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

MONITORING REPORT NO. 5
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Executive Summary

This report 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, 2011 (the "Reporting Period"). The Wolfe Island Wind Plant is a 197.8 megawatt ("MW") wind plant on Wolfe Island, Township of Frontenac Islands, Frontenac County, Province of Ontario. Eighty-six 2.3 MW wind turbine generators ("WTGs") and ancillary facilities have been placed over the western portion of Wolfe Island with additional supporting electrical infrastructure on the Kingston mainland.

This report, the fifth in a series, contains the results of the post-construction monitoring program for the period between January 1 and June 30, 2011. The wind plant achieved commercial operation on June 26, 2009.

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
- disturbance effects monitoring – staging and foraging migratory waterfowl
- disturbance effects monitoring – breeding waterfowl
- disturbance effects monitoring – breeding grassland, woodland and marsh birds

The results of the first year of post-construction monitoring at the Wolfe Island Wind Plant indicate that annual raptor and vulture mortality exceeds the notification threshold identified in the Follow-up Plan of 0.09 raptors and vultures per MW. As per the Follow-up Plan, TransAlta initiated a response plan, which involved supplementary studies of raptor and vulture behaviour in the fall of 2010 and spring of 2011, the results of which are provided in this monitoring report.

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 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 31 carcasses of 20 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). Two of the species have been identified as species of conservation priority by Ontario Partners in Flight (2008); Savannah Sparrow and Bobolink.

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 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 16.4 Bobolink fatalities over the Reporting Period. The number of fatalities is small relative to the estimated 1,000-1,500 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, 2008a) and the estimated Ontario population of 800,000 (Cadman et al., 2007).

Seven raptor fatalities were recorded within the mapped search area over the course of this Reporting Period: two Red-tailed Hawks, three Rough-legged Hawks and two Ospreys. Based on the dates of recovery, the Rough-legged Hawk fatalities (March 16, March 28 and May 11) represent wintering and migratory birds, the Red-tailed Hawk fatalities (March 28 and April 1) would represent either resident or migratory birds and the Osprey fatalities (May 2 and May 23) would represent either breeding or migratory birds. In addition to the seven raptors recorded in the mapped search area, two Red-tailed Hawks and one Turkey Vulture were found outside the area over the Reporting Period.

The seven raptor carcasses recovered within the mapped search area, when corrected for scavenger removal and percent area searched, represent an estimated total raptor mortality rate of 0.19 raptors/turbine (0.08 raptors/MW) for the Reporting Period. The estimated mortality rate for all birds is 1.72 birds/turbine (0.74 birds/MW) for the Reporting Period. When combined with the results of the July to December 2010, the annual mortality rate can be estimated, and has been calculated to be 10.0 birds/turbine (4.34 birds/MW). This annual mortality rate is well below the adaptive management threshold of 11.7 birds/MW identified in the Follow-up Plan.

The annual bird mortality rate of 4.34 birds/MW is lower than that observed at the Maple Ridge, New York facility (5.81 birds/MW) in 2006 (Jain et al., 2007), and slightly higher than the rate observed at Maple Ridge in 2007 (3.82 birds/MW; Jain et al., 2009). The Maple Ridge facility is located approximately 75 km south of the Wolfe Island Wind Plant. The Wolfe Island mortality rates are within the mortality range of 0 birds/MW 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 numbers, 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, and therefore any fatalities occurring over the winter months were not included in annual mortality rates. The data for the Wolfe Island Wind Plant includes winter fatalities.

When combined with the results of the July to December 2010 monitoring period, the annual raptor mortality rate can be estimated, and has been calculated to be 0.28 raptors per turbine (0.12 raptors/MW). The annual raptor and vulture mortality rate of 0.12 raptors per MW is within the mortality range observed at other facilities in North America outside California (0 – 0.49 raptors/MW; Strickland et al., 2011) and would rank 11th out of the 34 wind farms summarized outside of California. It is approximately half of the rate observed at Maple Ridge in 2007, (0.25 raptors/MW as reported by NWCC, Strickland et al., 2011).

The annual raptor and vulture mortality rate 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 factors to raptor mortality. These surveys were conducted in fall of 2010 and spring of 2011, the results of which are presented in this report.

A total of seven carcasses of two bat species were collected during the Reporting Period. The Big Brown Bat (5 fatalities) was the most common species observed, followed by Hoary Bat (1 fatality). A single bat fatality was not identifiable given its advanced state of decomposition. Both 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. Correcting for searcher efficiency, scavenger and other removal rates, and percent area searched, the seven recovered carcasses represent an estimated total bat mortality rate for the Reporting Period of 0.48 bats/turbine (0.21 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 2010 (9.50 bats/MW), the resultant estimated annual mortality rate of 9.71 bats per MW is within the range of mortality reported by NWCC (Strickland et al., 2011) (0 to 39.7 bats/MW/study period).

The annual bat mortality rate is 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 will be presented in the monitoring report that covers the period from July 1 to December 31, 2011, with further details provided in an upcoming stand-alone report.

Winter raptor surveys were completed in November and December 2010, the results of which were presented in Monitoring Report No. 4. This report addresses the entire winter raptor season (i.e. November 2010 to March 2011) which allowed for a full comparison to the preconstruction surveys conducted in 2006-2007, and the post-construction surveys conducted in 2009/2010. Maximum numbers of observations during any one survey in the 2010/2011 winter raptor surveys include 31 Rough-legged Hawks (December 8), 15 Red-tailed Hawks (November 9), 16 Northern Harriers (December 16) and 4 American Kestrels (Nov 9 and Feb 17). The largest number of Bald Eagles (3 observations) was observed on January 20, 2011. Peak numbers of Short-eared Owls were observed in 2011, with up to 45 individuals observed on a single survey (January 6). 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) 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 appeared to peak in abundance that year. The results for the current Reporting Period (0.54 raptors/kilometer) demonstrated that raptor abundance had increased significantly from the 2009/2010 season, but numbers were lower than that observed 2006/2007. Differences in raptor density observed within the study area between 2006/2007, 2009/2010 and 2010/2011 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.

In total, nine species of waterfowl were observed foraging inland during the spring 2011 post-construction monitoring; all species were either geese or dabbling ducks. Species composition in 2011, dominated by Canada Goose, was very similar to that observed during the 2007 pre-construction monitoring. Overall, the total number of waterfowl days was higher in 2011, totaling 99,141 compared to 57,906 waterfowl days in the spring of 2010 and 85,219 in the spring of 2007.

In the spring of 2011, areas of highest foraging waterfowl concentration occurred in the southern portion of Wolfe Island, south of Reed's Bay Road. The largest flocks usually occurred in close proximity to the bays where they stage overnight. When comparing 2007, 2010 and 2011 spring results, the areas of waterfowl concentration were generally similar with some localized shifting (e.g., using different fields with increased foraging opportunities within the same concession). Geese were routinely observed foraging in fields that contain WTG's. Overall, the results suggest that proximity to wind turbines is not an important factor to the foraging field selection of waterfowl.

Major waterfowl movement routes were similar in 2007, 2010 and 2011. All major routes were associated with the primary offshore staging areas, namely Reed's Bay, Pyke's Bay, Button

Bay, Bayfield Bay and the small inlet off Carpenter's Point Rd. In contrast to the results from 2010, the majority of ducks and geese were observed flying below blade sweep height. Wind speed appeared to be a significant influencing factor, with lower flight heights often occurring in high wind conditions. In many cases, avoidance behaviour was observed, as flocks of waterfowl adjusted their flight course as they approached a WTG.

Waterfowl use of offshore staging areas, as measured through aerial surveys, was very similar in the spring of 2008, 2009, 2010 and 2011; waterfowl days in the spring of 2011 was 3% larger than that of 2010 and 2009 and 12% larger than 2008. A moderate increase in waterfowl days in 2011 was observed along the southern side of the Wolfe Island (23% larger than 2010), including Button Bay. The north and west sides of Wolfe Island experienced less variability in waterfowl days between years, although the west side experienced an increase in waterfowl days (49% larger than 2010). As the overall waterfowl days remained similar between years, the observed fluctuations between sectors is likely due in large part to movement of flocks around the island, and their location at the time of the survey. Swans, geese and large dabblers were recorded in larger numbers in the spring 2011 than the other spring surveys from 2008-2010 and appear to be displaying an increasing trend. The waterfowl days for sea ducks fluctuated notably, with 2011 being the year of highest abundance. Overall, it is apparent that waterfowl remained abundant in each sector and each of the major staging areas each year, with no apparent avoidance of the wind plant during construction in 2009 or operation in 2010 and 2011.

Breeding waterfowl surveys found a total of 5 species of waterfowl, all of which were expected to be breeding within the five major wetlands in proximity to WTG's. Mallard (26 observed breeding pairs) was the most common species, followed by Canada Goose (10 observed breeding pairs). Other species were observed in lower numbers; 1 to 2 breeding pairs across the five wetlands. The Bayfield Bay Marsh route had the largest number of breeding pairs observed, 18 in total, all of which were Mallard. Overall, the waterfowl breeding pairs surveys found populations of breeding geese and/or ducks in each of the major wetlands that are in proximity to WTG. The results of the surveys did not provide any indication that waterfowl avoided nesting in proximity to WTG's.

Overall, the grassland surveys indicated that grassland breeding birds remained common throughout the 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. However, decreases were not observed for the same species through paired point count surveys and grassland area searches; one potential explanation for the decrease observed at grassland 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. Densities of Bobolink and Savannah Sparrow recorded in suitable breeding habitat (hay or pasture) in the Northwest Area experienced a slight increase in 2011, when compared to 2007 and 2010. When comparing densities in suitable breeding habitat in the Southeast Area, Bobolink experienced and increase in 2011 over 2007 pre-construction surveys, while Savannah Sparrow experienced a slight decline compared to 2007 and 2010 data. Potential explanations for these decreases include seasonally wet cool weather, habitat suitability 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.

Generally, the abundance of wetland breeding birds, as measured by the point counts and area searches, remained similar between pre and post-construction surveys. Results of the wetland point counts and area searches suggest population of breeding birds in the five major wetlands in proximity to WTGs remained relatively consistent between pre and both post-construction surveys.

Relatively high breeding bird species diversity was recorded through area searches in the surveyed woodlands in proximity to WTGs. For most species, point count data suggest there was little change in breeding densities between 2008 pre-construction and 2011 post-construction surveys.

Raptor behavioural studies examining potential risk factors of raptor collisions during different weather conditions and in various habitat elements were conducted over four survey periods in 2010 and 2011. It was assumed that the amount of flying time spent at WTG blade swept height (i.e. 35 to 125m above the ground) was correlated with risk of mortality. As such, the proportion of time spent at blade sweep height was used as an index of potential risk. The result of the study found that raptors tended to spend more time in the blade swept area and therefore, may be at higher risk during the following conditions:

- Increased risk during high wind conditions;
- Decreased risk during low temperatures (i.e. below 10ºC); and
- Decreased risk during light to heavy rain.

The raptor studies completed to date have provided insight into potential risk factors to raptor mortality. These raptor behavioural studies fulfill the requirements of the adaptive management provision, as outlined in the Follow-up Plan.

Mortality and disturbance effects monitoring should proceed in 2011 and 2012 according to the February 2010 Follow-up Plan. Scavenger removal trials conducted in January, 2010 support the continued once-weekly carcass search frequency at all WTGs in the winter months (December, January and February).

As discussed in the Monitoring Report #4, 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. As such, it is recommended that the inland foraging and movement surveys be discontinued.

The Aerial waterfowl studies will continue through the fall of 2011, which will provide 4 full years (8 seasons) of data. 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 wind plant. As such, it is recommended that the aerial waterfowl surveys be discontinued in the spring of 2011.

Table of Contents

EXECUTIVE SUMMARY E.1

1.0 INTRODUCTION 1.1
1.1 PROJECT OVERVIEW 1.1
1.2 POST-CONSTRUCTION FOLLOW-UP PLAN 1.2
1.3 MONITORING REPORT OVERVIEW 1.2

2.0 METHODS 2.1
2.1 MORTALITY MONITORING 2.1
2.1.1 Field Surveys 2.1
2.1.2 Correction Factors and Data Analysis 2.2
2.1.2.1 Searcher Efficiency 2.3
2.1.2.2 Scavenger Trials 2.4
2.1.2.3 Percent Area Searched 2.5
2.2 DISTURBANCE EFFECTS 2.6
2.2.1 Winter Raptor Surveys 2.6
2.2.2 Foraging Waterfowl Surveys 2.7
2.2.3 Overland Waterfowl Movement Surveys 2.7
2.2.4 Aerial Waterfowl Surveys 2.8
2.2.5 Waterfowl Breeding Pairs Surveys 2.9
2.2.6 Grassland Breeding Bird Point Counts, Paired Point Counts and Area Searches 2.9
2.2.7 Wetland Breeding Bird Point Counts and Area Searches 2.11
2.2.9 Raptor Behavioural Surveys 2.12
2.2.9.1 Driving Surveys 2.12
2.2.9.2 Observational Surveys 2.13

3.0 RESULTS 3.1
3.1 MORTALITY MONITORING 3.1
3.1.1 Correction Factors 3.1
3.1.1.1 Searcher Efficiency 3.1
3.1.1.2 Scavenger Removal 3.1
3.1.1.3 Percent Area Searched 3.2
3.1.2 Direct Effects - Birds 3.2
3.1.3 Direct Effects - Bats 3.3
3.2 DISTURBANCE EFFECTS MONITORING 3.4
3.2.1 Winter Raptor Surveys 3.4
3.2.2 Foraging Waterfowl Surveys 3.5
3.2.3 Overland Waterfowl Movement Surveys 3.6
3.2.4 Aerial Waterfowl Surveys 3.7
3.2.5 Waterfowl Breeding Pairs Surveys 3.8
3.2.6 Grassland Breeding Bird Point Counts, Paired Point Counts and Area Searches 3.8

Table of Contents

3.2.7 Wetland Breeding Bird Point Counts and Area Searches 3.11
3.2.8 Woodland Breeding Bird Point Counts and Area Searches in Woodlots Larger than 10ha 3.11
3.3 RAPTOR BEHAVIOURAL STUDY 3.12
3.3.1 Driving Surveys 3.12
3.3.2 Observational Surveys 3.13
3.4 NOTIFICATIONS 3.14
3.4.1 High Annual Mortality Rates – Raptors and Vultures 3.14
3.4.2 Mortality of Species at Risk 3.14

4.0 DISCUSSION AND RECOMMENDATIONS 4.1
4.1 DIRECT EFFECTS – MORTALITY 4.1
4.1.1 Birds 4.1
4.1.2 Bats 4.3
4.2 INDIRECT EFFECTS – DISTURBANCE 4.4
4.2.1 Wintering Raptors 4.4
4.2.2 Foraging Waterfowl Surveys 4.5
4.2.3 Overland Waterfowl Movement Surveys 4.6
4.2.4 Aerial Waterfowl Surveys 4.6
4.2.5 Waterfowl Breeding Pairs Surveys 4.8
4.2.6 Grassland Breeding Bird Point Counts, Paired Point Counts and Area Searches 4.9
4.2.7 Wetland Breeding Bird Point Counts and Area Searches 4.11
4.2.8 Woodland Breeding Bird Point Counts and Area Searches in Woodlots Larger than 10ha 4.12
4.3 RAPTOR BEHAVIOURAL STUDIES 4.12
4.3.1 Driving Surveys 4.12
4.3.2 Observational Surveys 4.14
4.4 RECOMMENDATIONS 4.15

5.0 REFERENCES 5.1

Table of Contents

List of Appendices

Appendix A Figures
Appendix B Tables
Appendix C Mortality Monitoring Schedule
Appendix D Survey Conditions
Appendix E Mortality Monitoring Results
Appendix F Aerial Waterfowl Data During Spring Migration
Appendix G Waterfowl Breeding Pairs Survey Results
Appendix H Grassland Breeding Bird Survey Results
Appendix I Woodland Breeding Bird Survey Results
Appendix J Notifications and Agency Responses

List of Figures

Appendix A

Figure 1: Wolfe Island Project Layout
Figure 2: Wolfe Island Waterfowl Survey Location
Figure 3: Marsh and Breeding Waterfowl Area Search Route
Figure 4: Location of Grassland and Marsh Breeding Bird Points Counts
Figure 5: Post-Construction Breeding Bird Area Search Locations
Figure 6: Woodlot Point Count and Area Search Location
Figure 7: Fatalities by Date
Figure 8: Fatalities at each Turbine
Figure 9: Comparison of Wintering Raptor Concentration 2006/2007 and 2009/2010
Figure 10: Comparison of Wintering Short-eared Owl Concentration 2006/2007 and 2009/2010
Figure 11: Comparison of Wintering Spring Waterfowl Foraging in 2007 and 2010
Figure 12: Comparison of Spring Waterfowl Morning Movement 2007 and 2010
Figure 13: Comparison of Spring Waterfowl Evening Movement 2007 and 2010
Figure 14: Raptor Behavioral Driving Survey Observations.

Table of Contents

List of Tables

Appendix B

Table 2.1: Aerial Waterfowl Survey Sectors
Table 2.2: Species Composition of Waterfowl Guilds
Table 3.1 Results of Searcher Efficiency Trials May – July 2011
Table 3.2: Weighted Searcher Efficiency by Month
Table 3.3: Results of Scavenger Trials by Month
Table 3.4: Results of Raptor Scavenger Trials
Table 3.5: Summary of Bird Fatalities, Reporting Period
Table 3.6: Calculation of Raptor and Vulture Mortality Rates
Table 3.7: Calculation of Bird Mortality Rates (Other Than Raptors and Vultures)
Table 3.8: Summary of Bat Fatalities, Reporting Period
Table 3.9: Calculation of Bat Mortality Rates, January – June 2010
Table 3.10: Winter Raptor Survey Results, November 2010 to March 2011
Table 3.11: Maximum number of Short-eared Owls observed on any one survey in November to March 2006/2007, 2009/2010 and 2010/2011
Table 3.12: Comparison of total winter raptor observations, November to March 2006/2007, 2009/2010 and 2010/2011
Table 3.13: Summary of Kingston Area Christmas Bird Count results from 2000-2010
Table 3.14: Comparison of Species Composition of Field Foraging Waterfowl: March-May 2007, 2010 and 2011
Table 3.15: Spring 2011 Waterfowl Morning Movement
Table 3.16: Spring 2011 Waterfowl Evening Movement
Table 3.17: Comparison of Waterfowl Use by Sector During the Spring Season
Table 3.18: Comparison of Waterfowl Use by Staging Area During the Spring Season
Table 3.19: Comparison of Waterfowl Use by Guild During the Spring Season
Table 3.20: Number of waterfowl breeding pairs observed in each wetland in May 2011
Table 3.21: Comparison of Breeding Densities (pairs/10ha), as measured by point count, in grassland habitat between 2006 and 2007 pre-construction and 2010 post-construction surveys
Table 3.22: Comparison of breeding bird densities (pairs/10ha) at three distance regimes from WTG bases, as measured by grassland paired point counts.
Table 3.23: Comparison of Breeding Bird density (pairs/10ha) between pre-construction (2007) and post-construction (2010 and 2011) grassland area searches across all sectors
Table 3.24: Comparison of Breeding Bird density (pairs/10ha) between pre-construction (2007) and post-construction (2010 and 2011) grassland area searches in only sectors with grassland habitat (i.e. hay or pasture).
Table 3.25: 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

Table of Contents

Table 3.26: 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.
Table 3.27: Comparison of Forest Breeding Species Densities (pairs/10ha) in Woodland Habitat between pre-construction (2008) and post-construction surveys (2010 and 2011)
Table 3.28: Summary of species and abundance observations during raptor behavioural driving surveys
Table 3.29: Summary of Height observations during raptor behavioural driving surveys
Table 3.30: Summary of behaviours observed during raptor behavioural driving surveys
Table 3.31: Summary of raptor nests observed and proximity to closest recorded fatalities
Table 3.32: Summary of percent of time spent at each behaviour type, as observed in raptor behavioural observation study
Table 3.33: Comparison of wind speed and percent of time spent in each behaviour, as observed in raptor behavioural observation study
Table 3.34: Comparison of wind speed and percent of time spent at each height, as observed in raptor behavioural observation study
Table 3.35: Comparison of temperature and percent of time spent at each height, as observed in raptor behavioural observation study
Table 3.36: Comparison of cloud cover and percent of time spent at each height, as observed in raptor behavioural observation study
Table 3.37: Comparison of precipitation and percent of time spent at each height, as observed in raptor behavioural observation study
Table 3.38: Comparison of distance to shoreline and percent of time spent at each height, as observed in raptor behavioural observation study
Table 3.39: Comparison of distance to nearest turbine and percent of time spent at each height, as observed in raptor behavioural observation study
Table 3.40: Summary of Notifications - Reporting Period

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 have been placed over the western portion of Wolfe Island (**Figure 1.0, Appendix A**) with additional supporting electrical infrastructure on the Kingston mainland.

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"), 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 fifth in a series, contains the results of the post-construction monitoring program for the period between January 1 and June 30, 2011 (the "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
- disturbance effects monitoring – staging and foraging migratory waterfowl
- disturbance effects monitoring – breeding waterfowl
- disturbance effects monitoring – breeding grassland, woodland and marsh birds

The results of the first year of post-construction monitoring at the Wolfe Island Wind Plant indicate that annual raptor and vulture mortality exceeds the notification threshold of 0.09 raptors and vultures per MW. As per the Follow-up Plan, TransAlta initiated a response plan, which involved supplementary studies of raptor and vulture behaviour in the fall of 2010 and spring of 2011, the results of which are provided in this monitoring report.

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 consulting firm. Their activities were carried out according to methods prepared by 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 Consulting Ltd., 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. During spring, 2011 WTGs were searched three times over a two week period. Prior to the start of carcass searches, a schedule was prepared to ensure all WTGs received the appropriate coverage (**Appendix C**).

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 to February 28, 2011, weather permitting.

Carcass searches for birds and bats were conducted at 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 very deep snow prevented access or presented a safety concern. A complete summary of survey dates, times, and weather conditions is provided in **Appendix D**.

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
- 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:

$C = c / (Se \times Sc \times Ps)$, 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
- scavenger rates are lower for larger birds as they are harder for scavengers to carry off. 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 May 2011 scavenger trials using 6 raptor carcasses. Additionally, to account for the greater visibility of large birds such as raptors or vultures, separate estimation of Ps was undertaken (Section 2.2.1.3). 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 June 8 to July 12, 2011 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 15 to 18 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. 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 16, May 22 and June 19, 2011, 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 winter months when WTGs were searched weekly and for spring when turbines were searched three times over a two week period.

Additional scavenger trials were conducted using two raptor carcasses, placed at two different WTGs on January 16, 2011, and four raptor carcasses, placed at four different WTGs on May 22, 2011. Their presence or absence was recorded during regularly-scheduled carcass searches over the subsequent two weeks, and Sc for raptors and vultures was calculated 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.

Ps was calculated for the Reporting Period based on data collected during regularly-scheduled surveys between January 6 and January 15, 2011 (applied from January 1 to April 30) and June 3 and June 8, 2011 (applied from May 1 to June 30).

In each season, 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 January 2011, 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:

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

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 for short periods of time (**Appendix D**). 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, spring waterfowl migrant studies (i.e. field foraging surveys, overland movement surveys and aerial surveys of bays, wetlands and rivers), waterfowl breeding pairs surveys, breeding bird surveys and raptor behavioural surveys. Breeding bird surveys included point counts and area searches of grassland, wetland and woodland habitat. In total, forty-two point counts (27 in grassland, 8 in wetland and 7 in woodland habitat) were conducted in the same locations as the pre-construction surveys, using the same standard point count protocols as the pre-construction surveys. In addition to the standard point counts, paired point counts were conducted at turbine locations in grassland habitat and playback surveys were conducted at wetland point count stations.

Survey dates, times and weather conditions for all disturbance effects monitoring surveys are provided in **Appendix D**.

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, 2010 through March, 2011. Monitoring Report No. 4 - July to December 2009, presented the findings of the November and December 2010 winter raptor surveys. This report will address the entire winter raptor season (i.e. November 2010 to March 2011) which will allow for a full comparison to 2006-2007 results.

2.2.2 Foraging Waterfowl Surveys

In spring and fall, geese and dabbling ducks that stage in the bays surrounding Wolfe Island move inland to forage in agricultural fields. Studies were completed during the Reporting Period to examine any changes in patterns of spring foraging across the study area compared to pre-construction conditions.

The post-construction spring foraging waterfowl surveys were conducted using the same protocols as the pre-construction baseline surveys carried out in the spring of 2007. Weekly daytime surveys were conducted for 8 consecutive weeks during peak waterfowl migration and staging, between March 24 and May 16, 2011.

These daytime surveys consisted of two experienced surveyors driving all north-south roads and the majority of the east-west roads in the study area at slow speeds (i.e., 30-40 km/h), using binoculars to scan fields and open areas. Information on species, numbers, location, and activity for all waterfowl observed inland was recorded and mapped.

Data on waterfowl use of fields was calculated in the form of “waterfowl days”, as described in Dennis and Chandler (1974) as cited by Ross (1989). This analysis involves averaging results for each successive pair of surveys, multiplying the results by the number of days separating each survey pair, and summing over the migration period.

2.2.3 Overland Waterfowl Movement Surveys

The purpose of the overland movement surveys was to record movement of waterfowl across the study area at dawn and dusk, when waterfowl are most active. Although some movement of waterfowl may occur throughout the day, the largest movements occur at dawn, with waterfowl moving from the bays into the fields to forage, and at dusk, with waterfowl returning from the fields into the bays to roost for the night. The post-construction waterfowl movement surveys were carried out using the same protocols established during the pre-construction baseline surveys conducted in the spring of 2007.

The surveys were conducted weekly for 8 consecutive weeks from late March to mid-May. During each survey, two observers were stationed at separate points (**Figure 12, Appendix A**) placed at locations with locally high elevation and good visibility towards the bays. One observer was situated on the western side of the study area, with views towards Pyke's Bay, Big Sandy Bay Wetland and Reeds Bay Wetland. The other observer was situated on the eastern side of the study area with views towards Bayfield Bay Marsh and Button Bay Wetland.

The same two locations were used for each survey in 2007, 2010 and 2011 waterfowl studies. Movement of waterfowl flocks was mapped and the height, direction, and flight path were recorded along with the size of the flock and species, where possible.

2.2.4 Aerial Waterfowl Surveys

The purpose of the aerial waterfowl surveys was to record the abundance of staging waterfowl in the bays, shorelines and coastal marshes around Wolfe Island. The surveys focused on both the western and eastern portions of the island.

Aerial surveys were conducted using Canadian Wildlife Services ("CWS") methodologies as outlined in Ross (1989). The same methods were used in CWS's 1999 waterfowl surveys, the pre-construction monitoring in 2008 and the post-construction monitoring in 2009, 2010 and 2011.

Pre-construction surveys were undertaken by Stantec and CWS in the spring of 2008. In the spring of 2009, construction of the facility was occurring with turbines erected and a few beginning to come on-line during the waterfowl staging season (i.e. late March to early May). During the construction of spring 2009, CWS conducted aerial waterfowl surveys of Wolfe Island as part of their eastern Lake Ontario studies and provided the results to Stantec. In the spring of 2010 and 2011, Stantec undertook post-construction surveys of staging waterfowl.

In the spring of each year (i.e. 2008 to 2011), surveys were conducted over an 8 week period from late-March/early April to early May. Surveys were conducted from a four-seater fixed-wing aircraft by two qualified surveyors accompanied by one pilot. One surveyor was situated in the front passenger (shore) side of the plane, while the other was situated in the back left, behind the pilot (offshore side). The plane departed from the Kingston airport and completed a standardized route following a line roughly 200 metres off the shoreline. Waterfowl numbers were assessed, and individuals were identified to species where possible, and to larger species grouping (guild) when segregation to species was not possible. Observations were recorded on digital recorder and later transcribed onto paper data forms.

Data were recorded according to a sector system as established by CWS (see **Figure 2.0, Appendix A** and **Table 2.1, Appendix B**). Data for each of the major staging areas (i.e., Bayfield Bay, Button Bay, Pyke's Bay and Reed's Bay) were collected separately so specific results could be discerned from the sectors. Species were grouped into one of eight guilds (**Table 2.2**, **Appendix B**). Data on waterfowl use of bays are presented in the form of "waterfowl days", as calculated in Dennis and Chandler (1974) and cited by Ross (1989).

2.2.5 Waterfowl Breeding Pairs Surveys

The purpose of the waterfowl breeding pairs survey was to record the density of breeding waterfowl in wetlands adjacent to the wind plant. Daytime surveys for breeding waterfowl were conducted twice in May, 2011 within major wetlands in the vicinity to the Project. Button Bay Marsh and Big Sandy Bay Wetland were traversed on foot from the edge and trails. Bayfield Bay Marsh, Reed's Bay Wetland and Sandy Bay Wetland were less accessible and therefore traversed by canoe. The routes traveled in each wetland are shown in **Figure 3.0, Appendix B**.

The location and species of all waterfowl were recorded. For species with sexual dimorphism, the number of males and females in each grouping were noted. Waterfowl sightings were assessed record by record and considered to be breeding (versus migrating) based on the species' breeding range, late migration date, early nesting date, and habitat requirements during breeding and migration. The Canadian Wildlife Service's table "Calculation of Indicated Pairs" was used to determine the number of breeding pairs.

2.2.6 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.

Each of the 27 point counts in grassland habitat established during pre-construction surveys was resurveyed in 2011, 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 4.0, Appendix A**.

Paired point counts were conducted at 20 WTGs that were in prime grassland habitat (**Figure 4.0, Appendix A**). Paired point counts consisted of two 10-minute point counts; one half circle, 100m-radius point count at the WTG base and one full circle, 100m-radius point count 200m from the base of the WTG. During both point counts, birds were recorded at 100m intervals allowing bird occurrences to be mapped in 100m bands from 0-300 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 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 100m of the observer.

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 5.0, Appendix B**). Each area search covered two large tracts containing areas of high quality grassland habitat with relatively high WTG density, one in the northwestern portion of the study area (199ha) and the other in the southeastern portion (195ha). Both area searches were conducted twice in June, 2011.

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 twelve 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 61 ha of hay, 101 ha of pasture, 10 ha of fallow and 23 ha of wheat. Total grassland habitat (i.e. hay and pasture) in the Southeast Area encompassed 141ha in 2007, 165 ha in 2010 and 172 ha in 2011.

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 nine sub-areas, or “sectors” based on land use. Separate lists of breeding birds were recorded for each sector. The Northwest Area encompassed 110ha of hay fields, 42ha of plowed or bare fields, 45ha of soy and 2.5ha of woodland. Total grassland habitat (i.e. hay) encompassed 199 ha in 2007, 147 ha in 2010 and 110 ha in 2011.

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 of each species were recorded. 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 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.

2.2.7 Wetland Breeding Bird Point Counts and Area Searches

The wetland breeding bird surveys recorded species presence and density of breeding birds in major wetlands adjacent to the wind plant. The purpose of the surveys was to establish post-construction data to examine any disturbance/displacement effects on breeding wetland birds compared to pre-construction surveys.

Wetland point counts and area searches were conducted twice in June 2011 using the same locations and protocols as the pre-construction surveys. 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 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 100m of the observer. The area search routes typically followed open channels and focused on portions of the wetlands in the vicinity of WTG's. Button Bay Marsh and Big Sandy Bay Wetland were traversed on foot and Bayfield Bay Marsh, Reed's Bay Wetland and Sandy Bay Wetland were traversed by canoe. Survey routes (same as those used during pre-construction surveys and post-construction waterfowl breeding pairs surveys) are shown in **Figure 3.0, Appendix A**. The species and number of all breeding pairs heard or seen during the area search were recorded. Observations were recorded at unlimited distance, but restricted to the marsh community.

All eight wetland point counts established during pre-construction surveys were resurveyed in June 2011 (**Figure 4.0, Appendix A**). Each point count consisted of a standard ten minute, 100m radius point count followed by an additional ten minute playback survey. Playback surveys were used to aid in detection of more secretive marsh bird species, specifically Virginia Rail, Sora, Least Bittern and King Rail, and were conducted in accordance with Bird Studies Canada's Marsh Monitoring Program ("MMP") protocols. The playback surveys involved broadcasting taped breeding calls of each species listed above, to induce a vocal or approach response. The call of each species was repeated for a duration of approximately one minute, followed by a one minute pause to listen for a response. The response of marsh birds during the playback survey were recorded at an unlimited radius.

2.2.8 Woodland Breeding Bird Point Counts and Area Searches in Woodlots Larger than 10ha

The woodland breeding bird surveys collected species presence and density of birds in woodlots larger than 10ha in size that are located in proximity to WTG's. Two forested areas were surveyed, including the woodlot immediately south of the Sand Bay Wetland (16.4 ha) and the wooded area associated with the Big Sandy Bay ANSI (101 ha) (**Figure 6.0, Appendix A**).

In total, seven standard point counts were conducted in the same location as pre-construction surveys in June 2008, one in the forested area south of the Sand Bay Wetland and six points in the Big Sandy Bay woodlot (**Figure 6.0, Appendix A**). 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 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 100m of the observer. Area searches were conducted in both woodlots consisting of traversing the woodlot on foot, along the routes used in pre-construction surveys, and recording all species observed.

2.2.9 Raptor Behavioural Surveys

Many authors have noted that raptors' foraging and flight characteristics can put them at risk of collision with WTG blades. Hoover and Morrison (2005) found that Red-tailed Hawk behaviour in a wind turbine development changed according to wind speed. Other specific habitat and weather elements that could affect foraging and flight behaviour include topography, prey concentrations, proximity to turbines, wind direction, and precipitation.

To establish which factors in the wind plant area might contribute to risk of mortality during potentially vulnerable periods, studies of raptor and vulture behaviour were undertaken in the fall of 2010 and spring of 2011. The surveys covered four week-long periods throughout periods of concern identified in 2009-2010: late summer (end of August, early Sept), late fall (beginning of November), and spring (April and May).

Each week-long survey period included both driving surveys to assess numbers and locations of actively migrating and staging raptors and vultures, and observational studies of individual raptors or vultures to assess the types and frequency of behaviours and the habitat/weather factors related to potentially risky behaviour.

2.2.9.1 Driving Surveys

Two half-day driving surveys were conducted each week, following the methods employed in 2007 (Stantec, 2008b) and in the winter raptor surveys. The survey team consisted of two experienced surveyors in one vehicle. All north-south roads and the majority of the east-west roads in the study area were driven at slow speeds (i.e., 30-40 km/h), in order to have clear views of all open areas. The fields and woodlots were scanned using binoculars to detect any raptors and vultures and a spotting scope was used for closer inspection of stationary birds. The ages of raptors, as determined by plumage, was recorded where possible.

All raptor observations and flight paths of actively migrating raptors were recorded and mapped. Flight height and behaviour of each raptor was recorded. Behaviour observations were used to establish if the raptor was actively migrating or was staging (e.g., hunting, perching, etc.)

2.2.9.2 Observational Surveys

Six person-days per week were directed towards finding and observing the behaviour of individual raptors or vultures. Red-tailed Hawks and Turkey Vultures, the two most frequent casualties at the wind plant in 2009-2010, were targeted. Behaviour was observed and recorded for as long as the bird was in sight from a stationary point, up to two hours. A separate field form was completed for each individual, and was comprised of an activity log with a new entry each time a behaviour or habitat parameter changed (weather was assumed constant over the maximum two-hour observational period).

Efforts were made to survey over a range of weather conditions. Weather parameters recorded included:

- Wind speed (as recorded by on-site meteorological towers, measured at 10 m
- Cloud cover
- Precipitation

The wind plant area is relatively flat and does not appear to exhibit any prominent topographical ridges or bluffs that have the potential to concentrate migratory activity. Because the 2009-2010 fatalities appear to be distributed throughout the wind plant area, it was assumed that prey concentrations are relatively uniform throughout. Physical parameters that were recorded include:

- Distance to lakeshore
- Distance to turbine
- Habitat

Behaviour was characterized as in Hoover and Morrison (2005):

- Thermal soaring (kettling): soaring in a circle within a thermal, without wingbeats
- Flapping: flight powered by wingbeats
- Gliding: flight in a straight line without wingbeats

- Kiting (hovering): relatively motionless, flapless flight of a bird within a deflection updraft. Suitable slopes to produce deflection updrafts are not present on Wolfe Island, and hovering with or without wingbeats is more likely to occur.

- Perching: perching element will be recorded

Height was recorded for each of the five behaviour categories. The observational data were summarized as proportions of time spent in each behavioural mode and habitat element, as it relates to weather conditions, for the two target species. It has been supplemented by qualitative assessments of potential risk of each behaviour.

3.0 Results

3.1 MORTALITY MONITORING

3.1.1 Correction Factors

3.1.1.1 Searcher Efficiency

Individual searcher efficiency during the Reporting Period ranged from 67% to 85% (**Table 3.1, Appendix B**). 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 B** and ranged from 0.781 to 0.823. 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, 93.5% of trial carcasses were not removed by scavengers over the average search interval (**Table 3.3, Appendix B**). The winter results were applied to those months that were on the winter search schedule, specifically January and February. In spring, the May scavenger trial indicated that, on average, 68.6% of carcasses were not removed by scavengers (**Table 3.3, Appendix B**). The spring results were applied to March, April and May, which were on the regular search schedule. In June, regular monitoring of the scavenger trial carcasses were interrupted one day due to weather (thunderstorms). The trial carcasses that were missed were omitted from the correction factor calculation and are listed as “interference” in **Table 3.3 (Appendix B)**. The June scavenger trial indicated that, on average, 60.3% of carcasses were not removed by scavengers over the search interval (**Table 3.3, Appendix B**).These values were applied to assess bat and small bird mortality rates.

The scavenger removal rate of raptor and vulture carcasses is expected to be less than for that of bats and smaller birds. During the January 2011 scavenger trial using raptor carcasses, no scavenging was observed. This Sc of 1.00 was applied to January and February (**Table 3.4, Appendix B**). The results of the May scavenger trial using raptor and vulture carcasses found approximately 93.3% of carcasses were not removed by scavengers over the search interval. This Sc of 0.933 was applied from March to June (**Table 3.4 Appendix B**), when the regular search schedule was used.

3.1.1.3 Percent Area Searched

The average proportion of the 50 m radius search area that was physically searched during January, February and March, when vegetation was lower, was 57.9%. In April, May and June the average propitiation of the 50 m radius was reduced to 32.9% due to vegetation growth. These values were applied to assess bat and small bird mortality rates.

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 59.4% in January, February and March and 38.1% in April, May and June. These results were applied to assess raptor and vulture mortality rates.

3.1.2 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 31 carcasses of 20 bird species, including raptors and vultures, were collected during mortality monitoring during the Reporting Period. A summary is presented in **Table 3.5 (Appendix B)**.

All species have provincial S-Ranks of S5 (i.e., Secure – common, widespread and abundant in Ontario) or S4 (i.e., Apparently Secure – uncommon but not rare), with the exception two species that were ranked SNA (i.e., Not Applicable - A conservation status rank is not applicable because the species is not a suitable target for conservation activities), specifically the European Starling (which is not native to Ontario) and the Snow Bunting (which is a common winter visitor, but rarely breeds in Ontario).

Three Bobolink fatalities were recorded, recovered on May 3, 12 and 16 2011; all were males. 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 COSEWIC as threatened, but has not been added to a schedule of the *Species at Risk Act (200*2). Based on the dates of recovery, these individuals were likely breeding and on territory.

Two of the species have been identified as species of conservation priority by Ontario Partners in Flight (2008); Bobolink (discussed above) and Savannah Sparrow which were recorded on June 14 and 23, 2011 (one fatality each date).

Seven raptor fatalities were recorded over the course of this Reporting Period within the mapped search area: three Rough-legged Hawk, two Red-tailed Hawks and 2 Ospreys. Based on the dates of recovery, the Rough-legged Hawk fatalities (March 16, March 28 and May 11) represent wintering and migratory birds, the Red-tailed Hawk fatalities (March 28 and April 1) would represent either resident or migratory birds and the Osprey fatalities (May 2 and May 23) would represent either breeding or migratory birds. Three raptors were observed outside of the mapped search area, including a Turkey Vulture and two Red-tailed Hawks. These fatalities were accounted for in the estimate of mortality through the percent search area correction factor.

The majority of bird fatalities occurred later in the Reporting Period, in May and June 2011. Fewer fatalities were observed in March and April with no fatalities observed in January or February (**Figure 7, Appendix A**). Bird fatalities were distributed relatively uniformly across the wind plant area, with no more than 2 birds recovered from any individual turbine (**Figure 8, Appendix A**).

The seven 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 0.19 raptors/turbine (0.08 raptors/MW) for the Reporting Period (**Table 3.6, Appendix B**). The 24 other bird carcasses recovered after corrections represent an estimated bird mortality rate (excluding raptors) for the Reporting Period of 1.53 birds/turbine (0.66 birds/MW) (**Table 3.7, Appendix B**). Combined, the estimated total bird mortality rate is 1.72 birds/turbine (0.74 birds/MW) for the Reporting Period.

3.1.3 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 7 carcasses of two bat species were collected during the Reporting Period. A summary is provided in **Table 3.8 (Appendix B)**. The Big Brown Bat (5 fatalities) was the most common species observed, followed by Hoary Bat (1 fatality). A single bat fatality was not identifiable given its advanced state of decomposition. Both 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.

Bat fatalities occurred in May and June 2011, with no fatalities observed earlier in the Reporting Period (**Figure 7, Appendix A**). Bat fatalities were distributed relatively uniformly across the wind plant area, with no more than 2 bats recovered from any individual turbine (**Figure 8, Appendix A**).

Correcting seasonally for searcher efficiency, scavenger removal, and percent area searched, the 7 recovered carcasses represent an estimated total bat mortality rate for the Reporting Period of 0.48 bats/turbine (0.21 bats/MW) (**Table 3.9, Appendix B**).

3.2 DISTURBANCE EFFECTS MONITORING

3.2.1 Winter Raptor Surveys

A complete summary of raptors and owls recorded during each survey throughout the winter season (November 2010 to March 2011) is provided in **Table 3.10 (Appendix B).** Although not within the Reporting Period, November and December 2010 were included to provide a full season of results, allowing for a complete comparison to pre-construction surveys.

Within the 2010/2011 season, Rough-legged Hawk (184 observations) was the most common raptor observed during the afternoon surveys. Other common species included Red-tailed Hawk (76 observations), Northern Harrier (75 observations) and American Kestrel (16 observations). Other raptor species had 5 or fewer observations over the course of the winter raptor season.

Maximum numbers of observations during any one survey include 31 Rough-legged Hawks (December 8), 15 Red-tailed Hawks (November 9), 16 Northern Harriers (December 16) and 4 American Kestrels (Nov 9 and Feb 17). The largest number of Bald Eagles (3 observations) was observed on January 20, 2011.

Over the course of the 2010/2011 post-construction winter raptor monitoring, 3.3% of observations were at the height of WTG blade sweep **(Table 3.10, Appendix B)**; the majority of these observations were in early November or late March.

During the evening surveys, Short-eared Owls were common with a total of 142 observations throughout the season. The maximum number of Short-eared Owls observed in a single survey was 45 on January 6, 2011. **Table 3.11 (Appendix B)** compares the maximum number of Short-eared Owls observed in a single survey during the pre-construction 2006/2007 surveys and the two years of post-construction surveys in 2009/2010 and 2010/2011. Observations of other owl species include single a Great Horned Owl and a single Long-eared Owl during the December 21, 2011 survey.

Approximately 35% of the Short-eared Owls observed attained WTG blade sweep height at some point during the observations **(Table 3.10, Appendix B)**. Generally, the blade sweep height was attained during swarming behaviour early in the evening as Short-eared Owls left their roosts, while hunting flights were typically below blade sweep height.

Table 3.12 (Appendix B), provides a comparison of 2006/2007 pre-construction, 2009/2010 and 2010/2011 post-construction survey results by species. Results of the afternoon survey show a significant annual variability between the years. A decline in raptors was observed between 2006/2007 and the first year of post-construction monitoring in 2009/2010. However, results from the second year of post-construction monitoring in 2010/2011 suggest an increase in abundance over the first year post-construction, although slightly lower numbers when compared to pre-construction conditions.

Species with particular variability in observed abundance include Northern Harrier, which peaked in 2006/2007 at 159 individuals (more than twice as many as in the next highest year in 2010/2011) and Rough-legged Hawk which peaked in 2010/2011 at 184 (55% higher than during the pre-construction monitoring). Snowy Owls also showed considerable variability, peaking during the first year of post-construction monitoring in 2009/2010 and no observations during the current year of monitoring.

Results from the evening surveys suggest the current year of monitoring in 2010/2011 was a peak year for Short-eared Owls on Wolfe Island, with a 71% 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 3.13, Appendix B** summarizes the results of the Kingston Christmas Bird Count ("CBC") from 2000 to 2010, and demonstrates annual fluctuations in wintering raptor numbers in the Kingston area. 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 2010 CBC data generally corresponds to the 2010/2011 post-construction monitoring results, and show peaks in Rough-legged Hawk and Short-eared Owl abundance. Similar trends were observed in 2006 and 2010 across southern Ontario, as recorded by other CBC counts such as Fisherville, another area known for concentrations of wintering raptors.

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 per kilometer or more than 3 owls per kilometer) were mapped. Areas of high raptor and high owl density, as defined above, are shown in **Figure 9.0** and **Figure 10.0, Appendix A**, respectively. Results of the multi-year study suggest areas of winter raptor concentration shift between years. Most areas of raptor concentration in 2010/2011 occur in the south-central portion of the study area, south of Baseline between Concession 5 and Concession 9. When compared to pre-construction results, the 2010/2011 season had more winter raptor concentrations in this south-central area, but no concentration areas in the northwestern portion of the study area, west of Concession 4. It was noted however that many raptors were observed throughout this area, just not in densities used to define concentration areas. Similar trends were observed with Short-eared Owl concentration areas, with 2010/2011 having more concentration areas in the northeastern portion of the study area, when compared to 2006/2007 pre-construction results, but no concentration areas in the northwestern portion.

3.2.2 Foraging Waterfowl Surveys

In total, nine species of waterfowl were observed foraging inland during the spring 2011 post-construction monitoring; all species were either geese or dabbling ducks. Canada Goose was the most abundant species, representing approximately 97% of all observations. Mallard represented approximately 2% of observations, with only a small number of the remaining five species (American Black Duck, Wood Duck, American Wigeon, Northern Pintail and Green-winged Teal). The species composition was very similar to that observed during the 2007 pre-construction monitoring and the 2010 post-construction monitoring, with the exception of observations in 2011 of Snow Goose, Cackling Goose, Wood Duck and American Wigeon, all of which were present in small numbers (**Table 3.14, Appendix B**).

Overall, the number of waterfowl observed during 2007, 2010 and 2011 surveys were 10,295, 9031 and 16,993 respectively. Numbers observed in 2011 increased 39% from 2007 pre-construction observations. When the results are expressed as waterfowl days, the difference between 2007 and 2011 is 14%, reflecting an increase from 85,219 waterfowl days in 2007 to 99,141 waterfowl days in 2011.

The number of waterfowl days at inland foraging areas in spring 2007, 2010 and 2011 are shown in **Figure 11.0, Appendix A**. In the spring of 2011, areas of highest waterfowl concentration occurred in the southern portion of Wolfe Island, south of Reed's Bay Road. The largest flocks usually occurred in close proximity to the bays where they stage overnight. The three years of spring surveys yielded similar results, although areas of waterfowl concentration exhibited some localized shifting (e.g., using different fields within the same concession).

3.2.3 Overland Waterfowl Movement Surveys

Summaries of the spring 2011 morning and evening waterfowl movement surveys are provided in **Tables 3.15** and **3.16 (Appendix B)**, respectively. **Figures 12.0 and 13.0 (Appendix A)** compare the major routes used by waterfowl in spring during the 2007 pre-construction and 2010 and 2011 post-construction monitoring. Generally, major movement routes were similar in all years. All major routes were associated with the primary offshore staging areas, namely Reed's Bay, Pyke's Bay, Button Bay, Bayfield Bay and the small inlet off Carpenter's Point Rd. Routes used by waterfowl were typically similar during morning and evening movement, with the directions reversed. As in past years, waterfowl observed during the spring 2011 post-construction monitoring flew between WTGs. In many instances, flocks of Canada Geese appeared to alter their course to avoid WTGs. In most cases, these were minor adjustments to avoid individual WTGs.

Canada Geese represented the majority of movement observations in 2007, 2010 and 2011, representing 95%, 99% and 97% of observations respectively. Dabbling ducks represented 5% of the observations in 2007, <1% in 2010 and 3% in 2011.

The results of the 2011 spring waterfowl movement monitoring indicated that the majority of waterfowl moving between bays and inland foraging areas flew below WTG blade sweep height. Of the 5671 observations during morning and evening movement monitoring, 2325 (41%) were observed at blade sweep height for at least a portion of their flight. In contrast, the results of the 2010 spring waterfowl movement monitoring indicated that the majority of waterfowl (81%) moving between bays and inland foraging areas flew at WTG blade sweep height. Wind speed appeared to be a significant factor influencing flight height, with flights below blade sweep height often occurring during high wind conditions.

3.2.4 Aerial Waterfowl Surveys

Waterfowl data collected during spring 1999, 2008, 2009, 2010 and 2011 aerial surveys were grouped into guilds and waterfowl days were calculated for each sector. **Appendix F** presents the waterfowl days in each guild by sector during the spring surveys each year. The waterfowl days by guild for each major staging area (i.e., Bayfield Bay, Button Bay, Pyke's Bay and Reed's Bay) for spring 2008, 2009, 2010 and 2011 are also provided in **Appendix F**; data specific to each major staging area were not collected in 1999.

Table 3.17, Appendix B, compares the number of waterfowl days in each sector in the springs of 1999, 2008, 2009, 2010 and 2011, inclusive of major staging areas. Overall, 1999 had the largest number of waterfowl days (474,079); approximately 23% higher than the average of the four recent surveys. When comparing the four recent years, the total number of waterfowl days observed was very similar, with the waterfowl days in the spring of 2011 being 4% larger than that of 2010, 3% larger than 2009 and 12% larger than 2008. Waterfowl days in Sectors C7 and C8 were relatively similar between the four recent years of data. Sector C11 exhibited an increase of 23% from the pre-construction surveys (average of 2008 and 2009). Sector C10 experienced a significant increase in waterfowl days, up 161% from pre-construction surveys. Compared to the data from 2009 and 2008, the spring 2011 waterfowl days within Sector C9 experienced a decrease of 45%.

Table 3.18, Appendix B, compares the waterfowl days in each of the major staging areas in the springs of 2008, 2009, 2010 and 2011. Overall, the total number of waterfowl days within the major staging areas was highest in 2009, approximately 13% higher than in the spring of 2011. The large number of total waterfowl days in 2009 can largely be attributed to Bayfield Bay. Waterfowl days in Bayfield Bay recorded in 2011 were 64% lower than 2009 observations but 7% higher than the 2010 observations. Waterfowl days in Reed's Bay in 2011 were similar to 2008, but significantly higher than 2009 or 2010. Waterfowl days in Pyke's Bay were relatively similar in 2010 and 2011, but were lower compared to 2008.

Table 3.19, Appendix B, compares the waterfowl days for each guild in the springs of 1999, 2008, 2009, 2010 and 2011. Generally, the numbers of waterfowl days for each guild were somewhat variable between the five years of spring surveys, without distinctive trends, although numbers for the swan, geese and large dabblers guilds appear to be steadily increasing. Waterfowl days for geese were similar in 2011, 2010 and 2009, but were significantly lower in 2008. Among the four recent years, 2011 had the highest waterfowl days for large dabblers but the lowest for small dabblers. The number of waterfowl days for large dabblers was much higher in 1999 than in 2011. In 2011, bay ducks were 26% lower when compared to the pre-construction monitoring average from 2008 and 2009. The waterfowl days for the goldeneye guild were quite variable over the years, with 2011 results similar (2% increase) to the pre-construction average. Waterfowl days for mergansers in the spring of 2011 were the highest observed over the monitoring program, with a 159% increase from the pre-construction average. Sea duck observations in the spring of 2011 were also significantly higher than the pre-construction average (182% increase).

3.2.5 Waterfowl Breeding Pairs Surveys

Appendix G provides the results in each wetland on each of the waterfowl breeding pairs surveys. **Table 3.20, Appendix B** provides a summary of the maximum breeding pairs in each wetland, based on the calculation of indicated pairs.

In total, 5 species of waterfowl were observed during the breeding pairs surveys, all of which are expected to be breeding on Wolfe Island. Mallard was the most common species with 26 breeding pairs observed across the 5 wetlands. Canada Goose were also relatively common with 10 breeding pairs. Other species were observed in fewer numbers, with 1 to 2 breeding pairs across the 5 wetlands.

The Bayfield Bay Marsh route had the largest number of breeding pairs observed: 18 in total, all of which were Mallard. Button Bay Wetland route had the lowest number of breeding pairs observed, 1 in total. However, as Button Bay was the shortest route, fewer observations would be anticipated. Big Sandy Bay Wetland route had the second highest number of breeding pairs; in total 10 pairs of 2 species. Reed's Bay had the highest species diversity, with pairs of all 5 observed species present. Sandy Bay Wetland had the second highest species diversity, with 3 species present. It also had the third highest number of breeding pairs, 7 in total.

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

Point Counts

Table 3.21, Appendix B compares grassland breeding bird densities, as measured through the 2006 and 2007 pre-construction and 2010 and 2011 post-construction grassland breeding bird point counts. Results of the 2011 monitoring found Red-winged Blackbird and Savannah Sparrow to be the most abundant species observed, followed by Bobolink.

When comparing the densities of grassland breeding birds across the 4 years of pre and post-construction surveys, several species, such as Eastern Kingbird and Savannah Sparrow showed little change in recorded breeding densities. Species that appear to experience a decline in 2011 include Bobolink, Eastern Meadowlark, Horned Lark and Upland Sandpiper. In addition, a number of species that are not considered "grassland birds" appeared to experience a decrease in abundance in 2011; specifically Mourning Dove, American Robin, Yellow Warbler and Common Grackle.

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 4.2.6**.

Paired Point Counts

Table 3.22, Appendix B provides the results of the grassland paired point count surveys, comparing average breeding bird densities (pairs/10ha) at three distance regimes; within 100m of the WTG bases, 100-200m and 200-300m from the bases. Detailed results are provided in **Appendix H**.

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 0-100m and 100-200m from the WTG base. However, an apparent decrease in breeding density 200-300m from the WTG base was observed. Summary statistics are provided in **Appendix H**. The single factor ANOVA analysis of the results indicated that the decrease in density at 200-300m from the WTG base is statically significant ($p<0.05$, **Appendix H**).

When comparing the six most common grassland species combined (i.e., Upland Sandpiper, Eastern Kingbird, Savannah Sparrow, Grasshopper Sparrow, Bobolink and Eastern Meadowlark), a similar trend was noted, with little change in density between 0-100m and 100-200m, but a significant decrease at 200-300m ($p<0.05$, **Appendix H**). The same trend was significant when examining Bobolink, Savannah Sparrow and Grasshopper Sparrow individually. The statistical analysis of Eastern Meadowlark did not find any significant differences between the distance regimes ($p>0.05$, **Appendix H**).

Southeast Area Search

In total, 30 species were observed breeding within the Southeast Area. Detailed observations are provided in **Appendix H**. **Table 3.23, Appendix B** compares the densities of grassland breeding birds in the 2007 pre-construction to the 2010 and 2011 post-construction surveys. **Table 3.24, Appendix B** 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 3.23, Appendix B**), Savannah Sparrow was the most abundant species (7.3 pairs/10ha), followed by Bobolink (6.2 pairs/10ha), European Starling (2.8 pairs/10ha) and Red-winged Blackbird (2.6 pairs/10ha). A pair of Northern Harriers was observed and likely bred within the Southeast Area during both pre and post-construction surveys.

The Southeast Area provided 5.4% less suitable grassland habitat (hay and pasture) in 2011 compared to 2010 resulting from crop rotation practices. When correcting for this change in availability of suitable habitat (**Table 3.24, Appendix B**), Savannah Sparrow experienced the largest change in density, experiencing a decline in 2011 compared to 2007 and 2010 data. Bobolinks were also recorded in lower densities in 2011 compared to 2010 but exhibited an increase from 2007 pre-construction surveys. Eastern Meadowlarks were recorded in lower densities in 2011, compared to an increase between 2007 and 2010. Densities of Eastern Kingbird and Grasshopper Sparrow observed decreases between 2007 pre and 2011 post-construction surveys. However, these differences are attributed to a relatively small change in the number of breeding pairs; 6 and 4 fewer breeding pairs respectively for Eastern Kingbird and Grasshopper Sparrow.

Northwest Area Search

In total, 28 species were observed breeding within the Northwest Area. Detailed observations are provided in **Appendix H**. **Table 3.23, Appendix B** compares the densities of grassland breeding birds between 2007 pre-construction and 2010 and 2011 post-construction surveys. **Table 3.24, Appendix B** compares the densities within grassland sectors alone, to account for change in the amount of hay and pasture between years.

Over the entire northwest search area (**Table 3.23, Appendix B**), European Starling had the highest observed density (15.8 pairs/10ha), followed by Bobolink (15.2 pairs/10ha) and Savannah Sparrow (12.7 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 Block, 146.5 ha in 2010, and 106.7 ha in 2011. This difference in suitable grassland habitat reflects a 27.2% decrease in 2011 compared to 2010, and a 26.7% decrease in 2010 compared to 2007. Overall, a 46.5% decrease in high-quality grassland habitat has occurred from 2007 to 2011. When correcting for this change in availability of suitable habitat (**Table 3.24, Appendix B**), the overall density of Bobolinks increased in 2011 over 2010 and 2007. Similarly, Savannah Sparrow density within the Northwest Area was higher in suitable grassland habitat in 2011 over the densities recorded during the 2010 and 2007 surveys.

As observed during pre-construction surveys, Upland Sandpiper was a common species within the Northwest Area during the 2011 post-construction monitoring. As a species that will nest on disturbed soils, it was not as affected by the loss of hayfield as other grassland species (**Table 3.23, Appendix B**).

An observed decline in Grasshopper Sparrows was recorded between the 2007 pre-construction and 2010 post-construction survey. However, densities in 2011 were very similar to those in 2010. Slightly fewer Eastern Meadowlarks were observed during the 2011 post-construction monitoring, when compared to 2010 or 2007.

3.2.7 Wetland Breeding Bird Point Counts and Area Searches

Table 3.25, Appendix B compares the breeding densities of wetland birds, as measured through the 2007 pre-construction and 2010 and 2011 post-construction wetland breeding bird point counts. Red-winged Blackbird, Swamp Sparrow, Marsh Wren, Yellow Warbler and Common Yellowthroat were the most common species during the 2007, 2010 and 2011 surveys. For most species, abundance was similar, with differences in breeding density resulting from a small change in the number of breeding pairs observed. Densities of Red-winged Blackbird appeared to be particularly variable between the three years of monitoring. However, given the relatively small number of point counts conducted in wetland habitat, the data is heavily influenced by outlier points. A gregarious species such as the Red-winged Blackbird would be particularly prone to such influence, as a breeding colony could be located just within, or just outside of, the 100m point count station. In such cases, the area search data provides a more accurate comparison of breeding bird abundance. Red-winged Blackbird numbers, as recorded during the area searches (**Table 3.26, Appendix B**) indicates relatively consistent abundance within all 5 wetlands surveyed.

Densities of Common Yellowthroat, a species that appeared to experience a significant increase in 2010, were lower in 2011, but still well above densities observed during the pre-construction monitoring. Least Bittern, which was detected during the 2010 monitoring, was not found in 2011. Another marsh bird, Virginia Rail, which was observed in 2007 and 2010, was not observed in 2011. For most other species, the area searches (**Table 3.26, Appendix B**) recorded similar abundance during pre and post-construction surveys.

Species diversity between the years was very similar. In 2007, 43 species were observed during the wetland area searches, 40 of which were likely breeding in the wetlands; 3 were visiting to forage (Double-crested Cormorant, Great Blue Heron and Osprey). In 2010, 50 species were observed, 41 of which were likely breeding within the wetlands; 8 were visiting to forage (Double-crested Cormorant, Great Blue Heron, Bald Eagle, Osprey, Herring Gull, Ring-billed Gull, Caspian Tern and Barn Swallow) and 1 was a late migrant (Least Sandpiper). In 2011, 48 species were observed, 40 of which were likely breeding within the wetlands; 8 were visiting to forage (Ring-billed Gull, Double-crested Cormorant, Great Blue Heron, Barn Swallow, Caspian Tern, American Crow and Bald Eagle).

3.2.8 Woodland Breeding Bird Point Counts and Area Searches in Woodlots Larger than 10ha

Point counts and area searches were conducted in two of the large woodland areas that were in close proximity to WTGs, the woodlands connected to Big Sandy Bay Wetland and woodlands associated with the Sandy Bay Wetland. The Big Sandy Bay woodland habitat consisted mostly of swamp, ranging from mature closed canopy silver maple swamp to more open canopy ash-maple swamp with a dense understorey. The Sandy Bay woodland consisted of a deciduous forest community dominated by ironwood, sugar maple and white ash with hawthorn in the understorey.

Respective totals of 45, 51 and 43 species were recorded during the 2008 pre-construction and 2010 and 2011 post-construction area search surveys (**Appendix I**). Due to the wet nature of the Big Sandy Bay woodlands, some species typical of thicket swamps were recorded, such as Swamp Sparrow and Common Yellowthroat. Waterfowl, including Canada Goose, Mallard and Wood Duck were observed in the swamp communities; they were considered potential breeders as suitable habitat was present. The woodlands also supported many forest breeding species such as Wood Thrush, Eastern Wood-Pewee, Great Crested Flycatcher, Red-eyed Vireo and Rose-breasted Grosbeak in 2011. Area-sensitive forest nesting species were recorded within the two woodlands in 2011 including American Redstart and Mourning Warbler.

Woodland point count results are provided in **Table 3.27, Appendix B**. The most abundant species were generally similar during both pre and post-construction surveys including Yellow Warbler, American Robin and Song Sparrow; these are species that are generally characteristic of the more open canopy nature of most of the woodlands present. Species characteristic of more mature forests, such as Wood Thrush or Rose-breasted Grosbeak, were typically less common. For most species, the point counts recorded very similar densities between pre and post-construction surveys, with differences resulting from a small change in the number of breeding pairs observed.

3.3 RAPTOR BEHAVIOURAL STUDY

3.3.1 Driving Surveys

The locations of raptors observed during the raptor behavioural driving surveys are provided in **Figure 14.0, Appendix A**; the figure depicts which birds were actively migrating, hunting (or other flight suggesting staging or resident individual) or perched (or roosting). Raptor observations were relatively evenly distributed throughout the study area, with actively migrating individuals most commonly observed in proximity to the shoreline.

A complete summary of raptors recorded on the raptor behavioural driving surveys during spring and fall migration are provided in **Table 3.28, Appendix B**. The most abundant species observed was Northern Harrier, which appeared to be more abundant in fall than spring. Turkey Vultures were common in September and May. American Kestrel was observed during each week of surveys, however they were much more abundant in September. The Buteo species, namely Red-tailed Hawk and Rough-legged Hawk, were observed in higher numbers during the November and April survey; likely overwintering individuals.

Table 3.29, Appendix B, summarizes the height observations during the raptor behavioural driving surveys. Observations suggest that most species spent the vast majority of their time below blade sweep height. Two species were more commonly observed at blade sweep height, including Turkey Vulture (32% of observations) and Osprey (20% of observations). Although the summary suggests 100% of Sharp-shinned Hawk occur at blade sweep height, this was based on a single observation and therefore not considered an accurate characterization of this species' behaviour.

Table 3.30, Appendix B, summarizes the behaviour observed during the raptor behavioural driving surveys. The majority of observations (81% of raptors recorded) were of birds either actively hunting or perched. A small number of individuals (2% of raptors recorded) were observed in direct, pursing flights, which were likely migrants. During the spring surveys in April and May, some breeding behaviour was observed (i.e. sitting on nest or courtship displays). In a few instances, mobbing behaviour was observed.

Table 3.31, Appendix B, provides information on active raptor nests that were located during the raptor behavioural studies. In total, 5 nests were located within the study area, including 2 Osprey and 3 Red-tailed Hawks, all of which were active in 2011. The raptor behavioural monitoring did not attempt to determine nesting success. However, incidental observations of one Osprey nest located on the microwave tower at the Operations and Maintenance building confirm this nest was successful in 2011, but unsuccessful in 2010 due to nest damage resulting from a wind storm.

3.3.2 Observational Surveys

The observational surveys aimed to identify changes in raptor behaviour in reactions to different weather conditions, proximity to the lakeshore and proximity to WTGs. As stated in **Section 2.2.9.2**, observational surveys focused on Red-tailed Hawk and Turkey Vultures, two species that appear to be a higher risk of collision with WTGs. To better reveal trends, data was pooled for the two species and across the 8 weeks of surveys.

It was assumed that the amount of time spent at the height of WTG blade sweep area was correlated with risk of mortality. As such, the proportion of time spent at blade sweep height was used as an index of potential risk, when comparing different weather conditions and habitat elements.

Table 3.32, Appendix B, shows the amount of time spent at each behaviour. Raptors were observed perched the majority of time. While in flight, relatively equal amounts of time were spent in thermal soaring, flapping flight and gliding. **Table 3.31, Appendix B**, also compares the height of raptors observed in each of the 5 different behaviour categories. For the three behaviour types of flight (i.e. thermal soaring, flapping flight and gliding), relatively equal amounts of time were spent at blade sweep height, with slightly more time at blade sweep height during thermal soaring.

Table 3.33, Appendix B, compares the amount of time spent in each behaviour type at different wind speeds; a few trends were evident. At low wind speeds, raptors tended to spend little time thermal soaring or in gliding flight and more time perching. Time spent in flapping and gliding flight generally increased with increasing wind speed. The time spent perched generally decreased as wind speeds increased, suggesting birds tended to stay on the wing more during higher wind conditions.

Table 3.34, Appendix B, compares wind speed and the amount of time spent at each height. There appeared to be a correlation between wind speed and time spent at blade sweep height.

Table 3.35, Appendix B, compares temperature and the amount of time spent at each height. Generally, much less time was spent a blade sweep height during low temperatures (i.e. below 10ºC).

Table 3.36, Appendix B, compares the percent cloud cover and the amount of time spent at each height. It was found that raptors spent less time at blade sweep height when cloud cover exceeded 75%. However, this trend may be related to precipitation during high cloud cover more than cloud cover itself; it was found that raptors rarely achieve blade sweep height during rain (**Table 3.37, Appendix B**).

Table 3.38, Appendix B, compares the distance to shoreline and the amount of time spent at each height. Results suggest raptors in close proximity to the shoreline spent more time at blade sweep height. **Table 3.39, Appendix B**, compares the distance to the nearest turbine and the amount of time spent at each height. No strong correlations were apparent, however, there was a slight decrease in time spent at blade sweep height for raptors in closer proximity to WTGs.

3.4 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 3.40 Appendix B**), related to mortality of raptors and vultures or species at risk.

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

3.4.1 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. Three of the six notifications were related to raptor and vulture fatalities, and were submitted on March 29, April 4, May 16, 2011 (**Table 3.40, Appendix B**). Each notification involved two raptor or vulture fatalities over periods of varying length, but less than six weeks (**Table 3.38, Appendix B**).

3.4.2 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. Three of the six notifications were related to Bobolink fatalities, and were submitted on May 9, May 16 and May 19, 2011 (**Table 3.40, Appendix B**). Each notification represented a single male Bobolink 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 Reporting Period of January 1 and June 30 2011, 31 bird carcasses and 7 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

A review of bird mortality rates from 14 wind power facilities across North America with modern turbines was conducted by Arnett et al. (2007). Results from these facilities were based upon standardized mortality monitoring using a systematic survey process for a minimum of one year and incorporating scavenging and searcher efficiency bias corrections. These studies yielded bird mortality rates ranging from 0.95 to 11.67 birds per MW per year. A recent summary of available mortality rates for birds, raptors and bats has been prepared by the National Wind Coordinating Committee ("NWCC") (Strickland et al., 2011), who reports bird mortality rates of up to 14 birds per MW per year.

The estimated mortality rate for the six-month Reporting Period at the Wolfe Island Wind Plant, at 0.74 birds per MW (1.72 birds per turbine), is below that observed during the same period in 2010 (2.83 birds/MW or 6.51 birds/turbine). The lower estimated mortality rate can be partially attributed to a reduction in the actual number of bird fatalities observed (66 fatalities in 2010 compared to 31 in 2011). Differences in correction factors between the two years were also noted; while Ps decreased in 2011, both Sc and Se increased, when compared to 2010. The increase in Sc in 2011 may be due to the use of native bird carcasses, instead of chicks used in 2010. It was noted that native bird carcasses generally persist longer that chick carcasses, possibly due to the presence of adult feathers (verses the down feather on chicks) that were more resistance to decomposition.

When the results of the Reporting Period (January-June) are combined with the estimated mortality rate for the period July to December 2010 (3.60 birds per MW), the resultant estimated mortality rate is 4.34 birds per MW per year. This estimated annual mortality rate is well below the adaptive management threshold of 11.7 birds/MW identified in the Follow-Up Plan.

As identified in the ERR, grassland species that conduct aerial mating displays may be at higher risk to collisions with turbines. In particular, Wilson's Snipe was a species that was identified as having an elevated risk as males perform aerial territorial displays at the height of turbine blade sweep and as suitable breeding habitat is common throughout the wind plant area. Three Wilson's Snipe fatalities were recorded during the spring period in which they conduct their aerial displays. This is small relative to the common and secure Ontario population, which is estimated at 500,000 individuals (Cadman et al., 2007). Wilson's Snipe is a managed game bird in Ontario, with a daily bag limit of 10 individuals which is considered an acceptable take in managing the population. Overall, the annual mortality rate of Wilson's Snipe, which is far below limits set for hunting, is anticipated to have a negligible impact on the local population.

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).

Five Bobolink fatalities were recorded from July 2010 to June 2011, three of which were recorded since the species has been listed as Threatened. When applying correction factors to the five Bobolink fatalities, the estimated mortality rate is 22.5 Bobolinks for the July to December 2010 period and 16.4 Bobolinks for the January to June 2011 period. The total annual Bobolink mortality rate is estimated at 38.9 fatalities per year over the entire project. This level of mortality is small relative to the estimated 1,000-1,500 (i.e. approx. 3-4%) 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 individuals (i.e. approx. 0.005%) (Cadman et al., 2007). The population estimate for the sturdy 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., 3-4%) would be lower if these additions of young were accounted for.

The three Bobolink fatalities recorded within the Reporting Period were male, which were likely at higher risk of collision due to their aerial displays. Bobolinks can be polygynous with reduced brooding effort from males. In some cases, females will rear broods without assistance from a male (Martin and Gavin 1995). As such, losses of a small number of males many not affect recruitment, as females would have the ability to breed with another male and/or rear young alone. Overall, the local population of Bobolinks is unlikely to be impacted by the loss of a small number of males.

One other species of conservation priority was on the list of fatalities during the Reporting Period; specifically, two Savannah Sparrow fatalities were observed. This level of mortality is not considered to be a concern at the population level for this species, estimated at 4,000,000 breeding individuals in Ontario (Cadman et al., 2007).

The estimated raptor and vulture mortality rate over the Reporting Period of 0.08 raptors per MW is similar to that observed over the same period in 2010. When combined with the estimated mortality rate for the period July to December 2010 (0.04 raptors per MW), the resultant estimated mortality rate is 0.12 raptors per MW per year. This annual raptor and vulture mortality rate is in the middle of the mortality range observed at other facilities in North

America outside California (0 – 0.49 raptors/MW; NWCC, Strickland et al., 2011), and would rank 11th out of the 34 wind farms summarized outside of California. It is approximately half of the rate observed at Maple Ridge in 2007 (0.25 raptors/MW as reported by NWCC, Strickland et al., 2011), although higher than the rate observed at Maple Ridge in 2006 (approximately 0.05 raptors/MW, as reported by NWCC, 2010).

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. Three (33.3%) of the 9 raptor and vulture fatalities recorded between July 2010 and June 2011 were found between mid-November and the end of March; fatalities that would not have been recorded using search schedules in other studies.

The annual raptor and vulture mortality rate (0.12/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 are presented in this report.

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 per MW per year. Of the seven sites located in the eastern U.S., the bat mortality rates ranged from 14.9 to 53.3 bats per MW. A recent summary of available mortality rates for birds, raptors and bats has been prepared by the National Wind Coordinating Committee ("NWCC") (Strickland et al., 2011), who reports bat mortality rates of between less than one and approximately 40 bats per MW per year.

The estimated bat mortality rate for the Reporting Period at the Wolfe Island Wind Plant at 0.21 bats per MW (0.48 bats/turbine), is significant lower than that observed during the same period in 2010 (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 2010 (9.50 bats per MW), the resultant estimated mortality rate of 9.71 bats per MW is well within the range of rates reported by NWCC (Strickland et al., 2011) and Arnett et al., (2007).

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. During the Reporting Period (i.e. January to June) bat mortality was found to be very low; approximately 2% of the estimated annual mortality between July 2010 to June 2011.

The annual bat mortality rate (9.71/MW) is 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 will be presented in the monitoring report that covers the period from July 1 to December 31, 2011, with further details provided in an upcoming stand-alone report.

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 appeared to peak in abundance that winter. The results for the current Reporting Period (0.54 raptors/kilometer) demonstrate that raptor abundance had increased significantly from the 2009/2010 season, but numbers were lower than that observed 2006/2007.

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 were likely 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, which include Wolfe Island and other areas surrounding Kingston, generally correlate with the differences observed between the 2006/2007 pre-construction, 2009/2010 and 2010/2011 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. Peak numbers of Short-eared Owls were also recorded by both studies during the 2010/2011 season.

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 2010/2011, 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 9.0** and **10.0**, **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) 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. However it was noted that no raptor or owl concentration areas were recorded in the northwest end of Wolfe Island, an area of relatively high WTG concentration, although raptor observations of lesser density were recorded. 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 Foraging Waterfowl Surveys

The results of the spring 2011 inland foraging surveys indicated a general increase in waterfowl abundance between 2010 and 2011, compared to a decrease in abundance between 2007 pre-construction and 2010 post-construction monitoring. In all years, Canada Goose was by far the most common species observed. As such, any change in waterfowl days can almost entirely be attributed to the Canada Goose. Higher goose observations were relatively consistent throughout the spring 2011 season, with higher numbers observed on most surveys when compared to the same week in 2007 and 2010. Possible explanations for the fluctuation in the abundance of Canada Geese include natural variability or crop rotation. Regardless, it is clear from the 2010 and 2011 post-construction surveys that Canada Geese remained an abundant species on Wolfe Island through the spring migratory season.

Mallard observations increased in 2011 following a decrease in 2010 as compared to the 2007 pre-construction data. However, given the low numbers of Mallard recorded in all years, outlier observations such as the 125 Mallards observed on April 4, 2007 and the 155 Mallards observed on March 24, 2011, have had a significant influence on the perceived overall abundance. The difference in Mallards recorded between all of the surveys resulted from a small number of flock observations.

The distribution of flocks in 2007, 2010 and 2011 was similar, with flocks often choosing to forage in the same general locations. Geese were routinely observed foraging in fields that contain WTG's. For example, on 9 of the 10 foraging waterfowl surveys over the Reporting Period, one or more flocks of geese were observed within the same field as a WTG. The only survey without observations in close proximity to a WTG, was the last survey in late May, when few geese were observed overall. The results suggest that proximity to wind turbines is not an important factor to the foraging field selection of waterfowl. Factors that are likely to have more significant influences on foraging field selection would include foraging opportunities and field management.

4.2.3 Overland Waterfowl Movement Surveys

Routes selected during the waterfowl morning and evening movement were very similar during the spring surveys each year (2007, 2010, and 2011). The major movement routes occurred in and out of the primary off-shore staging areas for geese and dabblers, including Reed's Bay, Pyke's Bay, Button Bay, Bayfield Bay and the small inlet off Carpenter's Point Rd. The majority of waterfowl were observed flying below blade sweep height, with flight height appearing to be affected by wind conditions; lower flight heights being more prevalent during periods of stronger winds.

Waterfowl appeared to adjust their flight route to avoid flying in close proximity to WTGs. In many cases, avoidance behaviour was observed, as flocks of waterfowl adjusted their flight course as they approached a WTG. As a result, more routes were recorded during the post-construction monitoring, as flocks chose difference paths around WTGs to reach their destination. Overall, overland movement routes were very similar during pre and post-construction surveys, with slight changes likely attributable to changes in foraging fields and adjustments around WTGs.

4.2.4 Aerial Waterfowl Surveys

The total number of waterfowl days were very similar in 2008, 2009, 2010 and 2011, although down from 1999. When comparing the recent years of data including 2008 pre-construction, 2009 during construction and 2010 and 2011 post-construction, there was little change in overall waterfowl abundance throughout the Wolfe Island study area.

Through analysis of the spring data, it is not apparent if the reduction in the number of waterfowl days from 1999 to 2008-2011 is attributable to natural variation, a decreasing trend in waterfowl abundance over the past decade, or perhaps in part, an artefact of variability related to sampling on a large scale. Survey interval may also result in some variability between years; although biweekly surveys capture the majority of waterfowl that forage on the island, flocks that remain on the island for only brief periods of time have the potential to be captured by biweekly surveys in some years and overlooked in others. Also, aerial surveys may not account for waterfowl foraging inland at the time the survey is conducted.

Despite the consistency in overall waterfowl days from 2008 to 2011, the distribution of waterfowl observations between the five Wolfe Island sectors fluctuated considerably. Specifically, the 2011 post-construction surveys revealed a reduction of waterfowl days in Sector 9 (including Bayfield Bay) compared with 2010 and pre-construction data. In Sector 10 (including Button Bay), waterfowl days were similar during the spring surveys of 2010 and 2011, a significant increase from pre-construction observations. Waterfowl days in Sector 11 (including Reed's Bay) exhibited an increase in 2011 compared to a general decreasing trend from 2008 through 2010. Evidence from morning movement surveys (both pre- and post-construction) suggest that large flocks of bay ducks make daily movements between bays, specifically Button Bay and Bayfield Bay. As the overall waterfowl days remained similar between years, the observed fluctuations between sectors is likely due in large part to movement of flocks, and their location at the time of the survey. Regardless, it is apparent that waterfowl remained abundant in each sector and each of the major staging areas each year. No apparent avoidance of the wind plant was observed during construction in 2009 or operation in 2010 and 2011.

For most guilds, waterfowl days recorded in the spring of 2011 were consistent with the variability observed over all previous surveys. Swans, geese and large dabblers were recorded in larger numbers in the spring 2011 than the other spring surveys from 2008-2010 and appear to be displaying an increasing trend. The Ontario Breeding Bird Atlas (Cadman et al., 2007) suggests Tundra Swan has experienced a significant increase in Hudson Bay Lowlands breeding population (67% increase in probability of observation) since the first atlas period (1981-1985). An increased breeding population of Tundra Swans likely explains the increase in staging migrants observed. No observations of the small dabbler guild were made in the spring 2011 surveys, although numbers were generally quite low for all of the spring surveys for this guild. The waterfowl days for sea ducks experienced significant fluctuations, with peak numbers observed in 2011. However, the waterfowl days for sea ducks should be viewed with some caution, as they are observed in relatively small numbers, and as such, a small deviation of waterfowl days results in a large percent change. The goldeneye guild exhibited an average number of waterfowl days in 2011, despite fluctuations throughout all surveys. Bay ducks showed a decrease while mergansers appeared to experience a peak in 2011. The fluctuations in goldeneye, mergansers and bay ducks can likely be attributed to natural variability in staging abundance; staging numbers of the goldeneye guild in particular are known to fluctuate widely among years (K. Ross, pers. comm., 2010). Overall, the fluctuation of waterfowl days within the guilds can be attributed to natural fluctuation, survey interval and variability related to sampling on a large scale.

4.2.5 Waterfowl Breeding Pairs Surveys

Overall, all five wetlands surveyed for breeding pairs of waterfowl supported breeding populations of geese and/or ducks. Although the surveys routes did not cover the entire wetlands, and therefore did not attempt to identify every breeding pair within each wetland, the surveys provide an indication of waterfowl breeding in portions of the wetlands close to WTGs.

The largest number of breeding pairs in 2011 was observed in the Bayfield Bay Marsh, as was also the case in 2010. Although the species diversity was lower than the 2010 monitoring, the number of breeding pairs was highest in 2011. The predominant species observed was Mallard. Extensive suitable breeding habitat was present, including cattail marsh with small ponds and channels, including channels that were created as part of a Ducks Unlimited Canada's habitat project. Woodlands, providing potential nesting cavities, occurred along the shoreline, adjacent to the marsh. Two WTGs occur approximately 350 m south of the wetland edge.

Button Bay Wetland had the fewest numbers of breeding pairs and the lowest species diversity, although it is smaller in size compared to the other wetlands, and the overall breeding density would be similar or higher than other wetlands, if compared on an area by area base. Similar observations were made from the 2010 survey; however, the species diversity was slightly higher. Habitat was limited to the open bay with marginal cattail habitat, surrounded by agricultural fields. A fallow area with patches of trees occurs to the north of the wetland. The treed area potentially provided suitable nesting cavities for the Wood Ducks observed, although more mature forest cover occurs at the east end of Button Bay. Two WTGs occur in the field to the west, approximately 200 m from the wetland edge.

Big Sandy Bay Wetland encompasses extensive swamp habitat. Due to limited accessibility, only a portion of the wetland was surveyed along the existing trail system (consistent with the 2010 survey). Compared to the 2010 survey, species diversity was slightly lower and the number of breeding pairs was very similar. Habitat along the survey route included dense thicket swamp, mature deciduous swamp and a dug open channel. Two species of waterfowl were observed, the most common being Canada Goose. A string of WTGs occur to the east of the wetland, approximately 150 m from the wetland edge.

Reed's Bay Wetland had the highest diversity of waterfowl with five species (Mallard, Canada Goose, Gadwall, Wood Duck and Blue-winged Teal) observed breeding. Species diversity was higher than in the 2010 survey, but the number of breeding pairs was similar. Habitat was limited to cattail marsh surrounding the open bay. The wetland was surrounded by agricultural fields with tree cover limited to patches along the lakeshore. No WTGs are present in the immediate vicinity of the wetland, with individual WTGs occurring more than 500 m away to the north, east and south.

Sandy Bay Wetland had three species observed breeding, compared to the six observed in 2010. A group of Red-breasted Mergansers was observed during the May 13, 2010 survey, and included 3 females and a male, indicating a potential breeding pair. Habitat consisted of cattail marsh surrounding the open bay, with mature willow trees along the lakeshore. WTGs are present within 150 m, to the north and south of the wetland. Waterfowl observations were made in portions of the wetland closest to WTG, suggesting that presence of the WTG did not deter breeding.

Overall, the waterfowl breeding pairs surveys found populations of breeding geese and/or ducks in each of the major wetlands that are in proximity to WTGs. Compared to the results from the 2010 survey, the overall species diversity was lower, however, the number of breeding pairs remained similar. The results of the surveys did not provide any indication that waterfowl avoided nesting in proximity to the WTGs.

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

The grassland surveys indicated that grassland breeding birds remained common throughout the wind plant area. 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. 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. 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). However, 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, it is likely that some other factors, unrelated to the operation of the wind plant, have contributed to the decrease. 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.

One potential explanation for the decrease observed at grassland point counts is roadside avoidance. Twenty-three of the 27 grassland point counts were conducted from roadsides and as such, changes in breeding bird density may be related to changes in the roadside habitat due to road improvements related to the wind plant, or disturbance effects due to increased traffic. 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.

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. For some species, such as Bobolink, a slight decrease in density was noted at the 0-100m distance, when compared to 100-200m from the WTG bases. At some turbines, portions of the 0-100m sector consisted of disturbed areas in a state of succession, where the gravel pads used during construction had been removed. These successional areas, which were not suitable for nesting Bobolink, made up a relatively small proportion of the 0-100m sectors. However, the small reduction in suitable habitat may account for the slight reduction in Bobolink density between 0-100m, when compared to 100-200m distance. Species that are more likely to nest within the early successional areas, such as Savannah Sparrow or Upland Sandpiper, did not show any reduction in density within the 0-100m sectors.

Lower densities of grassland breeding birds were observed at 200-300m from WTG bases. Lower densities in the 200-300 m distance regime may partially be due to survey variability. While walking to the point count station, the 100-200 sector would be transversed, whereas the 200-300m sector would not. It is possible that by walking through the sector prior to the survey, some birds may be flushed or disturbed in the 100-200m sector and therefore more easily observed during the subsequent point count. However, overall the results of the paired point counts did not provide any evidence to suggest avoidance of the most common grassland breeding birds around WTG's.

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 more abundant in the Southeast Area search during the 2010 post-construction monitoring than in the 2007 pre-construction monitoring or 2011 post-construction monitoring. Savannah Sparrows also showed a decrease in abundance between 2010 and 2011. A potential hypothesis for these decreases is the wet spring experienced in 2011, which may have inundated low lying habitat, thus reducing its suitability. Total rainfall, as measured by Environment Canada's weather station at the Norman Rogers Airport in Kingston, was recorded at 44.1mm in May of 2010 and 138.7mm in May of 2011; over a 200% increase. The effect of the increase rainfall was particularly evident in Section 8 (**Figure 4, Appendix A**) of the Southeast Area Search, where displaying Bobolinks were completely absent through the middle of the Sector which was low-lying and quite wet. However, around the periphery of Sector 8, Bobolinks did occur on the drier slopes. Considering much of Wolfe Island has shallow, poorly drained soils, and experienced flooding through the spring of 2011, it is possible some grassland species such as Bobolink and Savannah Sparrow may have had lower breeding success in many parts of the island that year.

In the Northwest Area, a slight increase in Bobolink and Savannah Sparrow densities was observed, when compared to 2010 and 2007 results after correcting for amount of grassland habitat. The Northwest Area generally slopes south towards the lake without the flooded low-lying areas observed in the Southeast Area. As such, the grassland species in the Northwest Area were potentially not as affected by the wet spring.

Numbers of observed Upland Sandpipers has remained very constant in the Northwest Area between 2007, 2010 and 2011. 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 B**).

Grasshopper Sparrow densities from the 2011 post-construction surveys remained very similar to those from 2010, although in 2010 they were observed in lower numbers than during the 2007 pre-construction survey. The decrease in 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. Generally, 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.

4.2.7 Wetland Breeding Bird Point Counts and Area Searches

Generally, the abundance of wetland breeding birds, as measured by the point counts and area searches, remained similar between pre and post-construction surveys. The point count data recorded an apparent increase in the abundance of Red-winged Blackbirds in 2011, compared to a decrease the previous year. However, given the small number of wetland point counts, the calculated density was heavily influenced by a relatively minor difference in observed numbers of Red-winged Blackbirds. Results of the wetland area search are considered to provide a more accurate estimate of abundance pre and post-construction, which showed an overall consistency in Red-winged Blackbird abundance.

According to the point count data, Common Yellowthroat densities increased significantly in 2010 compared to pre-construction results. The 2011 results suggest the Common Yellowthroat densities were beginning to return to pre-construction numbers, but remained higher than pre-construction results. The area search data confirmed a similar trend. There is no clear reason for the fluctuation in Common Yellowthroat abundance, although it could likely be attributed to natural variation.

During the 2011 wetland surveys, there were no Virginia Rail observations in Big Sandy Bay; a species that had been relatively common in previous years. As a species that responds readily to playback surveys, it is unlikely the species was simply overlooked in 2011. It was noted the water levels in Big Sandy Bay (and other wetlands) were particularly high in the spring and early summer of 2011. It is possible the high water level in this wetland made it less suitable for

Virginia Rails, if shallow foraging areas or nesting sites above the water surface were not available. One other waterbird, Least Bittern, was recorded in 2010 but not in 2011. Least Bittern is a more secretive bird and as such, there is potential it could have been overlooked in 2011. However, as this species was not observed during pre-construction surveys, it is possible that it is simply an infrequent breeder in Big Sandy Bay. As with Virginia Rail, there is also potential the high water levels in 2011 made the marsh less suitable for Least Bittern nesting.

Overall, results of the wetland point counts and area searches suggest population of breeding birds in the five major wetlands in proximity to WTGs remained relatively consistent between pre and both post-construction surveys.

4.2.8 Woodland Breeding Bird Point Counts and Area Searches in Woodlots Larger than 10ha

Relatively high breeding bird species diversity was recorded in 2011 through area searches in the surveyed woodlands in proximity to WTGs. For most species, point count data suggest there was little change in breeding densities between 2010 and 2011 post-construction surveys. The largest decrease in abundance was observed in Swamp Sparrow, relating to an average decrease of 1 breeding pair per point count. House Wrens also observed a decrease, continuing an apparent decline from 2008 pre-construction numbers, although this relates to an average decrease of less than 1 breeding pair per point count. It is likely such fluctuations in observed breeding density are a result of natural variability and variability resulting from the relatively small sample size of point counts.

During the 2008 surveys, Wood Thrush were observed at 5 of the 7 woodland point count stations, with observations in both the Big Sandy Bay woodland and Sandy Bay woodland. However, during the 2010 surveys, Wood Thrush was observed at only a single point count station, in the Big Sandy Bay woodland and in 2011, no observations of this species were made during point counts. Anecdotal reports (L. Friesen per. comm) suggest Wood Thrush has experienced significant declines in numbers over its southern Ontario breeding range over the past few breeding seasons. Although the reason for the Wood Thrush's decline has yet to be confirmed, the most likely cause is the loss the suitable mature forest habitat in its overwintering range in Central America.

4.3 RAPTOR BEHAVIOURAL STUDIES

4.3.1 Driving Surveys

As seen in **Figure 14.0, Appendix A**, raptor density was relatively uniform throughout the wind plant area; no areas were identified that are likely to have raptors in higher concentration and therefore at higher risk. **Table 3.28, Appendix B**, summarizes the abundance of different species of raptors in the study area during their migration in the fall of 2010 and the spring of 2011. An analysis of behaviour (**Table 3.30, Appendix B**) suggests the vast majority of these individuals were staging and not actively migrating.

Height data collected during the driving surveys (**Table 3.29, Appendix B**) suggest Turkey Vultures and Ospreys spent more time at blade sweep height than other species, a behaviour that may put them a higher risk of mortality. These two species may regularly obtain greater heights as a result of their flight behaviours. Turkey Vultures, which rely heavily on thermals for flight, may frequently be pushed into blade sweep height. In addition, by using olfactoral cues instead of sight, it is possible Turkey Vultures could effectively search for food at greater heights than other raptor species. Ospreys, which do not hunt over land, were often observed flying at blade sweep height while making transient flights between nesting sites and offshore hunting areas.

Two Osprey nests are known to occur within the study area (**Table 3.31, Appendix B**). Additional nests may also be present, but were not detectable by roadside surveys. None of the three Osprey fatalities were observed at WTGs in proximity to these known nests (the closest fatality being 4.2 km away). However, Ospreys are known to travel distances over 10 km from nest to forage (Poole et al. 2002, in Sandilands 2005). Regardless, there is no evidence to suggest observed Osprey fatalities were individuals from one of the two known nest locations. Incidental observations of the nest at the Operations and Maintenance building confirm there were no fatalities of the pair using this nest, which is located 200 m and 530m from the nearest turbines.

Observed egg dates for Ospreys in the Kingston area range from April 23 to June 10 (Weir 2008). Considering the dates of recorded Osprey fatalities at the Wolfe Island Wind Plant (May 2 to May 23), it cannot be determined if these were migratory or breeding individuals.

Red-tailed Hawk fatalities recorded over the monitoring program to date (i.e. May 2009 through June 2011) have been relatively distributed across the wind plant, with no areas of particular concentration. Those Red-tailed Hawk fatalities observed outside of the breeding season (i.e. Nov 17, 2009) were assumed not to be related to the location of known nests. During the breeding season Red-tailed Hawks are known to be highly territorial (Preston and Beane 2009, in Sandilands 2005). Territories are typically circular or oval in shape with reported sizes ranging from 31 to 550 ha (Sandilands 2005); equating to territories approximately 300 to 1350m in diameter. As such, Red-tailed Hawk fatalities are unlikely to be birds nesting upwards of 1.4 km from the WTG. Comparing the location of known Red-tailed Hawk nests and fatalities presented in **Table 3.31, Appendix B**, Red-tailed Hawks at Nests #4 and #5 would likely be at very low risk of mortality due to WTG collision. However, there is a possibility that the April 15, 2010 fatality of an adult at turbine 27, 250m from Nest #3, would be that of a nesting bird.

Overall, comparing the location of the 5 known raptor nests to the locations of recorded raptor fatalities, there is potential of a slight increased risk when nesting in close proximity to WTG.

4.3.2 Observational Surveys

As discussed in Section 3.2.9.2, the proportion of time spent at blade sweep height was used as an index of potential risk, when comparing different weather conditions and habitat elements.

It was observed that both the amount of time in flight and the amount of time that flight was at blade sweep height increased as wind speeds increased (**Tables 3.33 and 3.34, Appendix B**). Overall, there was an apparent correlation between amount of time at blade sweep height, and thus risk of collision, with increased wind speeds. Raptors will often utilize winds to assist in flight, allowing themselves to be pushed by the wind instead of self-propelled flight; a behaviour which may explain the greater amount of time spent at blade sweep height during higher winds.

Results of the observation surveys suggest raptors spent less time at blade sweep height during low temperatures (i.e. below 10ºC) (**Table 3.35, Appendix B**), possibly due to decreased opportunity for thermal soaring. The post-construction monitoring to date has found relatively low raptor mortality through the winter months. Although observational behavioural studies were not conducted through the winter to compare to spring and fall studies, it is possible cold winter temperatures could result in raptors spending less time a blade sweep height. Results of the 2010/2011 post-construction winter raptor monitoring found only 3.3% of observations were at blade sweep height, the majority of which occurred in early November or late March during warmer (i.e. 7 to 8ºC) temperatures.

It was noted that raptors rarely obtained blade sweep height during any type of precipitation (from light to heavy rain) (**Table 3.37, Appendix B**), suggesting raptors would be a little risk of collision during these conditions.

There was an increase in the amount of time spent at blade sweep height in proximity to the lakeshore (**Table 3.38, Appendix B**); possibly due to raptors using wind currents off the lake to assist in flight. However, based on the results of post-construction mortality monitoring completed to date, raptor fatalities have been relatively uniformly disturbed across the wind plant suggesting WTG closer to the shoreline do not pose a higher risk to raptors collisions.

In summary, the results of the raptor behavioural observational surveys suggest the following trends in risk of collision:

- Increased risk during high wind conditions;
- Decreased risk during low temperatures (i.e. below 10ºC);
- Decreased risk during light to heavy rain; and

Although not addressed by the results of the raptor behavioural surveys, there are other factors that are hypothesized to increase the risk of collision. In addition to spending more time at blade sweep height during high winds, raptors may be at increased risk of collisions during gusty conditions, as a result of reduced flight control. In particular, species such a Turkey

Vultures, with low wing-loading and high aspect ratio, are susceptible to being blow off course by gusts of wind. Such a decrease in flight control, although temporary during a gust, may hinder a raptor's ability to avoid collisions.

It is hypothesized that raptors, and other birds, would be at higher risk of collision while distracted during flight (James, 2010). As a commonly used staging area, there is likely to be frequent interactions between resident birds and migrating birds during migration. Behaviours such as birds chasing or being chased by each other are likely to result in distracted flight. Similar interactions are likely to occur amongst resident birds in the spring, when they are aggressively defending breeding territories. Many raptor species, such as Red-tailed Hawks, conduct dramatic courtship displays involving locking talons, tumbling and breaking off before hitting the ground. Such behaviours are likely to be particularly distracting. Risk of courtship displays is more evident in species such as Wilson's Snipe, which have recorded fatalities in the spring when they would be conducting aerial courtship displays, but are rarely observed as fatalities at other times of the year.

Many of these distracted behaviours are more likely to occur during spring and fall migration or early in the breeding season in spring; timing which generally correlates to periods of higher raptor mortality, as observed through the post-construction monitoring.

4.4 RECOMMENDATIONS

Mortality and disturbance effects monitoring should proceed in 2011 according to the February 2010 Follow-up Plan and as amended through discussions with the parties to the Plan. Scavenger removal trials conducted in January, 2011support the continued once-weekly carcass search frequency in the winter months (December, January and February).

As discussed in the Monitoring Report #4, 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. As such, it is recommended that the inland foraging and movement surveys be discontinued.

The Aerial waterfowl studies will continue through the fall of 2011, which will provide 4 full years (8 seasons) of data. 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 wind plant. As such, it is recommended that the aerial waterfowl surveys be discontinued in the spring of 2011.

The raptor studies completed to date have 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. These raptor behavioural studies fulfill the requirements of the adaptive management, as outlined in the Follow-up Plan.

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Senior Ecologist/Project Manager

Nicole Kopysh
Ecologist

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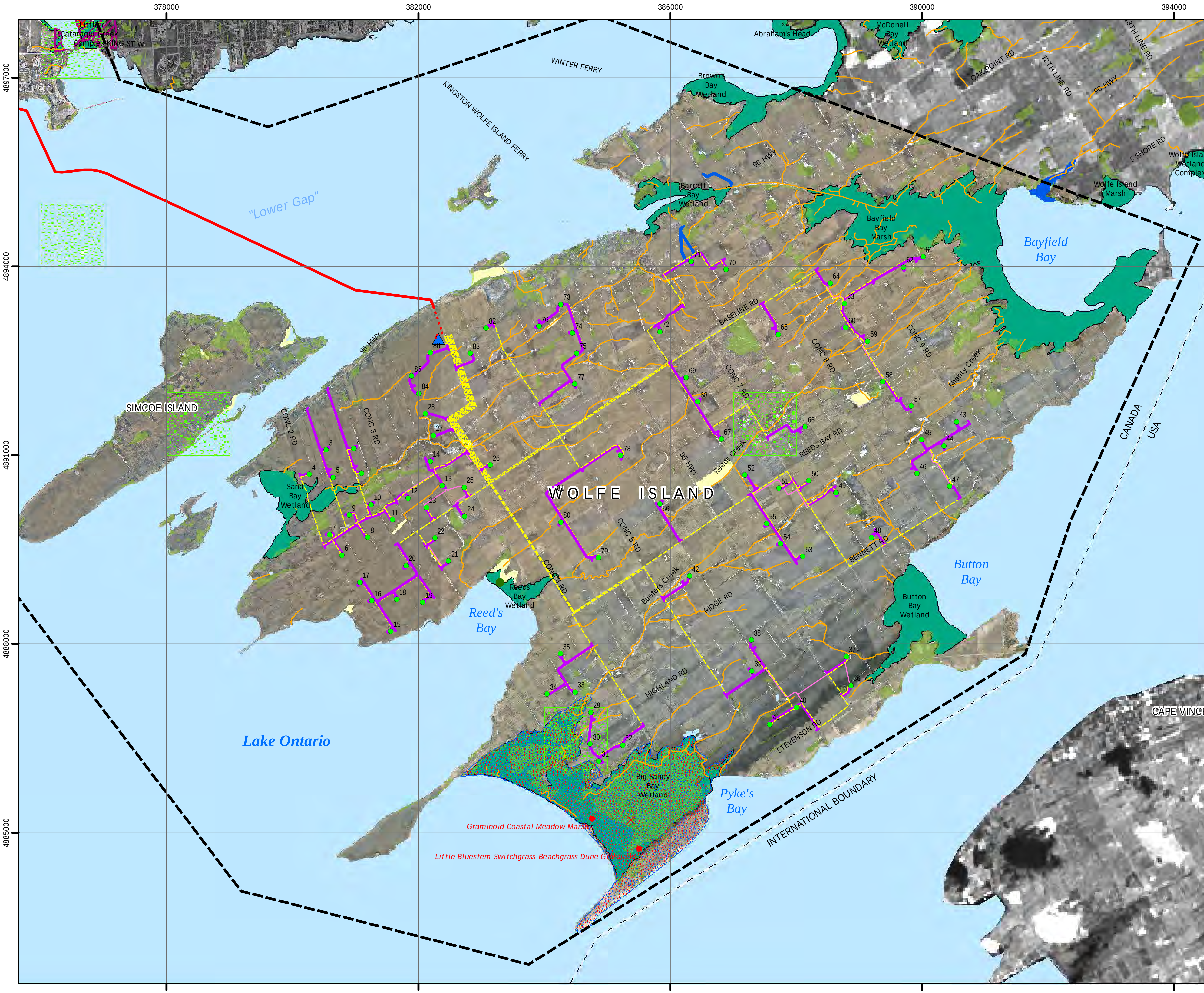
Appendix A

Figures



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N W E S

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

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
- 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.

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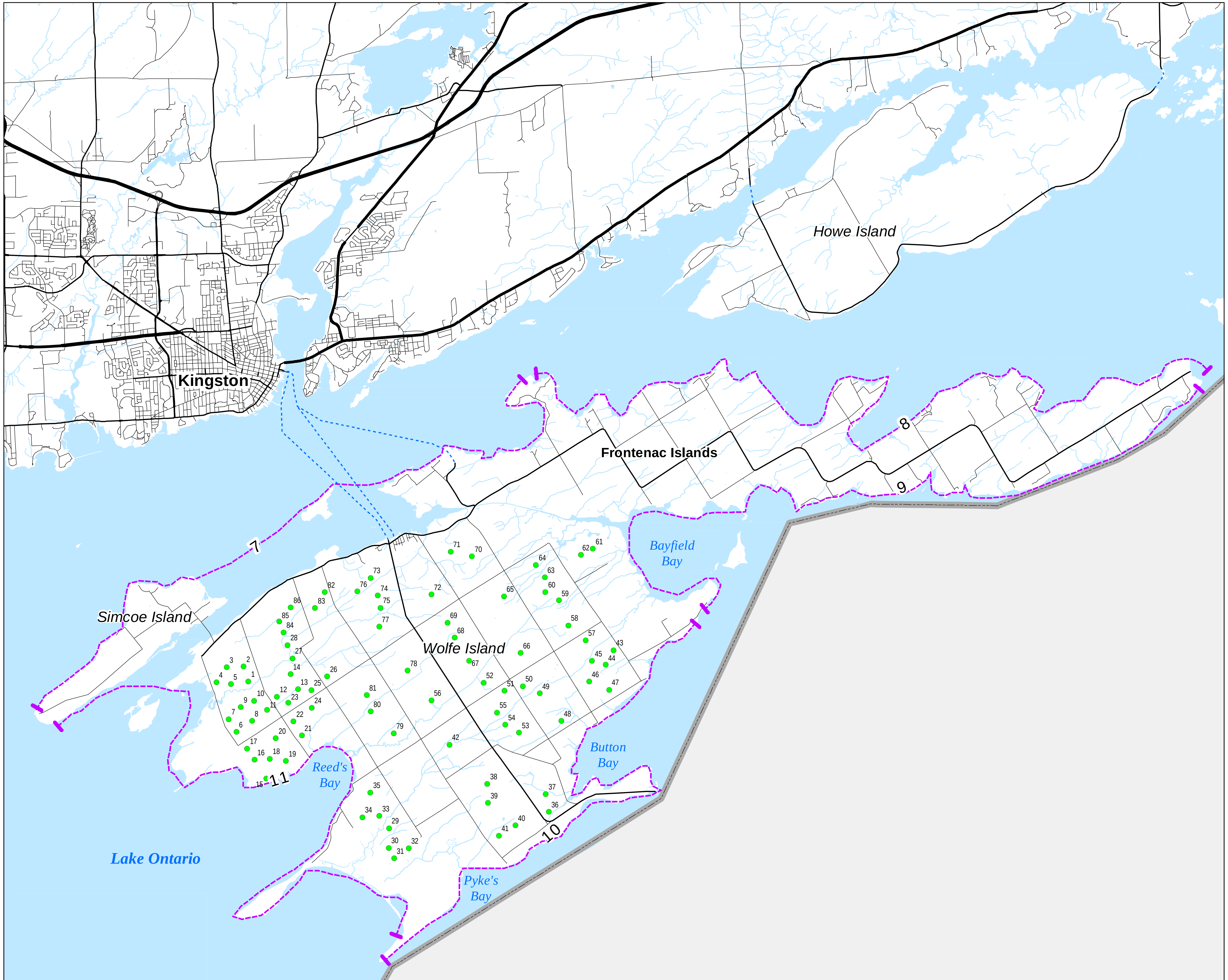
WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

Figure No.

1.0

Title

Wolfe Island Project Layout



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Legend

- Turbine Layout
- Expressway / Highway
- Primary Road
- Secondary Road
- Ferry
- International Boundary
- Watercourse
- Waterbody

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
2. Data Sources: Ontario Ministry of Natural Resources © Queens Printer Ontario, 2009.

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Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

Figure No.

2.0

Title

Wolfe Island Waterfowl Survey Sectors

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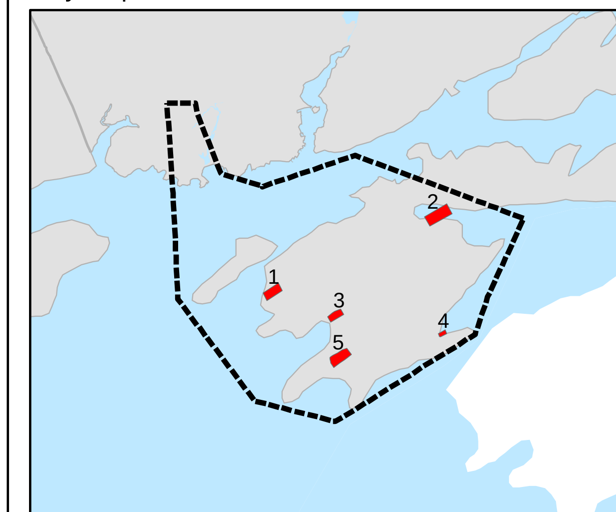
Legend

- Search Routes
- Location of Breeding Bird Point Count

Key Map



Notes

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WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

Figure No.
3.0

Title
Marsh and Breeding Waterfowl Area Search Route

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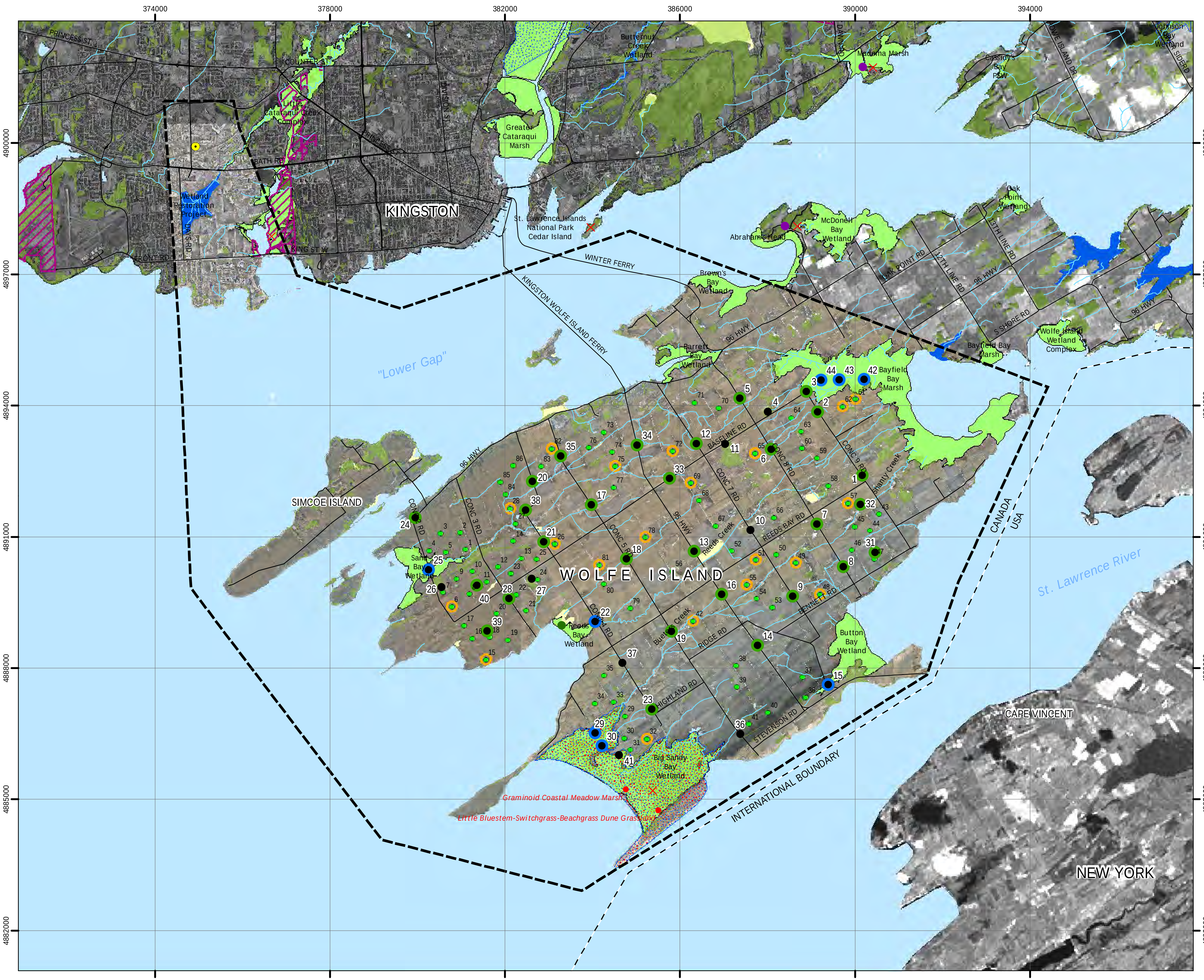

Legend

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

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
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4. Natural environmental features and hydrological data is from the Ministry of Natural Resources Peterborough District NRVIS 2006, the Cataraqui Region Conservation Authority, 2006, and Ducks Unlimited Canada, April 2006.

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Figure No.

4.0

Title

Location of Grassland and Marsh Breeding Bird Point Counts

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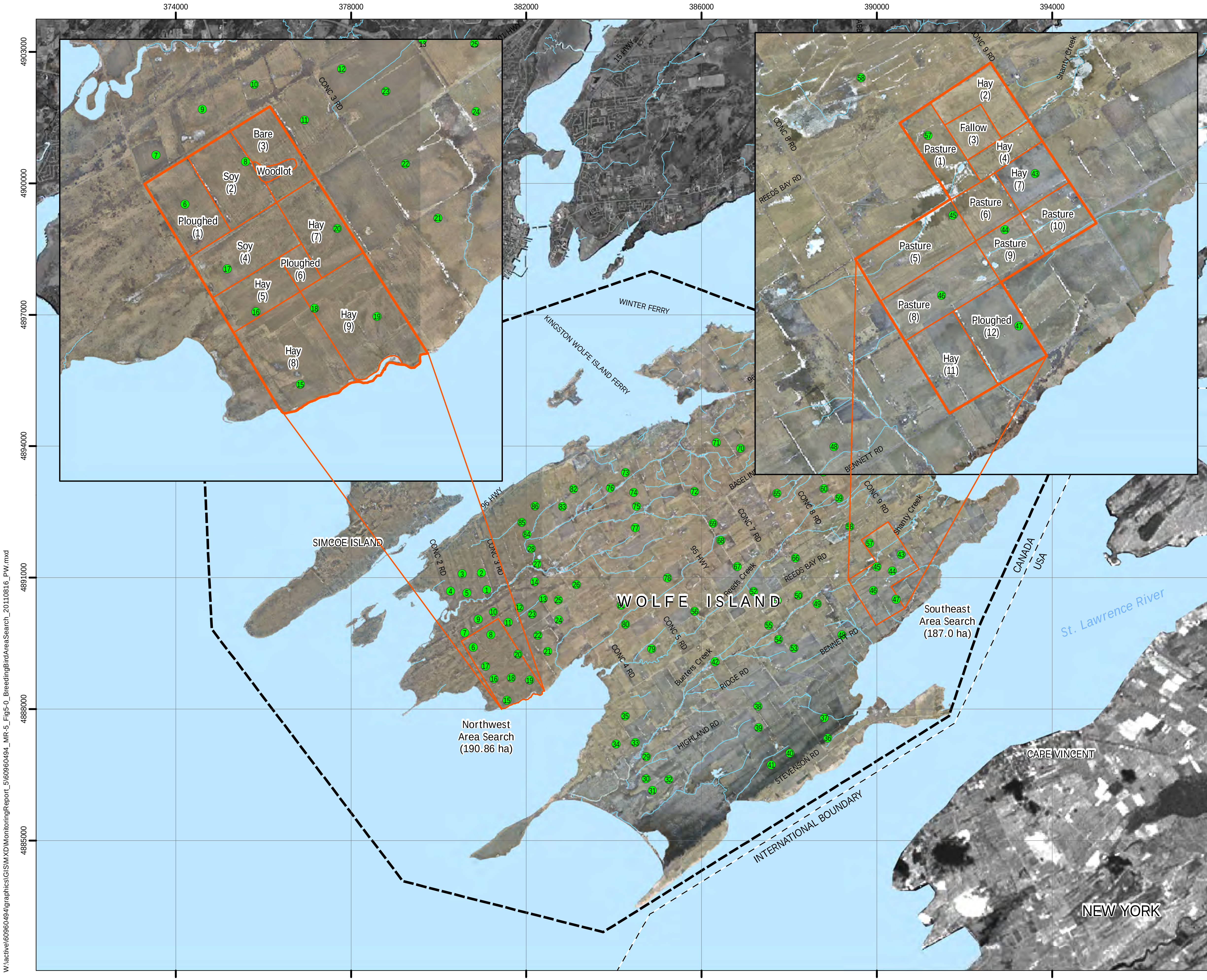

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N W E S

Legend

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

Notes

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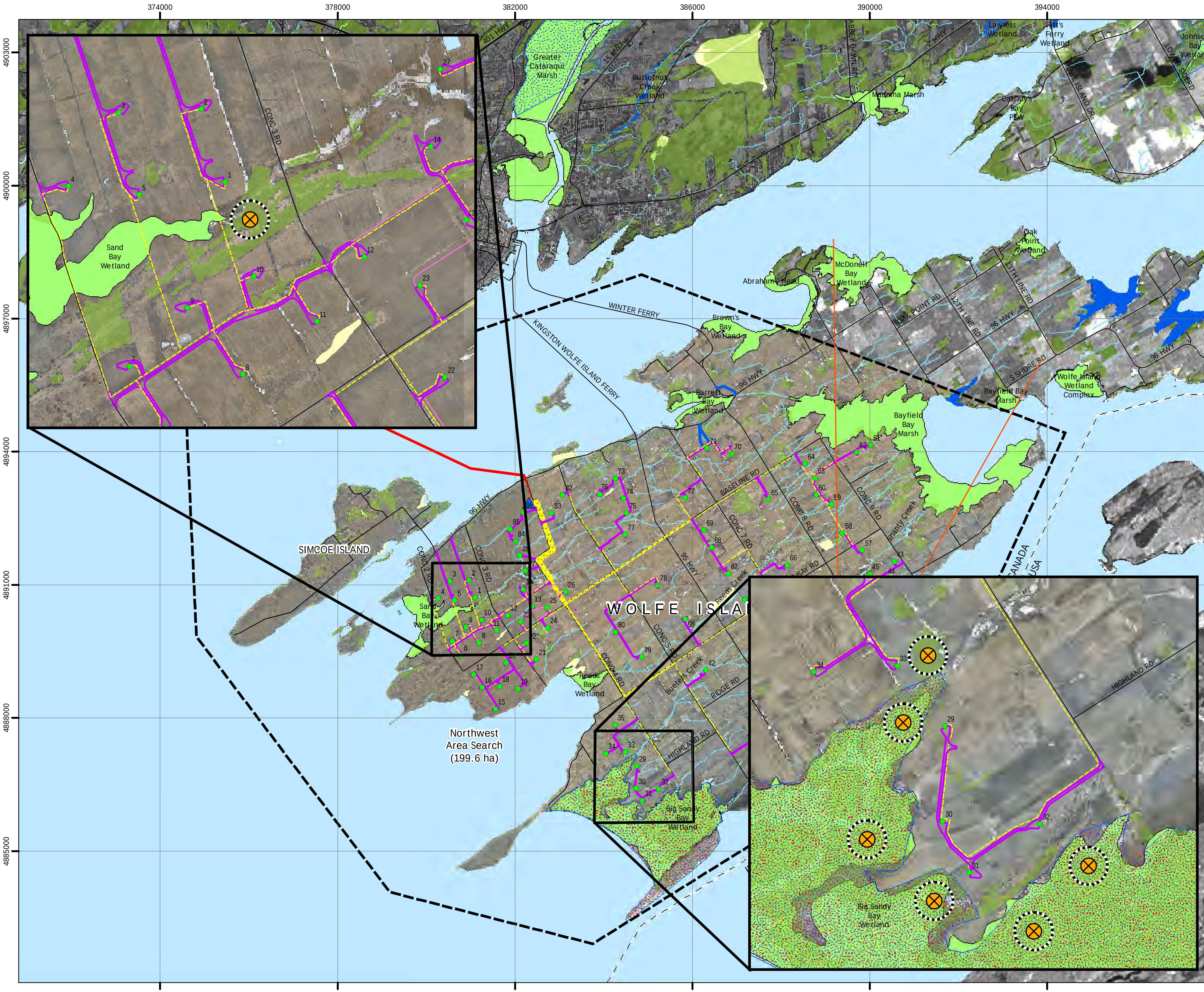
MONITORING REPORT NO. 5

Figure No.
5.0

Title
Post-Consturction Breeding Bird Area Search Locations



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Stantec

0 1 2 Kilometers

Legend

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

Area of Natural or Scientific Interest (ANSI)

- Earth
- Life

Wetlands

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

Notes

1. Coordinate System: UTM NAD 83 - Zone 18 (N).
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Client/Project
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MONITORING REPORT NO. 5

Figure No.
6.0

Title
Woodlot Point Count and Area Search Locations

Figure 7.0. Wolfe Island Wind Farm: Numbers of Bird and Bat Fatalities by Survey Date

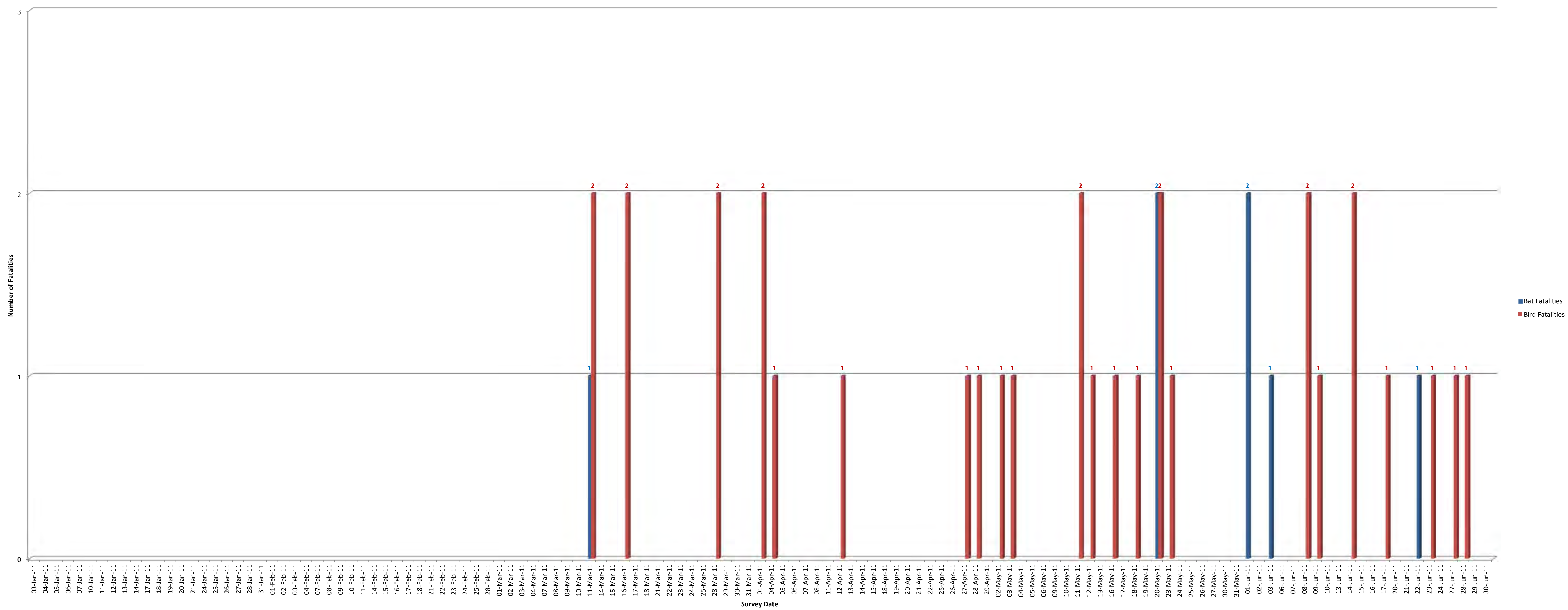
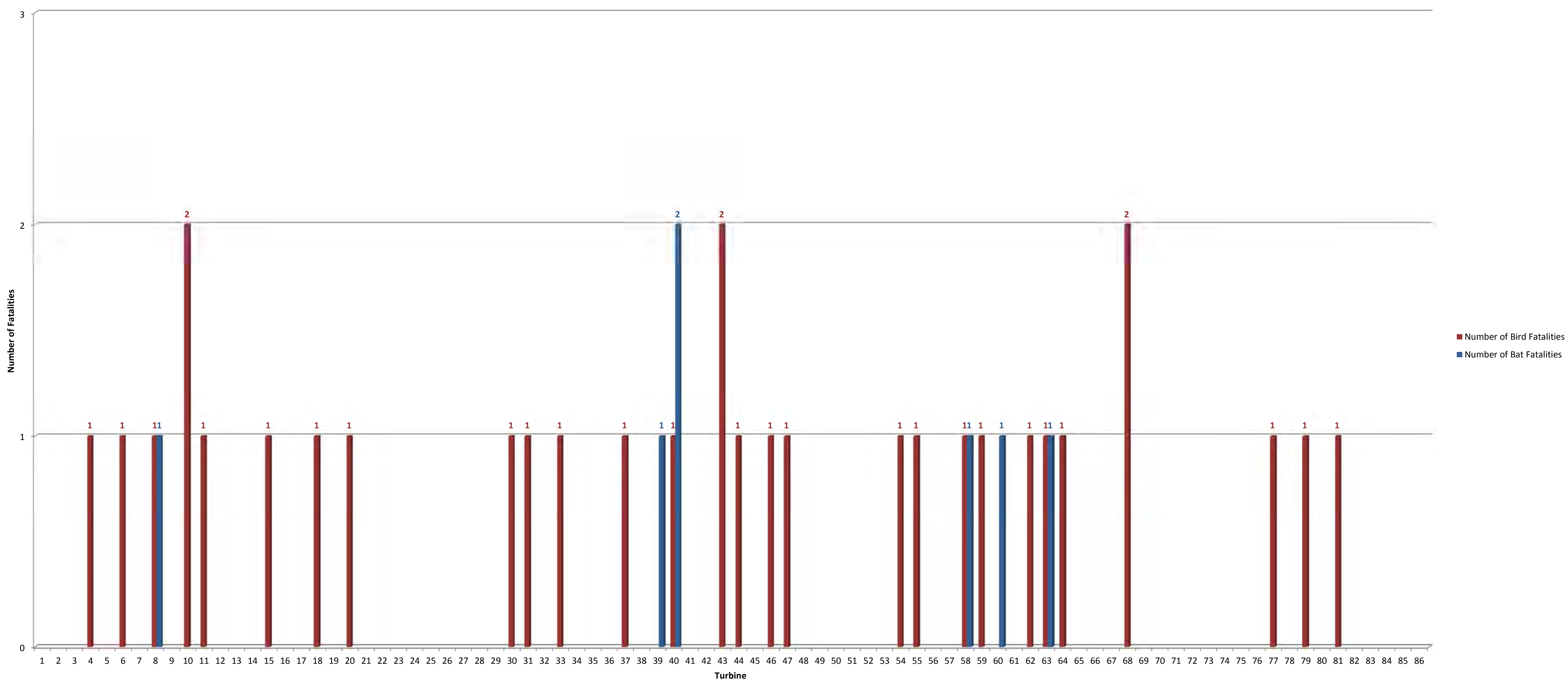


Figure 8.0. Wolfe Island Wind Farm: Bird and Bat Fatalities by Turbine
January 1 Through June 30, 2011



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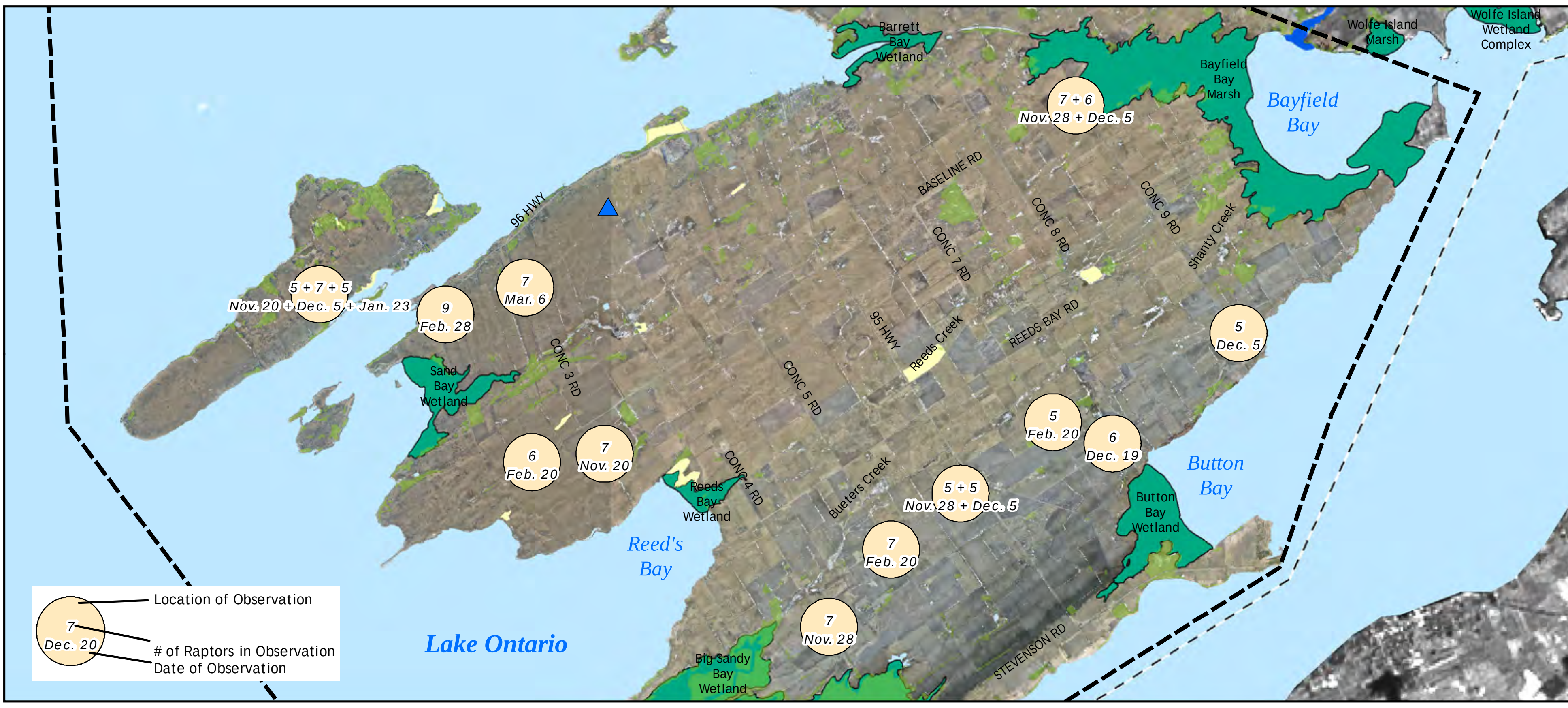
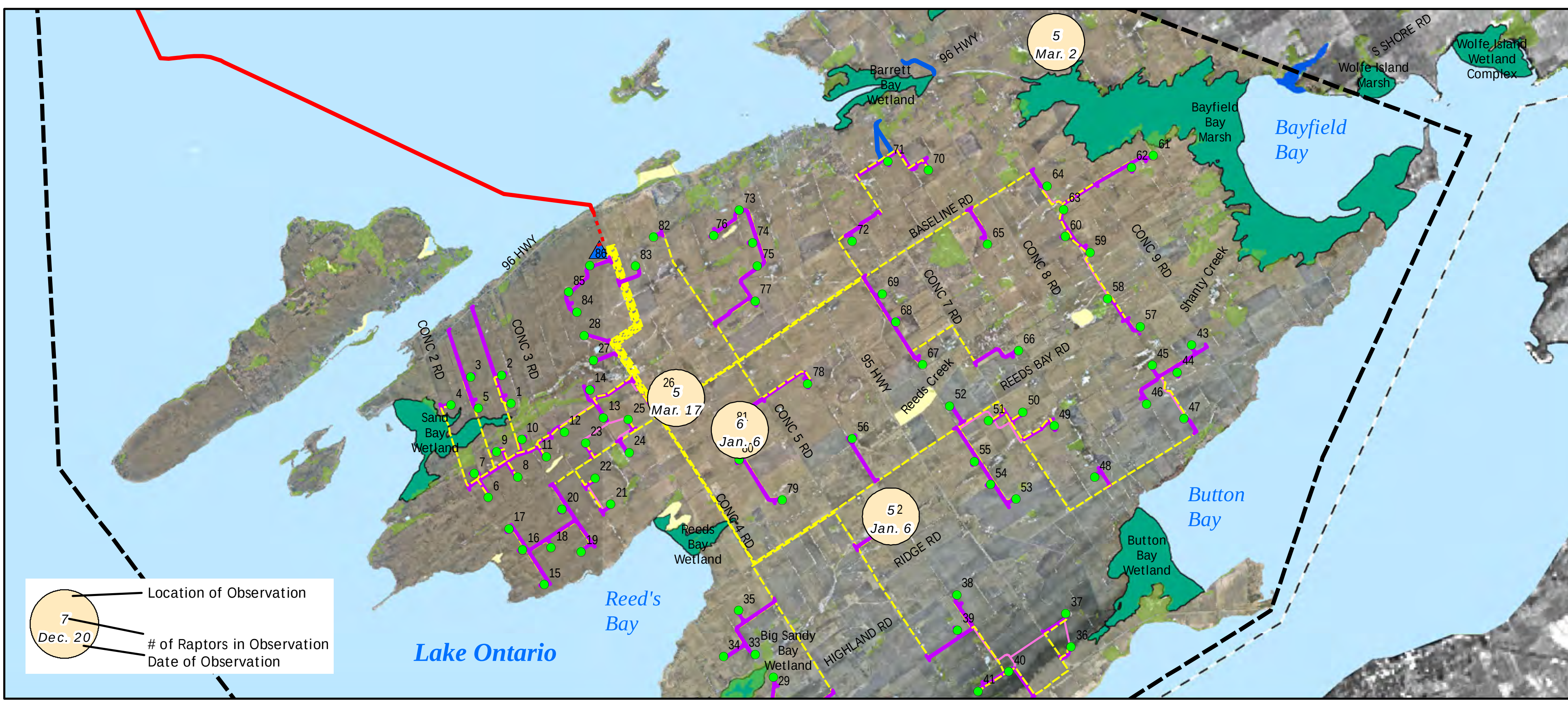


2009/2010 Post-Construction Results



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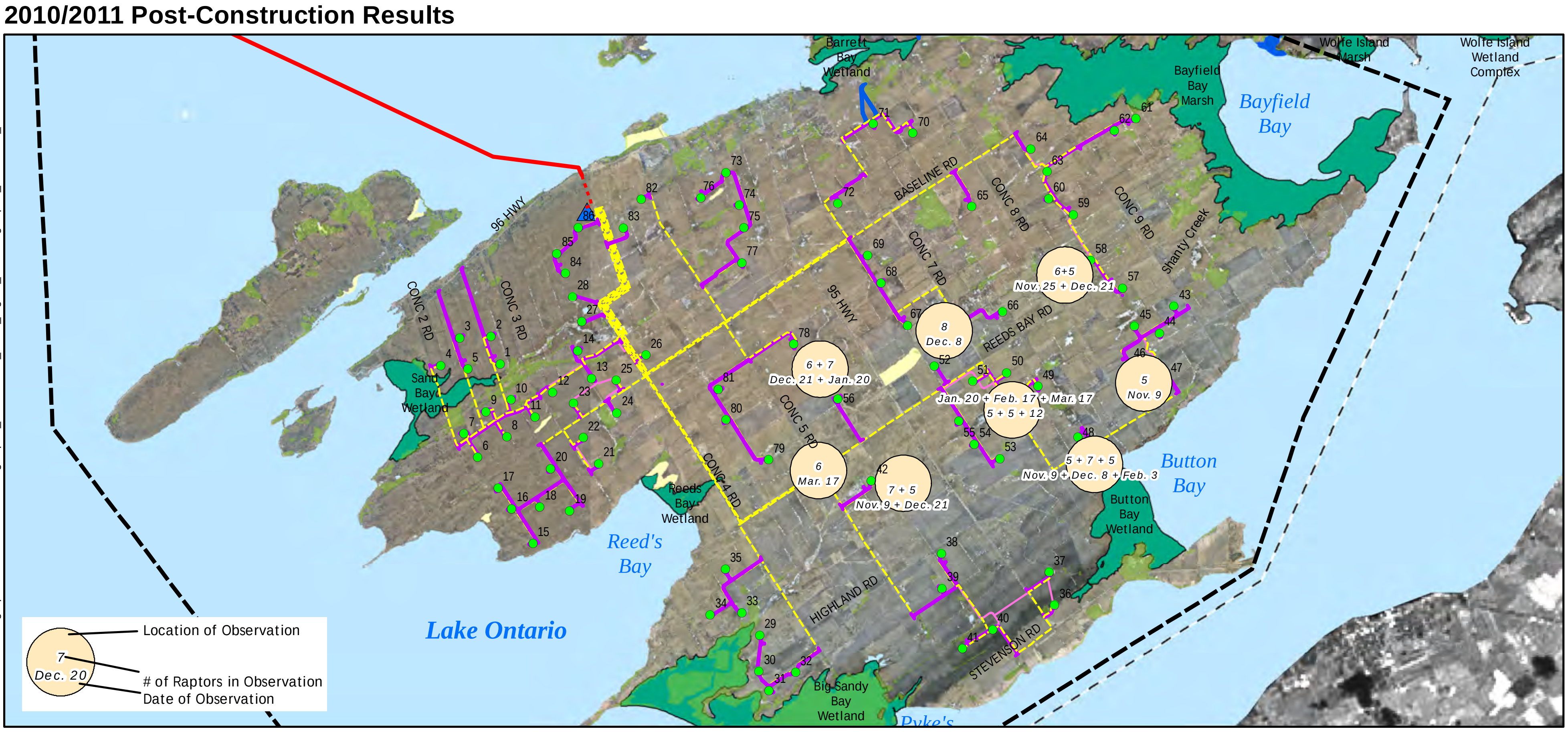

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Legend

- 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 E S W

Notes

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MONITORING REPORT NO. 5

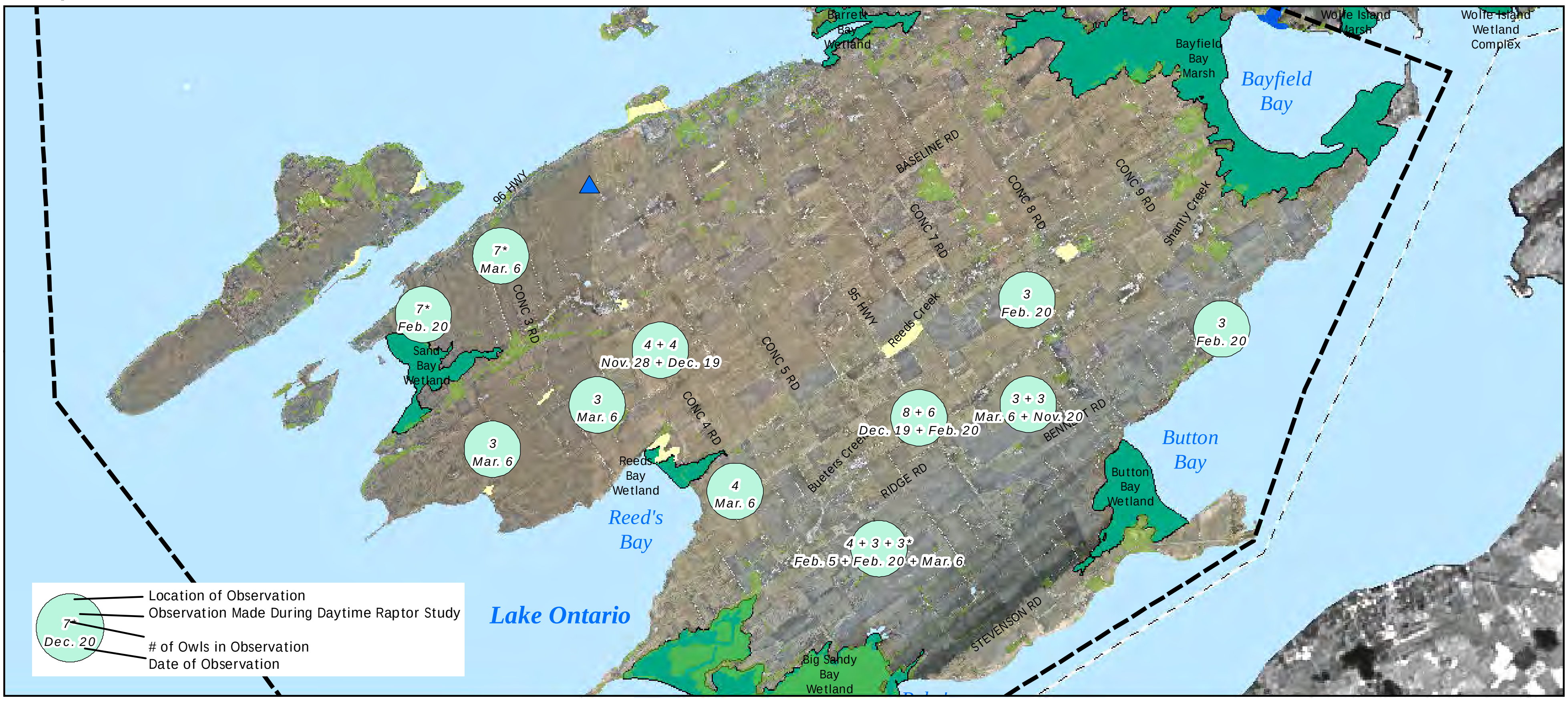
Figure No.

9.0

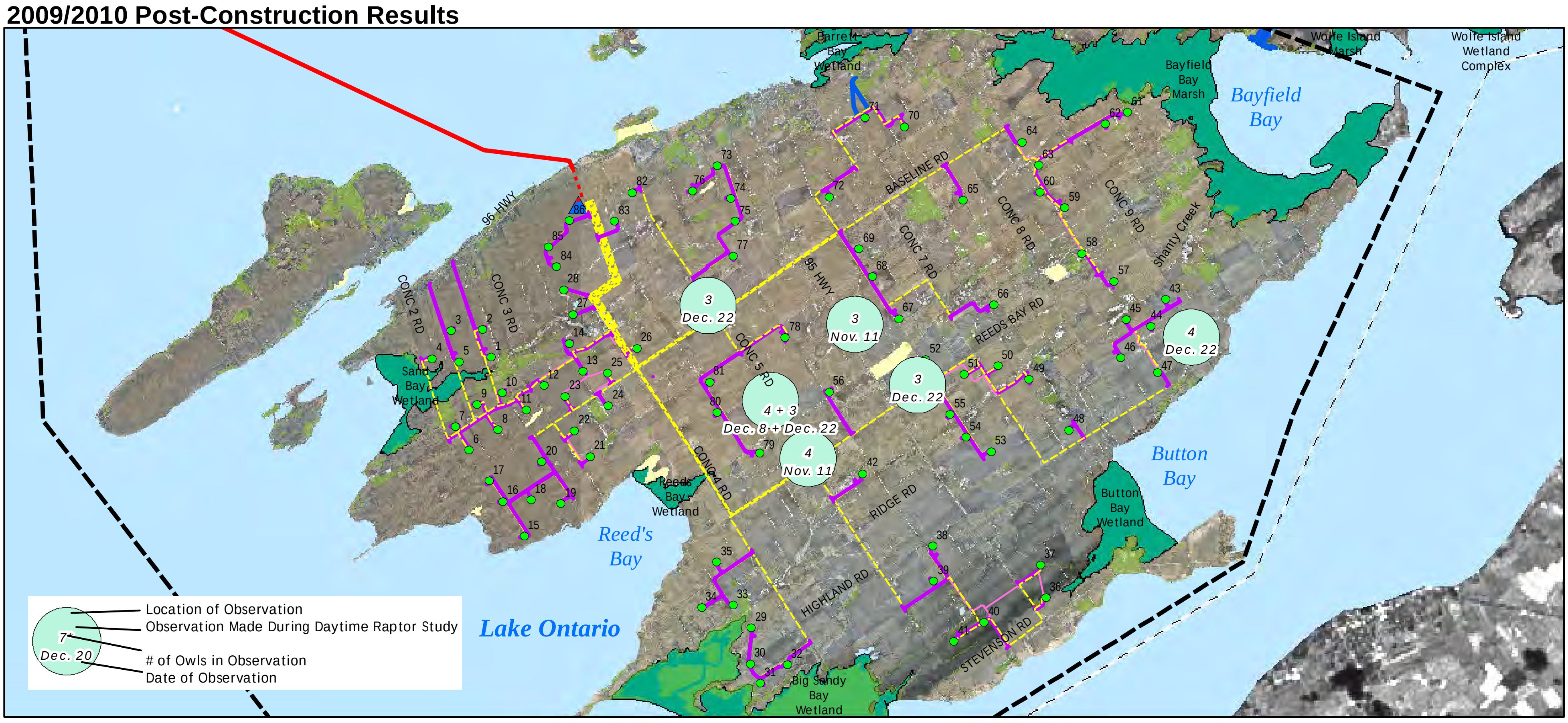
Title

Comparison of Wintering Raptor Concentrations 2006/07, 2009/10 and 2010/11

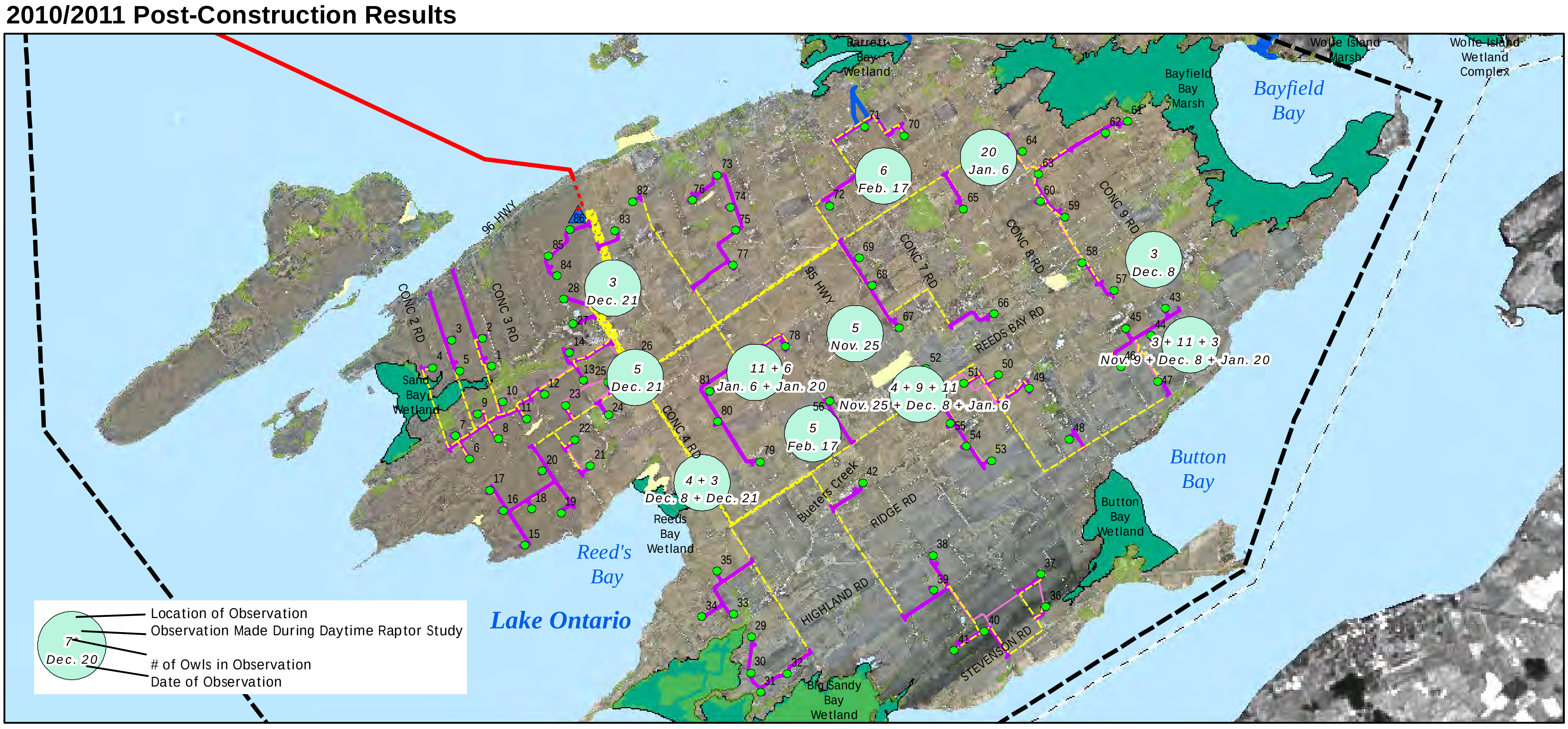
2006/2007 Pre-Construction Results



2009/2010 Post-Construction Results



2010/2011 Post-Construction Results



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August 2011
160960494

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

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MONITORING REPORT NO. 5

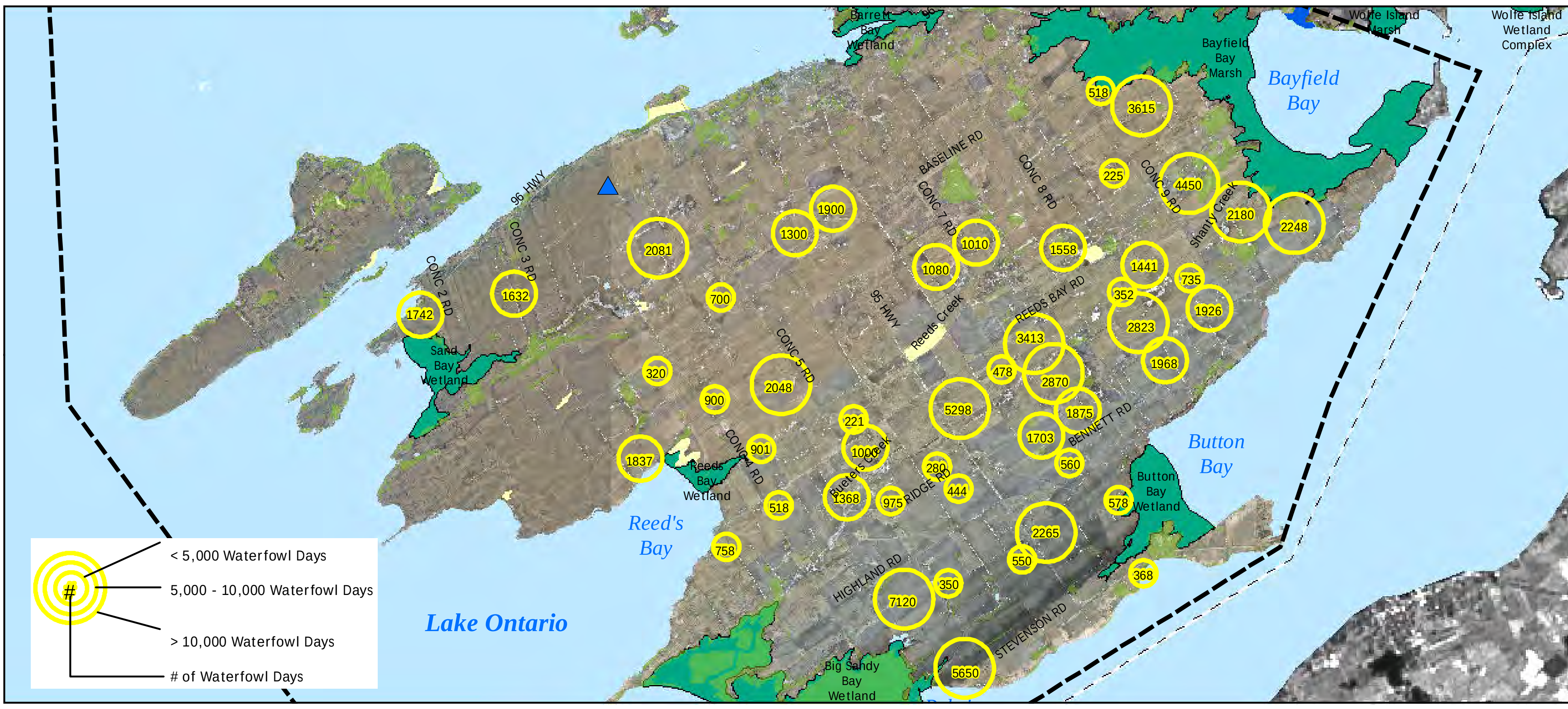
Figure No.

10.0

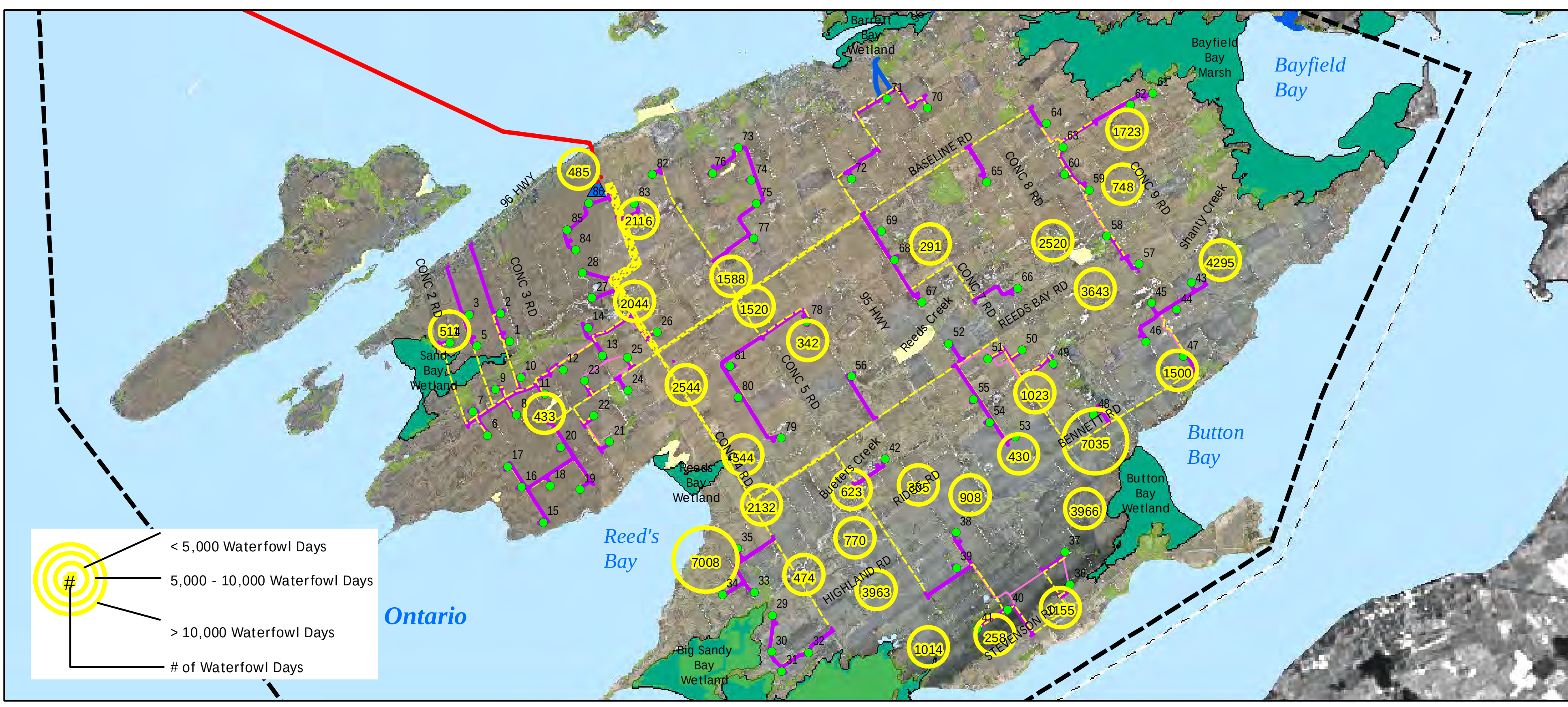
Title

Comparison of Wintering Short-eared Owl Concentrations 2006/07, 2009/10 and 2010/11

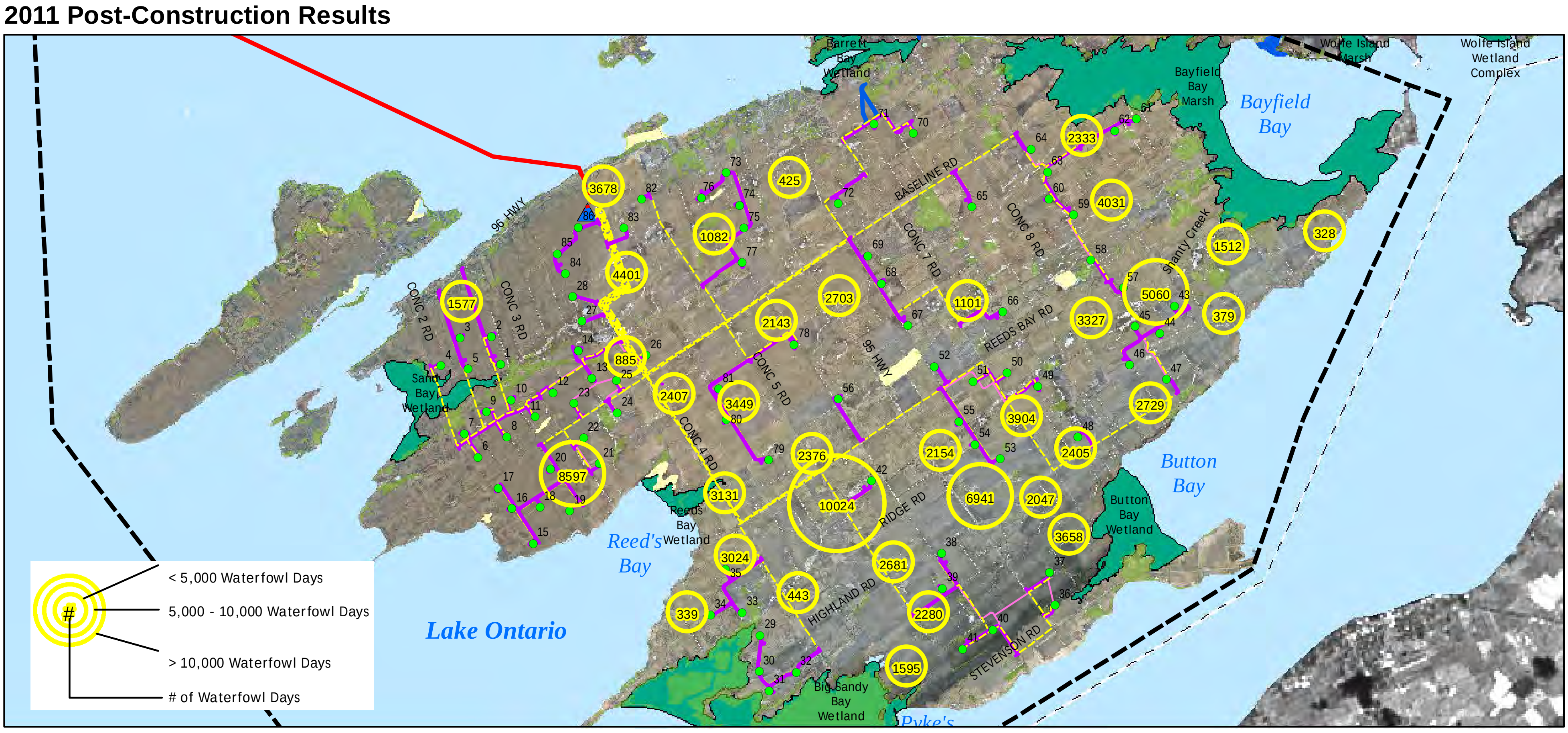
2007 Pre-Construction Results



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

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WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

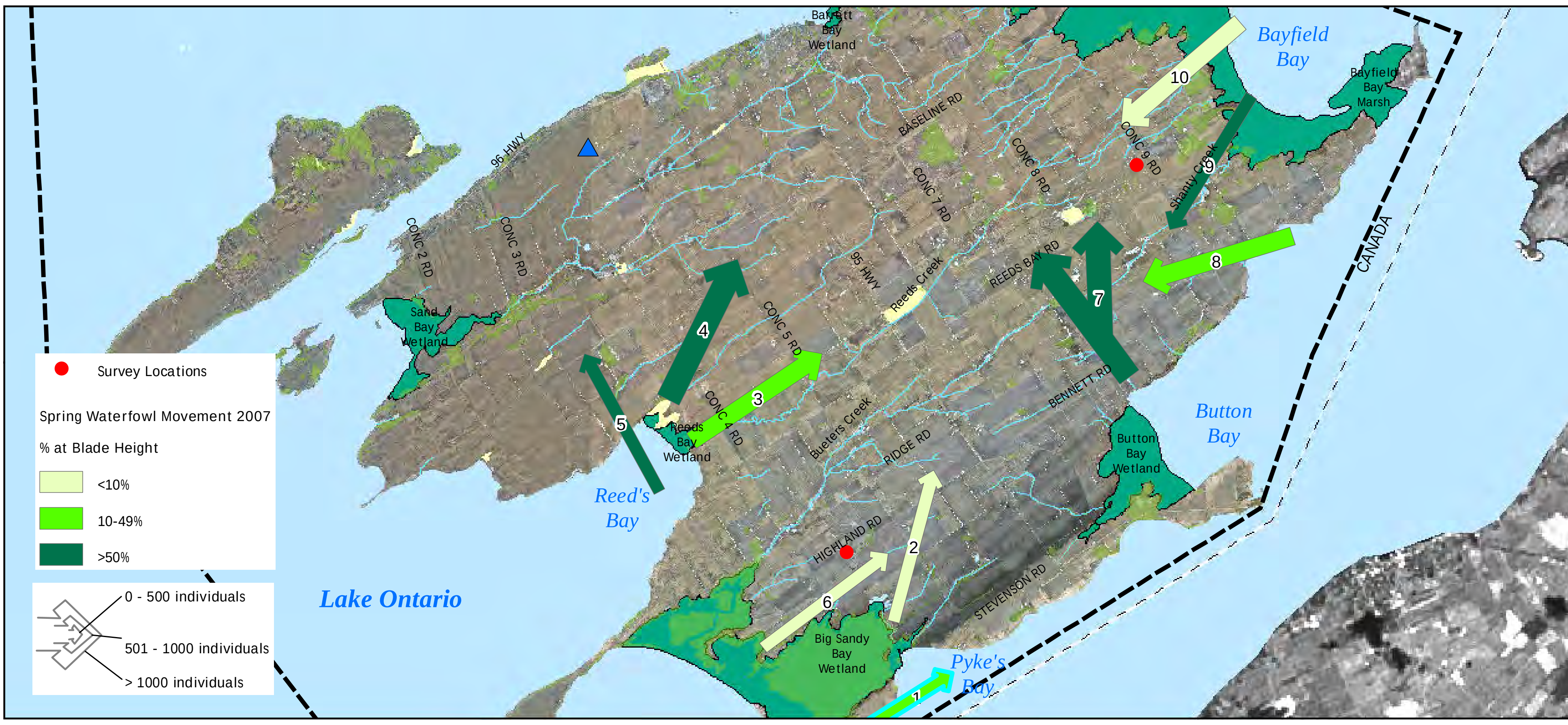
Figure No.
11.0

Title
Comparison of Spring Waterfowl Foraging in 2007, 2010 and 2011

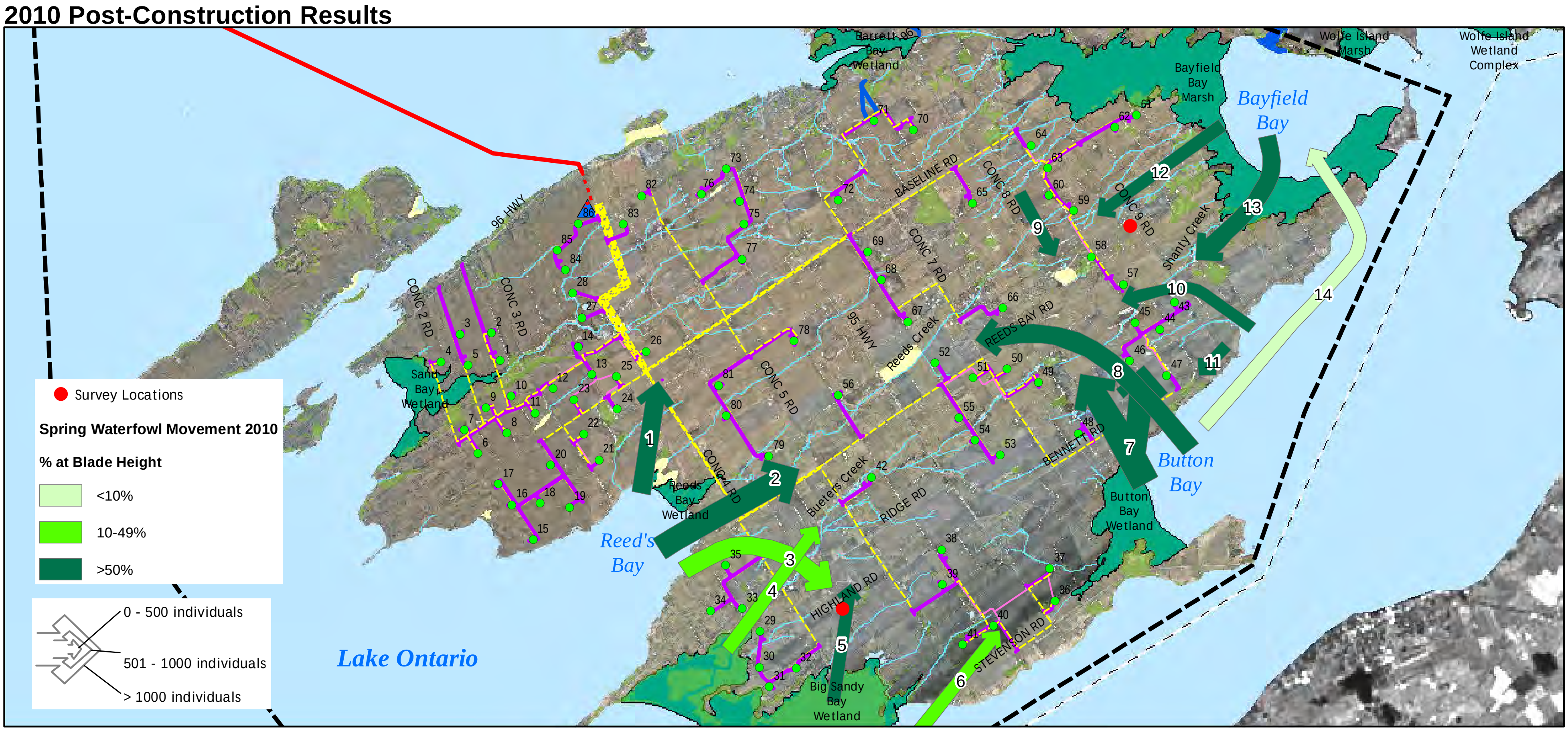
Stantec

TransAlta

2007 Pre-Construction Results



2010 Post-Construction Results



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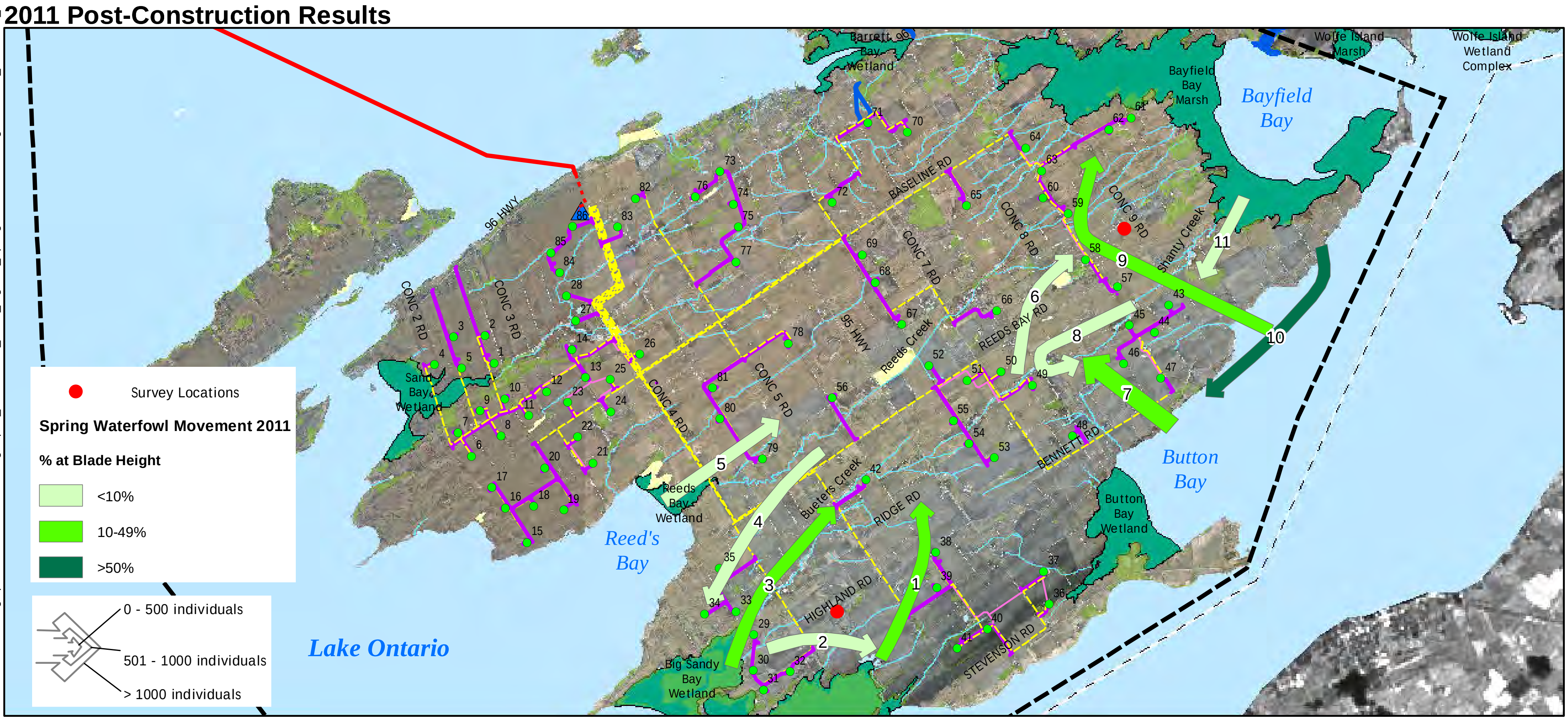
2011 Post-Construction Results



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

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WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

Figure No.

12.0

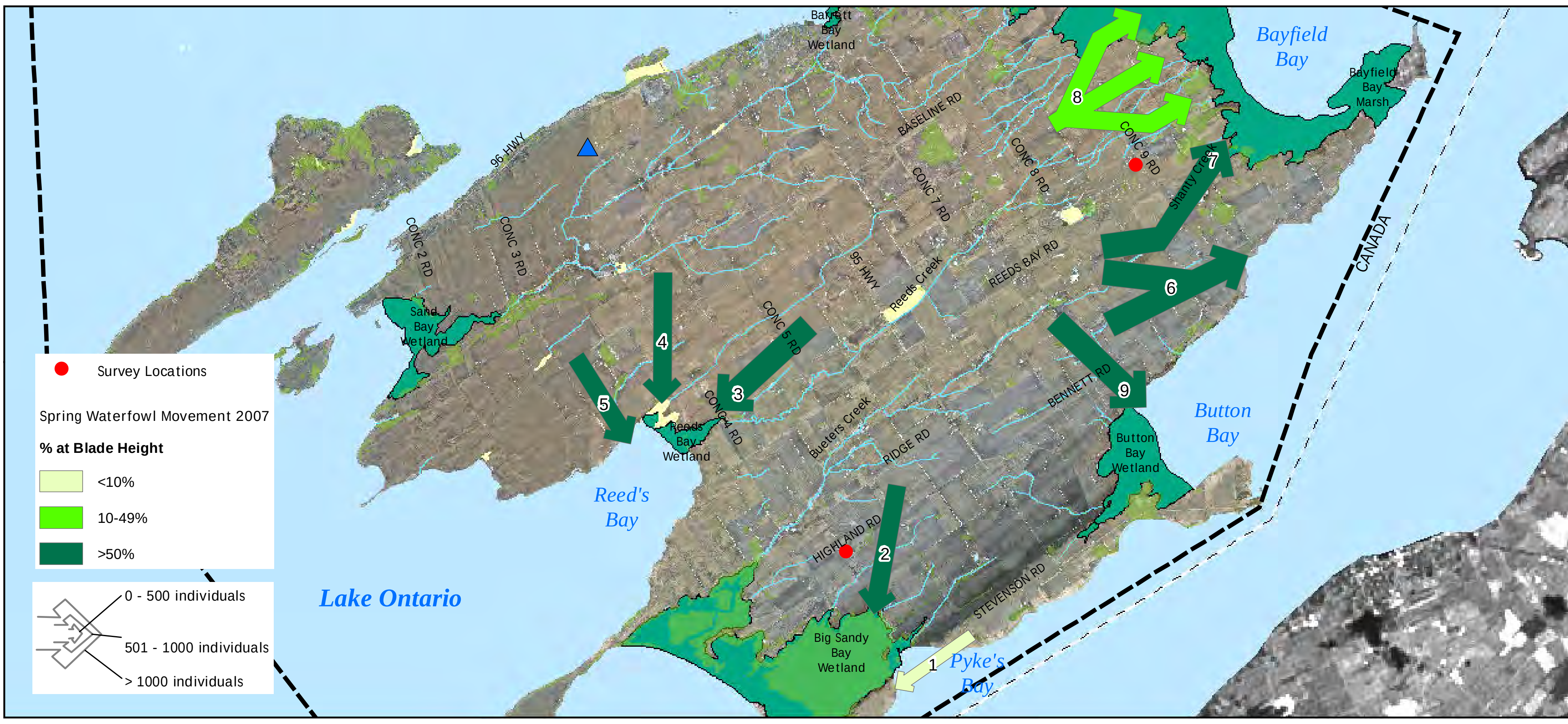
Title

Comparison of Spring Waterfowl Morning Movement 2007, 2010 and 2011

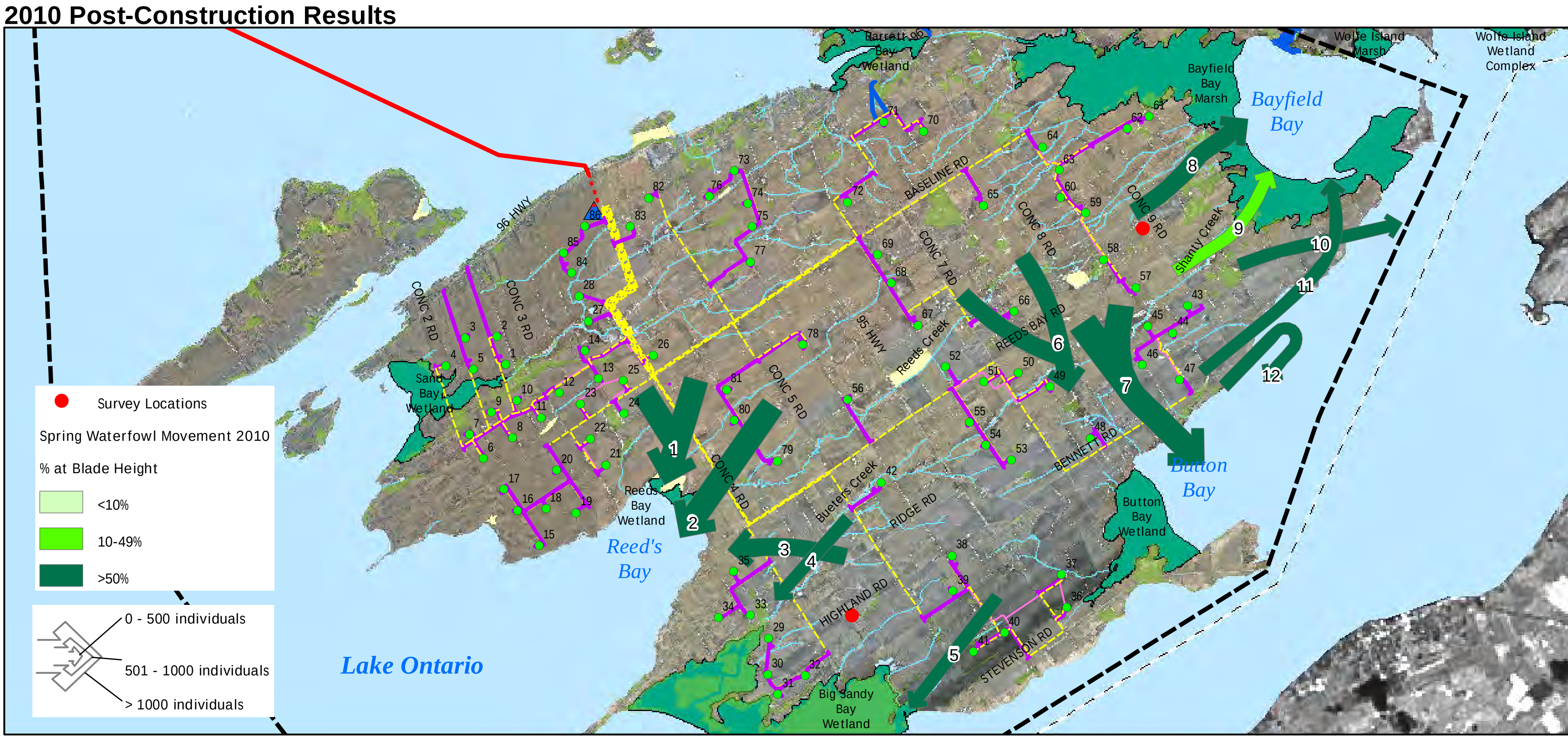
Stantec

TransAlta

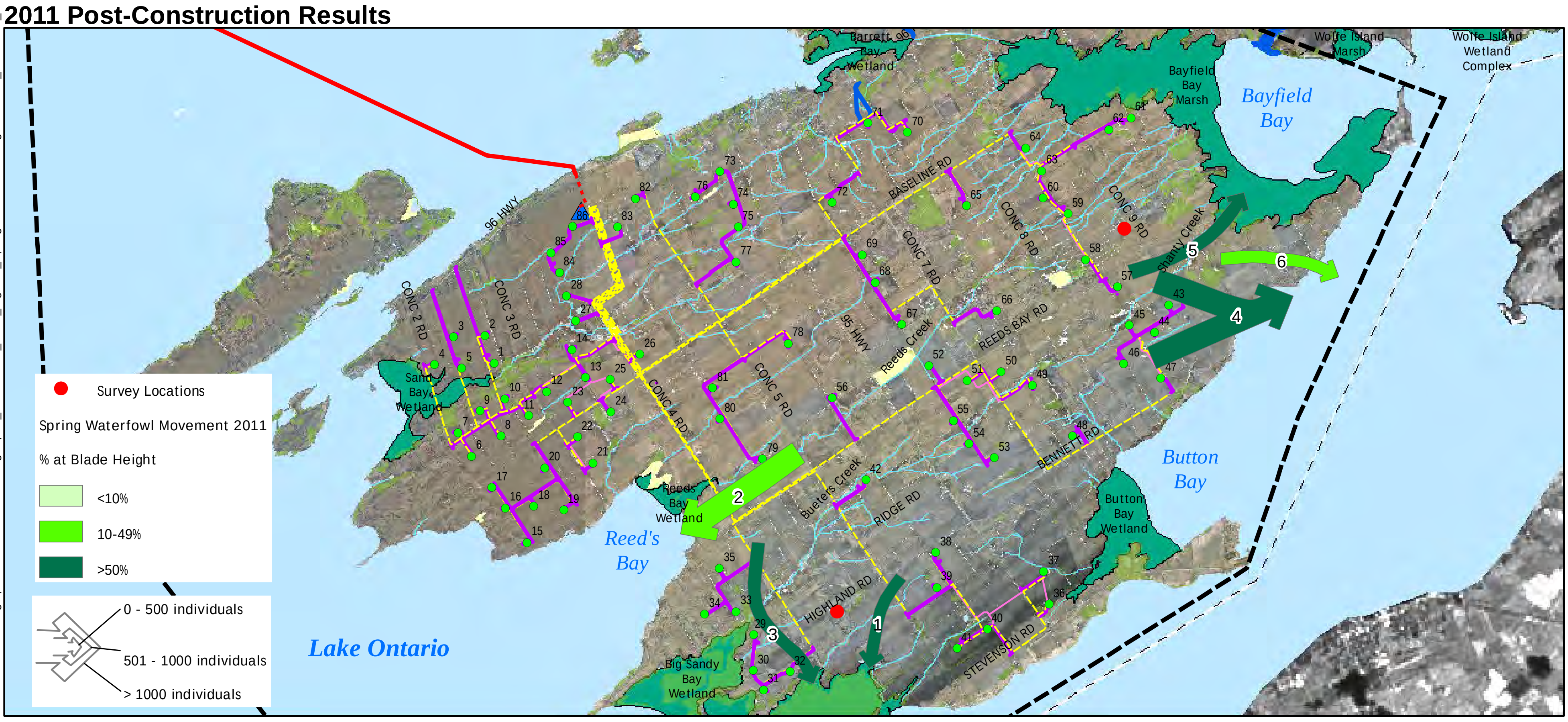
2007 Pre-Construction Results



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

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WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

Figure No.

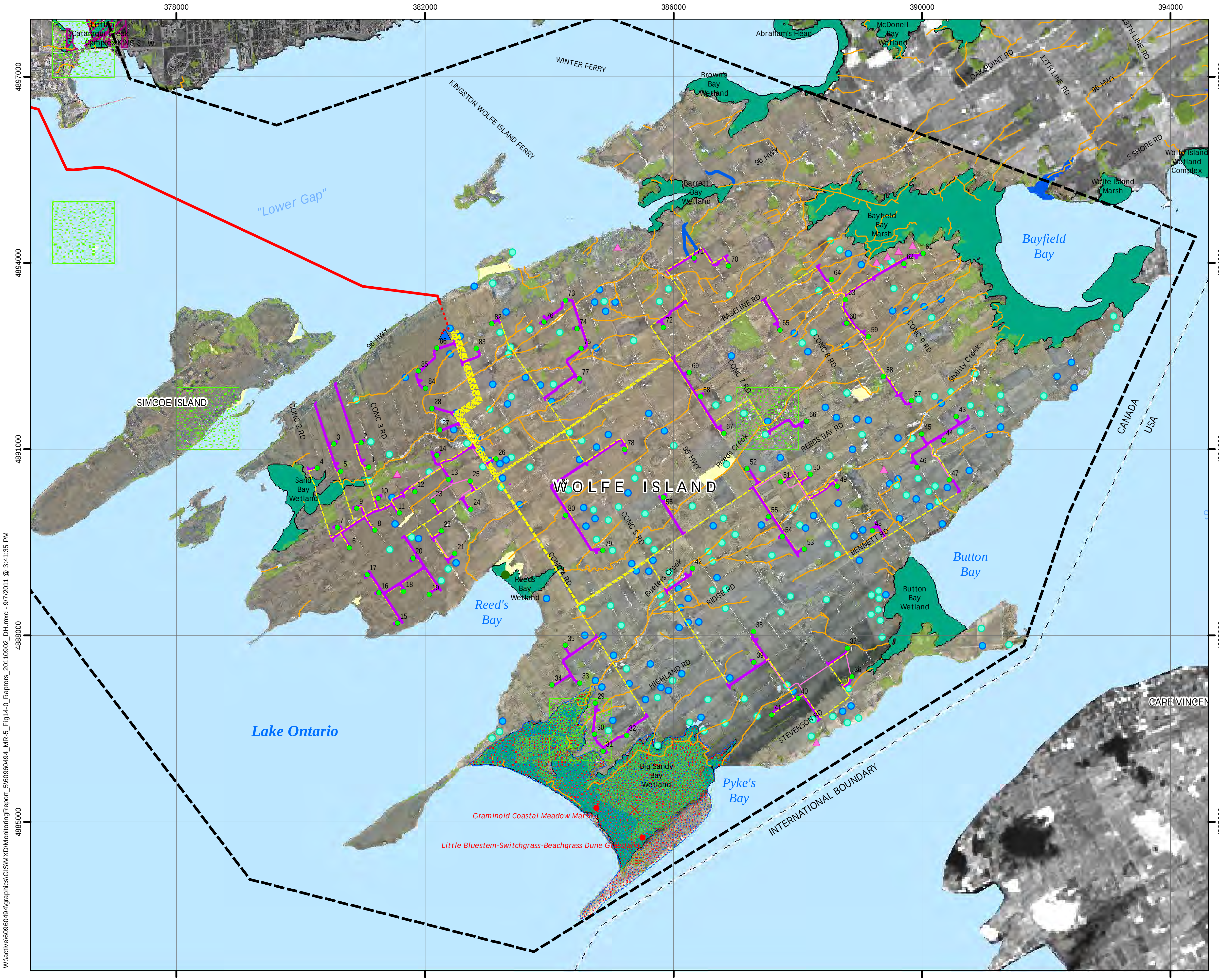
13.0

Title

Comparison of Spring Waterfowl Evening Movement 2007, 2010 and 2011

Stantec

TransAlta



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TransAlta

Stantec

0 1 2 Kilometers

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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

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
- Woodlot

Raptor Sightings 2011

- Actively Migrating
- Hunting
- Perched/ Roosting

Notes

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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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Client/Project

WOLFE ISLAND ECOPOWER CENTRE
MONITORING REPORT NO. 5

Figure No.

14.0

Title

Raptor Behavioral Driving Survey Observations

Appendix B

Tables

Table 2.1: Aerial Waterfowl Survey Sectors

Sector	Description
C7	Nine Mile Point to 10th Line near Brophy Point
C8	10th Line near Brophy Point to the tip of the island north of Port Metcalf
C9	Tip of the island north of Port Metcalf to Carpenter Point including Bayfield Bay
C10	Carpenter Point to Bear Point
C11	Bear Point to Nine Mile Point

Table 2.2: Species Composition of Waterfowl Guilds

Guild	Species
Swans	Tundra Swan (*Cygnus columbianus*), Trumpeter Swan (*Cygnus buccinator*), Mute Swan (*Cygnus olor*).
Geese	Snow Goose (*Anser caerulescens*), Brant (*Branta bernicula*), Canada Goose (*Branta Canadensis*)
Large Dabblers	American Black Duck (*Anas rubripes*), Mallard *(Anas platyrhynchos*), Northern Pintail (*Anas acuta*), Gadwall (*Anas strepera*)
Small Dabblers	Wood Duck (*Aix sponsa*), Green-winged Teal (*Anas crecca*), Blue-winged Teal (*Anas discors*), American Wigeon (*Anas Americana*), Northern Shoveler (*Anas clypeata*)
Bay Ducks	Canvasback (*Aythya valisineria*), Redhead (*Aythya americana*), Ring-necked Duck (*Aythya collaris*), Greater Scaup (*Aythya marila*), Lesser Scaup (*Aythya affinis*), Ruddy Duck (*Oxyura jamaicensis*)
Sea Ducks	Long-tailed Duck (*Clangula hyemalis*), Black Scoter (*Melanitta nigra*), Surf Scoter (*Melanitta perspicillata*), White-winged Scoter (*Melanitta fusca*), Common Eider (*Somateria mollissi*), King Eider (*Somateria spectabilis*)
Goldeneye	Bufflehead (*Bucephala albeola*), Common Goldeneye (*Bucephala clangula*)
Merganser	Hooded Merganser (*Lophodytes cucullatus*), Common Merganser (*Mergus merganser*), Red-breasted Merganser (*Mergus serrator*)

Table 3.1 Results of Searcher Efficiency Trials May – July 2011

Surveyor	number of carcasses placed	number of carcasses scavenged	number of carcasses found	Individual Se
1	27	7	16	0.800
2	25	5	17	0.850
3	22	2	16	0.800
4	15	0	10	0.667

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	0.800	36.1% (0.289)	23.6% (0.189)	29.0% (0.232)	28.6% (0.229)	31.5% (0.252)	33.2% (0.266)
2	0.850	54.8% (0.466)	40.3% (0.343)	50.1% (0.426)	47.6% (0.405)	46.0% (0.391)	39.1% (0.332)
3	0.800	6.1% (0.048)	6.5% (0.052)	16.2% (0.130)	9.6% (0.077)	13.0% (0.104)	16.0% (0.128)
4	0.667	3.0% (0.020)	29.7% (0.198)	4.7% (0.031)	14.2% (0.095)	9.5% (0.063)	11.7% (0.078)
		100% (0.823)	**100% (0.781)**	**100% (0.819)**	**100% (0.805)**	**100% (0.810)**	**100% (0.804)**

Table 3.3: Results of Scavenger Trials by Month

	Number of Test Carcasses Placed	Number Remaining - Visit 1	Number Remaining - Visit 2	Number Remaining - Visit 3	Number Remaining - Visit 4	Sc
January	23	23	20			0.935
May	40	31	24	10	7	0.686
June	40	27	8 (interference at 11)	4	2	0.603

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	2	2	2			1.000
May	4	4	4	3	3	0.933

Table 3.5: Summary of Bird Fatalities, Reporting Period

Species	Dates Observed	Turbine Number
American Tree Sparrow	16-Mar-11	68
American Woodcock	04-Apr-11	10
Blue Jay	28-Apr-11	47
Bobolink - Male	03-May-11 12-May-11 16-May-11	15, 20, 10
Common Merganser	11-May-11	79
European Starling	08-Jun-11	68
Horned Lark	27-Apr-11	40
Killdeer	01-Apr-11	44
Mallard - Male	20-May-11	6
Osprey	02-May-11	33, 59

Table 3.5: Summary of Bird Fatalities, Reporting Period

Species	Dates Observed	Turbine Number
	23-May-11	
Ovenbird	12-Apr-11	31
Red-tailed Hawk	28-Mar-11	46, 64
	01-Apr-11	
Red-winged Blackbird	17-Jun-11	58
Ring-billed Gull	08-Jun-11	54
Rough-legged Hawk	16-Mar-11	55, 77, 81
	28-Mar-11	
	11-May-11	
Savannah Sparrow	14-Jun-11	43, 63
	23-Jun-11	
Snow Bunting	11-Mar-11	37
Tree Swallow	09-Jun-11	4, 18, 43
	27-Jun-11	
	28-Jun-11	
Wild Turkey	11-Mar-11	8
Wilson's Snipe	18-May-11	11, 30, 62
	20-May-11	
	14-Jun-11	

Table 3.6: Calculation of Raptor and Vulture Mortality Rates

	c (raptors)	Ps	Sc	Se	C (raptors)
January	0	0.594	1.000	1.000	0.00
February	0	0.594	1.000	1.000	0.00
March	3	0.594	0.933	1.000	5.14
April	1	0.381	0.933	1.000	2.81
May	3	0.381	0.933	1.000	8.44
June	0	0.381	0.933	1.000	0.00
total	**7**				**16.39**
per turbine					**0.19**
per MW					**0.08**

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: Calculation of Bird Mortality Rates (Other Than Raptors and Vultures)

	c (birds)	Ps	Sc	Se	C (birds)
January	0	0.579	0.935	0.823	0.00
February	0	0.579	0.935	0.781	0.00
March	3	0.579	0.686	0.819	9.22
April	5	0.329	0.686	0.805	27.52
May	7	0.329	0.686	0.810	38.29
June	9	0.329	0.603	0.804	56.43
total	**24**				**131.46**
per turbine					**1.53**
per MW					**0.66**

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 3.8: Summary of Bat Fatalities, Reporting Period

Species	Dates Observed	Turbine Number
Bat Sp.	11-May-11	40
Big Brown Bat	20-May-11	8, 40, 58, 60, 63
	01-Jun-11	
	03-Jun-11	
	22-Jun-11	
Hoary Bat	01-Jun-11	39

Table 3.9: Calculation of Bat Mortality Rates, January – June 2010

	c (bats)	Ps	Sc	Se	C - bats
January	0	0.579	0.935	0.823	0.00
February	0	0.579	0.935	0.781	0.00
March	0	0.579	0.686	0.819	0.00
April	0	0.329	0.686	0.805	0.00
May	3	0.329	0.686	0.810	16.41
June	4	0.329	0.603	0.804	25.08
total	**7**				**41.49**
per turbine					**0.48**
per MW					**0.21**

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 3.10: Winter Raptor Survey Results, November 2010 to March 2011

Species	Survey Date										Total
	Nov-9-2010	Nov-25-2010	Dec-08-2010	Dec-21-2010	6-Jan-2011	20-Jan-2011	3-Feb-2011	17-Feb-2011	1-Mar-2011	17-Mar-2011	
Afternoon Survey											
Short-eared Owl			1			4					**5**
Turkey Vulture										2	**2**
Bald Eagle	1			1		3			1		**6**
Northern Harrier	14	15	13	16	4			2	3	8	**75**
Sharp-shinned Hawk						1					**1**
Cooper's Hawk		1				1					**2**
Red-tailed Hawk	15	4	6	9		6	4	12	11	9	**76**
Rough-legged Hawk	23	15	31	25	13	17	9	12	10	29	**184**
American Kestrel	4	1	2	1	1		2	4		1	**16**
Merlin				1							**1**
Total	57	36	53	53	18	32	15	30	25	49	**368**
Total Kilometers	68	67	68	68	68	68	68	68	68	68	**679**
Density / kilometer	0.8	0.5	0.8	0.8	0.3	0.5	0.2	0.4	0.4	0.7	**0.5**
% at WTG Blade Sweep Height	5.3%	0.0%	1.9%	1.9%	11.1%	0.0%	0.0%	0.0%	0.0%	10.2%	**3.3%**
Evening Survey											
Short-eared Owl	7	13	32	16	45	15	0	14	0	0	**142**
Total Kilometers	62	62	61	61	59	60	65	65	65	65	**625**

Table 3.10: Winter Raptor Survey Results, November 2010 to March 2011

	Survey Date										
Species	Nov-9-2010	Nov-25-2010	Dec-08-2010	Dec-21-2010	6-Jan-2011	20-Jan-2011	3-Feb-2011	17-Feb-2011	1-Mar-2011	17-Mar-2011	Total
Density / kilometer	0.1	0.2	0.5	0.3	0.8	0.3	0.0	0.2	0.0	0.0	**0.2**
% at WTG Blade Sweep Height	0.0%	30.8%	37.5%	18.8%	68.9%	0.0%	0.0%	0.0%	0.0%	0.0%	**34.7%**

Table 3.11: Maximum number of Short-eared Owls observed on any one survey in November to March 2006/2007, 2009/2010 and 2010/2011

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

Table 3.12: Comparison of total winter raptor observations, November to March 2006/2007, 2009/2010 and 2010/2011

	Total Observations November - March		
	2006/2007	**2009/2010**	**2010/2011**
Afternoon Survey			
Great Horned Owl	0	1	0
Snowy Owl	14	34	0
Short-eared Owl	39	12	5
Turkey Vulture	0	0	2
Bald Eagle	6	11	6
Northern Harrier	159	19	75
Sharp-shinned Hawk	1	0	1
Cooper's Hawk	0	1	2
Red-tailed Hawk	85	60	76
Rough-legged Hawk	119	13	184
American Kestrel	30	30	16
Merlin	2	4	1
Unidentified	0	2	0
Total	**455**	**187**	**368**
Total Kilometers	**634**	**734**	**679**
Density / kilometer	**0.72**	**0.25**	**0.54**
Evening Survey			
Short-eared Owl	83	52	142
Total Kilometers	**519**	**603**	**625**
Density / kilometer	**0.16**	**0.09**	**0.23**

Table 3.13: Summary of Kingston Area Christmas Bird Count results from 2000-2010

Species	Number of Raptors per Party Hour										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
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**
Snowy Owl	0.09	0.07	0.06	0.01	0.03	0.03	**0.06**	N/A	0.09	**0.07**	**0.01**
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**
Bald Eagle	0.20	0.10	0.04	0.08	0.08	0.13	**0.02**	N/A	0.29	**0.70**	**0.23**
Northern Harrier	0.01	0.13	0.04	0.29	0.18	0.02	**0.60**	N/A	0.18	**0.18**	**0.37**
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**
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**
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**
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**
American Kestrel	0.15	0.16	0.11	0.01	0.03	0.08	**0.10**	N/A	0.13	**0.05**	**0.17**
Merlin	0.04	0.02	0.01	0.00	0.01	0.03	**0.02**	N/A	0.02	**0.02**	**0.02**

N/A – data not available.

Bolded numbers highlight 2006, year of pre-construction monitoring, 2009 and 2010, years of post-construction monitoring.

Table 3.14: Comparison of Species Composition of Field Foraging Waterfowl: March-May 2007, 2010 and 2011

	2007	2010	2011
Canada Goose	10052	8903	16472
Cackling Goose			4
Snow Goose			52
Mallard	203	92	373
American Black Duck		4	14
Gadwall		6	
Wood Duck			2
American Wigeon			2
Northern Shoveler	7		
Northern Pintail		5	21
Green-winged Teal	3	21	53
Teal sp.	30		
Total	**10295**	**9031**	**16993**

Table 3.15: Spring 2011 Waterfowl Morning Movement

	Route*

Date	1	2	3	4	5	6	7	8	9	10	11	Other**	Total
29-Mar-11	7	2	29										38
5-Apr-11						2			63	112	63	17	257
15-Apr-11	11		14				295		113		27	3	463
19-Apr-11	9						62	7	137		4		219
26-Apr-11	25		5	15		25	130	2	112				314
3-May-11	1	3						2		1		10	17
10-May-11	24	3		5	60		17	32	1	20		15	177
17-May-11		2							8				10
Total	**77**	**10**	**48**	**20**	**60**	**27**	**504**	**43**	**434**	**133**	**94**	**45**	**1495**
% at Blade Height	**27%**	**0%**	**29%**	**0%**	**0%**	**7%**	**26%**	**5%**	**15%**	**100%**	**6%**	**47%**	**20%**

Notes: Cells represent number of individuals.

*Routes depicted on Figure 13.0

**Represents the sum of smaller flocks not following a major flight route

Table 3.16: Spring 2011 Waterfowl Evening Movement

Date	Route*

	1	2	3	4	5	6	Other**	Total
29-Mar-11		42			24			66
4-Apr-11	66		27		50			143
14-Apr-11		93		66	25		1	185
18-Apr-11			37	575			1	613
25-Apr-11	202	107	10	221		69		609
2-May-11		820	46	680	2	64	2	1614
9-May-11	18	72	2	10	280	560	1	943
16-May-11		3						3
Total	**286**	**1137**	**122**	**1552**	**381**	**693**	**5**	**4176**
% at Blade Height	**53%**	**53%**	**51%**	**50%**	**87%**	**90%**	**53%**	**61%**

Notes: Cells represent number of individuals.

*Routes depicted on Figure 14.0

**Represents the sum of smaller flocks not following a major flight route

Table 3.17: Comparison of Waterfowl Use by Sector During the Spring Season

	1999	2008	2009	2010	2011
C7	36,316	33,363	35,696	47,060	47,251
C8	121,622	33,846	31,110	39,092	37,034
C9	266,231	148,667	212,323	145,796	96,808
C10	23,054	54,425	46,492	101,349	131,815
C11	26,857	69,806	45,658	35,422	68,778
Total	**474,079**	**340,105**	**371,278**	**368,718**	**381,684**

Notes: Cells represent waterfowl days.

Table 3.18: Comparison of Waterfowl Use by Staging Area During the Spring Season

	2008	2009	2010	2011
Bayfield	62,794	158,209	52,939	57,087
Button	18,242	11,529	67,126	74,996
Pyke's	13,183	5,359	6,143	8,072
Reed's	19,905	8,593	6,705	19,937
Total	**114,124**	**183,689**	**132,913**	**160,092**

Notes: Cells represent waterfowl days.

Table 3.19: 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.

Table 3.20: 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

Table 3.21: Comparison of Breeding Densities (pairs/10ha), as measured by point count, in grassland habitat between 2006 and 2007 pre-construction and 2010 post-construction surveys

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

Table 3.22: Comparison of breeding bird densities (pairs/10ha) at three distance regimes from WTG bases, as measured by grassland paired point counts.

Species	Distance from Turbine Base		
	0-100	100-200	200-300
Bobolink	20.06	28.98	10.51
Savannah Sparrow	19.11	22.29	2.55
Red-winged Blackbird	11.46	13.69	0.00
European Starling	9.87	7.32	1.91
Song Sparrow	8.92	6.37	0.32
Yellow Warbler	6.05	4.78	0.32
Eastern Meadowlark	2.87	3.82	3.50
Grasshopper Sparrow	1.91	5.10	0.00
Eastern Kingbird	4.14	2.55	0.00
Brown-headed Cowbird	2.23	4.46	0.00
American Robin	2.87	2.87	0.00
Willow Flycatcher	2.55	1.27	0.96
American Goldfinch	2.87	0.96	0.32
Mourning Dove	1.27	2.23	0.00
American Crow	0.32	0.00	2.87
Common Grackle	2.55	0.32	0.32
Killdeer	2.23	0.32	0.32
Common Yellowthroat	1.27	1.59	0.00
Northern Harrier	0.32	0.96	0.64
Chipping Sparrow	1.27	0.64	0.00
Warbling Vireo	0.64	0.64	0.32
Mallard	0.00	1.27	0.00
Ring-necked Pheasant	0.00	0.00	1.27
Spotted Sandpiper	0.64	0.64	0.00
Baltimore Oriole	0.96	0.32	0.00
American Kestrel	0.00	0.32	0.64
Horned Lark	0.64	0.32	0.00
Gray Catbird	0.64	0.32	0.00
Field Sparrow	0.64	0.32	0.00
American Bittern	0.00	0.00	0.64
Upland Sandpiper	0.32	0.32	0.00
Northern Flicker	0.64	0.00	0.00
House Wren	0.64	0.00	0.00
Brown Thrasher	0.32	0.00	0.32

Table 3.23: Comparison of Breeding Bird density (pairs/10ha) between pre-construction (2007) and post-construction (2010 and 2011) grassland area searches across all sectors

	Southeast Area Search	Northwest Area Search

	Pre-con	Post-con		Pre-con	Post-con	
	2007	2010	2011	2007	2010	2011
Northern Harrier	0.1	0.1	0.2	0.1	0.1	0.1
Killdeer	0.4	0.3	0.2	0.1	0.3	0.8
Upland Sandpiper	0.2	0.1	0.0	0.4	0.5	0.5
Wilson's Snipe	0.1	0.0	0.1	0.1	0.0	0.1
Eastern Kingbird	0.6	0.3	0.4	0.3	0.5	0.3
Horned Lark	0.8	0.2	0.2	0.0	0.3	0.2
Field Sparrow	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
Savannah Sparrow	9.3	9.7	7.3	17.5	15.1	12.7
Grasshopper Sparrow	0.3	0.2	0.1	0.7	0.1	0.1
Bobolink	4.3	9.4	6.2	22.0	16.6	15.2
Eastern Meadowlark	0.4	1.2	0.1	0.5	0.2	0.1

Table 3.24: Comparison of Breeding Bird density (pairs/10ha) between pre-construction (2007) and post-construction (2010 and 2011) grassland area searches in only sectors with grassland habitat (i.e. hay or pasture).

	Southeast Area Search			Northwest Area Search		
	Pre-con	Post-con		Pre-con	Post-con	
	2007	2010	2011	2007	2010	2011
Northern Harrier	0.1	0.1	0.2	0.1	0.1	0.1
Killdeer	0.1	0.2	0.1	0.1	0.1	0.3
Upland Sandpiper	0.1	0.1	0.0	0.4	0.3	0.1
Wilson's Snipe	0.1	0.0	0.1	0.1	0.0	0.1
Eastern Kingbird	0.8	0.4	0.4	0.3	0.6	0.3
Horned Lark	0.1	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	0.1	0.0	0.0	0.0	0.0	0.0
Savannah Sparrow	11.6	11.6	7.6	17.5	18.4	20.2
Grasshopper Sparrow	0.4	0.2	0.1	0.7	0.1	0.2
Bobolink	5.7	11.1	6.8	22.0	22.6	27.2
Eastern Meadowlark	0.5	1.5	0.1	0.5	0.3	0.2

Table 3.25: 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

Table 3.26: 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

Table 3.26: 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
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

Table 3.27: Comparison of Forest Breeding Species Densities (pairs/10ha) in Woodland Habitat between pre-construction 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

Table 3.27: Comparison of Forest Breeding Species Densities (pairs/10ha) in Woodland Habitat between pre-construction post-construction surveys (2010 and 2011)

Species	Pre-construction Results (2008)	Post-construction Results (2010)	Post-construction Results (2011)
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

Table 3.28: Summary of species and abundance observations during raptor behavioural driving surveys

Week of	7-Sep-10	8-Sep-10	30-Oct-10	1-Nov-10	15-Apr-11	16-Apr-11	11-May-11	12-May-11	Total
Turkey Vulture	8	14			2		13	23	60
Osprey					1	2		2	5
Northern Harrier	12	13	15	16	11	3	7	4	81
Sharp-shined Hawk								1	1
Buteo sp.							1		1
Red-tailed Hawk			15	18	6	12	3	4	58
Rough-legged Hawk			3	22	13	14	7	9	68
American Kestrel	25	25	3	6	5	5	1	1	71
Merlin		2							2
Peregrine Falcon	1								1
Total	**46**	**54**	**36**	**62**	**38**	**36**	**32**	**44**	**348**

Table 3.29: Summary of Height observations during raptor behavioural driving surveys

Species	Turkey Vulture	Osprey	Northern Harrier	Sharp-shined Hawk	Buteo sp.	Red-tailed Hawk	Rough-legged Hawk	American Kestrel	Merlin	Peregrine Falcon	Average
Below Blade	68.3%	80.0%	96.3%	0.0%	100.0%	96.5%	92.8%	98.6%	100.0%	100.0%	90.8%
At Blade	31.7%	20.0%	3.7%	100.0%	0.0%	3.5%	7.2%	1.4%	0.0%	0.0%	9.2%
Above Blade	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 3.30: Summary of behaviours observed during raptor behavioural driving surveys

Species	Turkey Vulture	Osprey	Northern Harrier	Sharp-shinned Hawk	Buteo sp.	Red-tailed Hawk	Rough-legged Hawk	American Kestrel	Merlin	Peregrine Falcon	Total
Flying											
Thermal Soaring	13		1	1		1	2				**18**
Flapping Flight			3			5	5	2			**15**
Pursing flight (likely migrating)	2		2			2		1			**7**
Hunting											
Hunting in flight	42	1	66			13	17	27			**166**
Hover hunting			1				11	1			**13**
Breeding Behaviour											
Courtship Display			2								**2**
Perched on or near nest		3				5					**8**
Mobbing											
Mobbing			1			2					**3**
Perched											
Perched	3	1	5		1	30	33	40	2	1	**116**
Total	**60**	**5**	**81**	**1**	**1**	**58**	**68**	**71**	**2**	**1**	**348**

* Note, totals may include same individuals observed and counted on different days.

Table 3.31: Summary of raptor nests observed and proximity to closest recorded fatalities

Nest #	Species	Location of nest	Activity at nest	Closest recorded Fatalities
1	Osprey	Located off Conc. 4; situated on the tower of the projects Operations and Maintenance building.	Nest has been active in 2010 and 2011. In 2010, nest suffer wind damage and as a result, was unsuccessful. However, nest was successful in 2011.	No Osprey fatalities were observed in proximity to the nest. Distance between the nest and closest turbines with Osprey fatalities were;
				- 5.7 km; May 2, 2011
				- 6.6 km; May 23, 2011
				- 8.1 km; May 3, 2010
2	Osprey	Located on platform on Joy Rd in northeastern corner of study area.	Success of nest have not been monitoring, but has been active each year during both pre and post-construction monitoring	No Osprey fatalities were observed in proximity to the nest. Distance between the nest and closest turbines with Osprey fatalities were;
				- 4.2 km; May 23, 2011
				- 6.3 km, May 3, 2010
				- 9.0 km; May 2, 2011
3	Red-tailed Hawk	Located near the sharp bends in Conc. 4 in a cluster of trees.	Nest was first discovered in 2009 and has been active during each year of post-construction monitoring. Nesting success was not monitored	Distance between the nest and closest turbines with Red-tailed Hawk fatalities were;
				- 0.25 km; April 15, 2010 (Adult)
				- 1.4 km; July 14, 2009 (Adult)
				- 2.0 km; March 29, 2011 (Adult)
4	Red-tailed Hawk	Located in a cluster of trees near Conc. 5 and Reed's Bay Rd.	Nest was discovered and active in spring of 2011. Activity of nest in previous year is unknown.	Distance between the nest and closest turbines with Red-tailed Hawk fatalities were;
				- 2.0 km; Feb 8, 2010 (age unknown) and April 9, 2010 (Adult)
				- 2.3 km; Nov 17, 2009 (Adult)
5	Red-tailed Hawk	Located in a cluster of trees at the south end of Conc. 5.	Nest was discovered and active in spring of 2011. Activity of nest in previous year is	Distance between the nest and closest turbines with Red-tailed Hawk fatalities were;

Table 3.31: Summary of raptor nests observed and proximity to closest recorded fatalities

Nest #	Species	Location of nest	Activity at nest	Closest recorded Fatalities
			unknown.	- 3.8 km; Feb 8, 2010 (age unknown) and April 9, 2010 (Adult)
				- 3.7 km; Nov 17, 2009 (Adult)

Table 3.32: Summary of percent of time spent at each behaviour type, as observed in raptor behavioural observation study

Behaviour	Thermal Soaring	Flapping	Gliding	Hovering	Perched	Total
Below Blade	2.8%	7.5%	4.6%	0.8%	62.7%	78.4%
At Blade	**8.0%**	**5.8%**	**6.5%**	**0.0%**	**0.0%**	**20.5%**
Above Blade	0.5%	0.1%	0.3%	0.0%	0.2%	1.1%
Total % of time at each behaviour	11.3%	13.4%	11.4%	0.9%	63.0%	100.0%
Total amount of time (min)	590.0	697.5	594.5	46.5	3280.0	5208.5

Table 3.33: Comparison of wind speed and percent of time spent in each behaviour, as observed in raptor behavioural observation study

Wind Speed (m/s)	1 - 2.9	3 - 4.9	5 - 6.9	7 - 8.9	9 - 11	Overall
Thermal Soaring	2.9%	11.5%	14.3%	9.7%	14.1%	11.3%
Flapping	11.4%	12.6%	14.2%	23.3%	20.0%	13.4%
Gliding	3.3%	13.2%	9.2%	31.6%	17.8%	11.4%
Hovering	0.2%	0.7%	1.4%	1.2%	0.0%	0.9%
Perhced	82.2%	62.0%	60.9%	34.2%	48.1%	63.0%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 3.34: Comparison of wind speed and percent of time spent at each height, as observed in raptor behavioural observation st

Wind Speed (m/s)	1 - 2.9	3 - 4.9	5 - 6.9	7 - 8.9	9 - 11	Overall
Below Blade	95.9%	76.3%	76.8%	72.6%	60.0%	78.4%
At Blade	**3.3%**	**22.8%**	**21.5%**	**27.4%**	**40.0%**	**20.5%**
Above Blade	0.8%	0.9%	1.7%	0.0%	0.0%	1.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Total amount of time (min)	616.5	2698.5	1656.5	169.5	67.5	5208.5

Table 3.35: Comparison of temperature and percent of time spent at each height, as observed in raptor behavioural observation st

Temperature (ºC)	0 - 4	5 - 9	10 - 14	15 - 19	20+	Overall
Below Blade	95.3%	91.0%	69.6%	68.5%	71.3%	78.4%
At Blade	**4.7%**	**6.9%**	**29.5%**	**30.7%**	**28.7%**	**20.5%**
Above Blade	0.0%	2.0%	0.9%	0.8%	0.0%	1.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	
Total amount of time (min)	339.5	1770.5	1188	1380	530.5	5208.5

Table 3.36: Comparison of cloud cover and percent of time spent at each height, as observed in raptor behavioural observation study

Cloud Cover (%)	0-24	25-49	50-74	75-100	Overall
Below Blade	77.6%	76.3%	72.6%	90.0%	78.4%
At Blade	**22.1%**	**22.0%**	**25.4%**	**9.5%**	**20.5%**
Above Blade	0.3%	1.7%	2.0%	0.5%	1.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Total amount of time (min)	1589	980.5	1555	1084	5208.5

Table 3.37: Comparison of precipitation and percent of time spent at each height, as observed in raptor behavioural observation study

Precipitation	None	Light	Moderate	Heavy	Overall
Below Blade	74.6%	100.0%	99.9%	100.0%	78.4%
At Blade	**24.1%**	**0.0%**	**0.1%**	**0.0%**	**20.5%**
Above Blade	1.3%	0.0%	0.0%	0.0%	1.1%
Total	100.0%	100.0%	100.0%	100.0%	100.0%
Total amount of time (min)	4428	188	552.5	40	5208.5

Table 3.38: Comparison of distance to shoreline and percent of time spent at each height, as observed in raptor behavioural observation study

Distance to shoreline (km)	0 - 1.9	2 - 3.9	4 - 5.9	Overall
Below Blade	75.1%	88.8%	92.7%	78.4%
At Blade	**24.0%**	**9.2%**	**7.3%**	**20.5%**
Above Blade	1.0%	1.9%	0.0%	1.1%
Total	100.0%	100.0%	100.0%	100.0%
Total amount of time (min)	3996.5	984.5	227.5	5208.5

Table 3.39: Comparison of distance to nearest turbine and percent of time spent at each height, as observed in raptor behavioural observation study

Distance to turbine (m)	0 - 499	500 - 999	1000+	Overall
Below Blade	81.3%	76.9%	77.6%	78.4%
At Blade	**16.3%**	**22.6%**	**21.8%**	**20.5%**
Above Blade	2.3%	0.5%	0.7%	1.1%
Total	100.0%	100.0%	100.0%	100.0%
Total amount of time (min)	3996.5	984.5	227.5	5208.5

Table 3.40: Summary of Notifications - Reporting Period

Notification No.	Date	Period	Notification
1	March 29	March 16 - 28	High Annual Mortality - Raptors (2)
2	April 4	March 29 – April 1	High Annual Mortality - Raptors (2)
3	May 9	May 3	Mortality of Species at Risk (Bobolink - male)
4	May 16	May 2 - 11	High Annual Mortality - Raptors (2)
5	May 16	May 12	Mortality of Species at Risk (Bobolink - male)
6	May 19	May 16	Mortality of Species at Risk (Bobolink - male)

Appendix C

Mortality Monitoring Schedule

WEEK	SUBSET	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1	Subset A		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	(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 D

Survey Conditions

Survey Date	Survey Type	Weather	Start Time	End Time
06-Jan-11	Winter Raptor Survey	Temp: -5 C Wind: 3 Cloud: 100% PPT: periods of snow, 3 cm snow fall in last 24 hours	2:30pm	4:25pm
06-Jan-11	Winter Short-eared Owl	Temp: -5 C Wind: 3 Cloud: 95% PPT: none, 3 cm snow fall in last 24 hours	4:15pm	5:05pm
20-Jan-11	Winter Short-eared Owl	Temp: -10 C Wind: 2 NW Cloud 100% PPT: none, 3 cm snow fall in last 24 hours, average snow depth of 25 cm	4:00pm	5:15pm
20-Jan-11	Winter Raptor Survey	temp: -10 C Wind: 2 NW Cloud: 90% PPT: none, 3cm of snow in last 24 hours, average snow depth of 25cm	10:00am	2:30pm
03-Feb-11	Winter Short-eared Owl	Temp: -10 C Wind: 5 SW Cloud: 30% PPT: none, blizzard in last 24 hours, average snow peth of 15cm	4:30pm	6:00pm
03-Feb-11	Winter Raptor Survey	Temp: -3 C Wind: 3-4 Cloud: 80% PPT: light snow, 5cm of snow in last 24 hours, average dnow depth of 20cm	2:20pm	4:20pm
17-Feb-11	Winter Short-eared Owl	Temp: 5 C Wind: 3 SW Cloud: 100% PPT: none, avergae snow depth of 15 cm	4:09pm	6:05pm
17-Feb-11	Winter Raptor Survey	Temp: 5 C Wind: 3 SW Cloud: 100% PPT: drizzle, average snow depth of 15cm	2:30pm	4:45pm
01-Mar-11	Winter Short-eared Owl	Temp: -6 C Wind: 3 SW Cloud: 0% PPT: none, average snow depth of 0-5cm	5:30pm	6:20pm
01-Mar-11	Winter Raptor Survey	Temp: -1 C Wind: 4 SW Cloud: 40% PPT: none, average snow depth of 0-10cm	2:30pm	5:00pm
17-Mar-11	Winter Short-eared Owl	Temp: 11 C Wind: 1 Cloud: 90% PPT: none, patchy snow on ground	6:25pm	7:45pm
17-Mar-11	Winter Raptor Survey	Temp: 8-11 C Wind: 1 SW Cloud: 80% PPT: rain, rain in last 24 hours	3:25pm	5:30pm
24-Mar-11	Aerial Waterfowl Staging	Temp: 4 C Wind: 2 Cloud: 80% PPT: none	4:10pm	5:00pm
24-Mar-11	Waterfowl Migration	Temp: -5 C Wind: 1 Cloud: 70% PPT: none	6:40pm	8:00pm
24-Mar-11	Waterfowl Migration	Temp: -2 C Wind: 3 Cloud: 75% PPT: none	2:40pm	6:00pm
25-Mar-11	Waterfowl Migration	Temp: -5 to -13 C Wind: 2 Cloud: 5% PPT: none	6:50am	8:00am
29-Mar-11	Waterfowl Migration	Temp: -5 Wind: 0 Cloud: 0 PPT: none	6:35am	7:35am
29-Mar-11	Waterfowl Migration	Temp: 4 C Wind: 1 Cloud: 50% PPT: none	NA	NA
29-Mar-11	Waterfowl Migration	Temp: 6 C Wind: 1 Cloud 90% PPT: none	3:20pm	5:15pm
04-Apr-11	Waterfowl Migration	Temp: 9 C Wind: 5-6 Cloud: 100% PPT: none	7:05pm	8:05pm
05-Apr-11	Aerial Waterfowl Staging	Temp: 3 C Wind: 3 Cloud: 20% PPT: none, rain in last 24 hours	9:25am	10:15am
05-Apr-11	Waterfowl Migration	Temp: 3 C Wind: 6 Cloud: 100% PPT: rain and snow, rain in last 24 hours	6:45am	7:45am
05-Apr-11	Waterfowl Migration	Temp: 3 C Wind:1 Cloud 100% PPT: none, rain in last 24 hours	9:20am	12:25pm
14-Apr-11	Waterfowl Migration	Temp: 9 C Wind: 4 NE Cloud: 10% PPT: none	7:15pm	8:15pm
15-Apr-11	Waterfowl Migration	Temp: -2 C Wind: 5 NE Cloud: 10% PPT: none	6:00am	7:00am
15-Apr-11	Waterfowl Migration	Temp: 0 C Wind: 5 NE Cloud: 10% PPT: none	7:30am	11:45am
18-Apr-11	Aerial Waterfowl Staging	Temp: 2 C Wind: 4 Cloud: 90% PPT: none	1:25pm	2:10pm
18-Apr-11	Waterfowl Migration	Temp: 1-2 C Wind: 3-4 W Cloud: 50-70% PPT: none, rain in last 24 hours	7:40pm	8:30pm
18-Apr-11	Waterfowl Migration	Temp: 2 C Wind: 4-5 SW Cloud: 100% PPT: none, rain in last 24 hours	4:30pm	7:00pm
19-Apr-11	Waterfowl Migration	Temp: -2 C Wind: 0-1 E Cloud: 80% PPT: none	6:15am	7:15am
25-Apr-11	Waterfowl Migration	Temp: 8 C Wind: 0 Cloud: 100% PPT: rain, rain in last 24 hours	7:35pm	8:35pm
26-Apr-11	Waterfowl Migration	Temp: 7-8 C Wind: 3-4 Cloud: 100% PPT: spitting, rain in last 24 hours	5:55am	7:05am
26-Apr-11	Waterfowl Migration	Temp: 8-10 C Wind: 3 Cloud: 100% PPT: rain, rain in last 24 hours	8:42am	12:30pm
02-May-11	Waterfowl Migration	Temp: 12 C Wind: 1 Cloud: 90% PPT: none	7:45pm	8:51pm
03-May-11	Waterfowl Migration	Temp: 7 C Wind: 2 Cloud: 100% PPT: Light intermittent rain, rain in last 24 hours	5:45am	6:45am
03-May-11	Waterfowl Migration	Temp: 8 C Wind: 3 Cloud: 100% PPT: rain, rain in last 24 hours	9:20am	12:12pm
04-May-11	Aerial Waterfowl Staging	Temp: 6 C Wind: 1-2 Cloud: 100% PPT: light rain, rain in last 24 hours	7:15am	8:20am
09-May-11	Waterfowl Migration	Temp: 13 C Wind: 1 Cloud: 0% PPT: none	7:58pm	8:58pm

Survey Date	Survey Type	Weather	Start Time	End Time
10-May-11	Breeding Waterfowl	Temp: 17 C Wind: 3 Cloud: 10% PPT: none	12:30pm	5:00pm
10-May-11	Waterfowl Migration	Temp: 6 C Wind: 1 Cloud: 100% PPT: none	5:30am	6:30am
11-May-11	Waterfowl Migration	Temp: 8 C Wind: 1 Cloud: 10% PPT: none	7:04am	10:16am
16-May-11	Waterfowl Migration	Temp: 10 C Wind: 5 Cloud: 100% PPT: rain, rain in last 24 hours	8:45pm	9:10pm
16-May-11	Waterfowl Migration	Temp: 10 C Wind: 4 Cloud: 100% PPT: light rain, rain in last 24 hours	2:25pm	4:00pm
17-May-11	Breeding Waterfowl	Temp: 10 C Wind: 5 Cloud: 100% PPT: none, rain in last 24 hours	8:30am	10:45am
17-May-11	Waterfowl Migration	Temp: 7 C Wind: 5 Cloud: 100% PPT: none, rain in last 24 hours	6:30am	6:50am
24-May-11	Waterfowl Migration	Temp: 10 C Wind: 4 Cloud: 95% PPT: none	5:24am	6:24am
24-May-11	Waterfowl Migration	Temp: 15 C Wind: 4 Cloud: 40% PPT: none, rain in last 24 hours	8:10pm	9:10pm
24-May-11	Waterfowl Migration	Temp: 23 C Wind: 3 Cloud: 45% PPT: none, rain in last 24 hours	4:43pm	6:56pm
25-May-11	Aerial Waterfowl Staging	Temp: 19 C Wind: 1 Cloud: 10% PPT: none	3:15pm	4:05pm
30-May-11	Breeding Bird - Woodland Point Counts and Area Search	Temp: 15-19 C Wind: 1-2 Cloud 40-60% PPT: none	6:00am	9:01am
01-Jun-11	Breeding Bird - Marsh and Grassland Point Counts and Area Search	Temp: 15-19 C Wind: 2-3 Cloud: 50% PPT: none	6:09am	9:55am
03-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 11 C Wind: 3-4 WNW Cloud: 80-100% PPT: none, rain in last 24 hours	6:13am	9:37am
04-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 12-13 C Wind: 1-2 Cloud: 100% PPT: none	6:15am	9:17am
05-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 14-15 C Wind: 0 Cloud: 100% PPT: none	5:57am	9:32am
06-Jun-11	Breeding Bird - Paired Grassland Point Counts and Area Searches	Temp: 14-17 C Wind: 0-1 Cloud: 0%, Morning Fog PPT: none	6:04am	9:40am
06-Jun-11	Winter Raptor Survey	Temp: -5 C Wind: 3 S Cloud: 100% PPT: snow, 5cm of snow in last 24 hours, average snow peth of 10cm	2:30pm	4:25pm
07-Jun-11	Breeding Bird - Grassland Point Counts and Area Searches	Temp: 15 C Wind: 1 Cloud: 5% PPT: none	5:42am	9:28am
07-Jun-11	Breeding Bird - Grassland Area Search	Temp: 18 C Wind: 1 Cloud: 5% PPT: none	5:30am	9:30am
08-Jun-11	Breeding Bird - Grassland Area Search	Temp: 18 C Wind: 4 Cloud: 5%, fog PPT: none	5:00am	9:32am
09-Jun-11	Breeding Bird - Marsh Point Counts and Area Search	Temp: 19 C Wind: 3-4 SW Cloud: 95% PPT: none, thunderstorms in last 24 hours	6:00am	8:40am
10-Jun-11	Breeding Bird - Grassland Point Counts and Area Searches	Temp: 14-17 C Wind: 3 Cloud: 50-90% PPT: none, rain in last 24 hours	6:00am	8:53am
12-Jun-11	Breeding Bird - Grassland Point Counts and Area Searches	Temp: 15-18 C Wind: 3 WNW Cloud: 30-50% PPT: none, rain in last 24 hours	5:51am	8:45am
17-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 16-18 C Wind: 2-3 Cloud: 30-50 PPT: none	5:26am	9:34am
18-Jun-11	Breeding Bird - Grassland Point Counts	Temp:17-20 C Wind: 1 Cloud: 60% PPT: none	5:26am	9:15am
21-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 15-18 C Wind: 0-1 Cloud: 0% PPT: none	5:19am	9:13am
22-Jun-11	Breeding Bird - Woodland Point Counts and Area Search	NA	5:30am	9:43am

Survey Date	Survey Type	Weather	Start Time	End Time
23-Jun-11	Breeding Bird - Wetland Point Counts and Area Search	Temp: 18 C Wind: 2-3 E Cloud 100% PPT: drizzle, rain in last 24 hours	5:25am	9:30am
24-Jun-11	Breeding Bird - Grassland Point Counts and Area Searches	Temp: 16-18 C Wind: 3-4 SW Cloud: 70-90% PPT: none	6:19am	9:00am
24-Jun-11	Breeding Bird - Grassland Area Search	Temp: 16-18 C Wind: 3-4 SW Cloud: 70-90% PPT: none	5:25am	9:00am
25-Jun-11	Breeding Bird - Grassland Area Search	Temp: 16-18 C Wind: 4-5 Cloud: 100% PPT: none, rain in last 24 hours	5:22am	10:15am
26-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 16-18 C Wind: 2-3 Cloud: 100% PPT: none, rain in last 24 hours	5:17am	9:22am
27-Jun-11	Breeding Bird - Grassland Point Counts	Temp: 17-20 C Wind: 2-3 SW Cloud: 20% PPT: none, rain in last 24 hours	5:18am	9:10am

Survey Date	Temp (° C)	Wind Speed	Cloud	PPT	Overnight PPT	Start Time	End Time
03-Jan-11	1	4	Partly	None		12:10 PM	2:51 PM
03-Jan-11						8:25 AM	10:45 AM
04-Jan-11						9:57 AM	12:13 PM
04-Jan-11	-2	4-6	Overcast	Snow	Snow	10:20 AM	1:02 PM
05-Jan-11	-5		None	None		8:00 AM	11:33 AM
05-Jan-11	-5	2-4	None	None		12:32 PM	3:20 PM
06-Jan-11						8:47 AM	11:07 AM
06-Jan-11	-6	2-4	Overcast	Light Snow		10:40 AM	1:05 PM
10-Jan-11						9:16 AM	11:44 AM
10-Jan-11	-7	2-4	Partly	None		12:25 PM	2:53 PM
11-Jan-11						9:11 AM	11:55 AM
11-Jan-11	-8	3-4	Overcast	Light Snow		12:12 PM	2:46 PM
12-Jan-11						10:00 AM	11:58 AM
12-Jan-11	-7	4-5	Overcast	Snow		11:10 AM	1:28 PM
13-Jan-11	-8	1-2	Overcast	None		12:25 PM	2:45 PM
14-Jan-11	-8	1-2	Partly	None		12:25 PM	2:43 PM
17-Jan-11	-24	4	None			9:19 AM	11:40 AM
17-Jan-11	-17	1-3	None	None		12:13 PM	2:48 PM
18-Jan-11	0	4-5	Overcast	Freezing Rain		11:20 AM	1:32 PM
18-Jan-11	-3	2-4	Overcast			1:35 PM	3:59 PM
19-Jan-11	-12	4-5	Overcast	Snow	Snow	10:21 AM	12:54 PM
19-Jan-11	-14	4	Overcast	Snow		8:16 AM	11:54 AM
21-Jan-11	-4	1-3	Overcast			1:25 PM	3:51 PM
21-Jan-11	-3	0-1	Overcast			1:28 PM	3:41 PM
24-Jan-11	-20	2-4	Partly			11:10 AM	1:26 PM
24-Jan-11	-26	2	Overcast			9:16 AM	10:38 AM
25-Jan-11	-10	1-3	Overcast	Light Snow		11:25 AM	2:08 PM
25-Jan-11	-12	1	Overcast	Snow		10:09 AM	12:06 PM
26-Jan-11	-3	1-3	Overcast	Light Snow		12:35 PM	2:33 PM
27-Jan-11	-5	1	Overcast			9:03 AM	11:18 AM
27-Jan-11	-4	1-3	Overcast			11:35 AM	1:44 PM
31-Jan-11	-19	2-4	Partly			10:30 AM	1:06 PM
31-Jan-11	-25	2	None			9:16 AM	1:30 PM
1-Feb-11	-11	3-4	Overcast	Snow		11:25 AM	1:49 PM
1-Feb-11	-25	2	None			8:12 AM	10:12 AM
2-Feb-11						7:45 AM	9:35 AM
3-Feb-11	-12	1-3	Partly	Flurries		11:35 AM	2:03 PM
4-Feb-11	-4	4	Overcast			11:34 AM	1:59 PM
7-Feb-11	-2					8:00 AM	1:30 PM
7-Feb-11						10:35 AM	11:29 AM
8-Feb-11	-10					7:45 AM	3:05 PM
9-Feb-11	-11	6+	Overcast	Snow			
9-Feb-11	-12	4	Overcast	Snow		11:06 AM	1:58 PM
10-Feb-11	-11	6+	Overcast	Snow			
10-Feb-11	-15	1				10:26 AM	12:22 PM
11-Feb-11	-7	2-3	Overcast			12:20 PM	1:42 PM
11-Feb-11	-7	2-4	Overcast	Light Snow			
14-Feb-11	4	6+	Overcast			11:10 AM	11:34 AM
14-Feb-11	4	6+	Overcast			9:25 AM	9:35 AM
14-Feb-11	3	5	Overcast			9:22 AM	1:24 PM
15-Feb-11	-9	1-3	None			2:48 PM	4:50 PM
15-Feb-11	-10	1-2	None			3:05 PM	5:06 PM
16-Feb-11	-3		Overcast			8:40 AM	12:55 PM

Survey Date	Temp (° C)	Wind Speed	Cloud	PPT	Overnight PPT	Start Time	End Time
16-Feb-11	2	4	Overcast			1:24 PM	3:29 PM
17-Feb-11	-6	3	None			8:10 AM	10:25 AM
18-Feb-11	4	5	Overcast	Rain		8:39 AM	12:07 PM
18-Feb-11	7	6+	None			1:29 PM	2:49 PM
18-Feb-11	8	5-6	None			1:30 PM	2:51 PM
21-Feb-11	-16	4				8:16 AM	9:42 AM
21-Feb-11	-12	4-6	None			1:10 PM	3:37 PM
22-Feb-11	-9	2-4	None			1:16 PM	3:26 PM
22-Feb-11	-8					7:45 AM	3:50 PM
23-Feb-11						11:10 AM	1:39 PM
23-Feb-11	-3					8:00 AM	10:55 AM
24-Feb-11	-10	4	Overcast	Snow		8:11 AM	10:42 AM
25-Feb-11	-8	4-6+	Overcast	Snow		11:21 AM	1:42 PM
28-Feb-11	2	1-3	Overcast	Rain		10:23 AM	1:06 PM
28-Feb-11	3		Overcast	Rain		8:00 AM	10:50 AM
1-Mar-11	-10	4	Overcast	Snow		8:39 AM	5:15 PM
1-Mar-11	-4	1-3	None			9:19 AM	11:10 AM
1-Mar-11	-4	1-3	None			9:20 AM	11:10 AM
2-Mar-11	-3	5	Overcast			8:07 AM	11:03 AM
2-Mar-11	-3	4-6+	Partly	Flurries		11:15 AM	1:31 PM
3-Mar-11	-8	2	None			9:02 AM	11:23 AM
3-Mar-11	-9	1-2	None			11:20 AM	1:13 PM
7-Mar-11	-8	4				7:27 AM	10:42 AM
7-Mar-11	-7	2-4	None			10:25 AM	1:00 PM
8-Mar-11	-8	4				8:21 AM	11:32 AM
8-Mar-11	-6	3-4	None			10:15 AM	12:54 PM
9-Mar-11	-3	4	Overcast			10:27 AM	1:07 PM
9-Mar-11	-4	3-4	Overcast			10:28 AM	1:07 PM
10-Mar-11	5	1-2	Overcast	Light Rain		2:44 PM	5:29 PM
10-Mar-11	4	3				8:59 AM	3:10 PM
11-Mar-11	7	4	Overcast			1:20 PM	4:14 PM
11-Mar-11	5	4	Overcast			8:03 AM	10:34 AM
14-Mar-11	3	3-4	None			11:10 AM	2:07 PM
14-Mar-11						9:02 AM	12:03 PM
15-Mar-11						8:38 AM	11:13 AM
16-Mar-11						7:48 AM	11:16 AM
15-Mar-11	6	2-4	None			1:44 PM	4:13 PM
16-Mar-11	5	4-6	Overcast	Light Rain		11:33 AM	2:17 PM
17-Mar-11	8	4-6	None			12:10 PM	3:05 PM
17-Mar-11	9	4	Light			2:50 PM	5:25 PM
18-Mar-11	12	4-6	None			12:08 PM	3:16 PM
18-Mar-11	10	4-6	None			2:50 PM	5:32 PM
21-Mar-11	4	4-6	Overcast	Snow/Rain Mix		12:13 PM	2:51 PM
22-Mar-11	4	2-4	Overcast			11:23 AM	2:09 PM
23-Mar-11	-5	4-6	Overcast			10:18 AM	1:21 PM
24-Mar-11	-3	4	None			9:21 AM	12:07 PM
24-Mar-11	-3	4	None			9:18 AM	12:12 PM
25-Mar-11	-3	4	None			10:20 AM	1:19 PM
25-Mar-11						12:35 PM	3:05 PM
28-Mar-11	-2	4	None			8:42 AM	12:09 PM
28-Mar-11	-2	3-4	None			10:24 AM	1:14 PM
29-Mar-11	-2	2	Overcast			8:45 AM	11:44 AM
29-Mar-11	2	4	Overcast			10:18 AM	12:52 PM

Survey Date	Temp (° C)	Wind Speed	Cloud	PPT	Overnight PPT	Start Time	End Time
30-Mar-11	-3	1	None			6:55 AM	9:43 AM
30-Mar-11	8	2-4	None			2:40 PM	5:55 PM
31-Mar-11	2	2-4	Overcast			10:18 AM	1:08 PM
31-Mar-11						8:00 AM	10:56 AM
1-Apr-11	4	1	Overcast	Light Rain		9:00 AM	12:46 PM
1-Apr-11	4	3-4	Overcast	Light Rain		10:28 AM	1:21 PM
4-Apr-11	7	5	Overcast	Rain		7:48 AM	11:19 AM
4-Apr-11	4	4-6	Overcast	Rain		10:18 AM	12:50 PM
5-Apr-11	5	4-6	Overcast	Light Rain		10:15 AM	12:52 PM
5-Apr-11	4	5	Overcast	Rain		9:51 AM	1:08 PM
6-Apr-11						10:15 AM	1:49 PM
6-Apr-11	3	4	Overcast	Light Snow (Trace)		10:14 AM	1:10 PM
7-Apr-11						12:30 PM	3:31 PM
7-Apr-11	7	2-4	Partly			12:10 PM	2:57 PM
8-Apr-11	9	2-4	Overcast			11:18 AM	2:16 PM
8-Apr-11						7:49 AM	10:50 AM
11-Apr-11	11			Light Rain		8:00 AM	10:33 AM
11-Apr-11	14	4-6+	Partly	Periodic Light Rain		10:09 AM	1:06 PM
12-Apr-11	7	3-4	Partly			9:15 AM	11:58 AM
12-Apr-11	8	3-4	Partly			9:25 AM	11:57 AM
13-Apr-11	4	4	Overcast	Rain		8:45 AM	12:06 PM
13-Apr-11	8	4	Overcast	Light Rain		11:20 AM	2:24 PM
14-Apr-11	3	4	Overcast			8:32 AM	11:17 AM
14-Apr-11	8	4-6	Partly			11:20 AM	2:18 PM
15-Apr-11						9:21 AM	2:44 PM
15-Apr-11	6	4-6	None			12:23 PM	1:43 PM
15-Apr-11	8	4-5	None			4:00 PM	5:21 PM
18-Apr-11						8:39 AM	12:08 PM
18-Apr-11	6	3-4	Overcast			10:13 AM	12:46 PM
19-Apr-11						7:02 AM	10:12 AM
19-Apr-11	8	4-6	None			10:16 AM	12:57 PM
20-Apr-11	8	4-6	Overcast	Rain	Light Fog	4:10 PM	5:42 PM
20-Apr-11	7	4-6	Overcast			6:40 PM	7:51 PM
20-Apr-11						10:15 AM	2:37 PM
21-Apr-11	2	4-5				9:20 AM	12:03 PM
21-Apr-11	3	4-6	Overcast			9:21 AM	11:56 AM
22-Apr-11						9:07 AM	11:50 AM
22-Apr-11	13	2-4	None			11:10 AM	2:05 PM
25-Apr-11						7:18 AM	10:44 AM
25-Apr-11	13	2-4	Overcast			11:26 AM	2:27 PM
26-Apr-11	12	4-5	Overcast			10:17 AM	1:06 PM
26-Apr-11	10	4	Overcast	Light Rain		6:05 AM	8:41 AM
27-Apr-11	24		None			10:45 AM	1:59 PM
27-Apr-11	23	3-4	Partly			10:21 AM	1:25 PM
28-Apr-11	17		Overcast			12:00 PM	3:02 PM
28-Apr-11	18	6+	Partly			10:28 AM	1:18 PM
29-Apr-11	8	4	Overcast			11:25 AM	2:06 PM
29-Apr-11	7	4	Overcast			7:00 AM	10:23 AM
2-May-11	11	4	Overcast	Rain		6:42 AM	9:14 AM
2-May-11						4:20 PM	7:30 PM
3-May-11	11	4	Overcast	Rain		7:51 AM	10:42 AM
3-May-11	7	2-4	Overcast	Rain		10:19 AM	1:00 PM
4-May-11	11	4	Overcast	Rain		7:04 AM	9:58 AM

Survey Date	Temp (° C)	Wind Speed	Cloud	PPT	Overnight PPT	Start Time	End Time
4-May-11	9	3-4	Overcast	Light Rain		10:25 AM	1:18 PM
5-May-11	16	4	Partly			2:50 PM	5:36 PM
5-May-11	10	4	Partly			10:19 AM	1:11 PM
6-May-11	10		None			9:00 AM	11:40 AM
6-May-11	11	4-6	Partly			9:22 AM	12:21 PM
9-May-11	15	4	None			9:50 AM	12:23 PM
9-May-11	16	3-4	None			9:44 AM	12:23 PM
10-May-11	16	4	None			10:29 AM	1:00 PM
10-May-11	15	4-5	None			10:16 AM	1:01 PM
11-May-11						11:38 AM	2:40 PM
11-May-11	21	4	None			11:30 AM	2:38 PM
12-May-11						9:17 AM	11:52 AM
12-May-11	20	2-4	None			10:10 AM	12:55 PM
13-May-11	23	4-5	None			11:27 AM	12:41 PM
13-May-11	24	4	Hazy			1:23 PM	2:41 PM
13-May-11						7:50 AM	10:36 AM
16-May-11	8		Overcast	Rain		11:00 AM	2:18 PM
16-May-11	9	4-5	Overcast	Light Rain	Rain	10:15 AM	12:34 PM
17-May-11						7:44 AM	10:30 AM
17-May-11	11	4-6	Overcast			10:16 AM	12:55 PM
18-May-11						6:52 AM	10:00 AM
18-May-11	12	3-4	Overcast	Light Rain	Light Rain	10:16 AM	12:54 PM
19-May-11	23	2-4	Partly			12:15 PM	3:05 PM
20-May-11						8:14 AM	10:55 AM
20-May-11	16	1-3	Overcast		Rain	10:15 AM	1:10 PM
23-May-11	22	4-6	Partly	Periodic Light Rain	Light Rain	10:19 AM	2:28 PM
23-May-11	21	6+	None			10:20 AM	3:44 PM
23-May-11						6:35 AM	9:24 AM
24-May-11	17	3-4	Partly			12:05 PM	1:18 PM
24-May-11						7:42 AM	10:22 AM
25-May-11	20	1-3	None			1:20 PM	4:15 PM
25-May-11						7:23 AM	10:45 AM
26-May-11	21	1-3	None	*t-storm a.m., then clear in the p.m.	Rain	1:10 PM	3:59 PM
26-May-11	23		Partly			1:40 PM	4:40 PM
27-May-11	12	4	Overcast			10:14 AM	12:32 PM
27-May-11	15	3-4	Overcast	Rain	Rain	11:17 AM	2:05 PM
30-May-11						7:13 AM	10:24 AM
30-May-11	23	2-4	None			11:15 AM	2:10 PM
31-May-11						10:30 AM	12:32 PM
31-May-11	23	3-4	None			10:07 AM	12:52 PM
1-Jun-11	24	4-6				10:10 AM	11:29 AM
1-Jun-11	24	5-6	None			11:50 AM	1:17 PM
1-Jun-11						6:34 AM	9:40 AM
2-Jun-11	15	4-6	Partly			10:14 AM	1:06 PM
2-Jun-11	15	4-6	Partly			10:47 AM	1:29 PM
3-Jun-11	14	2-3	None			7:51 AM	10:29 AM
3-Jun-11	20	3-4	None			11:15 AM	2:47 PM
6-Jun-11	24		None			3:10 PM	4:42 PM
6-Jun-11	21	2-4	None			10:30 AM	11:39 AM
6-Jun-11						7:31 AM	10:23 AM
7-Jun-11	23	4	None			11:12 AM	12:28 PM
7-Jun-11	24	2-4	None			2:49 PM	4:08 PM

Survey Date	Temp (° C)	Wind Speed	Cloud	PPT	Overnight PPT	Start Time	End Time
7-Jun-11						5:51 AM	11:38 AM
8-Jun-11	33	4	Hazy			12:01 PM	3:01 PM
8-Jun-11						6:45 AM	10:24 AM
9-Jun-11	36	4	Partly			1:20 PM	4:13 PM
9-Jun-11	27					6:30 AM	10:10 AM
10-Jun-11	24	3-4	None			11:04 AM	12:19 PM
10-Jun-11	23	2-3	None			2:56 PM	4:29 PM
10-Jun-11	26					8:45 AM	11:00 AM
13-Jun-11	12	2-3	None			5:30 AM	8:08 AM
13-Jun-11	18	3-4	Partly			11:27 AM	2:41 PM
14-Jun-11	13		Overcast			7:30 AM	10:16 AM
14-Jun-11	13	4	None			10:11 AM	1:01 PM
15-Jun-11	19	1-3				9:04 AM	12:08 PM
15-Jun-11						6:16 AM	9:39 AM
16-Jun-11	23	2-4	Hazy			12:24 PM	2:35 PM
16-Jun-11						6:30 AM	9:05 AM
17-Jun-11	20	3-4	Overcast		Rain	11:07 AM	1:54 PM
17-Jun-11						7:18 AM	10:37 AM
20-Jun-11						6:31 AM	9:00 AM
20-Jun-11	22	1-3	None			10:06 AM	11:20 AM
20-Jun-11	24	2	None			2:52 PM	3:07 PM
21-Jun-11	23					6:00 AM	9:50 AM
21-Jun-11	27	3-4	None			10:31 AM	1:14 PM
22-Jun-11						6:17 AM	9:11 AM
23-Jun-11							
23-Jun-11						8:21 AM	11:27 AM
24-Jun-11	23	4	Partly			11:53 AM	2:27 PM
24-Jun-11	24		Overcast			9:00 AM	12:17 PM
27-Jun-11						6:11 AM	7:19 PM
27-Jun-11	26	3-4	None			11:25 AM	1:56 PM
28-Jun-11						6:31 AM	9:43 AM
28-Jun-11	28	3-4	Hazy			12:36 PM	3:20 PM
29-Jun-11	19	4-6	Overcast			12:20 PM	2:52 PM
29-Jun-11						7:28 AM	4:38 PM
30-Jun-11	23	3-4	None			12:30 PM	3:20 PM
30-Jun-11						7:12 AM	9:52 AM
1-Jul-11	30	3-4	Partly			12:10 PM	2:45 PM
1-Jul-11						6:12 AM	9:10 AM
4-Jul-11						6:53 AM	9:35 AM
4-Jul-11	27	3-4	None			12:05 PM	3:06 PM
5-Jul-11						6:50 AM	9:19 AM
5-Jul-11	25	3-4	Partly			12:10 PM	2:36 PM
6-Jul-11	24	4	Overcast			11:05 AM	1:39 PM
6-Jul-11						6:43 AM	11:34 AM
7-Jul-11	26	2-4	Partly			12:30 PM	3:25 PM
7-Jul-11						6:30 AM	8:56 AM
8-Jul-11	25	2-4	Partly			9:10 AM	11:45 AM
8-Jul-11	23	0-1	None			9:18 AM	12:00 PM

Appendix E

Mortality Monitoring Results

Date	Turbine #	GPS Location Zone Easting Northing	Observer	Species	Guild	Condition/Estimated Time Since Death	Injuries Sustained	Distance (m)	Direction (°)	Direction (compass)	Ground Cover
11-Mar-11	37	0388796 4887799	CF	Snow Bunting	bird	Fresh, 1-2 days	Neck	1	6	N	Gravel
11-Mar-11	8	0381208 4889691	WS	Wild Turkey	bird	Fresh, < 3 days	Nothing visible	18	292		Snow/Grass
16-Mar-11	68	0386425 4891833	WS	American Tree Sparrow	bird	Fresh, < 3 days		1	192		Grass
16-Mar-11	77	0384456 4892130	WS	Rough-legged Hawk	bird	Old, > 5 days		26	82		Tall Grass
28-Mar-11	55	0387556 4889905	WS	Rough-legged Hawk	bird	Fresh, < 3 days	*frozen	23	300		Long grass
28-Mar-11	64	0388507 4893724	CF	Red-tailed Hawk	bird	Fresh, 1-2 days	Neck	13	130	SE	Gravel
29-Mar-11	8	0381191 4889730	WS	Red-tailed Hawk*	bird	Old, > 30 days	Bones & Feathers	15	220		Grass
01-Apr-11	22	0382270 4889683	WS	Turkey Vulture*	bird	Old, > 30 days	Bones & Feathers	18	352		Grass
01-Apr-11	46	0389956 4890712	CF	Red-tailed Hawk	bird	Fresh, 1-2 days	Neck / Wing	36	285	W	Vegetation
01-Apr-11	44	039033 4891145	CF	Killdeer	bird	Fresh, 2-3 days	Neck / Wing (scavenged)	9	68	E	Veg / Soil
04-Apr-11	10	0381229 4890206	CF	American Woodcock	bird	Fresh, 1-2 days	Breast / Head	22	58	E	Gravel
06-Apr-11	75	0384566 4892650	CF	European Starling*	bird	Fresh, 1-2 days	Neck / Head	53	268	W	Gravel
12-Apr-11	31	0384883 4886171	CF	Ovenbird	bird	Old, 2-4 days	Abdomen	35	172	S	Gravel
13-Apr-11	82	0383128 4893024	WS	Red-tailed Hawk*	bird	< 3 days	Scavenged	56	283		Grass
27-Apr-11	40	0388032 4887013	CF	Horned Lark	bird	Fresh, 1-2 days	Neck	32	254	W	Gravel
28-Apr-11	47	0390467 4890489	CF	Bluejay	bird	Old, 2-3 days	Unknown - found wing	36	291	W	Gravel
02-May-11	33	0384514 4887205	WS	Osprey	bird	Fresh, < 3 days	Wing / Head trauma	8	122		Grass
03-May-11	20	0381822 4889253	CF	Bobolink - Male	bird	Fresh, 1-2 days	Neck / Wing	17	275	W	Gravel
11-May-11	79	0384831 4889382	CF	Common Merganser	bird	Fresh, 1 day	Abdomen / Neck	25	128		Gravel / Soil
11-May-11	81	0384126 4890335	CF	Rough-legged Hawk	bird	Fresh, 1-2 days	Scavenged - head missing	39	51	NE	Gravel
12-May-11	15	0381568 4888213	WS	Bobolink - Male	bird	Fresh, < 3 days	Broken neck	0	80		Tower base
16-May-11	10	0381235 4890201	CF	Bobolink - Male	bird	Fresh, 1-2 days	Neck?	1	120	E	Soil
18-May-11	62	0389706 4893962	WS	Wilson's Snipe	bird	Fresh, 3-5 days	Severe trauma	1	40		Grass
20-May-11	6	0380781 4889410	WS	Mallard - male	bird	Old, > 5 days	Scavenged	11	318		Grass
20-May-11	30	0384727 4886403	CF	Wilson's Snipe	bird	Fresh, 1-2 days	Wing / Back	5	4	NE	Gravel
23-May-11	59	0389158 4892813	WS	Rough-legged Hawk	bird	Old, > 5 days		31	243		Grass
08-Jun-11	68	0386424 4891853	CF	European Starling	bird	Old, 3-4 days	Head / Neck	7	110		Gravel
08-Jun-11	54	0387789 4889562	WS	Gull sp.	bird	Fresh, < 3 days	Broken wing	46	308		Grass
09-Jun-11	43	0390575 4891493	CF	Tree Swallow	bird	Fresh, 1-2 days	Head / Neck	13	309		Gravel
14-Jun-11	11	0387886 4890793	RD	Wilson's Snipe	bird	Fresh, 1 day	Broken neck	20	160		Gravel
14-Jun-11	63	0388764 4893376	CF	Savannah Sparrow	bird	Old, 2-3 days	Abdomen Trauma	35	40		Gravel
17-Jun-11	58	0389366 4892182	WS	Red-winged Blackbird	bird	Old, > 5 days	Unknown	9	150		Grass
23-Jun-11	43	0390551 4891521	WS	Sparrow sp.	bird	Fresh, < 3 days	No visible trauma	6	312		Gravel
27-Jun-11	4	0380240 4890681	CF	Tree Swallow	bird	Fresh, 1-2 days	Wing / Abdomen	30	65		Gravel
28-Jun-11	18	0381640 4888745	CF	Tree Swallow	bird	Fresh, 1-2 days	Wing	33	175		Gravel

Date	Turbine #	GPS Location Zone Easting Northing	Observer	Species	Guild	Condition/Estimated Time Since Death	Injuries Sustained	Distance (m)	Direction (°)	Direction (compass)	Ground Cover
11-May-11	40	0388022 4887043	CF	Bat Sp.	bat	Old - unknown	Unknown	48	215		Soil
20-May-11	8	0381180 4889727	WS	Brown bat	bat	Fresh, < 3 days	Nothing visible (wings folded)	23	135		Gravel
20-May-11	63	0388753 4893404	CF	Big Brown Bat	bird	Fresh, 1-2 days	Vortex?	13	68	E	Gravel
01-Jun-11	40	0388011 4886989	WS	Brown bat	bat	Fresh, < 3 days	No visible trauma	1	360		Soil
01-Jun-11	39	0387320 4887600	WS	Hoary bat	bat	Fresh, < 3 days	No visible trauma	33	235		Soil
03-Jun-11	60	0388791 4893048	CF	Big Brown Bat	bat	Fresh, 1-2 days	Vortex?	13	212		Gravel
22-Jun-11	58	0389384 4892172	WS	Brown bat	bat	Fresh, < 3 days	Unknown	1	192		Gravel

Appendix F

Aerial Waterfowl Data During Spring Migration

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**

Appendix G

Waterfowl Breeding Pairs Survey Results

Wetland	Date	Species	Gender in each grouping	# of Breeding Pairs*
Bayfield Bay Marsh	5/10/11	Mallard	M	1
		Mallard	MMMM	4
		Mallard	MF	1
		Mallard	MF	1
		Mallard	MM	2
		Mallard	UUU	0
		Mallard	MM	2
		Mallard	MF	1
	5/17/11	Canada Goose	UUUUU	0
		Mallard	MM	2
		Mallard	MF(with 3 young)	1
		Mallard	MF	1
		Mallard	M	1
		Mallard	M	1
Button Bay Wetland	5/10/11	Wood Duck	MF	1
	5/17/11	***No Observations***		
Big Sandy Bay Wetland	5/10/11	Canada Goose	U(on nest)	1
	5/17/11	Mallard	MF	1
		Canada Goose	U	1
		Canada Goose	UU	1
		Canada Goose	UU	1
		Canada Goose	UU	1
		Canada Goose	UU	1
		Mallard	MM	2
		Mallard	M	1
Reed's Bay Wetland	5/10/11	Mallard	MF	1
		Gadwall	MF	1
	5/17/11	Canada Goose	UU (with 8 young)	1
		Blue-winged Teal	M	1
		Wood Duck	M	1
		Mallard	MMMMMFFF	0
Sandy Bay Wetland	5/10/11	Gadwall	MF	1
		Mallard	M	1
	5/17/11	Canada Goose	UU (with 6 young)	1
		Canada Goose	UU	1
		Mallard	MMF	2
		Canada Goose	UU	1

M - Male

F - Female

U - Gender indetermined

* - # of breeding pairs as determined by Calculation of Indicated Pairs

Appendix H

Grassland Breeding Bird Survey Results

Detailed Results of Grassland Area Searches

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	Fallow		Density	Hay		Density	Pasture		Density	Pasture		Density
Dates	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)
BIRDS																		
Northern Harrier			0.0			0.0			0.0			0.0	1	1	0.4		1	0.9
Killdeer			0.0			0.0			0.0			0.0			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			0.0	1	1	1.3		1	1.2		1	0.4		1	0.9
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	15	13	9.9	11	10	7.3	8	6	10.6	3	5	6.1	17	14	6.9	12	11	10.7
Grasshopper Sparrow			0.0		1	0.7			0.0			0.0			0.0			0.0
Bobolink	6		4.0	21	15	13.9	2		2.7	5	4	6.1	13	6	5.2	9	9	8.1
Eastern Meadowlark			0.0			0.0			0.0			0.0	1	2	0.8			0.0

Southeast Area Search																						
Sector	**7**			**8**			**9**			**10**			**11**			**12**			**Totals**			**Density**
Habitat (area in ha)	Hay		Density	Pasture		Density	Pasture		Density	Pasture		Density	Hay		Density	Plowed		Density				
Dates	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	8-Jun	25-Jun	(pair/10ha)	**round 1**	**round 2**	**Max**	**(pairs/10ha)**
BIRDS																						
Northern Harrier			0.0		1	0.4	1		0.9			0.0	1		0.5			0.0	3	3	**3**	**0.2**
Killdeer			0.0			0.0	2	1	1.7			0.0			0.0	2	2	0.9	4	3	**4**	**0.2**
Upland Sandpiper			0.0			0.0			0.0			0.0			0.0			0.0	0	0	**0**	**0.0**
Wilson's Snipe			0.0			0.0		1	0.9			0.0			0.0			0.0	0	1	**1**	**0.1**
Eastern Kingbird			0.0	1		0.4		1	0.9			0.0	1	1	0.5			0.0	3	7	**7**	**0.4**
Horned Lark			0.0			0.0			0.0			0.0			0.0	3	1	1.4	3	1	**3**	**0.2**
Field Sparrow			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**
Savannah Sparrow	14	9	11.2	33	12	13.7	9	8	7.8	3	5	3.9	8	15	6.9	4		1.8	137	108	**137**	**7.3**
Grasshopper Sparrow			0.0			0.0			0.0		1	0.8			0.0			0.0	0	2	**2**	**0.1**
Bobolink	12	15	12.0	19	9	7.9	4		3.5			0.0	24	31	14.2			0.0	115	89	**115**	**6.1**
Eastern Meadowlark	1		0.8			0.0			0.0			0.0			0.0			0.0	2	2	**2**	**0.1**

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

Northwest Area Search															
Sector	**1**			**2**			**3**			**4**			**5**		
Habitat (area in ha)	Plowed		Density	Soya		Density	Bare		Density	Soya		Density	Hay		Density
Dates	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)
BIRDS															
Northern Harrier		1	0.5			0.0			0.0			0.0		1	0.7
Killdeer	4		2.0		2	1.0	5	2	3.3	3	2	1.4		1	0.7
Upland Sandpiper	1	2	1.0	2		1.0	2	7	4.6	1	1	0.7			0.0
Wilson's Snipe			0.0			0.0		1	0.7			0.0			0.0
Eastern Kingbird	1	1	0.5			0.0	1	1	0.7			0.7	1		0.0
Horned Lark			0.0		1	0.5			0.0	4		0.0			0.0
Field Sparrow			0.0			0.0			0.0			0.0			0.0
Vesper Sparrow			0.0			0.0			0.0			0.0			0.0
Savannah Sparrow		3	1.5	14		7.0	3	1	2.0	8	6	19.8	28	13	9.2
Grasshopper Sparrow			0.0			0.0			0.0			0.0			0.0
Bobolink			0.0			0.0		3	2.0		1	28.9	41	9	6.4
Eastern Meadowlark			0.0			0.0			0.0			0.7	1		0.0

Northwest Area Search																
Sector	**6**			**7**			**8**			**9**			**Totals**			**Density**
Habitat (area in ha)	Plowed		Density	Hay		Density	Hay		Density	Hay		Density				
Dates	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)	7-Jun	24-Jun	(pair/10ha)	**round 1**	**round 2**	**Max**	**pairs/10ha)**
BIRDS																
Northern Harrier			0.0			0.0			0.0	1		0.3	1	2	**2**	**0.1**
Killdeer	1	1	2.1			0.0	2	1	0.6		1	0.3	15	10	**15**	**0.8**
Upland Sandpiper			0.0			0.0	1		0.3			0.0	7	10	**10**	**0.5**
Wilson's Snipe			0.0			0.0	1		0.3			0.0	1	1	**1**	**0.1**
Eastern Kingbird			0.0			0.0	1	1	0.3	1		0.3	5	3	**5**	**0.3**
Horned Lark			0.0			0.0			0.0			0.0	4	1	**4**	**0.2**
Field Sparrow			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**
Savannah Sparrow	3	11	23.4	72	19	38.1	48	21	13.2	67	33	18.0	243	107	**243**	**12.7**
Grasshopper Sparrow			0.0	2	1	1.1			0.0			0.0	2	1	**2**	**0.1**
Bobolink	1	6	12.8	75	21	39.7	78	45	21.5	96	46	25.7	291	131	**291**	**15.2**
Eastern Meadowlark			0.0			0.0			0.0	1		0.3	2	0	**2**	**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)**
Canada Goose			**0**	**0.00**		13	**13**	**0.68**
Mallard	4	1	**4**	**0.21**			**0**	**0.00**
Wild Turkey	1		**1**	**0.05**			**0**	**0.00**
Turkey Vulture		1	**1**	**0.05**			**0**	**0.00**
Northern Harrier	3	3	**3**	**0.16**	1	2	**2**	**0.10**
Red-tailed Hawk		1	**1**	**0.05**			**0**	**0.00**
American Kestrel		1	**1**	**0.05**			**0**	**0.00**
Killdeer	4	3	**4**	**0.21**	15	10	**15**	**0.79**
Upland Sandpiper			**0**	**0.00**	7	10	**10**	**0.52**
Spotted Sandpiper	1	1	**1**	**0.05**	2	8	**8**	**0.42**
Wilson's Snipe		1	**1**	**0.05**	1	1	**1**	**0.05**
Ring-billed Gull		2	**2**	**0.11**			**0**	**0.00**
Mourning Dove	2	3	**3**	**0.16**	1	1	**1**	**0.05**
Northern Flicker		1	**1**	**0.05**			**0**	**0.00**
Willow Flycatcher	1	1	**1**	**0.05**		1	**1**	**0.05**
Least Flycatcher	1	1	**1**	**0.05**			**0**	**0.00**
Eastern Kingbird	3	7	**7**	**0.37**	5	3	**5**	**0.26**
American Crow		2	**2**	**0.11**			**0**	**0.00**
Horned Lark	3	1	**3**	**0.16**	4	1	**4**	**0.21**
Tree Swallow	0	3	**3**	**0.16**		14	**14**	**0.73**
Barn Swallow	15	17	**17**	**0.91**		5	**5**	**0.26**
American Robin	11	6	**11**	**0.59**	10	7	**10**	**0.52**
Brown Thrasher			**0**	**0.00**		1	**1**	**0.05**
European Starling	4	53	**53**	**2.83**		301	**301**	**15.77**
Cedar Waxwing		1	**1**	**0.05**		1	**1**	**0.05**
Yellow Warbler	4	5	**5**	**0.27**	4	8	**8**	**0.42**
Common Yellowthroat		1	**1**	**0.05**	2	4	**4**	**0.21**
Chipping Sparrow		1	**1**	**0.05**			**0**	**0.00**
Savannah Sparrow	137	108	**137**	**7.33**	243	107	**243**	**12.73**
Grasshopper Sparrow		2	**2**	**0.11**	2	1	**2**	**0.10**
Song Sparrow	3	4	**4**	**0.21**	8	8	**8**	**0.42**
Rose-breasted Grosbeak			**0**	**0.00**		8	**8**	**0.42**
Bobolink	115	89	**115**	**6.15**	291	131	**291**	**15.25**
Red-winged Blackbird	48	39	**48**	**2.57**	86	72	**86**	**4.51**
Eastern Meadowlark	2	2	**2**	**0.11**	2		**2**	**0.10**
Rusty Blackbird		6	**6**	**0.32**			**0**	**0.00**
Common Grackle		1	**1**	**0.05**	1	1	**1**	**0.05**
Brown-headed Cowbird	1	3	**3**	**0.16**	1	2	**2**	**0.10**
Orchard Oriole			**0**	**0.00**		1	**1**	**0.05**
Baltimore Oriole			**0**	**0.00**	1		**1**	**0.05**
American Goldfinch	1	2	**2**	**0.11**	1	2	**2**	**0.10**

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

Anova: Single Factor - All Species

Groups	Count	Sum	Average	Variance
0-100	20	317	15.85	12.55526316
100-200	20	341	17.05	16.15526316
200-300	20	84	4.2	4.168421053

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	2015.2333	2	1007.617	91.93877061	1.45E-18	3.158843
Within Groups	624.7	57	10.95965			
Total	2639.9333	59				

Anova: Single Factor - Grassland Species

Groups	Count	Sum	Average	Variance
0-100	20	92	4.6	3.621052632
100-200	20	204	10.2	10.58947368
200-300	20	56	2.8	1.957894737

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	595.73333	2	297.8667	55.26822917	4.52E-14	3.158843
Within Groups	307.2	57	5.389474			
Total	902.93333	59				

Anova: Single Factor - Bobolink

Groups	Count	Sum	Average	Variance
0-100	20	63	3.15	1.502631579
100-200	20	91	4.55	4.155263158
200-300	20	33	1.65	1.397368421

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	84.133333	2	42.06667	17.88735546	9.35E-07	3.158843
Within Groups	134.05	57	2.351754			
Total	218.18333	59				

Anova: Single Factor - Savannah Sparrow

Groups	Count	Sum	Average	Variance
0-100	20	60	3	1.789473684
100-200	20	70	3.5	1
200-300	20	8	0.4	0.357894737

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	110.8	2	55.4	52.80602007	1.06E-13	3.158843
Within Groups	59.8	57	1.049123			
Total	170.6	59				

Anova: Single Factor - Grasshopper Sparrow

Groups	Count	Sum	Average	Variance
0-100	20	6	0.3	0.326315789
100-200	20	16	0.8	0.589473684
200-300	20	0	0	0

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	6.5333333	2	3.266667	10.70114943	0.000113	3.158843
Within Groups	17.4	57	0.305263			
Total	23.933333	59				

Anova: Single Factor - Eastern Meadowlark

Groups	Count	Sum	Average	Variance
0-100	20	9	0.45	0.260526316
100-200	20	12	0.6	0.252631579
200-300	20	11	0.55	0.681578947

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	0.2333333	2	0.116667	0.292951542	0.747175	3.158843
Within Groups	22.7	57	0.398246			
Total	22.933333	59				

Appendix I

Woodland Breeding Bird Survey Results

COMMON NAME	SCIENTIFIC NAME	Pre-construction (2008)	Post-construction (2010)	Post-construction (2011)	ONTARIO STATUS	GLOBAL STATUS	COSSARO	COSEWIC	AREA (ha)	REGION	Local Status PIF Priority Species	Area Sensitive Reference		
Canada Goose	*Branta canadensis*	X	X	X	S5	G5								
Wood Duck	*Aix sponsa*		X	X	S5	G5								
Mallard	*Anas platyrhynchos*	X	X	X	S5	G5								
Ring-necked Pheasant	*Phasianus colchicus*		X		SNA	G5								
Wild Turkey	*Meleagris gallopava*	X	X	X	S5	G5								
Wilson's Snipe	*Gallinago delicata*	X	X	X	S5B	G5								
American Woodcock	*Scolopax minor*	X			S4B	G5								
Mourning Dove	*Zenaida macroura*	X	X	X	S5	G5								
Yellow-billed Cuckoo	*Coccyzus americanus*		X		S4B	G5								
Black-billed Cuckoo	*Coccyzus erythropthalmus*	X		X	S5B	G5					X			
Ruby-throated Hummingbird	*Archilochus colubris*		X	X	S5B	G5								
Red-bellied Woodpecker	*Melanerpes carolinus*		X		S4	G5								
Downy Woodpecker	*Picoides pubescens*	X	X	X	S5	G5								
Northern Flicker	*Colaptes auratus*	X	X	X	S4B	G5					X			
Pileated Woodpecker	*Dryocopus pileatus*	X			S5	G5			30-50*			Naylor et al., 1996		
Eastern Wood-Pewee	*Contopus virens*	X	X	X	S4B	G5					X			
Willow Flycatcher	*Empidonax traillii*		X	X	S5B	G5					X			
Least Flycatcher	*Empidonax minimus*	X	X	X	S4B	G5								
Great Crested Flycatcher	*Myiarchus crinitus*	X	X	X	S4B	G5								
Eastern Kingbird	*Tyrannus tyrannus*	X	X	X	S4B	G5					X			
Warbling Vireo	*Vireo gilvus*	X	X	X	S5B	G5								
Red-eyed Vireo	*Vireo olivaceus*	X	X	X	S5B	G5								
Blue Jay	*Cyanocitta cristata*	X	X	X	S5	G5								
American Crow	*Corvus brachyrhynchos*	X	X	X	S5B	G5								
Tree Swallow	*Tachycineta bicolor*	X	X	X	S4B	G5								
Black-capped Chickadee	*Poecile atricapillus*	X	X	X	S5	G5								
White-breasted Nuthatch	*Sitta carolinensis*	X	X	X	S5	G5			10					
House Wren	*Troglodytes aedon*	X	X	X	S5B	G5								
Blue-gray Gnatcatcher	*Polioptila caerulea*		X		S4B	G5			30					
Veery	*Catharus fuscescens*	X	X		S4B	G5			10-20					
Wood Thrush	*Hylocichla mustelina*	X	X	X	S4B	G5					X			
American Robin	*Turdus migratorius*	X	X	X	S5B	G5								
Gray Catbird	*Dumetella carolinensis*	X	X	X	S4B	G5								
Brown Thrasher	*Toxostoma rufum*	X	X	X	S4B	G5					X			
European Starling	*Sturnus vulgaris*	X	X	X	SNA	G5								
Cedar Waxwing	*Bombycilla cedrorum*	X	X	X	S5B	G5								
Yellow Warbler	*Dendroica petechia*	X	X	X	S5B	G5								
Chestnut-sided Warbler	*Dendroica pensylvanica*	X			S5B	G5								
American Redstart	*Setophaga ruticilla*		X	X	S5B	G5			20-30					
Northern Waterthrush	*Seiurus noveboracensis*		X	X	S5B	G5			20					
Mourning Warbler	*Oporornis philadelphia*		X		S4B	G5			30					
Common Yellowthroat	*Geothlypis trichas*	X	X	X	S5B	G5								
Eastern Towhee	*Pipilo erythrophthalmus*	X	X		S4B	G5					X			
Chipping Sparrow	*Spizella passerina*	X	X		S5B	G5								
Field Sparrow	*Spizella pusilla*	X	X		S4B	G5					X			
Song Sparrow	*Melospiza melodia*	X	X	X	S5B	G5								
Swamp Sparrow	*Melospiza georgiana*	X	X	X	S5B	G5								
Northern Cardinal	*Cardinalis cardinalis*	X	X	X	S5	G5								
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	X	X	X	S4B	G5					X			

COMMON NAME	SCIENTIFIC NAME	Pre-construction (2008)	Post-construction (2010)	Post-construction (2011)	ONTARIO STATUS	GLOBAL STATUS	COSSARO	COSEWIC	AREA (ha)	REGION	Local Status PIF Priority Species	Area Sensitive Reference
Indigo Bunting	*Passerina cyanea*	X	X	X	S4B	G5						
Red-winged Blackbird	*Agelaius phoeniceus*	X	X	X	S5	G5						
Common Grackle	*Quiscalus quiscula*	X	X	X	S5B	G5						
Brown-headed Cowbird	*Molothrus ater*	X	X	X	S4B	G5						
Baltimore Oriole	*Icterus galbula*	X	X	X	S4B	G5					X	
American Goldfinch	*Carduelis tristis*	X	X	X	S5B	G5						

Explanation of Status and Acronymns

COSSARO: Committee on the Status of Species at Risk in Ontario
COSEWIC: Committee on the Status of Endangered Wildlife in Canada
REGION: Rare in a Site Region
S1: Critically Imperiled—Critically imperiled in the province (often 5 or fewer occurrences)
S2: Imperiled—Imperiled in the province, very few populations (often 20 or fewer),
S3: Vulnerable—Vulnerable in the province, relatively few populations (often 80 or fewer)
S4: Apparently Secure—Uncommon but not rare
S5: Secure—Common, widespread, and abundant in the province
SX: Presumed extirpated
SH: Possibly Extirpated (Historical)
SNR: Unranked
SU: Unrankable—Currently unrankable due to lack of information
SNA: Not applicable—A conservation status rank is not applicable because the species is not a suitable target for conservation activities.
S#S#: Range Rank—A numeric range rank (e.g., S2S3) is used to indicate any range of uncertainty about the status of the species
?: Indicates uncertainty in the assigned rank
G1: Extremely rare globally; usually fewer than 5 occurrences in the overall range
G1G2: Extremely rare to very rare globally
G2: Very rare globally; usually between 5-10 occurrences in the overall range
G2G3: Very rare to uncommon globally
G3: Rare to uncommon globally; usually between 20-100 occurrences
G3G4: Rare to common globally
G4: Common globally; usually more than 100 occurrences in the overall range
G4G5: Common to very common globally
G5: Very common globally; demonstrably secure
T: Denotes that the rank applies to a subspecies or variety
END: Endangered
THR: Threatened
SC: Special Concern
2, 3 or NS after a COSEWIC ranking indicates the species is either on Schedule 2, Schedule 3 or No Schedule of the Species At Risk Act (SARA)
NAR: Not At Risk
IND: Indeterminant, insufficient information to assign status
DD: Data Deficient
6: Rare in Site Region 6
7: Rare in Site Region 7
Area: Minimum patch size for area-sensitive species (ha)
H- highly significant in Hamilton Region (i.e. rare)
m- moderately significant in Hamilton Region (i.e. uncommon)
L1- extremely rare locally (Toronto Region)
L2- very rare locally (Toronto Region)

COMMON NAME	SCIENTIFIC NAME	Pre-construction (2008)	Post-construction (2010)	Post-construction (2011)	ONTARIO STATUS	GLOBAL STATUS	COSSARO	COSEWIC	AREA (ha)	REGION	Local Status PIF Priority Species	Area Sensitive Reference

L3- rare to uncommon locally (Toronto Region)
HR- rare in Halton Region, highly significant
HU- uncommon in Halton Region, moderately significant
* The Pileated Woodpecker will incorporate smaller woodlots into its homerange, therefore it may not be a true area-sensitive species (Naylor et al. 1996)

LATEST STATUS UPDATE

Butterflies: September, 2009
Reptiles: September, 2009
Birds: September, 2009
Mammals: September, 2009
S and G ranks and explanations: September, 2009

NOTE

All rankings for birds refer to breeding birds unless the ranking is followed by N

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Appendix J

Notifications and Agency Responses

From: Garry Perfect [Garry_Perfect@transalta.com]
Sent: Tuesday, March 29, 2011 4:04 PM
To: Prevost, Eric (MNR); Read,Rob [Burlington]; rob.dobos@ec.gc.ca; Leblanc, Mathieu
Cc: Wyatt, Valerie
Subject: Wolfe Island Wind Plant Notification # 1

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 16-28, 2011.

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 contacted if two raptor fatalities are noted over a six week period.

On March 16, one Rough-legged Hawk carcass was discovered at turbine 77 during the on-going mortality searches (the identification has yet to be confirmed by Stantec). On March 28, one Rough-legged Hawk carcass was found at turbine 55 and one Red-tailed Hawk carcass was found at turbine 64.

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

Garry Perfect
Environmental Specialist

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Taylor, Andrew

From: Garry Perfect [Garry_Perfect@transalta.com]
Sent: Monday, April 04, 2011 3:40 PM
To: Prevost, Eric (MNR); Read,Rob [Burlington]; rob.dobos@ec.gc.ca; Leblanc, Mathieu
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification #2

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 29-April 1, 2011.

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.

On March 29, one Red-tailed Hawk carcass was discovered at turbine 8 during the on-going mortality searches. A second Red-tailed Hawk was found at turbine 46 on April 1.

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

Garry Perfect
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Taylor, Andrew

From: Garry Perfect [Garry_Perfect@transalta.com]
Sent: Monday, May 09, 2011 12:08 PM
To: Prevost, Eric (MNR); Read,Rob [Burlington]; rob.dobos@ec.gc.ca; Leblanc, Mathieu
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification #3

Good afternoon all:

This email provides the details of one notification threshold that has been met at the Wolfe Island Wind Plant.

Mortality of Species at Risk

As stated in the Post-Construction Follow-Up Plan, NRCan, EC and MNR will be notified if mortality of species at risk is observed. On May 3, 2011 a single male Bobolink fatality was recorded at T20. 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*.

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

Garry Perfect
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Taylor, Andrew

From: Garry Perfect [Garry_Perfect@transalta.com]
Sent: Monday, May 16, 2011 10:38 AM
To: Prevost, Eric (MNR); Read,Rob [Burlington]; rob.dobos@ec.gc.ca; Leblanc, Mathieu
Cc: Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification #4

Good morning all:
The following provides the details of one notification threshold that has been met at the Wolfe Island Wind Plant.

High Annual Mortality Rate - Raptors
The Post-Construction Follow-Up Plan states that NRCan, EC, and MNR will be notified if two raptor fatalities are noted over a six week period.
On May 2, one Osprey carcass was discovered at T33 during the on-going mortality searches. A Rough-legged Hawk casualty was found at T81 on May 11.

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

Garry Perfect
Environmental Specialist

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Taylor, Andrew

From: Garry Perfect [Garry_Perfect@transalta.com]
Sent: Monday, May 16, 2011 3:45 PM
To: Prevost, Eric (MNR); Read,Rob [Burlington]; rob.dobos@ec.gc.ca; Leblanc, Mathieu
Cc: liz.sauer@ec.gc.ca; mary.vincent@ec.gc.ca; madeline.austen@ec.gc.ca; Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification #5

Good afternoon all:
The following provides the details of one notification threshold that has 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 12, 2011 a single male Bobolink fatality was recorded at turbine 15. 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.*

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

Best regards,

Garry Perfect
Environmental Specialist

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Taylor, Andrew

From: Garry Perfect [Garry_Perfect@transalta.com]
Sent: Thursday, May 19, 2011 9:21 AM
To: Prevost, Eric (MNR); Read,Rob [Burlington]; rob.dobos@ec.gc.ca; Leblanc, Mathieu
Cc: liz.sauer@ec.gc.ca; mary.vincent@ec.gc.ca; madeline.austen@ec.gc.ca; Taylor, Andrew
Subject: Wolfe Island Wind Plant Notification #6

Good morning all:
This emails provides the details of one notification threshold that has 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, 2011 a single male Bobolink fatality was recorded at turbine 10. This species 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*.

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

Garry Perfect
Environmental Specialist

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