280	0.537	0.918	0.000
May (1x weekly)	0	0.261	0.485	0.930	0.000
May (2x weekly)	7	0.270	0.537	0.930	51.913
June (1x weekly)	1	0.261	0.391	0.933	10.503
July (2x weekly)	0	0.27	0.558	0.933	0.000
Total	**8**				62.416
Per Turbine					0.726
Per MW					0.316

Sc: Scavenger Impact Trial Results

Se: Searcher Efficiency Trial Results

Ps: Percent Area Searched

C: Corrected Number of Fatalities

Per Turbine: C Divided by Total Number of Turbines

Per MW: C Divided by Total Number of MW

Table 3.11: Comparison of Mortality Rates per Turbine by Guild (May 2009-June 2012)

Reporting Period	Bird Morality Rate[(a)] (corrected fatalities/turbine)	Raptor Morality Rate (corrected fatalities/turbine)	Bat Mortality Rate (corrected fatalities/turbine)
1 (May - June, 2009)	0.52	0	0.52
2 (July – December, 2009)	6.85	0.15	14.77
3 (January – June, 2010)	6.27	0.12	5.22
4 (July – December, 2010)	8.18	0.09	21.84
5 (January – June, 2011)	1.53	0.19	0.48
6 (July - December, 2011)	3.62	0.09	5.73
7 (January – June, 2012)	1.76	0.36	0.73

Table 3.12: Winter Raptor Survey Results, November 2011 to March 2012

Species	Survey Date										Total
	7-Nov-2011	23-Nov-2011	5-Dec-2011	19-Dec-2011	9-Jan-2012	18-Jan-2012	6-Feb-2012	21-Feb-2012	6-Mar-2012	17-Mar-2012	
Afternoon Survey											
Snowy Owl	0	0	3	8	6	20	10	9	19	1	**76**
Short-eared Owl	0	1	7	0	0	15	0	0	0	0	**23**
Turkey Vulture	0	1	0	0	0	0	0	0	0	2	**3**
Bald Eagle	0	0	2	0	0	1	0	3	1	2	**9**
Northern Harrier	14	16	9	10	12	9	9	9	24	11	**123**
Red-tailed Hawk	7	5	7	3	8	14	4	13	7	11	**79**
Rough-legged Hawk	11	22	14	9	6	10	2	3	32	25	**134**
American Kestrel	3	6	4	2	6	3	0	1	3	5	**33**
Total	35	51	47	32	38	72	25	38	86	57	**481**
Total Kilometers	74	72.5	69.5	70.5	94	74.1	85.3	85.3	85.3	85.3	**795.8**
Density / kilometer	0.5	0.7	0.7	0.5	0.4	1.0	0.3	0.4	1.0	0.7	**0.6**
Evening Survey											
Short-eared Owl	2	22	29	10	2	34	0	4	67	35	**205**
Total Kilometers	63.5	60	42.5	55.5	85.3	54.9	85.3	85.3	85.3	85.3	**702.9**
Density / kilometer	0.0	0.4	0.7	0.2	0.0	0.6	0.0	0.0	0.8	0.4	**0.3**

Table 3.13: Maximum number of Short-eared Owls observed on any one survey in November to March during pre- and post-construction surveys

Survey Type/Species	Pre-construction	Post-construction		
	2006/2007	2009/2010	2010/2011	2011/2012
Evening Survey				
Short-eared Owl	27	15	45	67

Table 3.14: Comparison of Total Winter Raptor Observations, November to March Pre-Construction (2006/2007) to Post-Construction (2009/2010, 2010/2011 and 2011/2012)

Survey Type/Species	Pre-construction Total Observations (Nov – March)	Post-Construction Total Observations (Nov – March)		
	2006/2007	2009/2010	2010/2011	2011/2012
Afternoon Survey				
Great Horned Owl	0	1	0	0
Snowy Owl	14	34	0	76
Short-eared Owl	39	12	5	23
Turkey Vulture	0	0	2	3
Bald Eagle	6	11	6	9
Northern Harrier	159	19	75	123
Sharp-shinned Hawk	1	0	1	0
Cooper's Hawk	0	1	2	0
Red-tailed Hawk	85	60	76	79
Rough-legged Hawk	119	13	184	134
American Kestrel	30	30	16	33
Merlin	2	4	1	0
Unidentified	0	2	0	1
Total	**455**	**187**	**368**	**481**
Total Kilometers	**634**	**734**	**679**	**795**

Table 3.14: Comparison of Total Winter Raptor Observations, November to March Pre-Construction (2006/2007) to Post-Construction (2009/2010, 2010/2011 and 2011/2012)

Survey Type/Species	Pre-construction Total Observations (Nov – March)	Post-Construction Total Observations (Nov – March)		
	2006/2007	2009/2010	2010/2011	2011/2012
Density / kilometer	**0.72**	**0.25**	**0.54**	**0.6**
Evening Survey				
Short-eared Owl	83	52	142	205
Total Kilometers	**519**	**603**	**625**	**702**
Density / kilometer	**0.16**	**0.09**	**0.23**	**0.3**

Table 3.15: Summary of Kingston Area Christmas Bird Count results from 2000-2011

Species	Number of Raptors per Party Hour [(a)]											
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Great Horned Owl	0.04	0.14	0.09	0.06	0.14	0.06	**0.08**	N/A	0.04	**0.06**	**0.06**	**0.06**
Snowy Owl	0.09	0.07	0.06	0.01	0.03	0.03	**0.06**	N/A	0.09	**0.07**	**0.01**	**0.13**
Short-eared Owl	0.03	0.00	0.03	0.03	0.03	0.00	**0.04**	N/A	0.01	**0.00**	**0.10**	**0.04**
Bald Eagle	0.20	0.10	0.04	0.08	0.08	0.13	**0.02**	N/A	0.29	**0.70**	**0.23**	**0.14**
Northern Harrier	0.01	0.13	0.04	0.29	0.18	0.02	**0.60**	N/A	0.18	**0.18**	**0.37**	**0.30**
Sharp-shinned Hawk	0.03	0.03	0.03	0.01	0.03	0.05	**0.04**	N/A	0.03	**0.05**	**0.03**	**0.01**
Cooper's Hawk	0.05	0.04	0.03	0.02	0.01	0.06	**0.02**	N/A	0.03	**0.02**	**0.01**	**0.01**
Red-tailed Hawk	0.40	0.40	0.42	0.27	0.27	0.23	**0.51**	N/A	0.49	**0.22**	**0.70**	**0.37**
Rough-legged Hawk	0.11	0.14	0.02	0.43	0.08	0.06	**0.18**	N/A	0.18	**0.08**	**0.71**	**0.34**
American Kestrel	0.15	0.16	0.11	0.01	0.03	0.08	**0.10**	N/A	0.13	**0.05**	**0.17**	**0.09**
Merlin	0.04	0.02	0.01	0.00	0.01	0.03	**0.02**	N/A	0.02	**0.02**	**0.02**	**0.01**

N/A – data not available.

[(a)]Bolded numbers highlight 2006, year of pre-construction monitoring, 2009 and 2010, years of post-construction monitoring.

Table 3.16: Comparison of Breeding Densities (pairs/10ha), as measured by point count, in grassland habitat between 2006 and 2007 pre-construction and 2010, 2011 and 2012 post-construction surveys

Common name	Pre-construction		Post-construction		
	2006	2007	2010	2011	2012
Bobolink	14.86	15.92	14.90	7.93	9.19
Red-winged Blackbird	16.50	15.26	10.82	14.66	10.04
Savannah Sparrow	11.43	12.63	10.22	11.78	7.23
American Robin	4.25	3.95	2.52	1.44	2.45
Yellow Warbler	3.92	3.51	2.28	1.92	3.31
Eastern Meadowlark	6.04	5.71	3.12	1.08	1.35
Mourning Dove	3.43	2.75	1.08	0.60	1.35
Common Grackle	2.94	2.31	0.72	0.36	0.49
American Goldfinch	2.94	1.76	0.96	0.84	0.61
Barn Swallow	3.92	1.10	0.12	0.36	1.59
Song Sparrow	1.80	3.07	2.40	3.61	0.73
Brown-headed Cowbird	3.92	1.10	0.84	0.36	1.96
Horned Lark	1.63	1.43	0.48	0.00	0.00
Upland Sandpiper	3.10	1.43	0.36	0.00	0.00
Killdeer	2.29	1.21	0.72	1.08	0.37
Eastern Kingbird	2.29	1.76	1.92	1.20	0.37
Tree Swallow	0.82	0.77	0.12	3.24	1.35
Common Yellowthroat	0.49	0.88	0.96	1.68	0.49
Gray Catbird	0.16	0.11	0.12	0.12	0.86

Table 3.17: Comparison of breeding bird densities (pairs/10ha) at three distance bands from turbine bases, as measured by grassland paired point counts.

Species	Distance from Turbine Base (m)		
	0 to 100	100 to 200	200 to 300
Bobolink	35.03	28.98	39.49
Savannah Sparrow	24.52	16.88	18.47
Red-winged Blackbird	15.29	14.65	14.65
European Starling	9.55	3.50	6.69
Yellow Warbler	5.73	3.82	4.46
American Goldfinch	2.55	6.69	2.55
American Robin	2.87	3.18	2.55
Song Sparrow	2.55	2.55	2.23
Common Yellowthroat	1.59	1.59	3.82
Eastern Meadowlark	3.82	0.96	1.91
Eastern Kingbird	3.18	2.23	1.27
Canada Goose	3.18	0.00	2.87
Mourning Dove	0.64	1.27	2.55
Ring-billed Gull	0.32	3.50	0.32
Cedar Waxwing	3.50	0.64	0.32
Killdeer	2.55	0.64	1.59
Least Flycatcher	1.59	0.32	0.64
Northern Harrier	0.96	0.96	0.64
Barn Swallow	0.00	0.96	1.27
Tree Swallow	0.96	0.00	1.27
Vesper Sparrow	0.00	0.32	1.91
Willow Flycatcher	0.00	0.64	1.27
American Crow	0.32	0.64	0.96
Brown Thrasher	1.27	0.00	0.32
Gray Catbird	0.96	0.32	0.32
Wild Turkey	1.27	0.32	0.00

Table 3.17: Comparison of breeding bird densities (pairs/10ha) at three distance bands from turbine bases, as measured by grassland paired point counts.

Species	Distance from Turbine Base (m)		
	0 to 100	100 to 200	200 to 300
Brown-headed Cowbird	0.64	0.00	0.64
Bank Swallow	0.00	0.64	0.32
Field Sparrow	0.32	0.32	0.32
Upland Sandpiper	0.32	0.32	0.32
Wood Thrush	0.00	0.00	0.64
Grasshopper Sparrow	0.00	0.00	0.96
Rock Pigeon	0.96	0.00	0.00
American Kestrel	0.00	0.32	0.32
American Redstart	0.00	0.00	0.64
Blue Jay	0.00	0.32	0.32
Common Grackle	0.00	0.64	0.32
Wilson's Snipe	0.00	0.00	0.64
Orchard Oriole	0.00	0.64	0.00
Red-tailed Hawk	0.32	0.00	0.32
Ring-necked Pheasant	0.32	0.32	0.00
Black-billed Cuckoo	0.00	0.32	0.00
Eastern Bluebird	0.32	0.00	0.00
House Wren	0.32	0.00	0.00
Northern Cardinal	0.32	0.00	0.00
Northern Flicker	0.00	0.32	0.00
Swamp Sparrow	0.00	0.00	0.32

Table 3.18: Comparison of Breeding Bird density (pairs/10 ha) between pre-construction (2007) and post-cons (2010, 2011 and 2012) grassland area searches across all sectors

	Southeast Area Search (Breeding Pairs/10 ha)				Northwest Area Search (Breeding Pairs/10 ha)			
	Pre-construction	Post-construction			Pre-construction	Post-construction		
	2007	2010	2011	2012	2007	2010	2011	2012
Northern Harrier	0.1	0.1	0.2	**0.2**	0.1	0.1	0.1	**0.2**
Killdeer	0.4	0.3	0.2	**0.8**	0.1	0.3	0.8	**0.3**
Upland Sandpiper	0.2	0.1	0.0	**0.0**	0.4	0.5	0.5	**0.4**
Wilson's Snipe	0.1	0.0	0.1	**0.0**	0.1	0.0	0.1	**0.0**
Eastern Kingbird	0.6	0.3	0.4	**0.4**	0.3	0.5	0.3	**0.3**
Horned Lark	0.8	0.2	0.2	**0.4**	0.0	0.3	0.2	**0.0**
Field Sparrow	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
Vesper Sparrow	0.1	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
Savannah Sparrow	9.3	9.7	7.3	**8.9**	17.5	15.1	12.7	**6.1**
Grasshopper Sparrow	0.3	0.2	0.1	**0.0**	0.7	0.1	0.1	**0.0**
Bobolink	4.3	9.4	6.2	**14.3**	22.0	16.6	15.2	**10.7**
Eastern Meadowlark	0.4	1.2	0.1	**0.3**	0.5	0.2	0.1	**0.1**

Table 3.19: Comparison of Breeding Bird density (pairs/10ha) between pre-construction and post-construction Southeast and Northeast Areas only in sectors with grassland habitat (i.e. hay or pasture).

	Southeast Area Search (Breeding Pairs/10 ha)				Northwest Area Search (Breeding Pairs/10 ha)			
	Pre-construction	Post-construction			Pre-construction	Post-construction		
	2007	2010	2011	2012	2007	2010	2011	2012
Northern Harrier	0.1	0.1	0.2	**0.2**	0.1	0.1	0.1	**0.3**
Killdeer	0.1	0.2	0.1	**0.4**	0.1	0.1	0.3	**0.0**
Upland Sandpiper	0.1	0.1	0.0	**0.0**	0.4	0.3	0.1	**0.0**
Wilson's Snipe	0.1	0.0	0.1	**0.0**	0.1	0.0	0.1	**0.0**
Eastern Kingbird	0.8	0.4	0.4	**0.4**	0.3	0.6	0.3	**0.2**
Horned Lark	0.1	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
Field Sparrow	0.0	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
Vesper Sparrow	0.1	0.0	0.0	**0.0**	0.0	0.0	0.0	**0.0**
Savannah Sparrow	11.6	11.6	7.6	**9.9**	17.5	18.4	20.2	**9.6**
Grasshopper Sparrow	0.4	0.2	0.1	**0.0**	0.7	0.1	0.2	**0.0**
Bobolink	5.7	11.1	6.8	**16.2**	22.0	22.6	27.2	**22.2**
Eastern Meadowlark	0.5	1.5	0.1	**0.3**	0.5	0.3	0.2	**0.1**

Table 3.21: Summary of Notifications - Reporting Period

Notification No.	Date	Period	Notification
1	March 30	March 23 – 29	High Annual Mortality - Raptors (2)
2	May 3	April 17 – May 1	High Annual Mortality - Raptors (2)
3	May 15	May 3 – 15	High Annual Mortality - Raptors (2)
4	May 22	May 17	High Annual Mortality - Raptors (2)
5	June 6	May 16-28	Mortality of Species at Risk (Bobolink – two females)
6	June 19	June 18	Mortality of Species at Risk (Bobolink - female)

Appendix D

Survey Conditions

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Appendix D: Mortality Monitoring Weather Conditions January 1 - June 29, 2012

Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
02-Jan-12	CF	3	4-6	Overcast			11:03 AM	1:27 PM
02-Jan-12	WS						9:13 AM	11:24 AM
03-Jan-12	CF	-13	3-4	Partly			10:06 AM	12:31 PM
03-Jan-12	WS						9:03 AM	2:43 PM
04-Jan-12	CF	-8	4-5	Overcast	Light Snow (1-2 cm)		9:16 AM	11:30 AM
04-Jan-12	WS						9:02 AM	11:02 AM
05-Jan-12	CF	1	3-4	Partly			11:25 AM	1:37 PM
05-Jan-12	WS						12:32 PM	3:31 PM
09-Jan-12	WS						9:02 AM	11:36 AM
10-Jan-12	WS						9:04 AM	11:07 AM
11-Jan-12	WS						9:02 AM	11:11 AM
11-Jan-12	JL	-2	5-6				2:42 PM	4:22 PM
11-Jan-12	CF	-2	4-6	Partly			2:40 PM	4:09 PM
12-Jan-12	RD	-1		Overcast	Freezing Rain	Freezing Rain,	10:00 AM	11:20 AM
13-Jan-12	RD	-3		Overcast	Freezing Rain	Freezing Rain,	11:46 AM	12:49 PM
13-Jan-12	CF	-3	6+	Overcast			11:12 AM	1:14 PM
16-Jan-12	WS						9:02 AM	11:18 AM
16-Jan-12	CF	-7	4-6	Overcast			10:05 AM	12:28 PM
17-Jan-12	WS						9:02 AM	11:20 AM
17-Jan-12	CF	3	2-4	Overcast	Rain		11:10 AM	1:35 PM
18-Jan-12	WS						11:27 AM	1:31 PM
18-Jan-12	CF	-10	4	Partly			7:55 AM	10:09 AM
19-Jan-12	WS						9:29 AM	11:32 AM
19-Jan-12	CF	-7	4	Overcast			12:25 PM	2:38 PM
23-Jan-12	RD						9:00 AM	11:27 AM
23-Jan-12	CF	5	3-4	Overcast			11:15 AM	1:38 PM
24-Jan-12	WS						9:05 AM	11:14 AM
24-Jan-12	CF	-2	4	Overcast	Trace Snow		10:06 AM	12:42 PM
25-Jan-12	CF	0	2-3	Overcast			11:08 AM	1:32 PM
25-Jan-12	RD						9:58 AM	12:30 PM
26-Jan-12	CF	2	3-4	Overcast			11:11 AM	1:30 PM
27-Jan-12	WS						9:06 AM	11:09 AM
30-Jan-12	WS						9:01 AM	11:45 AM
30-Jan-12	CF	-3	1-3	Overcast			11:16 AM	1:41 PM
31-Jan-12	CF	-1	2-3	Overcast	Light Snow (1-2 cm)		11:06 AM	1:32 PM
31-Jan-12	WS						9:01 AM	11:45 AM
1-Feb-12	CF	6	4-5	Overcast			11:16 AM	1:31 PM

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Appendix D: Mortality Monitoring Weather Conditions January 1 - June 29, 2012

Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
2-Feb-12	WS						9:13 AM	11:10 AM
2-Feb-12	CF	-4	2-4	Overcast			11:10 AM	1:27 PM
3-Feb-12	RD						10:00 AM	12:38 PM
6-Feb-12	CF						12:05 PM	2:32 PM
6-Feb-12	WS						9:03 AM	11:19 AM
7-Feb-12	WS						9:08 AM	11:22 AM
7-Feb-12	CF	-1	4	Partly			11:05 AM	1:30 PM
8-Feb-12	WS						8:13 AM	10:22 AM
8-Feb-12	CF	-6	2-3				11:30 AM	1:46 PM
9-Feb-12	RD						9:30 AM	11:57 AM
10-Feb-12	CF	3	4-5				11:09 AM	12:48 PM
10-Feb-12	JL	2	4-5	Overcast			11:10 AM	1:00 PM
13-Feb-12	WS						9:03 AM	11:13 AM
13-Feb-12	CF	1		Partly			9:20 AM	10:49 AM
13-Feb-12	JL	-1	4	Partly			9:21 AM	10:51 AM
14-Feb-12	WS						8:31 AM	10:49 AM
14-Feb-12	CF	5	4	Overcast			10:05 AM	12:35 PM
15-Feb-12	RD	2		Overcast	Rain	Rain	9:10 AM	11:41 AM
15-Feb-12	CF	3	2-3	Overcast			11:06 AM	1:26 PM
16-Feb-12	CF	5	2-3	Overcast			11:09 AM	1:29 PM
17-Feb-12	RD	2		Overcast			8:06 AM	10:40 AM
20-Feb-12	WS						9:04 AM	11:25 AM
20-Feb-12	CF	2	1-3				11:05 AM	1:32 PM
21-Feb-12	CF	1	4-6	Overcast			10:23 AM	12:47 PM
21-Feb-12	WS						8:45 AM	11:15 AM
22-Feb-12	CF	6	4-6	Overcast			9:15 AM	11:33 AM
22-Feb-12	WS						9:06 AM	11:23 AM
23-Feb-12	CF	3					11:05 AM	1:17 PM
23-Feb-12	RD						10:30 AM	1:05 PM
27-Feb-12	CF	4	5-6	Overcast			11:13 AM	1:41 PM
27-Feb-12	RD	2		Overcast			11:10 AM	1:48 PM
28-Feb-12	WS						9:17 AM	11:29 AM
28-Feb-12	CF	-1	1-3	Partly			10:05 AM	12:38 PM
29-Feb-12	WS						8:01 AM	10:21 AM
29-Feb-12	CF	0		Overcast			11:15 AM	1:39 PM
1-Mar-12	JL	2	4-6	Overcast	Rain		10:16 AM	1:22 PM
1-Mar-12	CF	2	4-6	Overcast			10:15 AM	1:09 PM

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Appendix D: Mortality Monitoring Weather Conditions January 1 - June 29, 2012

Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
5-Mar-12	WS	-1	2				8:09 AM	11:02 AM
5-Mar-12	CF	-9	2-4	Partly			11:06 AM	2:01 PM
6-Mar-12	RD						9:10 AM	1:26 PM
6-Mar-12	CF	3	4	Overcast			11:10 AM	1:40 PM
7-Mar-12	RD						10:14 AM	1:30 PM
7-Mar-12	JL	12	4-5				3:04 PM	4:40 PM
7-Mar-12	CF	9	5-6	Partly			10:08 AM	11:33 AM
8-Mar-12	WS	12	5-6		Rain		8:08 AM	10:50 AM
8-Mar-12	CF	5	4-6	Overcast			11:05 AM	1:51 PM
9-Mar-12	WS	-1	2				8:09 AM	10:35 AM
9-Mar-12	CF	2	1-3	Partly			11:30 AM	2:17 PM
12-Mar-12	WS						8:47 AM	11:32 AM
12-Mar-12	CF	12	1-3	Partly			2:35 PM	5:53 PM
13-Mar-12	WS						9:38 AM	12:10 PM
13-Mar-12	CF	12	4-6	Partly			2:39 PM	4:41 PM
13-Mar-12	JL	12	4-6	Partly			2:43 PM	4:42 PM
14-Mar-12	WS	5	4	Overcast			8:39 AM	11:26 AM
14-Mar-12	CF	11	3-4	Partly			1:10 PM	4:01 PM
15-Mar-12	JL	3	4	Overcast			9:11 AM	11:56 AM
15-Mar-12	CF	3	4	Overcast			7:55 AM	11:55 AM
16-Mar-12	JL	7	0-2		Foggy		11:15 AM	3:16 PM
16-Mar-12	CF	8	1-2	Overcast	Foggy		11:22 AM	3:15 PM
19-Mar-12	JL						3:08 PM	4:41 PM
19-Mar-12	WS	12	1		Foggy		8:26 AM	11:31 AM
19-Mar-12	CF	13					11:05 AM	12:26 PM
20-Mar-12	WS	14	0		Foggy		8:29 AM	11:27 AM
20-Mar-12	CF	22	2-4	Partly			2:40 PM	5:08 PM
21-Mar-12	CF	21	2-4				2:40 PM	5:36 PM
21-Mar-12	WS						8:19 AM	12:28 PM
22-Mar-12	WS						8:25 AM	11:29 AM
22-Mar-12	CF	20	2-4				11:05 AM	1:52 PM
23-Mar-12	JL	12	2-3	Overcast			9:20 AM	12:01 PM
23-Mar-12	CF	17	4	Overcast			1:10 PM	3:47 PM
26-Mar-12	WS						8:53 AM	12:44 PM
26-Mar-12	JL	-2	4				9:20 AM	11:04 PM
26-Mar-12	CF	-2	4-5				9:19 AM	11:17 AM
27-Mar-12	WS						8:58 AM	11:26 AM

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Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
27-Mar-12	CF	-2	1-3				10:04 AM	12:40 PM
28-Mar-12	CF	13	4-5	Partly			10:10 AM	1:06 PM
28-Mar-12	WS		5				8:23 AM	11:24 AM
29-Mar-12	CF	6	2-4	Overcast			2:45 PM	5:31 PM
29-Mar-12	WS						8:35 AM	11:21 AM
30-Mar-12	CF	4	2-4				11:15 AM	1:55 PM
30-Mar-12	WS						3:43 PM	6:34 PM
2-Apr-12	WS						8:27 AM	11:48 AM
2-Apr-12	CF	11	4-5				1:10 PM	2:43 PM
2-Apr-12	JL	12	4-6				4:40 PM	6:12 PM
3-Apr-12	WS						8:36 AM	11:25 AM
3-Apr-12	CF	7	2-4	Partly			11:10 AM	1:41 PM
4-Apr-12	WS						8:55 AM	11:56 AM
5-Apr-12	WS						8:38 AM	11:44 AM
5-Apr-12	JL	2	4	Overcast			9:09 AM	10:42 AM
6-Apr-12	WS						9:38 AM	11:18 AM
6-Apr-12	JL	7	4				2:10 PM	4:08 PM
9-Apr-12	WS						8:16 AM	11:14 AM
10-Apr-12	JL	6	4	Overcast			9:31 AM	11:22 AM
10-Apr-12	CF	6	4-5	Overcast			9:17 AM	11:21 AM
10-Apr-12	WS						8:16 AM	10:34 AM
11-Apr-12	WS						8:15 AM	11:26 AM
11-Apr-12	CF	8	2-4	Overcast			11:06 AM	2:01 PM
12-Apr-12	RD	9					4:40 PM	7:44 AM
12-Apr-12	CF	9	4	Partly			11:12 AM	2:08 PM
13-Apr-12	CF	11	3-4				11:13 AM	2:01 PM
13-Apr-12	WS						8:06 AM	10:49 AM
16-Apr-12	WS						8:44 AM	11:54 AM
16-Apr-12	CF	19	4-5	Overcast			11:15 AM	2:14 PM
17-Apr-12	CF	11	4-5	Partly			11:03 AM	1:34 PM
17-Apr-12	WS						8:44 AM	11:44 AM
18-Apr-12	WS						8:28 AM	11:17 AM
18-Apr-12	JL	5					9:09 AM	10:32 AM
18-Apr-12	CF	4	1-3				9:10 AM	10:53 AM
19-Apr-12	JL	18	3-4	Partly			2:48 PM	5:49 PM
19-Apr-12	CF	16	3-4	Partly			10:06 AM	1:02 PM
20-Apr-12	CF	11	3-4	Overcast			10:05 AM	12:50 PM

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Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
20-Apr-12	WS						11:02 AM	4:27 PM
23-Apr-12	CF	4	6	Overcast			12:05 PM	3:07 PM
23-Apr-12	JL	3	4-6	Overcast	Wet Snow		9:13 AM	12:04 PM
24-Apr-12	RD						11:16 AM	2:04 PM
24-Apr-12	JL	5		Overcast	Light Rain		9:05 AM	10:22 AM
24-Apr-12	CF	6	3-4	Partly	Light Rain		10:05 AM	11:33 AM
25-Apr-12	WS						8:37 AM	11:35 AM
25-Apr-12	CF	8	2-4	Partly			11:10 AM	2:09 PM
26-Apr-12	WS						8:45 AM	11:30 AM
26-Apr-12	CF	11	3-4	Overcast	Light Rain		11:04 AM	1:58 PM
27-Apr-12	CF	4	4-6	Overcast			10:10 AM	12:54 PM
27-Apr-12	RD						11:01 AM	4:17 PM
30-Apr-12	WS						9:01 AM	11:59 AM
30-Apr-12	CF	11	2-4	Overcast			10:05 AM	1:02 PM
1-May-12	CF	12	3-4				10:07 AM	12:36 PM
1-May-12	WS						9:21 AM	12:17 PM
2-May-12	CF	13	2-4	Overcast			10:10 AM	1:08 PM
2-May-12	WS						8:49 AM	11:59 AM
3-May-12	CF	14	1-3	Overcast	Fog / Mist		10:59 AM	1:44 PM
3-May-12	WS						2:15 PM	5:34 PM
4-May-12	CF	17	4	Partly			2:41 PM	5:23 PM
4-May-12	RD						6:30 AM	9:56 AM
7-May-12	CF	21	3-4	Partly			11:20 AM	2:21 PM
7-May-12	WS						8:44 AM	11:37 AM
8-May-12	WS						1:14 PM	3:41 PM
8-May-12	CF	14	2-4	Overcast			10:09 AM	1:01 PM
9-May-12	WS						8:45 AM	11:41 AM
9-May-12	CF	11	2-4	Overcast			11:08 AM	1:35 PM
10-May-12	WS						8:47 AM	11:20 AM
10-May-12	CF	14	3-4	Overcast			12:30 PM	3:21 PM
11-May-12	CF	13	4-5				10:15 AM	12:54 PM
11-May-12	RD	14					8:00 AM	10:50 AM
14-May-12	CF	17	2-4				10:30 AM	1:20 PM
14-May-12	WS						5:10 PM	8:06 PM
15-May-12	CF	20	2-4	Partly			11:10 AM	1:39 PM
15-May-12	WS						8:29 AM	11:33 AM
16-May-12	WS						9:31 AM	12:42 PM

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Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
16-May-12	CF	18	4-5	Overcast			10:10 AM	1:17 PM
17-May-12	CF	15	3-4	Partly			10:11 AM	1:34 PM
17-May-12	RD	13					5:00 PM	8:05 PM
18-May-12	JL	14	2-3	Partly			10:00 AM	12:48 PM
18-May-12	CF	18	2-4				11:10 AM	1:47 PM
21-May-12	CF	25	1-3	Partly			12:40 PM	3:33 PM
21-May-12	WS						7:13 AM	10:20 AM
22-May-12	WS						8:15 AM	10:41 AM
22-May-12	CF	23	2-4	Overcast			11:08 AM	1:55 PM
23-May-12	JL	23	2	Partly			1:15 PM	4:06 PM
23-May-12	CF	21	3-4	Partly			10:09 AM	1:04 PM
24-May-12	JL	21	4				7:55 AM	10:56 AM
24-May-12	CF	28	4-5				11:09 AM	1:56 PM
25-May-12	RD	20		Partly			7:40 AM	11:49 AM
25-May-12	CF	25	5-6	Partly			10:16 AM	12:52 PM
28-May-12	WS						8:02 AM	12:26 PM
28-May-12	CF	23	3-4	Overcast			10:11 AM	12:59 PM
29-May-12	WS						8:25 AM	10:29 AM
29-May-12	CF	30	4	Partly			10:35 AM	1:13 PM
30-May-12	CF	25	4				11:12 AM	1:54 PM
30-May-12	WS						8:12 AM	11:22 AM
31-May-12	WS						9:00 AM	11:28 AM
31-May-12	CF	23	2-4	Partly			12:20 PM	3:17 PM
1-Jun-12	CF	16	2-4	Overcast			10:10 AM	12:50 PM
1-Jun-12	WS						9:38 AM	12:08 PM
4-Jun-12	CF	13	3-4	Overcast			10:12 AM	1:02 PM
4-Jun-12	WS						9:32 AM	12:15 PM
5-Jun-12	CF	19	2-4	Partly			11:05 AM	1:30 PM
5-Jun-12	WS						8:15 AM	10:32 AM
6-Jun-12	CF	22	2-3	Partly			11:07 AM	2:08 PM
6-Jun-12	RD	23		Partly			7:10 AM	11:04 AM
7-Jun-12	CF	22	3-4	Partly			12:03 PM	2:49 PM
7-Jun-12	WS						7:06 AM	9:36 AM
8-Jun-12	CF	21	1-3	Overcast			11:09 AM	1:52 PM
8-Jun-12	WS						9:18 AM	12:06 PM
11-Jun-12	CF	32	2-4				11:01 AM	1:43 PM
11-Jun-12	WS						7:56 AM	10:32 AM

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Wolfe Island 2012 January 1 - June 30

Appendix D: Mortality Monitoring Weather Conditions January 1 - June 29, 2012

Survey Date	Personnel	Temp (° C)	Wind Speed*	Cloud	PPT	Overnight PPT	Start Time	End Time
12-Jun-12	JL				Thunderstorms			
12-Jun-12	RD	22		Overcast	Rain, heavy	Rain	4:05 PM	7:05 PM
12-Jun-12	CF	17	3-4	Overcast	Light rain		11:04 AM	12:31 PM
13-Jun-12	CF	19	2-3	Partly			11:06 AM	1:46 PM
13-Jun-12	WS						9:38 AM	2:44 PM
14-Jun-12	CF	21	2-3				2:41 PM	5:29 PM
14-Jun-12	RD	28					7:07 AM	11:00 AM
15-Jun-12	CF	23	1-2				9:11 AM	11:51 AM
15-Jun-12	RD						8:09 AM	11:39 AM
18-Jun-12	CF	23	4-5	Overcast			11:15 AM	2:07 PM
18-Jun-12	WS						8:45 AM	11:25 AM
19-Jun-12	CF	25	4-6	Partly			11:45 AM	2:35 PM
19-Jun-12	WS						9:06 AM	11:24 AM
20-Jun-12	CF	32	1-3	Partly			10:58 AM	1:46 PM
20-Jun-12	WS						7:46 AM	11:54 AM
21-Jun-12	CF	31	2-4				11:10 AM	1:53 PM
21-Jun-12	RD	28					6:00 AM	10:29 AM
22-Jun-12	CF	27	3-4	Partly			10:08 AM	12:49 PM
22-Jun-12	RD	22					5:31 AM	9:26 AM
25-Jun-12	WS						9:02 AM	12:07 PM
25-Jun-12	JL	18	2-4	Overcast			5:39 PM	7:10 PM
25-Jun-12	CF	16	2-4	Overcast	Light Rain		10:05 AM	11:21 AM
26-Jun-12	CF	22	3-4	Partly			11:03 AM	1:53 PM
26-Jun-12	WS						7:27 AM	9:49 AM
27-Jun-12	WS						8:01 AM	10:42 AM
27-Jun-12	CF	26	1-3				11:04 AM	1:51 PM
28-Jun-12	WS						7:12 AM	10:15 AM
28-Jun-12	CF	28	3-4				12:05 PM	2:47 PM
29-Jun-12	WS	`					8:00 AM	10:20 AM
29-Jun-12	CF	28	4				10:04 AM	12:46 PM

*Wind Conditions based on the Beaufort Scale

0 – calm (wind <2km/hr)

1 – light (2-6 km/hr)

2 – light (7-12 km/ hr)

3 – moderate (13-19 km/ hr)

4 – moderate (20-30 km/ hr)

5 – fresh (31-40 km/ hr)

6 – strong (41-51 km/ hr)

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Wolfe Island 2012 January 1 - June 30

Appendix D: Site Investigation Record

Survey Date	Survey Type	Completed By	Start Time	End Time	Weather Conditions
9-Jan-12	Short Eared Owl Survey	B. Holden; J. Mansell	4:25:00 PM	5:14:00 PM	2°C; 4 Beaufort; 100% cloud cover; No rain; No rain in last 24hrs; No Snow
9-Jan-12	Winter Raptor Survey	B. Holden; J. Mansell	12:55:00 PM	2:35:00 PM	3°C; 1 Beaufort; 90% cloud cover; No rain; No rain in last 24hrs
9-Jan-12	Winter Raptor Survey	D. Graham; M. Ross	1:20:00 PM	3:10:00 PM	3°C; 3 Beaufort; 75% cloud cover; No rain; No rain in last 24hrs
9-Jan-12	Short Eared Owl Survey	D. Graham; M. Ross	4:25:00 PM	5:20:00 PM	3°C; 1 Beaufort; 90% cloud cover; No rain; No rain in last 24hrs; No Snow
18-Jan-12	Winter Raptor Survey	B. Holden; J. Mansell	1:30:00 PM	4:45:00 PM	-9°C; 3 Beaufort; 0% cloud cover; No rain; No rain in last 24hrs
18-Jan-12	Winter Raptor Survey	A. Taylor; N. Kopysh	1:30:00 PM	4:45:00 PM	-7°C; 3 Beaufort; 0% cloud cover; No rain; Rain in last 24hrs
18-Jan-12	Short Eared Owl Survey	A. Taylor; N. Kopysh	4:45:00 PM	5:35:00 PM	-8°C; 2 Beaufort; 0% cloud cover; No rain; Rain in last 24hrs; Patches of Snow
18-Jan-12	Short Eared Owl Survey	B. Holden; J. Mansell	4:03:00 PM	5:17:00 PM	-8°C; 2 Beaufort; 0% cloud cover; No rain; Rain in last 24hrs; Patches of Snow
6-Feb-12	Winter Raptor Survey	J. Mansell; B. Holden	1:00:00 PM	3:15:00 PM	6°C; 2 Beaufort; 0% cloud cover; No rain; No rain in last 24hrs
6-Feb-12	Winter Raptor Survey	D. Graham; C. Korpijaakko	2:35:00 PM	4:26:00 PM	6°C; 1 Beaufort; 0% cloud cover; No rain; No rain in last 24hrs
6-Feb-12	Short Eared Owl Survey	J. Mansell; B. Holden	4:45:00 PM	6:07:00 PM	3°C; 1 Beaufort; 0% cloud cover; No rain; Rain in last 24hrs; No Snow
6-Feb-12	Short Eared Owl Survey	D. Graham; C. Korpijaakko	4:45:00 PM	6:07:00 PM	5°C; 1 Beaufort; 0% cloud cover; No rain; No rain in last 24hrs; No Snow
21-Feb-12	Winter Raptor Survey	B. Holden; J. Mansell	1:00:00 PM	2:30:00 PM	2°C; 1 Beaufort; 100% cloud cover; No rain; No rain in last 24hrs
21-Feb-12	Winter Raptor Survey	D. Graham; C. Korpijaakko	1:10:00 PM	2:50:00 PM	2°C; 2 Beaufort; 100% cloud cover; No rain; No rain in last 24hrs
21-Feb-12	Short Eared Owl Survey	B. Holden; J. Mansell	5:10:00 PM	6:13:00 PM	0°C; 4 Beaufort; 100% cloud cover; Snowing; No rain in last 24hrs; No Snow
21-Feb-12	Short Eared Owl Survey	D. Graham; C. Korpijaakko	4:50:00 PM	6:00:00 PM	2°C; 2 Beaufort; 100% cloud cover; Snowing; No rain in last 24hrs; No Snow
6-Mar-12	Winter Raptor Survey	A. Taylor; N. Kopysh	2:25:00 PM	5:15:00 PM	-1°C; 3 Beaufort; 100% cloud cover; No rain; No rain in last 24hrs
6-Mar-12	Winter Raptor Survey	B. Holder; J. Mansell	2:30:00 PM	4:30:00 PM	-2°C; 2 Beaufort; 100% cloud cover; No rain; No rain in last 24hrs

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Wolfe Island 2012 January 1 - June 30

Appendix D: Site Investigation Record

Survey Date	Survey Type	Completed By	Start Time	End Time	Weather Conditions
6-Mar-12	Short Eared Owl Survey	A. Taylor; N. Kopysh	5:30:00 PM	6:25:00 PM	1°C; 3 Beaufort; 50% cloud cover; No Rain; No rain in last 24hrs; No Snow
6-Mar-12	Short Eared Owl Survey	B. Holden; J. Mansell	5:45:00 PM	6:20:00 PM	0°C; 1 Beaufort; 30% cloud cover; No rain; No rain in last 24hrs; No Snow
19-Mar-12	Winter Raptor Survey	B. Holden; N. Charlton	3:05:00 PM	4:54:00 PM	18°C; 1 Beaufort; 50% cloud cover; No rain; No rain in last 24hrs
19-Mar-12	Winter Raptor Survey	C. Korpijaakko; J. Mansell	3:05:00 PM	4:54:00 PM	21°C; 1 Beaufort; 65% cloud cover; No rain; No rain in last 24hrs
19-Mar-12	Short Eared Owl Survey	C. Korpijaakko; J. Mansell	6:29:00 PM	7:28:00 PM	18°C; 0 Beaufort; 80% cloud cover; No rain; No rain in last 24hrs; No Snow
19-Mar-12	Short Eared Owl Survey	B. Holden; N. Charlton	6:50:00 PM	7:50:00 PM	15°C; 1 Beaufort; 50% cloud cover; No rain; No rain in last 24hrs; No Snow
4-Jun-12	Grassland Point Counts	J. Heslop	5:45:00 AM	10:00:00 AM	10°C; 1 Beaufort; 100% cloud cover; No rain; Showers in last 24hrs
5-Jun-12	Grassland Point Counts	J. Heslop	5:40:00 AM	9:18:00 AM	10°C; 1 Beaufort; 80% cloud cover; No rain; No rain in last 24hrs
6-Jun-12	Breeding Bird Area Search	A. Taylor	5:05:00 AM	9:58:00 AM	16°C; 2 Beaufort; 5% cloud cover; No rain; Showers in last 24hrs
6-Jun-12	Grassland Point Counts	A. Taylor	5:31:00 AM	7:35:00 AM	16°C; 2 Beaufort; 5% cloud cover; No rain; Showers in last 24hrs
6-Jun-12	Grassland Paired Point Counts	K. Walpole; A. Taylor	5:30:00 AM	9:55:00 AM	16°C; 2 Beaufort; 65% cloud cover; Light rain; Rain in last 24hrs
7-Jun-12	Grassland Paired Point Counts	K. Walpole	5:18:00 AM	10:05:00 AM	15°C; 0 Beaufort; 45% cloud cover; No rain; Rain in last 24hrs
7-Jun-12	Breeding Bird Area Search	A. Taylor	5:05:00 AM	8:30:00 AM	16°C; 1 Beaufort; 60% cloud cover; No rain; Showers in last 24hrs
7-Jun-12	Grassland Point Counts	A. Taylor	6:20:00 AM	8:30:00 AM	16°C; 1 Beaufort; 60% cloud cover; No rain; Showers in last 24hrs
8-Jun-12	Grassland Paired Point Counts	K. Walpole	5:10:00 AM	10:08:00 AM	15°C; 2 Beaufort; 10% cloud cover; No rain; Light rain in last 24hrs
17-Jun-12	Grassland Paired Point Counts	B. Holden	5:36:00 AM	10:46:00 AM	19°C; 4 Beaufort; 40% cloud cover; No rain; No rain in last 24hrs
18-Jun-12	Grassland Paired Point Counts	B. Holden	5:11:00 AM	10:18:00 AM	22°C; 5 Beaufort; 60% cloud cover and Hazey; No rain; No rain in last 24hrs
19-Jun-12	Grassland Birds Habitat Assessment	B. Holden	8:20:00 AM	10:10:00 AM	23°C; 2 Beaufort; 100% cloud cover; Rain early; Thunderstorm in last 24hrs

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Wolfe Island 2012 January 1 - June 30

Appendix D: Site Investigation Record

Survey Date	Survey Type	Completed By	Start Time	End Time	Weather Conditions
19-Jun-12	Breeding Bird Area Search	B. Holden	8:20:00 AM	10:10:00 AM	23°C; 2 Beaufort; 100% cloud cover; Rain early; Thunderstorm in last 24hrs
20-Jun-12	Breeding Bird Area Search	B. Holden	5:12:00 AM	10:33:00 AM	24°C; 2 Beaufort; 20% cloud cover; No rain; Rain in last 24hrs
20-Jun-12	Grassland Point Counts	B. Holden	9:08:00 AM	10:18:00 AM	24°C; 2 Beaufort; 20% cloud cover; No rain; Rain in last 24hrs
21-Jun-12	Grassland Point Counts	B. Holden	5:57:00 AM	10:07:00 AM	29°C; 3 Beaufort; 0% cloud cover; No rain; No rain in last 24hrs
22-Jun-12	Breeding Bird Area Search	B. Holden	5:50:00 AM	10:05:00 AM	24°C; 3 Beaufort; Variable 100-30% cloud cover; No rain; Drizzle in last 24hrs
22-Jun-12	Grassland Point Counts	B. Holden	6:31:00 AM	7:55:00 AM	24°C; 3 Beaufort; Variable 100-30% cloud cover; No rain; Drizzle in last 24hrs
23-Jun-12	Grassland Point Counts	B. Holden	6:02:00 AM	9:59:00 AM	25°C; 3 Beaufort; Variable 80-40% cloud cover; No rain; Rain in last 24hrs

Appendix E

Mortality Monitoring Results

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Wolfe Island 2012 January 1 - June 30

Appendix E: Wolfe Island Fatalities 2012-06-29

Date	Turbine #	Turbine Subset Interval	GPS Location Zone Easting Northing	Observer	Species	Guild	Condition/Estimated Time Since Death	Injuries Sustained	Distance (m)	Direction (°)	Ground Cover
21-Mar-12	5	1x	0380655 4890651	WS	Killdeer	bird	<3 days	Broken neck	8	288	Grass
16-May-12	5	1x	0380643 4890652	WS	Eastern Kingbird	bird	Fresh, < 3 days	No visible trauma on either	1	298	Grass
16-May-12	5	1x	0380643 4890652	WS	Eastern Kingbird	bird	Fresh, < 3 days	No visible trauma on either	1	298	Grass
17-Apr-12	20	2x	0381807 4889250	CF	bird species	bird	Fresh, 1 day	No visible trauma	1	296	Gravel
09-May-12	22	1x	0382239 4889663	CF	bird species	bird	Fresh, 1-2 days	Neck?	30	70	Gravel
30-Apr-12	23	2x	0382149 4890151	WS	Double-crested Cormorant	bird	Fresh, < 5 days	Wing is off	39	256	Mud
25-May-12	25	2x	0382737 4890467	CF	Horned Lark	bird	Fresh, 1-2 days	Neck?	16	334	Gravel
18-Jun-12	27	2x	0382253 4891321	WS	Wilson's Snipe	bird	Fresh, < 5 days		18	278	Gravel
21-Jun-12	28	2x	0382404 4891575	RD	Eastern Kingbird	bird	Fresh	Broken neck	4	200	Gravel
18-Apr-12	30	1x	0384738 4886415	WS	Brown-headed Cowbird	bird	Fresh, < 5 days	No visible trauma	6	243	Grass
16-May-12	31	1x	0384882 4886153	WS	American Redstart	bird	Old, dry - > 5 days	Unknown	20	172	Grassy Gravel
12-Mar-12	33	1x	0384498 4887245	WS	European Starling	bird	<3 days	headless, scavenger drop?	5	120	
28-May-12	43	2x	0390568 4891490	CF	Bobolink (F)	bird	Fresh, 1-2 days	Abdomen	40	349	Gravel
20-Apr-12	51	2x	0387746 4890497	CF	Golden-crowned Kinglet	bird	Fresh, 1 day	No visible trauma	30	234	Gravel
19-Apr-12	54	1x	0387786 4889588	CF	Golden-crowned Kinglet	bird	Fresh, 1 day	No visible trauma	34	263	Gravel
06-Jun-12	60	1x	0388794 4893033	CF	Black-billed Cuckoo	bird	Fresh, 1 day	Neck	2		Gravel
16-May-12	80	1x	0384264 4889941	CF	Bobolink (F)	bird	Fresh, 1-2 days	Neck?	1	200	Gravel
25-Jun-12	82	2x	0383083 4893028	WS	bird species	bird	Fresh, < 5 days		17	258	Gravel
18-Jun-12	86	2x	0382203 4892638	WS	Bobolink (F)	bird	Fresh, < 5 days		12	228	Gravel
25-Jun-12	86	2x	0382234 4892643	WS	Common Grackle	bird	Fresh, < 5 days		36	277	Gravel
19-Jun-12	10	1x	0381226 4898210	CF	Turkey Vulture	Raptor	Old, 3-4 days	Neck	22	83	Gravel
27-Mar-12	17	1x	0381043 4889001	WS	Rough-legged Hawk	Raptor	Fresh, < 3 days	Severe	28	148	Soil
17-May-12	23	2x	0382150 4890164	CF	Northern Harrier	Raptor	Fresh, 1-2 days	Abdomen	20	295	Vegetation
17-Apr-12	61	2x	0390056 4894147	WS	Hawk species	Raptor	< 4 days	Feathers only (scavenged)	36	309	Grass
23-Mar-12	71	1x	0386285 4894096	CF	Hawk species	Raptor	1 day	Severed head, no carcass	46	125	Gravel
03-Apr-12	71	2x	0386353 4894110	WS	Red-tailed Hawk	Raptor	Fresh, < 5 days - scavenged	Scavenged (wing apart fr body)	31	239	Grass
17-May-12	76	1x	0384891 4986148	RD	Red-tailed Hawk	Raptor	Fresh	Head	39	304	Long grass
13-Apr-12	78	2x	0385230 4891003	CF	Rough-legged Hawk	Raptor	Fresh, 1 day	Back & Abdomen trauma	15	240	Gravel
03-May-12	86	2x	0382214 4892643	CF	Osprey	Raptor	Fresh, 1 day	Broken neck & wing	28	252	Gravel
14-May-12	86	2x	0382205 4892640	WS	Osprey	Raptor	Fresh, 3-5 days	Outspread wings	15	218	Gravel
18-May-12	16	2x	0381279 4888708	JL	Silver-haired Bat	bat	Fresh, 1 day	Vortex	25	225	Gravel
10-May-12	28	2x	0382141 4891659	CF	Hoary Bat	bat	Fresh, 1 day	Vortex?	37	292	Gravel / Veg

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Wolfe Island 2012 January 1 - June 30

Appendix E: Wolfe Island Fatalities 2012-06-29

Date	Turbine #	Turbine Subset Interval	GPS Location Zone Easting Northing	Observer	Species	Guild	Condition/Estimated Time Since Death	Injuries Sustained	Distance (m)	Direction (°)	Ground Cover
11-May-12	39	2x	0387270 4887574	CF	Eastern Pipestrelle	bat	Old, 2-3 days	Vortex?	25	110	Soil
25-May-12	61	2x	0388504 4894441	RD	bat species	bat	Fresh, 1/2 day		13	150	Gravel
18-May-12	62	2x	0389722 4893983	CF	Red Bat	bat	Fresh, 1-2 days	Vortex?	12	202	Gravel
20-Jun-12	63	1x	0388745 4893382	CF	bat species	bat	Fresh, 1-2 days	Vortex?	39	56	Gravel
22-May-12	71	2x	0386316 4894105	CF	Big Brown Bat	bat	Fresh, 1-2 days	Vortex?	26	172	Gravel
07-May-12	85	2x	0381907 4892284	CF	bat species	bat	Fresh, 1-2 days	Vortex?	21	232	Gravel

Appendix F

Grassland Breeding Bird Survey Results

Table 1: Summary of Grassland Species Observations in Southeast Area Search

Southeast Area Search

Sector	1			2			3			4			5			6		
Habitat (area in ha)	Pasture		Density	Hay		Density	Hay		Density	Pasture		Density	Pasture		Density	Hay		Density
Dates	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)
BIRDS																		
Northern Harrier			0.0			0.0		1	1.2		1	0.4			0.0			0.0
Killdeer	2		1.3			0.0			0.0	1		0.4			0.0			0.0
Upland Sandpiper			0.0			0.0			0.0			0.0			0.0			0.0
Wilson's Snipe			0.0			0.0			0.0			0.0			0.0			0.0
Eastern Kingbird		1	0.7	1		0.7		1	1.2	1	1	0.4			0.0	1	1	0.8
Horned Lark			0.0			0.0			0.0			0.0			0.0			0.0
Field Sparrow			0.0			0.0			0.0			0.0			0.0			0.0
Vesper Sparrow			0.0			0.0			0.0			0.0			0.0			0.0
Savannah Sparrow	8	18	11.9	17	14	11.3	7	8	9.8	28	12	11.3	22	6	19.7	17	9	13.6
Grasshopper Sparrow			0.0			0.0			0.0			0.0			0.0			0.0
Bobolink	10	2	6.6	33	25	21.9	25	2	30.6	41	20	16.5	28	19	25.1	27	15	21.6
Eastern Meadowlark			0.0		1	0.7	1		1.2	1	1	0.4	1		0.9			0.0

Sector	7			8			9			10			11			Totals			Density
Habitat (area in ha)	Pasture		Density	Pasture		Density	Pasture		Density	Hay		Density	Plowed		Density				
Dates	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	6-Jun	20-Jun	(pair/10ha)	8-Jun	20-Jun	(pair/10ha)	round 1	round 2	Max	(pairs/10ha)
BIRDS																			
Northern Harrier			0.0	1	1	0.9	1		0.8			0.0			0.0	2	3	**3**	**0.2**
Killdeer			0.0	3	1	2.6	1		0.8			0.0	8	1	3.6	15	2	**15**	**0.8**
Upland Sandpiper			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Wilson's Snipe			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Eastern Kingbird	1	2	0.8			0.0	1	1	0.8			0.0			0.0	5	7	**7**	**0.4**
Horned Lark			0.0			0.0			0.0			0.0	7	1	3.2	7	1	**7**	**0.4**
Field Sparrow			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Vesper Sparrow			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Savannah Sparrow	23	16	9.6	27	2	23.5	8	9	7.0	13	9	6.0	3	1	1.4	173	104	**173**	**8.9**
Grasshopper Sparrow			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Bobolink	40	16	16.6	22	3	19.1	22	2	17.1	31	32	14.7			0.0	279	136	**279**	**14.3**
Eastern Meadowlark		1	0.4	1		0.9		1	0.8	1		0.5			0.0	5	4	**5**	**0.3**

Table 2: Summary of Grassland Species Observations in Northwest Area Search

Northwest Area Search

Sector	1			2			3			4			7			8			9			Totals			Density
Habitat (area in ha)	Soya		Density	Corn		Density	Soya		Density	Plowed		Density	Hay		Density	Hay		Density	Hay		Density				
Dates	7-Jun	22-Jun	(pair/10ha)	7-Jun	22-Jun	(pair/10ha)	7-Jun	22-Jun	(pair/10ha)	7-Jun	22-Jun	(pair/10ha)	7-Jun	22-Jun	(pair/10ha)	7-Jun	22-Jun	(pair/10ha)	7-Jun	22-Jun	(pair/10ha)	round 1	round 2	Max	pairs/10ha)
BIRDS																									
Northern Harrier			0.0			0.0			0.0		1	0.7			0.0	1	1	0.3		2	0.5	1	4	**4**	**0.2**
Killdeer	2	1	1.0	2	1	1.0	2	2	1.3			0.0			0.0			0.0			0.0	6	4	**6**	**0.3**
Upland Sandpiper	2	2	1.0			0.0	1	1	0.7	3	5	3.3			0.0			0.0			0.0	6	8	**8**	**0.4**
Wilson's Snipe			0.0			0.0			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Eastern Kingbird	1	2	1.0			0.0			0.0	1	1	0.7			0.0		1	0.3	2	1	0.5	4	5	**5**	**0.3**
Horned Lark			0.0			0.0			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Field Sparrow			0.0			0.0			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Vesper Sparrow			0.0			0.0			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Savannah Sparrow	7	5	3.6	4	1	2.0	7	6	4.6	11	15	9.9	43	16	22.8	27	19	7.4	22	23	6.2	121	85	**121**	**6.1**
Grasshopper Sparrow			0.0			0.0			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Bobolink			0.0			0.0			0.0		1	0.7	53	53	28.0	71	82	22.6	89	76	23.9	213	212	**213**	**10.7**
Eastern Meadowlark			0.0			0.0		1	0.7			0.0	1		0.5			0.0			0.0	1	1	**1**	**0.1**

Table 3: Summary of all species observed in both the Southeast and Northwest Area Searches

	Southeast Area Search				Northwest Area Search			
	Round 1	Round 2	MAX	Density (pairs/10ha)	Round 1	Round 2	MAX	Density (pairs/10ha)
Northern Harrier	2	3	**3**	**0.15**	1	4	**4**	**0.20**
Killdeer	15	2	**15**	**0.77**	6	4	**6**	**0.30**
Upland Sandpiper				**0.00**	6	8	**8**	**0.40**
Eastern Kingbird	5	7	**7**	**0.36**	4	5	**5**	**0.25**
Horned Lark	7	1	**7**	**0.36**				**0.00**
Savannah Sparrow	173	104	**173**	**8.87**	121	85	**121**	**6.08**
Bobolink	279	136	**279**	**14.31**	213	212	**213**	**10.70**
Eastern Meadowlark	5	4	**5**	**0.26**	1	1	**1**	**0.05**
American Robin	4	17	**17**	**0.87**	8	14	**14**	**0.73**
Cedar Waxwing		3	**3**	**0.15**		1	**1**	**0.05**
Red-winged Blackbird	79	52	**79**	**4.05**	75	42	**75**	**3.93**
Mourning Dove	1	6	**6**	**0.31**		5	**5**	**0.26**
Spotted Sandpiper		1	**1**	**0.05**	2	1	**2**	**0.10**
Common Yellowthroat	2	2	**2**	**0.10**	2	1	**2**	**0.10**
Yellow Warbler	5	6	**6**	**0.31**	5	6	**6**	**0.31**
American Goldfinch	1	2	**2**	**0.10**	2	3	**3**	**0.16**
Song Sparrow	1	5	**5**	**0.26**	6	12	**12**	**0.63**
Common Grackle		5	**5**	**0.26**		1	**1**	**0.05**
Brown-headed Cowbird		5	**5**	**0.26**		6	**6**	**0.31**
European Starling		87	**87**	**4.46**		10	**10**	**0.52**
Tree Swallow	1	6	**6**	**0.31**	6	4	**6**	**0.31**
Barn Swallow	5	5	**5**	**0.26**		3	**3**	**0.16**
Northern Flicker		1	**1**	**0.05**				**0.00**
Brown Thrasher	1	3	**3**	**0.15**				**0.00**
Orchard Oriole		1	**1**	**0.05**				**0.00**
Willow Flycatcher	5	1	**5**	**0.26**	1	1	**1**	**0.05**
Swamp Sparrow				**0.00**	1	1	**1**	**0.05**
Herring Gull				**0.00**	1		**1**	**0.05**
Warbling Vireo		1	**1**	**0.05**		1	**1**	**0.05**
Common Raven				**0.00**		1	**1**	**0.05**
Wild Turkey				**0.00**		2	**2**	**0.10**
Ring Billed Gull		6	**6**	**0.31**		1	**1**	**0.05**
American Crow		1	**1**	**0.05**		1	**1**	**0.05**
Purple Martin	1		**1**	**0.05**		1	**1**	**0.05**
Mallard	1		**1**	**0.05**				**0.00**
Red-Tailed Hawk		1	**1**	**0.05**				**0.00**
Turkey Vulture		9	**9**	**0.46**				**0.00**
Belted Kingfisher		1	**1**	**0.05**				**0.00**
Eastern Bluebird		1	**1**	**0.05**				**0.00**
Ring-necked Pheasant	1		**1**	**0.05**				**0.00**

Visitor; not anticipated to be breeding in the searched area.

Anova: Single Factor - All Species

Groups	*Count*	*Sum*	*Average*	*Variance*
0-100	20	427	21.35	50.13421053
100-200	20	314	15.7	26.85263158
200-300	20	381	19.05	21.73421053

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	322.9	2	161.45	4.906248334	0.010814	3.158843
Within Groups	1875.7	57	32.90702			
Total	2198.6	59				

Anova: Single Factor - Grassland Species

Groups	*Count*	*Sum*	*Average*	*Variance*
0-100	20	221	11.05	20.89210526
100-200	20	155	7.75	5.881578947
200-300	20	196	9.8	19.22105263

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	111.03333	2	55.51667	3.621066484	0.03308	3.158843
Within Groups	873.9	57	15.33158			
Total	984.93333	59				

Anova: Single Factor - Bobolink

Groups	*Count*	*Sum*	*Average*	*Variance*
0-100	20	118	5.9	8.726315789
100-200	20	91	4.55	3.944736842
200-300	20	124	6.2	11.64210526

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	30.9	2	15.45	1.906375149	0.157974	3.158843
Within Groups	461.95	57	8.104386			
Total	492.85	59				

Anova: Single Factor - Savannah Sparrow

Groups	*Count*	*Sum*	*Average*	*Variance*
0-100	20	80	4	3.789473684
100-200	20	53	2.65	2.344736842
200-300	20	58	2.9	3.042105263

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.3	2	0.15	1.879120879	0.162064	3.158843
Within Groups	4.55	57	0.079825			
Total	4.85	59				

Anova: Single Factor - Eastern Meadowlark

Groups	*Count*	*Sum*	*Average*	*Variance*
0-100	20	12	0.6	0.463157895
100-200	20	3	0.15	0.134210526
200-300	20	6	0.3	0.221052632

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2.1	2	1.05	3.848874598	0.027045	3.158843
Within Groups	15.55	57	0.272807			
Total	17.65	59				

Appendix G

Notifications and Agency Responses

From: Garry Perfect <Garry_Perfect@transalta.com>
Sent: Friday, March 30, 2012 3:12 PM
To: Prevost, Eric (MNR); 'Rob.Read@ec.gc.ca'; rob.dobos@ec.gc.ca; mathieu.leblanc@nrcan-rncan.gc.ca
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification

Good afternoon all:

This email provides the details of one notification threshold that has been met at the Wolfe Island Wind Plant during the period March 23 – 27, 2012.

High Annual Mortality Rates - Raptors

The Post-Construction Follow-Up Plan for Bird and Bat Resources at the Wolfe Island Wind Plant states that NRCan, EC, and MNR will be notified if two raptor fatalities are noted over a six-week period.

A hawk carcass (species identification yet to be confirmed by Stantec) was discovered at turbine 71 on March 23 during the on-going mortality searches. The second raptor, a Rough-legged Hawk, was discovered at turbine 17 on March 27.

Please feel free to contact me directly should you wish to discuss this notification.

Garry Perfect
Environmental Specialist

Ph:519-826-4645 x225 Cell:519-820-8204 Fax:519-826-4745
34 Harvard Road, Guelph, Ontario, N1G 4V8
Garry_Perfect@transalta.com

TransAlta
www.transalta.com

From: Garry Perfect <Garry_Perfect@transalta.com>
Sent: Thursday, May 03, 2012 9:24 AM
To: Prevost, Eric (MNR); 'Rob.Read@ec.gc.ca'; rob.dobos@ec.gc.ca; mathieu.leblanc@nrcan-rncan.gc.ca
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification

Good morning all:

This email provides the details of one notification threshold that has been met at the Wolfe Island Wind Plant during the period April 17 – May 1, 2012.

High Annual Mortality Rates - Raptors

The Post-Construction Follow-Up Plan for Bird and Bat Resources at the Wolfe Island Wind Plant states that NRCan, EC, and MNR will be notified if two raptor fatalities are noted over a six week period.

Hawk feathers of a suspected turbine causality were discovered at Turbine 61 on April 17 during the regular mortality searches. A second raptor, a Red-tailed Hawk, was discovered at Turbine 62 on May 1.

Please feel free to contact me directly should you wish to discuss this notification.

Garry Perfect
Environmental Specialist

Ph:519-826-4645 x225 Cell:519-820-8204 Fax:519-826-4745
34 Harvard Road, Guelph, Ontario, N1G 4V8
Garry_Perfect@transalta.com

TransAlta
www.transalta.com

From: Christine Nicholls <Christine_Nicholls@transalta.com>
Sent: Tuesday, May 15, 2012 4:20 PM
To: eric.prevost@ontario.ca; Rob.Read@ec.gc.ca; rob.dobos@ec.gc.ca; mathieu.leblanc@nrcan-rncan.gc.ca
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification

Hello

This email provides the details of one notification threshold that has been met at the Wolfe Island Wind Plant during the period May 3 – May 15, 2012.

High Annual Mortality Rates - Raptors

The Post-Construction Follow-Up Plan for Bird and Bat Resources at the Wolfe Island Wind Plant states that NRCan, EC, and MNR will be notified if two raptor fatalities are noted over a six week period.

An Osprey fatality was discovered at Turbine 86 on May 3 during the regular mortality searches. A second Osprey was discovered at the same turbine during the regular monitoring on May 15. Given the proximity of Turbine 86 to the active nest at the Operations and Maintenance building, there is potential the two Osprey fatalities represent a breeding pair.

I have contacted Eric by phone and have requested direction from his agency with respect to chicks in the nest. TransAlta will provide resources to help out as directed.

Please feel free to contact me directly should you wish to discuss this notification.

Regards

Christine

Christine Nicholls M.Sc., P.Ag.
Environmental Specialist

Ph: 403-267-7689 | Cell: 587-580-5947
Box 1900, Station "M" | 110-12 Avenue S.W. Calgary, AB T2P 2M1

From: Christine Nicholls <Christine_Nicholls@transalta.com>
Sent: Tuesday, May 22, 2012 11:08 AM
To: eric.prevost@ontario.ca; Rob.Read@ec.gc.ca; rob.dobos@ec.gc.ca; mathieu.leblanc@nrcan-rncan.gc.ca
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification

Good morning, gentlemen

This email provides the details of one notification threshold that has been met at the Wolfe Island Wind Plant on May 17, 2012.

High Annual Mortality Rates - Raptors

The Post-Construction Follow-Up Plan for Bird and Bat Resources at the Wolfe Island Wind Plant states that NRCan, EC, and MNR will be notified if two raptor fatalities are noted over a six week period.

During the regular mortality monitoring on May 17, two raptor fatalities were discovered. A Red-tailed Hawk was found at T76. A second raptor (species yet to be confirmed) was found at T23.

Please feel free to contact me directly should you wish to discuss this notification.

Regards

Christine

Christine Nicholls M.Sc., P.Ag.
Environmental Specialist

Ph: 403-267-7689 | Cell: 587-580-5947
Box 1900, Station "M" | 110-12 Avenue S.W. Calgary, AB T2P 2M1

From: Christine Nicholls <Christine_Nicholls@transalta.com>
Sent: Wednesday, June 06, 2012 2:44 PM
To: eric.prevost@ontario.ca; Rob.Read@ec.gc.ca; rob.dobos@ec.gc.ca; mathieu.leblanc@nrcan-rncan.gc.ca
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification

This email provides the details of two notification thresholds that have been met at the Wolfe Island Wind Plant.

Mortality of Species at Risk

As stated in the Post-Construction Follow-Up Plan for the Wolfe Island Wind Plant, NRCan, EC, and MNR will be notified if mortality of a species at risk is observed.

On May 16, 2012 a single female Bobolink fatality was recorded at turbine 80 during the on-going mortality searches. A second female Bobolink fatality was recorded at turbine 43 on May 28, 2012. The notification is being submitted at this time, as the identification of both fatalities has recently been confirmed.

This species is listed as Threatened on the Species at Risk in Ontario List of the provincial *Endangered Species Act* (2007). Bobolink has also been evaluated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), but is currently not on a Schedule of the federal *Species at Risk Act.*

Regards

Christine

Christine Nicholls M.Sc., P.Ag.
Environmental Specialist

Ph: 403-267-7689 | Cell: 587-580-5947
Box 1900, Station "M" | 110-12 Avenue S.W. Calgary, AB T2P 2M1

From: Christine Nicholls <Christine_Nicholls@transalta.com>
Sent: Tuesday, June 19, 2012 10:49 AM
To: eric.prevost@ontario.ca; Rob.Read@ec.gc.ca; rob.dobos@ec.gc.ca; mathieu.leblanc@nrcan-rncan.gc.ca
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification

Hello

As stated in the Post-Construction Follow-Up Plan for the Wolfe Island Wind Plant, NRCan, EC, and MNR will be notified if mortality of a species at risk is observed.

Mortality of Species at Risk

On June 18, 2012 a single Bobolink fatality was recorded at turbine 86. The fatality was either female or juvenile; an attempt to confirm the age of each specimen will be made prior to preparation of the monitoring report. This species is listed as Threatened on the Species at Risk in Ontario List of the provincial *Endangered Species Act* (2007). Bobolink has also been evaluated as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), but is currently not on a Schedule of the federal *Species at Risk Act.*

Regards

Christine

Christine Nicholls M.Sc., P.Ag.
Environmental Specialist

Ph: 403-267-7689 | Cell: 587-580-5947
Box 1900, Station "M" | 110-12 Avenue S.W. Calgary, AB T2P 2M1

Appendix H

Summary Data from Previous Reports

Comparison of Waterfowl Use by Guild During the Spring Season

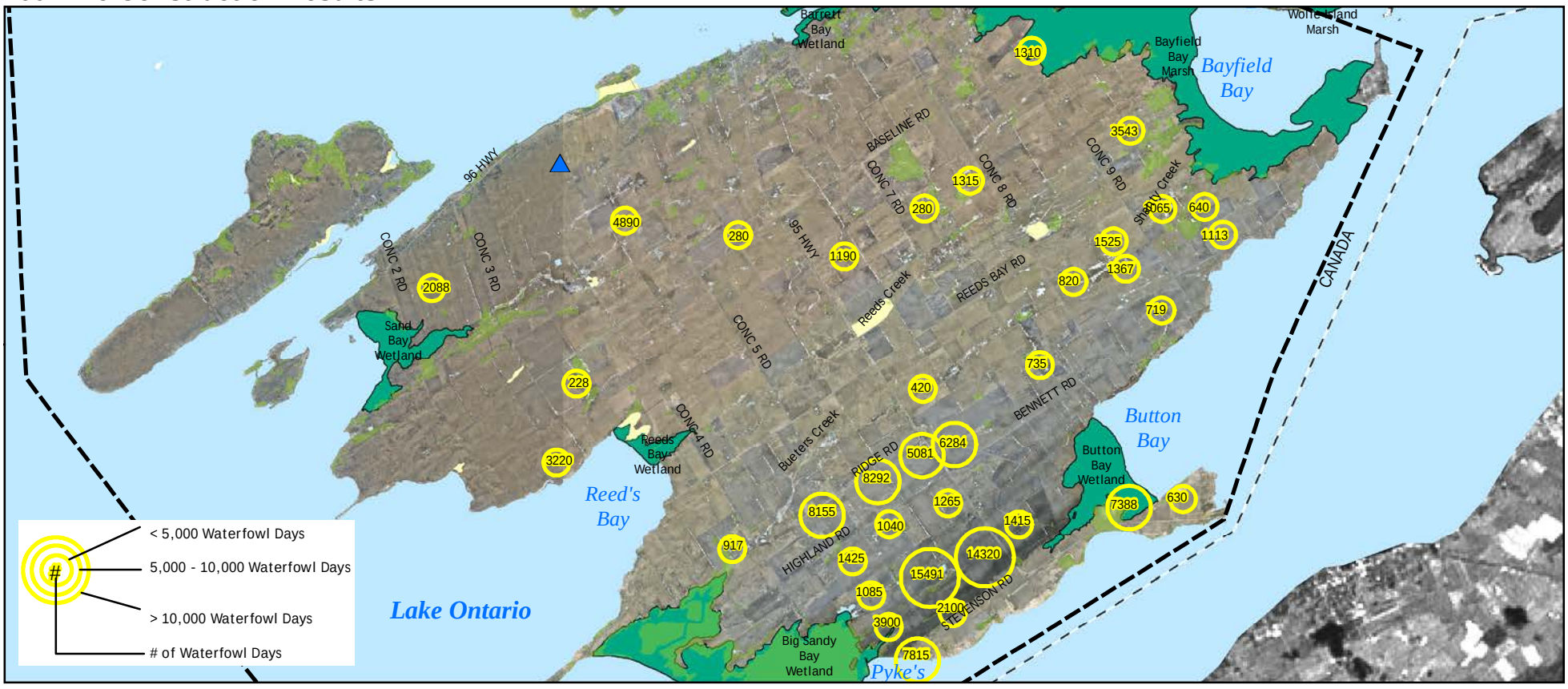
	1999	2008	2009	2010	2011
Swans	218	35	214	582	649
Geese	17,867	7,251	23,779	26,152	30,448
Large dabblers	23,360	1,214	8,321	16,282	17,221
Small dabblers	663	62	78	1,185	0
Bay ducks	381,605	186,325	179,704	205,895	135,977
Sea ducks	89	108	4,118	1,050	5,951
Goldeneye	30,628	125,058	54,093	83,109	91,015
Mergansers	19,651	17,247	55,737	29,777	94,473
Unknown		2,809	45,236	4,688	5,951
Total	**474,079**	**340,105**	**371,278**	**368,718**	**381,684**

Notes: Cells represent waterfowl days.

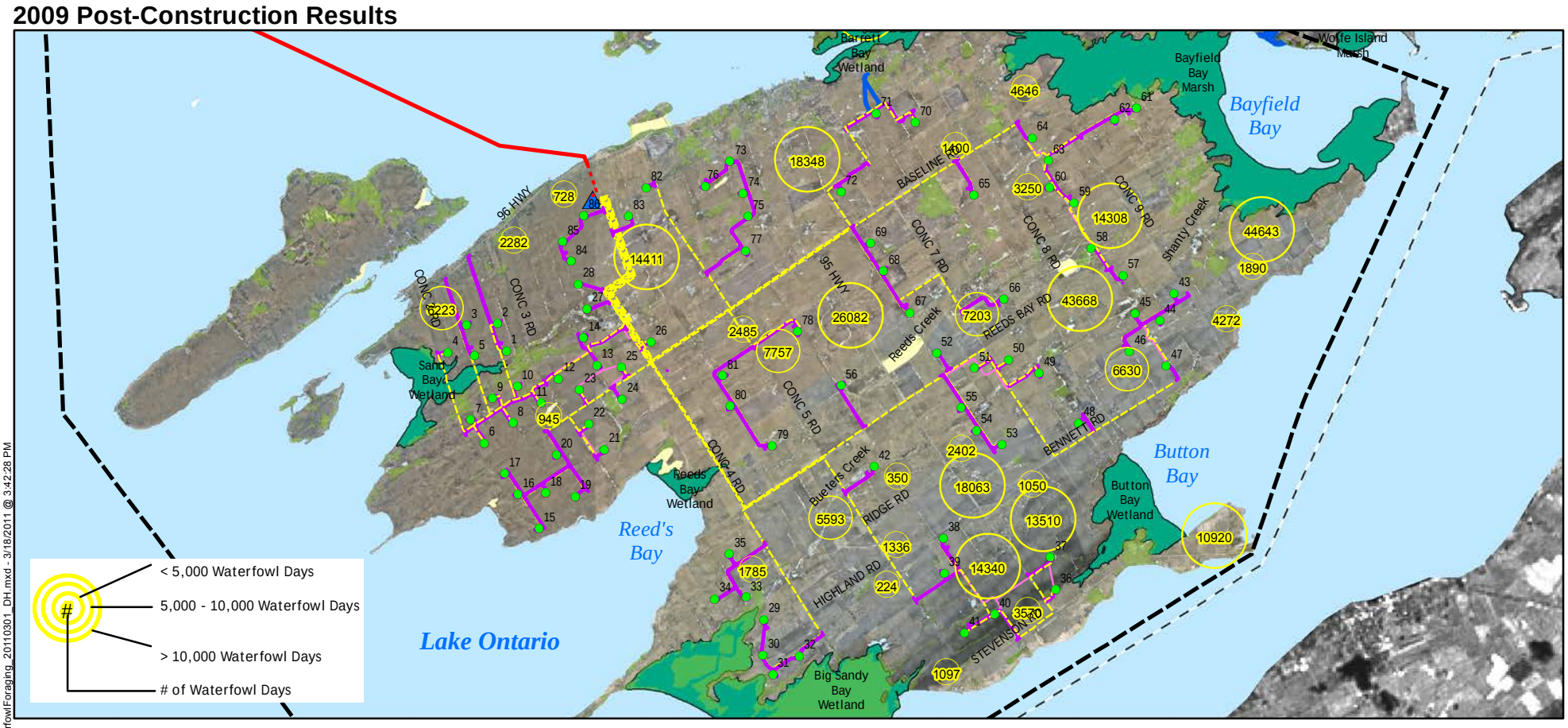
Comparison of Waterfowl Use by Guild During the Fall Season

	1999	2008	2009	2010	2011
Swans	9,484	20,960	30,338	26,180	33,578
Geese	496,794	390,868	391,859	308,948	282,872
Large dabblers	762,557	354,443	340,805	292,984	325,185
Small dabblers	47,190	132,761	25,988	32,927	13,574
Bay ducks	1,153,076	1,139,233	1,459,697	854,554	1,112,723
Sea ducks	333	85	6,664	5,276	3,979
Goldeneye	75,595	137,951	69,564	211,813	133,761
Mergansers	43,665	58,403	36,052	150,455	62,992
Total	**2,588,692**	**2,234,702**	**2,360,965**	**1,886,494**	**1,968,663**

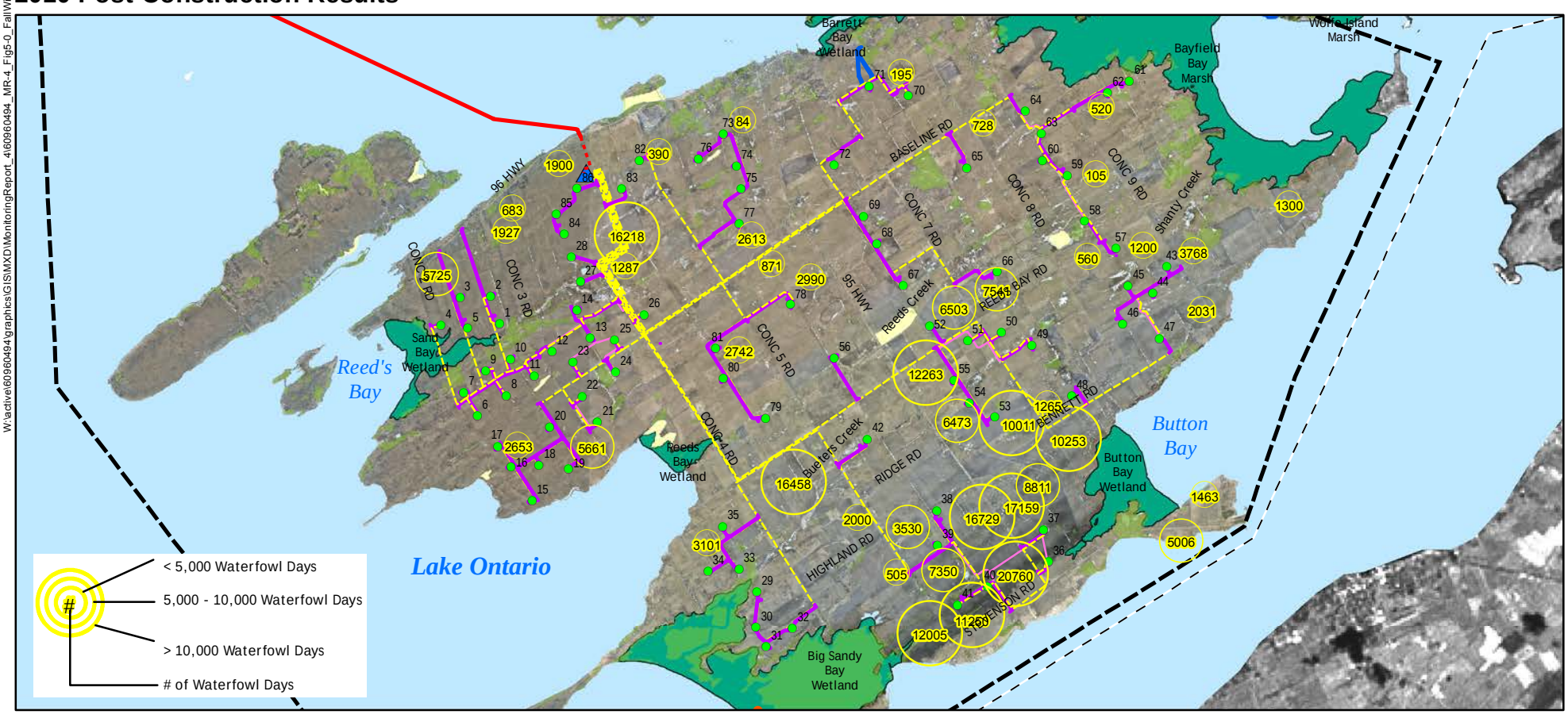
2007 Pre-Construction Results



2009 Post-Construction Results



2010 Post-Construction Results



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Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road
- Crane Walk Path
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

0 1 2 Kilometers

1:85,000

N W E S

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006 and the Cataraqui Region Conservation Authority, 2006.

Stantec

TransAlta

March, 2011
160960494

Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 4

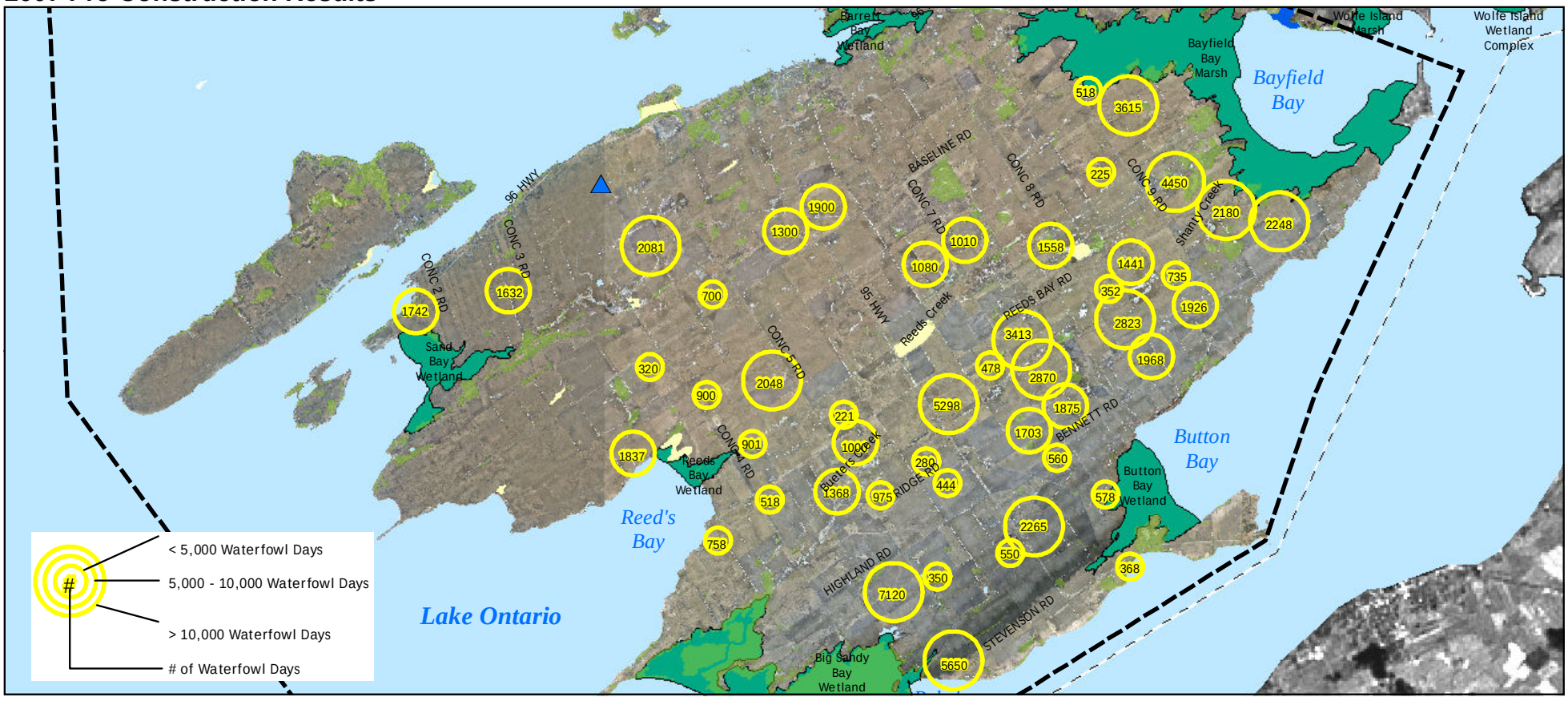
Figure No.

5.0

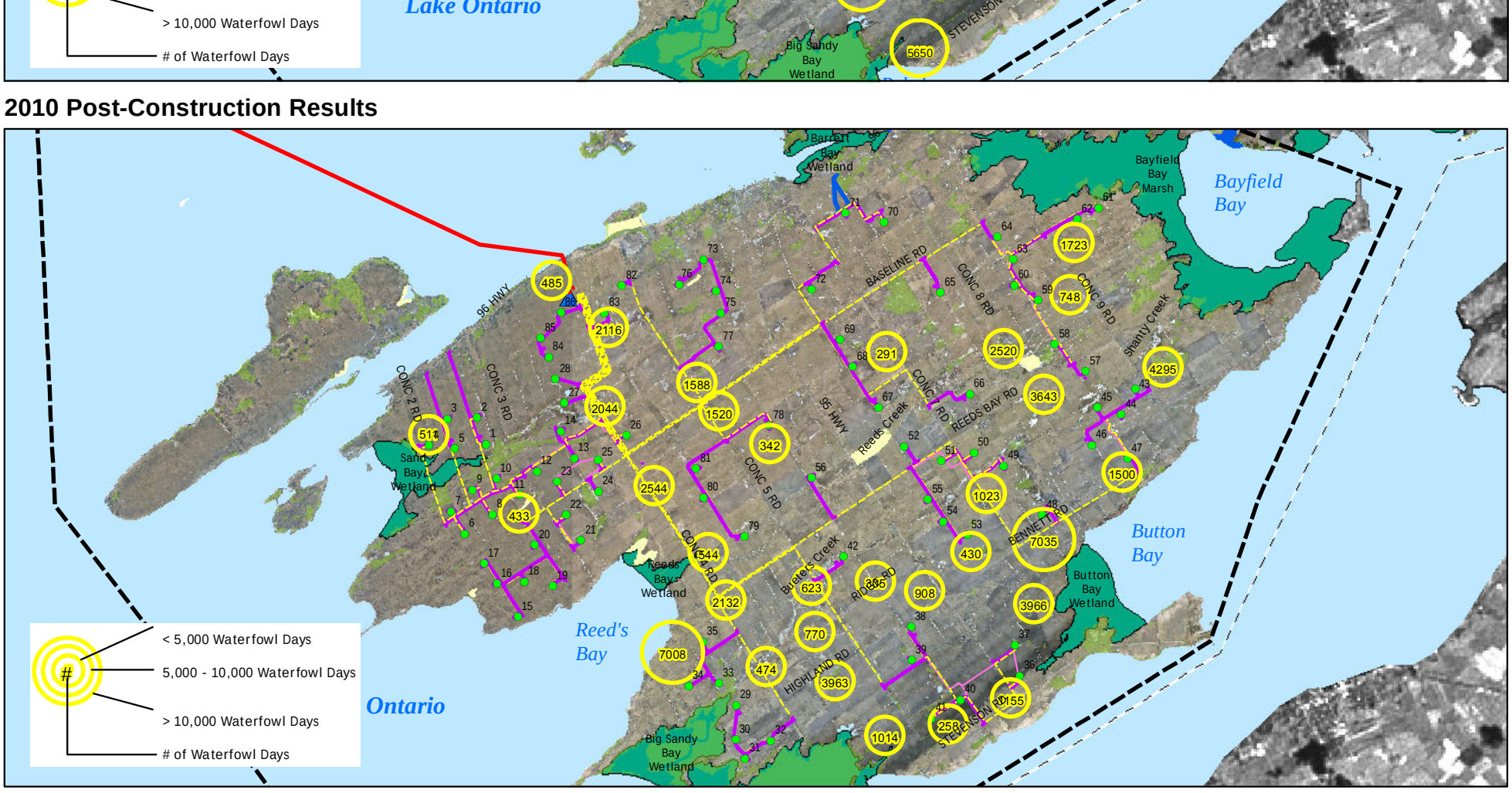
Title

Comparison of Fall Waterfowl Foraging in 2007, 2009 and 2010

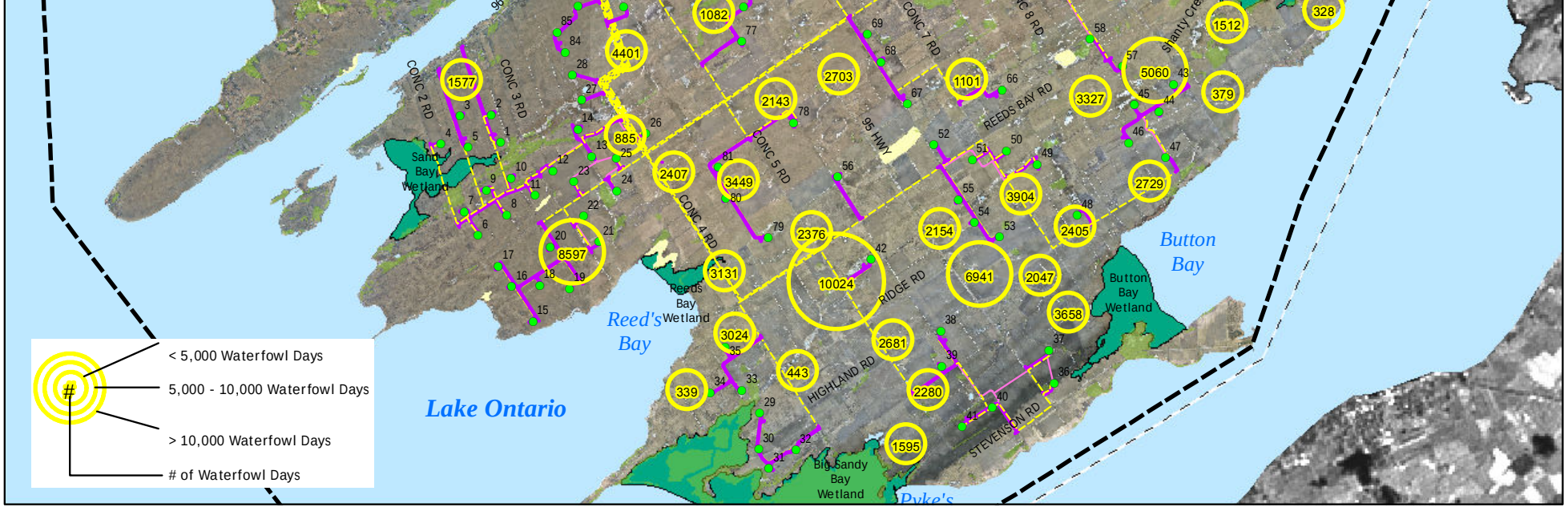
2007 Pre-Construction Results



2010 Post-Construction Results



2011 Post-Construction Results



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Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road
- Crane Walk Path
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

0 1 2 Kilometers

1:85,000

N W E S

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006 and the Cataraqui Region Conservation Authority, 2006.

Stantec

TransAlta

August 2011
160960494

Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

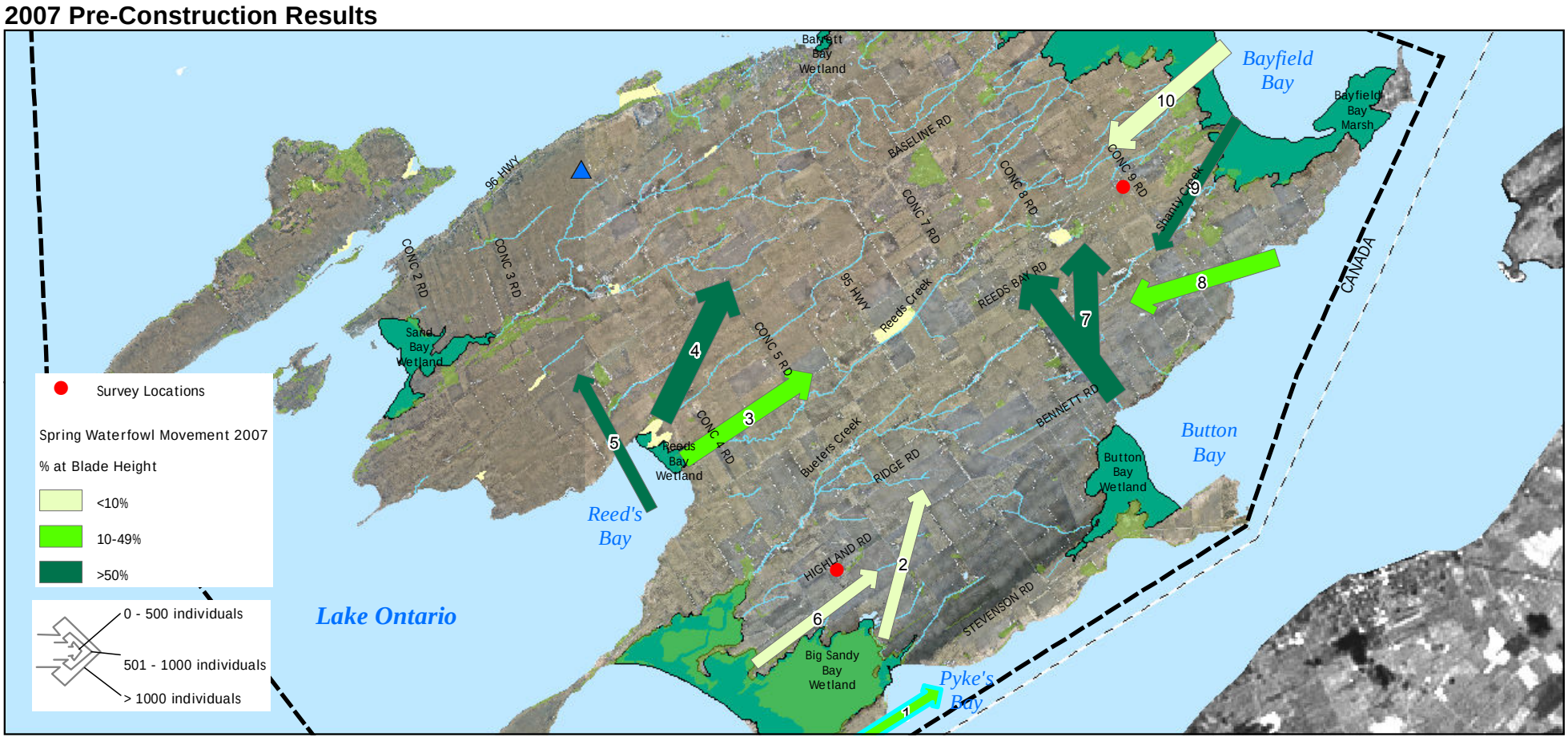
Figure No.

11.0

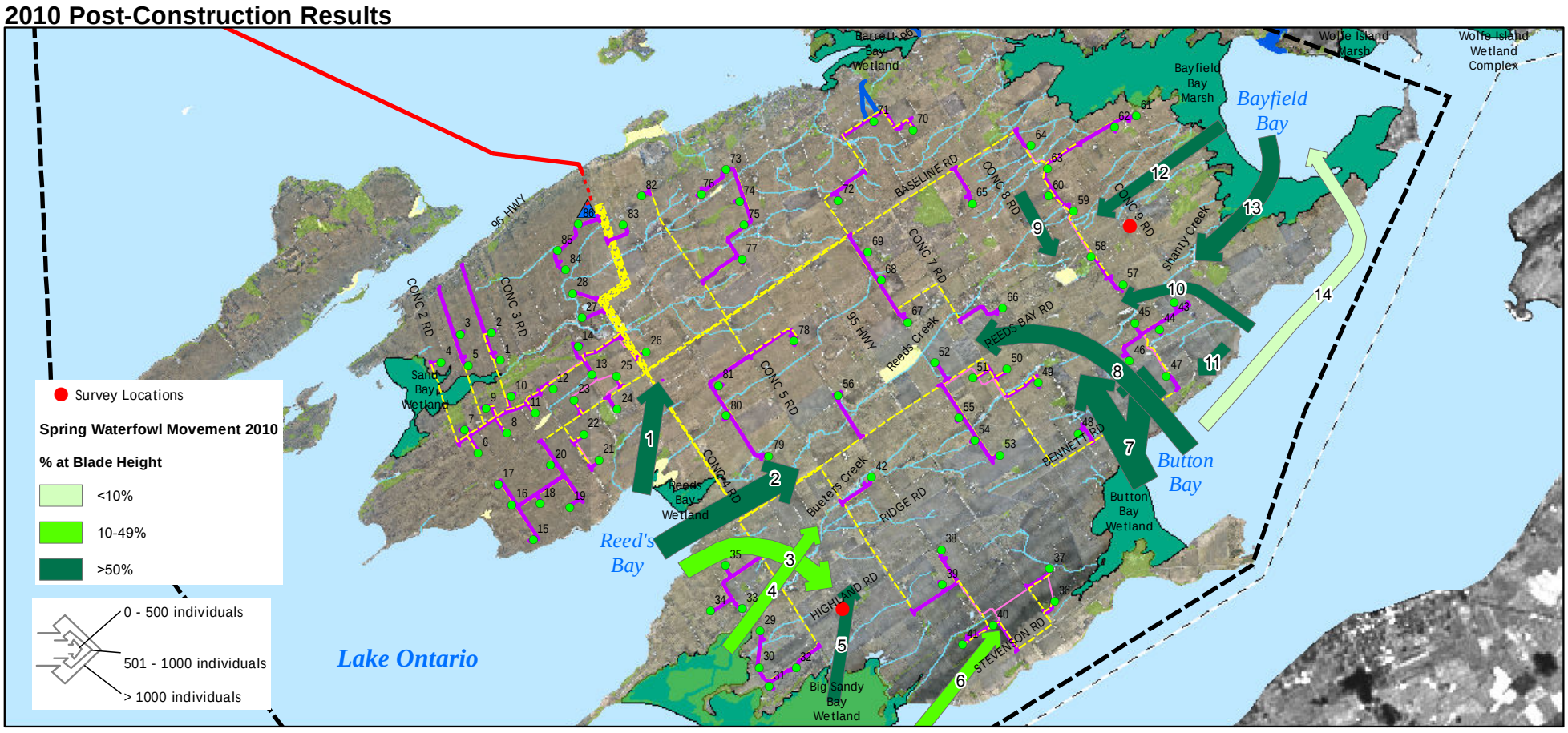
Title

Comparison of Spring Waterfowl Foraging in 2007, 2010 and 2011

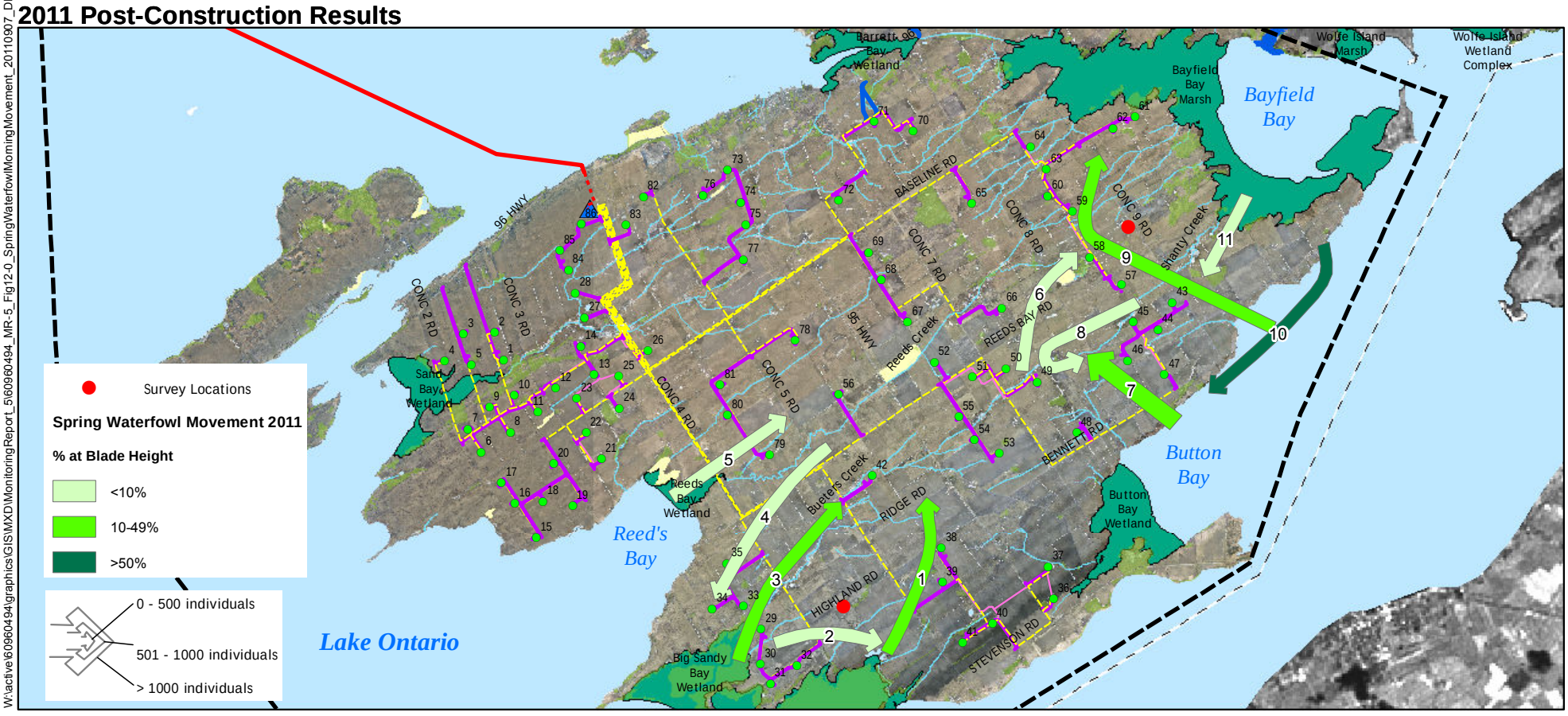
2007 Pre-Construction Results



2010 Post-Construction Results



2011 Post-Construction Results



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Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road
- Crane Walk Path
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

0 1 2 Kilometers

1:85,000

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006 and the Cataraqui Region Conservation Authority, 2006.

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August, 2011
160960494

Client/Project

WOLFE ISLAND ECOPOWER CENTRE MONITORING REPORT NO. 5

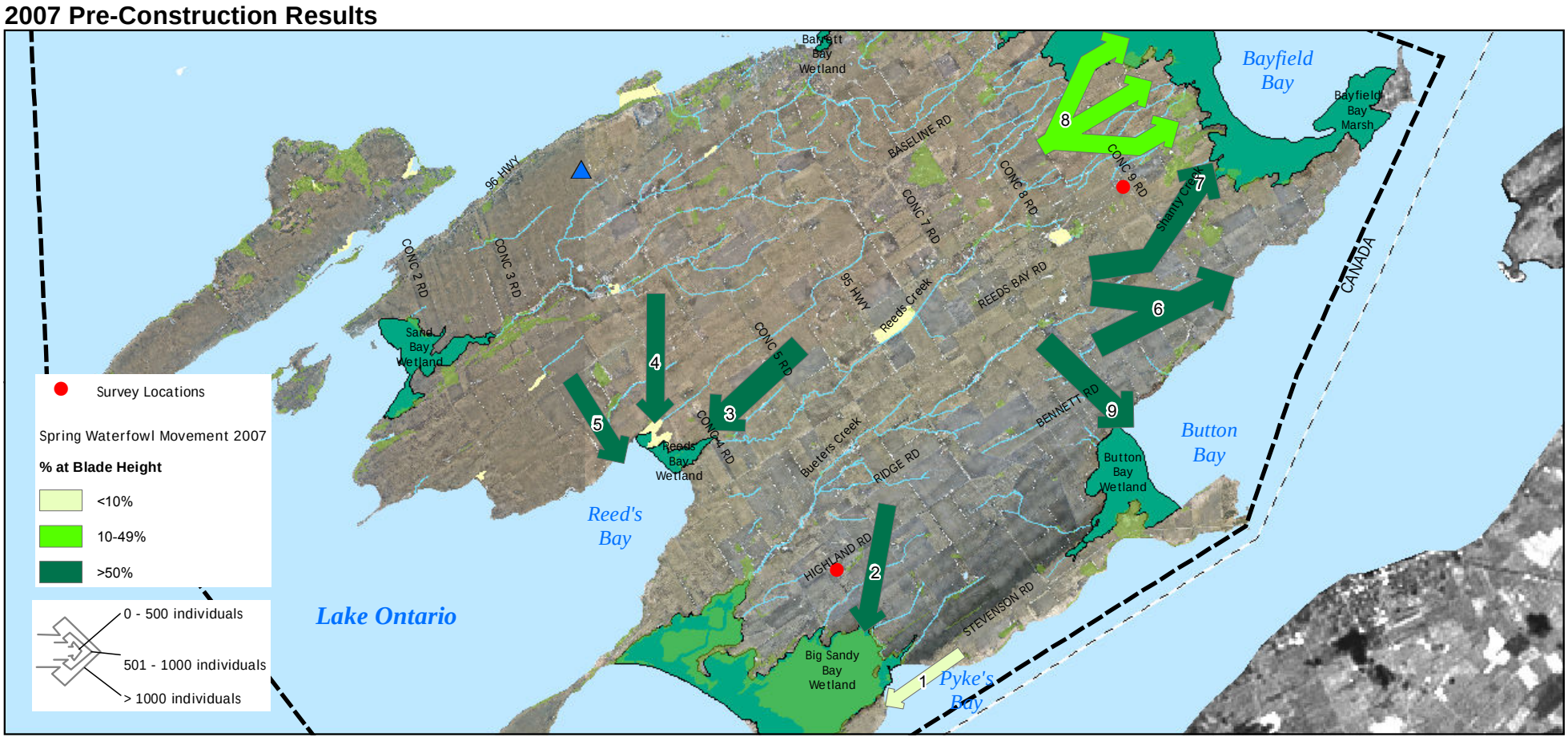
Figure No.

12.0

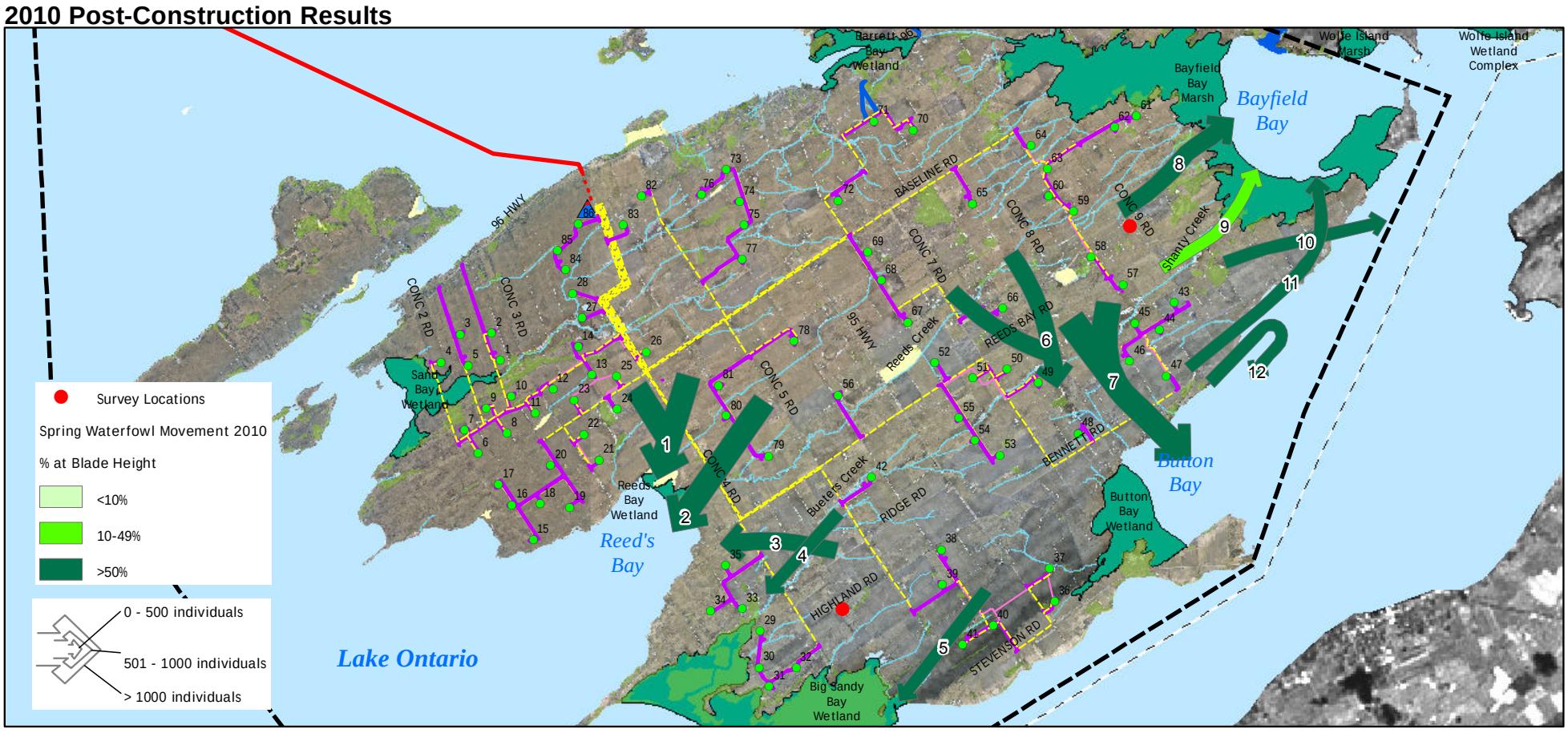
Title

Comparison of Spring Waterfowl Morning Movement 2007, 2010 and 2011

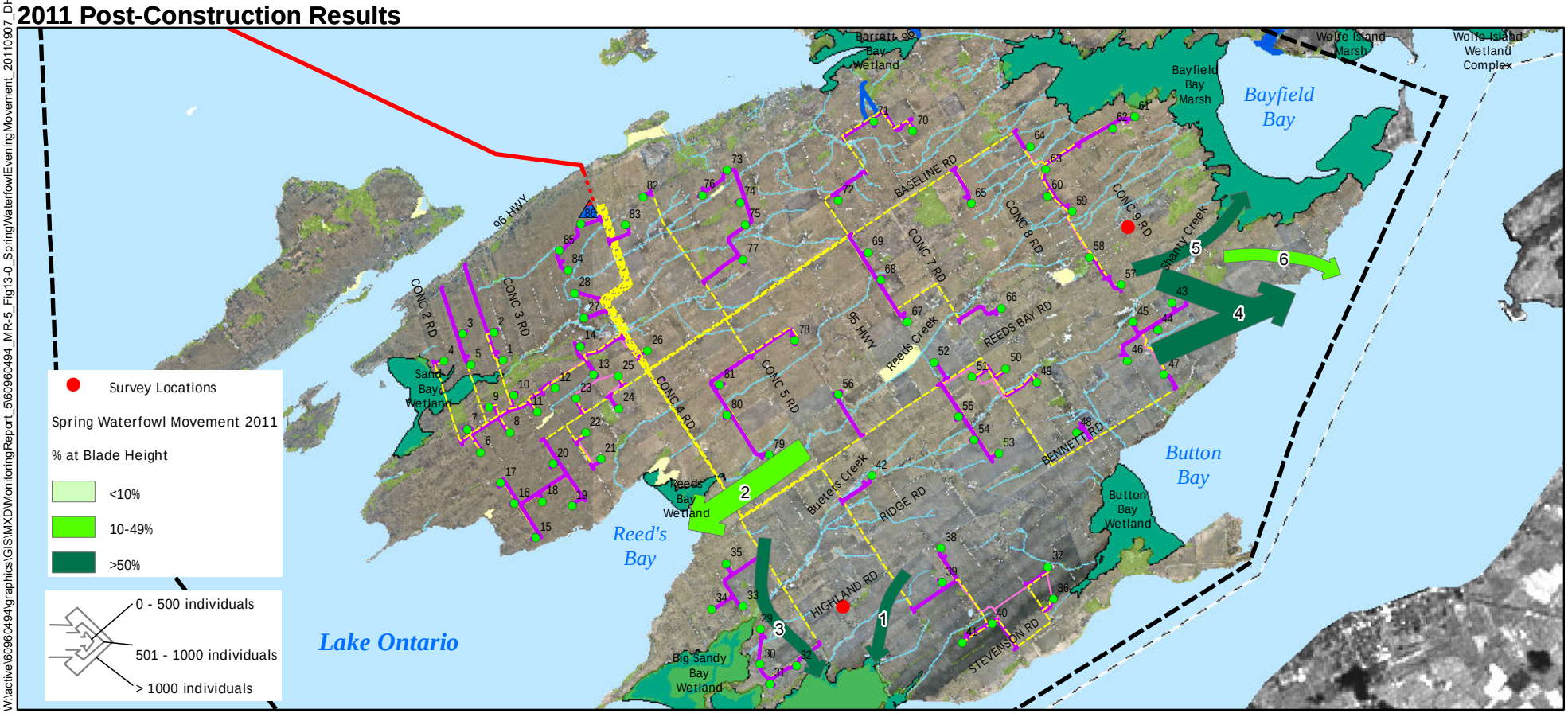
2007 Pre-Construction Results



2010 Post-Construction Results



2011 Post-Construction Results



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Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road
- Crane Walk Path
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

0 1 2 Kilometers

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Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

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August, 2011
160960494

Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

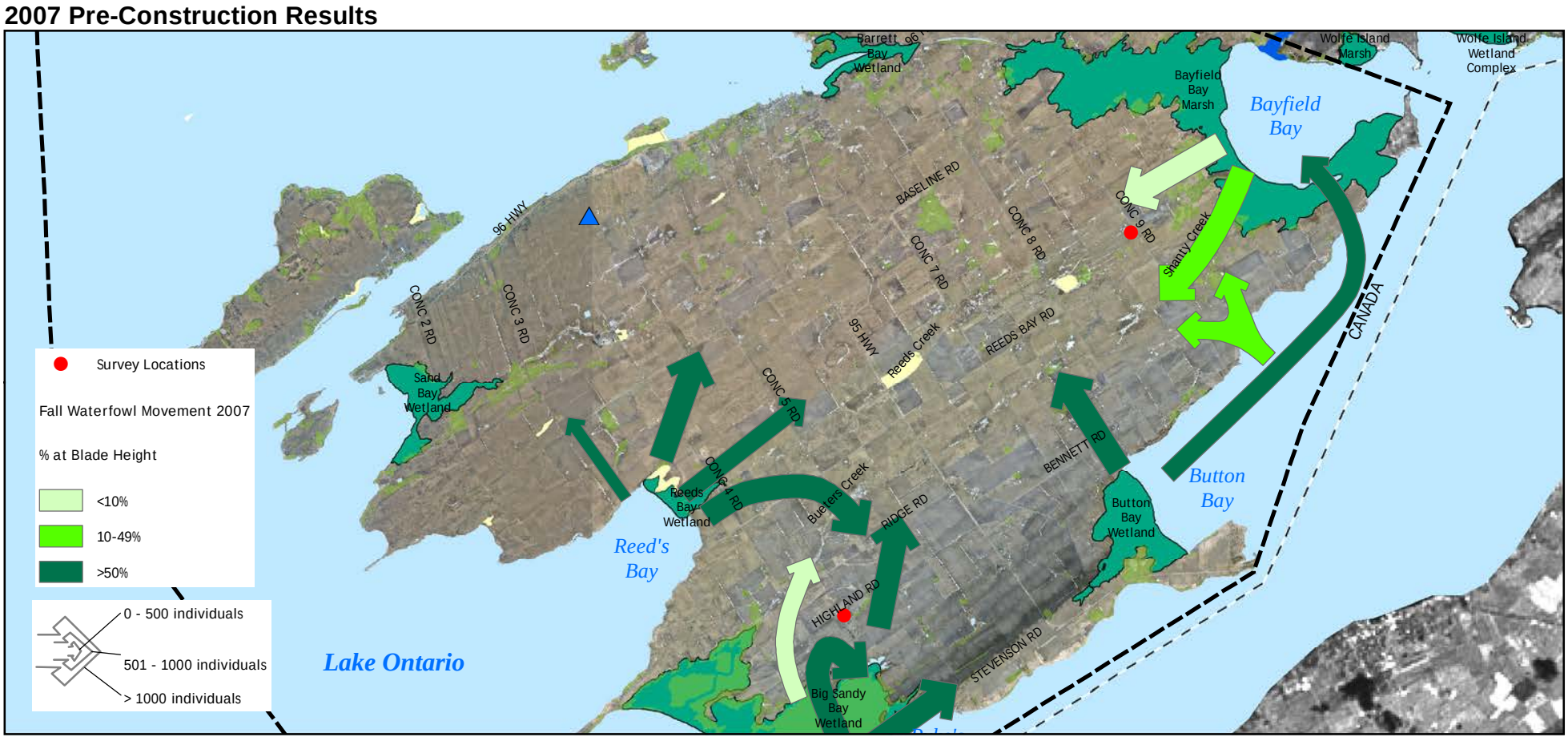
Figure No.

13.0

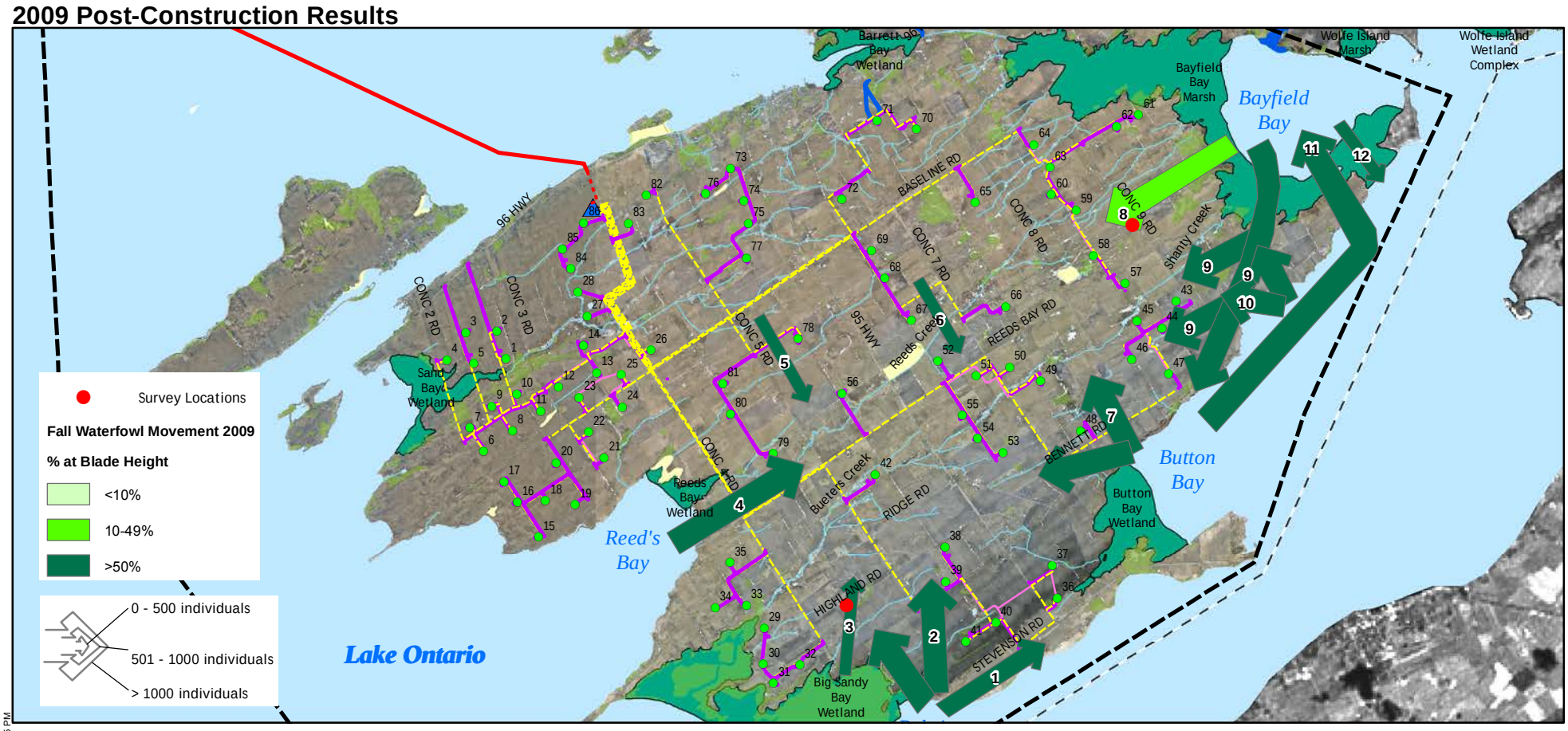
Title

Comparison of Spring Waterfowl Evening Movement 2007, 2010 and 2011

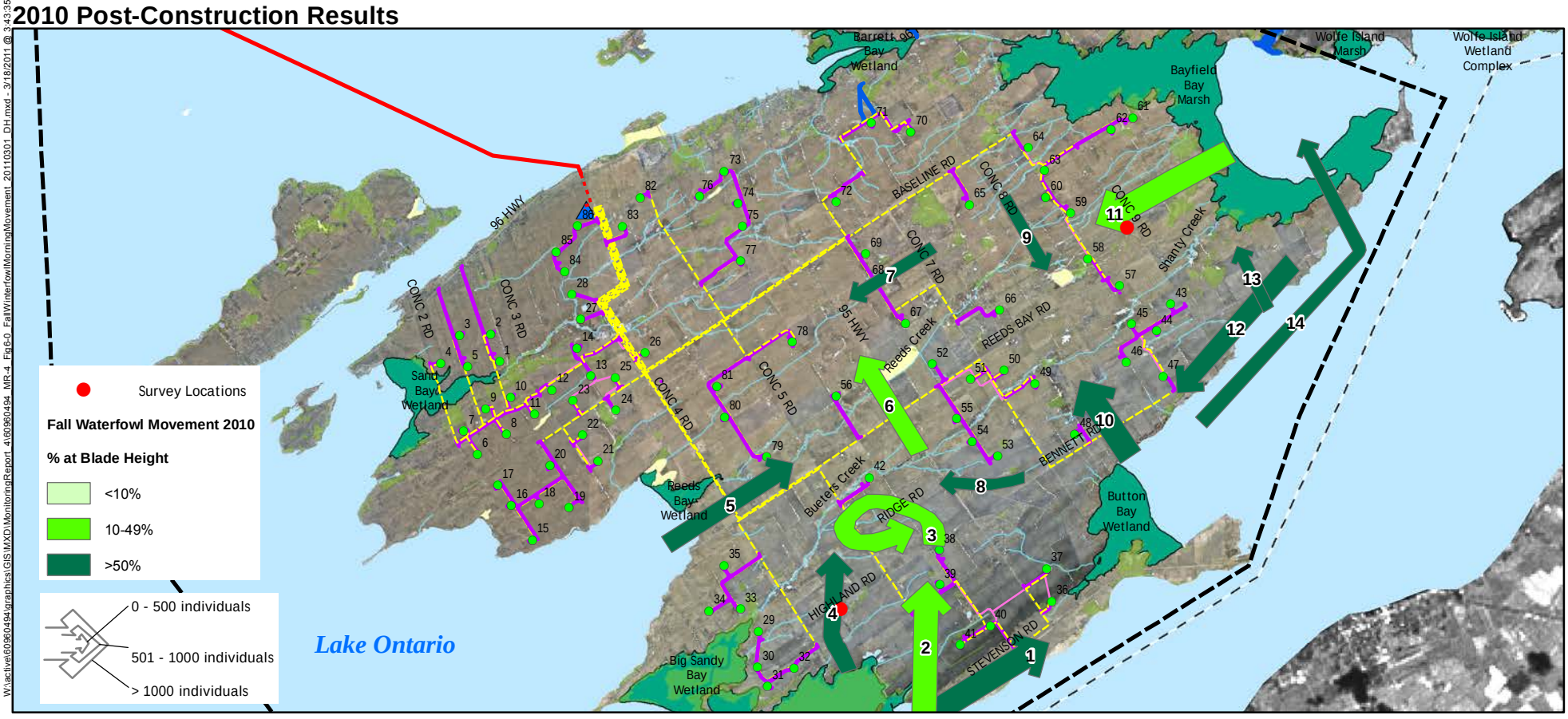
2007 Pre-Construction Results



2009 Post-Construction Results



2010 Post-Construction Results



W:\active\60960494\graphics\GIS\MXD\MonitoringReport 4\60960494_MR-4_Fig6-0_FallWinterfowlMorningMovement_20110301_DH.mxd - 3/18/2011 @ 3:43:35 PM

Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road
- Crane Walk Path
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

0 1 2 Kilometers

1:85,000

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
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3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

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March, 2011
160960494

Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 4

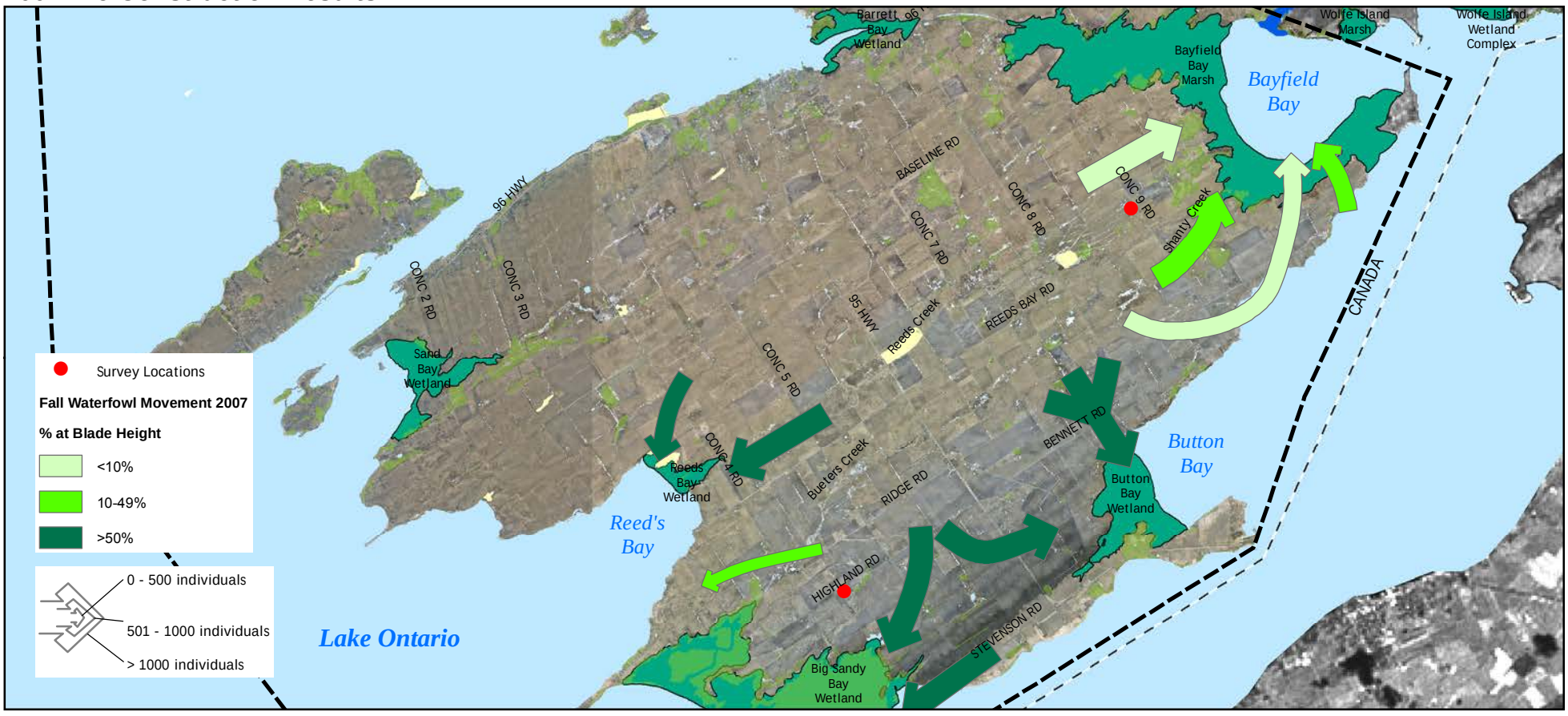
Figure No.

6.0

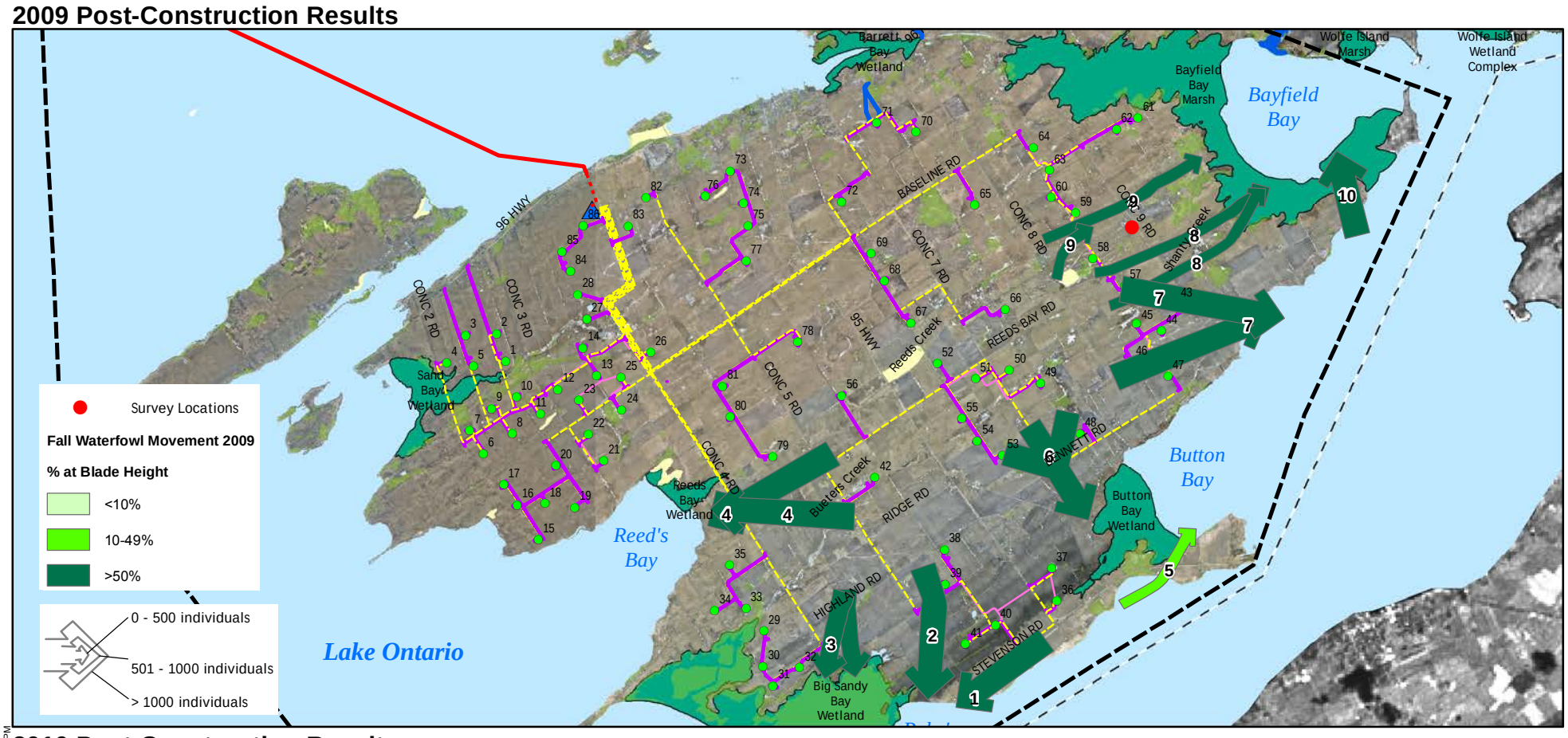
Title

Comparison of Fall Waterfowl Morning Movement 2007, 2009 and 2010

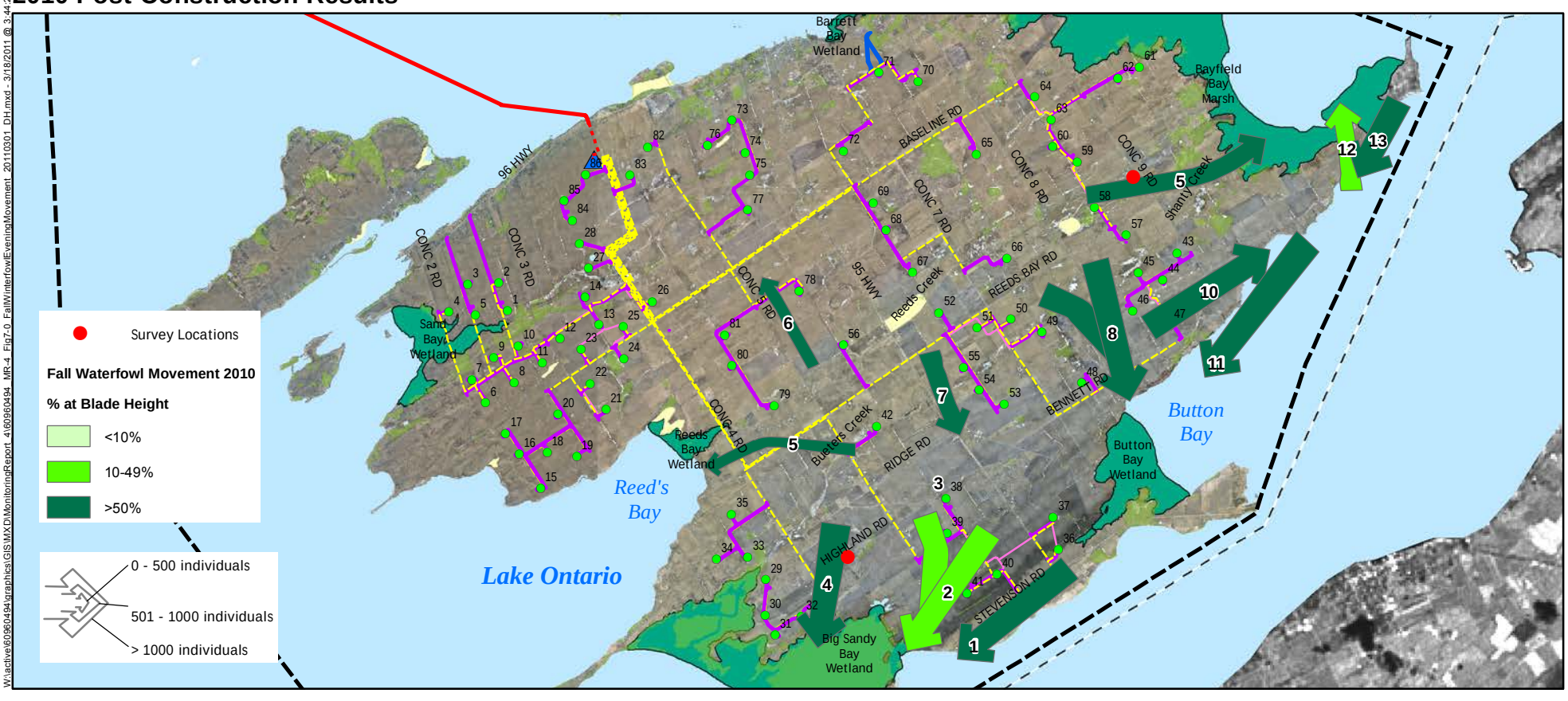
2007 Pre-Construction Results



2009 Post-Construction Results



2010 Post-Construction Results



W:\active\60960494\graphics\GIS\MXD\MonitoringReport_4\60960494_MR4_Fig7-0_FallWinterfowlEveningMovement_20110301_DH.mxd - 3/18/2011 @ 3:44:22 PM

Legend

- Study Area
- Gardiners Transformer Station
- Turbine Layout
- 230 kV Submarine Cable
- 230 kV Transmission Line - Underground
- Access Roads
- 34.5 kV Collector Lines
- 230 kV Substation / Operation & Maintenance Building
- Temporary Road
- Crane Walk Path
- Woodlot

Wetlands

- Provincially Significant Wetland
- Non-Provincially Significant Wetland
- Unevaluated Wetland

0 1 2 Kilometers

1:85,000

N W E S

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.
3. Image Sources: © LIDAR (study area coverage), January 2006; © LANDSAT7 (U.S. coverage), 1999; © City of Kingston (city coverage), 2005.

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WOLFE ISLAND ECOPOWER CENTRE MONITORING REPORT NO. 4

Figure No.

7.0

Title

Comparison of Fall Waterfowl Evening Movement 2007, 2009 and 2010

2011 Aerial Waterfowl Summary

Table 1: Waterfowl Guild by Sector, Spring 2011

	C7	C8	C9	C10	C11	Total
Swans	58	196	160	191	45	649
Geese	2,052	12	6,506	11,677	10,201	30,448
Large dabblers	1,254	2,807	8,842	3,274	1,046	17,221
Small dabblers	0	0	0	0	0	0
Bay ducks	6,788	2,845	47,935	77,481	929	135,977
Sea ducks	800	0	0	2,451	2,701	5,951
Goldeneye	19,264	14,109	17,600	14,681	25,363	91,015
Mergansers	16,513	14,067	15,698	21,763	26,434	94,473
Unknown	524	3,000	68	298	2,061	5,951
Total	**47,251**	**37,034**	**96,808**	**131,815**	**68,778**	**381,684**

Table 2: Waterfowl Guild by Major Staging Area, Spring 2011

	Bayfield	Button	Pyke's	Reed's	Total
Swans	160	167	0	0	327
Geese	1,156	4,282	2,475	9,296	17,209
Large dabblers	5,463	2,005	845	473	8,785
Small dabblers	0	0	0	0	0
Bay ducks	31,255	57,085	0	480	88,820
Sea ducks	0	0	798	1,740	2,538
Goldeneye	12,158	4,875	2,054	4,024	23,110
Mergansers	6,896	6,583	1,901	3,825	19,204
Unknown	0	0	0	100	100
Total	**57,087**	**74,996**	**8,072**	**19,937**	**160,092**

2010 Aerial Waterfowl Summary

Table 3: Waterfowl Guild by Sector, Spring 2010

	C7	C8	C9	C10	C11	Total
Swans	71	469	14	14	14	582
Geese	2,485	35	521	20,570	2,541	26,152
Large dabblers	736	3,401	10,022	1,162	962	16,282
Small dabblers	210	210	765	0	0	1,185
Bay ducks	12,337	15,517	116,540	58,867	2,634	205,895
Sea ducks	0	0	0	0	1,050	1,050
Goldeneye	24,819	9,379	9,868	15,843	23,201	83,109
Mergansers	6,376	9,130	4,746	4,786	4,740	29,777
Unknown	27	953	3,321	108	280	4,688
Total	**47,060**	**39,092**	**145,796**	**101,349**	**35,422**	**368,718**

Table 4: Waterfowl Guild by Major Staging Area, Spring 2010

	Bayfield	Button	Pyke's	Reed's	Total
Swans	0	0	0	0	0
Geese	318	7,720	3,492	2,370	13,900
Large dabblers	9,448	733	278	138	10,596
Small dabblers	765	0	0	0	765
Bay ducks	34,831	53,225	0	103	88,158
Sea ducks	0	0	0	0	0
Goldeneye	4,025	4,118	1,992	3,314	13,448
Mergansers	1,773	1,332	382	780	4,266
Unknown	1,780	0	0	0	1,780
Total	**52,939**	**67,126**	**6,143**	**6,705**	**132,912**

2009 Aerial Waterfowl Summary

Table 5: Waterfowl Guild by Sector, Spring 2009

	C7	C8	C9	C10	C11	Total
Swans	29	29	15	0	142	214
Geese	5,076	3,668	9,782	1,588	3,667	23,779
Large dabblers	851	1,355	3,002	1,171	1,942	8,321
Small dabblers	0	0	45	0	33	78
Bay ducks	7,985	10,974	134,288	22,994	3,465	179,704
Sea ducks	118	200	2,508	281	1,011	4,118
Goldeneye	11,930	3,017	6,079	9,867	23,200	54,093
Mergansers	9,624	11,869	12,805	9,242	12,199	55,737
Unknown	86	0	43,800	1,350	0	45,236
Total	**35,696**	**31,110**	**212,323**	**46,492**	**45,658**	**371,278**

Table 6: Waterfowl Guild by Major Staging Area, Spring 2009

	Bayfield	Button	Pyke's	Reed's	Total
Swans	0	0	0	0	0
Geese	4,430	638	40	2,550	7,657
Large dabblers	2,559	230	800	645	4,234
Small dabblers	45	0	0	0	45
Bay ducks	110,989	7,737	1,600	165	120,490
Sea ducks	0	0	0	63	63
Goldeneye	2,400	1,165	2,014	3,341	8,919
Mergansers	4,487	1,760	906	1,830	8,982
Unknown	33,300	0	0	0	33,300
Total	**158,209**	**11,529**	**5,359**	**8,593**	**183,689**

2008 Aerial Waterfowl Summary

Table 7: Waterfowl Guild by Sector, Spring 2008

	C7	C8	C9	C10	C11	Total
Swans	0	0	0	8	27	35
Geese	0	88	1,256	747	5,161	7,251
Large dabblers	203	231	237	395	149	1,214
Small dabblers	0	0	54	8	0	62
Bay ducks	8,485	18,620	119,933	24,027	15,260	186,325
Sea ducks	0	0	0	0	108	108
Goldeneye	20,840	11,779	19,844	25,781	46,815	125,058
Mergansers	3,836	3,128	4,594	3,461	2,229	17,247
Unknown	0	0	2,750		59	2,809
Total	**33,363**	**33,846**	**148,667**	**54,425**	**69,806**	**340,105**

Table 8: Waterfowl Guild by Bay, Spring 2008

	Bayfield	Button	Pyke's	Reed's	Total
Swans	0	0	0	0	0
Geese	0	222	375	2,912	3,509
Large dabblers	87	225	75	27	414
Small dabblers	54	8	0	0	62
Bay ducks	50,460	11,985	5,625	4,850	72,920
Sea ducks	0	0	0	0	0
Goldeneye	8,956	5,202	6,958	11,712	32,828
Mergansers	737	601	150	347	1,835
Unknown	2,500	0	0	59	2,559
Total	**62,794**	**18,242**	**13,183**	**19,905**	**114,124**

1999 Aerial Waterfowl Summary

Table 9: Waterfowl Guild by Sector, Spring 1999

	C7	C8	C9	C10	C11	Total
Swans	0	0	68	150	0	218
Geese	3,097	607	3,099	2,919	8,146	17,867
Large dabblers	1,458	696	9,254	8,019	3,933	23,360
Small dabblers	0	25	116	69	453	663
Bay ducks	19,912	112,954	245,418	2,545	777	381,605
Sea ducks	0	0	0	75	14	89
Goldeneye	6,523	3,361	4,745	5,701	10,299	30,628
Mergansers	5,326	3,980	3,533	3,577	3,236	19,651
Unknown						
Total	**36,316**	**121,622**	**266,231**	**23,054**	**26,857**	**474,079**

Aerial Waterfowl Survey Results by Sector

FALL 2011: **Waterfowl Days by guild for each of 5 Wolfe Island survey sectors**

	C7	C8	C9	C10	C11	Total
Swans	4,094	8591	10,800	5,231	4,862	33,578
Geese	41,380	9467	73,713	132,689	25,623	282,872
Large dabblers	35,322	42,352	126,500	68,892	52,120	325,185
Small dabblers	720	2690	9,248	191	725	13,574
Bay ducks	187,354	96,032	637,605	146,233	45,500	1,112,723
Sea ducks	162	3305	78	289	145	3,979
Goldeneye	34,986	12,222	8,166	31,500	46,888	133,761
Mergansers	22,156	13,721	8,910	6,989	11,217	62,992
Total	**326,173**	**188,380**	**875,018**	**392,013**	**187,080**	**1,968,663**

FALL 2010: **Waterfowl Days by guild for each of 5 Wolfe Island survey sectors**

	C7	C8	C9	C10	C11	Total
Swans	2,927	2,090	8,032	10,509	2,623	26,180
Geese	45,116	12,016	73,808	144,763	33,247	308,948
Large dabblers	25,797	26,969	130,887	53,994	55,338	292,984
Small dabblers	5,991	1,110	25,026	800	0	32,927
Bay ducks	141,190	48,898	374,865	254,726	34,875	854,554
Sea ducks	4,098	0	23	178	977	5,276
Goldeneye	56,938	29,821	15,741	60,064	49,250	211,813
Mergansers	45,681	45,695	10,188	14,599	34,293	150,455
Total	**330,136**	**166,597**	**639,528**	**539,631**	**210,602**	**1,886,494**

FALL 2009: **Waterfowl Days by guild for each of 5 Wolfe Island survey sectors**

	C7	C8	C9	C10	C11	Total
Swans	3,856	3,973	8,664	11,198	2,648	**30,338**
Geese	86,328	7,489	42,433	161,464	94,146	**391,859**
Large dabblers	32,211	58,932	102,652	60,698	86,314	**340,805**
Small dabblers	92	0	24,555	188	1,154	**25,988**
Bay ducks	208,707	173,084	937,169	117,987	22,751	**1,459,697**
Sea ducks	6,496	0	121	11	36	**6,664**
Goldeneye	16,075	11,973	5,329	7,312	28,876	**69,564**
Mergansers	8,394	12,630	3,482	2,953	8,594	**36,052**
Total	**362,157**	**268,080**	**1,124,403**	**361,809**	**244,517**	**2,360,965**

FALL 2008: Waterfowl Days by guild for each of 5 Wolfe Island survey sectors

	C7	C8	C9	C10	C11	Total
Swans	3,880	2,811	7,712	5,149	1,409	**20,960**
Geese	57,908	13,909	70,155	204,340	44,558	**390,868**
Large dabblers	24,206	54,148	89,837	92,804	93,449	**354,443**
Small dabblers	18	3,508	123,614	4,090	1,532	**132,761**
Bay ducks	88,611	44,682	663,450	305,338	37,154	**1,139,233**
Sea ducks	0	45	0	0	40	**85**
Goldeneye	39,137	9,929	5,815	24,662	58,410	**137,951**
Mergansers	4,734	9,251	11,907	24,841	7,670	**58,403**
Total	**218,493**	**138,282**	**972,487**	**661,222**	**244,219**	**2,234,702**

FALL 1999: Waterfowl Days by guild for each of 5 Wolfe Island survey sectors

	C7	C8	C9	C10	C11	Total
Swans	0	29	60	4,326	5,070	**9,484**
Geese	32,257	11,086	178,610	123,667	151,176	**496,794**
Large dabblers	65,807	90,719	275,893	131,518	198,621	**762,557**
Small dabblers	615	80	46,115	0	380	**47,190**
Bay ducks	46,486	2,648	997,650	104,538	1,755	**1,153,076**
Sea ducks	304	0	0	0	29	**333**
Goldeneye	7,117	6,652	6,444	16,408	38,975	**75,595**
Mergansers	10,365	10,459	11,360	4,818	6,664	**43,665**
Total	**162,950**	**121,671**	**1,516,131**	**385,273**	**402,668**	**2,588,692**

Aerial Waterfowl Survey Results by Major Staging Area

FALL 2011: Waterfowl Days by guild for major staging areas on Wolfe Island

	Bayfield	Button	Pyke's	Reed's	Total
Swans	7,520	2,692	438	858	11,508
Geese	39,705	50,254	20,817	15,313	126,089
Large dabblers	57,127	23,452	13,376	17,366	111,321
Small dabblers	7,253	26	0	0	7,279
Bay ducks	601,225	108,028	0	3,480	712,733
Sea ducks	0	0	0	0	0
Goldeneye	2,351	3,965	7,302	12,605	26,223
Mergansers	6,143	668	624	2,335	9,770
Total	**721,322**	**189,083**	**42,555**	**51,956**	**1,004,916**

FALL 2010: Waterfowl Days by guild for major staging areas on Wolfe Island

	Bayfield	Button	Pyke's	Reed's	Total
Swans	2,972	6,036	364	165	9,536
Geese	2,908	26,538	70,695	22,837	122,977
Large dabblers	104,985	14,943	17,550	14,323	151,800
Small dabblers	23,723	800	0	0	24,523
Bay ducks	332,765	234,678	0	0	567,443
Sea ducks	546	0	0	13	559
Goldeneye	3,953	11,052	7,020	14,834	36,859
Mergansers	781	2725	747	8746	13,004
Total	**472,637**	**296,770**	**96,376**	**60,918**	**926,700**

FALL 2009: Waterfowl Days by guild for major staging areas on Wolfe Island

	Bayfield	Button	Pyke's	Reed's	Total
Swans	6,390	5,658	0	316	**12,363**
Geese	10,961	22,743	95,084	75,954	**204,741**
Large dabblers	28,347	18,639	28,341	29,719	**105,046**
Small dabblers	24,437	0	0	56	**24,493**
Bay ducks	880,773	114,136	230	1,623	**996,762**
Sea ducks	55	0	11	36	**102**
Goldeneye	1,402	1,752	1,144	6,001	**10,299**
Mergansers	2,067	191	1,219	3,955	**7,432**
Total	**954,431**	**163,118**	**126,029**	**117,659**	**1,361,236**

FALL 2008: Waterfowl Days by guild for major staging areas on Wolfe Island

	Bayfield	Button	Pyke's	Reed's	Total
Swans	6,293	2,525	0	359	**9,177**
Geese	5,944	44,745	83,388	16,586	**150,662**
Large dabblers	10,127	28,221	32,855	31,650	**102,853**
Small dabblers	112,209	3,555	400	0	**116,164**
Bay ducks	512,438	301,888	0	0	**814,325**
Sea ducks	0	0	0	40	**40**
Goldeneye	4,325	9,515	1,518	14,019	**29,377**
Mergansers	3,745	22,612	141	608	**27,105**
Total	**655,080**	**413,060**	**118,302**	**63,261**	**1,249,702**

Number of waterfowl breeding pairs observed in each wetland in May 2010

	Number of breeding pairs				
	Bayfield Bay Marsh	**Button Bay Wetland**	**Big Sandy Bay Wetland**	**Reed's Bay Wetland**	**Sandy Bay Wetland**
Canada Goose	1	0	2	3	3
Wood Duck	4	2	2		1
Gadwall	1				1
American Wigeon					0
Mallard	8		4	3	4
Blue-winged Teal	0				
Green-winged Teal		2	1		
Bufflehead					0
Common Merganser		1			1
Red-breasted Merganser					1
Pied-billed Grebe	0				
Total	14	5	9	6	11

0 - indicates species was observed but not expected to be breeding based on Calculation of Indicated Pairs

Number of waterfowl breeding pairs observed in each wetland in May 2011

	Number of breeding pairs				
	Bayfield Bay Marsh	**Button Bay Wetland**	**Big Sandy Bay Wetland**	**Reed's Bay Wetland**	**Sandy Bay Wetland**
Canada Goose	0		6	1	3
Wood Duck		1		1	
Gadwall				1	1
Mallard	18		4	1	3
Blue-winged Teal				1	
Total	18	1	10	5	7

0 - indicates species was observed but not expected to be breeding based on Calculation of Indicated Pairs

Comparison of Breeding Species Densities (pairs/10ha), as measured by point count, in wetland habitat between pre-construction (2006/2007) and post-construction (2010 and 2011) surveys

Species	Pre-construction Results (2006/2007)	Post-construction Results (2010)	Post-construction Results (2011)
Red-winged Blackbird	26.48	12.28	16.83
Swamp Sparrow	6.37	8.19	8.64
Marsh Wren	5.70	8.19	10.46
Yellow Warbler	5.03	5.46	5.91
Common Yellowthroat	3.64	9.55	7.73
Mallard	3.35	0.45	0.45
American Robin	3.02	2.73	3.18
Song Sparrow	2.35	4.09	1.82
American Goldfinch	2.01	0.91	0.91
Common Grackle	2.01	0.91	0.00
Great Blue Heron	2.01	0.91	0.45
Tree Swallow	2.01	0.45	1.82
European Starling	1.68	0.00	0.00
Wood Duck	1.01	2.27	2.73
Mourning Dove	1.01	0.91	0.45
Brown-headed Cowbird	1.01	0.45	0.00
Canada Goose	0.67	2.73	0.00
Wilson's Snipe	0.67	1.36	0.45
Virginia Rail	0.67	0.45	0.00
Gray Catbird	0.34	1.36	0.45
Willow Flycatcher	0.00	2.73	2.27
American Bittern	0.00	0.00	0.45
Least Bittern	0.00	0.45	0.00

Comparison of Wetland Area Search Results between pre-construction (2007) and post-construction (2010 and 2011) surveys.
Results are expressed as number of pairs observed along each route.

	Bayfield Bay			Button Bay			Big Sandy Bay			Reed's Bay			Sandy Bay			Total		
	2007	2010	2011	2007	2010	2011	2007	2010	2011	2007	2010	2011	2007	2010	2011	2007	2010	2011
Wood Duck	5	10	12	0	2	0	2	0	0	0	2	2	1	1	0	8	15	14
Gadwall	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
American Black Duck	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Mallard	10	2	4	1	2	1	1	0	2	3	2	4	2	1	0	17	7	11
Blue-winged Teal	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Redhead	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0
Hooded Merganser	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Common Loon	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	2	1	1
Pied-Billed Grebe	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
American Bittern	0	3	2	0	0	0	0	0	0	0	0	0	0	1	0	0	4	2
Least Bittern	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Great Blue Heron	7	8	5	3	2	1	2	2	2	2	5	5	1	2	0	15	19	13
Green Heron	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	2	0	0
Osprey	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1
Bald Eagle	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1
Northern Harrier	1	2	2	0	0	0	0	0	0	0	0	0	1	0	0	2	2	2
Virginia Rail	0	0	0	0	0	0	4	1	0	0	0	0	0	0	0	4	1	0
Spotted Sandpiper	1	0	0	1	0	0	0	2	0	2	1	1	3	1	0	7	4	1
Least Sandpiper	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0
Wilson's Snipe	0	0	0	0	0	0	2	4	2	1	2	0	1	0	0	4	6	2
Alder Flycatcher	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Willow Flycatcher	1	3	4	2	2	0	2	5	7	0	1	1	1	2	1	6	13	13
Marsh Wren	19	40	36	5	9	2	3	0	1	15	14	15	15	14	13	57	77	67
Yellow Warbler	8	16	4	2	7	3	8	10	10	2	2	2	4	4	2	24	39	21
Common Yellowthroat	12	37	14	3	16	9	2	14	6	1	11	6	3	16	8	21	94	43
Swamp Sparrow	26	24	19	4	6	6	6	15	9	7	6	4	5	6	3	48	57	41
Red-winged Blackbird	25	24	16	26	33	30	12	24	24	27	24	14	24	23	15	114	128	99

Comparison of Forest Breeding Species Densities (pairs/10ha) in Woodland Habitat between pre-construction (and post-construction surveys (2010 and 2011)

Species	Pre-construction Results (2008)	Post-construction Results (2010)	Post-construction Results (2011)
Yellow Warbler	6.37	4.55	4.55
House Wren	4.55	1.82	0.91
Mourning Dove	3.64	0.91	1.36
American Robin	2.73	5.91	4.09
Song Sparrow	2.73	3.18	3.64
Swamp Sparrow	2.73	4.09	0.91
Wood Thrush	2.73	0.45	0.00
American Goldfinch	1.82	1.82	1.36
Common Grackle	1.82	0.45	0.91
Common Yellowthroat	1.36	4.55	3.64
Eastern Wood-Pewee	1.36	2.27	0.45
Gray Catbird	1.36	1.82	1.82
Great Crested Flycatcher	1.36	1.36	1.82
Red-eyed Vireo	1.36	2.27	1.36
Rose-breasted Grosbeak	1.36	1.36	0.45
Black-capped Chickadee	0.91	1.36	0.45
Downy Woodpecker	0.91	1.36	0.45
Least Flycatcher	0.91	0.00	0.91
Northern Flicker	0.91	0.00	0.00
American Crow	0.45	0.45	0.00
Baltimore Oriole	0.45	1.36	0.91
Black-billed Cuckoo	0.45	0.00	0.45
Brown-headed Cowbird	0.45	0.45	1.36
Cedar Waxwing	0.45	3.64	3.18
Chestnut-sided Warbler	0.45	0.00	0.00
European Starling	0.45	0.00	0.45
Northern Cardinal	0.45	1.36	0.91
Tree Swallow	0.45	0.00	0.00
Veery	0.45	1.36	0.00
Warbling Vireo	0.00	1.82	1.82
Willow Flycatcher	0.00	1.36	0.91
Ovenbird	0.00	0.91	0.00
American Redstart	0.00	0.45	0.45
Blue Jay	0.00	0.45	0.91
Brown Thrasher	0.00	0.45	0.91
Indigo Bunting	0.00	0.45	0.45
Mourning Warbler	0.00	0.45	0.00
Northern Waterthrush	0.00	0.45	0.00
Ruby-throated Hummingbird	0.00	0.45	0.00
Yellow-billed Cuckoo	0.00	0.45	0.00