



Henvey Inlet Wind LP

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Henvey Inlet Wind Energy Centre

Environmental Effects Monitoring Plan

Final

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Henvey Inlet Wind Energy Centre – Environmental Effects Monitoring Plan (EEMP) – Final

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1. Purpose of the Environmental Effects Monitoring Plan

The HIFN EA Guidance document includes a requirement to complete a Natural Heritage Assessment (NHA) having regard to the provincial process. Under the provincial process, a proponent who proposes to engage in a renewable energy project is required to conduct a NHA, consisting of the following:

- A Records Review;
- A Site Investigation; and
- An Evaluation of Importance (EOI).

Through this process, proponents identify natural features near the proposed HIWEC location and determine if prohibitions and setbacks apply. In instances where the HIWEC location is proposed within such a setback, the proponent must prepare an Environmental Impact Study (EIS) Report to identify and assess the potential negative environmental effects that may result from the proposed HIWEC, identify appropriate mitigation measures and describe how the potential effects will be addressed through the Environmental Effects Monitoring Plan Report for Birds and Bats and Construction Plan Report.

This document is intended to address the Environmental Effects Monitoring Plan Report for Birds and Bats (hereafter referred to as the EEMP) requirements of the HIWEC, as set out in the HIFN EA Guidance document, including:

- Prepare an EEMP in respect of birds and bats. In preparing the report, the proponent shall have regard for the following publications:
 - *Bird and Bird Habitats: Guidelines for Wind Power Projects* (Ontario Ministry of Natural Resources and Forestry (MNRF), 2011a), as amended from time to time; and
 - *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNRF, 2011b), as amended from time to time.

This EEMP has also been developed in accordance with the following federal guidance, based on correspondence with Environment Canada – Canadian Wildlife Service (EC-CWS):

- *Wind Turbines and Birds: A Guidance Document for Environmental Assessment* (EC-CWS, 2007a); and
- *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC-CWS, 2007b).

Throughout this EEMP, the term “significant” or “significance” as per provincial requirements has been changed to “important” or “importance” as the term “significance” has specific meaning in the federal EA process which is different from the meaning in the provincial process. Therefore, the term in the provincial process has been changed to avoid confusion. The meaning of “significance” in the provincial process is carried over to the term “importance” for the purpose of this EEMP. The term “significance” is not changed if it is in the title of a reference document.

1.1 Project Overview

The HIWEC will consist of the following permanent infrastructure as mapped in **Figure 1-1**:

- 120 Vestas V126-3.3MW wind turbine generators (WTGs) and pad-mounted transformers (however, only up to 91 WTGs will ultimately be constructed);

- Two (2) transformer stations (TSs) and ancillary equipment;
- 34.5 kV electrical collection lines to connect the WTG to the proposed TSs and ancillary equipment, that run overhead or below ground dependent on site specific conditions;
- A section of overhead transmission line of 230 kV will be constructed on HIFN I.R. #2 and will consist of aluminum conductor steel reinforced (ACSR) cable attached to insulators and tower structures (steel monopole and / or wood structures) that will have optical ground wires (OPGWs) installed;
- Crane pads at each WTG;
- Access roads;
- Four (4) permanent meteorological towers; and
- An operations and maintenance (O&M) building and ancillary facilities and equipment such as an electrical service line connected to the local distribution network, with a back-up, liquid fuel-fired generator.

The HIWEC will consist of the following temporary infrastructure as mapped in **Figure 1-1**:

- Staging area at each WTG(including temporary staging areas for construction equipment and storage for excavated materials); and
- Two (2) temporary construction compounds / laydown yards to support general construction activities and for temporary storage of WTG components, electrical equipment (e.g., cable reels and pad-mounted transformers), construction materials, containers, vehicles, equipment, office trailers, concrete batch plant(s), crusher(s) and portable toilets.

1.2 Provincial Guidance Requirements

Under provincial guidance (MNRF, 2011a and 2011b), an EEMP must be prepared to address negative environmental effects that may result from engaging in a Class 4 wind energy project. The EEMP must set out:

- Post-construction bird and bat mortality surveys requirements for three (3) years to address potential negative environmental effects to birds and bats;
- Avoidance / disturbance effects monitoring where a project is located within 120 m of bird Important Wildlife Habitat (IWH);
- Performance objectives in respect of the potential negative environmental effects of the project on bird and / or bat IWH;
- Mitigation measures to assist in achieving the performance objectives; and
- A program for monitoring negative environmental effects including a contingency plan to be implemented if any mitigation measures fail.

1.3 Federal Guidance Requirements

Under federal guidance (EC-CWS, 2007a), proponents are required to identify, assess, monitor and mitigate the potential negative effects of a proposed wind energy project on birds, especially those protected under the *Migratory Birds Convention Act* and Species at Risk (SAR) protected under the federal *Species at Risk Act, 2002*. The Level of Concern Category of a wind energy project is determined using a matrix that combines the site sensitivity and size of the proposed facility. The presence of bird species listed as Endangered or Threatened under

Schedule 1 of the federal *Species at Risk Act, 2002* within the HIWEC study area (including Canada Warbler, Common Nighthawk, Kirtland's Warbler, Olive-sided Flycatcher and Whip-poor-will) results in a site sensitivity rating of very high, and the proposed size of facility is considered large (41 to 100 turbines). Therefore, the Level of Concern Category associated with the HIWEC is Category 4.

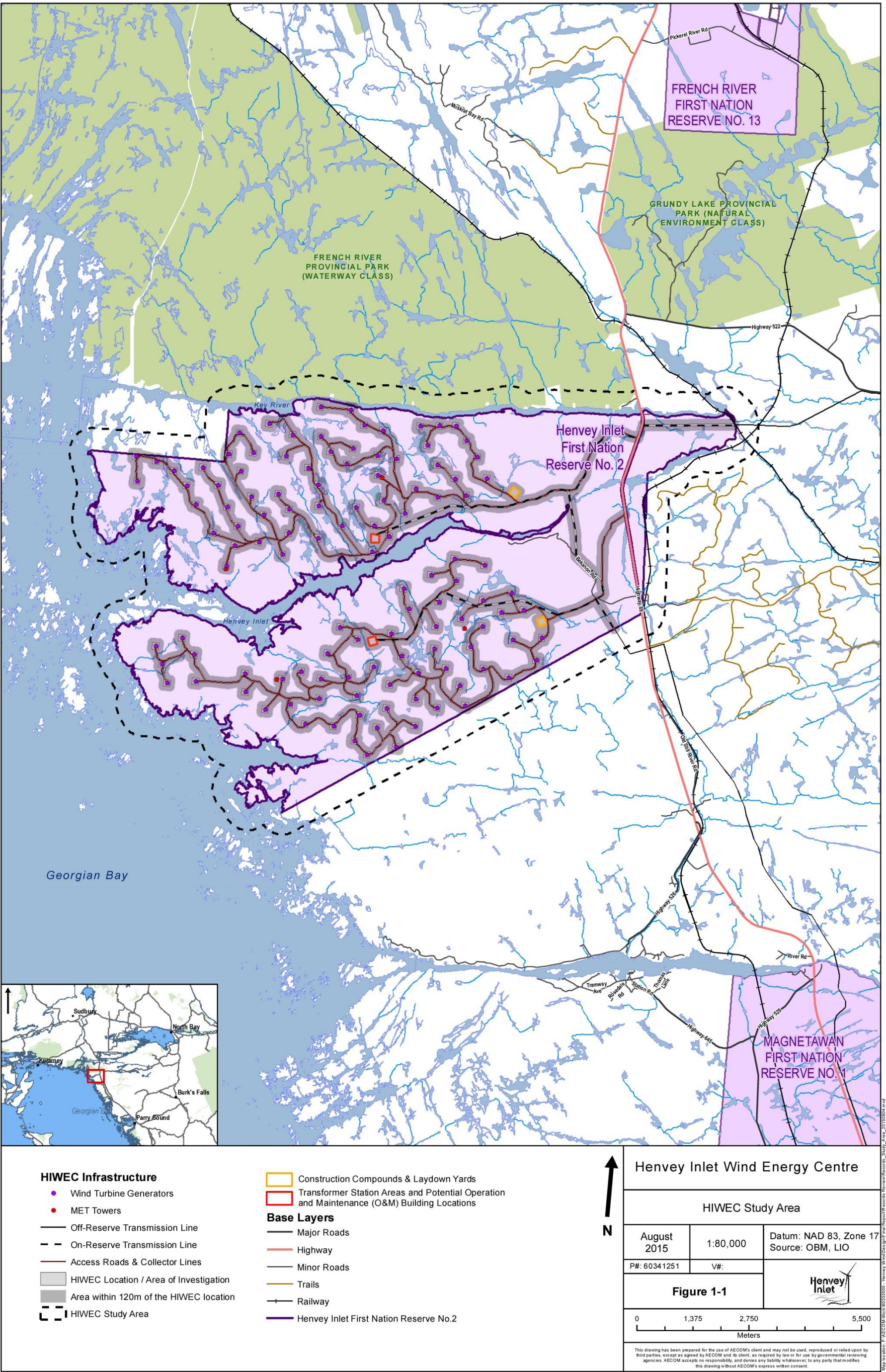
Based on EC-CWS guidance (2007a), Category 4 projects present a relatively high level of potential risks to birds, and consequently relatively detailed follow-up monitoring is typically required for these projects including:

- Two (2) to three (3) years of post-construction follow-up surveys, following pre-construction survey methods, to determine changes in bird use of the area associated with construction of the turbines;
- At least two (2) years of carcass searches around turbines during seasons when there is an elevated collision risk (e.g. when high concentrations of birds are present, or during the migration season); and
- Information gathered for more than two (2) years would normally be targeted to answering very specific questions or concerns, and should in most cases only require limited work in the later years.

For any category wind project, the extent of post-construction monitoring may be increased if unexpected high mortality or other adverse environmental effects on birds occurs. In these instances, additional studies to determine the reason for these environmental effects may be needed, additional mitigation measures should be identified and implemented, and additional monitoring would be required to evaluate the effectiveness of the mitigation measures through an adaptive management approach (EC-CWS, 2007a).

Post-construction monitoring requirements specific to Species at Risk (SAR) potentially affected by operation of the HIWEC will be developed in consultation with Environment Canada – Canadian Wildlife Service (EC-CWS) during the permitting process and are not included here.

Figure 1-1: HIWEC Study Area



2. Post-Construction Monitoring for Bird and Bat Habitats

Under provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN EA Guidance document, an EEMP must include:

- Avoidance / disturbance effects monitoring where a project is located within 120 m of bird IWH;
- Performance objectives in respect of the potential negative environmental effects of the project on bird and / or bat IWH;
- Mitigation measures to assist in achieving the performance objectives; and
- A program for monitoring negative environmental effects including a contingency plan to be implemented if any mitigation measures fail.

Under federal guidance (EC-CWS, 2007a), proponents are required to identify, assess, monitor and mitigate the potential negative effects of a proposed wind energy project on birds, especially those protected under the *Migratory Birds Convention Act*. Category 4 projects typically require two (2) to three (3) years of post-construction follow-up surveys, conducted using the same methods as pre-construction surveys, to determine changes in bird use of the area associated with construction of the turbines (EC-CWS, 2007a).

Baseline information pertaining to bird and bat IWH features that are potentially affected by the HIWEC are described in the following Natural Heritage (NHA) Reports (refer to Appendix F of Volume A of the main EA Report):

- *Natural Heritage Assessment: Records Review Report* (AECOM, 2015a);
- *Natural Heritage Assessment: Site Investigation Report* (AECOM, 2015b);
- *Natural Heritage Assessment: Evaluation of Importance Report* (AECOM, 2015c); and
- *Natural Heritage Assessment: Environmental Impact Study Report* (AECOM, 2015d).

The following bird and bat IWH features were identified as being potentially affected by and located within 120 m of the HIWEC and will undergo post-construction monitoring¹:

- Bat Maternity Colonies;
- Waterfowl Nesting Areas;
- Bald Eagle and Osprey Nesting, Foraging and Perching Habitat;
- Woodland Raptor Nesting Habitats;
- Marsh Bird Breeding Habitats; and
- Habitats for bird Species of Conservation Concern (SOCC), including:
 - Black Tern (*Chlidonias niger*);
 - Eastern Wood-pewee (*Contopus virens*);
 - Prairie Warbler (*Setophaga discolor*);
 - Wood Thrush (*Hylocichla mustelina*); and
 - Yellow Rail (*Coturnicops noveboracensis*).

1. Some IWH features were assumed to be important for the purpose of the NHA. The importance of these features will be confirmed through the analysis of pre-construction evaluation of importance survey data. If these features are confirmed not to be important, the mitigation measures and monitoring commitments described herein will not be applied.

The potential negative environmental effects during operation of the HIWEC, performance objectives, mitigation strategy and contingency measures for these IWH features are described in **Table 2-1**. The EEMP for these bird and bat IWH features, including post-construction survey methods, monitoring locations, frequency and duration of sample collection, technical and statistical value of the data, and reporting requirements, is also described in **Table 2-1**. The post-construction monitoring methods may be modified in consultation with EC-CWS and HIFN. Note that the schedule for post-construction surveys and annual reports is based on an anticipated commercial operation date of February 2018; any delays in the start of operation of the HIWEC may result in changes to the post-construction monitoring and reporting schedule. Maps showing the locations of bird and bat IWH features are provided in the *Natural Heritage Assessment: Site Investigation Report* (AECOM, 2015b; refer to Appendix F of Volume A of the main EA Report). If the mitigation measures identified in **Table 2-1** are found to not be effective based on the results of post-construction monitoring, contingency measures and additional monitoring to confirm the effectiveness of the contingency measures will be implemented. An adaptive management approach will be used in the development of contingency measures wherever possible.

Table 2-1: Summary of the Environmental Effects Monitoring Plan for Bird and Bat Habitats

Bird or Bat IWH	Potential Negative Environmental Effects	Performance Objective	Mitigation Strategy	Environmental Effects Monitoring Plan					Contingency Measure
				Methodology	Monitoring Locations	Frequency and Duration of Sample Collection	Technical and Statistical Value of Data	Reporting Requirements	
Bat Maternity Colonies	<ul style="list-style-type: none">• Possible mortality of bats resulting from operating WTGs.• Avoidance behaviour and / or habitat degradation caused by turbine lighting and / or noise.• Bat mortality resulting from removal of cavity trees during routine maintenance of access roads, collector lines or transmission line.	<ul style="list-style-type: none">• Minimize risk of WTG related mortality.• Minimize disturbance to bat maternity colonies.• Avoid bat mortality from vegetation removal during maintenance activities.	<ul style="list-style-type: none">• Utilize a lighting scheme that will minimize continuous lighting and the use of bright lights throughout the HIWEC to minimize attraction of bat to lit structures (Rydell, 1992). Lighting scheme to include the following, where possible, while still fulfilling minimum Transport Canada requirements:<ul style="list-style-type: none">▪ Implement red LED flashing lights on WTGs.▪ Light WTGs and permanent meteorological / communication towers to the minimum federal standards.▪ Ground-level lights (i.e. buildings, WTG bases, etc.) will be directed downward and shall use motion or heat sensors where practical and allowed by applicable codes and the authority having jurisdiction.▪ Use of high-intensity lighting or spotlights, if required, will be temporary and will be kept to a minimum.▪ Any internal nacelle lighting will only be used when occupied.• Implement a proactive approach to feathering WTG blades below the manufacturer's recommended cut-in speed. Feathering refers to the act of pitching WTG blades by 90°, parallel to the wind or turning the WTG nacelle so that the blades are facing away from the wind.• Conduct maintenance activities during daylight hours for increased visibility as well as to avoid light pollution effects during the night, wherever possible.• Vegetation trimming will be limited to areas that have been previously cleared during construction.• Schedule trimming of any necessary vegetation removal during routine maintenance activities to occur outside of the overall bat roosting season, from April 30 to September 1. If any trees must be trimmed during the bat roosting season (April 30 to September 1) during the operation of the project, each tree will be searched for signs of maternity roosts by a qualified Biologist prior to vegetation maintenance. If an active maternity roost is found, removal activities will be scheduled after the bat roosting season (April 30 to September 1) or once a qualified biologist has confirmed the tree is no longer being actively used as a roost.<ul style="list-style-type: none">▪ If an active roost site is found, a buffer area will be implemented around the site. The radius of the buffer will vary depending on the species, type of roosting (bachelor or day roosting versus maternity roosting), level of disturbance and landscape context, which will be confirmed by a qualified Biologist experienced in bat ecology. The buffer will have a minimum radius of 10 m and will be applied only when bats are present at the roost site. This minimum buffer is expected to provide protection of the roost site from minor work, such as vegetation clearing and general heavy machinery usage or vehicle operation.▪ The UTM of the roost location will be recorded, and the limits of the buffer area will be clearly identified. If the qualified Biologist confirms that no bats are using the roost site, vegetation removal can proceed.• If any suitable hazard tree, such as a tree which poses an immediate safety risk to individuals and / or a risk to the functionality of HIWEC equipment, is identified, the tree may be removed at any time through consultation with EC-CWS. The need for additional mitigation measures or permits in these circumstances will be addressed on a site-specific basis.• Develop and implement a follow-up and monitoring plan as per Environment Canada guidelines which includes a post-construction bird and bat mortality and disturbance monitoring program consistent with <i>Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds</i> (EC-CWS, 2007b), <i>Wind Turbines and Birds A Guidance Document for Environmental Assessment</i> (EC-CWS, 2007a) as well as <i>Bats and Bat Habitats: Guidelines for Wind Power Projects</i> (MNRFP, 2011b).• Report the findings of the post-construction monitoring program to HIFN and EC-CWS as required on an annual basis.• Implement adaptive management techniques, such as operational mitigation, as determined appropriate through post-construction monitoring.	<ul style="list-style-type: none">• Conduct post-construction mortality and disturbance effects monitoring including:<ul style="list-style-type: none">▪ Pre-construction bat acoustic monitoring surveys completed in 2011 will be repeated annually for two (2) years post-construction to ensure similar species abundance and diversity continue to be found in the HIWEC study area. Post-construction bat acoustic monitoring surveys will follow the 2011 pre-construction survey protocol described in <i>Summary of 2011, 2012 and 2013 Bat Acoustic Monitoring Surveys – Henvey Inlet Wind Energy Centre Study Area</i> (AECOM, 2015e), which is provided in Appendix A of the <i>Natural Heritage Assessment: Records Review Report</i> (AECOM, 2015a);▪ Include representation of the WTGs within 120 m of bat maternity colony features in the post-construction mortality monitoring program;▪ An end of year report will be provided to EC-CWS, on an annual basis for the two (2) years of post-construction bat disturbance effects monitoring to determine if additional monitoring and / or mitigation measures are warranted.	<ul style="list-style-type: none">• Post-construction bat acoustic monitoring will occur at the same monitoring stations established during pre-construction bat acoustic surveys completed in 2011.	<ul style="list-style-type: none">• Two (2) years of post-construction bat acoustic monitoring will be completed between:<ul style="list-style-type: none">▪ June 1 and August 1, 2018; and▪ June 1 and August 1, 2019.	<ul style="list-style-type: none">• Compare pre-construction and post-construction survey data to determine if there are changes in bat abundance and / or species diversity.• If notable changes are observed, determine if there is evidence of a displacement or disturbance effect on roosting bats as a result of the HIWEC.• Determine if there is evidence of bat mortalities resulting from WTG operation.	<ul style="list-style-type: none">• Annual reports will be submitted to EC-CWS and HIFN by:<ul style="list-style-type: none">▪ January 2019; and▪ January 2020.	<ul style="list-style-type: none">• Consider changes in turbine operations (e.g. changes in cut-in speed, selective shutdown of specific turbines at key times of year or under certain weather conditions) during periods of high mortality.• In the event that, after two (2) years, bat acoustic monitoring surveys indicate notable changes in bat populations, EC-CWS will be consulted to determine if additional mitigation measures are warranted through an adaptive management approach.• Quantifying changes in local bat populations, as a result of the operation of this Project, will be difficult to determine based on the dramatic population declines of bats as a result of white-nose syndrome. The effects of this disease are already evident when comparing data from 2011 to 2013. Despite this difficulty in quantifying changes that may be attributed to the operating Henvey Inlet Wind Energy Centre, two (2) years of acoustic monitoring will be completed and compared to pre-construction results. Results will be discussed with EC-CWS to determine if additional mitigation measures are warranted through an adaptive management approach.• Prune any tree limbs or roots using proper arboricultural techniques.

Table 2-1: Summary of the Environmental Effects Monitoring Plan for Bird and Bat Habitats

Bird or Bat IWH	Potential Negative Environmental Effects	Performance Objective	Mitigation Strategy	Environmental Effects Monitoring Plan					Contingency Measure
				Methodology	Monitoring Locations	Frequency and Duration of Sample Collection	Technical and Statistical Value of Data	Reporting Requirements	
Waterfowl Nesting Area ²	<ul style="list-style-type: none">• Disturbance and / or displacement of waterfowl in nesting habitat during operation.• Possible mortality of waterfowl resulting from operating WTGs.• Possible mortality or disturbance to nesting waterfowl resulting from vegetation clearing during maintenance activities.	<ul style="list-style-type: none">• Minimize disturbance and / or displacement of waterfowl from nesting habitat.• Minimize risk of WTG related waterfowl mortality.• Avoid mortality and minimize disturbance to nesting waterfowl during maintenance activities.	<ul style="list-style-type: none">• Utilize a lighting scheme that will minimize potential risks for bird collisions, while still fulfilling Transport Canada requirements. Lighting scheme will include the following, where possible:<ul style="list-style-type: none">▪ Implement red LED flashing lights on WTGs.▪ Light WTGs and permanent meteorological / communication towers to the minimum federal standards.▪ Ground-level lights (i.e. buildings, WTG bases, etc.) will be directed downward and shall use motion or heat sensors where practical and allowed by applicable codes and the authority having jurisdiction.▪ Use of high-intensity lighting or spotlights, if required, will be temporary and will be kept to a minimum.▪ Any internal nacelle lighting will only be used when occupied.• Implement a proactive approach to feathering WTG blades below the manufacturer's recommended cut-in speed. Feathering refers to the act of pitching WTG blades by 90°, parallel to the wind or turning the WTG nacelle so that the blades are facing away from the wind.• Conduct maintenance activities during daylight hours for increased visibility as well as to avoid light pollution effects during the night, wherever possible.• Vegetation trimming will be limited to areas that have been previously cleared during construction.• Schedule trimming of any necessary vegetation removal during routine maintenance activities to occur outside of the overall bird nesting season, from April 1 to August 31 (Environment Canada (EC), 2014). If this is not possible (e.g., hazard tree), the following mitigation will apply, in accordance with the <i>MBCA</i> and the Wildlife Management Plan:<ul style="list-style-type: none">▪ Within complex habitats³, removal of all vegetation is proposed to occur outside the core bird nesting season of May 1 to July 28, when a minimum of 60% of nesting activity occurs in each of the three (3) habitat types, as per Environment Canada's Nesting Calendar for Zone C3 (EC, 2014);▪ Nest surveys will be conducted by a qualified Biologist in areas defined as simple habitat³ immediately prior to vegetation clearing and will include searching around the general vicinity of areas proposed for vegetation clearing, including within 10 m. Nesting activity will be documented when it consists of confirmed breeding evidence, as defined by Ontario Breeding Bird Atlas (OBBA) criteria (OBBA, 2001);▪ If an active nest or confirmed nesting activity is found, a buffer area will be implemented around the nest or nesting activity until a qualified Biologist has confirmed the nest is no longer active. The radius of the buffer will range depending on the species, level of disturbance and landscape context which will be confirmed by a qualified Biologist (EC, 2014b), but will protect a minimum area of 10 m surrounding the nest. This minimum buffer is expected to provide protection of the nest from nearby activities, such as vegetation clearing and heavy machinery or vehicle operation;▪ The nest itself will not be marked using flagging tape or other similar material as this increases the risk of nest predation; however, the outer limits of the buffer can be marked (EC, 2014) and Universal Transverse Mercator (UTM) coordinates will be taken; and• If any suitable hazard tree, such as a tree which poses an immediate safety risk to individuals and / or a risk to the functionality of HIWEC equipment, is identified, the tree may be removed at any time through consultation with EC-CWS. The need for additional mitigation measures or permits in these circumstances will be addressed on a site-specific basis.	<ul style="list-style-type: none">• Conduct post-construction mortality and disturbance effects monitoring including:<ul style="list-style-type: none">▪ Pre-construction breeding bird surveys completed in 2015, as well as pre-construction breeding bird surveys completed in 2011, 2012 and / or 2013 at 12 other representative sites at varying distances from the HIWEC location, will be repeated annually for two (2) years post-construction to ensure similar species abundance and diversity continue to be found in the HIWEC study area. Post-construction breeding bird surveys will follow the same pre-construction survey protocol described in Section 2.3.3.1 of the <i>Natural Heritage Assessment: Evaluation of Importance Report</i> (AECOM, 2015c).▪ Include representation of the WTGs within 120 m of waterfowl nesting areas in the post-construction mortality monitoring program; and▪ An end of year report will be provided to EC-CWS, on an annual basis for the two (2) years of post-construction bird disturbance effects monitoring to determine if additional monitoring and / or mitigation measures are warranted.	<ul style="list-style-type: none">• Post-construction breeding bird monitoring will occur at the same point count stations established during pre-construction breeding bird surveys completed in 2015, as well as the pre-construction breeding bird surveys completed at the 12 representative sites in 2011, 2012 and / or 2013.	<ul style="list-style-type: none">• Two (2) years of post-construction breeding bird monitoring will be completed between:<ul style="list-style-type: none">▪ May 24 and July 10, 2018; and▪ May 24 and July 10, 2019.	<ul style="list-style-type: none">• Compare pre-construction and post-construction survey data to determine if there are changes in breeding bird abundance and / or species diversity.• If notable changes are observed, determine if there is evidence of a displacement or disturbance effect on breeding birds as a result of the HIWEC.• Determine if there is evidence of waterfowl mortalities resulting from WTG operation.	<ul style="list-style-type: none">• Annual reports will be submitted to EC-CWS and HIFN by:<ul style="list-style-type: none">▪ January 2019; and▪ January 2020.	<ul style="list-style-type: none">• Consider changes in turbine operations (e.g. changes in cut-in speed, selective shutdown of specific turbines at key times of year or under certain weather conditions) during periods of high mortality.• In the event that, after two (2) years, breeding bird surveys indicate notable changes in bird populations, EC-CWS will be consulted to determine if additional mitigation measures are warranted through an adaptive management approach. Specific details of the adaptive management framework will be developed in consultation with EC-CWS during the permitting phase and documented in the Environmental Protection Plan.• Prune any tree limbs or roots using proper arboricultural techniques.

2. Some IWH features were assumed to be important for the purpose of the NHA. The importance of these features will be confirmed through the analysis of pre-construction evaluation of importance survey data. If these features confirmed not to be important, the mitigation measures and monitoring commitments described herein will not be applied.

3. Complex habitats refer to habitats that contain a variety of individual nesting sites in a range of habitats. For instance, forest and shrub-dominated communities may contain nesting spots within the canopy, sub-canopy, shrub layer and ground layer, where identification of active nests may be difficult. Simple habitats refer to habitats that contain few likely nesting spots or a homogenous community where identification of active nests can be completed with confidence. For instance, open rock barrens or other sparsely vegetated habitats may be considered simple habitats, depending on site-specific vegetation cover.

Table 2-1: Summary of the Environmental Effects Monitoring Plan for Bird and Bat Habitats

Bird or Bat IWH	Potential Negative Environmental Effects	Performance Objective	Mitigation Strategy	Environmental Effects Monitoring Plan					Contingency Measure
				Methodology	Monitoring Locations	Frequency and Duration of Sample Collection	Technical and Statistical Value of Data	Reporting Requirements	
			<ul style="list-style-type: none">Develop and implement a follow-up and monitoring plan as per Environment Canada guidelines which includes a post-construction bird and bat mortality and disturbance monitoring program consistent with <i>Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds</i> (EC-CWS, 2007b), <i>Wind Turbines and Birds A Guidance Document for Environmental Assessment</i> (EC-CWS, 2007a) as well as <i>Birds and Bird Habitats: Guidelines for Wind Power Projects</i> (MNR, 2011a).Report the findings of the post-construction monitoring program to HIFN and EC-CWS as required on an annual basis.Implement adaptive management techniques, such as operational mitigation as determined appropriate through post-construction monitoring.						
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat	<ul style="list-style-type: none">Disturbance and / or displacement of Osprey during operation.Possible mortality of Osprey from operating WTGs.Possible mortality of Osprey resulting from collisions with the transmission line.	<ul style="list-style-type: none">Minimize disturbance and / or displacement of Osprey.Minimize risk of Osprey mortality from of WTGs, collector lines or the transmission line.	<ul style="list-style-type: none">Utilize a lighting scheme that will minimize potential risks for bird collisions, while still fulfilling Transport Canada requirements. Lighting scheme will include the following, where possible:<ul style="list-style-type: none">Implement red LED flashing lights on WTGs.Light WTGs and permanent meteorological / communication towers to the minimum federal standards.Ground-level lights (i.e. buildings, WTG bases, etc.) will be directed downward and shall use motion or heat sensors where practical and allowed by applicable codes and the authority having jurisdiction.Use of high-intensity lighting or spotlights, if required, will be temporary and will be kept to a minimum.Any internal nacelle lighting will only be used when occupied.Implement a proactive approach to feathering WTG blades below the manufacturer's recommended cut-in speed. Feathering refers to the act of pitching WTG blades by 90°, parallel to the wind or turning the WTG nacelle so that the blades are facing away from the wind.Conduct maintenance activities during daylight hours for increased visibility as well as to avoid light pollution effects during the night, wherever possible.Vegetation trimming will be limited to areas that have been previously cleared during construction.Schedule trimming of any necessary vegetation removal during routine maintenance activities to occur outside of the overall bird nesting season, from April 1 to August 31 (EC, 2014). If this is not possible (e.g., hazard tree), the following mitigation will apply, in accordance with the <i>MBCA</i> and the <i>Wildlife Management Plan</i>:<ul style="list-style-type: none">Within complex habitats³, removal of all vegetation is proposed to occur outside the core bird nesting season of May 1 to July 28, when a minimum of 60% of nesting activity occurs in each of the three (3) habitat types, as per Environment Canada's Nesting Calendar for Zone C3 (EC, 2014);Nest surveys will be conducted by a qualified Biologist in areas defined as simple habitat³ immediately prior to vegetation clearing and will include searching around the general vicinity of areas proposed for vegetation clearing, including within 10 m. Nesting activity will be documented when it consists of confirmed breeding evidence, as defined by OBBA criteria (OBBA, 2001);If an active nest or confirmed nesting activity is found, a buffer area will be implemented around the nest or nesting activity until a qualified Biologist has confirmed the nest is no longer active. The radius of the buffer will range depending on the species, level of disturbance and landscape context which will be confirmed by a qualified Biologist (EC, 2014b), but will protect a minimum area of 10 m surrounding the nest. This minimum buffer is expected to provide protection of the nest from nearby activities, such as vegetation clearing and heavy machinery or vehicle operation;The nest itself will not be marked using flagging tape or other similar material as this increases the risk of nest predation; however, the outer limits of the buffer can be marked (EC, 2014) and Universal Transverse Mercator (UTM) coordinates will be taken; and	<ul style="list-style-type: none">Conduct post-construction mortality and disturbance effects monitoring as described in the EEMP, including:<ul style="list-style-type: none">Pre-construction breeding bird surveys completed in 2015, as well as pre-construction breeding bird surveys completed in 2011, 2012 and / or 2013 at 12 other representative sites at varying distances from the HIWEC location, will be repeated annually for two (2) years post-construction to ensure similar species abundance and diversity continue to be found in the HIWEC study area. Post-construction breeding bird surveys will follow the same pre-construction survey protocol described in Section 2.3.3.1 of the <i>Natural Heritage Assessment: Evaluation of Importance Report</i> (AECOM, 2015c).Include representation of the WTGs within 120 m of Osprey nests in the post-construction mortality monitoring program; andAn end of year report will be provided to EC-CWS, on an annual basis for the two (2) years of post-construction bird disturbance effects monitoring to determine if additional monitoring and / or mitigation measures are warranted.	<ul style="list-style-type: none">Post-construction breeding bird monitoring will occur at the same point count stations established during pre-construction breeding bird surveys completed in 2015, as well as the pre-construction breeding bird surveys completed at the 12 representative sites in 2011, 2012 and / or 2013.	<ul style="list-style-type: none">Two (2) years of post-construction breeding bird monitoring will be completed between:<ul style="list-style-type: none">May 24 and July 10, 2018; andMay 24 and July 10, 2019.	<ul style="list-style-type: none">Compare pre-construction and post-construction survey data to determine if there are changes in breeding bird abundance and / or species diversity, including Osprey.If notable changes are observed, determine if there is evidence of a displacement or disturbance effect on breeding birds, including Osprey, as a result of the HIWEC.Determine if there is evidence of Osprey mortalities resulting from WTG operation.	<ul style="list-style-type: none">Annual reports will be submitted to EC-CWS and HIFN by:<ul style="list-style-type: none">January 2019; andJanuary 2020.	<ul style="list-style-type: none">Consider changes in turbine operations (e.g. changes in cut-in speed, selective shutdown of specific turbines at key times of year or under certain weather conditions) during periods of high mortality.In the event that, after two (2) years, breeding bird surveys indicate notable changes in bird populations, EC-CWS will be consulted to determine if additional mitigation measures are warranted through an adaptive management approach. Specific details of the adaptive management framework will be developed in consultation with EC-CWS during the permitting phase and documented in the Environmental Protection Plan.Prune any tree limbs or roots using proper arboricultural techniques.

Table 2-1: Summary of the Environmental Effects Monitoring Plan for Bird and Bat Habitats

Bird or Bat IWH	Potential Negative Environmental Effects	Performance Objective	Mitigation Strategy	Environmental Effects Monitoring Plan					Contingency Measure
				Methodology	Monitoring Locations	Frequency and Duration of Sample Collection	Technical and Statistical Value of Data	Reporting Requirements	
			<ul style="list-style-type: none">• If any suitable hazard tree, such as a tree which poses an immediate safety risk to individuals and / or a risk to the functionality of HIWEC equipment, is identified, the tree may be removed at any time through consultation with EC-CWS. The need for additional mitigation measures or permits in these circumstances will be addressed on a site-specific basis.• Develop and implement a follow-up and monitoring plan as per Environment Canada guidelines which includes a post-construction bird and bat mortality and disturbance monitoring program consistent with <i>Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds</i> (EC-CWS, 2007b), <i>Wind Turbines and Birds A Guidance Document for Environmental Assessment</i> (EC-CWS, 2007a) as well as <i>Birds and Bird Habitats: Guidelines for Wind Power Projects</i> (MNRf, 2011a).• Report the findings of the post-construction monitoring program to HIFN and EC-CWS as required on an annual basis.• Implement adaptive management techniques, such as operational mitigation as determined appropriate through post-construction monitoring.• Bird diverters / anti-perching devices should be considered in areas of Osprey nests along the on-reserve transmission line to minimize potential collisions.						
Woodland Raptor Nesting Habitat ²	<ul style="list-style-type: none">• Disturbance and / or displacement of nesting raptors during operation.• Possible mortality of raptors from operating WTGs.• Possible mortality of raptors resulting from collisions with the transmission line.	<ul style="list-style-type: none">• Minimize disturbance and / or displacement of nesting raptors.• Minimize risk of raptor mortality from of WTGs, collector lines or the transmission line.	<ul style="list-style-type: none">• Utilize a lighting scheme that will minimize potential risks for bird collisions, while still fulfilling Transport Canada requirements. Lighting scheme will include the following, where possible:<ul style="list-style-type: none">▪ Implement red LED flashing lights on WTGs.▪ Light WTGs and permanent meteorological / communication towers to the minimum federal standards.▪ Ground-level lights (i.e. buildings, WTG bases, etc.) will be directed downward and shall use motion or heat sensors where practical and allowed by applicable codes and the authority having jurisdiction.▪ Use of high-intensity lighting or spotlights, if required, will be temporary and will be kept to a minimum.▪ Any internal nacelle lighting will only be used when occupied.• Implement a proactive approach to feathering WTG blades below the manufacturer's recommended cut-in speed. Feathering refers to the act of pitching WTG blades by 90°, parallel to the wind or turning the WTG nacelle so that the blades are facing away from the wind.• Conduct maintenance activities during daylight hours for increased visibility as well as to avoid light pollution effects during the night, wherever possible.• Vegetation trimming will be limited to areas that have been previously cleared during construction.• Schedule trimming of any necessary vegetation removal during routine maintenance activities to occur outside of the overall bird nesting season, from April 1 to August 31 (EC, 2014). If this is not possible (e.g., hazard tree), the following mitigation will apply, in accordance with the <i>MBCA</i> and the Wildlife Management Plan:<ul style="list-style-type: none">▪ Within complex habitats³, removal of all vegetation is proposed to occur outside the core bird nesting season of May 1 to July 28, when a minimum of 60% of nesting activity occurs in each of the three (3) habitat types, as per Environment Canada's Nesting Calendar for Zone C3 (EC, 2014);▪ Nest surveys will be conducted by a qualified Biologist in areas defined as simple habitat³ immediately prior to vegetation clearing and will include searching around the general vicinity of areas proposed for vegetation clearing, including within 10 m. Nesting activity will be documented when it consists of confirmed breeding evidence, as defined by OBBA criteria (OBBA, 2001);▪ If an active nest or confirmed nesting activity is found, a buffer area will be implemented around the nest or nesting activity until a qualified Biologist has confirmed the nest is no longer active. The radius of the buffer will range depending on the species, level of disturbance and landscape context which will be confirmed by a qualified Biologist (EC,	<ul style="list-style-type: none">• Conduct post-construction mortality and disturbance effects monitoring including:<ul style="list-style-type: none">▪ Pre-construction breeding bird surveys completed in 2015, as well as pre-construction breeding bird surveys completed in 2011, 2012 and / or 2013 at 12 other representative sites at varying distances from the HIWEC location, will be repeated annually for two (2) years post-construction to ensure similar species abundance and diversity continue to be found in the HIWEC study area. Post-construction breeding bird surveys will follow the same pre-construction survey protocol described in Section 2.3.3.1 of the <i>Natural Heritage Assessment: Evaluation of Importance Report</i> (AECOM, 2015c).▪ Include representation of the WTGs within 120 m of confirmed raptor nests (if present) in the post-construction mortality monitoring program; and▪ An end of year report will be provided to EC-CWS, on an annual basis for the two (2) years of post-construction bird disturbance effects monitoring to determine if	<ul style="list-style-type: none">• Post-construction breeding bird monitoring will occur at the same point count stations established during pre-construction breeding bird surveys completed in 2015, as well as the pre-construction breeding bird surveys completed at the 12 representative sites in 2011, 2012 and / or 2013.	<ul style="list-style-type: none">• Two (2) years of post-construction breeding bird monitoring will be completed between:<ul style="list-style-type: none">▪ May 24 and July 10, 2018; and▪ May 24 and July 10, 2019.	<ul style="list-style-type: none">• Compare pre-construction and post-construction survey data to determine if there are changes in breeding bird abundance and / or species diversity.• If notable changes are observed, determine if there is evidence of a displacement or disturbance effect on breeding birds as a result of the HIWEC.• Determine if there is evidence of raptor mortalities resulting from WTG operation.	<ul style="list-style-type: none">• Annual reports will be submitted to EC-CWS and HIFN by:<ul style="list-style-type: none">▪ January 2019; and▪ January 2020.	<ul style="list-style-type: none">• Consider changes in turbine operations (e.g. changes in cut-in speed, selective shutdown of specific turbines at key times of year or under certain weather conditions) during periods of high mortality.• In the event that, after two (2) years, breeding bird surveys indicate notable changes in bird populations, EC-CWS will be consulted to determine if additional mitigation measures are warranted through an adaptive management approach. Specific details of the adaptive management framework will be developed in consultation with EC-CWS during the permitting phase and documented in the Environmental Protection Plan.• Prune any tree limbs or roots using proper arboricultural techniques.

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				Methodology	Monitoring Locations	Frequency and Duration of Sample Collection	Technical and Statistical Value of Data	Reporting Requirements	
			<p>2014b), but will protect a minimum area of 10 m surrounding the nest. This minimum buffer is expected to provide protection of the nest from nearby activities, such as vegetation clearing and heavy machinery or vehicle operation;</p> <ul style="list-style-type: none">▪ The nest itself will not be marked using flagging tape or other similar material as this increases the risk of nest predation; however, the outer limits of the buffer can be marked (EC, 2014) and Universal Transverse Mercator (UTM) coordinates will be taken; and• If any suitable hazard tree, such as a tree which poses an immediate safety risk to individuals and / or a risk to the functionality of HIWEC equipment, is identified, the tree may be removed at any time through consultation with EC-CWS. The need for additional mitigation measures or permits in these circumstances will be addressed on a site-specific basis.• Develop and implement a follow-up and monitoring plan as per Environment Canada guidelines which includes a post-construction bird and bat mortality and disturbance monitoring program consistent with <i>Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds</i> (EC-CWS, 2007b), <i>Wind Turbines and Birds A Guidance Document for Environmental Assessment</i> (EC-CWS, 2007a) as well as <i>Birds and Bird Habitats: Guidelines for Wind Power Projects</i> (MNR, 2011a).• Report the findings of the post-construction monitoring program to HIFN and EC-CWS as required on an annual basis.• Implement adaptive management techniques, such as operational mitigation as determined appropriate through post-construction monitoring.• Bird diverters / anti-perching devices should be considered in areas of confirmed raptor nests along the on-reserve transmission line to minimize potential collisions.	<p>additional monitoring and / or mitigation measures are warranted.</p>					
Marsh Bird Breeding Habitat, including habitat for Bird SOCC (Black Tern and Yellow Rail)²	<ul style="list-style-type: none">• Disturbance and / or displacement of marsh breeding birds during operation.• Possible mortality of marsh breeding birds resulting from operating WTGs.• Possible mortality or disturbance to marsh breeding birds resulting from vegetation clearing during maintenance activities.	<ul style="list-style-type: none">• Minimize disturbance and / or displacement of marsh breeding birds.• Minimize risk of WTG related marsh breeding bird mortality.• Avoid mortality and minimize disturbance to marsh breeding birds during maintenance activities.	<ul style="list-style-type: none">• Utilize a lighting scheme that will minimize potential risks for bird collisions, while still fulfilling Transport Canada requirements. Lighting scheme will include the following, where possible:<ul style="list-style-type: none">▪ Implement red LED flashing lights on WTGs.▪ Light WTGs and permanent meteorological / communication towers to the minimum federal standards.▪ Ground-level lights (i.e. buildings, WTG bases, etc.) will be directed downward and shall use motion or heat sensors where practical and allowed by applicable codes and the authority having jurisdiction.▪ Use of high-intensity lighting or spotlights, if required, will be temporary and will be kept to a minimum.▪ Any internal nacelle lighting will only be used when occupied.• Implement a proactive approach to feathering WTG blades below the manufacturer's recommended cut-in speed. Feathering refers to the act of pitching WTG blades by 90°, parallel to the wind or turning the WTG nacelle so that the blades are facing away from the wind.• Conduct maintenance activities during daylight hours for increased visibility as well as to avoid light pollution effects during the night, wherever possible.• Vegetation trimming will be limited to areas that have been previously cleared during construction.• Schedule trimming of any necessary vegetation removal during routine maintenance activities to occur outside of the overall bird nesting season, from April 1 to August 31 (EC, 2014). If this is not possible (e.g., hazard tree), the following mitigation will apply, in accordance with the <i>MBCA</i> and the Wildlife Management Plan:<ul style="list-style-type: none">▪ Within complex habitats³, removal of all vegetation is proposed to occur outside the core bird nesting season of May 1 to July 28, when a minimum of 60% of nesting activity occurs in each of the three (3) habitat types, as per Environment Canada's Nesting Calendar for Zone C3 (EC, 2014);▪ Nest surveys will be conducted by a qualified Biologist in areas defined as simple habitat³ immediately prior to vegetation clearing and will include searching around the general vicinity of areas proposed for vegetation clearing, including within 10 m. Nesting activity will be	<ul style="list-style-type: none">• Conduct post-construction mortality and disturbance effects monitoring including:<ul style="list-style-type: none">▪ Pre-construction breeding bird surveys completed in 2015, as well as pre-construction breeding bird surveys completed in 2011, 2012 and / or 2013 at 12 other representative sites at varying distances from the HIWEC location, will be repeated annually for two (2) years post-construction to ensure similar species abundance and diversity continue to be found in the HIWEC study area. Post-construction breeding bird surveys will follow the same pre-construction survey protocol described in Section 2.3.3.1 of the <i>Natural Heritage Assessment: Evaluation of Importance Report</i> (AECOM, 2015c).▪ Include representation of the WTGs within 120 m of marsh bird breeding habitats in the post-construction mortality monitoring program; and	<ul style="list-style-type: none">• Post-construction breeding bird monitoring will occur at the same point count stations established during pre-construction breeding bird surveys completed in 2015, as well as the pre-construction breeding bird surveys completed at the 12 representative sites in 2011, 2012 and / or 2013.	<ul style="list-style-type: none">• Two (2) years of post-construction breeding bird monitoring will be completed between:<ul style="list-style-type: none">▪ May 24 and July 10, 2018; and▪ May 24 and July 10, 2019.	<ul style="list-style-type: none">• Compare pre-construction and post-construction survey data to determine if there are changes in breeding bird abundance and / or species diversity.• If notable changes are observed, determine if there is evidence of a displacement or disturbance effect on breeding birds as a result of the HIWEC.• Determine if there is evidence of marsh breeding bird and / or bird SOCC mortalities resulting from WTG operation.	<ul style="list-style-type: none">• Annual reports will be submitted to EC-CWS and HIFN by:<ul style="list-style-type: none">▪ January 2019; and▪ January 2020.	<ul style="list-style-type: none">• Consider changes in turbine operations (e.g. changes in cut-in speed, selective shutdown of specific turbines at key times of year or under certain weather conditions) during periods of high mortality.• In the event that, after two (2) years, breeding bird surveys indicate notable changes in bird populations, EC-CWS will be consulted to determine if additional mitigation measures are warranted through an adaptive management approach. Specific details of the adaptive management framework will be developed in consultation with EC-CWS during the permitting phase and documented in the Environmental Protection Plan.• Prune any tree limbs or roots using proper arboricultural techniques.

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			<p>documented when it consists of confirmed breeding evidence, as defined by OBBA criteria (OBBA, 2001);</p> <ul style="list-style-type: none">▪ If an active nest or confirmed nesting activity is found, a buffer area will be implemented around the nest or nesting activity until a qualified Biologist has confirmed the nest is no longer active. The radius of the buffer will range depending on the species, level of disturbance and landscape context which will be confirmed by a qualified Biologist (EC, 2014b), but will protect a minimum area of 10 m surrounding the nest. This minimum buffer is expected to provide protection of the nest from nearby activities, such as vegetation clearing and heavy machinery or vehicle operation;▪ The nest itself will not be marked using flagging tape or other similar material as this increases the risk of nest predation; however, the outer limits of the buffer can be marked (EC, 2014) and Universal Transverse Mercator (UTM) coordinates will be taken; and• If any suitable hazard tree, such as a tree which poses an immediate safety risk to individuals and / or a risk to the functionality of HIWEC equipment, is identified, the tree may be removed at any time through consultation with EC-CWS. The need for additional mitigation measures or permits in these circumstances will be addressed on a site-specific basis.• Develop and implement a follow-up and monitoring plan as per Environment Canada guidelines which includes a post-construction bird and bat mortality and disturbance monitoring program consistent with <i>Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds</i> (EC-CWS, 2007b), <i>Wind Turbines and Birds A Guidance Document for Environmental Assessment</i> (EC-CWS, 2007a) as well as <i>Birds and Bird Habitats: Guidelines for Wind Power Projects</i> (MNRF, 2011a).• Report the findings of the post-construction monitoring program to HIFN and EC-CWS as required on an annual basis.• Implement adaptive management techniques, such as operational mitigation as determined appropriate through post-construction monitoring.	<ul style="list-style-type: none">▪ An end of year report will be provided to EC-CWS, on an annual basis for the two (2) years of post-construction bird disturbance effects monitoring to determine if additional monitoring and / or mitigation measures are warranted.					
Habitat for Bird SOCC (Eastern Wood-pewee, Prairie Warbler, Wood Thrush)²	<ul style="list-style-type: none">• Disturbance and / or displacement of avian SOCC during operation.• Possible mortality of avian SOCC resulting from operating WTGs.• Possible mortality or disturbance to avian SOCC resulting from vegetation clearing during maintenance activities.	<ul style="list-style-type: none">• Minimize disturbance and / or displacement of avian SOCC.• Minimize risk of WTG related avian SOCC mortality.• Avoid mortality and minimize disturbance to avian SOCC during maintenance activities.	<ul style="list-style-type: none">• Utilize a lighting scheme that will minimize potential risks for bird collisions, while still fulfilling Transport Canada requirements. Lighting scheme will include the following, where possible:<ul style="list-style-type: none">▪ Implement red LED flashing lights on WTGs.▪ Light WTGs and permanent meteorological / communication towers to the minimum federal standards.▪ Ground-level lights (i.e. buildings, WTG bases, etc.) will be directed downward and shall use motion or heat sensors where practical and allowed by applicable codes and the authority having jurisdiction.▪ Use of high-intensity lighting or spotlights, if required, will be temporary and will be kept to a minimum.▪ Any internal nacelle lighting will only be used when occupied.• Implement a proactive approach to feathering WTG blades below the manufacturer's recommended cut-in speed. Feathering refers to the act of pitching WTG blades by 90°, parallel to the wind or turning the WTG nacelle so that the blades are facing away from the wind.• Conduct maintenance activities during daylight hours for increased visibility as well as to avoid light pollution effects during the night, wherever possible.• Vegetation trimming will be limited to areas that have been previously cleared during construction.• Schedule trimming of any necessary vegetation removal during routine maintenance activities to occur outside of the overall bird nesting season, from April 1 to August 31 (EC, 2014). If this is not possible (e.g., hazard tree), the following mitigation will apply, in accordance with the <i>MBCA</i> and the Wildlife Management Plan:<ul style="list-style-type: none">▪ Within complex habitats³, removal of all vegetation is proposed to occur outside the core bird nesting season of May 1 to July 28, when a minimum of 60% of nesting activity occurs in each of the three (3) habitat types, as per Environment Canada's Nesting Calendar for Zone C3 (EC, 2014);	<ul style="list-style-type: none">• Conduct post-construction mortality and disturbance effects monitoring as described in the EEMP, including:<ul style="list-style-type: none">▪ Pre-construction breeding bird surveys completed in 2015, as well as pre-construction breeding bird surveys completed in 2011, 2012 and / or 2013 at 12 other representative sites at varying distances from the HIWEC location, will be repeated annually for two (2) years post-construction to ensure similar species abundance and diversity continue to be found in the HIWEC study area. Post-construction breeding bird surveys will follow the same pre-construction survey protocol described in Section 2.3.3.1 of the <i>Natural Heritage Assessment: Evaluation of Importance Report</i>	<ul style="list-style-type: none">• Post-construction breeding bird monitoring will occur at the same point count stations established during pre-construction breeding bird surveys completed in 2015, as well as the pre-construction breeding bird surveys completed at the 12 representative sites in 2011, 2012 and / or 2013.	<ul style="list-style-type: none">• Two (2) years of post-construction breeding bird monitoring will be completed between:<ul style="list-style-type: none">▪ May 24 and July 10, 2018; and▪ May 24 and July 10, 2019.	<ul style="list-style-type: none">• Compare pre-construction and post-construction survey data to determine if there are changes in breeding bird abundance and / or species diversity.• If notable changes are observed, determine if there is evidence of a displacement or disturbance effect on breeding birds as a result of the HIWEC.• Determine if there is evidence of bird SOCC mortalities resulting from WTG operation.	<ul style="list-style-type: none">• Annual reports will be submitted to EC-CWS and HIFN by:<ul style="list-style-type: none">▪ January 2019; and▪ January 2020.	<ul style="list-style-type: none">• Consider changes in turbine operations (e.g. changes in cut-in speed, selective shutdown of specific turbines at key times of year or under certain weather conditions) during periods of high mortality.• In the event that, after two (2) years, breeding bird surveys indicate notable changes in bird populations, EC-CWS will be consulted to determine if additional mitigation measures are warranted through an adaptive management approach. Specific details of the adaptive management framework will be developed in consultation with EC-CWS during the permitting phase and documented in the Environmental Protection Plan.• Prune any tree limbs or roots using proper arboricultural techniques.

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			<ul style="list-style-type: none">▪ Nest surveys will be conducted by a qualified Biologist in areas defined as simple habitat³ immediately prior to vegetation clearing and will include searching around the general vicinity of areas proposed for vegetation clearing, including within 10 m. Nesting activity will be documented when it consists of confirmed breeding evidence, as defined by OBBA criteria (OBBA, 2001);▪ If an active nest or confirmed nesting activity is found, a buffer area will be implemented around the nest or nesting activity until a qualified Biologist has confirmed the nest is no longer active. The radius of the buffer will range depending on the species, level of disturbance and landscape context which will be confirmed by a qualified Biologist (EC, 2014b), but will protect a minimum area of 10 m surrounding the nest. This minimum buffer is expected to provide protection of the nest from nearby activities, such as vegetation clearing and heavy machinery or vehicle operation;▪ The nest itself will not be marked using flagging tape or other similar material as this increases the risk of nest predation; however, the outer limits of the buffer can be marked (EC, 2014) and Universal Transverse Mercator (UTM) coordinates will be taken; and• If any suitable hazard tree, such as a tree which poses an immediate safety risk to individuals and / or a risk to the functionality of HIWEC equipment, is identified, the tree may be removed at any time through consultation with EC-CWS. The need for additional mitigation measures or permits in these circumstances will be addressed on a site-specific basis.• Develop and implement a follow-up and monitoring plan as per Environment Canada guidelines which includes a post-construction bird and bat mortality and disturbance monitoring program consistent with <i>Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds</i> (EC-CWS, 2007b), <i>Wind Turbines and Birds A Guidance Document for Environmental Assessment</i> (EC-CWS, 2007a) as well as <i>Birds and Bird Habitats: Guidelines for Wind Power Projects</i> (MNRF, 2011a).• Report the findings of the post-construction monitoring program to HIFN and EC-CWS as required on an annual basis.• Implement adaptive management techniques, such as operational mitigation as determined appropriate through post-construction monitoring.	<p>(AECOM, 2015c).</p> <ul style="list-style-type: none">▪ Include representation of the WTGs within 120 m of avian SOCC habitat areas in the post-construction mortality monitoring program; and▪ An end of year report will be provided to EC-CWS, on an annual basis for the two (2) years of post-construction bird disturbance effects monitoring to determine if additional monitoring and / or mitigation measures are warranted.					

3. Post-construction Bird and Bat Mortality Monitoring

Under provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN EA Guidance document, an EEMP must be prepared to address negative environmental effects that may result from engaging in a Class 4 wind energy project, including post-construction bird and bat mortality surveys for three (3) years to address potential negative environmental effects to birds and bats.

Based on EC-CWS guidance (2007a), Category 4 projects typically require at least two (2) years of carcass searches around turbines during seasons when there is an elevated collision risk (e.g. when concentrations of birds are present, or during the migration season). Guidelines for estimating mortality, including protocols for searching around turbines, carrying out observer efficiency trials and estimating total mortality from the number of carcasses found are provided in *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC-CWS, 2007b).

The following post-construction bird and bat mortality monitoring program has been developed in consideration of both federal and provincial guidelines.

3.1 Mortality Thresholds

EC-CWS guidance (EC-CWS, 2007a and 2007b) does not specify mortality thresholds for bird mortality that would trigger adaptive management if exceeded during post-construction mortality monitoring. Therefore, the thresholds established by provincial guidance (MNRF, 2011a and 2011b) will be used for the post-construction mortality monitoring program at the HIWEC.

3.1.1 Bats

In accordance with provincial guidance (MNRF, 2011b), bat mortality is considered to be significant when a threshold of annual bat mortality (averaged across the HIWEC) exceeds:

- 10 bats / WTG / year.

A monitoring year is considered to be from May 1 to October 31 (MNRF, 2011b).

3.1.2 Birds

In accordance with provincial guidance (MNRF, 2011a), bird mortality is considered to be significant when a threshold of annual bird mortality exceeds:

- 14 birds / WTG / year at individual WTGs or WTG groups;
- 0.2 raptors / WTG / year (all raptors) across a wind power project; or
- 0.1 raptors / WTG / year (provincially tracked raptors) across a wind power project.

A monitoring year is considered to be from May 1 to October 31 and continues until November 30 specifically for raptor monitoring. Provincially tracked raptors are defined as raptors of provincial conservation concern by MNRF's Natural Heritage Information Centre (NHIC) (MNRF, 2011a).

3.2 Post-Construction Monitoring Methods

Post-construction bird and bat mortality surveys are designed to estimate bird and bat mortality from operating WTGs. Bird and bat mortality surveys identify the number of birds or bats killed per WTG over a known period of time (e.g. expressed as bats / WTG / year or birds / WTG / year). This value represents an estimate of bird or bat mortality adjusted for carcass removal rates, searcher efficiency, and the area searched. The information obtained through post-construction bird and bat mortality monitoring can be used to evaluate the success of mitigation measures and inform adaptive management in the event that significant mortality is detected.

In accordance with provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN EA Guidance document, post-construction mortality monitoring is required for three (3) years at all Class 4 wind power projects and will consist of:

- Regular bird / bat carcass searches around specific wind turbines;
- Calculation of a correction factor to account for bird / bat carcass removal by scavengers;
- Calculation of a correction factor to account for bird / bat searcher efficiency (i.e., number of bat / bird fatalities present that are actually detected by surveyors);
- Calculation of a correction factor to account for the area searched;
- For birds, subsequent two (2) years of scoped mortality and cause and effects monitoring at individual WTGs (and unmonitored WTGs in near proximity), following any given year where an annual post-construction mortality report identifies significant bird or raptor mortality; and
- For birds and / or bats, should significant mortality be observed and operational mitigation implemented, post-construction monitoring will be conducted for an additional three (3) years from the implementation of operational mitigation to evaluate the effectiveness of the mitigation.

In accordance with EC-CWS guidance (EC-CWS, 2007a and 2007b), post-construction bird mortality monitoring is required for two (2) to three (3) years at all Category 4 wind power projects and will consist of:

- Regular bird carcass searches around selected wind turbines;
- Calculation of a correction factor to account for bird carcass removal by scavengers;
- Calculation of a correction factor to account for bird searcher efficiency (i.e., number of bird fatalities present that are actually detected by surveyors);
- Calculation of a correction factor to account for the area searched; and
- Post-construction monitoring requirements may be extended if substantial bird mortality occurs and subsequent mitigation measures are applied.

Post-construction mortality monitoring requirements for bats are not specified in federal guidelines including *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds* (EC-CWS, 2007b). Therefore, bat mortality monitoring requirements for the HIWEC were developed by consulting the provincial guidelines established in *Bats and Bat Habitats: Guidelines for Wind Power Projects* (MNRF, 2011b).

All federal and / or provincial permits required to handle any dead birds or bats found during carcass searches or used as part of scavenger removal trains or searcher efficiency trials will be acquired in advance of conducting post-construction mortality monitoring at the HIWEC. All staff involved in the handling of bird or bat carcasses will have up to date rabies pre-exposure vaccinations, or will follow alternative handling protocol that further eliminates potential contact with the rabies virus.

3.2.1 *Effort and Timing for Bird and Bat Mortality Monitoring*

Based on provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN EA Guidance document, minimum requirements for post-construction bird and bat mortality monitoring at the HIWEC include:

- Post-construction mortality monitoring (including carcass searches, scavenger removal and searcher efficiency trials) will occur from May 1 to October 31 for all birds and bats, and continue until November 30 specifically for raptor monitoring. This period covers the core season when birds are active in Ontario, including spring activity through fall migration (MNRF, 2011a), as well as the core season when bats are active in Ontario, including spring activity through fall swarming and migration (MNRF, 2011b).
- A sub-sample of at least 30% of WTGs will be selected to cover representative areas throughout the HIWEC.
- Bird and bat carcass searches will be conducted at each monitored WTG twice per week (3 and 4 day intervals) from May 1 to October 31.
- All WTGs within the HIWEC that are not part of the sub-sample will be monitored once a month during the May 1 to November 30 survey period for evidence of raptor mortalities, and surveys for raptor mortality will be completed once per week from November 1 to November 30 at the sub-sample of at least 30% of WTGs. These additional surveys are not to be added to the sample survey mortality estimate calculations; the purpose of the raptor mortality surveys is to identify any individual or groups of WTGs that may exceed the significant mortality threshold.
- Where significant annual bird mortality is identified, subsequent scoped mortality and cause effects monitoring will be conducted for two (2) years at individual WTGs (and unmonitored WTGs in near proximity).
- Should significant bat or bird mortality be observed, and operational mitigation implemented, post-construction monitoring will be conducted for an additional three (3) years from the implementation of operational mitigation to evaluate the effectiveness of the mitigation.

These requirements are generally consistent with federal guidance (EC-CWS, 2007a and 2007b), including:

- The minimum duration of carcass searches for birds would typically be six (6) weeks during the spring migratory period, which varies by region but generally is from early April to the end of May, as well as 8 weeks during the fall migratory period, which varies by region but generally extends from early August to the middle of October.
- If significant numbers of raptors, species with aerial mating displays, or other birds that during baseline behavioural studies showed a propensity for flying at the height of the blades are present at other times of the year (e.g. breeding season or over-winter), then additional carcass searching should be undertaken during the period when these birds are present.
- For the breeding season, this would normally be a six (6) week period from late May to early July.
- In winter, this would depend on when birds are present in the area, could be anywhere from four (4) to 12 weeks, and could vary with time of year and weather conditions.
- For smaller sites (1-10 turbines), every WTG should be searched. For larger sites, a subset of WTGs should be selected to cover representative areas throughout the wind energy installation.

The May 1 to November 30 survey period for birds specified by provincial guidance (MNRF, 2011a) encompasses the timing recommendations of federal guidance (EC-CWS, 2007b), with the possible exception of spring migratory

period and winter surveys. Baseline migratory bird surveys completed in support of the HIWEC EA are summarized in the following reports:

- *Summary of 2011, 2012 and 2013 Raptor Migration Surveys – Henvey Inlet Wind Energy Centre Study Area* (AECOM, 2015f);
- *Summary of 2011, 2012 and 2013 Passerine Migration Surveys – Henvey Inlet Wind Energy Centre Study Area* (AECOM, 2015g);
- *Summary of 2013 Waterfowl Migration Surveys – Henvey Inlet Wind Energy Centre Study Area* (AECOM, 2015h); and
- *Natural Heritage Assessment: Evaluation of Importance Report* (AECOM, 2015c).

Based on the results of the baseline migratory bird surveys and the location of the HIWEC, a start date of May 1 is considered appropriate to observe potential impacts during the peak spring migratory period. In addition, few birds are expected to over winter in the HIWEC study area; therefore, winter season mortality surveys are not considered necessary. Furthermore, the post-construction mortality monitoring season for the HIWEC of May 1 to October 31 is consistent with the monitoring requirements for other wind power projects in Ontario (MNRF, 2011a and 2011b) and will allow for a more robust comparison of results with other operational facilities.

A sub-sample of at least 27 WTGs (30% of up to 91 turbines) will be selected for carcass searches in consultation with EC-CWS and HIFN to cover representative areas throughout the HIWEC, following the evaluation of pre-construction Evaluation of Importance survey data and the determination of which WTGs (up to 91 of 120) will ultimately be constructed. WTGs will be selected through a scientifically defensible system (e.g. stratification). Representation of the WTGs adjacent to (i.e., within 120 m of) the following bird and bat IWH features will be included in the subset of WTGs (minimum 27) selected for the post-construction mortality monitoring program (refer to **Table 2-1**):

- Bat Maternity Colonies;
- Waterfowl Nesting Areas;
- Active Osprey nests;
- Confirmed raptor nests (if present);
- Marsh Bird Breeding Habitats; and
- Avian SOCC habitat areas.

Post-construction mortality monitoring will begin on May 1 of the year that the HIWEC is fully operational. The scheduled commercial operation date of the HIWEC is February 2018; therefore, it is anticipated that post-construction monitoring will begin on May 1, 2018. If full HIWEC commissioning is delayed, post-construction monitoring of a partially completed project will not be delayed for longer than one (1) year. If the HIWEC is constructed in phases, monitoring for each phase will coincide with the commencement of operation of that phase.

The above post-construction mortality monitoring methods may be modified in consultation with EC-CWS and HIFN.

3.2.2 Carcass Searches

Mortality of birds and bats from WTGs is determined by searching for carcasses. Based on provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN Guidance document, minimum requirements for carcass searches at the HIWEC include:

- The time required to search each WTG will vary depending on the surrounding habitat (e.g. open rock barren vs. forest) and individual searchers, but searchers will aim for a consistent search time for all surveyed WTGs (e.g. 20 minutes per turbine).
- Each surveyed WTG will have a search area that has a 50 m radius.

- Within this 50 m radius, the search area will be examined using transects spaced 5 to 6 m apart, allowing for a visual search of 2.5 to 3.0 m on each side. The search area may be rectangular, square or circular depending on WTG locations and arrangements and surrounding terrain.
- The search area of each WTG will be mapped into visibility classes according to the following table. Where the majority of the search area would not be searchable due to vegetation cover or other impediments (e.g. Visibility Class 4) these WTGs will not be included in the sub-sample of monitored turbines.

% Vegetation Cover	Vegetation Height	Visibility Class
≥ 90% bare ground	≤15 cm tall	Class 1 (Easy)
≥ 25% bare ground	≤15 cm tall	Class 2 (Moderate)
≤ 25% bare ground	≤ 25% > 30 cm tall	Class 3 (Difficult)
Little or no bare ground	≥ 25% > 30 cm tall	Class 4 (Very Difficult)

- Where possible, ground cover around WTGs will be maintained at a low level in order to facilitate more accurate bird and bat mortality surveys.
- A map of the actual search area for each WTG searched, and a description of areas deemed to be unsearchable (e.g., vegetation height, type, slope, etc.), will be provided in the post-construction mortality monitoring report.
- Mortality surveys that incorporate the use of trained dogs (i.e., dog handler teams to locate mortalities) to improve searcher efficiency will be considered, particularly in difficult terrain.
- For each WTG surveyed, the date, search start and end times, and area searched will be documented. All carcasses found will be photographed and recorded / labelled with species, sex, time and date it was found, location (UTM coordinates), carcass condition (e.g. state of decomposition), searcher, extent and type of injuries sustained, ground cover, and distance and direction to the nearest turbine.
- Weather conditions including wind speed and precipitation will be included as part of the data collection.
- The estimated number of days since death and condition of each carcass collected will be recorded in one of the following categories:
 - Fresh;
 - Early decomposition;
 - Moderate decomposition;
 - Advanced decomposition;
 - Complete decomposition; or
 - Scavenged.
- Bird carcasses found during carcass searches may be collected and stored in a freezer and used in carcass removal or searcher efficiency trials, assuming they are in reasonable condition.
- Carcasses of the following bat species found during carcass searches may be stored in a freezer and used in carcass removal or searcher efficiency trials, assuming they are in reasonable condition:
 - Silver-haired Bat (*Lasionycteris noctivagans*);
 - Hoary Bat (*Lasiurus cinereus*); and
 - Eastern Red Bat (*Lasiurus borealis*).

- Because of White-nose Syndrome contamination risks, the following species will not be used in carcass removal or searcher efficiency trials (instead, carcasses of these species may be sent to the Canadian Cooperative Wildlife Health Centre for analysis of White-nose Syndrome):
 - Northern Myotis (*Myotis septentrionalis*);
 - Little Brown Bat (*Myotis lucifugus*);
 - Eastern Small-footed Bat (*Myotis leibii*);
 - Tri-colored Bat (*Perimyotis subflavus*); and
 - Big Brown Bat (*Eptesicus fuscus*).

These requirements are generally consistent with federal guidance (EC-CWS, 2007a and 2007b), including:

- In most cases, carcass searches should be conducted every three (3) days at a site, to minimize loss of carcasses due to scavenging, and to more reliably estimate the actual date / weather conditions when mortality took place.
- Proponents should consider the use of trained dogs, which can increase the efficiency of carcass searches, particularly if the search area has significant vegetation.
- Visual detection of carcasses can be affected by light conditions, wind (a slight breeze causes feathers to flutter), and rain (rain can flatten feathers).
- Carcass searches should focus on areas around the WTG that can be searched efficiently (i.e., the gravel pad at the base of the WTG, roads extending from it, and areas of ground nearby with a high proportion of short vegetation or bare ground cover).
- Searching should be undertaken uniformly throughout the selected search area.
- Whenever possible, searches should begin as soon after sunrise as practical, to minimize carcass loss from early morning scavengers.
- Regardless of the area searched, it will usually be necessary to calculate a correction factor to allow for carcasses that fall in areas that were not searched. Therefore, the area that was searched, date, search start and end times, and average wind speed and direction on each night since the last search should be recorded, as well as the following information for each carcass found: date and time it was found, state of decomposition, extent and type of injuries sustained, species, distance and direction to nearest turbine as well as GPS coordinates of the carcass, and the substrate on which it was found.

Based on this guidance, carcass searches at the HIWEC will take place as soon after sunrise as practical, and the average wind strength and direction on each night since the last search will also be recorded.

The above carcass search methods may be modified in consultation with EC-CWS and HIFN.

3.2.3 Carcass Removal / Scavenger Trials

The level of carcass scavenging must be determined through carcass removal / scavenger trials. In these trials, carcasses are placed around WTGs and monitored until they disappear. The average carcass removal time is a factor in determining the estimated bird or bat mortality. Based on provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN Guidance document, minimum requirements for carcass removal / scavenger trials at the HIWEC include:

- Carcass removal / scavenger trials will be conducted at least once a season (Spring: May / June; Summer: July / August; and Fall: September / October) during the same period as the carcass searches.

- A minimum of 10 carcasses will be used for each trial.
- Placed carcasses will be monitored every 3 to 4 days in conjunction with carcass searches.
- Carcass removal / scavenger trials will be conducted in a variety of weather conditions. Weather conditions will be recorded.
- Carcasses will be distributed across the range of different habitats, substrates and visibility classes of WTGs being searched.
- To the extent possible, carcass removal trials will be conducted at turbines WTGs that are not part of the carcass search sub-sample.
- Carcasses will be placed before dusk using gloves and boots to avoid imparting human smell that might bias trial results (e.g., attract scavengers, etc.).
- Trials will continue until all carcasses are removed or have completely decomposed, generally two (2) weeks.
- To avoid confusion with WTG related fatalities, trial carcasses will be discretely marked (e.g., clipping of ear, wing, fur; hole punching ear, etc.) with a unique identification so they can be identified as trial carcasses.
- Carcasses used will be as fresh as possible since frozen or decomposed carcasses are less attractive to scavengers. If frozen carcasses are used, they will be thawed prior to beginning carcass removal trials.
- To the extent possible, bat carcasses will be used for at least one third of the carcass removal trials, and bird carcasses will comprise another third of the trial carcasses. Trials using other small brown mammal or bird carcasses (e.g., mice or brown chicks) may also be used when bird and bat carcasses are not available.
- Scavenging will be determined on a site-specific basis and rates will not be assumed to be similar between sites or used in calculations for other projects.

These requirements are generally consistent with federal guidance (EC-CWS, 2007a and 2007b), including:

- Carcass removal / scavenger trials should be conducted at least twice during each season when carcass searches are being undertaken, as the suite of scavengers is likely to change throughout the year.
- Carcass removal / scavenger trials should use carcasses that resemble native birds and are freshly dead or were frozen when freshly dead (e.g. turbine victims, quails and quail chicks from farmers, dark chicks from industrial chicken farms or breeders).
- Carcasses should be laid out in the search area, georeferenced by GPS, and then left in place for up to two (2) weeks while checking for them on the day of each carcass search.
- Carcasses should be distributed at all turbines where searches are undertaken, with no more than one or two carcasses per turbine.
- Carcasses should be distributed across the range of different substrates of WTGs being searched, roughly in proportion to their proportion in the search area.

Carcass searches conducted three (3) times a year (Spring: May / June; Summer: July / August; and Fall: September / October) are considered sufficient to account for changes in the suite of scavengers that may take place throughout the year. Given the number of WTGs at the HIWEC, and to prevent confounding of the results of carcass searches and carcass removal / scavenger trials, carcass removal / scavenger trials will take place at WTGs that are not part of the carcass search sub-sample. As well, larger birds (e.g. brown chickens) may be used to calculate raptor-specific correction factors for scavenging rates at the HIWEC.

The above carcass removal / scavenger trial methods may be modified in consultation with EC-CWS and HIFN.

3.2.4 Searcher Efficiency Trials

Searcher efficiency is another important factor in estimating bird and bat mortality. Searcher efficiency trials require a known number of discretely marked carcasses to be placed around a WTG. Searchers examine the WTG area, and the number of carcasses that they find is compared to the number of carcasses placed. Based on provincial guidance (MNR, 2011a and 2011b) and therefore in accordance with the HIFN Guidance document, minimum requirements for searcher efficiency trials at the HIWEC include:

- Searcher efficiency trials will be conducted at least once a season (Spring: May / June; Summer: July / August; and Fall: September / October) during the same period as the bird and bat carcass searches.
- A 'tester' will control the trials. The tester will set out carcasses within the area to be searched. The tester will return to collect marked trial carcasses at the completion of the trial to determine the number of carcasses remaining and if any carcasses were scavenged or removed during the trial.
- Searcher efficiency trials will be conducted for each individual searcher or team involved in searching for carcasses (including teams using dogs). The searcher will not be notified when they are participating in an efficiency trial to avoid potential search biases.
- A minimum of 10 carcasses per searcher per season in all applicable visibility classes (see table above) are to be used. The average per searcher across all visibility classes will be used for calculations; this average may be weighted by the relative proportion of WTGs in each visibility class.
- Trial carcasses will be spread out over the trial period (month or season) and conducted with the carcass searches. No more than three (3) trial carcasses will be placed at any one time to avoid bias and flooding the area with carcasses.
- Trial carcasses will be randomly placed within the search area and their location recorded so that they can be retrieved if they are not found during the trial.
- Trial carcasses will be discretely marked (e.g., clipping of ear, wing, leg, fur; hole-punching ear, etc.) with a unique identification so that they can be identified as a trial carcass by the tester.
- To the extent possible, bat carcasses will be used for at least one third of the carcass removal trials, and bird carcasses will comprise another third of the trial carcasses. Trials using other small brown mammal or bird carcasses (e.g., mice or brown chicks) may also be used when bird and bat carcasses are not available.
- If frozen carcasses are used, they will be thawed prior to beginning searcher efficiency trials.

These requirements are generally consistent with federal guidance (EC-CWS, 2007a and 2007b), including:

- Searcher efficiency must be tested for every individual or team involved in searching for carcasses.
- Unknown to the searcher, another person sets out the carcasses on the previous evening within the area to be searched the following day.
- Carcasses should be placed at random locations within the search area.
- Whenever possible, the carcasses of native species that may be expected at the WTG site should be used.
- No more than one (1) or two (2) carcasses should be placed in the search area of any given turbine on a single visit.
- At least 20 carcasses should be used when testing observers. These should be spread over multiple visits, so that the observer does not become aware that a test is underway.

- Data recorded for each bird carcass should include: species; date, time and location it was placed; date and time it was searched for and whether it was found, overlooked or scavenged; and name of searcher. If the carcass remained, its condition (intact, partially scavenged or decomposed) should also be recorded.

Based on this guidance, no more than two (2) carcasses will be placed in the search area of any given turbine on a single visit at the HIWEC. A minimum of 10 carcasses per searcher per season (or a minimum 30 carcasses per year) will meet both provincial and federal guidelines. Data recorded for each bird carcass will include: species; date, time and location it was placed; date and time it was searched for and whether it was found, overlooked or scavenged; and name of searcher. If the carcass remained, its condition (intact, partially scavenged or decomposed) should also be recorded.

The above searcher efficiency trial methods may be modified in consultation with EC-CWS and HIFN.

3.2.5 Calculations

EC-CWS guidance (EC-CWS, 2007a and 2007b) does not specify the statistical approach to be used to estimate total mortality. Therefore, bird and bat mortality rates will be estimated according to provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN Guidance document.

Scavenger Correction Factor

The following formula will be used to calculate the overall scavenger correction (S_c) factor based on the proportion of carcasses remaining after each search interval is pooled:

$$S_c = \frac{n_{\text{visit1}} + n_{\text{visit2}} + n_{\text{visit3}}}{n_{\text{visit0}} + n_{\text{visit1}} + n_{\text{visit2}}}$$

Where, S_c is the proportion of carcasses not removed by scavengers over the search period;
 n_{visit0} is the total number of carcasses placed; and
 n_{visit1} to n_{visit3} are the numbers of carcasses remaining on visits one (1) through three (3).

Searcher Efficiency

Searcher efficiency (S_e) will be calculated for each searcher as follows:

$$S_e = \frac{\text{number of test carcasses found}}{\text{number of test carcasses placed} - \text{number of carcasses scavenged}}$$

The number of WTGs that each individual searches will vary therefore it will be necessary to calculate a weighted average that reflects the proportion of WTGs searched by each searcher. The weighted average or overall searcher efficiency will be calculated as follows:

$$S_{e0} = S_{e1}(n_1/T) + S_{e2}(n_2/T) + S_{e3}(n_3/T) \dots$$

Where, S_{e0} is the overall searcher efficiency;
 S_{e1} and S_{e2} and S_{e3} are individual searcher efficiency ratings;
 N_1 and N_2 and N_3 are number of WTGs searched by each searcher; and
 T is the total number of WTGs searched by all searchers.

Proportion Area Searched

Proportion area searched (P_s) will be calculated as follows:

$$P_s = \frac{\text{actual area searched}}{\pi r^2}$$

Where, $r = 50$ m.

Corrected Mortality Estimates

The minimum estimated bird or bat mortality (C) is calculated as follows:

$$C = c / (S_{e0} \times S_c \times P_s)$$

Where, C is the corrected number of bird or bat fatalities;
 c is the number of carcasses found;
 S_{e0} is the weighted proportion of carcasses expected to be found by searchers (overall searcher efficiency);
 S_c is the proportion of carcasses not removed by scavengers over the search period; and
 P_s is the proportion of the area searched.

3.2.6 Additional Considerations

Based on provincial guidance (MNRF, 2011a and 2011b) and therefore in accordance with the HIFN EA Guidance document, additional considerations for the HIWEC include:

- The above calculations will be presented in corrected numbers of bats / WTG / year and birds / WTG / year. In this context, the year is from May 1 to October 31 for all birds and bats and continues until November 30 specifically for raptor monitoring.
- Additional bird or bat mortality reported through supplemental monitoring (e.g., associated with IWH) and using the same standard protocols, will be included in the calculation of mortality rates. In this case, a monitoring year is defined as all reporting periods in one calendar year (i.e., from January 1 to December 31).
- A separate calculation for raptor mortality should use the searcher efficiency and carcass removal results relevant to raptors.
- Carcasses may be discovered incidental to formal searches. These carcasses will be processed (i.e., collected and recorded, etc.) and fatality data will be included with the calculation of fatality rates. If the incidentally discovered carcass is found outside a formal search plot, the data will be reported separately.
- Tissue samples from bat and bird carcasses may be used in a number of DNA analyses to provide insight into population size and structure, as well as the geographic origin of migrants. EC-CWS may be contacted prior to disposing of bird carcasses, to determine if this type of research is occurring in the area.

Based on EC-CWS guidance (EC-CWS, 2007a and 2007b), carcasses of species listed as Threatened or Endangered under SARA may be required to be sent to the nearest EC-CWS office.

3.3 Post-Construction Mitigation

Post-construction mitigation may be required where post-construction monitoring identifies significant annual bird or bat mortality, disturbance effects associated with bird or bat IWH, or significant bird mortality events.

3.3.1 *Birds*

Based on provincial guidance (MNRF, 2011a) and therefore in accordance with the HIFN EA Guidance document, post-construction mitigation requirements related to birds for the HIWEC include:

- Post-construction mitigation or additional scoped monitoring may be required at individual WTGs or groups of WTGs where post-construction monitoring identifies significant annual bird mortality, disturbance effects associated with bird IWH, or significant bird mortality events.
- For WTGs located outside 120 m of bird IWH, two (2) years of subsequent scoped mortality and cause and effects monitoring is required where a significant annual mortality threshold has been exceeded. Following scoped monitoring, post-construction mitigation (e.g., operational mitigation) and effectiveness monitoring may be required at individual WTGs where a mortality effect has been identified or significant annual mortality persists.
- For WTGs located within 120 m of bird IWH, immediate post-construction mitigation (including operational mitigation) and three (3) years of effectiveness monitoring may be required where monitoring identifies significant annual bird mortality or disturbance effects associated with bird IWH.
- Operational mitigation techniques may include periodic shut-down of select WTGs and / or blade feathering at specific times of the year when mortality risks to the affected bird species is particularly high (e.g., migration).
- Emerging and new technologies may be considered to reduce bird fatalities.

EC-CWS guidance (EC-CWS-2007a) also describes post-construction mitigation considerations for wind power developments including:

- Where a follow-up monitoring program demonstrates that unanticipated serious adverse effects to birds are occurring, such as a high number of direct fatalities or higher than expected disturbance effects, additional studies to determine the reason for these effects may be needed, and modifications to the turbine design or operation may be recommended.
- Where accidental mortality rate is higher than expected, or where sensitive species such as SAR have been killed, the proponent should determine whether there are specific turbines consistently involved and evaluate the placement of problem turbines in relation to topographic features and other turbines, as well as site-specific conditions, to inform an adaptive management approach and help guide future research and development in wind energy.
- If a moving blade appears to be causing high bird mortality along a particular flight path, the turbine can be shut down during time periods or weather conditions when risks are particularly high to reduce the number of direct hits.
- Unanticipated adverse effects may require special mitigation strategies which could include a range of options to be developed under each specific circumstance. For example, if habitat disturbance effects are found to be greater than anticipated, and various mitigation strategies to avoid or reduce the adverse effect prove unsuccessful, other option could include purchasing and protecting (through a conservation easement or other approach) a parcel of land of similar size and habitat type, and within the same general region.

3.3.2 Bats

The majority of bat mortalities from WTG operations occur during fall migration. Across North America, it is estimated that 90% of bat fatalities occur from mid-July through September. Operational mitigation refers to adjustments made to the operation of WTGs to help mitigate potential negative environmental effects on bats (i.e., significant bat mortality). Based on provincial guidance (MNRF, 2011b) and therefore in accordance with the HIFN Guidance document, post-construction mitigation requirements related to bats for the HIWEC include:

- Operational mitigation for bat mortality includes changing the WTG cut-in speed to 5.5 m/s (measured at hub height), or feathering of WTG blades when wind speeds are below 5.5 m/s.
- Where a post-construction monitoring annual report indicates that the annual bat mortality threshold of 10 bats / WTG / year has been exceeded, operational monitoring will be implemented across the HIWEC (i.e., at all WTGs) from sunset to sunrise, from July 15 to September 30. This mitigation will continue for the duration of the HIWEC. Should site-specific monitoring indicate a shifted peak mortality period, operational mitigation may be shifted to match the peak mortality, with mitigation maintained for a minimum duration of ten (10) weeks. Any shift in the operational mitigation period to match peak mortality should be determined in coordination with and confirmed by MNRF.
- Where post-construction mitigation is applied, an additional three (3) years of effectiveness monitoring is required. Monitoring the effectiveness of any post-construction mitigation techniques will help to evaluate the success of this mitigation.

Post-construction mitigation requirements for bats are not specified in EC-CWS guidelines (EC-CWS, 2007a and 2007b).

3.4 Contingency Plans

A contingency plan addresses immediate actions necessary in case of a significant bird or mortality event, or if mitigation actions fail. A contingency plan allows additional mitigation measures to be implemented in the event that unanticipated negative environmental effects are observed during a single mortality monitoring survey.

3.4.1 Birds

Based on provincial guidance (MNRF, 2011a) and therefore in accordance with the HIFN EA Guidance document, contingency plan requirements related to birds for the HIWEC include:

- A contingency plan addresses immediate mitigation actions necessary in case of a significant bird mortality event, or if mitigation actions fail. A contingency plan allows additional mitigation measures to be implemented in the event that unanticipated negative environmental effects are observed during a single mortality monitoring survey.
- A contingency plan is required when a significant bird mortality event occurs. A significant bird mortality event is defined to have occurred when bird mortality during a single mortality monitoring survey (as observed in the field on a single day) exceeds:
 - Ten (10) or more birds at any one WTG; or
 - Thirty-three (33) or more birds (including raptors) at multiple WTGs.

EC-CWS and HIFN will be notified within 48 hours if one of the thresholds above is exceeded during a single mortality monitoring survey. EC-CWS and HIFN will be consulted to determine appropriate contingency plans

should a significant bird mortality event occur or if mitigation actions fail. Should mitigation be implemented and the bird mortality threshold continue to be exceeded, additional mitigation and scoped monitoring requirements will be determined in consultation with EC-CWS and HIFN.

3.4.2 Bats

Based on provincial guidance (MNRF, 2011b) and therefore in accordance with the HIFN EA Guidance document, contingency plan requirements related to bats for the HIWEC include:

- A contingency plan addresses mitigation actions necessary in case of continued significant bat mortality after mitigation has been implemented. A contingency plan allows additional mitigation measures to be implemented in the event that ongoing adverse environmental effects are observed.
- Should cut-in speed mitigation be implemented and the bat mortality threshold continue to be exceeded, additional mitigation and scoped monitoring requirements will be determined in consultation with HIFN.

Contingency plan requirements for bats are not specified in EC-CWS guidelines (EC-CWS, 2007a and 2007b).

4. Reporting Requirements

4.1 Timing of Report Submissions

EC-CWS and HIFN will be provided with an annual report that summarizes the results of post-construction monitoring completed in accordance with the EEMP as described in this report. Below is a summary of the anticipated report submission dates and the contents of each report:

4.1.1 Post-construction Bird and Bat Habitat Monitoring

- **January 2019** – First year of post-construction disturbance effects monitoring results, including:
 - Post-construction bat acoustic monitoring; and
 - Post-construction breeding bird monitoring.
- **January 2020** – Second year of post-construction disturbance effects monitoring results, including:
 - Post-construction bat acoustic monitoring; and
 - Post-construction breeding bird monitoring.

4.1.2 Post-construction Bird and Bat Mortality Monitoring

- **January 2019** – First year of post-construction bird and bat mortality monitoring results;
- **January 2020** – Second year of post-construction bird and bat mortality monitoring results; and
- **January 2021** – Third year of post-construction bird and bat mortality monitoring results.

Note: where a single mortality event of 10 birds / turbine or 33 birds (including raptors) at multiple turbines is observed, the event will be documented and reported to EC-CWS and HIFN within 48 hours of detection.

Note: The federal Species at Risk Registry will be consulted to determine species listed under the Species at Risk Act, 2002 (SARA) or designated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). A confirmed mortality or injury of any Endangered or Threatened species listed under Schedule 1 of SARA will be reported to EC-CWS and HIFN within 48 hours.

4.2 Data Standards for Annual Mortality Monitoring Reports

All bat and bird post-construction monitoring data and associated reports will be submitted to the EC-CWS and HIFN. Bird and bat mortality monitoring data will satisfy the data standards and requirements of the Wind Energy Bird and Bat Monitoring Database (EC-CWS, *et al.* 2015) in order to facilitate comparability of post-construction mortality monitoring results between the proposed HIWEC and other wind energy projects in Ontario subject to provincial regulations and processes. Standardized templates available online through the Wind Energy Bird and Bat Monitoring Database (EC-CWS, *et al.* 2015) will be used to record and report all post-construction mortality monitoring field data.

Reports will also include maps of areas searched for each surveyed WTG, and raw data for all carcass searches, searcher efficiency trials and carcass removal / scavenger trials will be required as part of the annual reports. A data sheet sample will also be provided with the annual reports.

5. References

- AECOM, 2015a:
Natural Heritage Assessment: Records Review Report. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015b:
Natural Heritage Assessment: Site Investigation Report. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015c:
Natural Heritage Assessment: Evaluation of Importance Report. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015d:
Natural Heritage Assessment: Environmental Impact Study Report. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015e:
Summary of 2011, 2012 and 2013 Bat Acoustic Monitoring Surveys – Henvey Inlet Wind Energy Centre Study Area. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015f:
Summary of 2011, 2012 and 2013 Raptor Migration Surveys – Henvey Inlet Wind Energy Centre Study Area. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015g:
Summary of 2011, 2012 and 2013 Passerine Migration Surveys – Henvey Inlet Wind Energy Centre Study Area. Prepared for Henvey Inlet Wind LP. September 2015.
- AECOM, 2015h:
Summary of 2013 Waterfowl Migration Surveys – Henvey Inlet Wind Energy Centre Study Area. Prepared for Henvey Inlet Wind LP. September 2015.
- Environment Canada (EC), 2014:
Avoidance Guidelines - Technical Information. Accessed August 11, 2015. Available: <http://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=AB36A082-1>.
- Environment Canada Canadian Wildlife Service (EC-CWS), Canadian Wind Energy Association (CanWEA), Bird Studies Canada (BSC) and Ontario Ministry of Natural Resources and Forestry (MNRF), 2015:
Wind Energy Bird and Bat Monitoring Database. Accessed September 2015. Available: <http://www.bsc-eoc.org/birdmon/wind/main.jsp>
- Environment Canada Canadian Wildlife Service (EC-CWS), 2007a:
Wind Turbines and Birds: A Guidance Document for Environment Assessment. Quebec: Environment Canada. 52 pp.
- Environment Canada Canadian Wildlife Service (EC-CWS), 2007b:
Recommended Protocols for Monitoring Impacts of Wind turbines on Birds. Quebec: Environment Canada. 33 pp.

Ontario Breeding Bird Atlas (OBBA), 2001:

Ontario Breeding Bird Atlas: Guide for Participants.

Ontario Ministry of Natural Resources and Forestry (MNRF), 2011a:

Birds and Bird Habitats: Guideline for Wind Power Projects. Second Edition. Ontario: Queen's Printer.

Ontario Ministry of Natural Resources and Forestry (MNRF), 2011b:

Bats and Bat Habitats: Guideline for Wind Power Projects. Second Edition. Ontario: Queen's Printer.

Rydell, J., 1992:

Exploitation of insects around streetlamps by bats in Sweden. *Functional Ecology*, Volume 6, p. 744-750.